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Transportation Noise Assessment

Wattle Grove South – Local Structure Plan

Reference: 21016047-05d Transport Noise LSP

Prepared for:
Hesperia Property Pty Ltd ATF Wattle Grove Trust

Reference: 21016047-05d Transport Noise LSP

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1. INTRODUCTION

An application has been made for a Local Structure Plan (LSP) over the area referred to as Wattle Grove South (refer *Figure 1-1*) with the proposed LSP shown in *Figure 1-2*. The site adjoins Tonkin Highway to the west with Welshpool Road East to the north, both of which are considered 'Strategic Freight/Major Traffic Routes' as shown on PlanWA Maps. As such, a road traffic noise assessment is required in accordance with *State Planning Policy No. 5.4 Road and Rail Noise*. In addition, aircraft noise from the future parallel runway is also given consideration.

Figure 1-1: Structure Plan Location (Source: DPLH PlanWA)

Figure 1-2: Proposed Local Structure Plan

With regard to traffic noise, Lloyd George Acoustics worked with Main Roads WA on the Tonkin Highway Corridor project, which relates to the upgrade of Tonkin Highway adjoining this site, including grade separation of interchanges, one of which is at Welshpool Road East. The methodology from the Main Roads WA study[1] has been utilised in this report.

Appendix B contains a description of some of the terminology used throughout this report.

[1] *Transportation Noise Assessment, Tonkin Highway Corridor; Reference: 20015359-01, 30 June 2021*

2. CRITERIA

2.1. Road Traffic Noise

The criteria for road traffic is provided in *State Planning Policy No. 5.4 Road and Rail Noise* (hereafter referred to as SPP 5.4) produced by the Western Australian Planning Commission (WAPC). SPP 5.4 is supported by the *Road and Rail Noise Guidelines* (the Guidelines) and the Department of Planning, Lands and Heritage mapping. The objectives of SPP 5.4 are to:

- Protect the community from unreasonable levels of transport noise;
- Protect strategic and other significant freight transport corridors from incompatible urban encroachment;
- Ensure transport infrastructure and land-use can mutually exist within urban corridors;
- Ensure that noise impacts are addressed as early as possible in the planning process; and
- Encourage best practice noise mitigation design and construction standards.

Table 2-1 sets out noise targets that are to be achieved by proposals under which SPP 5.4 applies. Where the targets are exceeded, an assessment is required to determine the likely level of transport noise and management/mitigation required.

Table 2-1: Noise Targets for Noise Sensitive Land-Use

Scenario	Outdoor Noise Target		Indoor Noise Target	
Noise-sensitive land-use and/or development	55 dB $L_{Aeq(Day)}$	50 dB $L_{Aeq(Night)}$	40 dB $L_{Aeq(Day)}$ (Living and Work Areas)	35 dB $L_{Aeq(Night)}$ (Bedrooms)
Road Upgrade	60 dB $L_{Aeq(Day)}$	55 dB $L_{Aeq(Night)}$	N/A	N/A

Notes:

- Day period is from 6am to 10pm and night period from 10pm to 6am.
- The outdoor noise target is to be measured at 1-metre from the most exposed, habitable[2] facade of a noise sensitive building.
- For all noise-sensitive land-use and/or development, indoor noise targets for other room usages may be reasonably drawn from Table 1 of Australian Standard/New Zealand Standard AS/NZS 2107:2016 *Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors* (as amended) for each relevant time period.
- Outdoor targets are to be met at all outdoor areas as far as is reasonable and practicable to do so using the various noise mitigation measures outlined in the Guidelines.

The application of SPP 5.4 is to consider anticipated traffic volumes for the next 20 years from when the noise assessment has been undertaken.

From *Table 2-1*, it can be seen that for new noise-sensitive development, the requirement is 5 dB less than that for the Tonkin Highway Corridor road upgrade project. Furthermore, the road upgrade project would only consider noise impacts to existing residences. However, with both projects occurring at similar times, a shared noise management plan is considered appropriate such that various options are provided in this report for discussion between the project team and Main Roads WA.

[2] *A habitable room is defined in State Planning Policy 3.1 as a room used for normal domestic activities that includes a bedroom, living room, lounge room, music room, sitting room, television room, kitchen, dining room, sewing room, study, playroom, sunroom, gymnasium, fully enclosed swimming pool or patio.*

2.2. Aircraft Noise

The relevant policy for aircraft noise is *State Planning Policy No. 5.1 Land Use Planning in the Vicinity of Perth Airport* (hereafter referred to as SPP 5.1) produced by the Western Australian Planning Commission (WAPC). SPP 5.1 is supported by *Aircraft Noise Insulation for Residential Development in the Vicinity of Perth Airport, 2004*, also produced by WAPC. The objectives of SPP 5.1 are to:

- Protect Perth Airport from unreasonable encroachment by incompatible (noise-sensitive) development, to provide for its ongoing development and operation; and
- Minimise the impact of airport operations on existing and future communities with reference to aircraft noise.

SPP 5.1 applies to any land within ANEF 20 and separates land into three zones:

- Areas below 20 ANEF;
- Area between 20 ANEF and 25 ANEF; and
- Areas above 25 ANEF.

For the subject site, the area falls outside ANEF 20 (refer *Figure 2-1*).

With regard to areas below 20 ANEF, SPP 5.1 states *"There is no restriction on zoning or development within this noise exposure zone, which is identified as 'Acceptable' for all building types in the building site acceptability table [of AS 2021]. According to AS 2021 however, noise nuisance may still be experienced in areas below the 20 ANEF exposure level, particularly in the case of newly exposed communities."*

