

Pine Rivers Shire Council

Planning Scheme Policy

PSP6 Traffic Noise Attenuation

Planning Scheme Policy for Pine Rivers Shire

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ADOPTION

Pine Rivers Shire Council adopted this planning scheme policy on 19 June 2006.

COMMENCEMENT

This planning scheme policy took effect from 15 December 2006.

I, Ray Burton, Chief Executive Officer, of the Pine Rivers Shire Council, hereby certify that this document is a true copy of the original.



Ray Burton
Chief Executive Officer

PSP6 - TRAFFIC NOISE ATTENUATION

HEAD OF POWER

This policy is a document that supports the planning scheme for the Shire and has been made by Council using the process prescribed in Chapter 2, Part 1, Division 5 of the *Integrated Planning Act 1997*.

OBJECTIVE

The purpose of the policy is:-

- (1) To provide information to registered proprietors of residential lots about traffic noise levels. (Where noise levels may impact on domestic activities, property notes shall be placed on Council's property note system recommending types of dwelling construction to control the intrusion of noise into the dwelling, and the need to maintain the integrity of fences installed for traffic noise reduction);
- (2) To identify residential lots which may be affected by significantly increased future traffic noise or noise levels which may be effectively ameliorated by traffic noise barriers;
- (3) To set out the general method of calculation for predicting traffic noise levels at the facade of dwellings in residential zones;
- (4) To define the format in which a Traffic Noise Study shall be presented to Council to encourage accurate interpretation by members of the public;
- (5) To identify existing and/or proposed Park which may be affected by significantly increased future traffic noise or noise levels which may be effectively ameliorated by traffic noise barriers; and
- (6) To prescribe approved traffic noise amelioration measures required to be undertaken by the developer.

DEFINITIONS/APPLICATION

Application

This policy applies to all residential development adjacent to:-

- (1) Queensland Department of Transport/Main Roads:-
 - (a) State Controlled Roads;
 - (b) Transit/Transport Corridors; and
- (2) Pine Rivers Shire Council:-
 - (a) Arterial Roads;
 - (b) Sub-arterial Roads;
 - (c) Access Restricted Roads; and
 - (d) Other Roads and Driveways as may be necessary due to site specific environmental factors.

Definitions

Unless otherwise indicated in this policy, all terms used have the meanings prescribed in Chapter 7 of the Planning Scheme for the Shire.

POLICY STATEMENT

(1) Requirement for Traffic Noise Study

A Traffic Noise Study must be supplied as part of the supporting documentation for an application to reconfigure lots to which this policy applies. (The assessment of the study shall be in accordance with this policy.)

(2) Prediction of Design Traffic Noise

The Traffic Noise Study (TNS) shall include predictions for noise generated by the design traffic.

The calculation for the predicted Traffic Noise Levels shall be in accordance with "Calculation of Road Traffic Noise" (HMSO, 1988 being reference 2) and parameters set out in this policy.

It is accepted that the design procedure proposed in "Calculation of Road Traffic Noise" is valid for distances of up to 300 metres from the noise source line.

(a) Queensland Department of Transport/Main Roads Controlled Roads and Corridors

The TNS and amelioration measures shall be in accordance with this policy, except where the Queensland Department of Transport/Main Roads have additional requirements.

(b) Pine Rivers Shire Council Roads

(i) Noise Generation

A TNS should consider the following elements and parameters in determining noise generation:

(A) Noise source line

The numbers and frequency of road traffic generally allow each lane to be treated as a noise source line.

Each noise source line is defined to be the source of traffic noise and shall be a line 0.5 metres above the road surface and 3.5 metres in from the nearside lane edge.

(B) Traffic flow

The deemed-to-comply traffic flow shall be the design traffic flow for the road classifications as stated in Table 1 below.

In special circumstances, the traffic flow may be derived from traffic studies commissioned by Council and adjusted for average annual growth rates as advised by Council.

(The traffic flows in Table 1 are for 24 hour periods and shall be adjusted for the 18 hour period between 0600 hours and 2400 hours on a normal weekday.)

(C) Traffic composition and speed

The percentage of commercial vehicles varies (CV%) with the road classification. The deemed-to-comply percentages are given in Table 1. Some roads may have specific environmental factors which may increase the percentage of commercial vehicles. In these cases the Acoustic Engineer shall increase the percentage accordingly.

