
Guide to the management of effects on noise sensitive land use near to the state highway network

Noise sensitive activities such as a new residential building near to an existing state highway can potentially be affected by road-traffic noise. This could cause annoyance and sleep disturbance potentially resulting in adverse health effects. In turn, this can cause reverse sensitivity effects on the state highway network.

This guide describes how the NZ Transport Agency, working together with local authorities and landowners/developers, manages reverse sensitivity effects from noise and vibration sensitive activities. Appropriate setback distances and criteria for acoustically treating buildings are provided, together with model district plan rules and resource consent conditions.

September 2015, Version 1.0



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This publication is also available on NZ Transport Agency's website at www.nzta.govt.nz



The NZ Transport Agency is part of, and contributes to, the Safer Journeys programme.

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For more information visit www.saferjourneys.govt.nz

DOCUMENT MANAGEMENT PLAN

1. PURPOSE

This management plan outlines the updating procedures and contact points for the document.

2. DOCUMENT INFORMATION

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3. AMENDMENTS AND REVIEW STRATEGY

All corrective action/improvement requests (CAIRs) suggesting changes will be acknowledged by the document owner.

ACTIVITY	COMMENTS	FREQUENCY
Amendments (minor revisions)	Updates incorporated soon as practicable.	As required
Review (major revisions)	Amendments fundamentally changing the content or structure of the document will be incorporated as soon as practicable. They may require coordinating with the review team timetable.	At least biennially
Notification	All users that have subscribed to HNO Technical Advice Notes (http://hip.nzta.govt.nz/tan) will be advised by email of amendments and updates.	Immediately

RECORD OF AMENDMENT

AMENDMENT NUMBER	DESCRIPTION OF CHANGE	EFFECTIVE DATE	UPDATED BY

1 INTRODUCTION

PURPOSE OF THIS DOCUMENT

The purpose of this guide is to promote good practice for the management of noise sensitive land use near to state highways. This guide provides information that can be applied to avoid or manage adverse effects, such as sleep disturbance, for people in buildings located near to state highways. This guide is consistent with the levels of service (noise criteria) outlined in NZS 6806:2010 Acoustics – road traffic noise – new and altered roads.

The good practice this guide promotes recognises the social, economic and health benefits of managing interior working and living environments located near to state highways and other land transport networks. Relieving stress related illness and other sleep deprivation related health effects, reduces both individual and collective expenditure on health care. Careful and considered planning also balances the aspirations and wellbeing of landowners with New Zealanders' desire to have access to a safe and efficient road transport network.

Contained within this document is information about:

- the nature of reverse sensitivity issues
- the roles and responsibilities of the Transport Agency, local councils and landowners
- information on regional and district plans; and resource consents and plan changes
- performance standards
- noise mitigation options
- model plan provisions and consent conditions.

Transport Agency and council planners are the primary audience for this guide, but the information is also relevant to other staff in the Transport Agency; local councils; developers; acoustics specialists and the general public.

This guide includes detailed technical information relating to noise and vibration, and planners will require specialist support when implementing some aspects. For queries relating to the state highway network, please contact environment@nzta.govt.nz.

For the general public, particularly private house builders or those undertaking alterations, this guide explains the noise and vibration effects that should be considered. Further information on the process required for building works near to state highways can be found at the Transport Agency website⁰¹ and in an information brochure⁰².

For the Transport Agency, this guide presents a consistent approach and performance criteria to implement when:

1. determining the appropriate footprint of new state highway designations
2. submitting on council plan reviews/changes under the Resource Management Act 1991 (RMA)
3. submitting or giving affected party approval to plan changes and resource consent applications under the RMA.

The Transport Agency has prepared various other guides, which are also relevant, including:

- *Guide to assessing road-traffic noise using NZS 6806 for state highway asset improvement projects*⁰³
- *State highway noise barrier design guide*⁰⁴
- *State highway guide to acoustic treatment of buildings*⁰⁵

This guide replaces the information previously contained in Appendix 5D to the NZ Transport Agency *Planning policy manual*⁰⁶.

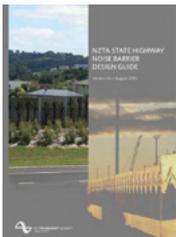
01 Building a house near a state highway
www.acoustics.nzta.govt.nz

02 NZ Transport Agency state highways – development and access
www.nzta.govt.nz

03 NZ Transport Agency (2011) *Guide to assessing road-traffic noise using NZS 6806 for state highway asset improvement projects*. www.nzta.govt.nz



04 NZ Transport Agency (2010) *State highway noise barrier design guide*. www.nzta.govt.nz



05 NZ Transport Agency (2015) *State highway guide to acoustic treatment of buildings*. www.nzta.govt.nz

06 Transit NZ (2007) *Planning policy manual, SP/M/001, Appendix 5D reverse sensitivity*.



WHAT IS REVERSE SENSITIVITY?

Reverse sensitivity is the legal vulnerability of an established activity to complaint from a new land use⁰⁷. This can occur in situations where different land uses/activities are located in close proximity to each other, resulting in conflict between the activities. The term 'reverse sensitivity' generally relates to the effects of the development of a sensitive activity in an area that is already affected by established activities⁰⁸.

For land transport network operators, including the Transport Agency, there is a risk that new activities (such as houses and schools) that choose to locate near to established roads or railways may object to the effects of the land transport network (such as noise and vibration) and take action against the operator. The same issues arise around ports, airports and other infrastructure. The focus of this guide is on managing reverse sensitivity effects on the state highway network, but the information may also be relevant when managing effects on railways and regionally significant local roads.

Vehicles on state highways can produce adverse effects that extend beyond the state highway boundary, such as:

- noise and vibration
- vehicle generated emissions, especially to air
- lighting/glare
- dust
- non-point source pollution e.g. stormwater run-off, spray-drift and litter.

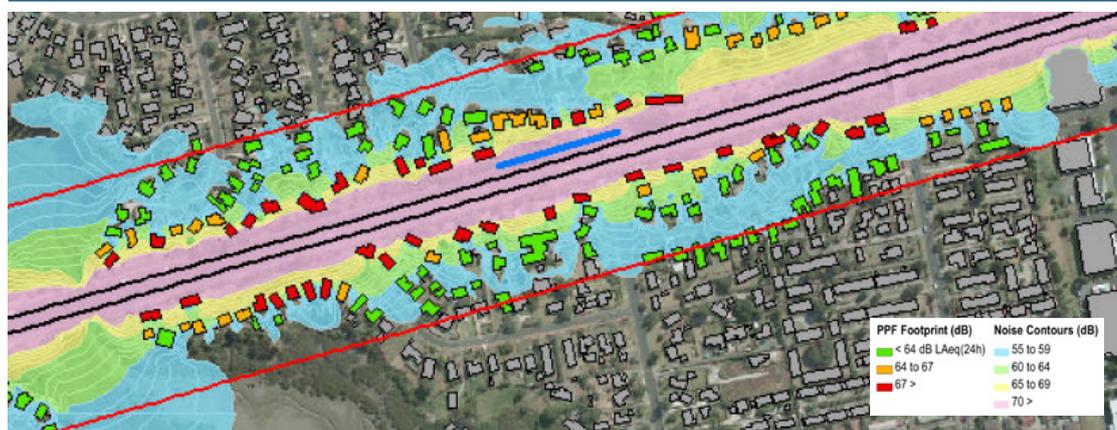
Sensitive receivers, which are susceptible to the effects of roads, can include houses, schools and childcare facilities, hospitals, offices and hotels/motels. While there are a range of issues, the most widespread effects generally relate to noise. Methods in this guide have been devised initially for the management of noise. Other effects are generally addressed indirectly by the buffer areas required for noise.

This guide addresses effects from existing state highways, and also from confirmed designations for future state highways. The Transport Agency also develops new state highways, and section 2 summarises how noise effects are addressed in those cases.

⁰⁷ NZ Journal of Environmental Law (1999) Volume 3, Pardy, B. and Kerr, J. *Reverse sensitivity - the common law giveth, and the RMA taketh away.* www.nzcel.auckland.ac.nz/uoa

⁰⁸ Judge Sheppard (RMA 10/97) confirmed: 'the term reverse sensitivity is used to refer to the effects of the existence of sensitive activities on other activities in their vicinity, particularly by leading to restraints in the carrying on of those other activities.'

FIGURE 1: NOISE MODELLING



WHY IS REVERSE SENSITIVITY AN ISSUE?

Tension can arise between the Transport Agency's requirement to operate and maintain the state highway network and the desire of neighbouring landowners to develop their land as they wish, or to enjoy their property free from unreasonable interference or nuisance. While the Transport Agency aims to manage interference or nuisance through careful planning, complaints from sensitive receivers still arise.

For the 10-year period between 2002 and 2012, the Transport Agency received over 250 complaints about noise from the operation and maintenance of the Auckland state highway network. Nationally, the Transport Agency receives in the order of ten complaints each month about noise from the state

highway network, as recorded in its Customer Relationship Management System (2014). Complaints predominantly relate to noise experienced by residents living near to a state highway.

Modelling undertaken by the Transport Agency (2011) showed that noise levels adjacent to the state highway network throughout the Auckland region could cause disturbance for new sensitive activities, if they locate close to state highways. Similar patterns occur adjacent to state highways throughout New Zealand. This guide sets out a nationally consistent approach that the Transport Agency applies to encourage appropriate planning for and treatment of sensitive environments near state highways.

ENVIRONMENTAL AND SOCIAL RESPONSIBILITY POLICY

The NZ Transport Agency has a strong regard for the natural, built and social environment, which is demonstrated through its Environmental and Social Responsibility Policy⁰⁹. The Transport Agency aims to continuously improve performance in the management of environmental and social impacts; improve the knowledge and understanding of the extent and conditions of New Zealand’s environment; and identify and comply with all relevant environmental legislation and regulation.

This policy, together with the Government Policy Statement¹⁰ are consistent with the Land Transport Management Act 2003 and the RMA.

