Tasmanian State Road Traffic Noise Management Guidelines

Revision 1

October 2015

Department of State Growth

Tasmania
Explore the possibilities

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Glossary

Part A

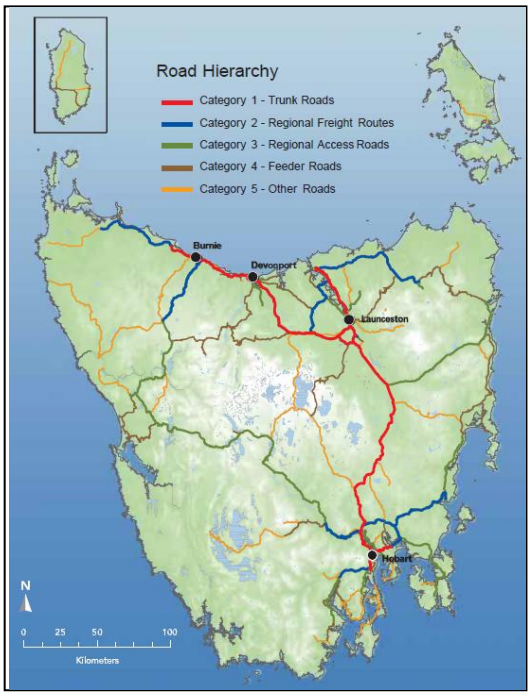
Guideline summary for non-technical readers

This Part A of the guidelines provides a summary for non-technical readers. Part B provides a convenient summary of the process for use by designers and decision makers. The full guidelines are provided in Part C.

What are these guidelines for?

These guidelines – the *Tasmanian State Road Traffic Noise Management Guidelines* – are used by the Department of State Growth to manage traffic noise on State roads. They reflect the overarching principles and strategies of the *State Road Noise Strategy 2011*.

State roads are those roads for which the Department is responsible. They are roads such as highways, main roads, secondary roads and tourist roads. State roads are classified into five categories under the State road hierarchy, as shown in the map below, but these guidelines apply equally to all those roads.



These guidelines do not explicitly apply to any other roads, such as local roads or urban streets, which are the responsibility of relevant councils[1]. Councils may nevertheless choose to use or refer to these guidelines when managing traffic noise on their roads, as they see fit.

What is traffic noise?

Traffic noise is noise generated by vehicles as they travel on roads. Every moving vehicle generates noise, mainly from their tyres and engine.

The level of traffic noise at any given time is primarily dependent on the number of vehicles passing (more vehicles means more noise), the mix of vehicle types (trucks make more noise than passenger vehicles), their speed (faster vehicles make more noise), the road surface (usually rougher surfaces cause more tyre noise) and the road gradient (steeper roads mean more engine noise).

The resultant noise from all these factors propagates outwards from the road as the traffic moves along. The noise diminishes with distance from the road, and can be blocked by intervening ground or structures, but what remains can reach houses or other sensitive buildings such as hotels, schools and hospitals.

How might traffic noise affect me?

As with many other types of noise, traffic noise can cause annoyance if it is too loud. People have differing sensitivities to noise – what may not bother one person may bother another – and no traffic noise management guideline can necessarily satisfy everyone.

However, many decades of studies and experience have led to the development of guideline noise levels that are very well established and widely accepted around the world as providing reasonable and appropriate protection for the general community.

Authorities responsible for managing traffic noise seek to reduce traffic noise to below accepted limits to the extent reasonable, practical and cost-effective. However, it may not always be possible to achieve guideline levels for all houses, meaning that some may be left exposed to higher than desirable noise levels.

These guidelines describe how the Department makes traffic noise management decisions.

Under these guidelines, the Department only considers noise mitigation when a new or upgraded road project is being contemplated. In the absence of a specific project, the Department will not consider mitigating the progressive creep in traffic noise that occurs as a natural consequence of traffic growth.

What level of traffic noise is acceptable?

The key noise level that these guidelines use is 63 dB(A), which means 63 decibels (dB) measured on an A-weighted scale, a scale that matches the way a human ear perceives noise.

By convention, traffic noise is measured and managed using the L_{A10} statistic, which is the noise level exceeded for 10% of the measurement period – in simple terms, the loudest 10% of noise.

The L_{A10} used is the average measured over an 18-hour period between 6 am and midnight. It

[1] Nor do they apply to special roads such as forestry roads, hydro roads or national parks roads

therefore takes account of the varying level of traffic over the day, including the higher noise levels from morning and afternoon traffic peaks and also the noise from traffic extending into the late evening.

A noise level of 63 dB(A) is about the same as the noise level inside a busy office.

The measurement point is outside the house, 1 metre from the most exposed façade. Usually, this will be the front façade[2], so the measurement point will be on a verandah or in the front yard immediately outside the house.

The 63 dB(A) level is set outside a house to protect noise levels inside the house – this outside location means that noise measurements can be made without having to go inside houses.

The external measurement point does not mean that the Department intends to protect the noise environment on the verandah or in front yard and it will not consider such mitigation under any circumstances. However, where it is not practicable to protect the interior noise levels for some reason, the Department may nevertheless as an alternative consider protecting the noise environment outside the rear of the house[3].

For a standard house construction (ie. no special acoustic protection) with doors and windows closed, a traffic noise reduction from outside to inside of at least 25 dB(A) can be expected[4]. This means that a 63 dB(A) noise level outside a house will reduce to less than 38 dB(A) inside the house. This is typical of what would be experienced inside most homes.

The noise level that is examined when making decisions under these guidelines is the predicted level 10 years into the future, recognising the incremental growth in traffic volume that will occur over that period.

Future 18-hour noise levels below 63 dB(A) are deemed to be acceptable. Future noise levels above 63 dB(A) are considered to be undesirable, and where it is reasonable, practical and cost effective the Department will consider incorporating measures into the project that will reduce those future levels to below 63 dB(A).

[2] Although if a house is oriented at an angle to the road it may be another of the facades

[3] Or if a house is oriented at an angle to the road, at the façade opposite to the most exposed facade

[4] Australian Standard 3671-1989 Acoustics—Road traffic noise intrusion—Building siting and construction

Even if reducing noise to less than 63 dB(A) cannot be achieved, that does not necessarily mean that noise impacts will be excessive. The way the decibel scale and the human ear works, noise differences of 2 dB(A) are not noticeable by most people.

This means that a level of 65 or 66 dB(A) may not be perceptibly different to 63 dB(A) even though it is measurably different using a noise meter.

The existing traffic noise levels at a house are also relevant to the noise mitigation decision making under these guidelines. For example, if the noise levels are already over 63 dB(A) prior to the road project occurring, the target future level may be higher than 63 dB(A).

This may lead to situations that might seem unfair to some people. For example, a house whose noise level will increase by 2 dB(A) from its current 64 dB(A) to a new 66 dB(A) may not be eligible for mitigation but a neighbouring house whose level will increase by the same amount but from its current 62 dB(A) to a new 64 dB(A) may be eligible.

This potential apparent unfairness is a consequence of the need for these guidelines to achieve a balance between trying to mitigate traffic noise equally for everyone and having to recognise competing priorities for scarce road funds. As noted in the overarching *State Road Noise Strategy 2011*, noise levels above 63 dB(A) but below 68 dB(A) are not necessarily considered to be unacceptable. While the Department will within its available resources attempt to prevent houses that are currently below 63 d(A) from creeping above that target limit, funding limitations prevent it from dealing equally with already noisier houses.

For the same reasons of prudent expenditure of limited funds, the Department may not always be able to achieve the 63 dB(A) target limit anyway. In each case it will apply tests of reasonableness, practicality and cost-effectiveness. Because noise increases of 3 dB(A) or less will not be readily perceptible, a numerical exceedence of 63 dB(A) by less than 3 dB(A) will not necessarily result in a perceptible loss of amenity.

How can traffic noise be reduced?

Reducing traffic noise can be done by reducing the noise at source, reducing its propagation towards houses or reducing its transmission into the house interiors, or by a combination of all three.

Reducing traffic noise at source is primarily through choosing an appropriate seal type. For example, a dense graded asphalt seal is

approximately 4 dB(A) quieter than a 14 mm chip seal. However, asphalt is much more expensive and is also not as hard wearing as chip seal, so it carries a significant cost burden.

Reducing traffic noise propagation is usually done by constructing noise mounds (mounds of soil, which are then vegetated) or noise walls alongside the road. To be most effective, these need to be as close as possible to the road (thereby blocking the most noise), without causing a safety hazard. A similar effect can be achieved by constructing the road in cut if the topography and budget allow that – the sides of the cutting then effectively become a noise wall. As an approximate guide, blocking the line of sight of the road from a house will also block much of the traffic noise, although, unlike sight, some residual noise can 'bleed' around and over these barriers and still reach houses.

Reducing traffic noise transmission into house interiors is usually done by using acoustic glass on windows that face the road. This is often referred to in shorthand as "double glazing" windows but it needs to be the right type of double glazing, and the right type of single glazing can also be effective.

The Department's approximate order of preference of mitigation methods is generally as follows, although this is only an approximate guide and may not be applicable on any particular project.

1. **Road design**: If noise impacts can be reduced by appropriate road design while not compromising other design intents (eg. safety, functionality), the need for supplementary mitigation can be avoided or reduced.
2. **Road seal selection**: If a quieter road seal (eg. an asphalt rather than a chip seal) can be afforded by the project, the need for supplementary mitigation can be avoided or reduced. However, quieter seals such as asphalt are significantly more expensive and are usually less resilient to damage from tyres, requiring more frequent maintenance and replacement at greater cost.
3. **Noise mounds**: Where the road alignment and topography allows, the construction of earthen noise mounds, ideally using excavation fill from the construction works, can effectively screen houses to mitigate noise. If construction fill can be used, mounds can be very cost-effective. However, noise mounds occupy a comparatively large footprint and are often not possible unless the road reservation is wide and/or roadside freehold land is purchased or compulsorily acquired.
4. **Roadside noise barriers**: Constructed noise walls can be very effective and can usually be constructed within the road reservation (but outside the safety run-off zone of vehicles). However, they must be made of appropriate materials and have strong structural foundations and are comparatively expensive. They are also vulnerable to graffiti attacks and can create undesirable alleys and lurk places.
5. **Architectural treatment of houses**: The preceding measures tackle traffic noise at or near the source, reducing the noise that reaches buildings in the first instance. By reducing noise propagation, they also provide benefits to all buildings in the vicinity, rather than address noise on a house by house basis. Architectural treatment of houses provides an alternative or supplemental mitigation measure at individual houses, usually by providing acoustic glass to windows. A disadvantage is that they require individual landowner agreements and construction works at individual houses, which can be intrusive, and unlike the preceding methods they only address internal noise with no ancillary benefits for noise in outside areas.

When might these guidelines be relevant to me?

Because these guidelines only explicitly apply to State roads, they are only explicitly relevant to houses that lie along the road corridors shown in the map earlier.

It is possible, however, that councils may choose to use them for local roads or urban streets too.

The Department only considers reducing traffic noise when there is a road construction or upgrade project planned. Traffic noise mitigation considerations can then form part of the project's budget.

The Department has no funds to use to mitigate traffic noise unless there is such a project. For example, while the progressive growth of traffic on a long established road may over the years have led to traffic noise from that road now exceeding 63 dB(A) at nearby houses, in the absence of an upgrade project there is no significant prospect of noise mitigation work being undertaken.

Where there is a project to construct a new road or upgrade an existing road, these guidelines will be activated and they will be applied to houses in the vicinity of the project.

What happens if there's a road project near me?

When there is a new or upgrade road project, the Department will apply these guidelines as part of its project planning and design work[5].

In practical terms, the process will typically be as follows.

1. The Department will use these guidelines to determine whether the project is eligible for noise mitigation.
2. If the project is eligible, the Department will usually measure the existing traffic noise along the project route and also deploy traffic counters to measure existing traffic volumes.
3. The future design of the road and the future traffic volumes will be used to predict 10-year future traffic noise at houses along the project route.
4. The Department will use these guidelines to determine which (if any) houses along the project route are eligible for noise mitigation.
5. In making these decisions, the Department will apply the principles of feasibility, reasonableness and practicality.
6. The Department will determine what (if any) noise mitigation measures will be considered for each eligible house – the primary options are low noise road seal, noise mounds, noise walls and acoustic windows.
7. If the project requires a development application to be submitted to the relevant council, the development application will include a description of the proposed noise mitigation measures – usually this will be advertised by the council for public comment.
8. If the proposed noise mitigation includes measures that directly affect houses or properties such as installing noise fences along property boundaries or offering acoustic glass for houses, the Department will consult directly with the property owners.
9. If part of a property must be compulsorily acquired for the project, noise impacts on the property will form part of the compensation negotiations.
10. Following construction, the Department may measure noise levels again to assess the effectiveness of the mitigation. This is not to provide any guarantee of effectiveness, however. While mitigation will be designed in good faith the many variables affecting noise mean that there can be no absolute certainty of outcome and the Department makes no guarantees of such.

Noise study reports undertaken for road projects will usually be made publicly available as part of the development approval process – they would form part of the supporting documentation advertised for public comment.

However, in some cases the reports might be withheld from public display because, for example, they may show current and expected future noise levels that might unreasonably affect the privacy of home owners or the value of their property. In these cases, the Department will treat the reports as being commercial-in-confidence.

[5] The Department usually engages specialist consultants for much of this work

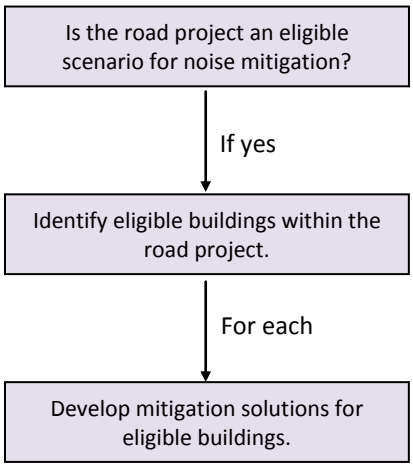
Part B

Guideline summary
for
designers and decision makers

These guidelines describe the process that the Department will follow to better manage traffic noise on State roads. The process follows three stages. Firstly, a decision is made as to whether a particular situation is eligible for traffic noise mitigation. Secondly, if the situation is eligible then the specific eligibility of particular buildings within that situation is determined. Thirdly, for each eligible building the appropriate mitigation approach is determined.

Part A of the guidelines provides a summary for non-technical readers. This Part B provides a convenient summary of the process for use by designers and decision makers. The full guidelines are provided in Part C.

Decision making approach



Identifying scenarios and buildings for which noise mitigation will be considered

The Department will only consider noise mitigation in particular circumstances. Before proceeding to determine whether a project is eligible for noise mitigation, the project must first be determined to be a project for which noise mitigation will be considered.

The road project should be reviewed against Table A, Table B, Table C and Table D in this Part B (respectively Table 7, Table 8, Table 9 and Table 11 in Part C) to determine whether the project falls into a scenario where noise mitigation will be considered by the Department.

Table A is relevant to projects on existing roads. Table B is relevant to new road projects. Table C describes common scenario complications and provides guidance on how they should be resolved. Table D describes the procedure that should be taken to identify eligible scenarios.

If the project is deemed to be eligible, buildings within the project should then be labelled according to the terminology described in Table E in this Part B (Table 10 in Part C) and assessed for eligibility using the procedure described in Table F in this Part B (Table 12 in Part C).

If a building is deemed to be eligible, mitigation solutions should be developed using the procedures described in Table G in this Part B (Table 13 in Part C). If decisions need to be made between mitigation method alternatives, Table H in this Part B (Table 6 in Part C) can be used to assist the comparative evaluation.

The decision making process should be recorded using the templates provided in Table I to Table L in this Part B (Table 14 to Table 17 in Part C).

Mitigation scenarios – existing roads

Table A: Scenarios for the Department 's consideration of traffic noise mitigation - existing roads

Scenario	Description	Noise mitigation consideration
Minor road works	Maintenance, repair and minor upgrades of roads, including: (a) minor widening or narrowing of existing carriageways; and (b) making, placing or upgrading kerbs, gutters, footpaths, roadsides, traffic control devices and markings, street lighting and landscaping.	No mitigation will be considered.
Safety upgrades	Works related to improving road safety. Examples include: installation of crash barriers and fences; seal replacement for skid prevention; road shoulder sealing; widening to create turning lanes; installation of speed controls; signage; signals; removal of vegetation.	No mitigation will be considered.
Reconfiguration	The reconfiguration of lanes or traffic controls within the existing carriageway width. Examples include: the creation of a bus lane; the construction of traffic islands; the rearrangement of safety barriers; a change in lane width, road shoulder sealing.	No mitigation will be considered.
Junction signalization	Installing traffic lights.	No mitigation will be considered.
Roundabout construction	Replacing a junction with a roundabout.	No mitigation will be considered.
Junction upgrade	An upgrade of a junction, other than signalization or roundabout construction	No mitigation will be considered.
Land use change	Land use changes, such as rezoning or subdivision, may bring sensitive developments (e.g. houses) closer to an existing road.	No mitigation will be considered.
Speed increase	Increases in zone speed limits.	Mitigation will be considered where there is a permanent increase in a speed limit of more than 20 km/h. No mitigation will be considered for speed increases less than this.
Maintenance change to a noisier seal on a previously mitigated road	A change to a noisier seal as part of maintenance pavement resurfacing on a section of road that has previously been the subject of mitigation considerations under these guidelines.	If the resealing is necessary for safety reasons, no mitigation will be considered but otherwise mitigation will be considered.
Maintenance change to a noisier seal on a previously unmitigated road	A change to a noisier seal as part of maintenance pavement resurfacing on a section of road that has not previously been the subject of mitigation considerations under these guidelines.	Mitigation will not be considered unless the immediate consequential L_{A10}(18 hour) will exceed 68 dB(A).
Natural traffic growth	Traffic volumes naturally increase as population increases. Growth rates vary depending on the location and type of road but are typically in the order of 1 to 3 %.	Mitigation will not be considered unless the immediate L_{A10}(18 hour) exceeds 68 dB(A) and then it will be considered on a State wide prioritisation basis.
Traffic volume change due to permanent rerouting	Road network decisions, such as opening or closing roads can have permanent flow on effects for other roads. Temporary rerouting, such as due to road works, will not warrant noise mitigation consideration.	Mitigation will not be considered unless the rerouting results in a material (>10%) increase in traffic volumes and the immediate consequential L_{A10}(18 hour) will exceed 68 dB(A). Mitigation considerations will be limited to sections of immediately affected roads extending no further than their junction with any other road. Mitigation will not be considered for temporary rerouting.
Heavy traffic permanent rerouting	Road network decisions on preferred heavy vehicle routes may permanently increase the proportion of heavy vehicles of particular routes. Temporary rerouting, such as due to road works, will not warrant noise mitigation consideration.	Mitigation of night time noise will be considered for category 1, 2 and 3 roads if the 10-year future L_{A10}(8 hour) from heavy vehicles will exceed 45 dB(A) as a result of a Departmental decision. For other situations, including heavy vehicle daytime noise, mitigation will not be considered but operational measures will be encouraged. Mitigation will not be considered for temporary rerouting.
Lane addition or realignment within existing road corridor	Road widening by lane addition or road realignment within an established road corridor.	No mitigation will be considered if the lane addition or realignment is simply to improve safety or traffic flow. If the lane addition or realignment is to facilitate a material (>10%) increase in traffic volume, mitigation will be considered.
Lane addition or realignment extending outside existing road corridor	Road widening by lane addition or road realignment may take the carriageway outside the established road corridor.	This will be taken to be a new road scenario (Table B).
Carriageway addition within an existing road corridor	Road capacity increase by the addition of a new carriageway within an established road corridor.	This will be taken to be a new road scenario (Table B).
In all the above scenarios where mitigation will be considered, the general over-riding exclusion will apply, namely that the Department will not consider traffic noise mitigation for new buildings or extensions to existing buildings or new sensitive uses in existing buildings if those buildings or extensions are less than 50 m from the edge of an existing or planned category 1, 2 and 3 road corridor.		