The speed of vehicles is recognised as that which is most commonly travelled by the majority of vehicle traffic. The speeds also reflect free flowing traffic appropriate to the road classification.

Table 1 - Deemed-to-Comply Traffic Parameters

Road Classification	V.P.D.	CV%	K.P.H.
Collector	3,000	3	40
Trunk Collector	9,000	4	60
Sub-Arterial	12,000	8	70
Arterial	30,000	10	80
QDOT/DMR Roads*		10	80

* Obtain traffic parameters (ultimate figures) from QDOT/DMR, but not less than values in table.

(D) Road gradients

Additional noise generated at gradients shall be considered in determining segments of road for analysis.

The TNS must include a plan detailing segments of road used in prediction calculations.

(E) Road surface

The type of road surface shall be determined and stated in the assessment report.

(ii) Noise Propagation

The TNS shall consider, among other things, the following elements which affect noise propagation:-

(A) Ground cover

For the purposes of the TNS, all ground surfaces (other than carriageways) are absorbent in nature. Where it is determined that a noise barrier is required, then ignore noise attenuation caused by absorbent ground surfaces.

(B) Obstructions

For the purposes of the TNS, propagation within road reserves is not obstructed, except for topographic shadow.

(C) Shielding effects

The deemed-to-comply shielding effects of intervening dwellings on primary allotments/lots (those adjacent the noise source road) shall be zero.

The Acoustic Engineer may consider these effects using a 15 x 10 metre single storey (lowset) design dwelling situated with minimum setback. Further, consideration may be given to treating a uniform row of dwellings as a "screening event" where the distance to the next row of houses is sufficiently large.

(D) Opposite facade effects

For all new access restricted roads, noise attenuation barriers shall be assumed to be constructed on both sides of the road unless the topography provides a natural noise barrier (e.g. cut embankment).

For existing roads with dwellings fronting the road opposite the subject development, assume that no noise barrier will be constructed opposite the development, but include the effect of opposite fence and dwelling facades.

(E) Receptor point facades

The receptor point shall be 1 metre in front of the most exposed part of an external window or door in a dwelling wall facing the road and 1.6 metres in height (all design dwellings are single storey (lowset) slab on ground construction).

A facade reflection of 2.5dB(A) shall be applied.

(F) Dwelling setbacks

The applicable boundary setbacks for dwellings vary according to the type of development and zone. Those accepted as deemed-to-comply setbacks are tabulated in Table 2.

Table 2 - Deemed-to-Comply Dwelling Setbacks

Zone	Dwelling	Common Road Boundary	Setback (m)
Residential A	Detached Dwelling	Rear	15
		Side	1.5
		Front	6
	Integrated Housing	Rear	10
		Side	0.15
		Front	6
	Dwelling units within a community titles scheme		12
Other Zones	Building Area		Shortest Distance

(G) Side roads

The impact of side roads and the contribution that they make to the total noise level at adjacent receptor point facades must be carefully considered and fully documented in the TNS.

(3) Methodology

- (a) Where existing traffic flows are less than 30% of design conditions, the predicted traffic noise levels shall be determined by calculation.
- (b) Where existing traffic flows are greater than 30% of design conditions, predicted traffic noise levels may be determined by measurement of existing noise and extrapolating the data to the design conditions in accordance with AS2702-1984 "Methods of Measurement of Road Traffic Noise".

Extrapolation of the measured noise data to design conditions shall be obtained by applying the following corrections:-

- (i) For increased traffic numbers, add:

$$10 \log (Q_{\text{design}}/Q_{\text{test}})$$

where:

Q_{design} = design daily flow rate;

Q_{test} = equivalent daily flow rate at the time of testing.

- (ii) For increased percentage of heavy vehicles, add:

$$10 \log (1 + (5P_{\text{design}}/V))/(1 + (5P_{\text{test}}/V))$$

where:

P_{design} = design percentage heavy vehicles;

P_{test} = the percentage heavy vehicles during tests;

V = traffic speed.

- (iii) Where appropriate, increased traffic noise generated by greatly increased design speeds shall be taken into account.

(4) Traffic Noise Barriers

(a) Requirements for Noise Barriers

- (i) Traffic Noise Barriers shall be provided to obtain Traffic Noise Reduction (TNR) when:-
 - (A) Required by the Queensland Department of Transport/Main Roads; or
 - (B) The combined expected noise levels generated by traffic exceed 63dB(A) L_{10} (18 hours) on any part of the residential lot; or
 - (C) The noise levels generated by traffic is expected to increase by more than 5dB(A) on any part of a residential lot when existing road traffic increases to the design traffic flow for the road classification as stated in Table 1.