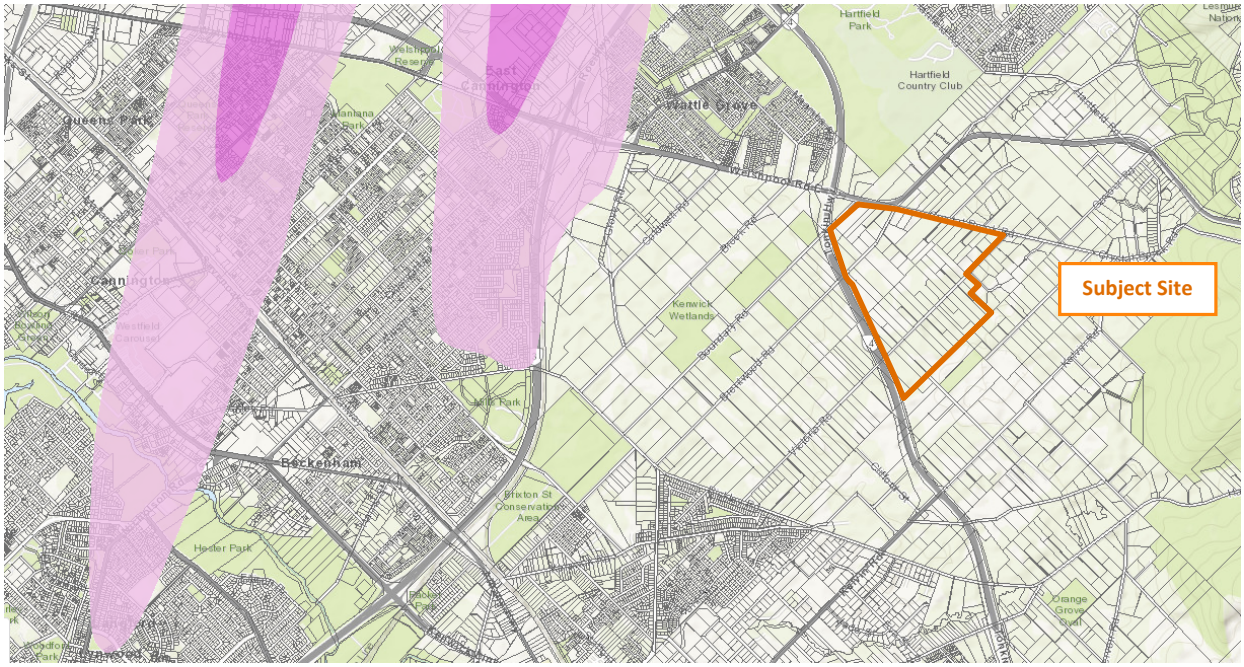


Figure 2-1: Site Locality in Relation to ANEF Contours

3. METHODOLOGY

Road traffic noise measurements and modelling have been undertaken in accordance with the requirements of SPP 5.4 and associated Guidelines, as described in *Section 3.1* and *Section 3.2*.

3.1. Road Traffic Site Measurements

Noise monitoring was undertaken for the Tonkin Highway Corridor project. The methodology of the noise monitoring is provided in a separate study[3]. This is not specifically detailed in this report, however the results of relevant monitoring are provided in *Section 4.1*. Some further monitoring was also undertaken and detailed in *Table 3-1*. Whilst all logging data is relatively old, it is still considered suitable for model calibration purposes.

Table 3-1: Noise Monitoring Information

Site	Location	Serial No.	Set-up Date	Collection Date	Photograph
1	128 Victoria Road, Wattle Grove 22m from Tonkin Hwy edge	8780F7	10/02/21	18/02/21	
2	14 Brentwood Road, Wattle Grove 40m from Welshpool Road edge	8780F5	10/02/21	18/02/21	

[3] *Pre-Construction Noise Monitoring Report, Tonkin Grade Separated Interchange (Hale Road, Welshpool Road and Kelvin Road); Reference: 19105232-01, dated 15-Jan-20*

3.2. Road Traffic Noise Modelling

The computer program *SoundPLAN 8.2* was utilised incorporating the *Calculation of Road Traffic Noise* (CoRTN) algorithms, modified to reflect Australian conditions. The modifications included the following:

- Vehicles were separated into heavy (Austroads Class 3 upwards) and non-heavy (Austroads Class 1 and 2) with non-heavy vehicles having a source height of 0.5 metres above road level and heavy vehicles having two source heights at 1.5 metres and 3.6 metres above road level;
- A -0.8 dB correction has been applied to the lower level heavy vehicle noise source and -8.0 dB to the higher level noise source based on the *Transportation Noise Reference Book*; Paul Nelson (1987), so as to provide consistent results with the CoRTN algorithms;
- Adjustments of -0.8 dB and -1.7 dB have been applied to the predicted levels for the 'free-field' and 'at façade' cases respectively, based on the findings of *An Evaluation of the U.K. DoE Traffic Noise Prediction*; Australian Road Research Board, Report 122 ARRB – NAASRA Planning Group (March 1983).

Predictions are made at heights of 1.4 metres above ground floor level. At subdivision stage, noise modelling will also be undertaken for possible first floor receivers of possible two storey dwellings.

Various input data are included in the modelling and these are discussed in *Section 3.2.1* to *Section 3.2.5*.

3.2.1. Ground Topography

Topographical data and road design was provided by Main Roads WA for the Tonkin Highway Corridor project, including digital data from Landgate (building outlines, existing topography and roads) and road design information from Arup (emails dated 24-May-2021 and 28-May-21). Design or finished lot levels for the LSP are currently unavailable.

Indicative building outlines have been included as these can provide barrier attenuation when located between a source and a receiver, in much the same way as a hill or wall. All buildings are assumed to be single storey with heights of 3.5 metres. Noise wall heights are generally relative to the road design at the location shown.

3.2.2. Road Surface

The corrections applied for different road surface finishes are provided in *Table 3-2*.

Table 3-2: Noise Relationship Between Different Road Surfaces

Chip Seal				Asphalt			
14mm	10mm	5mm	Slurry	Dense Graded	Novachip	Stone Mastic	Open Graded
+3.5 dB	+2.5 dB	+1.5 dB	+1.0 dB	0.0 dB	-0.2 dB	-1.5 dB	-2.5 dB

The existing road surface of Tonkin Highway varies between 14mm chip seal, dense graded asphalt, stone mastic asphalt and open graded asphalt. In some areas, each lane may have a different road surface. The information for these road surfaces was provided by Mamun Bhuiyan (Pavements Engineer, Materials Engineering Branch at Main Roads WA) via email on 28 May 2021. For the purpose of the existing/calibration scenario and model calibration, where lanes had different road surfaces, the quieter road surface was assumed so that the model calibration was conservative.

The future road surface will be open graded asphalt, with on ramps dense graded asphalt within approximately 150 metres of the intersection.

Welshpool Road East is assumed to be dense graded asphalt for the existing and future scenario.

3.2.3. Vehicle Speed

The posted speeds used in the noise model are provided in *Table 3-3*.