Mitigation scenarios – future roads

Table B: Scenarios for the Department's consideration of traffic noise mitigation - future roads

Scenario	Description	Noise mitigation consideration
Lane addition to an existing road but extending outside existing road corridor	Road widening by lane addition may take the width of the carriageway outside the established road corridor.	Mitigation will be considered.
Carriageway addition to an existing road within an existing road corridor	Road capacity increase by the addition of a new carriageway within an established road corridor.	Mitigation will be considered.
Carriageway addition to an existing road but extending outside an existing road corridor	Road capacity increase by the addition of a new carriageway outside an established road corridor.	Mitigation will be considered.
Realignment of an existing road, extending outside existing road corridor	Road realignment may be for many reasons, including improving safety or traffic flow.	Mitigation will be considered.
New road outside a proclaimed future road corridor and planning scheme future road corridor	A new road is proposed but without sufficient planning lead time to either proclaim a road corridor or show the corridor in the planning scheme.	Mitigation will be considered.
New road within a proclaimed future road corridor	A new road is proposed and there has been sufficient planning lead time to proclaim a road corridor.	Mitigation will not be considered within the proclaimed corridor. Mitigation will be considered outside the proclaimed corridor but not on land that was rezoned or subdivided after the proclamation date.
New road within a planning scheme future road corridor	A new road is proposed and there has been sufficient planning lead time to show the corridor in the planning scheme.	Mitigation will be considered but not on land that was rezoned or subdivided after the road corridor was established in the planning scheme.
All mitigation consideration is for 10-year future noise. In all the above scenarios where mitigation will be considered, the general over-riding exclusion will apply, namely that the Department will not consider traffic noise mitigation for new buildings or extensions to existing buildings or new sensitive uses in existing buildings if those buildings or extensions are less than 50 m from the edge of an existing or planned category 1, 2 and 3 road corridor.		

Scenario complications

Table C: Approaches to anticipated scenario complications

Scenario complication	Department's approach
Some sensitive use building owners might want noise barriers to be constructed but others may not (eg. because they may block views)	The Department will examine the feasibility of using a combination of noise barriers and acoustic treatments to attempt to satisfy all parties. However, if a mix of barriers and treatments is not reasonable and practicable, the Department will adopt the most cost effective single solution approach.
A sensitive use building owner might accept money to pay for acoustic treatment to their building but then not install that treatment	When offering any acoustic treatment, the Department will not provide money directly to owners but instead will agree on the acoustic treatment to be done. The owner will then seek quotes and the Department and the owner will agree on which quote to accept. The Department will then pay for agreed works to be completed.
A resident might be annoyed by traffic noise even though the noise level is less than L_{A10}(18 hour) 63 dB(A)	The Department will not consider noise mitigation in these circumstances, unless noise mitigation forms part of a compensation agreement made under the *Land Acquisition Act 1993.*
A sensitive use building owner might forego offered acoustic treatment for their building but later change their mind	The Department will not reconsider offering acoustic treatment if an offer has been previously refused unless a fresh upgrade or new road project is being considered.
A sensitive use building owner might forego offered acoustic treatment for their building but later sell their building to someone who does want acoustic treatment	The Department will not consider offering acoustic treatment to the new owner unless a fresh upgrade or new road project is being considered.
A sensitive use building might be multistorey, with living areas not on the ground floor, making the use of noise barriers for mitigation problematic	The Department will only consider noise mitigation to protect ground floors, using a prediction and measurement reference point 1.5 m above the natural ground surface. Upper floors may also gain some benefit from that mitigation but the design will not target those upper levels.
A fresh spray seal will initially be noisier until it beds down with use	There will be a temporary higher noise that will abate as the seal settles in and the sharp angles of fresh stones are abraded. The Department will adopt the expected noise level from the bedded seal for its mitigation considerations and will not consider mitigation for the temporary extra noise.
While barriers constructed within a road project area can mitigate sideways propagation of traffic noise, the orientation of a road might mean that noise propagating lengthways may affect sensitive use building further along the road, away from the defined project area	Noise barriers constructed as part of new or upgrade road projects will not extend beyond the extent of the project area. If any sensitive use buildings beyond the project area are predicted to be exposed to traffic noise greater than a target criterion as a result of the project, noise mitigation by acoustical treatment will be considered.
Not all situations neatly fit into one scenario. Example 1: A safety upgrade and reconfiguration (which on its own is an ineligible scenario) may require a minor excursion outside the existing road corridor (which on its own is an eligible scenario). Example 2: Conversely, a realignment outside the existing road corridor to achieve better traffic flow (which on its own is an eligible scenario) may also involve a reconfiguration and improve safety (which on its own is an ineligible scenario).	The predominant scenario will apply. In Example 1, the predominant purpose of the project is a safety upgrade and reconfiguration, so the project will be deemed ineligible for noise mitigation notwithstanding the fact that there is an excursion outside the existing road corridor. In Example 2, the predominant purpose is a road realignment for improved traffic flow, so the project will be deemed eligible for noise mitigation, notwithstanding the fact that the project also includes a reconfiguration and improves safety.
Noise walls may be the most appropriate mitigation solution but may not be supported by some house owners; for example, because they shade their garden or block their view	Subject to the tests of reasonableness, practicality and cost-effectiveness the Department will seek a solution or combination of solutions that has the support of the majority of residents but in doing so there can be no guarantee that all residents will receive their preference.
On a project that moves a road further away from an eligible house, the future noise due to natural traffic growth will be less than what it would otherwise have been if there had been no project and that growth had simply occurred on the existing road.	Although just by moving the road away the project provides a noise benefit even without noise mitigation, the Department will nevertheless consider additional mitigation if the target noise limit is exceeded.

Identifying eligible scenarios

Table D: Identification of eligible scenarios

Step		Outcome
1	Is the road a State road (ie. within the Department's responsibility)	If no, stop. No further consideration of noise mitigation.
		If yes, proceed to step 2.
2	Is the scenario one of the following?	If no, stop. No further consideration of noise mitigation.
		If yes, proceed to step 3.
	Existing roads Permanent increase in the maximum speed limit to more than 20 km/hr above the existing limit. Change to a noisier seal type that takes 10-year future traffic noise above L_{A10}(18 hour) 68 dB(A). Natural traffic growth that takes 10-year future traffic noise above L_{A10}(18 hour) 68 dB(A). A permanent material (>10%) increase in the volume of traffic as a result of a Departmental decision that takes 10-year future traffic noise above L_{A10}(18 hour) 68 dB(A). A permanent increase in the proportion of heavy vehicles as a result of a Departmental decision that takes 10-year future night time traffic noise from heavy vehicles (considered alone) on a category 1, 2 or 3 road above L_{Aeq}(8 hour) 45 dB(A). Lane addition or road realignment within an established road corridor to facilitate a material (>10%) increase in traffic volume (not simply safety or traffic flow improvements). **Future roads** Lane addition extending outside the existing road corridor Carriageway addition to existing road Realignment extending outside the existing road corridor New road outside a proclaimed future road corridor and planning scheme road corridor New road within a proclaimed future road corridor and adjacent land was built on or zoned for sensitive use prior to the proclamation date New road within a planning scheme road corridor and adjacent land was built on or zoned for sensitive use prior to the corridor addition to the scheme	
3	Proceed to Table F to identify buildings eligible for noise mitigation.	

(See Table C for guidance on how to manage scenario complications.)

Table E: Building eligibility labels

<table>
<tr><th colspan="4">Greenfield situation</th></tr>
<tr><td colspan="2" rowspan="2">Compares existing L_{Aeq}(16 hour) noise in the absence of a road with 10-year future traffic noise when the road will be present</td><td colspan="2">Future L_{10}(18 hour) dB(A)</td></tr>
<tr><td>≤ 15 increase</td><td>> 15 increase</td></tr>
<tr><td colspan="2">Ineligible</td><td>15-delta</td></tr>
<tr><th colspan="4">Non-greenfield situation</th></tr>
<tr><td colspan="2" rowspan="2">Compares existing traffic noise with 10-year future traffic noise</td><td colspan="3">Future L_{10}(18 hour) dB(A)</td></tr>
<tr><td>L ≤ 63</td><td>63 < L ≤ 68</td><td>L > 68</td></tr>
<tr><td rowspan="2">Now</td><td>L ≤ 63</td><td>Ineligible</td><td>63-plus</td><td>63-plus</td></tr>
<tr><td>L > 63</td><td>Ineligible</td><td>63-stet (ineligible)</td><td>68-plus</td></tr>
<tr><th colspan="4">Heavy vehicle night time</th></tr>
<tr><td colspan="2" rowspan="2">Compares existing night time heavy vehicle noise with 10-year future night time heavy vehicle noise</td><td colspan="2">Future L_{eq}(8 hour) dB(A)</td></tr>
<tr><td>≤ 45</td><td>> 45</td></tr>
<tr><td colspan="2">Ineligible</td><td>45-heavy</td></tr>
<tr><td colspan="4">See Table F for more explanation of labeling</td></tr>
</table>

Identifying eligible buildings

Table F: Identification of eligible buildings

Step	
1	Identify all sensitive use buildings within the traffic noise assessment area, being an area out to a nominal distance of 300 m either side of the road.
2	Where there is an existing approved but undeveloped residential subdivision within the noise assessment area, assume a reasonable location for future sensitive use building and adopt those locations as presumed sensitive use buildings.
3	Exclude from further assessment all buildings that are less than 50 m away from the edge of the road corridor and which were built subsequent to the construction of the road or the proclamation of the road corridor or the depiction of the road corridor in a planning scheme.
4	Measure existing L_{A10}(18 hour) traffic noise and traffic counts at representative locations(s) along the road or, in the case of a greenfield situation, measure L_{Aeq}(16 hour) ambient noise at representative locations along the proposed road alignment.
5	Determine (by measurement or modeling) existing L_{A10}(18 hour) traffic noise at assessment building facades (allowing for the 2.5 dB(A) façade effect**).
6	Predict L_{A10}(18 hour) noise at assessment building facades (allowing for the 2.5 dB(A) façade effect) for 10 years in the future for existing roads or 10 years after the completion of the road works for future roads.
7	Identify all ***63-plus*** buildings, being assessment buildings where the existing L_{A10}(18 hour) traffic noise at the building façade is less than or equal to 63 dB(A) but at which the 10-year future noise will be greater than 63 dB(A).
8	Exclude from further assessment all ***63-stet*** buildings, being assessment buildings where the existing L_{A10}(18 hour) traffic noise is already greater than 63 dB(A) but at which the 10-year future L_{A10}(18 hour) traffic noise will be less than or equal to 68 dB(A).
9	Identify all ***68-plus*** buildings, being assessment buildings where the existing L_{A10}(18 hour) traffic noise is already greater than 63 dB(A) and at which the 10-year future L_{A10}(18 hour) traffic noise will be greater than 68 dB(A).
10	For a greenfield situation, identify all ***15-delta*** buildings, being assessment buildings where the 10-year future L_{A10}(18 hour) traffic noise will be more than 15 dB(A) greater than the existing L_{Aeq}(16 hour) ambient noise.
11	Identify any ***45-heavy*** buildings where a permanent increase in the proportion of heavy vehicles as a result of a Departmental decision will take 10-year future night time heavy vehicle traffic noise on a category 1, 2 or 3 road above L_{Aeq}(8 hour) 45 dB(A).
12	Carry all ***63-plus***, ***68-plus***, ***15-delta*** and ***45-heavy*** buildings forward as eligible buildings and apply Table G to develop mitigation solutions.

* Category 1, 2 or 3 roads as per the State Road Hierarchy (see section 2.1 of Part C).

** See section 6.2 of Part C.

Developing mitigation solutions

Table G: Development of mitigation solutions for eligible buildings

	Step
1	For ***63-plus*** buildings, determine the external noise mitigation requirements (speed changes, road seal type, noise barriers, noise mounds etc) that would be required to reduce the external 10-year future road traffic noise at the most exposed sensitive use building façade to L_{A10}(18 hour) 63 dB(A) or less.
2	For ***68-plus*** buildings, determine the external noise mitigation requirements (speed changes, road seal type, noise barriers, noise mounds etc) that would be required to reduce the external 10-year future road traffic noise at the most exposed sensitive use building façade to L_{A10}(18 hour) 68 dB(A) or less.
3	For ***15-delta*** buildings, determine the external noise mitigation requirements (speed changes, road seal type, noise barriers, noise mounds etc) that would be required to reduce the external 10-year future road traffic noise increase at the most exposed sensitive use building façade to L_{A10}(18 hour) 15 dB(A) or less.
4	Assess the reasonableness and practicality of the required noise mitigation to determine whether the relevant noise criterion can be achieved within the budget.
5	Where the external noise targets at the most exposed façade of a ***63-plus***, ***68-plus*** or ***15-delta*** building cannot be achieved, determine the reasonableness, practicality and desirability of achieving the alternative external noise criterion of L_{A10}(18 hour) 52 dB(A) in any existing outdoor living area located on the opposite side of the sensitive use building to the façade most exposed to road traffic noise.
6	Where external noise criteria can reasonably and practicably be achieved for a ***63-plus***, ***68-plus*** or ***15-delta*** building, proceed with the road design on that basis.
7	Where external noise criteria cannot reasonably and practicably be achieved for a ***63-plus***, ***68-plus*** or ***15-delta*** building, develop any reasonable and practicable acoustic treatment solutions calculated to achieve a nominal daytime internal traffic noise design criterion of L_{Aeq}(16 hour) 35 dB(A)).
8	For any ***45-heavy*** buildings, develop any reasonable and practicable acoustic treatment solutions calculated to achieve a nominal internal 10-year future night time traffic noise design criterion of L_{Aeq}(8 hour) 30 dB(A)).
9	For any building where acoustic treatment is proposed, offer that treatment to the sensitive use building owner and, if the offer is accepted, enter into a corresponding agreement.
10	Proceed with the project, incorporating all reasonable and practicable external noise mitigations and agreed acoustic treatments.

Table H: Qualitative noise mitigation methodology option evaluation matrix

Assessment criteria	Road design	Road seal	Noise mounds	Noise walls	Acoustic windows	Monetary compensation	Other (specify)
Road safety implications							
Integration with road design							
Achievement of target noise levels				`			
Encroachment onto private land							
Impingement on houses							
Aesthetic considerations							
Local community acceptance							
Wider community acceptance							
Risks of antisocial consequences							
Constructability							
Maintainability							
Capital cost to project							
Ongoing maintenance costs							
Net score							

Scoring

+++	Major benefits
++	Moderate benefits
+	Minor benefits
0	Insignificant (no) effects
-	Minor drawbacks
- -	Moderate drawbacks
- - -	Major drawbacks

The scoring should be done by each team member independently. Each criterion of each option should be scored using +++ to - - -. The reason for each score should be recorded in a similar companion matrix. The scores of each column should then to be added to calculate a net score (each plus cancels out a minus and *vice versa*) for each option.

The Project Manager should then transfer the net scores of each team member to a similar aggregated matrix. The overall reason for each score should be summarised in a similar companion matrix. The scores of each column of the aggregated matrix should then to be added to calculate an overall net score for each option.

Decision making templates

Table I: Decision documentation - Project eligibility

Project name:

Project manager:

Date:

	Step	Yes/No	Outcome
1	Is the road a State road (i.e. within the Department's responsibility)?		If no, proceed to step 3 then stop, with no further consideration of noise mitigation. If yes, proceed to step 2.

2	**PROJECT SCENARIO – is the scenario one of the following?**	**Yes/No**
	Existing roads	
a.	Permanent increase in the maximum speed limit to more than 20 km/hr above the existing limit?	
b.	Change to a noisier seal type that takes 10-year future traffic noise above L_{A10}(18 hour) 68 dB(A)?	
c.	Natural traffic growth that takes 10-year future traffic noise above L_{A10}(18 hour) 68 dB(A)?	
d.	A permanent material (>10%) increase in the volume of traffic as a result of a Departmental decision that takes 10-year future traffic noise above L_{A10}(18 hour) 68 dB(A)?	
e.	A permanent increase in the proportion of heavy vehicles as a result of a Departmental decision that takes 10-year future night time traffic noise from heavy vehicles (considered alone) on a category 1, 2 or 3 road above L_{Aeq}(8 hour) 45 dB(A)?	
f.	Lane addition or road realignment within an established road corridor to facilitate a material (>10%) increase in traffic volume (not simply safety or traffic flow improvements)?	
	Future roads	
g.	Lane addition extending outside the existing road corridor?	
h.	Carriageway addition to existing road?	
i.	Realignment extending outside the existing road corridor?	
j.	New road outside a proclaimed future road corridor and planning scheme corridor?	
k.	New road within a proclaimed future road corridor and adjacent land was built on or zoned for sensitive use prior to the proclamation date?	
l.	New road within a planning scheme road corridor and adjacent land was built on or zoned for sensitive use prior to the corridor addition to the scheme?	
	Scenario complications Is a scenario complication invoked? If yes, describe it below:	
	Do multiple scenarios apply? If so, describe below which scenario is considered to be dominant and why:	

3	Based on all the above, is the project eligible for mitigation? If no, stop, with no further consideration of noise mitigation. If yes, proceed to identify buildings eligible for noise mitigation.	**Yes/No**

Table J: Decision documentation - Building eligibility

Project name:

Project manager:

Date:

Receiver number	Receiver address	Existing traffic noise level at façade L_{10}(18 hour) dB(A)	10-year future traffic noise level at façade if the project does not proceed L_{10}(18 hour) dB(A)	10-year future traffic noise level at façade if the project does proceed L_{10}(18 hour) dB(A)	Building eligibility classification label (see Table F for label definitions)	Noise target to achieve L_{10}(18 hour) dB(A)	Required noise reduction to achieve target L_{10}(18 hour) dB(A)
1							
2							
3							
etc							

All noise levels are 1 m from the most exposed building façade and include a +2.5 dB(A) allowance for the façade effect

Table K: Decision documentation - Building eligibility for night time heavy vehicle noise

Project name:

Project manager:

Date:

Receiver number	Receiver address	10-year future number of heavy vehicles passing at night (between 11 pm and 7 am)	10-year future night time noise level at façade from those heavy vehicles L_{eq}(8 hour) dB(A)	Building eligibility classification (see Table F for label definitions)	Required noise reduction to achieve 45 dB(A) if building is 45-heavy or not applicable otherwise L_{eq}(8 hour) dB(A)
1					
2					
3					
etc					

All noise levels are 1 m from the most exposed building façade and include a +2.5 dB(A) allowance for the façade effect

Table L: Decision documentation - Summary statistics for building mitigation

Project name:

Project manager:

Date:

Classification group (see Table F for label definitions)	Total number of buildings in classification group	Number of buildings exceeding target by:			
		< 1 dB(A)	1 to 2 dB(A)	2 to 3 dB(A)	>3 dB(A)
Ineligible		(Not applicable)	(Not applicable)	(Not applicable)	(Not applicable)
63-stet		(Not applicable)	(Not applicable)	(Not applicable)	(Not applicable)
63-plus					
68-plus					
15-delta					
45-heavy					
Total					

Summary of guideline principles

Note: In applying these principles, reference should be made to the context within which they are each established in Part C.

1. The Department will apply these guidelines to the State road network. In practice, only category 1, 2 and 3 roads are likely to warrant noise mitigation because traffic volumes and speeds on category 4 and 5 roads will typically be too low to trigger established noise criteria.

2. The Department will only consider noise mitigation when a new or upgraded road project is being contemplated. In the absence of a specific project, the Department will not consider mitigating the progressive creep in traffic noise that occurs as a natural consequence of traffic growth.

3. Both existing buildings and buildings approved but not yet built at the cut-off date will be considered for mitigation eligibility – if a road project requires planning approval the cut-off date for building consideration will be the date that the road project's development application is submitted to Council; if planning approval is not required the cut-off date will be the date construction tenders are called or maintenance work is commissioned.

4. Target noise limits will be assessed against 10-year future noise levels, which are the predicted noise levels 10 years into the future after completion of the road project's construction.

5. The Department will not consider noise mitigation for buildings that are less than 50 m away from the edge of the road corridor and which were built subsequent to the construction of the road or the proclamation of the road corridor or the depiction of the road corridor in a planning scheme.

6. Any decision made by the Department under these guidelines will be subject to reasonableness, practicality and cost-effectiveness tests.

7. For the purposes of these guidelines, two of the key descriptors that the Department will commonly use are L_{A10}(18 hour) and L_{Aeq} (T), where the time period, T, depends on the situation.

8. The Department adopts L_{A10} (18 hour) 63 dB(A) as the design target external noise level and L_{A10} (18 hour) 68 dB(A) as the operational upper limit, both to be measured at the building façade most exposed to traffic noise (or in the case of an approved but not yet built building, 1 m from the most exposed edge of the approved building envelope).

9. The Department adopts L_{A10} (18 hour) 52 dB(A) as an alternative external target noise level, with assessment against this criterion to be in any outdoor living area located on the side of the building opposite to the façade most exposed to traffic noise (or in the case of an approved but not yet built building, 1 m from the most exposed edge of the approved building envelope).

10. Where external noise criteria cannot be reasonably or practicably achieved, the Department will consider the acoustic treatment of sensitive use buildings to achieve internal noise criteria.

11. In circumstances where the Department offers acoustical treatments to houses to mitigate daytime traffic noise, the Department will determine reasonable and practical treatments that are calculated to best achieve an internal noise criterion of L_{Aeq} (16 hour) 35 dB(A).