- (ii) Park

Where Park is proposed to be dedicated in a location subject to Traffic Noise levels which are predicted to exceed 63dB(A), the Council shall determine the TNR measures it requires for the park when considering the application. In making its decision, the Council will consider amenity, access, times of patronage and safety of the public.

- (iii) Infill Development

Where development is proposed on land subject to Traffic Noise Levels which are predicted to exceed 63dB(A) and the development "fills in" small sections of developable land along the traffic generating road, Council may direct not to apply the TNB section of this policy and only place appropriate property notes on Council's property note system.

- (iv) Community Title Schemes, Integrated Housing and Similar Developments

Where Council obtains sufficient surety that dwellings to be constructed will be designed and constructed to categories required in "AS 3671-1989, Acoustics - Road Traffic Noise Intrusion - Building Siting and Construction" for the predicted Traffic Noise Levels, Council may direct which parts of, if any of, this policy it wishes to apply, but in any circumstance, the appropriate property note shall be placed on Council's property note system.

- (v) Trunk Collector Roads and Sub Arterial Roads

Council may direct which part of, if any of, this policy it wishes to apply in instances where:-

- (A) the predicted annual average daily traffic will not exceed 9000 vehicles per day; and

- (B) it can be demonstrated that the traffic function will not be significantly affected; and
- (C) Council considers that appropriate measures are put in place to minimise traffic noise intrusion into dwellings for the predicted Traffic Noise Levels. (These appropriate measures may take the form of appropriate building setbacks, or suitable topography, or providing access via a service road/laneway).

However, in all instances, the appropriate property note shall be placed on Council's property note system.

(vi) Driveways

Where a driveway is associated with heavy vehicle access and it is adjacent to residential lots, this policy may be applied, and appropriate property notes shall be placed on Council's property note system for each of the adjoining lots.

(b) Limitations on Barriers

Although the intention of this policy is to reduce Traffic Noise Levels so that they do not exceed 63dB(A), it is recognised that in certain circumstances this may not be practical. In particular, the following should be avoided:-

- (i) Traffic Noise Barriers should not generally exceed 3.0 metres in height to keep to a minimum any degradation of visual amenity in residential areas;
- (ii) Where an acoustic fence is proposed as a Traffic Noise Barrier adjacent to lots, it shall not exceed 2.0 metres in height;

Where road and adjacent lot levels vary significantly, site specific solutions exceeding 3.0 metres in height may be approved by the Council's Engineer for short distances.

Where Traffic Noise Barriers are required to exceed 3.0 metres in height for long distances (greater than 60 metres) Council shall consider the proposed barrier and give direction as to:-

- (iii) The form of the barrier needed to keep predicted TNR's below 63dB(A); or
- (iv) Relax the performance criteria by limiting the height of the barrier and property noting affected lots to the effect that predicted traffic noise levels exceed 63dB(A).

(c) Types of Barriers

There are many types of TNB available, but those described below are the deemed-to-comply types:-

(i) Earth Mounds

The preferred TNB is an earth mound with an attenuating face slope of 3:1 (H:V), a crest at least 1 metre wide and a shadow face slope no steeper than 4:1 (H:V). The compaction of this mound shall be in accordance with Council's Civil Infrastructure Design Policy. Both faces shall be appropriately landscaped in accordance with Council's Civil Infrastructure Design Policy to reduce the visual impact and to keep maintenance to a minimum. Adequate provision shall be made for stormwater collection and disposal so as not to cause annoyance or nuisance.

Generally, the whole of the mound including drainage structures shall be located on road reserve (additional to that required by Council's standard cross section drawings for roads shown in the Civil Infrastructure Design Policy).

(ii) Acoustic Fences

An alternative TNB is an acoustic fence. Generally, the acoustic fence will comprise timber panels, being either plywood or palings and shall be designed such that it complies with the relevant Australian Standards for pool fences where the TNB abuts a residential lot. Fence barriers shall be designed as a structural element able to withstand environmental conditions and provide long term adequate levels of service for traffic noise reduction. Appendix A sets out the design and specification for traffic noise fences.