To implement the Environmental and Social Responsibility Policy, the Environmental and Social Responsibility Manual¹¹ contains standards, guidelines, tools and references applicable to all capital works and maintenance operations. This guide forms part of that manual.

09 NZ Transport Agency (2014) *Environmental and Social Responsibility Policy*. www.nzta.govt.nz

10 Ministry of Transport *Government policy statement on land transport* (updated every 3 years). www.transport.govt.nz

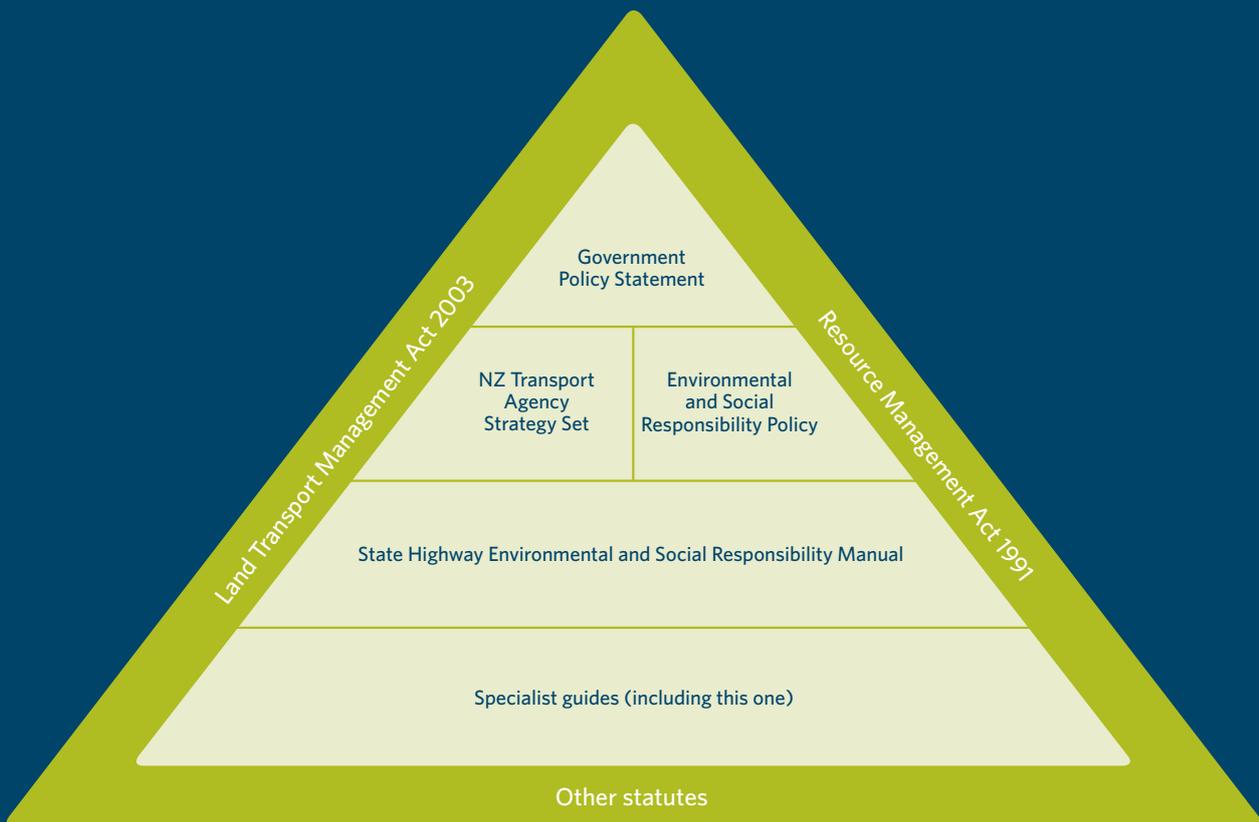
11 NZ Transport Agency *HNO Environmental and Social Responsibility Manual*. www.nzta.govt.nz

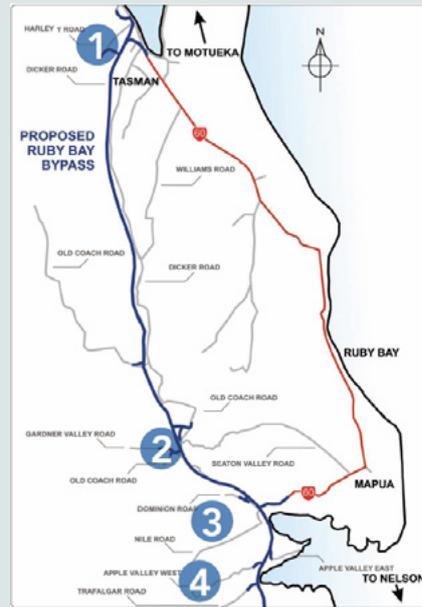
TRANSPORT AGENCY’S APPROACH TO PLANNING PROCESSES

The Transport Agency is committed to influencing regional and local planning processes to ensure:

- the long-term needs of state highways are recognised and provided for
- the delivery of an effective, efficient, safe, and affordable transport system that supports prosperity and economic growth, vibrant communities and a healthy environment
- recognition of the economic and social function of state highways and the diverse range of transport functions performed by high volume, regional arterial, collector and access roads
- new developments near state highways address potential adverse effects for future occupants and also the consequent reverse sensitivity effects on the transport network.

FIGURE 2: RELATIONSHIP OF THIS GUIDE TO KEY POLICY AND STRATEGY DOCUMENTS





Ruby Bay Bypass

CASE STUDY - EXAMPLE OF POOR OUTCOMES WHEN REVERSE SENSITIVITY NOISE EFFECTS ARE NOT FULLY ADDRESSED

This case study provides an example of the outcomes that can eventuate if reverse sensitivity noise effects are not fully addressed on the state highway network. In this example the residents remain unhappy with the noise effects they are experiencing.

The State Highway 60 Ruby Bay Bypass (completed 2010) links Richmond and Motueka in the Tasman District. The 10.7 km road consists of single lane carriageways in both directions with a number of passing lanes and connections to local roads. The road carries approximately 5,000 vehicles per day and bypasses the townships of Mapua and Ruby Bay.

The investigation phase for the bypass was completed in 1999 and a Notice of Requirement was lodged with Tasman District Council (TDC) and approved in 2000. Designation conditions required the Transport Agency to mitigate noise from the bypass at houses that had already been built at the time of the designation (2000), resulting in noise barriers being constructed as part of the project to protect those houses.

In 2005 TDC adopted controls within the district plan to assess the location of subdivisions relative to the proposed State Highway 60

route, and to provide discretion for the application of building noise control measures for locations exposed to traffic noise from the Ruby Bay Bypass.

The project enjoyed positive community support during the construction phase and once opened no complaints were raised due to road-traffic noise. However, following the application of a second coat seal in 2012, a number of noise complaints were received. These complaints were primarily from residents whose houses were consented after the approval of the bypass designation.

To assess these complaints the Transport Agency commissioned an independent consultant to conduct noise monitoring of both noise levels at houses and also of the road surface. The investigation concluded that the second coat seal had slightly changed the road-traffic noise but that the noise levels remained as expected and in compliance with the designation conditions. Some residents did not agree with these findings and remain dissatisfied with the noise effects they experience.

This situation is an example of a reverse sensitivity effect whereby new houses were built adjacent to an existing designation (without a

road in it at the time); the owners were then affected by road-traffic noise and complained about the operation of the state highway, requesting significant expenditure on new road surfacing.

While the designation itself could be found in the district plan, the plan does not include reverse sensitivity noise buffer and effects areas. In addition, the district plan did not identify noise mitigation performance standards for new construction or alterations. Including these provisions in district plans helps alert future residents of the traffic noise environment and encourages acoustic treatment of dwellings.

This outcome highlights the importance of land use planning provisions to control the location and design of new houses near existing and designated state highways. It also highlights the need to make information widely available to councils and the general public to inform them of potential current and future noise effects when developing properties adjacent to existing or designated state highways. With appropriate controls, houses could be built to achieve acceptable indoor environments.

2 A SHARED RESPONSIBILITY

There is a shared responsibility for managing reverse sensitivity noise effects because it is neither practical nor reasonable for any one party to assume sole responsibility. The Transport Agency, councils and landowners/developers must all assume responsibilities. For new and altered state highways the onus falls on the Transport Agency to address noise effects, whereas for new and altered noise sensitive activities near state highways the responsibility lies with councils to include appropriate land-use controls in district plans and on landowners/developers to implement them. Careful and considered planning is pivotal to protect the environment and enhance the quality of life for New Zealanders.

TRANSPORT AGENCY'S ROLE

The Transport Agency recognises that constructing, operating and maintaining state highways can impose adverse effects on communities and the environment, and takes reasonable steps to manage noise and vibration emissions, and other adverse effects.

For new or altered state highways, a good opportunity exists to integrate the highway with existing or anticipated adjacent land uses. The Transport Agency adopts NZS 6806¹² as best practice guidance for mitigating road-traffic noise during the planning, design and construction phases of new or altered state highway projects¹³.

On new and altered state highways the Transport Agency routinely uses low-noise road surfaces and noise barriers to reduce noise levels. In cases where there is unavoidable high noise exposure the Transport Agency acoustically treats individual buildings.

On existing state highways the Transport Agency adopts good practice measures to manage road surface noise and vibration¹³. It also investigates noise and vibration complaints and addresses issues where practicable, such as following up with truck operators using noisy engine brakes.

For maintenance works on existing state highways, the Transport Agency adopts good practice environmental management processes. This includes using noise and

vibration management plans to determine the controls necessary to minimise any adverse effects.

Existing state highways were designed and constructed to the relevant standards of their time, and there are often limited practicable opportunities to further mitigate adverse road-traffic noise and vibration effects.