12. In greenfield situations, where a new road is proposed in an area where the predicted L_{A10}(18 hour) noise level from the future traffic will be more than 15 dB(A) above the measured existing L_{Aeq}(16 hour) ambient noise outside affected sensitive use buildings, the Department will consider reasonable and

practical acoustical treatments that are calculated to best achieve an internal noise criterion of L_{Aeq}(16 hour) 35 dB(A).

13. The Department will use the external L_{Aeq}(8 hour) 45 dB(A) as the trigger criterion for heavy vehicle noise on category 1, 2 and 3 roads, where Departmental decision making results in changed patterns of heavy vehicle movements.

14. In circumstances where the Department offers acoustical treatments to sensitive use buildings to mitigate night time traffic noise, the Department will determine reasonable and practical treatments that are calculated to best achieve an internal night time noise criterion of L_{Aeq} (8 hour) 30 dB(A).

15. Road construction work will nominally be between the hours of 7 am and 6 pm Monday to Friday; 8 am and 6 pm Saturdays; and, 10 am to 6 pm on Sundays and public holidays. However, after balancing the potential impacts associated with extended hours of operation, extended construction period and increased construction costs, the Department may adopt different hours on a project by project basis.

16. When making external traffic noise assessments against the L_{A10}(18 hour) 63 dB(A) external noise target criterion or L_{A10}(18 hour) 68 dB(A) desirable upper limit, the Department will use the standard assessment location of 1 m from the building's most exposed façade (or in the case of an approved but not yet built building, 1 m from the most exposed edge of the approved building envelope).

17. When making external traffic noise assessments against the alternative location L_{A10}(18 hour) 52 dB(A) external noise target criterion, the Department will use an assessment location in the centre of any outdoor living area (if one exists) on the side of the building opposite to the façade most exposed to traffic noise (or in the case of an approved but not yet built building, 1 m from the most exposed edge of the approved building envelope).

18. When making external traffic noise assessments against the L_{Aeq}(8 hour) 45 dB(A) target criterion for night time noise from heavy vehicles, the Department will use the standard assessment location of 1 m from the most exposed building façade (or in the case of an approved but not yet built building, 1 m from the most exposed edge of the approved building envelope).

19. Acoustical treatments to achieve internal noise nominal design criteria will be determined by calculation from external noise done in good faith but with no performance guarantees and no internal noise measurements, either for design or post-construction confirmation.

20. The Department will only consider noise mitigation for undeveloped land where that land is already zoned for a sensitive use in an applicable planning scheme and is already subdivided.

21. The Department will only consider mitigation of traffic noise for new roads within a proclaimed road corridor for buildings that existed prior to proclamation or that have since been constructed on land that was zoned for a sensitive use prior to proclamation. If the new road goes outside the corridor in any place(s), mitigation works will be considered for eligible buildings out to a distance of 300 m from that excursion.

22. The Department will only consider traffic noise mitigation for new roads within a road corridor shown within a planning scheme, for buildings that existed prior to that corridor being added to the scheme or that have since been constructed on land that was zoned for a sensitive use prior to that corridor being added to the scheme. If the new road extends beyond the corridor in any place(s), mitigation works will be considered for eligible

buildings out to a distance of 300 m from that excursion.

23. The Department will not accept responsibility for traffic noise mitigation where a sensitive use has knowingly moved to an area where traffic noise problems are likely or where there is evidence of inadequate consideration of noise impacts by developers or landowners.

24. When selecting seal type, the Department will include noise minimisation amongst its design objectives but the final choice of seal will be one that achieves the best overall balance of all objectives.

25. Where practicable, the Department will locate road seal changes away from sensitive land uses.

26. The Department will not unnecessarily use audible edge markings but nevertheless will always favour road safety over noise reduction.

27. The Department will only consider the use of noise barriers at buildings (as distinct to near the road edge) in exceptional circumstances.

28. The Department will only consider noise mitigation out to 300 m in any direction from the end-to-end centreline of a road project.

29. While the Department will implement noise mitigation measures in good faith it makes no guarantee that their performance will be as predicted or that mitigation targets will be achieved.

Part C

Full Guidelines

Preface

These traffic noise management guidelines have been developed by the Department of State Growth for application across the State road network.

State roads are essential community infrastructure and our society could not function without them.

An unavoidable consequence of roads is that some members of the community may be impacted by traffic noise. These traffic noise management guidelines aim to provide road planners, designers and decision makers with a framework for ensuring that a consistent approach will be taken to manage traffic noise.

When making decisions about noise impacts, a major consideration is whether those impacts could constitute an environmental nuisance, as defined under the *Environmental Management and Pollution Control Act 1994*[6].

For noise, an environmental nuisance is often taken to be an increase in noise levels of more than 5 dB(A) above the background noise level. While this is a convenient and reasonable generic definition, it is not an appropriate standard for roads, in part because it includes no consideration of the greater community good provided by roads.

A common approach to managing road traffic noise is to adopt a maximum target noise level that is based on standards, largely irrespective of what the current noise environment might be. Sometimes this target may be lower if existing noise levels are low but the overriding principle is to keep noise levels below a *maximum* rather than applying a limit to how much the noise *increase* might be.

A similar approach is taken by these guidelines. They establish a specific delineation of what levels of traffic noise are acceptable and, by the inverse, delineate the circumstances of when traffic noise should be considered an environmental nuisance. The Department considers that a correct implementation of these guidelines will be the equivalent of a performance-based solution for traffic noise under planning schemes.

These guidelines were originally released in November 2011 to replace the (then) Department of Infrastructure Energy & Resources' *Code of Practice: Minimisation of Road Traffic Noise in Design and Construction*, which had been used by the Department since the early 2000's. This revision of the guidelines has been prepared to reflect the knowledge gained through their implementation and use over the subsequent 4 years.

The guidelines complement the Department's *State Noise Strategy 2011* and the Environment Protection Authority's *Environment Protection (Noise) Policy 2009*.

These guidelines will inform decision makers, developers and members of the public about how the Department manages traffic noise across the State road network, and under what circumstances mitigation will and will not be considered by the Department.

[6] The Act defines an environmental nuisance to be: *the emission of a pollutant that unreasonably interferes with, or is likely to unreasonably interfere with, a person's enjoyment of the environment*

1 Background

The Department of State Growth manages transport related noise emissions on State roads in accordance with the *Environmental Management and Pollution Control Act 1994* (EMPCA).

Under EMPCA, the Department is required to achieve best practice environmental management (BPEM) in its management and operation of transport infrastructure. In support of EMPCA, a key Departmental objective is to minimise environmental harm associated with transport noise, using practical and cost effective measures, assessed against applicable international and national standards.

A subsidiary policy under EMPCA is the 2009 *Environmental Protection Policy (Noise)*, which is administered by the Environment Protection Authority. The key objectives of the EPP (Noise) are:

- To further the objectives of EMPCA as they relate to the acoustic environment, and to
- Protect environmental values.

Environmental values protected under the Policy are defined as the qualities of the acoustic environment that are conducive to:

- The wellbeing of the community or a part of the community, including its social and economic amenity, or
- The wellbeing of an individual.

The Department recognises that transport generated noise emissions have the capacity to impact the 'wellbeing' of both the community and individual.

In response to the Policy, the Department developed the *State Road Noise Strategy 2011*, which gives effect to the principles of the Policy, although it should be noted that the Strategy is not a statutory document. The Strategy provides high-level policy and planning guidance on the impacts of road noise and identifies how noise related impacts can be managed to improve amenity.

The Strategy establishes the vision and objectives that these guidelines support.

The vision of the Strategy is:

- *To reduce community exposure to transport-related noise and excessive noise levels through effective management of Tasmania's strategic road network.*

The objectives of the Strategy are to:

- *Minimise the number of people exposed to unreasonable levels of transport noise.*
- *Manage noise levels on new and upgraded transport infrastructure to ensure that future noise levels remain acceptable.*
- *Reduce amenity conflicts and ensure long-term corridor viability by protecting major transport corridors from incompatible uses (for example, noise sensitive uses such as houses, schools and hospitals) and promoting good building design*.

Within the Strategy, the Department committed to the development of guidelines to assist its implementation. These guidelines fulfil this commitment.

The objective of these guidelines is to provide guidance to road and land use planners, road designers and the community on how the Department will manage traffic noise on the State road network.

The guidelines aim to ensure that the Department's traffic noise decision-making is consistent with the objectives of the EPP (Noise) 2009 and the State Noise Strategy (2011).

2 Scope

These guidelines apply to the State road network.

2.1 State road network

The Department road network consists of approximately 3650 km of road designed primarily to provide connectivity between cities

and towns and to provide for efficient transport of freight.

To plan and manage this network within a clear strategic framework, the Department has developed a five-tier road hierarchy[7]:

- **Category 1 – Trunk Roads**. The primary freight and passenger roads connecting Tasmania's largest population centres, major sea ports and key industrial locations. These roads facilitate inter-regional freight and passenger vehicle movement, and business interaction.

- **Category 2 – Regional Freight Roads**. Tasmania's major regional roads for carrying heavy freight. These roads facilitate heavy inter-regional and sub-regional freight and passenger vehicle movement, commercial interaction and tourist movement.

- **Category 3 – Regional Access Road**. The main access roads to Tasmania's regions, carrying less heavy freight than Regional freight Roads. These roads facilitate the connection of smaller regional bases with trunk and freight roads, local commercial interaction and subregional freight, passenger vehicle and tourist movements.

- **Category 4 – Feeder Roads**. Allowing safe travel between towns, major tourist destinations and industrial areas. These roads facilitate connection to Trunk, Regional Freight and Regional Access Roads. While some of these roads carry heavy freight traffic, they are not the Department's preferred heavy vehicle routes.

- **Category 5 – Other roads.** The remainder of the State roads.

Principle 1: The Department will apply these guidelines to the State road network. In practice, only category 1, 2 and 3 roads are likely to warrant noise mitigation as traffic volumes and speeds on category 4 and 5 roads will typically be too low to trigger established noise criteria.

[7] Tasmanian State Road Hierarchy

The Department's road hierarchy categories reflect the functional hierarchy of the State's roads. Road function will both reflect and determine the type and volume of traffic using particular roads but the management of traffic noise impacts requires broader planning considerations, which these guidelines also recognise.

2.2 Approach

Under these guidelines, the Department will only consider noise mitigation when a new or upgraded road project is being contemplated. In the absence of a specific project, the Department will not consider mitigating the progressive creep in traffic noise that occurs as a natural consequence of traffic growth.

Principle 2: The Department will only consider noise mitigation when a new or upgraded road project is being contemplated. In the absence of a specific project, the Department will not consider mitigating the progressive creep in traffic noise that occurs as a natural consequence of traffic growth.

The fundamental approach taken by these guidelines is for the Department to:

1. Determine whether a given situation is eligible for traffic noise mitigation;
2. For eligible situations then determine what buildings within that situation are eligible for traffic noise mitigation;
3. For eligible buildings determine what traffic noise mitigation is appropriate.

Both buildings that exist and buildings not yet built but which have obtained planning approval at the time the Department submits its application for planning approval for its road project will be considered for eligibility (if the project itself is eligible). Buildings for which planning approval is achieved after this date will not be considered for eligibility.

If a road project does not require planning approval, the cut-off date for building eligibility consideration will be the date the Department calls tenders for the project or, if it is a maintenance project to be undertaken under its

maintenance contract, the date that the contractor is requested to undertake the work.

Principle 3: Both existing buildings and buildings approved but not yet built at the cut-off date will be considered for mitigation eligibility – if a road project requires planning approval the cut-off date for building consideration will be the date that the road project's development application is submitted to Council; if planning approval is not required the cut-off date will be the date construction tenders are called or maintenance work is commissioned.

When determining noise mitigation requirements, the predicted noise 10 years into the future will be used.

Principle 4: Target noise limits will be assessed against 10-year future noise levels, which are the predicted noise levels 10 years into the future after the completion of the road project's construction.

To assist the decision making process, the guidelines identify "eligible scenarios" and "excluded scenarios", which describe the range of situations likely to arise. (Eligible scenarios are described later in Table 7 and Table 8 of these guidelines, and complicating factors are described in Table 9.)

An eligible scenario is a situation where traffic noise mitigation will be considered. An ineligible scenario is a situation where traffic noise mitigation will not be considered.

The Department will not accept responsibility for noise mitigation in ineligible situations.

An overarching exclusion that these guidelines adopt is to exclude from noise mitigation consideration any building built closer than 50 m from the boundary of a pre-existing road or road corridor. This exclusion reflects the over-riding importance of protecting these roads from residential encroachment and it is consistent with the minimum building setbacks established by the *Road and Railway Asset Code 2013*.

The intent of the setback is to protect road assets from encroachment that might restrict future upgrades and to prevent amenity issues as a result of poor land use planning.

Principle 5: The Department will not consider noise mitigation for buildings that are less than 50 m away from the edge of the road corridor and which were built subsequent to the construction of the road or the proclamation of the road corridor or the depiction of the road corridor in a planning scheme.

2.3 Recognition in planning schemes

The Department encourages councils to reflect these guidelines in their planning schemes and in particular to reflect the excluded situations in planning scheme zones and overlays.

In particular, the Department encourages council planners to retain a 50 m buffer between building envelopes and the boundary of category 1, 2 and 3 roads. The Department encourages councils to ensure that new buildings or modifications to existing structures incorporate sufficient noise mitigation so as to avoid future amenity concerns.

3 Reasonableness, practicality and cost-effectiveness

The Department routinely considers the need and potential for traffic noise mitigation works during new road or road upgrade projects, where the mitigation measures can be incorporated into the project design. However, resource constraints mean that the Department is rarely able to undertake noise mitigation works for existing roads as a project in their own right.

These guidelines establish target criteria for situations where traffic noise mitigation will be considered.

The ability for target criteria to be achieved will depend on many factors – in particular, the reasonableness, practicality and cost-effectiveness of potential solutions.

In some cases, these factors may prevent target criteria from being met, despite the best intent and best endeavours of the Department.

The Department must prioritise expenditure by applying the three factors of reasonableness, practicality and cost-effectiveness. For example, road safety and functionality requirements for the wider community will usually attract a higher priority than noise mitigation for individual residents who may be exposed to annoying traffic noise.

The Department has included significant noise mitigation provisions in road projects for more than a decade and this will continue under these guidelines, progressively improving the Tasmanian road noise environment.

While the Department can incorporate noise mitigation into road projects as they arise, the Department does not have resources allocated to retrofitting existing infrastructure, and will only consider doing so in exceptional circumstances.

In making decisions under these guidelines, the Department will apply the general principles established by the Tasmanian *Environment Protection Policy (Noise) 2009* for transport infrastructure, namely that:

- *It is recognised that although the operation or use of public roads, railways, ports or airports may prejudice protection of the environmental values, the function the transport network serves is necessary for the community's economic, environmental and social wellbeing.*
- *Transport planning initiatives for freight and passenger movement and new transport infrastructure will be developed in a systematic way to achieve an optimal balance of economic, environmental and social benefits and costs with a major criterion of minimising the number of people exposed to noise levels that would prejudice protection of the environmental values.*
- *Where environmental values are acutely prejudiced, existing transport infrastructure noise should be reduced to the greatest extent that is reasonably practical, consistent with achieving an optimal balance of economic, environmental and social benefits and costs.*
- *The allocation of any public resources to minimise noise impacts resulting from public roads will aim to achieve the most benefit for the greatest number of people exposed to those impacts.*

The Department will also apply the general principle of Best Practice Environmental Management established by the *Environmental Management and Pollution Control Act 1994*:

- *Best practice environmental management of an activity is the management of the activity to achieve an ongoing minimization of the activity's environmental harm through cost-effective measures assessed against the current international and national standards applicable to the activity.*

In addition to the above general principles, Departmental decision making under these guidelines will be based on the specific considerations of reasonableness, practicality and cost-effectiveness.

Reasonableness

The eligibility tests established by these guidelines for scenarios and buildings provide explicit tests of reasonableness.

Additional reasonableness tests will include social considerations:

- engagement with affected land users when deciding about urban design and aesthetic considerations and other impacts of noise abatement measures;
- the views of all affected land users, not just those making complaints, determined through early community consultation;
- risks of antisocial consequences, such as graffiti on noise walls and the creation of lurk spaces between noise walls and property fences.

Practicality

Practical measures are those that can be engineered and are practical to build given

project constraints such as safety and maintenance requirements.

Some situations have inherent constraints on practicality. Examples include:

- narrow road corridors, where there is inadequate space to install noise barriers without creating run-off safety risks;
- road junctions, where noise barriers would restrict sightlines, creating collision safety risks;
- bridges and flyovers, where there may be both space constraints and engineering constraints on installing noise walls.

Cost-effectiveness

Considerations of cost-effectiveness will include:

- the total cost of mitigation measures, taking into account the physical attributes of the site, e.g. topography, geology, and the cost variation to the project given the expected benefit;
- the proportional cost of the mitigation measures relative to the overall project;
- the perceptible consequences to houses relative to the cost of mitigation, recognising that exceedences of a target noise limit by less than 3 dB(A) will not actually be perceptible to most people, even though they are numerically measureable;
- operational and maintenance costs borne by the community, e.g. running air conditioners or mechanical ventilation in the case of architectural treatments;
- noise mitigation costs compared with wider priorities for the road budget, recognising the need for balance between satisfying individuals and achieving wider community benefits with finite funds – in particular, road safety considerations will always receive funding priority over noise mitigation.

Principle 6: Any decision made by the Department under these guidelines will be subject to reasonableness, practicality and cost-effectiveness tests.

4 Traffic noise characteristics

4.1 What is noise?

Sound is a wave of air pressure variations travelling through the air from the sound source to our ears. We hear sound by those waves causing our ear drums to vibrate.

Depending on what made the sound, the waves may be larger or lower and spaced closer (high frequency) or further apart (low frequency). These differences make the sound louder or softer and higher or lower pitch.

Sound and noise are really the same thing but we often use the term “noise” when we are talking about unwanted or annoying sound. However, this is not a formal definition and the terms “sound” and “noise” can be used interchangeably.

4.2 How is noise measured?

We measure noise by measuring the air pressure caused by sound waves. We therefore use the term “sound pressure”.

The human ear is able to detect a very wide range of sound pressures. The smallest detectable pressure is more than a million times smaller than the largest detectable pressure.

A logarithmic scale rather than linear scale is used to measure noise. Instead of a scale range of 0 to more than a million, this squeezes the scale into a manageable range, starting from 0 for the noise threshold of hearing, to 120 for the noise threshold of pain and then above for even greater sound pressures.

The units for this logarithmic scale are called decibels (dB).

The logarithmic scale is much more convenient for technical considerations but it often causes confusion for non-specialists because it is not a natural way of counting or doing maths.

For example, if we have two identical noise sources, each generating 40 dB of noise, the combined noise is not 80 dB but rather 43 dB. This is because adding the two noises together is a logarithmic addition, not the arithmetic addition we are familiar with in everyday life.

Generally, the smallest change (increase or decrease) in decibels that the human ear can detect is about 2 to 3 dB but this varies with individual sensitivity; however, a change of 5 dB is considered noticeable by most people. A 5 dB change is often used as a target objective when considering the potential for noise nuisance.

Noise meters are much more sensitive to changes in sound pressure than the human ear.

Like the range of sound pressures that our ears can detect, our ears are also attuned to a particular range of sound frequencies. Human ears can detect frequencies ranging from 20 to 20,000 vibration cycles per second (hertz, Hz) but we are most sensitive in the 2000 to 5000 Hz range at the threshold of hearing and 400 to 5000 Hz at 40 dB(A).

To account for the human ear's sensitivity to different frequencies, we use a weighted scale in noise meters. The weighting gives greater significance to frequencies we hear well and less significance to frequencies we hear poorly. The weighting scheme used for environmental noise is referred to as the A-weighted scale[8], which is written as dB(A).

Examples of noise levels are shown in Table 1.

Noise is rarely constant. It fluctuates in loudness and pitch. Because of its variability, noise in the environment is usually described in statistical terms.

Table 1: Examples of familiar noise levels

dB(A)	Example
0	The faintest sound that we can hear
30	A quiet library or a quiet location in the country
45	Typical office space
50	Noisy birds
60	Noisy office, busy street
70	Noise from a passing car
80	Loud music played at home, vacuum cleaner
90	Noise from a passing truck
100	Noise from a rock band
110	Taxiing aeroplane, jack hammer
120	Pain threshold

Sometimes we are most interested in the quietest noise. Often this is called the background noise, which is the noise left after the noisy activity has been taken away. Background noise is usually considered to be the bottom 10 percent of noise levels in the absence of the noisy activity, meaning that background noise is exceeded 90% of the time. This is referred to as the L_{90} or, more specifically, $L_{A90,}$ which denotes the use of the A-weighted scale.