Where an acoustic fence is approved by Council, additional road reserve (i.e. additional to that required by Council's standard cross section drawings for roads) may be required for buffer landscaping.

The landscaping shall be provided in accordance with Council's Civil Infrastructure Design Policy to reduce the visual impact of the fence and to keep maintenance to a minimum. Existing vegetation shall be retained wherever possible, (in particular tall trunk trees).

Where the area through which the acoustic fence is located has confirmed koala sightings, landscaping shall incorporate koala food native trees on both sides of the fence at no more than 15 metre spacings. These may be opposite or staggered so that branches will eventually overlap and provide a koala "corridor" with trees forming "bridges" over the fence.

Council's Engineer shall nominate the type of fence to be used on a site specific basis.

(iii) Combination Barrier

Where a TNB incorporates both mounds and acoustic fencing the maximum height of the fence shall not exceed 2.0 metres.

Mounds less than 1.0 metre in height may be located such that the crest and fence location are on the Access Restriction Strip and the additional road reserve required to contain the mound shall be equal to the width of the noise attenuating face and mound crest. In these situations the shadow face of the mound may be on lots or a retaining wall shall be constructed on the lot boundary.

Council's Engineer may approve combination barriers.

(iv) Other Structures

In special circumstances, alternative structures may be considered where the deemed-to-comply TNB do not provide optimum noise attenuation or the alternative may provide additional benefits. An example would be a brick wall used as an entrance statement to an estate or provided to "break-up" long lengths of timber fencing.

Each proposal will be individually assessed and should address the ability of the TNB to provide TNR, longevity of life, costs to repair damage caused by vandalism, maintenance requirements and whether the structure is appropriate for the area in which it is being proposed.

Council's Engineer may approve the proposals for the use of alternative structures.

(5) Required Noise Data and Form of Presentation

Traffic noise levels shall be quantified in terms of L10, 18hr level (dBA). This corresponds to the 10 percentile statistical exceedence level, averaged over eighteen one-hour periods between 6.00 a.m. and midnight on a typical weekday.

Predicted traffic noise levels shall apply to traffic flows under design conditions.

Predicted traffic noise data is to be presented in the form caused by isolated noise level contours constructed on a scaled drawing of the residential lot or lots within a subdivision.

Noise level contours shall be constructed assuming free-field propagation. No allowance shall be included for reflections from or attenuation by screening by buildings located on the subdivision.

The noise level contours shall allow for attenuation provided by noise barriers constructed on or adjacent to the subdivision and shall also include attenuation due to topographical screening.

(6) Traffic Noise Study (TNS) Documentation

The TNS shall include:-

- (a) Subject land legal description and locality sketch;
- (b) Site layout plan showing surface contours;
- (c) Measurements of Existing Traffic Noise (where applicable);
- (d) Prediction of Design Traffic Noise;
- (e) A plan detailing road segments (scale 1:1000);
- (f) A plan showing the predicted 55 and 63dB(A) traffic noise level contours;
- (g) A plan showing the location of the TNB and the 55 and 63dB(A) traffic noise level contours and detailing the:-
 - (i) height and extent of the TNB;
 - (ii) density of the TNB.

Note that the plans identified in (b), (f) and (g) above shall all be at the same scale, while the information shown on the plans identified in (f) and (g) shall be limited to lot boundaries, lot numbers, noise contour locations and road names.

(7) Traffic Noise Barriers (TNB)

Once the TNS has been approved, a TNB has been identified as being required and the type of TNB to be provided has been nominated by Council's Engineer, the following are required for review and approval by Council's Engineer:-

- (a) Structural details of the TNB to be constructed;
- (b) A copy of specifications for earthworks and compaction for earthmounds and, for timber fences, materials and workmanship specifications;
- (c) A landscaping plan detailing embankment protection works and all plant species, and certified as being in accordance with Council's Civil Infrastructure Design Policy.

(8) Property Notes

Property notes under this policy are advisory in nature and are intended to inform registered proprietors that, with normal dwelling construction materials and techniques, traffic noise intrusion may be apparent in dwellings. The property notes recommend that dwelling design consider traffic noise reduction (TNR) elements to reduce noise intrusion so that interior design noise levels as suggested by the relevant Australian Standards are achieved.