Separation is often the most effective method of mitigating adverse effects such as noise, vibration, vehicle emissions, lighting/glare and dust on adjoining land uses. New state highway designations are wider than the vehicle carriageways and can incorporate buffer areas between the road and existing or anticipated adjoining land uses. However, there is a tension between separating/isolating state highways for control of health and amenity effects, and maintaining connectivity and compact urban form, as well as a safe environment for all modes of transport. This can be partly addressed through other non-sensitive land uses providing a buffer in some areas. Alternative approaches may be required as a compromise in some constrained urban areas.

Section 3 provides an appropriate buffer area to control the most significant noise effects. For motorways and expressways this typically results in a 40m buffer area due to their relatively high traffic volumes and vehicle speeds (figure 4). This buffer may be achieved either through encumbrances on the

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

13 NZ Transport Agency (2014) Guide to state highway road surface noise. www.nzta.govt.nz



FIGURE 3: BUFFER AREA WIDTH

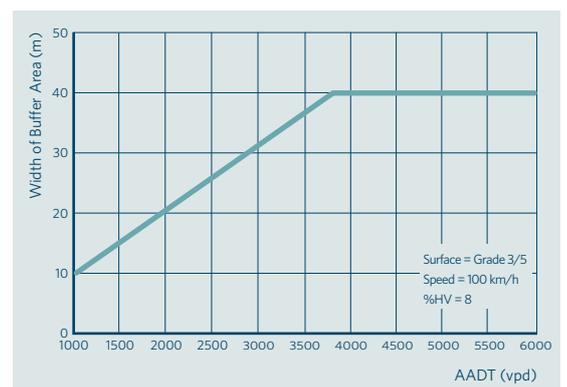
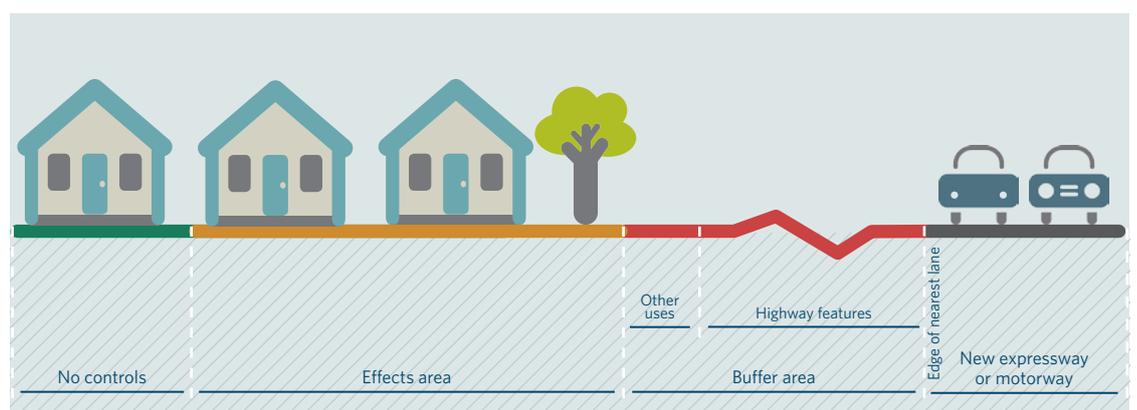


FIGURE 4: TYPICAL BUFFER AREA FOR A NEW MOTORWAY OR EXPRESSWAY



land preventing future noise sensitive development, or by including the land within the designation. Encumbrances may be put in place when surplus land owned by the Crown is disposed of or through separate agreements made with the landowner. In urban areas noise sensitive activities are generally accepted in the buffer area subject to additional controls.

The buffer area is created to promote separation between sensitive land use activities and the state highway, and is measured from the edge of the nearest traffic lane. The buffer typically incorporates shoulder areas, stormwater drains, stormwater treatment, utility

corridors, cycle and foot paths and other non noise sensitive activities. In many cases, the outer Buffer Area may be available for other activities, such as grazing, that do not compromise highway operations. Vibration and air quality effects also reduce with distance from a road, so a buffer from state highways and expressways would provide some protection from those potential adverse effects.

COUNCILS' ROLE

The Transport Agency and local authorities have a collective duty to balance the operation of an effective, efficient and safe land transport system with the desire of landowners to develop their land as they wish, or to enjoy their property free from unreasonable interference and nuisance.

As the effects of a state highway usually extend beyond the road designation, it is appropriate to control the establishment of new activities close to state highways to reduce potential conflicts and manage reverse sensitivity effects.

Land in rural areas can be zoned so that new sensitive activities are not permitted near to existing and/or designated state highways, or rules can be imposed requiring sensitive activities near state highways to manage effects from the highway.

FIGURE 5: EXAMPLE VIBRATION LEVELS¹⁴

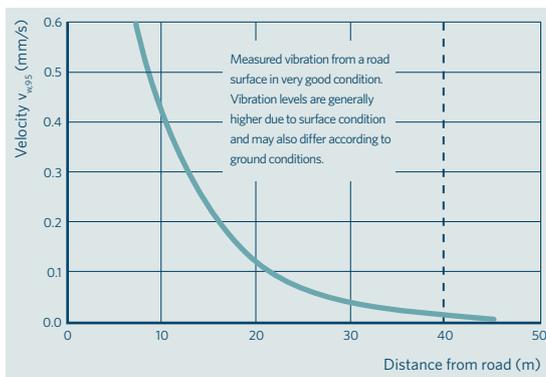


FIGURE 6: EXAMPLE AIR QUALITY LEVELS¹⁵

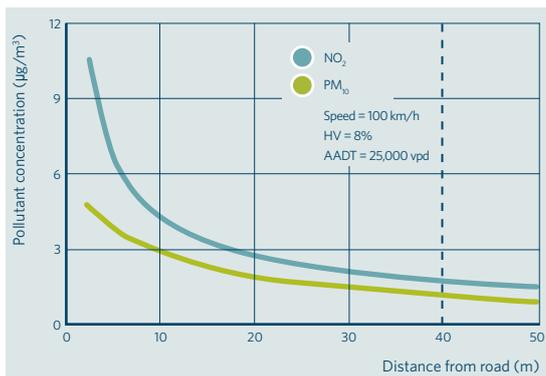
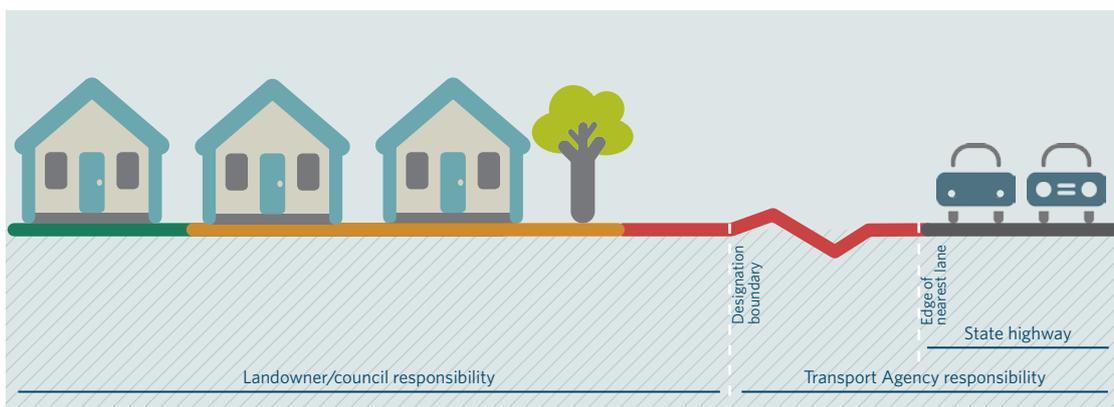


FIGURE 7: AREAS OF RESPONSIBILITY



¹⁴ NZ Transport Agency (2011) Acoustics Assessment, Transmission Gully Project. Technical report 12. www.nzta.govt.nz

¹⁵ NZ Transport Agency Air quality screening model v2.0. www.air.nzta.govt.nz

¹⁶ Judge Thompson (W055/04) stated: 'In a number of previous decisions this Court has held that reverse sensitivity is itself an adverse effect in terms of s3 RMA [e.g. A049/02 and A103/03]. That has a significant consequence. If reverse sensitivity is an adverse effect, then there is a duty, subject to other statutory directions to avoid, remedy or mitigate it, so as to achieve the Act's purpose of sustainable management.'

3 PERFORMANCE STANDARDS

BUFFER AND EFFECTS AREAS

The Transport Agency has developed a stepped approach to protect sensitive activities as shown below. The approach is based around buffer and effects areas, which are determined in the same way for both rural and urban state highways, but the applicable reverse sensitivity controls within each area vary depending on the environment. To achieve a reasonable level of acoustic amenity, all noise sensitive activities in rural areas should be located outside of a buffer area, providing a setback from state highways. The buffer area will be partly or sometimes fully within the state highway designation, particularly for more recent designations. However, in other cases where an existing state highway has a narrow designation, the buffer will need to be accommodated outside the designation, and for example might take the form of local roading, stormwater treatment or reserve land within a new residential development, or may be accommodated by building setbacks within larger sections. Beyond the buffer area buildings containing new noise sensitive activities within a wider 'effects area' may be allowed but need to be designed and constructed to achieve reasonable indoor acoustic amenity. In urban areas noise sensitive activities may be allowed in the buffer area, subject to additional vibration controls.

The Transport Agency will seek to have the buffer and effects areas overlaid on individual district plan maps. While the district planning review process is on a 10-year cycle the Transport Agency will update the buffer and effect areas every two years in order to reflect any changes to the state highway network¹⁷. However, the versions of the overlays in each district plan must be used when applying the controls in the district plan. The Transport Agency will generally not seek for updated overlays to be included in the district plan until the next plan review. In some cases, especially for significant changes in the state highway network, the Transport Agency may seek a specific plan change to include updates to the revised buffer and effect maps. For example, this may occur in parallel with a Notice of Requirement for a new state highway.

The buffer and effects areas discussed here are those proposed by the Transport Agency. However, the appropriate district plan should be consulted to determine the actual areas that apply as district plan provisions may differ.