Table 3-3: Modelled Posted Speeds

Road	Section	Existing (km/hr)	Future (km/hr)
Welshpool Road East	West of Tonkin Highway	70	70
	East of Tonkin Highway	80	80
Tonkin Highway	North of Welshpool Road East	100	100
	Welshpool Road East Interchange	80	100
	North of Kelvin Road	100	100
	On/Off Ramps	80	80

3.2.4. Traffic Volumes

Existing traffic volumes were obtained from Main Roads WA Traffic Map and are shown in *Figure 3-1*. The noise monitoring for the Tonkin Highway Corridor project was undertaken towards the end of 2019, aligning with most traffic counts. One traffic count was increased, utilising the change in traffic volume from a nearby site, as the observation was from 2017/2018.

The forecast volumes were obtained from a traffic plot provided by Main Roads WA (#43376) referred to as Ultimate Scenario, being beyond 2041 (e.g. 2051). No calibration of the modelled traffic volumes has been undertaken. No information was provided on percentage heavy vehicles such that 14% was used for all of Tonkin Highway and the existing percentages used for the side roads. The volumes used in the noise model are provided in *Table 3-4*. Should the volumes and/or percentage heavy vehicles vary from that modelled, there may be some variation in the results.

Road	Section	Northbound/Eastbound		Southbound/Westbound	
		Traffic Volume	% Heavies	Traffic Volume	% Heavies
Tonkin Highway	South of Hale Rd	22,358	19.3	21,298	17.9
	South of Welshpool Rd East	24,796	13.9	27,070	16.9
Welshpool Road East	West of Tonkin Hwy	9,703	13.9	11,592	12.5
	East of Tonkin Hwy	8,781	10.5	8,871	15.1

Figure 3-1: Existing Traffic Volumes Near Welshpool Road East

Table 3-4: Future (Ultimate – 2051) Traffic Volumes

Road	Section	Northbound/Eastbound		Southbound/Westbound	
		Traffic Volume	% Heavies	Traffic Volume	% Heavies
Tonkin Highway	South of Roe Highway	67,000	14	72,700	14
	Welshpool Road East Interchange	52,800	14	58,100	14
	South of Welshpool Rd East	72,900	14	71,900	14
Tonkin Highway Interchanges	Welshpool Road On Ramp	14,200	13	13,800	13
	Welshpool Road Off Ramp	20,000	13	14,600	13
Welshpool Road East	West of Tonkin Hwy	21,600	14	27,900	12
	Interchange	22,200	12	22,700	13
	East of Tonkin Hwy	25,500	10	25,100	15

3.2.5. Ground Absorption

The ground absorption has been assumed to be 0.2 (20%) for the road reserves and 0.65 (65%) elsewhere, noting that 0.0 represents hard reflective surfaces such as water and 1.0 represents absorptive surfaces such as grass.

4. RESULTS

4.1. Road Traffic Noise Monitoring

The results of the noise monitoring are summarised in *Table 4-1* with charts provided in *Figure 4-1* to *Figure 4-5*.

Table 4-1: Measured Average Noise Levels at Logger

Date	Parameter			
	$L_{A10,18hour}$, dB	$L_{Aeq,24hour}$, dB	$L_{Aeq(Day)}$, dB	$L_{Aeq(Night)}$, dB
128 Victoria Road	75.0	71.0	72.2	66.9
14 Brentwood Road	61.2	58.5	59.8	53.8
150 Victoria Road	65.7	62.4	63.1	60.3
20 Maamba Road	54.4	52.3	53.0	50.4
44 Maamba Road	60.0	56.9	57.8	54.2

From the data for Tonkin Highway, the $L_{Aeq(Night)}$ may be within 5 dB of the $L_{Aeq(Day)}$ whereas for the side roads the difference is around 5 dB. As such, this report uses the $L_{Aeq(Night)}$ parameter to determine the noise impacts.