- (a) Property notes shall be recorded for all lots where the 55dB(A) (fascade reflection adjusted) noise levels will be exceeded. The 55dB(A) lower limit has been adopted as it:-
 - (i) approximately represents half the perceived background noise level when exposed to a 63dB(A) background noise level;
 - (ii) is accepted as being reasonably achievable in quiet residential streets; and
 - (iii) is closely derived by the following calculation:

Maximum Interior Design Sound, AS 2107 - 1987	40dB(A)
Category 1 (Standard Construction), AS 3671 - 1989	10dB(A)
$L_{A10,T} = L_{Aeq,T} + 3dB(A)$	53dB(A)
Fascade Reflection	2.5dB(A)
Lower Limit	55.5dB(A)

- (b) The following property note shall be placed on Council's property note system for all lots with traffic noise levels in the Range of 55 – 63dB(A):-

"The predicted long term traffic noise levels are expected to be in the range of 55 - 63dB(A). To minimise intrusion of traffic noise into dwellings they should be designed to Categories 2 or 3 as defined in Australian Standard AS3671-1989. Where dwellings are elevated above ground or are of two storey design, they may have greater exposure to traffic noise. It is recommended that advice be sought from a person expert in dwelling design about ways to reduce traffic noise intrusion."

- (c) The following property note shall be placed on Council's property note system for all lots with traffic noise levels exceeding 63dB(A):-

"The predicted long term traffic noise levels are expected to exceed 63dB(A). To minimise intrusion of traffic noise into dwellings they should be designed to Categories 3 or 4 as defined in Australian Standard AS3671-1989. Where dwellings are elevated above ground or are of two storey design, they may have greater exposure to traffic noise. It is recommended that advice be sought from a person expert in dwelling design about ways to reduce traffic noise intrusion."

(9) Reference Documents

- (a) Calculation of Road Traffic Noise, Department of Environment, Welsh Office, HMS0, 1975.
- (b) Calculation of Road Traffic Noise, Department of Transport, Welsh Office, HMS0, 1988. ISBN 0 11 550847 3
- (c) Australian Standard AS1633 - 1985: Acoustics - Glossary of Terms and Related Symbols. ISBN 0 7262 3863 5
- (d) Australian Standard AS2107 - 2000: Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors. ISBN 0 7337 3719 6
- (e) Australian Standard AS 2702 - 1984: Acoustics - Methods for the measurement of Road Traffic Noise. ISBN 0 7262 3348 X

- (f) Australian Standard AS3671 - 1989: Acoustics - Road Traffic Noise Intrusion - Building Siting and Construction. ISBN 0 7262 5514 9
- (g) Interim Guidelines and Technical Notes for Traffic Noise Amelioration, Queensland Department of Transport, July 1992".

REVIEW TRIGGERS

This policy is reviewed internally for applicability, continuing effect and consistency with planning scheme and other legislative provisions when any of the following occurs:-

- (1) the planning scheme is amended;
- (2) the planning scheme is replaced by a new planning scheme;
- (3) amendments which affect the allowable scope and effect of a planning scheme policy are made to the Integrated Planning Act 1997; and
- (4) other circumstances as determined from time to time by a resolution of Council.

RESPONSIBILITY

Responsibility

This policy is to be:-

- (1) implemented by the Manager, Development Services; and
- (2) reviewed and amended in accordance with the "Review Triggers" by the Manager, Strategic Direction in consultation with the Manager, Development Services.

APPENDIX A

Noise Barrier Fence Design and Specification

This technical note details Council's requirements for traffic noise fences.

(1) Introduction

Where fencing is approved as a noise barrier the performance criteria requires that the fence be designed as a structural element able to withstand environmental conditions and provide long term adequate levels of service for traffic noise reduction and structural integrity.

The fence shall have no gaps between posts, panels, sleepers or the ground. Adequate drainage shall be provided to timber elements directly in contact with the ground.

This technical note provides a standard which is deemed-to-comply with the prescribed performance criteria. The Engineer shall ensure that the fence is designed to meet the performance criteria and shall include any additional printed manufacturer's recommendations (where applicable), provided they are not contradictory in nature to the requirements set out in this technical note.

(2) Design Loading Requirements

Noise barriers shall be designed by a Registered Professional Engineer Queensland to resist those loads applicable under AS 1170 and specifically allow for wind speed and dynamic suction imposed by moving vehicles as applicable.