Another commonly used descriptor of noise is a representation of the average noise level. For this we usually use L_{Aeq}, where 'eq' stands for "equivalent" noise, and is shown as L_{Aeq} 40 dB(A), for example. It is the notional constant noise level that if maintained over a specified period would deliver the same energy as a varying sound would over that same period. Strictly speaking it is not an average but for convenience can be thought of as one.

"Background" and "ambient" noise are often confused, and this can lead to problems with interpretation.

As described above, by convention "background" noise is usually taken to be the L_{A90} statistic, the noise level exceeded 90% of the time (ie. the 10% quietest noise). It is measured by excluding the noisy activity being examined, either by turning that noise source off (if this is possible) or by some other way excluding it from the measurements (eg. using directional microphones).

[8] Another scale is the C-weighted scale, which is often used when measuring worker exposure to industrial noise.

"Ambient" noise, however, is usually used to mean the measured noise from all sources, including the noisy activity being examined. It is typically measured using the L_{Aeq} metric.

At other times we might be interested in the loudest noise levels. For example, we might refer to the L_{10}, which is the level exceeded for only 10% of the time; 90% of the time levels will be lower than this. Traffic noise is commonly[9] reported as an L_{A10}. The L_{A10} metric is sensitive to traffic noise, particularly at low and moderate traffic volumes (less so for high, continuous traffic).

We also need to specify the time period over which the noise has been measured. A high L_{10} over 15 hours will be more environmentally significant than the same level over 1 hour.

By convention, traffic noise is often measured over the 18 hour period between 6 am and midnight. Typically, approximately 95% of traffic movements occur in this period.

The combination of all the above units gives us a traffic noise descriptor like L_{A10}(18 hour) 40 dB(A). This says that when traffic noise was measured using the A-weighted decibel scale over the 18 hour period between 6 am and midnight, 10% of readings were 40 dB(A) or higher.

We use similar units when we talk about traffic noise targets. A target of L_{10}(18 hour) 63 dB(A) means that we aim for no more than 10% of noise level readings between 6 am and midnight to be higher than 63 dB(A).

For continuous traffic, there is a strong relationship between L_{A10} and L_{Aeq}. For example, L_{A10}(18 hour) is typically equal to L_{Aeq} (24 hour) plus 3 dB(A)[10].

[9] A notable exception in Australia is NSW, who use the L_{Aeq} metric.

[10] Austroads (2005) *Modelling, measuring and mitigating road traffic noise*. AP-R277/05.

Principle 7: For the purpose of these guidelines, two of the key descriptors that the Department will commonly use are L_{A10}(18 hour) and L_{Aeq} (T), where the time period, T, depends on the situation.

4.3 What changes in noise can we perceive?

Very few people are able to detect a change in noise of 1 dB(A).

For most people, a change in noise has to be 3 dB(A) or more for it to be noticeable.

Because of the logarithmic decibel scale, a change of 3 dB(A) is a doubling of the noise energy. Adding two identical noise sources together will increase total noise by 3 dB(A).

4.4 How does noise propagate?

Sound waves travel through air as waves. If a noise was created at a point high above the ground, in a "free field" situation, the sound would propagate spherically in all directions from that point. The sound pressure would diminish with distance from the source in proportion to the square of the distance as the energy gets spread into an ever expanding sphere. As the radius of the sphere is doubled, the surface area quadruples so the sound energy at any given point on the sphere's surface reduces by a factor of four.

Because of the logarithmic decibel scale, this means that there is a 6 dB reduction in noise levels for each doubling of the distance from a point source, if that source is in "free field" (ie. mid-air). For example, if the noise level was measured to be 60 dB(A) 100 m from the source it would be 54 dB(A) 200 m from the source.

If that same sound was generated at ground level, the sound would instead propagate hemispherically (half a sphere) in all above-ground directions because the ground surface would reflect (most of) the sound back. Sound pressure would similarly diminish with the square of the distance but because the same energy is squeezed into half a sphere instead of a whole sphere, the level at any given distance would be twice that of the free field situation.

However, the reduction of noise remains 6 dB(A) for each doubling of distance.

In the case of traffic, noise is not generated at a single fixed point but rather from multiple moving points (i.e. vehicles), which creates a linear noise source. If the vehicles were moving high above the ground in a free field situation, their noise would propagate as a cylinder. In the case of a cylinder, doubling the radius (the distance from the linear noise source) doubles the surface area and halves the sound energy at any given point on the cylinder's surface.

Because of the logarithmic decibel scale, this equates to a 3 dB(A) reduction in noise levels for each doubling of distance from a linear source. For example, if the noise level was measured to be 60 dB(A) 100 m from a linear source it would be 57 dB(A) 200 m from the source.

In the case of traffic moving along the ground, the noise propagates into a half cylinder so at any given distance the sound energy will be twice that of the free field situation. However, as with the point source example, the reduction with distance in the hemispherical situation is still the same as in the free field situation, being 3 dB(A) in this case.

4.5 Can noise be blocked?

Because noise propagates as waves, objects can interfere with this in the same way that islands and breakwaters can interfere with wave propagation in the ocean. This interference includes reflection, refraction and absorption[11]. Putting a barrier in the path of noise can therefore make it quieter on the other side. In the case of traffic noise, these barriers generally take the form of noise walls or mounds.

The key design intent of noise barriers is to block direct propagation of noise from the source to the receiver.

In simple terms, this is achieved by blocking the line of sight between the source (e.g. car) and the receiver (e.g. house). Noise that reaches the receiver will then have been forced to refract over or around the barrier and will be diminished. For example, placing a barrier so that the line of sight between a house window and car tyres will reduce the tyre noise that reaches that window. However, if that same barrier is not high enough to block the line of sight from the window to the exhaust stacks of heavy vehicles, exhaust noise will not be reduced.

Another consideration is the linear continuity of the traffic noise source. Along the line of traffic, a barrier that blocks line of sight at one point on the road may not block line of sight from another.

Barrier design therefore needs to consider all the lines of sight from each receiver along a length of road for a range of heights above the road surface. When there are many receivers (e.g. many houses) along a road, design needs to consider impacts for each sensitive use building. This can become a very complicated process and computer software models are frequently used to do these calculations.

4.6 What causes traffic noise?

Traffic noise and its causes are well understood. There are five key variables to consider for general traffic flow.

1. **Road surface:** Different road surfaces generate different noise levels from tyres. For example, 7 mm and 10 mm chip seals respectively generate 2 and 4 dB(A) more noise than dense graded asphalt. These differences are taken into consideration by the Department for its road projects, and require a balancing of the often competing objectives of cost, longevity, safety and noise.
2. **Vehicle speed:** The lowest traffic noise for a typical traffic mix occurs at about 30 km/h. Increasing average vehicle speed above this increases traffic noise. For passenger vehicles, increasing speed from approximately 30 km/h to 100 km/hr increases noise by about 8 dB(A). The increase is less pronounced with increasing proportion of heavy vehicles because the base noise level is higher. With heavy vehicles there is also a small increase (order

[11] Sound can also transmit through objects, depending on the material

of 1 dB(A)) in noise above the base case with decreasing speed below 30 km/h.

3. **Road gradient:** The slope of the road influences vehicle noise. As slope increases, engine noise increases because engines need to work harder. On a gradient of 10%, traffic noise is 3 dB(A) greater than on a flat road.
4. **Traffic volume:** Traffic noise increases with traffic volume. On a flat road with traffic travelling at 75 km/h, 1000 passenger vehicles in an 18 hour day would generate a traffic noise of L_{A10}(18 hour) 60 dB(A) whereas 10,000 passenger vehicles in that period would generate 69 dB(A).
5. **Proportion of heavy vehicles:** The greater the proportion of heavy vehicles, the greater the traffic noise, with the difference becoming less marked with increasing average speed. At 75 km/h, a 5% proportion of heavy vehicles will add about 1.5 dB(A) and a 20% mix will add about 3.5 dB(A).

Another important variable is individual vehicle noise. This is a combination of the make and size of the vehicle but it is also modified by the age and condition of the engine, exhaust system, transmission, brakes, body and tyres. Individual vehicle noise is governed by National Design Rules and by the maintenance regimes of owners. These factors are not something that the Department can influence for individual road projects.

Other variables include driver behaviour, weather conditions (e.g. tyres on wet roads generate a different noise than dry roads) and traffic flow patterns but usually these are much less important and are usually not considered in noise calculations or assessments.

Of the five key variables, only road surface and traffic speed are readily controlled by the Department. Road gradient is considered during all stages of planning and design for new road projects and major upgrades and can be engineered to a certain extent. However, in Tasmania hilly topography and significant gradients are often unavoidable.

Hilly terrain causes more engine noise from climbing vehicles, particularly heavy vehicles. Hills can also make it more difficult to block noise propagation with barriers (see section 8.9).

The above variables for general traffic flow are commonly used in traffic noise predictive models to assist road planning and design studies. Good modelling software applied correctly can make predictions to within 1 or 2 dB(A) of field measurements.

4.7 When does traffic noise increase?

Traffic noise may increase incrementally (i.e. creep) or suddenly.

Incremental increases arise slowly over time as traffic volumes increase and as the road surface deteriorates with normal wear and tear.

Traffic volumes increase with increasing population size, usually at around 1 or 2% per year. However, these increases do not continue indefinitely because, as traffic volumes increase, congestion slows traffic down and slower traffic generally creates less noise.

Road surface wear is normal and unavoidable. Open graded asphalt, for example, is a very quiet seal type because it is relatively porous but it is also more vulnerable to tyre wear and consequential infilling by debris, which reduces its quietness. Due to its poor wearing characteristics, open graded asphalt is rarely used in Tasmania.

Chip seal, on the other hand is stronger but noisier, although the noisiness decreases over time as the chip points wear away. These types of changes are not typically noticeable, as the changes are generally less than 1 or 2 dB(A) per year.
Sudden increases in traffic noise may arise when there are sudden changes in traffic volume, patterns of vehicle movement, vehicle speed, speed limits, driver behaviour, or where there are changes in seal types.

4.8 How and where is traffic noise measured?

Traffic noise in Tasmania is measured in accordance with the methods described in the *Tasmanian Noise Measurement Procedures Manual 2004* and the *UK Department of*

Transport's Calculation of Road Traffic Noise (1988) (CoRTN) manual.

Traffic noise criteria almost invariably relate to the protection of noise sensitive buildings, such as houses.

By convention, the standard position for the microphone (noise receiver) is 1 m from the building façade (and 1.5 m above the ground) that is most exposed to traffic noise, which is usually the front of the building.

Being so close to the façade means that the microphone also measures the reflection of traffic noise back from the façade. This reflection adds 2.5 dB(A) to the measured noise compared to if the microphone was standing well away from the building. The additional 2.5 dB(A) is incorporated in the target criteria as part of the convention.

Ideally, traffic noise is measured by placing noise loggers at the measuring site for 2 or 3 weeks. This increases the likelihood of obtaining good data after windy and rainy days are excluded. Wind and rain both add their own noise and distort the apparent traffic noise.

Logged data are filtered to remove windy and rainy days and the valid data between 6 am and midnight on weekdays is analysed to calculate the measured L_{A10}(18 hour) level.

If background noise levels (L_{A90}) are of interest, these can also be measured, as described in the *Noise Measurement Procedures Manual 2004*.

CoRTN also provides a shortened measurement procedure, which involves measuring noise over 3 consecutive 1 hour periods between 1000 and 1700 hours on a weekday, again 1 m from the building façade. The three L_{A10}(1 hour) values are then arithmetically averaged and 1 dB(A) is subtracted from the result to give the estimated L_{A10}(18 hour value).

Traffic noise measurements are best understood if traffic volumes are also known. When noise loggers are deployed, traffic counters are often also deployed simultaneously. In the case of the shortened measurement procedure, traffic counts are made manually.

5 Traffic noise criteria

The target criteria that the Department has adopted for State roads are shown in Table 2.

The design target level of L_{A10} (18 hour) 63 dB(A) is a commonly used target in Australia on new and upgraded roads (see section 5.1 for a discussion). It should be noted that the criteria will not be appropriate for all situations, and will not always be reasonable, practical or affordable to achieve.

The operational practical upper limit of L_{A10} (18 hour) 68 dB(A) will be used to trigger mitigation retrofitting considerations when incremental noise increases occur on existing roads, such from traffic growth or maintenance changes to seal type.

Other states use a comparable upper limit for retrofitting decisions to reduce traffic noise on existing roads. For example, Victoria uses L_{A10} (18 hour) 68 dB(A) to trigger retrofitting considerations[12]; NSW uses L_{Aeq}(15 hour) 65 dB(A), which is equivalent to L_{A10} (18 hour) 67.2 dB(A) to prioritise retrofitting[13].

These guidelines describe how the Department will approach this target in the many different circumstances that may apply on roads around Tasmania.

[12] VicRoads *Traffic Noise Reduction Policy 2005*
[13] NSW ECC&W *NSW Road Noise Policy 2011*

Table 2: Target traffic noise criteria for new roads and major road upgrades

Target traffic noise level	Application	Comments
L_{A10} (18 hour) 63 dB(A)	On road construction and upgrade projects, the Department will aim to meet a design traffic noise level of LA10(18 hour) 63 dB(A) or below for noise sensitive land uses, subject to what is considered reasonable, practical and cost-effective.	A traffic noise level of 63 dB(A) or less (measured at a building façade), is considered by the Department to be acceptable for most adjacent uses for most people.
L_{A10} (18 hour) 68 dB(A)	Outside road construction and upgrade projects, where increases in traffic noise levels occur the Department will consider an operational traffic noise level of L_{A10}(18 hour) 68 dB(A) to be a practical upper limit.	As levels increase above 63 dB(A) impacts become less acceptable to more people. A level above 68 dB(A) (measured at a building façade) is considered by the Department to be undesirable for sensitive uses.

5.1 External traffic noise criteria

External traffic noise means traffic noise measured outside a building.

Tasmania has used L_{A10} (18 hour) 63 dB(A) as the primary traffic noise criterion for approximately ten years, as per the previous Department of Infrastructure, Energy and Resources' *Code of Practice for Road Traffic Noise*. The Code also recognised 68 dB(A) as the upper limit.

People become increasingly more annoyed at traffic noise as noise levels increase, as shown in Figure 1.

Different studies show slightly different numerical relationships but the trend of increasing annoyance is always similar. The L_{A10} (18 hour) 63 dB(A) criterion lies where approximately 10% of the population could be expected to be highly annoyed.

It is important to recognise that the L_{A10} (18 hour) 63 dB(A) criterion does not attempt to satisfy all people. As shown in Figure 1, adoption of the criterion means that approximately 10% of the whole population could be expected to be highly annoyed[14].

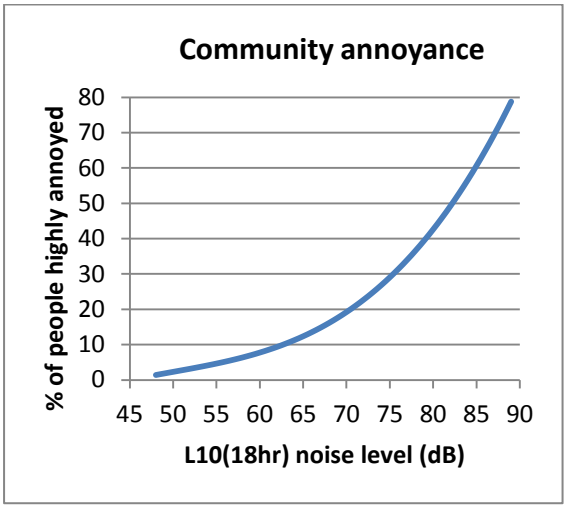


Figure 1: Indicative community annoyance relationship with increasing traffic noise[15]

The criterion aims to achieve a balance between the relative costs and benefits to individuals and to the community as a whole.

The L_{A10} (18 hour) 68 dB(A) criterion is an adopted upper limit indicator of 5 dB(A) above the 63 dB(A) target, a difference that is readily perceptible by most people.

[14] NSW ECC&W *NSW Road Noise Policy 2011*

[15] After European Commission (2002) *Position paper on dose response relationships between transportation noise and annoyance*. WG2-Dose Effect. (Noise converted from L_{eq}(24 hr) to L_{10}(18hr)) http://ec.europa.eu/environment/noise/pdf/noise_expert_network.pdf

Principle 8: The Department adopts L_{A10} (18 hour) 63 dB(A) as the design target external noise level and L_{A10} (18 hour) 68 dB(A) as the operational upper limit, both to be measured at the building façade most exposed to traffic noise (or in the case of an approved but not yet built building, 1 m from the most exposed edge of the approved building envelope).

This target for daytime noise includes noise from both light and heavy vehicles. No special consideration for noise from heavy vehicles will be made during the daytime. However, heavy vehicle noise at night will be given separate consideration due to the potential for sleep disturbance, as described in section 5.5.

5.2 Alternative external traffic noise criterion

In some circumstances, it may not be reasonable or practicable to achieve the criteria (which are assessed at the building's most exposed façade). The Department may then consider protecting outdoor living areas at the side of the building opposite to the most exposed façade (often the rear of the building)[16].

The target criterion will then be L_{Aeq}(16 hours) 50 dB(A), a level noted by the *Environment Protection Policy (Noise) 2009* (EPP Noise) as being an acoustic indicator of moderate annoyance in outdoor living areas.

Although in the EPP Noise the L_{Aeq}(16 hours) relates to all noise sources, for the purpose of these Guidelines it will be used as a measure of traffic noise only.

L_{Aeq}(16 hours) 50 dB(A) is equivalent[17] to an L_{A10}(18 hour) of: L_{Aeq}(16 hours) + 2 = 50 + 2 = 52 dB(A).

Use of this criterion will require information about the shape of the house and the outdoor living area and also the shape and relative positioning of surrounding houses. These information requirements are significantly greater than those for the primary criterion, which requires only the position of the most exposed facade.

Principle 9: The Department adopts L_{A10} (18 hour) 52 dB(A) as an alternative external target noise level, with assessment against this criterion to be in any outdoor living area located on the side of the building opposite to the façade most exposed to traffic noise (or in the case of an approved but not yet built building, 1 m from the most exposed edge of the approved building envelope).

5.3 Internal traffic daytime noise criterion

Internal traffic noise means traffic noise measured inside a building.

Internal traffic noise may need to be considered in circumstances where it is not be possible to achieve external noise targets.

The Department may then consider acoustical treatment of sensitive use buildings to reduce traffic noise intrusion into the building.

Principle 10: Where external noise criteria cannot be reasonably or practicably achieved, the Department will consider the acoustic treatment of sensitive use buildings to achieve internal noise criteria.

The Tasmanian *Environment Protection Policy (Noise)* 2009 establishes a daytime indoors indicator level of L_{Aeq} (16 hour) 35 dB(A).

The nominal internal design criterion for this approach will therefore be L_{Aeq} (16 hour) 35 dB(A).

However, because of the many differences between building designs and construction and how people use internal spaces, the Department will not use this nominal design criterion as the target for internal noise. Instead, the Department will first use the measured or predicted external noise L_{A10}(18

[16] An alternative location such as this appears not to have been used in other states.

[17] Austroads (2005) *Modelling, measuring and mitigating road traffic noise*. AP-R277/05.

hour) to calculate an assumed internal L_{Aeq}(16 hour) using the relationship[18]:

L_{Aeq}(16 hour) = L_{A10}(18 hour) – 2.0 dB(A).

The Department will then use AS3671-1989 *Acoustics – Road traffic noise intrusion – building siting and construction* to determine acoustical treatments that could best mitigate the external L_{Aeq}(16 hour) noise to achieve the nominal design criterion for internal noise of L_{Aeq} (16 hour) 35 dB(A).

The Department will then determine what, if any, acoustical treatments to offer an affected building owner.

Principle 11: In circumstances where the Department offers acoustical treatments to houses to mitigate daytime traffic noise, the Department will determine reasonable and practical treatments that are calculated to best achieve an internal noise criterion of L_{Aeq} (16 hour) 35 dB(A).

These calculations will be undertaken in good faith and the Department will make no guarantees as to their accuracy or the effectiveness of acoustic treatments, nor will performance check measurements be made.

5.4 Criteria for new roads in previously quiet rural areas

New projects in undeveloped landscapes are often referred to as a 'greenfield' developments and road projects are no different. It is fair to assume that any increase in noise in a greenfield situation is more noticeable when compared to an intensification of use in an already developed landscape. Noise related annoyance in greenfield developments may therefore be triggered at levels of noise well below the accepted target criterion of L_{A10} (18 hour) 63 dB(A).

An example is where a major bypass is constructed in a rural setting with the route of the new road running through an area with a very low existing noise level. In Tasmania, daytime background noise levels in rural areas can be well below 40 dB(A) and a 20dB(A) or more increase in noise might occur for a new bypass in a rural setting. While this would be considered to be significant, it may nevertheless not exceed the L_{A10} (18 hour) 63 dB(A) criterion.