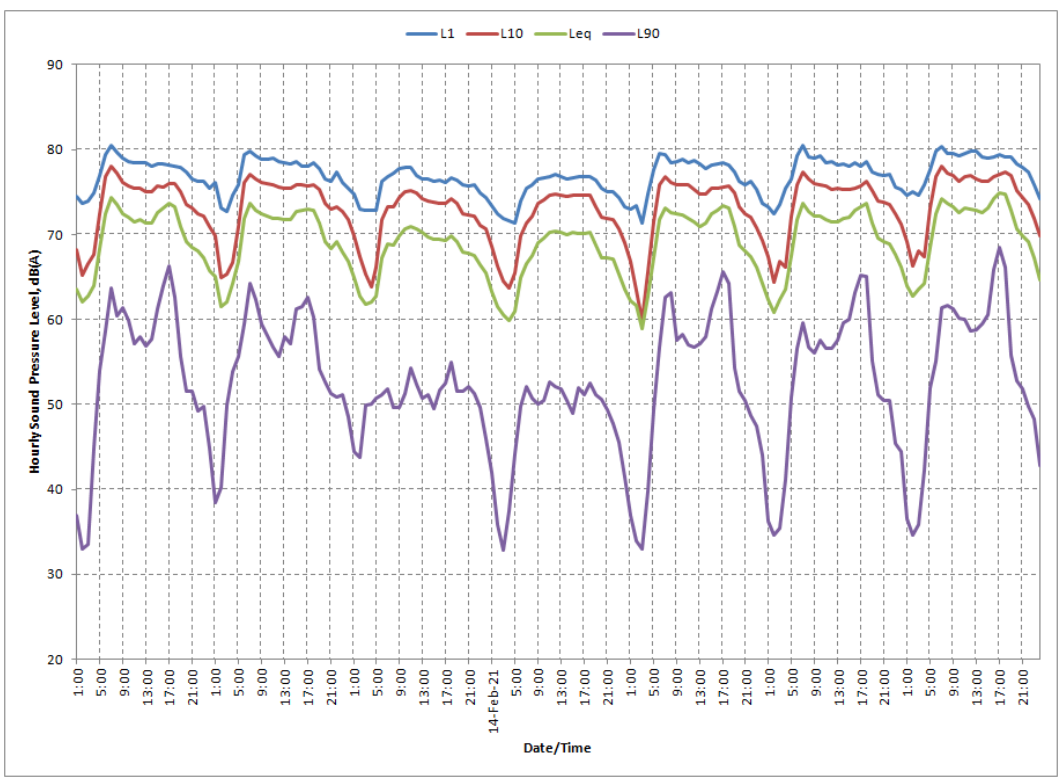


Figure 4-1: Noise Monitoring Results at 128 Victoria Road

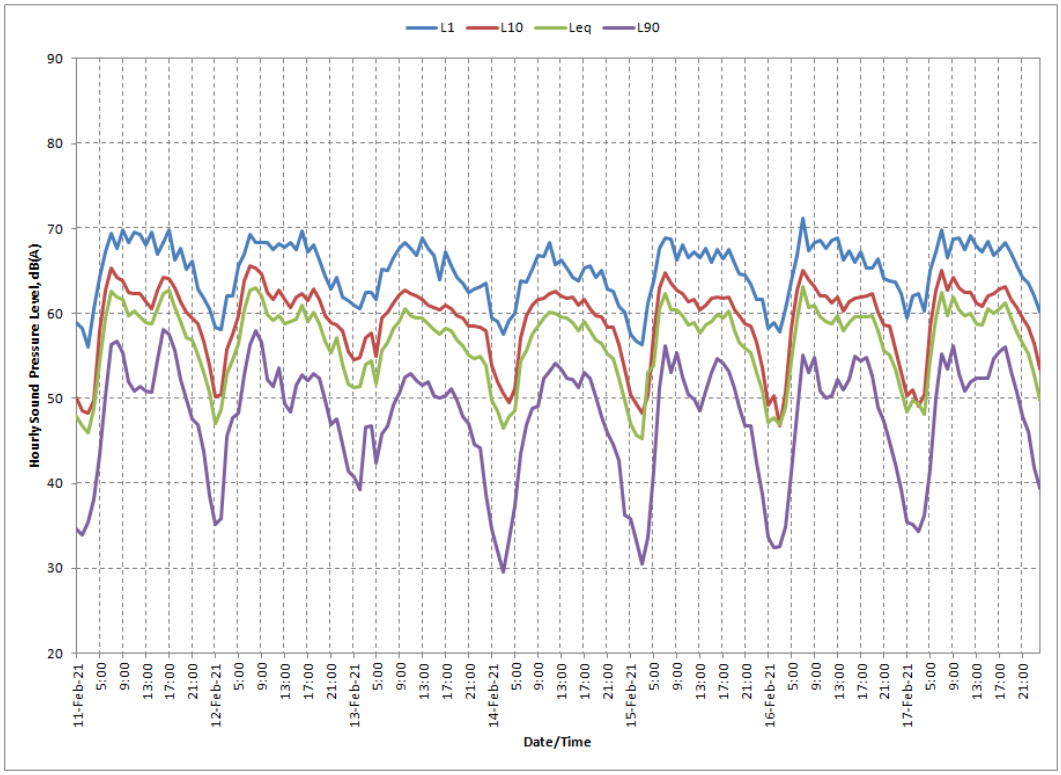


Figure 4-2: Noise Monitoring Results at 14 Brentwood Road

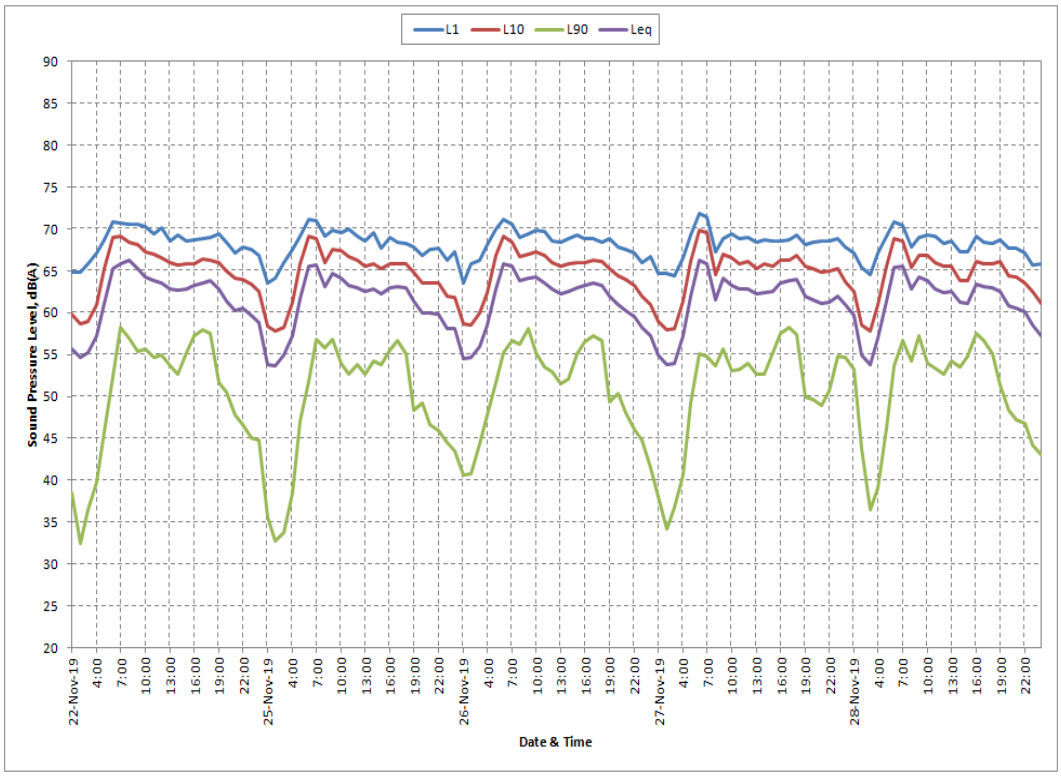


Figure 4-3: Noise Monitoring Results at 150 Victoria Road

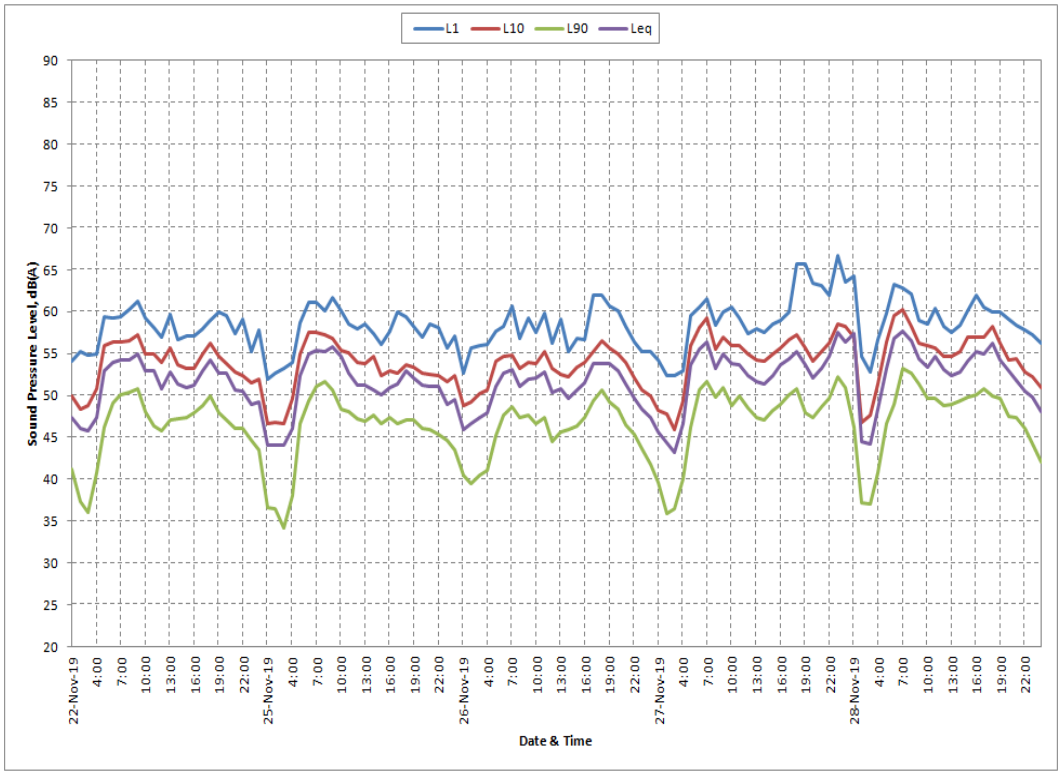


Figure 4-4: Noise Monitoring Results at 20 Maamba Road

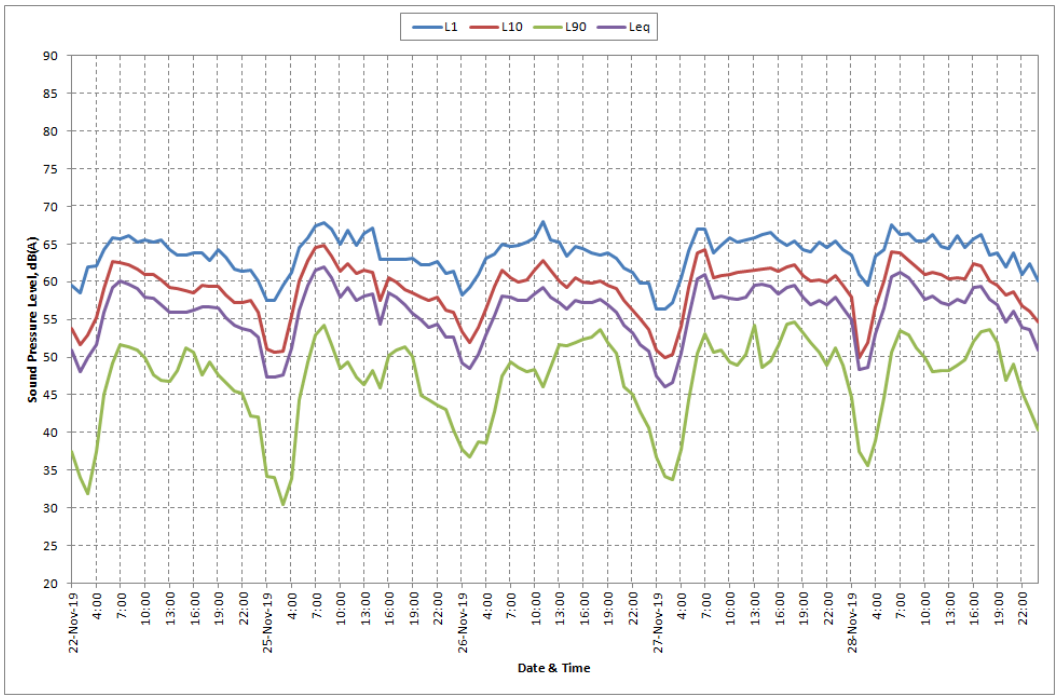


Figure 4-5: Noise Monitoring Results at 44 Maamba Road

4.2. Road Traffic Noise Modelling

As described in *Section 2.1*, work undertaken by Lloyd George Acoustics for Main Roads WA on the Tonkin Highway Corridor project considered noise mitigation requirements to achieve 55 dB $L_{Aeq(Night)}$ for existing residences in the form of noise walls. For the area in the vicinity of the subject site, the relevant noise wall design is provided in *Figure 4-6*, being *Figure 5-2* from the Main Roads WA study. This shows a preliminary noise wall design ranging from 3.6m to 5.0m in height but since this only considered existing residences, there are gaps in these walls. This project is currently out for tender where a contractor will be required to design the road upgrade and the associated noise mitigation, such that these walls are indicative only.