(3) Minimum Sections Sizes

The following minimum section sizes apply to the design:-

- (a) Steel members: 4mm minimum wall thickness;
- (b) Timber posts: 150mm diameter (minimum); or
100 x 100mm rectangular (minimum);
- (c) Sleepers: 200 x 38mm rectangular (minimum);
- (d) Noise panels: Minimum thickness shall be 25mm for softwood
(after shrinkage drying)
Minimum thickness shall be 16mm for Hardwood
(after shrinkage drying)
(Minimum density shall be that specified in the TNS
(after shrinkage drying))

(4) Design - Steel Components

(a) Materials

All structural posts shall be rolled sections conforming to AS 1163, Grade 350. Base plates and associated supports shall conform to AS 3678, Grade 250.

All fabrication shall be in accordance with AS 1554 Part 1.

All mild steel components shall be hot dipped galvanised after fabrication in accordance with AS 1650.

(b) Structural Design

Design strength of steel components shall be in accordance with AS 4100 or AS 4600.

(5) Design - Timber Components – Softwood & Hardwood

(a) Materials

All timber shall comply with the following rating specifications and performance requirements with reference to Queensland Forest Service Technical Pamphlet No. 1.

(b) Timber Performance Requirements

- (i) Timber posts, rails & palings may be F11 hardwood provided the grading and preservation equals that required in this Technical Note.

- (ii) Structural Pinus species shall be sawn timber graded in accordance with AS 2858 "Softwood", visually Stress-Graded for Structural Purposes, or round poles graded in accordance with AS 2209. The posts shall be strength group S5 (Slash Pine).
- (iii) Any sapwood cladding and structural timber not in contact with ground shall be treated to at least Hazard Level 3 to AS 1604 and any sapwood on timber in contact with the ground shall be treated to Hazard Level 5 to AS 1604.
- (iv) Durability Class 3 timbers coded "T" as suitable if preservative treated to Hazard Level 5 to AS 1604 may contain limited amounts of unpenetrated or inadequately treated heartwood not comprising more than 20% of the cross-section of the piece at any point.
- (v) End grains exposed to weather shall be protected by capping of wax emulsion with nail plate applied after construction.
- (c) Plywood Panels

Structural plywood shall be Stress Grade F14 in accordance with AS 2269. Plywood panels above ground shall be treated to Hazard Level 4 to AS 1604. Panels in contact with the ground shall be treated to Hazard Level 6 to AS 1604.
- (d) Timber Panels

Structural sawn softwood shall be graded to F5 or better in accordance with AS 2858.

Cladding shall be permitted to have the imperfections allowed in AS 2858 Structural Grade 5 with the following limitations:-

 - (i) Individual Knots - sound, tight and not exceeding one-third of the width of the face;
 - (ii) Heart-in material:-
 - (A) not exceeding 20% of the cross-sectional area;
 - (B) not extending from one surface to another;
 - (C) no pith;
 - (iii) Termite galleries - not permitted;
 - (iv) Heart shakes - not permitted;
 - (v) Decay - not permitted.
- (e) Structural Design

Timber posts and structural elements of noise panels shall be designed in accordance with AS 1720 and AS 2269.
- (6) **Design - Timber Panels**
 - (a) General

Timber noise barriers may be one of the types listed below.
 - (b) Fence Type 1 - Paling Panels

A Type 1 fence comprises posts, railings, a sleeper base strip and noise panels constructed of either softwood or hardwood CCA treated palings placed vertically such that:-

 - (i) Palings:-
 - (A) overlap to the adjoining paling by 25mm;
 - (B) terminate 25mm clear of the finished surface level of the ground;
 - (C) overlap the sleeper by not less than 75mm;
 - (D) are fixed to railings and sleepers with two connectors to each railing and sleeper;
 - (ii) Railings shall be less than 600mm apart with the top rail not more than 100 mm from the top of the palings;
 - (iii) Where a capping rail is provided, it shall sit over the palings and be fixed to the top railing at intervals of not greater than 450mm;
 - (iv) Sleepers shall be embedded 75mm into the ground;
 - (v) The backfill material shall be loam generally as specified in Table 1.
 - (c) Fence Type 2 - Plywood Panels

A Type 2 fence comprises noise panels constructed of plywood material such that:-

- (i) Panel configuration when viewed from a plan perspective is a sawtooth design with the leading edge of the panel "hidden" to the approaching traffic, ie., on the allotment side of the post;
- (ii) The fence assembly complies with the plywood manufacturer's recommendation;
- (iii) A capping rail sits over the top edge of the panel and is fixed to the panel at not greater than 450mm spacings;
- (iv) The panel sits 75mm below the finished surface level of the ground;
- (v) The backfill material shall be gravel as specified in Table 1.