¹⁷ NZ Transport Agency
Buffer and effects areas maps.
www.acoustics.nzta.govt.nz

FIGURE 8: BUFFER AND EFFECTS AREAS

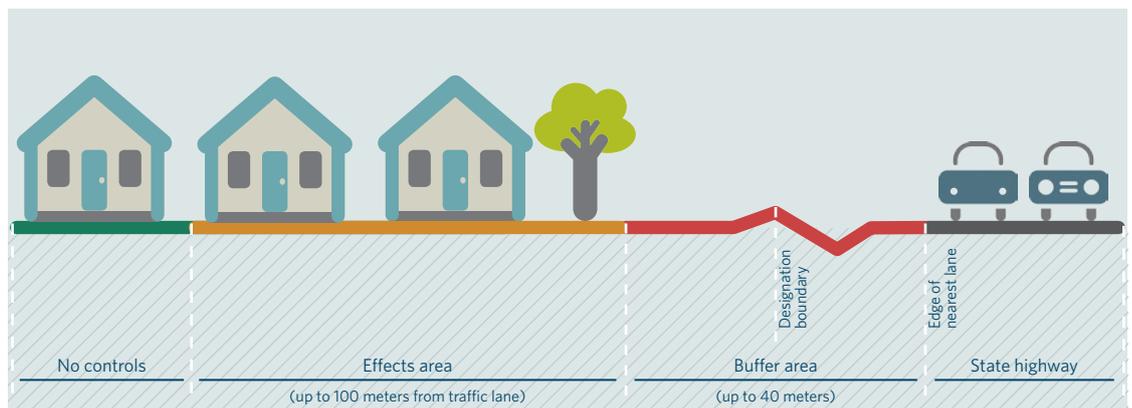
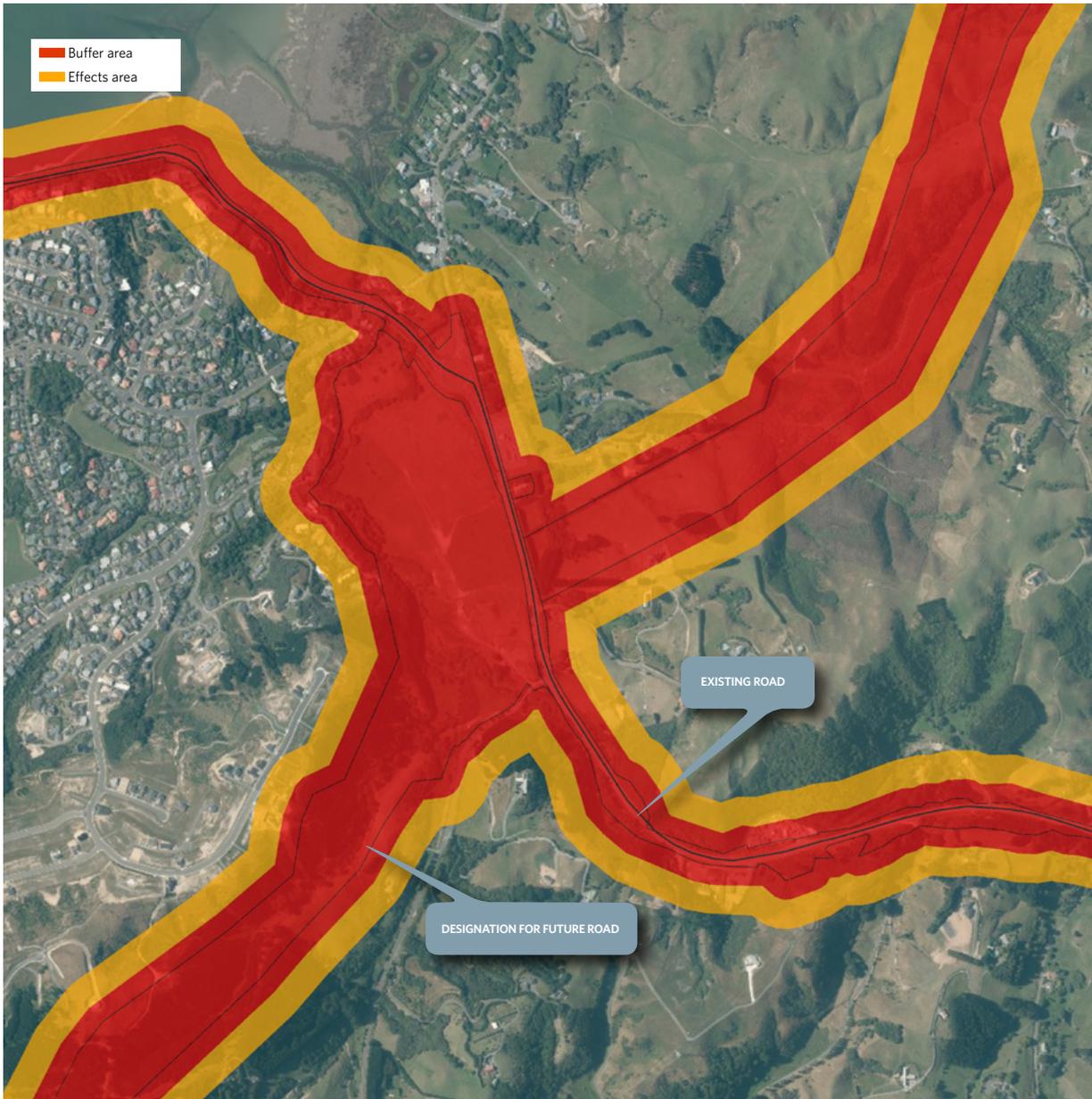


FIGURE 9: WEB BASED MAP SHOWING BUFFER AND EFFECTS AREAS



CALCULATION OF DISTANCES

The buffer area and effects area for the entire state highway network have been determined and are shown on a web based map¹⁷.

The Transport Agency will provide digital exports from these maps if required to be inserted into district plan maps (contact environment@nzta.govt.nz).

The maps will be updated nationwide biennially. Additional updates will be made for localised areas if required to reflect altered designations or significant changes to traffic volumes, road surfaces or speed limits.

The extent of the buffer area and the effects area depend on the noise level from the highway, with the dominant factors being the traffic flow, vehicle speed and percentage of heavy vehicles. Noise levels can be calculated using a road traffic noise model, such as the calculation of road-traffic noise¹⁸ (CRTN, the most commonly used road noise model in New Zealand). However, detailed modelling for the entire state highway network is not practicable. The equation

below is a simplified version of the CRTN calculation that can be used to determine the approximate extent of the buffer area and effects area, based on achieving the NZS 6806 new road noise criteria of 64 dB L_{Aeq,24h} (buffer) and 57 dB (effects). The simplified equation does not consider potential noise mitigation provided by existing topography or existing solid and continuous barriers (eg, a wall or another building). Where there is no line of sight between the road and the location of the proposed development (noise sensitive activity) then mitigation may not be required. The rules proposed in section 8 address such situations.

Recognising the limitations of the simplified calculation, the distances for the Buffer area and effects area have been grouped into categories and capped as described below.

For completeness this equation has been presented in this guide but in most situations the maps provided by the Transport Agency can be used to determine the buffer and effects areas¹⁹.

¹⁸ Department of Transport, Welsh Office (1988) *Calculation of road traffic noise*, published by HMSO, London. <http://products.ihf.com>

¹⁹ NZ Transport Agency *State highway traffic volumes*. www.nzta.govt.nz

EQUATION 1: CALCULATION OF EXTENT OF BUFFER AND EFFECTS AREAS

$$d = K \times \underbrace{AADT}_{\text{Traffic speed}} \times \left(V + 40 + \frac{500}{V} \right)^{3.3} \times \underbrace{\left[\left(1 - \frac{p}{100} \right) \times 10^{\left(\frac{R_c}{10} \right)} + \left(\frac{p}{100} + \frac{5p}{V} \right) \times 10^{\left(\frac{R_t}{10} \right)} \right]}_{\text{Road surface (and traffic speed and composition)}}$$

Where:

- d Distance (m)
- K Constant factor related to noise level (1.82 x 10⁻¹⁰ for buffer area, 9.13 x 10⁻¹⁰ for effects area)
- AADT Annual average daily traffic (vpd)^{19,20}
- V Traffic speed (km/h)
- p Percentage of heavy vehicles (percentage points, eg for 12 %HV, p = 12)^{19,20}
- R_c Surface correction¹³ for cars (dB)
- R_t Surface correction¹³ for trucks (dB)

Buffer area distances D _B	10, 20, 30 or 40 m
Effects area distances D _E	40, 50, 60, 70, 80, 90 or 100 m

The distances (d) calculated using the equation opposite are rounded and capped as follows:

Buffer area	Effects area
d < 15 then D _B = 10 m	d < 45 then D _E = 40 m
15 <= d < 25 then D _B = 20 m	45 <= d < 55 then D _E = 50 m
25 <= d < 35 then D _B = 30 m	55 <= d < 65 then D _E = 60 m
d >= 35 then D _B = 40 m	65 <= d < 75 then D _E = 70 m
	75 <= d < 85 then D _E = 80 m
	85 <= d < 95 then D _E = 90 m
	d >= 95 then D _E = 100 m

²⁰ Auckland Motorway Alliance *Mobile Road*. www.mobileroad.org

NOISE AND VIBRATION DESIGN LEVELS

New or altered buildings containing noise sensitive activities within the effects area should be designed, constructed and maintained to meet the internal noise levels set out in table 1.

These noise limits are based on NZS 6806 and AS/NZ 2107:2000²¹. In AS/NZS 2107 there is a satisfactory and maximum value given for each type of space. In the table below, the maximum values have generally been selected in recognition of reasonable expectations for the environment in close proximity to a state highway. The noise levels relate to the sensitivity of each activity, for example activities requiring active listening are more sensitive to noise than sleeping.