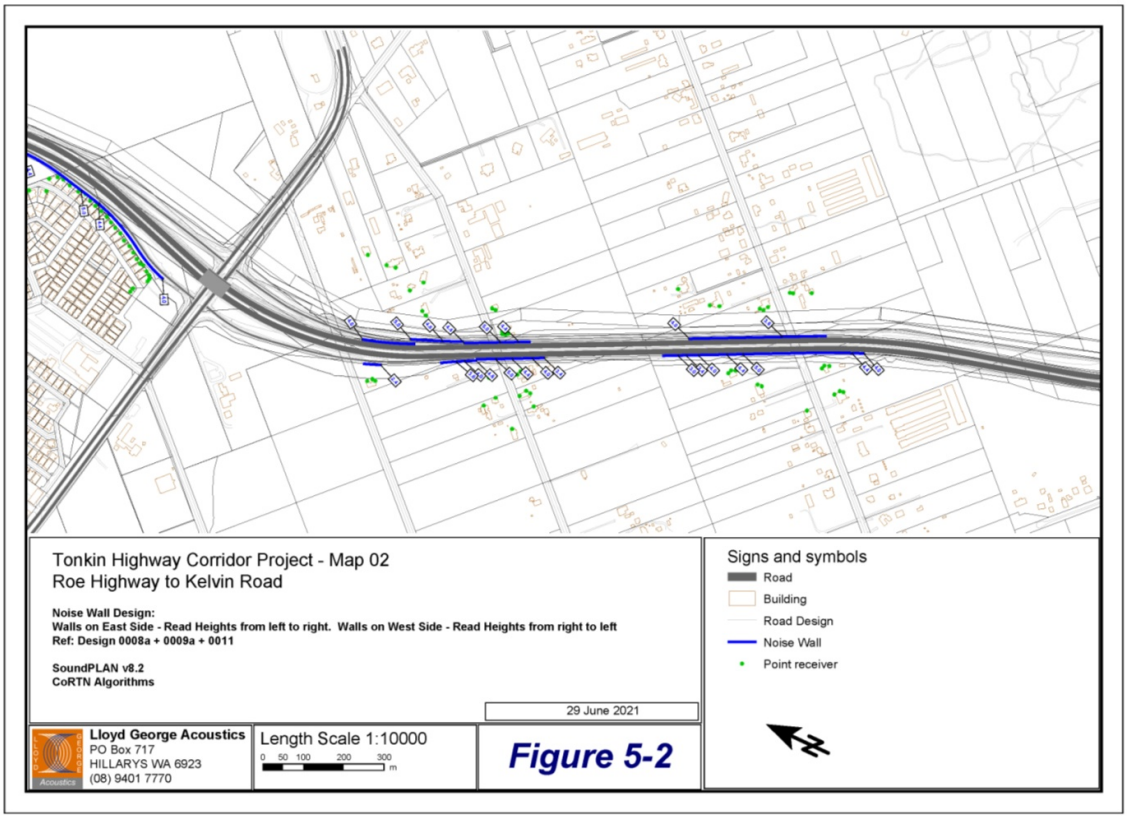
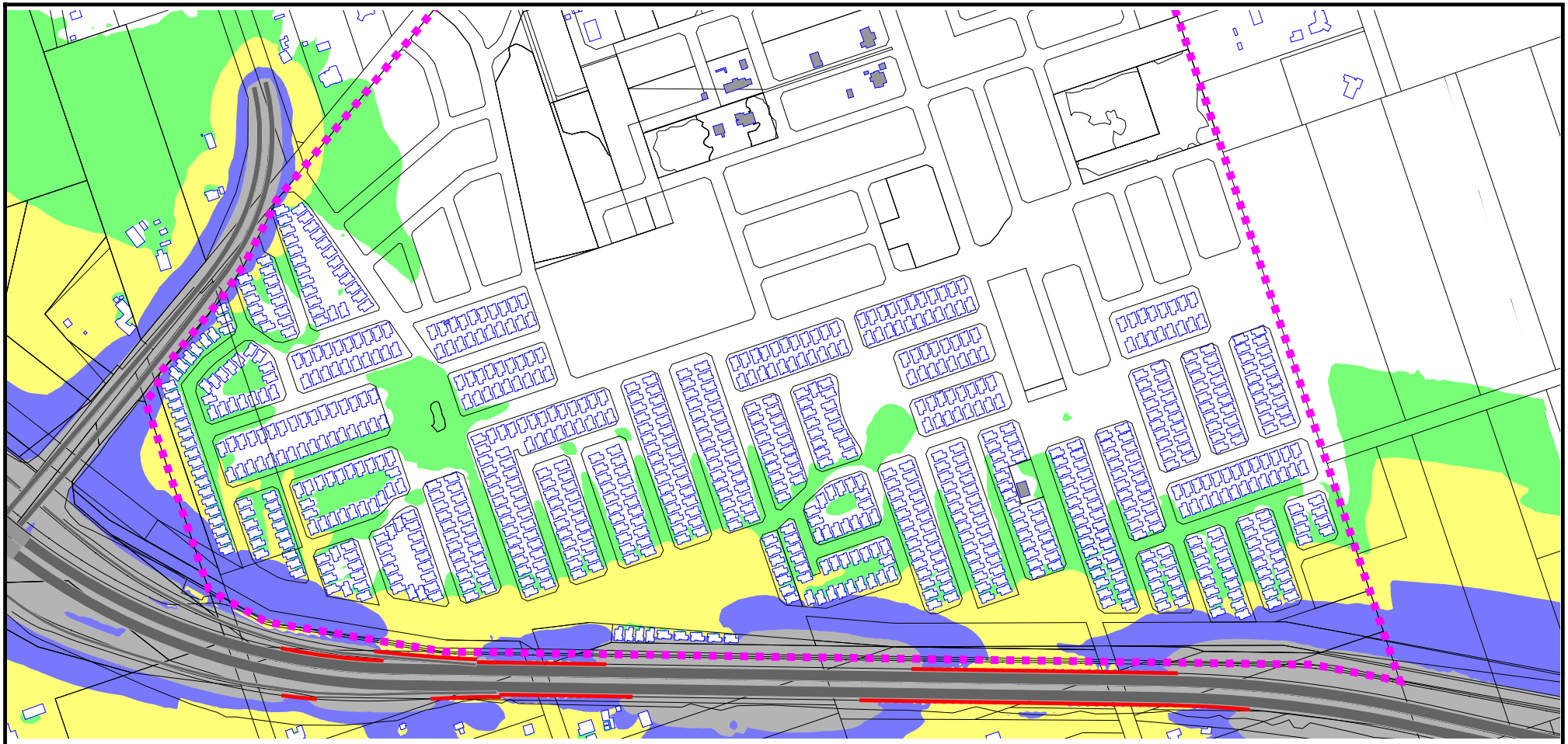


Figure 4-6: Indicative Noise Wall Design from Main Roads WA Study

Figure 4-7 provides the noise levels across the subject site, based on the indicative Main Roads WA noise walls. In this scenario, the closest dwellings to Tonkin Highway will be within Exposure C.

As discussed previously, Main Roads WA Study was to achieve 55 dB $L_{Aeq(Night)}$ at existing residences and therefore much of the proposed Wattle Grove South LSP will be impacted by road traffic noise, nominally Exposure B or C for those closest, other than the small western most proposed R80 development within Exposure D.