(7) Connectors

All connections shall be designed to adequately secure all members for the design loading.

All nails, screws, bolts, nuts and washers shall be hot dipped galvanised in accordance with AS 1214, AS 4534, AS 4680 and AS 2334 as applicable. (Stainless steel connectors are an approved alternative while chemically coated alternatives may be approved.)

Zinc plated screws, bolts or nails will not be accepted.

(8) Footings

(a) 450mm Diameter Footings

Generally footings shall be 450mm diameter to a suitable depth for stability. (The depth of footings in flat terrain with average ground conditions shall not be less than 900mm, unless they have been engineered designed.)

Any footing built on:-

- (i) an earth mound; or
- (ii) in the proximity of a batter or cutting; or
- (iii) in poor ground; or
- (iv) in saturated ground;

shall have the depth of the footing increased to compensate for the location.

(b) Alternative Footing Diameters

If the Engineer elects to use an alternative diameter footing a recognised method (eg. Brom's method) must be used. However, in no case shall the minimum depth of the footing be less than twice the footing diameter.

(c) Materials

Concrete cover shall be in accordance with AS 3600. The minimum strength shall be 20 MPa. Where required, reinforcing steel shall be in accordance with AS 4671, and 1554 as applicable.

(9) Retaining Walls

Noise barriers shall not act as a retaining wall unless specifically designed as such by an engineer taking into account all combined loadings. (The drawings shall include footing details, waterproofing, drainage and backfilling requirements.)

Should a retaining wall exceed 1.0m in height, it must be located on an allotment (not being public or crown land) and a separate approval for building work for the wall must be obtained prior to lodging the drawings with Council.

(10) Erection of Fence

(a) Footings

The posts shall be set in the excavation for the footings and firmly braced so as to allow no movement during the placing and setting of the concrete. The hole shall be filled with concrete to ground level. The concrete footings shall be constructed to the dimensions shown on the approved drawings.

(b) Erection of Timber Members

All timber members shall be erected as shown on the approved Plans. Barriers shall be continuous and solid with no visible air gaps between components.

(11) **Backfill to Noise Barrier**

Backfill materials shall have material properties similar to those stated in Table 1 below.

Table 1: Gravel and Loam Material Properties

AS Sieve Size (mm)	Percent (by mass) Passing Sieve	
	Gravel *	Loam
37.5	100	100
9.5	60-85	100
2.36	25-70	70-100
0.60	15-50	15-50
0.075	3-30	3-30
Linear Shrinkage Properties	8 max	6 max

* Material if size greater than 2.36mm shall be rock

(12) **Tolerances**

The following tolerances shall apply to the construction of the noise barriers.

Table 2: Tolerances

Criteria	Tolerance
Depth of Footing	+200mm -50mm
Centre to centre distance between posts	+50mm -200mm
Thickness of noise barrier panels	+5mm -1mm
Out of verticality of posts	5mm/m length

(13) **Design Drawings Approvals**

The structural design shall be undertaken (or directly supervised) by a Registered Professional Engineer Queensland.

The Engineer shall submit detailed drawings of the noise barrier including location, fence detail and specific footings for approval. The drawings shall clearly state the design wind speed. All drawings shall be certified by the Engineer as complying with this Technical Note. (For barriers which also constitute assessable building work under the Integrated Planning Act 1997, an appropriate development permit for that work must also be obtained.)

No construction shall commence until the design has been approved in writing by Council's Engineer.

(14) **Landscaping**

The engineering drawings shall be accompanied by a landscape plan certified in accordance with the requirements of Council's Civil Infrastructure Design Policy.

(15) **Sight Distances**

The Consultant Engineer responsible for road design shall certify that the fence and landscaping do not compromise driver sight distances for the road design speed.

(16) **As Constructed Drawings**

The Engineer in charge of works shall certify on the Approved Design Drawings that the barrier is constructed in accordance with the Approved Design Drawings and note any changes made due to localised site specific conditions. These drawings shall be submitted as the "As Constructed" drawings prior to acceptance "On-Maintenance".

(17) **Design Life**



The design service life of noise attenuation barriers shall be 40 years with minimum maintenance, and be resistant to being defaced and ignited.