NZS 6806 defines protected premises and facilities (PPFs) as spaces in buildings used for residential activities; marae; overnight medical care; teaching and sleeping in educational facilities; and playgrounds that are part of educational facilities that are within 20m of buildings used for teaching purposes. Other noise standards define 'noise sensitive activities/locations' and although there is some variability in the definitions, these are essentially PPFs. All PPFs in NZS 6806 are included in table 1. In this guide the term noise sensitive activity will be used.

²¹ Standards Australia/ Standards New Zealand (2000) AS/NZ 2107:2000 Recommended design sound levels and reverberation times for building interiors.
www.infostore.saiglobal.com

TABLE 1: INTERNAL NOISE LEVELS FOR BUILDINGS IN BUFFER AND EFFECTS AREAS

BUILDING TYPE	OCCUPANCY/ACTIVITY	MAXIMUM INDOOR DESIGN NOISE LEVEL $L_{Aeq(24h)}$
Residential	Living spaces, sleeping spaces (including visitor accommodation and retirement accommodation)	40 dB
Education	Assembly halls	35 dB
	Conference rooms, drama studios	40 dB
	Lecture rooms and theatres, music studios	35 dB
	Libraries	45 dB
	Sleeping areas in educational facilities	40 dB
	Teaching areas	40 dB
Health	Overnight medical care, wards	40 dB
	Clinics, consulting rooms, theatres, nurses' stations	45 dB
Cultural Buildings	Places of worship, marae	35 dB

In urban areas, and on occasion in other situations, it can be impractical to restrict noise sensitive activities from a buffer area around state highways. Should sensitive activities be required to locate within the buffer area, additional controls need to be applied. As well as the internal noise level controls set out in table 1, controls are required to manage the adverse effects of vibration and to manage noise in the main outdoor living space for residential activities in rural areas. Where development occurs within the buffer area, the criteria in table 2 should be applied, in addition to the criteria in table 1.

Internal noise levels have been specified rather than a façade reduction in order to obtain an effects based approach, which takes into account the actual road-traffic noise level outside a building. This approach is consistent with NZS 6806 for noise.

Road-traffic noise levels fluctuate over time: there are short-term changes over seconds as individual vehicles pass; variations over minutes due to the changing mixture of cars and trucks; and daily oscillations due to peak and off-peak traffic flows. A number of different noise measurement parameters are available. For road-traffic noise in New Zealand, the $L_{Aeq(24h)}$ is used, with the units of decibels (dB). This is an A-weighted, time-averaged noise level over 24 hours.

No differentiation has been made between living and sleeping spaces as the 40 dB design noise level is measured over a 24 hour period and is broadly equivalent to 35 dB during the night period combined with 40 dB during the day.

²² Norwegian Standard (2005) NS 8176:2005 *Vibration and shock - Measurement of vibration in buildings from landbased transport and guidance to evaluation of its effects on human beings.*
www.infostore.saiglobal.com

NS 8176²² has been used as the basis for the recommended vibration level, with class C corresponding to the 'value for vibration in new residential buildings'. A statistical maximum value for weighted vibration is used to quantify the vibration and class C has an upper limit of 0.3 mm/s $v_{w,95}$.

For vibration, NS 8176 uses the statistical maximum weighted velocity $v_{w,95}$ (units of mm/s), which is the maximum weighted velocity that can be expected with 95% probability. The 'combined frequency weighting' W_{mv} from ISO 8041:2005 is used to reduce to vibration influence outside the frequency range to which humans are sensitive.

TABLE 2: NOISE AND VIBRATION LEVELS FOR BUILDINGS IN BUFFER AREA

BUILDING TYPE	MAXIMUM EXTERNAL DESIGN NOISE LEVEL (RURAL AREAS)	INTERNAL DESIGN VIBRATION LEVEL (URBAN AND RURAL AREAS)
Residential	57 dB $L_{Aeq(24h)}$	NS 8176 Class C

ASSESSMENT METHODOLOGIES

When there is a requirement to assess noise and/or vibration as set out in the model plan rules/conditions (sections 8 and 9), an acoustics expert is typically required.

For noise, the assessment determines the existing road-traffic noise by measurement, prediction or a combination of both. To take into account the future permitted use of state highway 3 dB should be added to existing measured or predicted noise levels. The noise levels inside and outside the new sensitive land use are then predicted and any mitigation specified for the building design, barriers or bunds in order to achieve compliance with the required levels in table 1 or table 2. The Transport Agency provides a number of tools and data sources for this assessment:

- a guide to road surface noise¹³
- a road-traffic noise calculator www.acoustics.nzta.govt.nz
- traffic flow and percentage heavy vehicle data^{19,20}
- a guide to the acoustic treatment of buildings⁰⁵

For some parts of the state highway network (such as in Auckland) the Transport Agency may also have noise contours available on request (environment@nzta.govt.nz).

Due to the influence of local ground conditions and the condition of the road surface, site-specific measurements are recommended for a vibration assessment. These measurements should be carried out in accordance with NS 8176 on the ground surface, ('free-field') using a statistical maximum velocity or acceleration from a characteristic sample of road traffic. Empirical relationships can then be used²³ to determine the vibration inside a building.

The vibration levels will correspond to the road surface condition at the time of the measurements and should be used to assess vibration effects on the proposed development. However, if there is a temporary defect in the road surface at the time of the measurements causing elevated vibration levels then an adjustment should be made to the measured values. No adjustment should be made if elevated levels are caused by permanent features of the surface such as seal joints, completed repairs such as patches, or issues with the underlying pavement.

Where adopted, the draft plan rules and consent conditions in sections 8 and 9 make landowners/developers responsible for providing design solutions that achieve the specified performance standards. As specified in these rules/conditions, landowners have to supply an assessment from a suitably qualified acoustics specialist stating that each building in the effects area will achieve the prescribed design noise levels (and vibration level if a building is within the buffer area).

Noise and vibration assessments are estimated to cost \$1,000 (2015) with additional costs for any measurements. Advice on both of these assessment methodologies can be sought from the Environment and Urban Design Team (environment@nzta.govt.nz).

²³ NZ Transport Agency (2013) *State highway construction and maintenance noise and vibration guide.*
www.nzta.govt.nz

VENTILATION PROVISIONS

Where compliance with specified internal noise levels is required and building relocation/reorientation or noise barriers are not practicable, acoustic treatment of the building will be necessary. The overall acoustic performance of a building envelope is determined mainly by its weakest elements. In most cases, the weakest elements are ventilation openings such as windows through which natural ventilation is provided. Mechanical ventilation/cooling can allow windows to be kept closed, which can significantly reduce road-traffic noise and, in the majority of cases, is the only measure required.

Ventilation and cooling systems are often specified in district plans as part of reverse sensitivity controls for houses near airports, ports, roads and railways. However, there is substantial variation between specifications, despite the systems all serving the same basic purpose in each case. The range of different specifications commonly found in district plans was reflected in the proposed Auckland Unitary Plan in 2013, where houses near airports, ports, road and rail had varying ventilation provisions. A review²⁴ of these found that:

- Clause G4 of the Building Code (Schedule 1 of the Building Regulations 1992) is not designed to provide thermal comfort. District plans that specify compliance with Clause G4 for ventilation systems as part of reverse sensitivity controls are unlikely to achieve the intended outcome. Occupants would be likely to experience hot/stuffy conditions at least in summer, and would probably open the windows, which should remain closed to achieve appropriate indoor noise levels.
- Systems that seek to simulate cooling through provision of high air flow rates (up to 15 air changes per hour), have a number of drawbacks and will not always achieve the desired cooling effect. Issues with a high air flow rate ventilation only system include relatively high capital and maintenance costs, larger components, and higher levels of system noise to control.
- Provision of a ventilation system including cooling, such as from a reverse cycle heat pump, is likely to be the most effective way of achieving reasonable thermal comfort, commensurate with the effect that would be obtained by opening windows. However, in cooler regions such as the lower North Island and coastal and southern parts of the South Island, mechanical ventilation alone would be sufficient.

Where mechanical ventilation or cooling is provided as an alternative to opening windows it should be a genuine alternative such that occupants are not forced to choose between excess noise or hot/stuffy conditions. Prior to 2014, to achieve this outcome the Transport Agency generally sought either a high air flow rate or cooling, when ventilation systems were required as part of reverse sensitivity controls. On the basis of this review, the following specifications are now recommended.

SPECIFICATION FOR VENTILATION AND COOLING SYSTEMS

- Ventilation must be provided to meet clause G4 of the New Zealand Building Code. At the same time as meeting this minimum provision, the sound of the system shall not exceed 30 dB $L_{Aeq(30s)}$ when measured 1 m away from any grille or diffuser.
- The occupant must be able to control the ventilation rate in increments up to a high air flow setting that provides at least 6 air changes per hour (more than is specified in clause G4). At the same time the sound of the system shall not exceed 35 dB $L_{Aeq(30s)}$ when measured 1 m away from any grille or diffuser.
- The system must provide cooling that is controllable by the occupant and can maintain the temperature at no greater than 25°C. At the same time, the sound of the system must not exceed 35 dB $L_{Aeq(30s)}$ when measured 1 m away from any grille or diffuser.

(The last item can be omitted for cooler regions such as the lower North Island and coastal and southern parts of the South Island.)

To achieve this specification it is likely that the most common solution would be an in-ceiling ducted system with a reverse-cycle heat pump providing cooling (figure 13).

Note that in addition to the specification detailed above, any ventilation and cooling system must comply with district plan provisions for noise emissions to neighbouring property. This may constrain the location of external equipment and air grilles, and/or require screening and attenuation.

The specification is considered a minimum for ventilation and cooling systems implemented to address reverse sensitivity noise effects. Heating and additional cooling may be an overall design objective for these systems.

The noise limits for ventilation systems are lower than the 40 dB road-traffic noise limit, to avoid a cumulative effect. Ideally the ventilation systems would be 10 dB below the road-traffic noise but this is not practicable at higher duties so the ventilation specification is only 5 dB below the road-traffic noise limit in those instances.