Wattle Grove Local Structure Plan
Road Traffic Noise Level Contours - $L_{Aeq(Night)}$

Future (Ultimate) Tonkin Highway Conditions with MRWA Indicative Noise Walls

SoundPLAN v8.2
CoRTN Algorithms

24 July 2025

Lloyd George Acoustics
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Length Scale 1:7500

0 50 100 200 300 m

Figure 4-7

Signs and symbols

- Road
- Building
- MRWA Noise Wall
- Wattle Grove LSP

Noise levels

$L_{Aeq(Night)}$ dB

- <= 50
- <= 51 Exposure A
- <= 52
- <= 53
- <= 54 Exposure B
- <= 55
- <= 56
- <= 57
- <= 58 Exposure C
- <= 59
- <= 60
- <= 61
- > 61 Exposure D

SPP 5.4 (Sep 2019)

4.3. Aircraft Noise

In *Section 2.2*, it was shown that the subject site is outside the ANEF 20 contour and therefore there are no restrictions on development in relation to the noise source. SPP 5.1 does state *"…noise nuisance may still be experienced in areas below the 20 ANEF exposure level, particularly in the case of newly exposed communities."*

Perth Airport also provide N65 contours, which represent the average number of aircraft events above a noise level of 65 dB L_{Amax} and how the site relates to N65 contours is shown in *Figure 4-8*, noting the impact is from the future parallel runway.

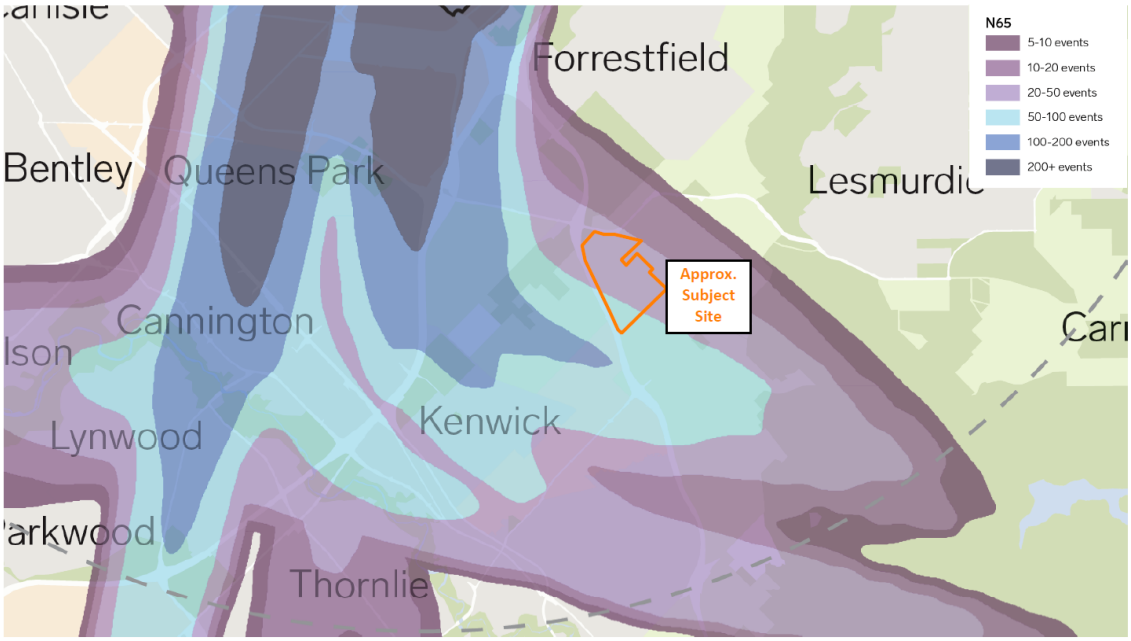

Figure 4-8: Site Locality in Relation to N65 Contours

It is understood Perth Airport provided a submission to the City's draft Crystal Brook Concept Plan during advertising, which recommended noise insulation be adopted in areas where the number of aircraft noise events above 65 dB L_{Amax} is above 50. The location of the 50 events line has been approximated on *Figure 4-9* across the structure plan. *Table 4-2* provides the recommended construction for dwellings within this area.

Wattle Grove Local Structure Plan
Area Requiring Noise Mitigation to Address Aircraft Noise for Noise-Sensitive Development

Shaded area approximate

SoundPLAN v8.2

24 July 2025

Signs and symbols

- Road
- Building
- Wattle Grove LSP
- > 50 N65 Events

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Length Scale 1:7500

0 50 100 200 300 m

Figure 4-9

Table 4-2: Recommended Construction for Properties within 50 N65 Events

Element	Orientation	Room	
		Bedroom	**Indoor Living and Work Areas**
External Windows	Facing	• Up to 40% floor area ($R_w + C_{tr} \geq 28$): ○ No less than fixed/awning or casement windows with minimum 6mm glass.	• Up to 60% floor area ($R_w + C_{tr} \geq 28$): ○ No less than fixed/awning or casement windows with minimum 6mm glass.
External Doors	Facing	• Up to 40% floor area ($R_w + C_{tr} \geq 28$): ○ No less than 6mm thick glass with acoustic seals to sliding door; ○ No less than 6mm thick glass to hinged door with acoustic seals; ○ 35mm thick solid timber core door with acoustic seals. Glass inserts to be minimum 5mm thick.	
External Walls	All	• $R_w + C_{tr} \geq 45$: ○ Two leaves of 90mm thick clay brick masonry with minimum 50mm cavity; or ○ One leaf of 90mm thick clay brick masonry, 50mm gap to stud with 90mm thick, 11kg/m^3 fibrous insulation and 13mm thick plasterboard; ○ EPS or 7mm thick fibre cement cladding to 90mm stud with 90mm thick, 14kg/m^3 fibrous insulation and 2 x 13mm thick sound-rated plasterboard.	
Roofs and Ceilings	All	• $R_w + C_{tr} \geq 35$: ○ Concrete or terracotta tile with sarking or metal sheet roof with *Anticon.* Minimum R4 fibrous insulation above 10mm plasterboard ceiling.	

5. RECOMMENDATIONS

5.1. Road Traffic Noise

The objectives of SPP 5.4 are to achieve:

- Indoor noise levels specified in *Table 2-1* in noise-sensitive areas (e.g. bedrooms and living rooms of houses); and
- A reasonable degree of acoustic amenity for outdoor living areas on each residential lot.