An increase in noise of more than 5 dB(A) above background can be considered as 'environmental nuisance' as defined by the *Environmental Management and Pollution Control Act 1994*. Many councils have incorporated this into their planning schemes.

However, this simple 5 dB(A) increase threshold does not take into account the community benefit of roads. While the loss of amenity for a particular sensitive use building may be substantial, the overall benefit to the community may be significant. The balance of individual impacts against that of the community is a constant challenge for road planners and project managers.

Transport related noise impacts are assessed by the Department on a case by case basis and mitigation is considered only where practicable and reasonable. Experience shows that there will always be situations where noise impacts are unavoidable or unmanageable.

For circumstances equivalent to a greenfield development, the Department adopts a threshold increase of 10 dB(A).

The 10 dB(A) increase threshold is considered to best achieve the necessary balance between community benefit and that of the individual. Also important is that acoustical treatment of building facades can practicably achieve a 10 dB(A) reduction between outside and inside noise. For example, compared to single pane 4 mm glazing, double 4 mm glazing can achieve a 5 dB(A) reduction and double 6 mm glazing can achieve a 10 dB(A) reduction[19].

Where this 10 dB(A) increase is exceeded, the Department would consider acoustical treatment of affected residences to reduce internal noise levels.

[18] Austroads (2005) *Modelling, measuring and mitigating road traffic noise*. AP-R277/05.

[19] Austroads (2005) *Modelling, measuring and mitigating road traffic noise*. AP-R277/05.

Because a greenfield situation will have little, if any, existing traffic noise, the L_{A10} (18 hour) traffic noise statistic is not appropriate to use to characterise existing noise. Instead, existing ambient noise would be measured as a daytime L_{Aeq}, measured over the 16 hour period from 7 am to 11 pm, and this L_{Aeq}(16 hour) would subsequently be compared with the predicted L_{A10} (18 hour) measurement of traffic noise[20].

The L_{Aeq}(16 hour) is measured external to the building in a free field situation[21], being what the occupiers would experience outside their building. This will be compared with the predicted future traffic L_{A10}(18 hour) value determined 1 m from the building façade.

To make this comparison, the calculation must recognise that the L_{A10}(18 hour) value includes a 2.5 dB(A) façade correction relative to free field. There is also an empirical difference of 2.0 dB(A) between it and the equivalent L_{Aeq}(16 hour) value for traffic noise[22]. These two differences combine to make a total differential of 4.5 dB(A). For convenience, this will be rounded to 5 dB(A), which needs to be added to the 10 dB(A) threshold difference, giving a net difference threshold of 15 dB(A).

Principle 12: In greenfield situations, where a new road is proposed in an area where the predicted L_{A10}(18 hour) noise level from the future traffic will be more than 15 dB(A) above the measured existing L_{Aeq}(16 hour) ambient noise outside affected sensitive use buildings, the Department will consider reasonable and practical acoustical treatments that are calculated to best achieve an internal noise criterion of L_{Aeq} (16 hour) 35 dB(A).

[20] Although the L_{Aeq} measurement period is different (16 hours versus the L_{A10} 18 hours), L_{Aeq}(16 hours) is used rather than L_{Aeq}(18 hours)because it is a common metric and there is an available formula for converting to L_{A10} (18 hours)

[21] That is, away from the confounding effects of structures such house facades and so on.

[22] Austroads (2005) *Modelling, measuring and mitigating road traffic noise*. AP-R277/05. [This reference has a table for converting between different traffic noise metrics.]

5.5 Night time sleep disturbance

By definition, the L_{A10} (18 hour) criterion is measured over the 18 hour period between 6 am and midnight. This period encompasses approximately 95% of traffic and is also the period when most people will be awake.

The small percentage of traffic that occurs at night can, however, generate considerable annoyance through wakening, particularly if the noise is from heavy truck movements.

Studies have shown that although the number of awakenings increases with the number of noise events, this is not necessarily a linear relationship[23]. As the number of night time events increases, the rate of wakening decreases. People become accustomed to night time noises and become less disturbed by them.

European studies[24] have determined a relationship between L_{Aeq} (8 hour) outside bedrooms and the probability of a person's sleep being disturbed (the 8 hour period is from 11 pm to 7 am). This is depicted in Figure 2.

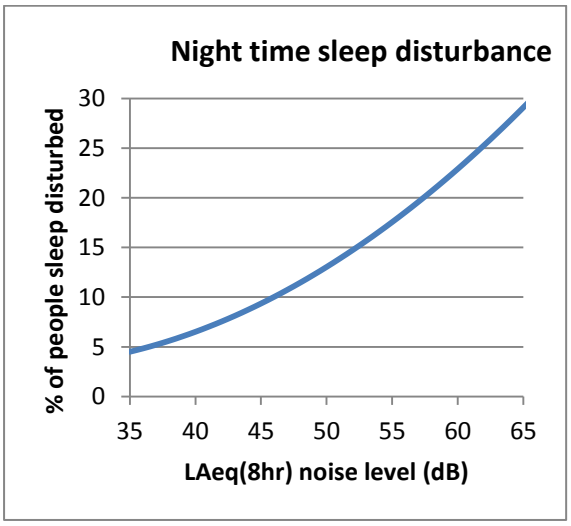


Figure 2: Indicative community sleep disturbance relationship with increasing noise outside bedroom windows[25]

[23] NSW EPA (1999) *Environmental criteria for road traffic noise*.

[24] European Commission (2004) *Position paper on dose-effect relationships for night time noise*. Working Group on Health and Socio-Economic Aspects.

[25] After European Commission (2002) *Position paper on dose response relationships between*

It is important to note that these studies are less relevant to roads that experience low volumes of intermittent night time traffic (e.g. category 4 or 5 roads).

Figure 2 shows that the L_{Aeq} (8 hour) 45 dB(A) noise level outside bedrooms is likely to cause sleep disturbance to approximately 10% of people. Consistent with the 10% disturbance objective for day time traffic noise (section 5.1), L_{Aeq} (8 hour) 45 dB(A) outside bedrooms is therefore an appropriate target criterion to adopt as the indicator criterion for night time traffic noise.

This is supported by the Tasmanian *Environment Protection Policy (Noise)* 2009, which also establishes an outside-bedroom[26] indicator level of L_{Aeq} (8 hour) 45 dB(A).

The Department adopts the L_{Aeq} (8 hour) 45 dB(A) level as an outside-bedroom night time criterion for situations where the Department decision-making results in significant increases in night time heavy vehicle movements.

This indicator criterion will not be used as a numerical noise target. Instead it will be used to trigger consideration of noise mitigation.

In these situations, the Department will calculate[27] the likely L_{Aeq} (8 hour) from heavy vehicles (alone, excluding other traffic)[28]. If the likely level is above 45 dB(A), the Department will give consideration as to whether that level can be reduced.

Principle 13: The Department will use the external L_{Aeq}(8 hour) 45 dB(A) as the trigger criterion for heavy vehicle noise on category 1, 2 and 3 roads, where the Department's decision making results in changed patterns of heavy vehicle movements.

The Tasmanian *Environment Protection Policy (Noise)* 2009 establishes a night time indoors indicator level of L_{Aeq} (8 hour) 30 dB(A). The nominal internal design criterion for this approach will therefore be L_{Aeq} (8 hour) 30 dB(A).

If the external trigger criterion of L_{Aeq}(8 hour) 45 dB(A) is exceeded, the Department will use AS3671-1989 *Acoustics – Road traffic noise intrusion – building siting and construction* to determine acoustical treatments that could best mitigate the external night time L_{Aeq}(8 hour) noise to achieve the nominal design criterion for internal noise of L_{Aeq} (8 hour) 30 dB(A).

The Department will then determine what, if any, acoustical treatments to offer an affected building owner.

Principle 14: In circumstances where the Department offers acoustical treatments to sensitive use buildings to mitigate night time traffic noise, the Department will determine reasonable and practical treatments that are calculated to best achieve an internal noise criterion of L_{Aeq} (8 hour) 30 dB(A).

As described in section 6.3, this internal noise criterion will be determined by calculation only and will not involve measurements for design or confirmation.

For category 4 and 5 roads, where noise mitigation works will not be considered for night time traffic noise, the Department will, where possible, manage night time noise emissions through broad operational measures such as vehicle maintenance and driver behaviour.

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transportation noise and annoyance. WG2-Dose Effect. (Noise converted to from Leq(24 hr) to L_{10}(18hr)) http://ec.europa.eu/environment/noise/pdf/noise_expert_network.pdf

[26] With windows open

[27] CoRTN does not use this statistic but other standards, such as the USA Federal Highway Administration Model, do and traffic noise modelling packages can calculate this statistic

[28] Because only heavy vehicles are being considered, there is no established conversion from L_{Aeq} to L_{A10} like there was in section 5.3.

5.6 Road construction & maintenance noise

Noise from road construction cannot be avoided but will be managed to all reasonable and practicable extents. Primarily, construction noise will be managed through compliance with permitted hours of operation, upkeep and maintenance of vehicles and machinery and driver education.

The length of road construction projects makes temporary noise mitigation problematic. However, in some situations temporary shielding (e.g. placing shipping containers between heavy machinery and nearby sensitive use buildings) may be possible.

The hours of construction will typically need to be a balance between the competing demands of minimising day-to-day impacts and minimising the duration of construction. Often it is preferred to extend working hours to reduce the construction period.

Schedule 7 of the *Environmental Management and Pollution Control (Miscellaneous Noise) Regulations 2004* prescribes permissible hours for the use of specified items of machinery on, or in relation to, domestic premises. These regulations place restrictions on general construction; in particular, those activities likely to create a noise nuisance.

Under Schedule 7 of the noise regulations, domestic construction work is permitted between the hours of 7 am and 6 pm Monday to Friday; 8 am and 6 pm Saturdays; and, 10 am to 6 pm on Sundays and public holidays.

These regulations do not apply to non-domestic situations, such as roads, but the Department often adopts similar construction hours for its road projects. However, circumstances may mean that extended hours are preferable. The Department will make construction hour decisions on a case-by-case basis as best suits the project.

The Department will extend road construction hours where it is considered to be in the best overall interest of the community.

Principle 15: Road construction work will nominally be between the hours of 7 am and 6 pm Monday to Friday; 8 am and 6 pm Saturdays; and, 10 am to 6 pm on Sundays and public holidays. However, after balancing the potential impacts associated with extended hours of operation, extended construction period and increased construction costs, the Department may adopt different hours on a project by project basis.

6 Assessing traffic noise against criteria

6.1 Measuring existing noise

The Department does not routinely measure traffic noise but may measure noise in locations where traffic noise appears to be a particular problem.

The Department will undertake noise monitoring for road upgrades and construction projects where existing noise levels need to be determined to assist or compare with predictions of future noise.

Noise measurement procedures will be consistent with the *Tasmanian Noise Measurement Procedures Manual (2004)*[29] and the *Calculation of Road Traffic Noise (CoRTN)* procedures[30].

As a preference, traffic noise measurements will use noise loggers deployed for long enough to provide a working week of recordings during suitable weather (not raining or too windy). This extended deployment enables a confident determination of the 18 hour (6 am to midnight) L_{A10} value.

Where extended deployment of loggers is not practicable, the shortened measurement procedure of CoRTN will be used. Under this method, the L_{A10}(1 hour) is measured over 3 consecutive hours between 10 am and 5 pm on a weekday. The arithmetic average of these 3

[29] Published by the Environment Division of the Department of Primary Industries, Parks, Water & Environment

[30] UK Department of Transport (1988) Calculation of Road Traffic Noise.

consecutive L_{A10} values is calculated and then 1 dB(A) is subtracted to give an estimate of the L_{A10}(18 hour) value.

6.2 Assessment locations - external

Target criteria require a location at which they will be judged.

The standard point for measuring traffic noise external to a building is 1.5 m above the ground and 1 m from the building façade most exposed to the traffic noise.

Being so close to the façade means that noise is reflected back from the façade to the microphone, almost doubling the measured noise exposure compared with a measurement taken away from a facade. As described in section 4.3, doubling the noise exposure increases the measured decibel level by 3 dB(A).

However, when calculating noise at the reference point, 2.5 dB(A) is added to the result, not 3 dB(A) because not all the noise hitting the façade is reflected (i.e. some noise is absorbed).

For example, if traffic noise was measured on an empty house block to be 50 dB(A) at a point 1 m from a future facade, that same measurement would be adjusted to 52.5 dB(A) for when the house has actually been built.

Principle 16: When making external traffic noise assessments against the L_{A10}(18 hour) 63 dB(A) external noise target criterion or L_{A10}(18 hour) 68 dB(A) desirable upper limit, the Department will use the standard assessment location of 1 m from the building's most exposed façade (or in the case of an approved but not yet built building, 1 m from the most exposed edge of the approved building envelope).

Where constraints mean that an external noise target criterion or desirable upper limit cannot be reasonably or practicably met, the Department may consider the alternative assessment location for external noise described in section 5.2.

Unless particular circumstances dictate otherwise, the alternative assessment location for external noise will be in the centre of any outdoor living area (if one exists) on the side of the building opposite to the façade most exposed to traffic noise. Commonly, this will be the rear of the building.

Principle 17: When making external traffic noise assessments against the alternative location L_{A10}(16 hour) 52 dB(A) external noise target criterion, the Department will use an assessment location in the centre of any outdoor living area (if one exists) on the side of the building opposite to the façade most exposed to traffic noise (or in the case of an approved but not yet built building, 1 m from the most exposed edge of the approved building envelope).

The standard assessment location will be used when assessing night time noise from heavy vehicles.

Principle 18: When making external traffic noise assessments against the L_{Aeq}(8 hour) 45 dB(A) target criterion for night time noise from heavy vehicles, the Department will use the standard assessment location of 1 m from the most exposed building façade (or in the case of an approved but not yet built building, 1 m from the most exposed edge of the approved building envelope).

6.3 Assessment locations - internal

In circumstances where acoustic treatment of buildings is the preferred mitigation strategy, the objective will be to reduce internal levels of traffic noise to the nominal design criterion of L_{Aeq}(16 hour) 35 dB(A) daytime or L_{Aeq}(8 hour) 30 dB(A) night time, as the case may be. This reduction will be calculated from the external noise (as described in section 5.3) and will not involve actual measurement of internal noise.

As described in that section, there are many complicating factors with building design and construction and how people use their internal rooms. Rather than attempting to address all these complicating factors, the Department will use AS3671 to represent typical building characteristics and then calculate noise reduction from outside to inside. This will require assumptions to be made about the building structure.

Principle 19: Acoustical treatments to achieve internal noise nominal design criteria will be determined by calculation from external noise done in good faith but with no performance guarantees and no internal noise measurements, either for design or post-construction confirmation.

6.4 Predicting future noise

Traffic noise predictions will be calculated using the *Calculation of Road Traffic Noise (CoRTN)* procedures[31] for L_{A10} statistics or the *Federal Highway Administration (FHWA)* model[32] for L_{Aeq} statistics.

The Department will typically use noise modelling software to make predictions of future traffic noise, although sometimes manual calculations will be sufficient.

Although the specific features of different software may vary from package to package, the basic approach is as follows:

1. Define the project area.
2. Define the noise modelling area. This will usually be the length of the project road, with a width of 300 m either side (a conservative distance to ensure that all potentially affected sensitive use buildings are included[33]).
3. Set up a 3-dimensional terrain model of the existing situation in the modelling software, including buildings and the existing road, with its seal types and speed regimes (assuming that traffic travels at the speed limit).
4. Undertake noise measurements of the existing situation at sites along the project route. If noise loggers are deployed, a traffic counter will usually be deployed simultaneously. If the shortened noise measurement procedure is used, traffic counts will be made manually.
5. Unless circumstances dictate otherwise, as a contingency against logger and traffic counter failure, a minimum of two loggers should be deployed on either side of the road section being examined and the loggers and traffic counter performance should be checked half way through the logging period.
6. Run the model using the measured traffic volumes to predict the existing traffic noise contours and compare these predictions with the measurements.
7. If the predictions and measurements generally agree within ±2 dB(A) at each measurement point, the model will be considered to be adequately calibrated. If there are consistently larger discrepancies, calibration adjustments to the model will be made (experience indicates that calibration adjustments are rarely required).
8. The existing road in the model will then be replaced by the future road design, which will be "cut in to" the terrain model.
9. The future road parameters, including anticipated traffic volumes, seal type, speed regimes and allowable noise barrier locations will then be entered into the model. For design purposes, the "future situation" will be 10 years after project opening. However, often it will be useful to also predict the noise level in the first year after opening.
10. If and where the predicted noise at sensitive use building facades is higher than the target criterion, the model will be used to "build" noise barriers at the allowable locations until the target criterion is achieved, if it can be within the barrier's location and height constraints.

These predictions will then be used by the Department to make a determination of what noise mitigation is appropriate, reasonable and practicable.

Noise reports prepared for the Department should present measurements and predictions using a combination of noise contour maps and data tables.

[31] UK Department of Transport (1988) Calculation of Road Traffic Noise.

[32] US Federal Highway Administration/US Department of Transport

[33] A distance of 300 m would satisfy even busy major city (eg. Sydney, Melbourne) freeways. For Tasmanian roads and traffic volumes, it is highly unlikely that adverse traffic noise impacts would extend out to anywhere near this distance.

Noise contour maps should show all sensitive use buildings within the project area and overlay traffic noise contours at 1 dB(A) intervals. Maps should be prepared for:

a. The existing situation
b. 10-year future noise if the project does not go ahead (ie. incremental traffic growth but with no changes to the road)
c. 10-year future noise if the project does go ahead.

Noise contours should have 2.5 dB(A) added for the façade effect and the map legend should clearly note this.

Reports should present tabulated data using the templates shown in Table 14 to Table 17 (in section 10). Noise measurements/predictions should be given to 1 decimal place.

Noise study reports undertaken for road projects will usually be made publicly available as part of the development approval process – they would form part of the supporting documentation advertised for public comment.

However, in some cases the reports might be withheld from public display because, for example, they may show current and expected future noise levels that might unreasonably affect the privacy of home owners or the value of their property. In these cases, the Department will treat the reports as being commercial-in-confidence.

7 Traffic noise and land use planning

Ideally, land use planning would anticipate the potential conflicts between amenity and traffic noise and maintain appropriate buffer distances between major roads and residential areas. However, these opportunities are rarely available in the real world.

Urban development typically begins and grows in close association with roads. These roads, in turn, become busier as the population grows. Buildings close to major roads therefore become progressively more exposed to traffic noise, something that is often referred to as 'noise creep'. Increasing residential density through subdivision also increases potential exposure to traffic noise.

Residential properties are generally serviced by local roads under the control of local government, and it should be recognised that these roads are not considered a significant source of general traffic noise. In terms of overall traffic volume (as distinct to individual noisy vehicles, which can be a problem on any road), the major sources of traffic noise are confined to category 1 (trunk), category 2 (regional freight) and category 3 (regional access) roads.

People who live close to trunk, regional and arterial roads are more likely than others to suffer a loss of amenity due to increases in traffic noise.

To the extent that is reasonable and practicable, both land use planners and road planners should seek to minimise existing and potential transport related noise impacts, but not at the expense of the greater community.

The fundamental spatial relationship between roads and urban development is largely already established. Urban developments in true greenfield situations are increasingly rare. Land use and road planners therefore must respond to the existing structure of urban areas.

The key challenge for land use planners is to minimise the encroachment of residential properties towards busy roads. In contrast, the key challenge for road planners is to minimise the exposure of existing residential properties to new roads and upgrades to existing infrastructure.

These guidelines aim to assist and provide for consistent decision-making by road planners.

Land use planning cannot, and does not attempt to, protect every property from all impacts. This would be both impractical and contrary to its intent; that is, to achieve outcomes that benefit the community as a

whole, notwithstanding potential impacts on individual members of the community.

To effectively manage for traffic noise, road planners must be provided with a series of reasonable and practical constraints to determine who and what to protect from traffic noise, and how best to do it.

For example, in a Rural zone with large properties and open spaces it is conceivable that a future house could be built almost anywhere. It would be unreasonable for road planners to provide for noise mitigation in anticipation of all potential future housing developments. A similar situation applies for land that is zoned Residential but not yet subdivided. On the other hand, in a Residential zone that is already subdivided and has small well-defined lots and defined building envelopes, the potential locations of future houses will be readily apparent and road planners would be able to plan for future housing.

Principle 20: The Department will only consider noise mitigation for undeveloped land where that land is already zoned for a sensitive use in an applicable planning scheme and is already subdivided.

The Tasmanian Planning Commission's *Revised Road and Railway Assets Code (February 2013)* provides primary guidance on land use planning matters relating to roads. These guidelines supplement that Assets Code.