²⁴ Beca Ltd (2014)
Ventilation systems installed for
road-traffic noise mitigation.
www.acoustics.nzta.govt.nz

4 NOISE BARRIERS

In some instances the noise criteria in section 3 can be achieved by screening the land use from the road by a barrier. Effective barriers can be formed with walls or bunds and advice can be found in the barrier guide⁰⁴ and urban design guidelines²⁵. The natural terrain and other buildings can also act as noise barriers.

Noise barriers erected close to the road often provide the best acoustic performance. However, in addition to potential urban design issues, structures within the state highway road reserve must be maintained by the Transport Agency. Therefore, noise barriers provided by developers for reverse sensitivity control should be located either where they will be maintained by the landowner, or preferably on land

that will be transferred to the local council for ongoing maintenance.

For most types of barrier, access is required to both sides for maintenance, and therefore locating a barrier on a cadastral boundary can be problematic. Consideration is also needed to avoid gaps between barriers and boundary fences, which can become litter traps and unsafe places.

If a noise barrier for an individual development does not join up with other noise barriers, or otherwise extend wider than the area to be protected, then it may be necessary to include return sections at each end of the barrier perpendicular to the state highway⁰⁴ (figure 10).

²⁵ NZ Transport Agency (2013) *Bridging the gap: NZTA urban design guidelines*. www.nzta.govt.nz

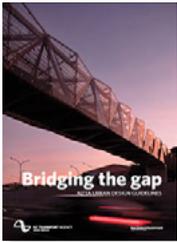


FIGURE 10: NOISE BARRIER RETURN

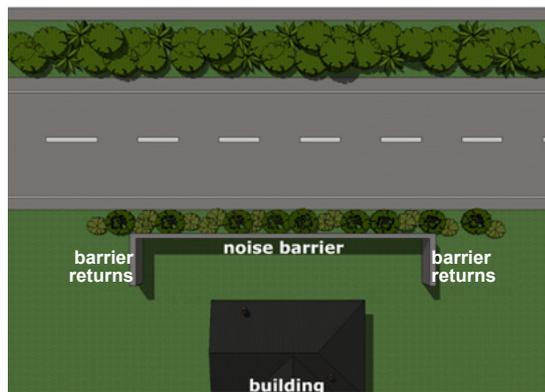


FIGURE 11: PLANTED BUNDS BESIDE SH1 IN ROLLESTON INSTALLED BY COUNCIL/DEVELOPER





Noise barriers on individual sections and council land in Christchurch



CASE STUDY - MAINTENANCE IMPLICATIONS FROM BARRIER LOCATION

This case study highlights difficulties that can arise with the ongoing maintenance of noise barriers depending on who owns the land on which they are located. The figure above is an aerial photograph showing two stages of a subdivision adjacent to State Highway 1 in Christchurch. For both stages a continuous noise barrier has been constructed adjacent to the state highway. The noise barrier comprises an earth bund with a timber fence on top. In the first stage of the subdivision (shown on the top half of the figure) the barrier

is located wholly within individual private sections of land. However, for the second stage (shown on the bottom half of the figure) the barrier is located wholly within a specific council reserve.

The council is responsible for both sides of the barrier within the council reserve. However, where the barrier is located within individual private sections of land (first stage), it is not obvious who will maintain the state highway side of the barrier. While it is the landowners' responsibility, the lack of direct access and varying ownership could

result in an unsightly barrier viewed from the state highway. Fortunately, at this particular location the planting of appropriate vegetation by the developer has meant minimal maintenance is required; although issues may arise in future. This is a good example of the importance of landscape design for noise bunds. However, in general it is recommended that noise barriers for reverse sensitivity control adjacent to state highways should not be within individual sections, but should be within a council reserve.

5 BUILDING DESIGN

Section 3 describes how installing mechanical ventilation/cooling is a common treatment to reduce road-traffic noise in buildings by allowing windows to be kept closed. Example systems and specific advice on the acoustic treatment of buildings is provided in the Transport Agency guide⁰³.

For higher noise exposures (closer to a road) it may be necessary to upgrade windows as well as providing mechanical ventilation/cooling. A common misconception is that 'double-glazing' is the primary means of noise control. However, if a significant noise reduction across a window is required, achieving

effective seals is usually more important than the glazing configuration. Thin thermal double-glazing has relatively poor acoustic performance due to resonance. More efficient means of noise reduction across windows can be achieved by using thicker glazing, secondary glazing or laminated glass. Typically only those rooms facing the state highway will require treatment, so the measures do not need to extend to the whole house. Additionally, within a certain room, the treatment might not be required for all elevations. For alterations to existing buildings, acoustic treatment should only be required for those parts of the building that are being altered.

FIGURE 12: GLAZING TYPES

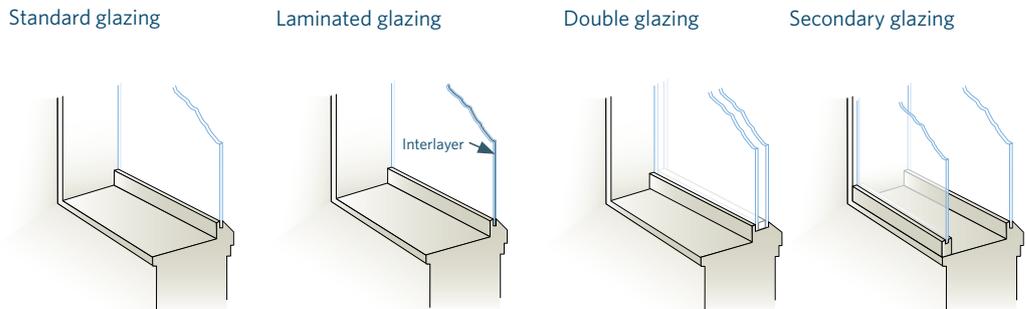
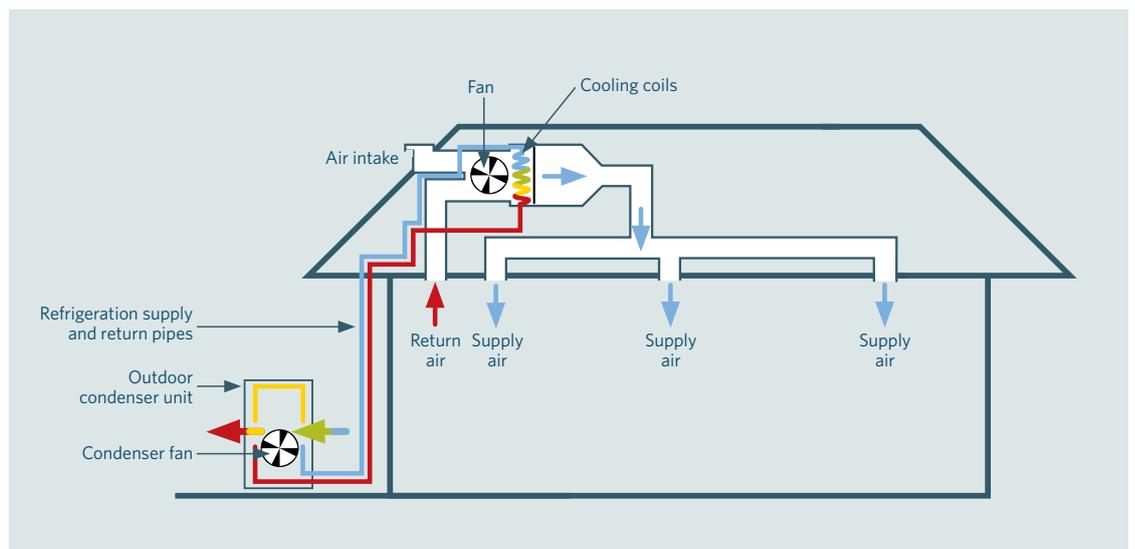


FIGURE 13: DUCTED AIR CONDITIONING SYSTEM



A study has been undertaken to assess the typical costs of treating buildings to achieve the criteria in section 3²⁶. Figure 16 shows the additional acoustic treatment costs calculated for a typical new build single storey home (three bedroom, 175 m²) and double storey home (four bedroom, 225 m²), with base prices of \$235,000 and \$332,000, respectively (2013). This study considers traffic noise levels that

would be similar to a location next to a road with a chip seal surface and 9,000 vehicles per day, or next to a road with a porous asphalt surface and 30,000 vehicles per day. There would also be design, consenting and operation and maintenance costs associated with the acoustic treatments. Many new houses include these acoustic treatments.

²⁶ Beca Ltd (2013) *New Zealand Transport Agency building acoustic mitigation case study.*
www.acoustics.nzta.govt.nz

FIGURE 14: TYPICAL SINGLE STOREY HOME

FIGURE 15: TYPICAL DOUBLE STOREY HOME

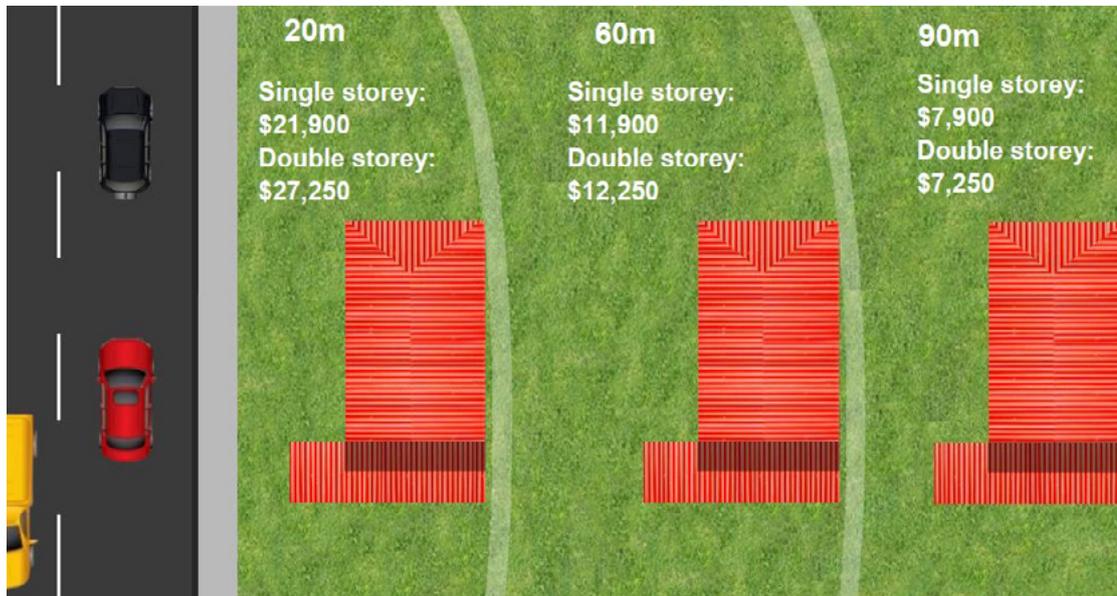


Image from A1 Homes



Image from A1 Homes

FIGURE 16: ACOUSTIC TREATMENT COSTS (EXCLUDING GST) - 2013²⁶



6 REGIONAL AND DISTRICT PLANS

The Transport Agency advocates for statutory planning documents to recognise the effects of nearby development on transport infrastructure, including the national state highway network.

Specifically, the Transport Agency will seek that reverse sensitivity is efficiently managed by local authorities through:

- imposing separation and setback distances between sensitive activities and the road edge (see section 3)
- encouraging non-sensitive land use to separate residential or other sensitive activities from major transport corridors
- adopting effective urban design principles (see page 13) and acoustic treatment performance standards within district plans
- requiring design and construction standards to achieve appropriate internal noise and vibration levels within effects areas.

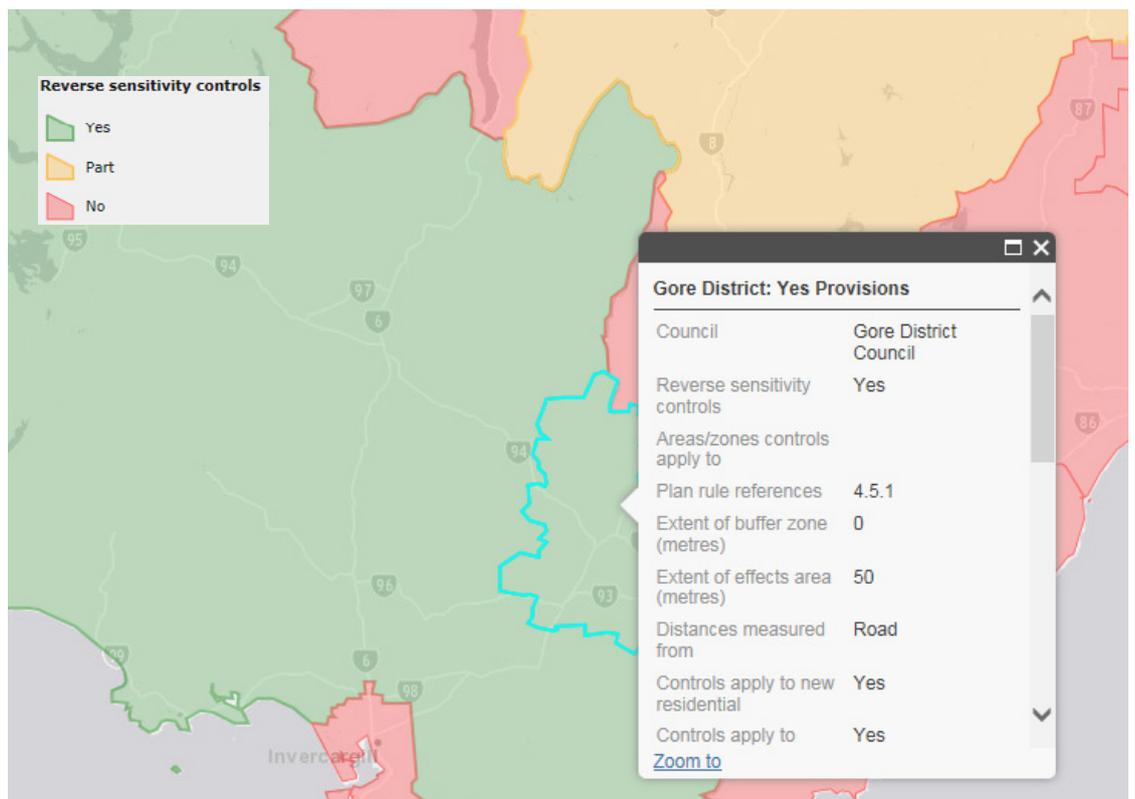
²⁷ NZ Transport Agency
District plan provisions.
www.acoustics.nzta.govt.nz

The Transport Agency participates in review processes of statutory planning documents to advocate for reverse sensitivity provisions that are consistent with the good practice set out in this guide. Using the formal review processes is favoured over initiating private plan change processes. This approach has been adopted because of the significant resource and expense required to prepare and lodge plan changes on numerous statutory planning documents throughout New Zealand. Model plan provisions are provided in section 8 of this guide.

The Transport Agency has collated information about existing reverse sensitivity rules within district plans and displays this material on a web based map²⁷. For current information and provisions it is recommended that the individual district plans are referenced.

Reverse sensitivity controls have the potential to encourage poor urban design outcomes. For example, if solid and tall fences were built to reduce noise in all houses adjacent to an urban arterial, then the vibrancy of the environment could be compromised, potentially affecting the local economy and creating safety issues for pedestrians and cyclists in the road corridor. It is therefore recommended that when implementing reverse sensitivity controls within a district plan, consideration should also be given towards applying good urban design practices.

FIGURE 17: WEB BASED MAP OF DISTRICT PLAN REVERSE SENSITIVITY PROVISIONS



7 RESOURCE CONSENTS AND PLAN CHANGES

The Transport Agency seeks to proactively manage reverse sensitivity effects through adoption of appropriate district-wide controls and standards within district plans. Where these controls have not yet been included in district plans, the Transport Agency also manages reverse sensitivity through participating in the consenting process, primarily through providing submissions on subdivision or land use resource consent applications, and less frequently on discharge consent applications. The Transport Agency can also be a submitter on district plan changes for specific areas. For complicated or significant projects in particular, the Transport Agency seeks to be consulted by applicants prior to lodging a consent application or plan change request. The district planning and consenting process can be used to effectively protect sensitive activities, such as residential development, from undesirable environmental effects of the state highway by identifying and imposing performance standards as conditions on resource consents.

The Transport Agency has developed an effects area, in which it seeks the management of reverse sensitivity effects through the district planning process, and in which it considers proposed developments may cause an effect on the Transport Agency. As described in section 3, the effects area may be up to 100 metres from a state highway, and is not dependent on whether the development directly accesses the state highway.

While the Transport Agency prefers that new noise and vibration sensitive activities are not developed within the buffer area (section 3), in urban areas this may not be a practical outcome, and urban design considerations may lead to development within the buffer area. In these cases the Transport Agency will seek to have appropriate noise and vibration controls included in the district plan or consent conditions.

Overall the Transport Agency considers the district plan process as a proactive mechanism to encourage developers to locate and/or treat their sensitive activity to mitigate reverse sensitivity effects. By including both appropriate permitted and restricted discretionary activity pathways and encouraging buffer and effects areas within district plans, ambiguity in the consenting process is reduced and developers are informed of the potential reverse sensitivity effects.

When an applicant approaches the Transport Agency prior to lodging an application, a review of the location of the development along with the sensitivity of the activity and the proposed controls is undertaken. Based on the outcome of this review, the following mechanisms may typically be sought to address the potential effects of reverse sensitivity:

- modifications to the location of the sensitive activity, and
- the building standards as set out in section 9 of this guide.

If a proposal satisfies the Transport Agency's mechanisms for managing reverse sensitivity and other effects, the Transport Agency will provide its affected party approval for consent applications. The Transport Agency may however decline to provide affected party approval where changes sought to a consent application do not satisfy the Transport Agency's concerns.

For notified consent applications, the Transport Agency may lodge a submission if the reverse sensitivity effects on the state highway network have not been addressed. Lodging a submission secures the Transport Agency's ability to participate in the consent process, including appeal if necessary.

The Transport Agency generally will not seek 'no complaints' covenants as a method to manage reverse sensitivity effects. While such covenants can forewarn prospective tenants of road-traffic noise exposure, it does not mitigate the potential effects.

URBAN DESIGN

There are a wide range of factors that should be considered, with respect to a state highway corridor and surrounding land uses, to achieve good urban design outcomes. The use of buffers and noise barriers for managing reverse sensitivity effects both require careful integration in urban areas to avoid causing other adverse effects.

The Transport Agency urban design guidelines *Bridging the gap*, provide examples of compatible land uses adjacent to urban arterials such as local roads/public transport, cycleways, commercial buildings and public spaces. These land uses form the necessary buffer to manage reverse sensitivity effects.



8 PLAN PROVISIONS

The following definitions, objectives, policies and rules, are provided as guidance for Transport Agency and council planners to manage reverse sensitivity noise and vibration effects on the state highway network. Because the state highway network is linear and therefore adjoins varying noise sensitive activities, it is recommended that local government adopt a district-wide approach to managing reverse sensitivity. These should be considered alongside other section 32 matters.

These rules can also be adapted to apply to mitigating reverse sensitivity effects on local arterial roads and railway infrastructure.

District plans should contain appropriate urban design guidance so that reverse sensitivity controls do not result in high, solid boundary fences/walls, where this would give rise to poor urban design outcomes.

DEFINITIONS

NOISE SENSITIVE ACTIVITIES

- Any residential activity (including visitor accommodation and retirement accommodation).
- Any educational activity.
- Any healthcare activity.
- Any congregations within places of worship/marae.

SIGNIFICANT LAND TRANSPORT NETWORK

Existing or proposed carriageways, structures and installations that due to their location and function are critical to the movement of people and goods within or between a region. These include:

- state highways and local roads classified as arterial or greater in accordance with the One Network Road Classification
- railway networks.