Existing roads will have been proclaimed as such under the *Roads and Jetties Act 1935*.

The locations of future (not yet built) roads can also be proclaimed under that Act and/or they may be shown on zoning maps local government planning schemes.

In both cases, the Department may also choose to acquire land intended for a future road, whether by forced acquisition or freehold purchase.

In some cases the Department may acquire land without a future road having yet been proclaimed or shown in a planning scheme. However, such purchases do not necessarily mean that the land will inevitably be used for a road – the purchase may simply be a 'just-in-case' action. Unless this land is subsequently proclaimed or shown in a planning scheme these guidelines treat this land no differently to any other land outside a road corridor

In common usage, a "road" is generally understood to comprise the road pavement and shoulders. "Proclaimed roads", however, also extend outwards to include the road reservations running alongside the road on either side.

To avoid confusion, these guidelines will therefore use the distinguishing terms "road" to refer to the road pavement and shoulders and "road corridor" to refer to the full width of the road reservation. Similarly, land zoned in a planning scheme to show where a road runs or will run will be referred to as a "road corridor".

7.1 Proclaimed future road corridors

Proclaimed road corridors are registered on property titles.

It is therefore assumed that current owners and future owners of lands within or adjacent to a proclaimed road corridor, are cognisant of the potential for future development and the impacts associated with transport infrastructure.

The Department will consider noise mitigation of affected sensitive use buildings in the following situations:

- Where the buildings already existed prior to the proclamation, and
- Where the buildings have been built in sensitive use sub-divisions that had been approved prior to the proclamation.

Conversely, once a road corridor has been proclaimed, owners and purchasers of that land or adjoining land could reasonably be assumed to be aware of the potential future road. Any change of that land to a more sensitive land use (i.e. residential building) subsequent to the proclamation could therefore reasonably be considered by the Department to have been undertaken at the owner's risk. If the road construction proceeds, the Department would

not consider noise mitigation works to protect those sensitive uses.

Even where a road corridor is proclaimed, it is possible that the alignment of the road design extends beyond the corridor boundary in one or more places. Sensitive buildings impacted by such excursions will be considered for mitigation to a distance of 300 m from the boundary of the road corridor.

Noise modelling studies typically extend out to a distance of approximately 300 m from a road because this is the likely maximum extent of any traffic noise impact.

Principle 21: The Department will only consider mitigation of traffic noise for new roads within a proclaimed road corridor for buildings that existed prior to proclamation or that have since been constructed on land that was zoned for sensitive use prior to proclamation. If the new road goes outside the corridor in any place(s), mitigation works will be considered for eligible buildings out to a maximum distance of 300 m from that excursion.

7.2 Planning scheme future road corridors

A companion or otherwise alternative mechanism for formally alerting the community to the likelihood of a new road being constructed is for the road corridor to be shown in a planning scheme(s). This mechanism is preferable because the planning scheme is a more readily accessible advisory system for the general community – it does not rely on property owners undertaking title searches.

While being a preferable advisory mechanism, planning schemes are not under the Department's control and the process of amending schemes can be slow.

Principle 22: The Department will only consider traffic noise mitigation for new roads within a road corridor shown within a planning scheme for buildings that existed prior to that corridor being added to the scheme or that have since been constructed on land that was zoned for a sensitive use prior to that corridor being added to the scheme. If the new road extends beyond the corridor in any place(s), mitigation works will be considered for eligible buildings out to a distance of 300 m from that excursion.

8 Traffic noise mitigation

There are a number of options available for mitigating traffic noise. Sometimes, one option will stand out as most suitable. At other times, combinations may be appropriate and, in some circumstances, mitigation of noise will not be reasonable, practical or cost-effective.

The following sections briefly describe potential mitigation options. More detailed information is available in other technical documents, notably the Austroads Research Report AP-R277/05 *Modelling, Measuring and Mitigating Road Traffic Noise* (2005)[34].

8.1 Avoidance through land use planning

Sound land use planning can significantly reduce the impact of traffic noise. A failure to include future road corridors in planning schemes can be the source of conflict, as can a failure to recognise roads and proposed road corridors when planning residential areas.

When planning new roads, to the extent practicable the Department seeks to avoid residential areas and other areas of known sensitive land uses.

For existing roads and where road corridors are shown in planning schemes, any decisions by others to rezone adjoining land for residential use will place the responsibility for traffic noise mitigation with the relevant planning authority and/or developer.

[34] http://trove.nla.gov.au/work/29710659?selectedversion=NBD40025707

Principle 23: The Department will not accept responsibility for traffic noise mitigation where a sensitive use has knowingly moved to an area where traffic noise problems are likely or where there is evidence of inadequate consideration of noise impacts by developers or landowners.

8.2 Building setbacks

Noise diminishes with distance (see section 4.4). With each doubling of distance from traffic, traffic noise diminishes by approximately 3 dB(A). If, for example, traffic noise measured alongside a road 8 m from the vehicles is 69 dB(A), it will be 66 dB(A) at a point 16 m from the vehicles, then 63 dB(A) 32 m from the vehicles, 60 dB(A) 64 m from the vehicles and so on. In this example, the 63 dB(A) target criterion would be achieved approximately 32 m from the vehicles.

Setting buildings back from a road can therefore help mitigate traffic noise experienced at the building position. However, typical residential block sizes mean that achieving the necessary setbacks within the available space will usually be problematic for blocks that are adjacent to busy roads. To be effective, setbacks need to be established during the early stages of planning.

8.3 Vehicle design and maintenance

The inherent noisiness of vehicles is determined by their design, which is governed by the Australian Design Rules. For vehicle noise, the current applicable rule is ADR 83/00[35], which has governed vehicles built since 1 January 2005. Vehicle design is not something that the Department can influence.

Departmental vehicle inspectors can, however, influence vehicle maintenance and condition.

Poor vehicle maintenance can lead to noise emissions that are greater than what is expected from a well maintained vehicle. Faulty or deliberately noisy mufflers are the most common problem, but noise can also come from the poorly maintained engines, the transmission and drive train and from non-aerodynamic surfaces such as roof racks.

All drivers have a responsibility to reduce vehicle noise by implementing good maintenance procedures and through use of sensible vehicle modifications.

Because tyres are such a significant source of vehicle noise, tyre tread is also an important consideration. Large tread tyres (e.g. off-road) can be particularly noisy.

8.4 Speed limits

There is a relationship between traffic speed and traffic noise.

For example, the noise from passenger vehicle traffic travelling at 100 km/hr is about 5 to 6 dB(A) higher than if that same traffic was travelling at 50 km/hr.

However, substantial speed reductions are necessary to achieve substantial noise reductions.

Indicatively, reducing speed limits by 10 km/hr can reduce traffic noise by only about 1 dB(A). The use of speed limits as a means of reducing traffic noise at source is therefore generally not effective or preferred.

8.5 Driver behaviour

Driver behaviour can heavily influence vehicle noise emissions principally through controlling vehicle speed but also through rapid acceleration and deceleration.

Because out of the ordinary individual events (e.g. fast accelerating vehicle) are by definition uncommon, they are unlikely to influence the overall traffic noise measured over prolonged periods (e.g. 18 hours). However, for residents they may well be very noticeable and annoying.

The Department has no direct control over individual driver behaviour and cannot prevent particular drivers from choosing to drive in a noisy manner (although Tasmania's anti-hooning regulations allow the police to deal with deliberately noisy driving).

[35] http://www.comlaw.gov.au/Details/F2009C01270

8.6 Road signage

In some areas, particularly on heavy vehicle routes at the bottom of hills, engine and exhaust braking at night can cause sleep disturbance.

In these situations, specific signage can be used to request truck drivers to avoid the use of engine brakes[36].

The Department also consults with transport operators to request cooperation with the use of engine brakes in sensitive areas.

8.7 Road design

Subject to topography and surrounding land use, traffic noise impacts can be reduced by appropriate road design, particularly through the horizontal and vertical alignment of the road.

The most obvious noise reduction measure is to keep the horizontal alignment of the road away from residential areas. However, the capacity to achieve substantial reductions is often limited because of existing land use and the inherent constraints of finding a viable route through already developed land.

Reducing the gradient of a road can achieve reductions in noise, mainly due to reducing the engine noise and gear changing of heavy vehicles. However, very large reductions in gradient are required to achieve significant noise reductions. For example, a 5% gradient reduction will only reduce traffic noise by 1 to 2 dB(A)[37].

The vertical alignment of roads can nevertheless be designed to make the most cost-effective use of the natural topography. Lowering a road into a cutting means that the sides of the cutting will become barriers to noise propagation. The deeper the cutting, the greater the reduction in noise propagation will be.

If space permits, excavated material can be formed into mounds alongside the road to create barriers to noise propagation.

8.8 Road surface

The type of road seal used can have a significant effect on tyre noise.

The quietest road surface is open graded asphalt; however, it is also expensive and more subject to wear and tear comparable to surfaces such as chip seal.

A comparison of surface noise from different seal types is provided in Table 3[38]. These values show noise levels relative to dense graded asphalt, which by convention is used as the default noise surface.

Table 3: Relative surface noise of seal types

Surface type	Noise variation (dB(A))
14 mm chip seal	+4
10 mm chip seal	+4
7 mm chip seal	+2
Tyned/broomed concrete	+1 to +4
Dense graded asphalt	0
Exposed aggregate concrete	-1 to +1
Open graded asphalt	-2

Although noise is an important consideration when determining seal type, it is only one of several competing factors. Factors that the Department considers when selecting pavement surfacing include:

- The likely users of the pavement including pedestrian, cycles, small wheeled vehicles and light and heavy motor vehicles;
- The social and environmental impact of surfacings such as noise, material consumption and damage to vehicles and property during and after the application of the surfacing;
- The nature and properties of the underlying pavement;

[36] See the Department's *Technical Advice Sheet No.9 – Truck Engine Brake Sign*. http://www.transport.tas.gov.au/__data/assets/pdf_file/0020/11684/tas09_604.pdf

[37] Austroads (2005) *Modelling, measuring and mitigating road traffic noise*. AP-R277/05.

[38] Vicroads (2005) *Interpretation and application of Vicroads Traffic Noise Reduction Policy 2005*. Vicroads Road Design Note 6-1a.

- The performance of the surfacing over its expected life;
- The anticipated treatment of the surfacing at the end of its design life;
- The capital and maintenance costs of the surfacing.

Principle 24: When selecting seal type, the Department will include noise minimisation amongst its design objectives but the final choice of seal will be one that achieves the best overall balance of all objectives.

As a road seal wears, the noise characteristics can change.

Examples of changes of noise over time are shown in Table 4[39].

Table 4: Changes in noise performance of seal types with surface wear

Surface type	Noise variation (dB(A))	
	Fresh	Several years old
14 mm chip seal	+4	+2
Dense graded asphalt	0	+2
Open graded asphalt	-2 to -4	-2 to 0

Other aspects of the road surface that can influence tyre noise include changes of seal, bridge expansion gaps and audible edge lines.

Sudden changes of seal type can induce greater annoyance at traffic noise than a particular seal type on its own might. For example, a change of seal from open graded asphalt to 10 mm chip seal will mean that each vehicle will create a "pulse" of noise as it crosses the change. This change might be worse for residents than if the entire seal was 10 mm chip.

Principle 25: Where practicable, the Department will locate road seal changes away from sensitive land uses.

Bridge expansion joints can cause a noise pulse as vehicles pass over them; however, there is little scope to nominate the positions of such joints because they are factored into the bridge design.

Audible edge markings by design create a distinct and loud noise when car types come in contact. This noise can cause annoyance to nearby residents. However, the markings are an important safety feature on Tasmanian roads. The Department recognises the potential for unwanted noise to be generated by audible edge markings but provision of a safe road network for all road users is paramount.

Principle 26: The Department will not unnecessarily use audible edge markings but nevertheless will always favour road safety over noise reduction.

8.9 Roadside noise barriers

The construction of noise barriers (e.g. wooden or concrete walls) adjacent to busy roads can block a significant amount of traffic noise propagation.

Effectively, they create a (partial) noise "shadow" behind them where traffic noise is reduced relative to the noise on the exposed side. In simple terms, the noise shadow matches the visual line of sight "shadow".

Noise barriers work mainly by reflecting some of the noise back towards the traffic and by absorbing some of the noise. Different materials reflect and absorb to different degrees, depending on their nature.

The location, length and height of noise barriers need to be carefully determined. The calculations are complex and typically performed by computer software models. Engineers then use this information to specify the location, type and form of barrier(s) to be used.

There are practical and aesthetic limitations to the height of walls and these constraints are set in the model. In Tasmania, 4 m is a typical maximum height. The computer model then calculates the optimised length and height of barriers possible within those constraints to

[39] Austroads (2005) *Modelling, measuring and mitigating road traffic noise*. AP-R277/05.

attempt to best achieve the target noise levels at specified buildings.

Noise barriers are able to achieve reductions in the order of 5 to 20 dB(A), although reductions at the high end of this range are very difficult to attain, as shown in Table 5[40].

Table 5: Ability to achieve noise reductions with barriers

Noise reduction (dB(A))	Degree of difficulty
5	Simple
10	Attainable
15	Very difficult
20	Nearly impossible

Noise barriers can be constructed from many types of materials, provided that they have a density of at least 10-50 kg/m^2. In Tasmania, the most common material is timber which is often specially manufactured from high density plywood; however, lightweight concrete is also in use.

Normal paling fences do not have sufficient density to be effective noise barriers but they can block visual exposure between traffic to residences, which can help to reduce annoyance.

Where noise barriers are constructed in parallel on opposite sides of a road, their effectiveness can be reduced by noise scattering and cross-reflection if barrier height is more than about one tenth of the road width[41].

To be most effective, noise barriers and mounds need to be positioned as close to the noise source as possible. Road safety constraints specify minimum separation distances which limit effectiveness. For example, noise barriers will never be built in front of road safety barriers and when noise barriers are behind safety barriers, a deformation distance needs to be catered for.

Noise barriers can also reduce line-of-sight visibility which limits their use on bends and near junctions. As a consequence, noise barriers are often located further from source than what is considered optimal for noise mitigation.

Noise mounds (which are usually made of mounded earth) require an even greater setback from the road because they have a much larger footprint. The batter angles of the mounds take the highest point of the mound further away from the road. Mounds are therefore usually less effective than barriers. However, they may be the preferred option in particular topographical situations.

8.10 Barriers at buildings

Locating barriers (or mounds) close to sensitive use buildings rather than close to the road is far less effective at reducing traffic noise. Because traffic noise spreads as it propagates from the road, a barrier or mound close to the road provides much wider protection than one placed next to a building.

Landscaped mounds near sensitive use buildings can, however, provide effective visual screening of roads.

Principle 27: The Department will only consider the use of noise barriers at houses (as distinct to near the road edge) in exceptional circumstances.

8.11 Roadside vegetation

Vegetation is not considered to be a good inhibitor of noise. Vegetation needs to be particularly dense to reduce the propagation of traffic noise, which at best can only reduce noise by 1 or 2 dB(A), a difference not detectable by most people.

Vegetation screening is therefore not a preferred option for the Department when considering how best to achieve numerical noise reductions.

However, roadside vegetation can provide an effective visual screen between a road and affected sensitive use buildings which can be effective in reducing the perception of noise,

[40] Austroads (2005) *Modelling, measuring and mitigating road traffic noise*. AP-R277/05.
[41] Austroads (2005) *Modelling, measuring and mitigating road traffic noise*. AP-R277/05.

even if the measured noise levels are not reduced.

8.12 Building treatments

Building acoustical treatment means noise insulation measures applied to a building itself. These may be either alternatives or supplements to external noise reduction measures at source.

The provision of building treatments will be undertaken through agreements (see section 8.15) between the Department and affected property owners. These agreements will provide a deed of release to the Department, whereby the owner accepts the building treatment and agrees that no further claims against the Department for traffic noise intrusion would be made.

The choice between roadside noise barriers (or mounds) and acoustic treatment of individual buildings will be made on a case by case basis. For example, if a roadside barrier is able to protect many houses, usually that will be the most cost-effective solution. On the other hand, if a long roadside barrier is necessary to protect just a few houses, it may be more cost-effective to treat the individual houses.

For new sensitive use buildings near existing or planned roads, the owner's choice of building design and building materials can provide the most effective noise mitigation. Australian Standard AS3671 *Road traffic intrusion – building siting and construction* provides detailed guidance to building designers on how best to prevent noise intrusion.

Owners can also choose to locate the building envelope so as to mitigate road related noise emissions.

Locating sensitive rooms, such as bedrooms, on the far side of the building away from the road can reduce exposure to intrusive noise. Similarly, outdoor living areas may best be located at the back of a building instead of front. The building itself then provides a noise barrier that screens the outdoor living area from noise.

Most buildings are able to reduce noise from outside to inside by 10 dB(A) even when windows are left sufficiently open to satisfy minimum fresh air requirements.

If windows are kept closed, an additional 10 to 15 dB(A) reduction may be possible. Upgrading window and door seals on the exposed building façade(s) can achieve another 5 to 10 dB(A) reduction.

Double glazing or special acoustic glass can also be effective in reducing noise. Glass may not reduce all components of the traffic noise frequency spectrum equally but an overall reduction in noise levels is achievable.

Replacing hollow-core doors with solid doors can help achieve a 10 to 15 dB(A) reduction.

In appropriate circumstances, the Department may offer owners acoustic treatments of impacted sensitive use buildings, in the form of window and door upgrades. Other forms of building treatments will not be considered unless exceptional circumstances apply.

8.13 Land acquisition compensation

Sometimes land must be compulsorily acquired by the Department under the *Land Acquisition Act 1993* to facilitate the construction of a new road or a road upgrade.

In the case of a full acquisition, where the whole property is acquired and the building is demolished, there will be no requirement to consider future noise impacts on that building.

However, if only part of a property is acquired and the building remains in use, it may become subjected to future increases in traffic noise. The provisions of the *Land Acquisition Act 1993* then provide the building owner with a right to claim compensation for 'injurious affection' if they are aggrieved by a real or perceived noise impact resulting from the works.

The value of a compensation claim (under the *Land Acquisition Act 1993*) is first determined by the Office of the Valuer-General. Typically, this would involve measurements of the noise immediately before project commencement and after project completion, so that injurious

affection can be quantified[42]. The post-construction measurements would reflect the changes to the road and also the benefits or otherwise of any noise mitigation that may have been implemented.

Based on this assessment, the Department will make an offer to the affected landowner. In circumstances where agreement cannot be reached between the Department and the affected landowner, fair compensation will be determined by arbitration or by a court.

It should be noted that in circumstances where the *Land Acquisition Act 1993* is triggered, these guidelines are of limited use, as the provisions of that Act will take precedence.

8.14 Distance to which mitigation will be considered

The Department will only consider mitigation for eligible houses[43] that at least partially fall within the area prescribed by a distance of 300 m in any direction from the end-to-end centreline of a road project.

> Principle 28: The Department will only consider noise mitigation out to 300 m in any direction from the end-to-end centreline of a road project.

8.15 Land owner agreements

Where noise mitigation involves:

- physical works on a person's land
- physical works to a person's house
- monetary compensation in lieu of physical mitigation

or where:

- a property owner wants to reject physical works outside their land that would have mitigated the exposure of their house to traffic noise,

the owner will be required to enter into an agreement with the Department.

The agreement will be negotiated on a case-by-case basis but may include matters such as:

- an acknowledgement that physical mitigation works undertaken or not undertaken by the Department will be done in good faith but with no guarantee of performance outcome
- a description of any physical works that will be undertaken on the owner's property and/or to their house
- a description of any off-property noise mitigation that has been rejected by the owner
- a restriction to prevent the current or any future owners making any claims for additional noise mitigation or compensation in relation to the same road project
- a requirement that the owner notify any potential future purchasers of the agreement and its implications for them.

Noise mitigation would only be considered for that house in the future if a new eligible scenario emerged and the house was found to be an eligible house under that scenario.

8.16 Preferential hierarchy on road projects

While all of the above measures can avoid or reduce road noise and road noise impacts, once a particular project is under consideration, the Department's approximate order of preference of mitigation methods is generally:

1. **Road design**: If noise impacts can be reduced by appropriate road design while not compromising other design intents (eg. safety, functionality), the need for supplementary mitigation can be avoided or reduced.
2. **Road seal selection**: If a quieter road seal (eg. an asphalt rather than a chip seal) can be afforded by the project, the need for supplementary mitigation can be avoided or reduced. However, quieter seals such as asphalt are significantly more expensive and are usually less resilient to damage from tyres, requiring more frequent maintenance and replacement at greater cost.

[42] In contrast to the usual approach in these guidelines of considering 10-year future noise, injurious affection considers only the change in noise from immediately before to immediately after the construction phase

[43] And this means the actual house structures, not the properties they sit within

3. **Noise mounds**: Where the road alignment and topography allows, the construction of earthen noise mounds, ideally using excavation fill from the construction works, can effectively screen houses to mitigate noise. If construction fill can be used, mounds can be very cost-effective. However, noise mounds occupy a comparatively large footprint and are often not possible unless the road reservation is wide and/or roadside freehold land is purchased or compulsorily acquired.
4. **Roadside noise barriers**: Constructed noise walls can be very effective and can usually be constructed within the road reservation (but outside the safety run-off zone of vehicles). However, they must be made of appropriate materials and have strong structural foundations and are comparatively expensive. They are also vulnerable to graffiti attacks and can create undesirable alleys and lurk scapes.
5. **Architectural treatment of houses**: The preceding measures tackle traffic noise at or near the source, reducing the noise that reaches buildings in the first instance. By reducing noise propagation, they also provide benefits to all buildings in the vicinity, rather than address noise on a house by house basis. Architectural treatment of houses provides an alternative or supplemental mitigation measure at individual houses, usually by providing acoustic glass to windows. A disadvantage is that they require individual landowner agreements and construction works at individual houses, which can be intrusive, and unlike the preceding methods they only address internal noise with no ancillary benefits for noise in outside areas.

The above order of preference of mitigation methods is only an approximate guide, however, and may not be applicable on any particular project. The ultimate discretion as to what the most appropriate form of mitigation is for any particular eligible house lies with the Department.

8.17 Selecting the mitigation option(s)

The Department will use these guidelines to determine what traffic noise mitigation is appropriate and what mitigation methodology(ies) to use.

To document the decision making process and to maximise the consistency of outcomes, the Department will typically use the following approach (this will not be obligatory, however).

1. A noise options summary note will be prepared by the Project Manager.
2. Project team members will complete an evaluation matrix for the options. In most cases this will be a qualitative triple-plus/triple-minus matrix, a generic example of which is shown in Table 6. However, in particularly complex projects, or where it is clear that some criteria are more important than others, a quantitative weighted multicriteria matrix approach might be used instead.
3. The Department will undertake representative consultation with potentially affected landowners.
4. The Project Manager will finalise the evaluation matrix and select the mitigation method(s) that will be used.
5. Following construction, the Department may measure noise levels again to assess the effectiveness of the mitigation. This is not to provide any guarantee of effectiveness, however. While mitigation will be designed in good faith the many variables affecting noise mean that there can be no absolute certainty of outcome and the Department makes no guarantees of such.

Principle 29: While the Department will implement noise mitigation measures in good faith it makes no guarantee that their performance will be as predicted or that mitigation targets will be achieved.

Table 6: Qualitative noise mitigation methodology option evaluation matrix

Assessment criteria	Road design	Road seal	Noise mounds	Noise walls	Acoustic windows	Monetary compensation	Other (specify)
Road safety implications							
Integration with road design							
Achievement of target noise levels				`			
Encroachment onto private land							
Impingement on houses							
Aesthetic considerations							
Local community acceptance							
Wider community acceptance							
Risks of antisocial consequences							
Constructability							
Maintainability							
Capital cost to project							
Ongoing maintenance costs							
Net score							

Scoring		
+++	Major benefits	The scoring should be done by each team member independently. Each criterion of each option should be scored using +++ to - - -. The reason for each score should be recorded in a similar companion matrix. The scores of each column should then to be added to calculate a net score (each plus cancels out a minus and *vice versa*) for each option. The Project Manager should then transfer the net scores of each team member to a similar aggregated matrix. The overall reason for each score should be summarised in a similar companion matrix. The scores of each column of the aggregated matrix should then to be added to calculate an overall net score for each option.
++	Moderate benefits	
+	Minor benefits	
0	Insignificant (no) effects	
-	Minor drawbacks	
- -	Moderate drawbacks	
- - -	Major drawbacks	

9 Scenarios for applying these guidelines

The Department will apply these guidelines to roads within the State road network.

Road projects take a variety of forms and are undertaken in a variety of circumstances. While these guidelines cannot anticipate every possible form and circumstance, a number of key scenarios can be identified to cover most situations. These scenarios are listed in Table 7 for existing roads and Table 8 for future roads.

The tables present the main factors that the Department will consider when determining if and to what extent noise mitigation is warranted. The scenarios and the associated mitigation considerations relate only to operational traffic noise, not the noise from the construction work itself (see section 5.6 for road construction noise mitigation measures).

In any given scenario there may be additional factors that complicate decision-making. However, experience suggests that some complicating factors are more common than others. These are described in Table 9.

Note that while these guidelines provide guidance, they are not intended to force or fetter the discretion of the Department. In all cases, the Department will retain the flexibility to consider or not consider, and provide or not provide, noise mitigation as circumstances allow or require.

This flexibility extends to providing only partial mitigation within an eligible scenario and also to providing some mitigation within an ineligible scenario. The Department's exercising of this flexibility will be guided by the tests of reasonableness, practicality and cost-effectiveness.

9.1 Scenarios for existing roads

Table 7: Scenarios for DIER's consideration of traffic noise mitigation - existing roads

Scenario	Description	Noise mitigation consideration
Minor road works	Maintenance, repair and minor upgrades of roads, including: (a) minor widening or narrowing of existing carriageways; and (b) making, placing or upgrading kerbs, gutters, footpaths, roadsides, traffic control devices and markings, street lighting and landscaping.	No mitigation will be considered.
Safety upgrades	Works related to improving road safety. Examples include: installation of crash barriers and fences; seal replacement for skid prevention; road shoulder sealing; widening to create turning lanes; installation of speed controls; signage; signals; removal of vegetation.	No mitigation will be considered.
Reconfiguration	The reconfiguration of lanes or traffic controls within the existing carriageway width. Examples include: the creation of a bus lane; the construction of traffic islands; the rearrangement of safety barriers; a change in lane width, road shoulder sealing.	No mitigation will be considered.
Junction signalisation	Installing traffic lights.	No mitigation will be considered.
Roundabout construction	Replacing a junction with a roundabout.	No mitigation will be considered.
Land use change	Land use changes, such as rezoning or subdivision, may bring sensitive developments (e.g. houses) closer to an existing road.	No mitigation will be considered.
Speed increase	Increases in zone speed limits.	Mitigation will be considered where there is a permanent increase in a speed limit of more than 20 km/h. No mitigation will be considered for speed increases less than this.
Maintenance change to a noisier seal on a previously mitigated road	A change to a noisier seal as part of maintenance pavement resurfacing on a section of road that has previously been the subject of mitigation considerations under these guidelines.	If the resealing is necessary for safety reasons, no mitigation will be considered but otherwise mitigation will be considered.
Maintenance change to a noisier seal on a previously unmitigated road	A change to a noisier seal as part of maintenance pavement resurfacing on a section of road that has not previously been the subject of mitigation considerations under these guidelines.	Mitigation will not be considered unless the immediate consequential L_{A10}(18 hour) will exceed 68 dB(A).
Natural traffic growth	Traffic volumes naturally increase as population increases. Growth rates vary depending on the location and type of road but are typically in the order of 1 to 3 %.	Mitigation will not be considered unless the L_{A10}(18 hour) exceeds 68 dB(A) and then it will be considered on a State wide prioritisation basis.
Traffic volume change due to permanent rerouting	Road network decisions, such as opening or closing roads can have permanent flow on effects for other roads. Temporary rerouting, such as due to road works, will not warrant noise mitigation consideration.	Mitigation will not be considered unless the rerouting results in a material (>10%) increase in traffic volumes and the immediate consequential L_{A10}(18 hour) will exceed 68 dB(A). Mitigation considerations will be limited to sections of immediately affected roads extending no further than their junction with any other road. Mitigation will not be considered for temporary rerouting.
Heavy traffic permanent rerouting	Road network decisions on preferred heavy vehicle routes may permanently increase the proportion of heavy vehicles of particular routes. Temporary rerouting, such as due to road works, will not warrant noise mitigation consideration.	Mitigation of night time noise will be considered for category 1, 2 and 3 roads if the 10-year future L_{A10}(8 hour) from heavy vehicles will exceed 45 dB(A) as a result of a Departmental decision. For other situations, including heavy vehicle daytime noise, mitigation will not be considered but operational measures will be encouraged. Mitigation will not be considered for temporary rerouting.
Lane addition or realignment within existing road corridor	Road widening by lane addition or road realignment within an established road corridor.	No mitigation will be considered if the lane addition or realignment is simply to improve safety or traffic flow. If the lane addition or realignment is to facilitate a material (>10%) increase in traffic volume, mitigation will be considered.
Lane addition or realignment extending outside existing road corridor	Road widening by lane addition or road realignment may take the carriageway outside the established road corridor.	This will be taken to be a new road scenario (Table 8).
Carriageway addition within an existing road corridor	Road capacity increase by the addition of a new carriageway within an established road corridor.	This will be taken to be a new road scenario (Table 8).
In all the above scenarios where mitigation will be considered, the general over-riding exclusion will apply, namely that DIER will not consider traffic noise mitigation for new buildings or extensions to existing buildings or new sensitive uses in existing buildings if those buildings or extensions are less than 50 m from the edge of an existing or planned category 1, 2 and 3 road corridor.		

9.2 Scenarios for future roads

Table 8: Scenarios for the Department's consideration of traffic noise mitigation - future roads

Scenario	Description	Noise mitigation consideration
Lane addition to an existing road but extending outside existing road corridor	Road widening by lane addition may take the width of the carriageway outside the established road corridor.	Mitigation will be considered.
Carriageway addition to an existing road within an existing road corridor	Road capacity increase by the addition of a new carriageway within an established road corridor.	Mitigation will be considered.
Carriageway addition to an existing road but extending outside an existing road corridor	Road capacity increase by the addition of a new carriageway outside an established road corridor.	Mitigation will be considered.
Realignment of an existing road, extending outside existing road corridor	Road realignment may be for many reasons, including improving safety or traffic flow.	Mitigation will be considered.
New road outside a proclaimed future road corridor and planning scheme future road corridor	A new road is proposed but without sufficient planning lead time to either proclaim a road corridor or show the corridor in the planning scheme.	Mitigation will be considered.
New road within a proclaimed future road corridor	A new road is proposed and there has been sufficient planning lead time to proclaim a road corridor.	Mitigation will not be considered within the proclaimed corridor. Mitigation will be considered outside the proclaimed corridor but not on land that was rezoned or subdivided after the proclamation date.
New road within a planning scheme future road corridor	A new road is proposed and there has been sufficient planning lead time to show the corridor in the planning scheme.	Mitigation will be considered but not on land that was rezoned or subdivided after the road corridor was established in the planning scheme.
All mitigation consideration is for 10-year future noise. In all the above scenarios where mitigation will be considered, the general over-riding exclusion will apply, namely that the Department will not consider traffic noise mitigation for new buildings or extensions to existing buildings or new sensitive uses in existing buildings if those buildings or extensions are less than 50 m from the edge of an existing or planned category 1, 2 and 3 road corridor.		

9.3 Scenario complications

Table 9: Approaches to anticipated scenario complications

Scenario complication	Department's approach
Some sensitive use building owners might want noise barriers to be constructed but others may not (eg. because they may block views)	The Department will examine the feasibility of using a combination of noise barriers and acoustic treatments to attempt to satisfy all parties. However, if a mix of barriers and treatments is not reasonable and practicable, the Department will adopt the most cost effective single solution approach.
A sensitive use building owner might accept money to pay for acoustic treatment to their building but then not install that treatment	When offering any acoustic treatment, the Department will not provide money directly to owners but instead will agree on the acoustic treatment to be done. The owner will then seek quotes and the Department and the owner will agree on which quote to accept. The Department will then pay for agreed works to be completed.
A resident might be annoyed by traffic noise even though the noise level is less than L_{A10}(18 hour) 63 dB(A)	The Department will not consider noise mitigation in these circumstances, unless noise mitigation forms part of a compensation agreement made under the *Land Acquisition Act 1993.*
A sensitive use building owner might forego offered acoustic treatment for their building but later change their mind	The Department will not reconsider offering acoustic treatment if an offer has been previously refused unless a fresh upgrade or new road project is being considered.
A sensitive use building owner might forego offered acoustic treatment for their building but later sell their building to someone who does want acoustic treatment	The Department will not consider offering acoustic treatment to the new owner unless a fresh upgrade or new road project is being considered.
A sensitive use building might be multistorey, with living areas not on the ground floor, making the use of noise barriers for mitigation problematic	The Department will only consider noise mitigation to protect ground floors, using a prediction and measurement reference point 1.5 m above the natural ground surface. Upper floors may also gain some benefit from that mitigation but the design will not target those upper levels.
A fresh spray seal will initially be noisier until it beds down with use	There will be a temporary higher noise that will abate as the seal settles in and the sharp angles of fresh stones are abraded. The Department will adopt the expected noise level from the bedded seal for its mitigation considerations and will not consider mitigation for the temporary extra noise.
While barriers constructed within a road project area can mitigate sideways propagation of traffic noise, the orientation of a road might mean that noise propagating lengthways may affect sensitive use building further along the road, away from the defined project area	Noise barriers constructed as part of new or upgrade road projects will not extend beyond the extent of the project area. If any sensitive use buildings beyond the project area are predicted to be exposed to traffic noise greater than a target criterion as a result of the project, noise mitigation by acoustical treatment will be considered.
Not all situations neatly fit into one scenario. Example 1: A safety upgrade and reconfiguration (which on its own is an ineligible scenario) may require a minor excursion outside the existing road corridor (which on its own is an eligible scenario). Example 2: Conversely, a realignment outside the existing road corridor to achieve better traffic flow (which on its own is an eligible scenario) may also involve a reconfiguration and improve safety (which on its own is an ineligible scenario).	The predominant scenario will apply. In Example 1, the predominant purpose of the project is a safety upgrade and reconfiguration, so the project will be deemed ineligible for noise mitigation notwithstanding the fact that there is an excursion outside the existing road corridor. In Example 2, the predominant purpose is a road realignment for improved traffic flow, so the project will be deemed eligible for noise mitigation, notwithstanding the fact that the project also includes a reconfiguration and improves safety.
Noise walls may be the most appropriate mitigation solution but may not be supported by some house owners; for example, because they shade their garden or block their view	Subject to the tests of reasonableness, practicality and cost-effectiveness the Department will seek a solution or combination of solutions that has the support of the majority of residents but in doing so there can be no guarantee that all residents will receive their preference.
On a project that moves a road further away from an eligible house, the future noise due to natural traffic growth will be less than what it would otherwise have been if there had been no project and that growth had simply occurred on the existing road.	Although just by moving the road away the project provides a noise benefit even without noise mitigation, the Department will nevertheless consider additional mitigation if the target noise limit is exceeded.

10 Noise mitigation decision making

The Department will only consider noise mitigation in particular circumstances.

The Department will follow a systematic approach to making decisions about noise mitigation. The decision process is shown in Figure 3.

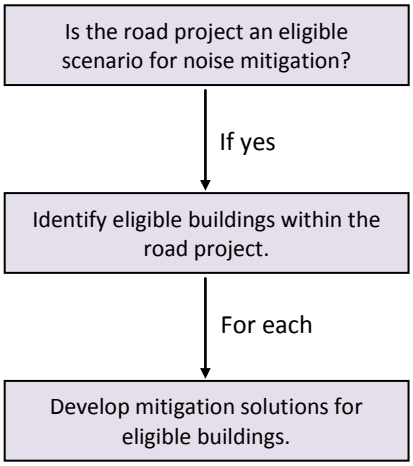

Figure 3: Noise mitigation decision sequence

Before proceeding to determine whether a building is eligible for noise mitigation, the project must first be determined to be a project for which noise mitigation will be considered.

Table 7, Table 8 and Table 9 above describe scenarios under which the Department will and will not consider noise mitigation.

Table 7 is relevant to projects on existing roads. Table 8 is relevant to new road projects. Table 9 describes a number of complications that might arise and provides guidance as to how these complications should be considered.

The road project should be reviewed against Table 7, Table 8 and Table 9 to determine whether the project falls into a scenario where noise mitigation will be considered by the Department.

Table 11 describes how that review should be undertaken.

If the project is deemed to be eligible, buildings within the project should then be assessed for eligibility using the procedure described in Table 12.

In the decision making process for buildings, eligibility is identified by the labelling system shown in Table 10.

Table 10: Building eligibility labels

Greenfield situation				
Compares existing L_{Aeq}(16 hour) noise in the absence of a road with 10-year future traffic noise when the road will be present		**Future L_{10}(18-hour) dB(A)**		
		≤ 15 increase		**> 15 increase**
		Ineligible		15-delta
Non-greenfield situation				
Compares existing traffic noise with 10-year future traffic noise		**Future L_{10}(18-hour) dB(A)**		
		L ≤ 63	**63 < L ≤ 68**	**L > 68**
Now	**L ≤ 63**	Ineligible	63-plus	63-plus
	L > 63	Ineligible	63-stet (ineligible)	68-plus
Heavy vehicle night time				
Compares existing night time heavy vehicle noise with 10-year future night time heavy vehicle noise		**Future L_{Aeq}(8 hour) dB(A)**		
		≤ 45		**> 45**
		Ineligible		45-heavy
See Table 12 for more explanation of labeling				

If a building is deemed to be eligible, mitigation solutions should be developed using the procedures described in Table 13.

Each step of the decision making process for whether the project is eligible for traffic noise mitigation consideration should be recorded using the decision making template provided in Table 14. If the project is eligible, the determination for each sensitive use building within the project should be documented using Table 15 and/or Table 16.

10.1 Identifying eligible scenarios

Table 11: Identification of eligible scenarios

Step		Outcome
1	Is the road a State road (i.e. within the Department's responsibility)	If no, stop. No further consideration of noise mitigation.
		If yes, proceed to step 2.
2	Is the scenario one of the following?	If no, stop. No further consideration of noise mitigation.
		If yes, proceed to step 3.
	Existing roads Permanent increase in the maximum speed limit to more than 20 km/hr above the existing limit. Change to a noisier seal type that takes 10-year future traffic noise above L_{A10}(18 hour) 68 dB(A). Natural traffic growth that takes 10-year future traffic noise above L_{A10}(18 hour) 68 dB(A). A permanent material (>10%) increase in the volume of traffic as a result of a Departmental decision that takes 10-year future traffic noise above L_{A10}(18 hour) 68 dB(A). A permanent increase in the proportion of heavy vehicles as a result of a Departmental decision that takes 10-year future night time traffic noise from heavy vehicles (considered alone) on a category 1, 2 or 3 road above L_{Aeq}(8 hour) 45 dB(A). Lane addition or road realignment within an established road corridor to facilitate a material (>10%) increase in traffic volume (not primarily safety or traffic flow improvements). **Future roads** Lane addition extending outside the existing road corridor Carriageway addition to existing road Realignment extending outside the existing road corridor New road outside a proclaimed future road corridor and planning scheme corridor New road within a proclaimed future road corridor and adjacent land was built on or zoned for sensitive use prior to the proclamation date New road within a planning scheme road corridor and adjacent land was built on or zoned for sensitive use prior to the corridor addition to the scheme	
3	Proceed to Table 12 to identify buildings eligible for noise mitigation.	

10.2 Identifying eligible buildings

Table 12: Identification of eligible buildings

Step	
1	Identify all sensitive use buildings within the traffic noise assessment area, being an area out to a nominal distance of 300 m either side of the road.
2	Where there is an existing approved but undeveloped sensitive use subdivision within the noise assessment area, assume a reasonable location for future sensitive use buildings and adopt those locations as presumed sensitive use buildings.
3	Exclude from further assessment all buildings that are less than 50 m away from the edge of the road corridor and which were built subsequent to the construction of the road or the proclamation of the road corridor or the depiction of the road corridor in a planning scheme.
4	Measure existing L_{A10}(18 hour) traffic noise and traffic counts at representative locations(s) along the road or, in the case of a greenfield situation, measure L_{Aeq}(16 hour) ambient noise at representative locations along the proposed road alignment.
5	Determine (by measurement or modeling) existing L_{A10}(18 hour) traffic noise at assessment building facades (allowing for the 2.5 dB(A) façade effect**).
6	Predict L_{A10}(18 hour) noise at assessment building facades (allowing for the 2.5 dB(A) façade effect) for 10 years in the future for existing roads or 10 years after the completion of the road works for future roads.
7	Identify all ***63-plus*** buildings, being assessment buildings where the existing L_{A10}(18 hour) traffic noise at the building façade is less than or equal to 63 dB(A) but at which the 10-year future noise will be greater than 63 dB(A).
8	Exclude from further assessment all ***63-stet*** buildings, being assessment buildings where the existing L_{A10}(18 hour) traffic noise is already greater than 63 dB(A) but at which the 10-year future L_{A10}(18 hour) traffic noise will be less than or equal to 68 dB(A).
9	Identify all ***68-plus*** buildings, being assessment buildings where the existing L_{A10}(18 hour) traffic noise is already greater than 63 dB(A) and at which the 10-year future L_{A10}(18 hour) traffic noise will be greater than 68 dB(A).
10	For a greenfield situation, identify all ***15-delta*** buildings, being assessment buildings where the 10-year future L_{A10}(18 hour) traffic noise will be more than 15 dB(A) greater than the existing L_{Aeq}(16 hour) ambient noise.
11	Identify any ***45-heavy*** buildings where a permanent increase in the proportion of heavy vehicles as a result of a Departmental decision will take 10-year future night time heavy vehicle traffic noise on a category 1, 2 or 3 road above L_{Aeq}(8 hour) 45 dB(A).
12	Carry all ***63-plus***, ***68-plus***, ***15-delta*** and ***45-heavy*** buildings forward as eligible buildings and apply Table 13 to develop mitigation solutions.