REVERSE SENSITIVITY

Reverse sensitivity is the vulnerability of an established land use to complaint from a new land use. In practice such complaints can compromise the established land use.

STATE HIGHWAY BUFFER AREA

The area shown on **[district plan maps]**.

STATE HIGHWAY EFFECTS AREA

The area shown on **[district plan maps]**.

OBJECTIVES

Objective 1

Significant land transport networks are protected from the reverse sensitivity effects associated with surrounding new and altered land use activities.

Objective 2

Conflict between new and altered land use activities and significant land transport networks is avoided, remedied or mitigated.

POLICIES

Policy 1

Ensure noise sensitive activities are set back a sufficient distance from significant land transport network boundaries to avoid, remedy and mitigate effects.

Policy 2

Allow noise sensitive activities to be located near significant land transport networks only where they do not compromise or limit the existing or planned function of the significant land transport network.

RULES

Within the state highway buffer area and the state highway effects area, all buildings containing new and altered noise sensitive activities must meet the following activity status and relevant standards:

- Activity status table
 - All permitted activities listed in the table below must comply with the standards set out in [3] as follows:
 - Standard [3].A, or
 - Standards [3].B, [3].C, [3].D, and [3].E.
 - All restricted discretionary activities listed in the table below must be assessed with discretion restricted to the matters set out in [2].

ACTIVITY	AREA	URBAN	RURAL / RURAL-RESIDENTIAL
Construction of a building containing a noise sensitive activity	Buffer	Permitted	Restricted discretionary
	Effects	Permitted	Permitted
Alteration of building containing a noise sensitive activity	Buffer and effects	Permitted	Permitted
Any other activity that does not meet [1.a]	Buffer and effects	Restricted discretionary	Restricted discretionary

2. Restricted discretionary activities

In determining an application for resource consent to construct or alter a building containing a noise sensitive activity in the state highway buffer area or effects area, council must have regard to the matters set out below, to which council has restricted the exercise of its discretion.

ACTIVITY LOCATION	MATTERS OF DISCRETION
In the state highway buffer area in (rural and rural-residential zones)	<ul style="list-style-type: none"> Whether the development is able to be located outside the state highway buffer area, and the extent to which the standards in [3] are achieved and the effects of any non-compliance.
All other locations in the state highway buffer area or effects area	<ul style="list-style-type: none"> The effects of non-compliance with the standards in [3].

3. Standards

A. New buildings or alterations to existing buildings containing noise sensitive activities must be at least 40 metres from the edge of the state highway carriageway and there is an existing solid and continuous building, fence, wall or landform that blocks the line of sight from all parts of all windows and doors to the new or altered habitable spaces to any part of the road surface of the state highway. This excludes unaltered existing spaces.

B. New buildings or alterations to existing buildings containing noise sensitive activities, in or partly in the state highway buffer area must be designed, constructed and maintained to achieve road-traffic vibration levels complying with class C of NS 8176E:2005.

C. New buildings or alterations to existing buildings containing noise sensitive activities, in or partly in the state highway buffer area or effects area must be designed, constructed and maintained to achieve the indoor design noise levels from road-traffic set out in (reference table below).

D. If windows must be closed to achieve the design noise levels in [C], the building must be designed, constructed and maintained with a ventilation and cooling system. For habitable spaces a ventilation cooling system must achieve the following:

- Ventilation must be provided to meet clause G4 of the New Zealand Building Code. At the same time, the sound of the system must not exceed 30 dB $L_{Aeq(30s)}$ when measured 1 m away from any grille or diffuser.
- The occupant must be able to control the ventilation rate in increments up to a high air flow setting that provides at least 6 air changes per hour. At the same time, the sound of the system must not exceed 35 dB $L_{Aeq(30s)}$ when measured 1 m away from any grille or diffuser.
- The system must provide cooling that is controllable by the occupant and can maintain the temperature at no greater than 25°C. At the same time, the sound of the system must not exceed 35 dB $L_{Aeq(30s)}$ when measured 1 m away from any grille or diffuser.

E. A design report prepared by a suitably qualified and experienced acoustics specialist must be submitted to the [council officer] demonstrating noise and vibration compliance prior to the construction or alteration of any building containing a noise sensitive activity in or partly in the state highway buffer area or effects area. The design must take into account the future permitted use of the state highway; for existing roads this is achieved by the addition of 3 dB to existing measured or predicted noise levels.

BUILDING TYPE	OCCUPANCY/ACTIVITY	MAXIMUM INDOOR DESIGN NOISE LEVEL $L_{Aeq(24h)}$
Residential	Living spaces, sleeping spaces (including visitor accommodation and retirement accommodation)	40 dB
	Assembly halls	35 dB
Education	Conference rooms, drama studios	40 dB
	Lecture rooms and theatres, music studios	35 dB
	Libraries	45 dB
	Sleeping areas in educational facilities	40 dB
	Teaching areas	40 dB
Health	Overnight medical care, wards	40 dB
	Clinics, consulting rooms, theatres, nurses' stations	45 dB
Cultural buildings	Places of worship, marae	35 dB

Note: Excludes areas not deemed to be habitable spaces as defined by schedule 1 of the Building Regulations 1992.

9 CONSENT CONDITIONS

The following conditions are appropriate for a land use consent enabling new residential buildings to be located in the state highway effects area (but outside the buffer area), where the relevant district plan rules do not cover reverse sensitivity noise effects. Use of these conditions by councils and developers will generally satisfy the Transport Agency with respect to reverse sensitivity effects.

1. Any dwelling on the site must be designed, constructed and maintained to achieve a design noise level of 40 dB $L_{Aeq(24h)}$ inside all habitable spaces.
2. If windows must be closed to achieve the design noise level in **[condition 1]**, the building must be designed, constructed and maintained with a ventilation and cooling system. For habitable spaces the system must achieve the following:
 - › Ventilation must be provided to meet Clause G4 of the New Zealand Building Code. At the same time the sound of the system must not exceed 30 dB $L_{Aeq(30s)}$ when measured 1 m away from any grille or diffuser.
 - › The occupant must be able to control the ventilation rate in increments up to a high air flow setting that provides at least 6 air changes per hour. At the same time the sound of the system must not exceed 35 dB $L_{Aeq(30s)}$ when measured 1 m away from any grille or diffuser.
 - › The system must provide cooling that is controllable by the occupant and can maintain the temperature at no greater than 25°C. At the same time, the sound of the system must not exceed 35 dB $L_{Aeq(30s)}$ when measured 1 m away from any grille or diffuser.
3. A design report prepared by an acoustics specialist must be submitted to the **[council officer]** demonstrating compliance with **[conditions 1 and 2]**, prior to construction or alteration of any dwelling. The design must take into account future permitted use of the state highway; for existing roads this is achieved by the addition of 3 dB to existing measured or predicted levels.



10 GLOSSARY

TERM	DEFINITION	TERM	DEFINITION
AADT	Annual average daily traffic - the vehicle count for an entire year in both directions past a point on the road, divided by the number of days in the year.	Land-use consent	A land-use consent is a resource consent that authorises an activity that is not otherwise permitted under a regional, city or district rule or national environmental standard. Land-use consents are often required for the construction of a new dwelling or alterations to an existing dwelling.
Acoustics specialist	A person with: an engineering or science degree including study of acoustics; at least five years professional experience in acoustics; and chartered or certified status with a body that audits continuing professional development.	Mitigation	Measures designed to reduce environmental effects such as external road-traffic noise levels. Mitigation can include low-noise road surfaces and noise barriers (walls/bunds).
Affected party	An affected party is defined in the RMA as a person or a group of people who may experience an adverse effect from a proposed activity. This effect will be greater than, or significantly different from, the effect on the general public.	Noise sensitive activity	An activity that may be affected by noise from an external source. For example, someone prevented from sleeping due to night-time noise from an adjacent airport.
Buffer area	An area adjacent to a state highway where new or altered sensitive activities should ideally be avoided.	Notice of Requirement	A notice of requirement is a proposal for a designation.
Design noise level	Target noise levels to be used during the design process.	NZS 6806	The New Zealand Standard that describes processes that can be used to assess and, where required, determine appropriate mitigation for road-traffic noise for new and altered roads.
Designations	A designation is a form of spot zoning provision in a RMA district plan that provides notice to the community that a requiring authority (e.g. the NZ Transport Agency) is using or intends to use land in the future for a particular work or project (eg a state highway).	Performance standards	The minimum standard to be met.
Designation conditions	Conditions imposed on a requiring authority as part of the approval to undertake a project or work. Conditions are typically set by a city or district council.	Resource Management Act (RMA)	The RMA sets out the functions, powers and duties of local government, including the resource consent and designation process.
Effects area	An area near a state highway where new or altered sensitive activities should be assessed and treated as necessary to mitigate effects from the state highway.	Requiring authority	A Minister of the Crown; a local or regional authority; or a network utility operator, including the NZ Transport Agency.
Environmental effect	The social, economic, aesthetic and cultural conditions that result in a positive or negative consequence whether temporary or permanent on ecosystems including people, communities and all natural and physical resource (refer RMA sections 2 and 3).	Reverse sensitivity	Reverse sensitivity is the vulnerability of an established land use to complaint from a new land use. In practice such complaints can compromise the established land use.
Habitable space	A space used for activities normally associated with domestic living, but excludes any bathroom, laundry, water-closet, pantry, walk-in wardrobe, corridor, hallway, lobby, clothes-drying room, or other space of a specialised nature occupied neither frequently nor for extended periods (refer NZ Building Code).	Shoulder areas	The general area (sealed or unsealed) between the edge of a traffic lane and a surface water channel, drain, berm or fence/ boundary.
		Significant land transport network	Existing or proposed, carriageways, structures and installations, which due to their location and function are critical to the movement of people and goods within or between regions. These include: <ul style="list-style-type: none"> state highways and local roads classified as arterial or greater in accordance with the One Network Road Classification railway networks.



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This publication is also available on NZ Transport Agency's website at www.nzta.govt.nz



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