*Category 1, 2 or 3 roads as per the State Road Hierarchy (see section 2.1).

** See section 6.2.

10.3 Developing mitigation solutions

Table 13: Development of mitigation solutions for eligible buildings

	Step
1	For ***63-plus*** buildings, determine the external noise mitigation requirements (speed changes, road seal type, noise barriers, noise mounds etc) that would be required to reduce the external 10-year future road traffic noise at the most exposed sensitive use building façade to L_{A10}(18 hour) 63 dB(A) or less.
2	For ***68-plus*** buildings, determine the external noise mitigation requirements (speed changes, road seal type, noise barriers, noise mounds etc) that would be required to reduce the external 10-year future road traffic noise at the most exposed sensitive use building façade to L_{A10}(18 hour) 68 dB(A) or less.
3	For ***15-delta*** buildings, determine the external noise mitigation requirements (speed changes, road seal type, noise barriers, noise mounds etc) that would be required to reduce the external 10-year future road traffic noise increase at the most exposed sensitive use building façade to L_{A10}(18 hour) 15 dB(A) or less.
4	Assess the reasonableness and practicality of the required noise mitigation to determine whether the relevant noise criterion can be achieved within the budget.
5	Where the external noise targets at the most exposed façade of a ***63-plus***, ***68-plus*** or ***15-delta*** building cannot be achieved, determine the reasonableness and practicality and desirability of achieving the alternative external noise criterion of L_{A10}(18 hour) 52 dB(A) in any existing outdoor living area located on the opposite side of the sensitive use building to the façade most exposed to road traffic noise.
6	Where external noise criteria can reasonably and practicably be achieved for a ***63-plus***, ***68-plus*** or ***15-delta*** building, proceed with the road design on that basis.
7	Where external noise criteria cannot reasonably and practicably be achieved for a ***63-plus***, ***68-plus*** or ***15-delta*** building, develop any reasonable and practicable acoustic treatment solutions calculated to achieve a nominal internal daytime traffic noise design criterion of L_{Aeq}(16 hour) 35 dB(A)).
8	For any **45-heavy** buildings, develop any reasonable and practicable acoustic treatment solutions calculated to achieve a nominal 10-year future night time internal traffic noise design criterion of L_{Aeq}(8 hour) 30 dB(A)).
9	For any building where acoustic treatment is proposed, offer that treatment to the sensitive use building owner and, if the offer is accepted, enter into a corresponding agreement.
10	Proceed with the project, incorporating all reasonable and practicable external noise mitigations and agreed acoustic treatments.

10.4 Documenting decisions – project eligibility

Table 14: Decision documentation – project eligibility

Project name:

Project manager:

Date:

	Step	Yes/No	Outcome
1	Is the road a State road (i.e. within the Department's responsibility)?		If no, proceed to step 3 then stop, with no further consideration of noise mitigation. If yes, proceed to step 2.

2	**PROJECT SCENARIO – is the scenario one of the following?**	**Yes/No**
	Existing roads	
a.	Permanent increase in the maximum speed limit to more than 20 km/hr above the existing limit?	
b.	Change to a noisier seal type that takes 10-year future traffic noise above L_{A10}(18 hour) 68 dB(A)?	
c.	Natural traffic growth that takes 10-year future traffic noise above L_{A10}(18 hour) 68 dB(A)?	
d.	A permanent material (>10%) increase in the volume of traffic as a result of a Departmental decision that takes 10-year future traffic noise above L_{A10}(18 hour) 68 dB(A)?	
e.	A permanent increase in the proportion of heavy vehicles as a result of a Departmental decision that takes 10-year future night time traffic noise from heavy vehicles (considered alone) on a category 1, 2 or 3 road above L_{Aeq}(8 hour) 45 dB(A)?	
f.	Lane addition or road realignment within an established road corridor to facilitate a material (>10%) increase in traffic volume (not simply safety or traffic flow improvements)?	
	Future roads	
g.	Lane addition extending outside the existing road corridor?	
h.	Carriageway addition to existing road?	
i.	Realignment extending outside the existing road corridor?	
j.	New road outside a proclaimed future road corridor and planning scheme corridor?	
k.	New road within a proclaimed future road corridor and adjacent land was built on or zoned for sensitive use prior to the proclamation date?	
l.	New road within a planning scheme road corridor and adjacent land was built on or zoned for sensitive use prior to the corridor addition to the scheme?	
	Scenario complications Is a scenario complication invoked? If yes, describe it below:	
	Do multiple scenarios apply? If so, describe below which scenario is considered to be dominant and why:	

3	Based on all the above, is the project eligible for mitigation? If no, stop, with no further consideration of noise mitigation. If yes, proceed to identify buildings eligible for noise mitigation.	**Yes/No**

10.5 Documenting decisions – building eligibility

Table 15: Decision documentation – building eligibility

Project name:							
Project manager:							
Date:							
Receiver number	**Receiver address**	**Existing traffic noise level at façade** L_{10}**(18 hour) dB(A)**	**10-year future traffic noise level at façade if the project does not proceed** L_{10}**(18 hour) dB(A)**	**10-year future traffic noise level at façade if the project does proceed** L_{10}**(18 hour) dB(A)**	**Building eligibility classification label (see Table 10 for label definitions)**	**Noise target to achieve** L_{10}**(18 hour) dB(A)**	**Required noise reduction to achieve target** L_{10}**(18 hour) dB(A)**
1							
2							
3							
etc							

All noise levels are 1 m from the most exposed building façade and include a +2.5 dB(A) allowance for the façade effect

10.6 Documenting decisions – building eligibility for night time heavy vehicle noise

Table 16: Decision documentation – building eligibility for night time heavy vehicle noise

Project name:					
Project manager:					
Date:					
Receiver number	**Receiver address**	**10-year future number of heavy vehicles passing at night (between 11 pm and 7 am)**	**10-year future night time noise level at façade from those heavy vehicles** L_{eq}**(8 hour) dB(A)**	**Building eligibility classification (see Table 10 for label definitions)**	**Required noise reduction to achieve 45 dB(A) if building is 45-heavy or not applicable otherwise** L_{eq}**(8 hour) dB(A)**
1					
2					
3					
etc					

All noise levels are 1 m from the most exposed building façade and include a +2.5 dB(A) allowance for the façade effect

10.7 Documenting decisions – building mitigation summary statistics

Table 17: Decision making template – summary statistics for building mitigation

Project name: **Project manager:** **Date:**					
Classification group (see Table 10 for label definitions)	**Total number of buildings in classification group**	**Number of buildings exceeding target by:**			
		< 1 dB(A)	**1 to 2 dB(A)**	**2 to 3 dB(A)**	**>3 dB(A)**
Ineligible		(Not applicable)	(Not applicable)	(Not applicable)	(Not applicable)
63-stet		(Not applicable)	(Not applicable)	(Not applicable)	(Not applicable)
63-plus					
68-plus					
15-delta					
45-heavy					
Total					

11 Summary of key guideline principles

1. The Department will apply these guidelines to the State road network. In practice, only category 1, 2 and 3 roads are likely to warrant noise mitigation because traffic volumes and speeds on category 4 and 5 roads will typically be too low to trigger established noise criteria.

2. The Department will only consider noise mitigation when a new or upgraded road project is being contemplated. In the absence of a specific project, the Department will not consider mitigating the progressive creep in traffic noise that occurs as a natural consequence of traffic growth.

3. Both existing buildings and buildings approved but not yet built at the cut-off date will be considered for mitigation eligibility – if a road project requires planning approval the cut-off date for building consideration will be the date that the road project's development application is submitted to Council; if planning approval is not required the cut-off date will be the date construction tenders are called or maintenance work is commissioned.

4. Target noise limits will be assessed against 10-year future noise levels, which are the predicted noise levels 10 years into the future after completion of the road project's construction.

5. The Department will not consider noise mitigation for buildings that are less than 50 m away from the edge of the road corridor and which were built subsequent to the construction of the road or the proclamation of the road corridor or the depiction of the road corridor in a planning scheme.

6. Any decision made by the Department under these guidelines will be subject to reasonableness, practicality and cost-effectiveness tests.

7. For the purposes of these guidelines, two of the key descriptors that the Department will commonly use are L_{A10}(18 hour) and L_{Aeq} (T), where the time period, T, depends on the situation.

8. The Department adopts L_{A10} (18 hour) 63 dB(A) as the design external noise level and L_{A10} (18 hour) 68 dB(A) as the operational upper limit, both to be measured at the building façade most exposed to traffic noise (or in the case of an approved but not yet built building, 1 m from the most exposed edge of the approved building envelope).

9. The Department adopts L_{A10} (18 hour) 52 dB(A) as an alternative external target noise level, with assessment against this criterion to be in any outdoor living area located on the side of the building opposite to the façade most exposed to traffic noise (or in the case of an approved but not yet built building, 1 m from the most exposed edge of the approved building envelope).

10. Where external noise criteria cannot be reasonably or practicably achieved, the Department will consider the acoustic treatment of sensitive use buildings to achieve internal noise criteria.

11. In circumstances where the Department offers acoustical treatments to houses to mitigate daytime traffic noise, the Department will determine reasonable and practical treatments that are calculated to best achieve an internal noise criterion of L_{Aeq} (16 hour) 35 dB(A).

12. In greenfield situations, where a new road is proposed in an area where the predicted L_{A10}(18 hour) noise level from the future traffic will be more than 15 dB(A) above the measured existing L_{Aeq}(16 hour) ambient noise outside affected sensitive use buildings, the Department will consider reasonable and practical acoustical treatments that are calculated to best achieve an internal noise criterion of L_{Aeq}(16 hour) 35 dB(A).

13. The Department will use the external L_{Aeq}(8 hour) 45 dB(A) as the trigger criterion for heavy vehicle noise on category 1, 2 and 3 roads, where Departmental decision making results in changed patterns of heavy vehicle movements.

14. In circumstances where the Department offers acoustical treatments to sensitive use buildings to mitigate night time traffic noise, the Department will determine reasonable and practical treatments that are calculated to best achieve an internal night time noise criterion of L_{Aeq} (8 hour) 30 dB(A).

15. Road construction work will nominally be between the hours of 7 am and 6 pm Monday to Friday; 8 am and 6 pm Saturdays; and, 10 am to 6 pm on Sundays and public holidays. However, after balancing the potential impacts associated with extended hours of operation, extended construction period and increased construction costs, the Department may adopt different hours on a project by project basis.

16. When making external traffic noise assessments against the L_{A10}(18 hour) 63 dB(A) external noise target criterion or L_{A10}(18 hour) 68 dB(A) desirable upper limit, the Department will use the standard assessment location of 1 m from the building's most exposed façade (or in the case of an approved but not yet built building, 1 m from the most exposed edge of the approved building envelope).

17. When making external traffic noise assessments against the alternative location L_{A10}(18 hour) 52 dB(A) external noise target criterion, the Department will use an assessment location in the centre of any outdoor living area (if one exists) on the side of the building opposite to the façade most exposed to traffic noise (or in the case of an approved but not yet built building, 1 m from the most exposed edge of the approved building envelope).

18. When making external traffic noise assessments against the L_{Aeq}(8 hour) 45 dB(A) target criterion for night time noise from heavy vehicles, the Department will use the standard assessment location of 1 m from the most exposed building façade (or in the case of an approved but not yet built building, 1 m from the most exposed edge of the approved building envelope).

19. Acoustical treatments to achieve internal noise nominal design criteria will be determined by calculation from external noise done in good faith but with no performance guarantees and no internal noise measurements, either for design or post-construction confirmation.

20. The Department will only consider noise mitigation for undeveloped land where that land is already zoned for a sensitive use in an applicable planning scheme and is already subdivided.

21. The Department will only consider mitigation of traffic noise for new roads within a proclaimed road corridor for buildings that existed prior to proclamation or that have since been constructed on land that was zoned for a sensitive use prior to proclamation. If the new road goes outside the corridor in any place(s), mitigation works will be considered for eligible buildings out to a distance of 300 m from that excursion.

22. The Department will only consider traffic noise mitigation for new roads within a road corridor shown within a planning scheme, for buildings that existed prior to that corridor being added to the scheme or that have since been constructed on land that was zoned for a sensitive use prior to that corridor being added to the scheme. If the new road extends beyond the corridor in any place(s), mitigation works will be considered for eligible buildings out to a distance of 300 m from that excursion.

23. The Department will not accept responsibility for traffic noise mitigation where a sensitive use has knowingly moved to an area where traffic noise problems are likely or where there is evidence of

inadequate consideration of noise impacts by developers or landowners.

24. When selecting seal type, the Department will include noise minimisation amongst its design objectives but the final choice of seal will be one that achieves the best overall balance of all objectives.

25. Where practicable, the Department will locate road seal changes away from sensitive land uses.

26. The Department will not unnecessarily use audible edge markings but nevertheless will always favour road safety over noise reduction.

27. The Department will only consider the use of noise barriers at buildings (as distinct to near the road edge) in exceptional circumstances.

28. The Department will only consider noise mitigation out to 300 m in any direction from the end-to-end centreline of a road project.

29. While the Department will implement noise mitigation measures in good faith it makes no guarantee that their performance will be as predicted or that mitigation targets will be achieved.

Comments?

Comments on these guidelines can be submitted to:
Email: eda@stategrowth.tas.gov.au
Traffic Noise Guideline Comments
Department of State Growth
GPO BOX 536
Hobart Tasmania 7001

Glossary

Terminology	Description
10-year future	The time 10 years after the completion of the road project's construction work
15-delta building	An assessment building where the 10-year future L_{A10}(18 hour) traffic noise will be less than 63 dB(A) but more than 15 dB(A) greater than the existing background noise, thereby making the building eligible for mitigation.
45-heavy building	An assessment building where a permanent increase in the proportion of heavy vehicles as a result of a Departmental traffic rerouting decision will take night time heavy vehicle traffic noise on a class 1 or class 2 road above L_{A10}(8 hour) 45 dB(A), thereby making the building eligible for mitigation.
63-plus building	An assessment building where the existing L_{A10}(18 hour) traffic noise at the building façade is less than or equal to 63 dB(A) but at which the 10-year future noise will be greater than 63 dB(A), thereby making the building eligible for mitigation.
63-stet building	An assessment building where the existing L_{A10}(18 hour) traffic noise at the building façade is greater than 63 dB(A) but where the 10-year future noise will be less than or equal to 68 dB(A), thereby making the building **not** eligible for mitigation (the status quo remains).
68-plus building	An assessment building where the existing L_{A10}(18 hour) traffic noise is already greater than 63 dB(A) and at which the 10-year future L_{A10}(18 hour) traffic noise will be greater than 68 dB(A), thereby making the building eligible for mitigation.
A-weighted	The most commonly used noise level scale, which is weighted to best approximate the sensitivity human hearing.
Acoustical treatment	Works undertaken on a building to reduce the penetration of traffic noise into the interior of the building (eg. double glazing, door seals).
Ambient noise	The combined noise in the environment from all sources, often measured as an L_{Aeq}.
Assessment building	A sensitive use building (eg. house) within an eligible scenario, for which traffic noise mitigation requirements will be considered.
Background noise	In a fluctuating noise environment, the noise exceeded for 90% of the time, L_{A90}, in the absence of the noise under consideration.
Best practice environmental management	The management of the activity to achieve an ongoing minimization of the activity's environmental harm through cost-effective measures assessed against the current international and national standards applicable to the activity.
Building setback	The horizontal distance from the edge of a road or property boundary (depending on the context the term is used) to the building structure.
Carriageway	A road, whether single or multilane, where traffic is able to travel in one direction only
Category 1 – Trunk roads	The primary freight and passenger roads connecting Tasmania's largest population centres, major sea ports and key industrial locations. These roads facilitate inter-regional freight and passenger vehicle movement, and business interaction.
Category 2 – Regional freight roads	Tasmania's major regional roads for carrying heavy freight. These roads facilitate heavy inter-regional and sub-regional freight and passenger vehicle movement, commercial interaction and tourist movement.
Category 3 – Regional access roads	The main access roads to Tasmania's regions, carrying less heavy freight than Regional freight Roads. These roads facilitate the connection of smaller regional bases with trunk and freight roads, local commercial interaction and subregional freight, passenger vehicle and tourist movements.
Category 4 – Feeder roads	Allowing safe travel between towns, major tourist destinations and industrial areas. These roads facilitate connection to Trunk, Regional Freight and Regional Access Roads. While some of these roads carry heavy freight traffic, they are not the Department's preferred heavy vehicle routes.
Category 5 – Other roads	The remainder of the State roads.

Community benefit	The use and development of land for: (a) the provision of public (includes a corporation owned by the State) utilities and infrastructure; or (b) the extraction of material required as a regional resource from a specific site (e.g. quarry).
CoRTN	The UK Department of Transport's Calculation of Road Traffic Noise (1988).
dB(A)	The abbreviation of decibel, measured on the A-weighted scale (the scale that best approximates human hearing).
decibel	The unit used when measuring noise on the logarithmic sound pressure scale.
Eligible scenario	A road works and/or road traffic scenario where the Department will consider traffic noise mitigation.
Excluded situation	A road works or traffic situation excluded from consideration for traffic noise mitigation.
External traffic noise	Traffic noise measured outside a building.
FHWA	The US Federal Highway Administration and US Department of Transport's Federal Highway Administration Model.
Future road	A corridor shown on the plans of a planning scheme within which a future road is intended to be built.
Greenfield situation	A situation where there is currently little, if any, traffic but where a future road is proposed to be constructed (an example is where a town bypass is going to be constructed through rural land where there are currently no roads)
Internal traffic noise	Traffic noise measured inside a building.
Junction	An intersection of two or more roads at a common level, including intersections of on and off ramps and grade-separated roads.
L_{A10} (18 hour)	The A-weighted noise level exceeded 10% of the time over the 18-hour period between 6 am and midnight. When applied to traffic, it relates to the noise from the traffic only.
L_{A90} (T)	The A-weighted environmental noise level during a specified measurement period T which is exceeded 90% of the time.
L_{Aeq} (16 hour)	The A-weighted equivalent noise level over the 16-hour period between 7 am and 11 pm. When applied to traffic in these guidelines, it relates to the noise from the traffic only.
L_{Aeq} (8 hour)	The A-weighted traffic equivalent noise level over the 8-hour period between 11 pm and 7 am. When applied to traffic in these guidelines, it relates to the noise from the traffic only.
Local road	Any road maintained by a Council.
Minor road works	Maintenance, repair and minor upgrades of roads, including: (a) minor widening or narrowing of existing carriageways; and (b) making, placing or upgrading kerbs, gutters, footpaths, roadsides, traffic control devices and markings, street lighting and landscaping.
Noise barrier	A wall made of timber, concrete or other dense material constructed alongside roads (in the case of traffic noise) to reduce the propagation of road traffic noise towards sensitive use buildings.
Noise mound	An earth mound wall constructed alongside roads (in the case of traffic noise) to reduce the propagation of road traffic noise towards sensitive use buildings.
Planned road	A future road for which the corridor has been proclaimed or which is shown in a planning scheme.
Planning scheme future road corridor	A ribbon of land designated in planning scheme zoning maps as being where a road may be constructed in the future
Proclaimed future road corridor	A ribbon of land proclaimed under the *Roads and Jetties Act 1935* as being where a road may be constructed in the future
Residential use	While this may formally be defined differently in different planning schemes, for the purposes of these guidelines residential use means land on which a domestic house has been or may be built.
Road	The road pavement (usually bitumen on State roads) and its adjacent (gravel) road shoulders
Road corridor	The wider ribbon of land within which an existing road lies, and which includes vacant Crown

	land either side of the road
Sensitive use	A residential use or a use involving the presence of people for extended periods such as in a caravan park, childcare centre, dwelling, hospital or school, except in the course of their employment.
Traffic volume	The number of vehicles using a given section of road in a specified period, usually measured as the Average Annual Daily Traffic (AADT).

CONTACT DETAILS

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