Where the outdoor noise targets of *Table 2-1* are achieved, no further noise controls are necessary. With reference to *Section 4.2*, it is evident the outdoor noise target will be exceeded at some lots noting that this uses the indicative noise wall design for the Tonkin Highway Corridor project, which only addresses noise to existing residences.

As described in *Section 2.1*, a better outcome would be for a joint noise management plan between the road provider and the developer. This is particularly important in this project as for the most part, Tonkin Highway will be elevated compared to the LSP area so that noise walls should be located close to the road. The exception is towards the southern end south of Victoria Road, where Tonkin Highway is in cut so in this case, locating the wall alongside the Principal Shared Path (PSP) would be suitable. In both cases, the noise walls are within Main Roads land and therefore would need to be constructed by the road provider.

As such, the following is recommended:

- Developer is to liaise with Main Roads WA to determine responsibilities/cost sharing arrangement etc. for noise walls. A generally constant noise wall height is considered appropriate with *Figure 5-1* and *Figure 5-2* showing the noise contours associated with 4.0-metre and 5.0-metre high noise walls. The wall alongside the on ramp is at 3.0-metres high in both scenarios.
- Developer would be responsible for noise wall construction to minimise noise impacts from Welshpool Road East, nominally shown as 2.4-metre high walls.
- Developer would be responsible for notifications on title and nominating appropriate Quiet House Packages (refer Appendix A) for affected lots by way of Local Development Plan for each subdivision stage.

The contour plots are indicative at this stage only and would need to be updated when subdivision designs are available and finished lot levels. At this stage, specific lots requiring architectural packages would be nominated, as well as an assessment to possible first floors of double storey residences.

5.2. Aircraft Noise

With regard SPP 5.1, the site is acceptable for residential development being outside the 20 ANEF Contours for Perth Airport. Parts of the site are however within the 50 Event N65 contour (refer *Figure 4-9*) where Perth Airport encourage local governments to inform future residents of possible aircraft noise exposure. It is therefore recommended that dwellings within this zone consider building insulation and architectural treatments in accordance with *Table 4-2*.

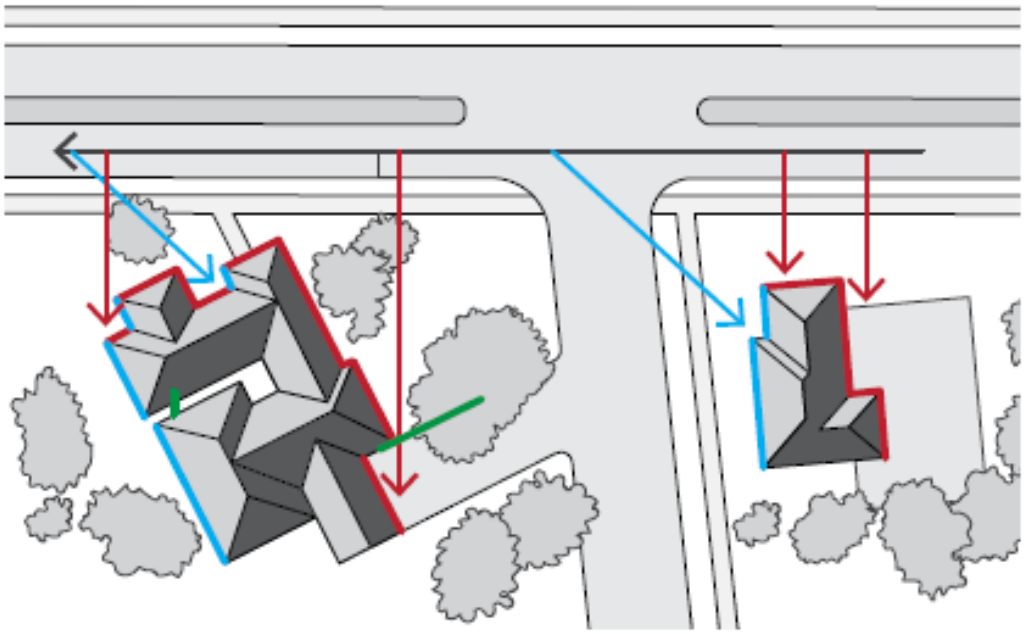
Appendix A – Quiet House Packages

The packages and information provided on the following pages are taken from *Road and Rail Noise Guidelines* (September 2019).

Where outdoor and indoor noise levels received by a noise-sensitive land-use and/or development exceed the policy's noise target, implementation of quiet house requirements is an acceptable solution.

With regards to the packages, the following definitions are provided:

- **Facing** the transport corridor (red): Any part of a building façade is 'facing' the transport corridor if any straight line drawn perpendicular (at a 90 degree angle) to its nearest road lane or railway line intersects that part of the façade without obstruction (ignoring any fence).
- **Side-on** to transport corridor (blue): Any part of a building façade that is not 'facing' is 'side-on' to the transport corridor if any straight line, at any angle, can be drawn from it to intersect the nearest road lane or railway line without obstruction (ignoring any fence).
- **Opposite** to transport corridor (green): Neither 'side on' nor 'facing', as defined above.



Quiet House Package A

56-58 dB $L_{Aeq(Day)}$ & 51-53 dB $L_{Aeq(Night)}$

Element	Orientation	Room	
		Bedroom	Indoor Living and Work Areas
External Glazing	Facing	• Up to 40% floor area ($R_w + C_{tr} \geq 28$): – Sliding or double hung with minimum 10mm single or 6mm-12mm-10mm double insulated glazing; – Sealed awning or casement windows with minimum 6mm glass. • Up to 60% floor area ($R_w + C_{tr} \geq 31$): – Sealed awning or casement windows with minimum 6mm glass.	• Up to 40% floor area ($R_w + C_{tr} \geq 25$): – Sliding or double hung with minimum 6mm single or 6mm-12mm-6mm double insulated glazing; • Up to 60% floor area ($R_w + C_{tr} \geq 28$); • Up to 80% floor area ($R_w + C_{tr} \geq 31$).
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less or max % area increased by 20%.	
	Opposite	No specific requirements	
External Doors	Facing	• Fully glazed hinged door with certified $R_w + C_{tr} \geq 28$ rated door and frame including seals and 6mm glass.	• Doors to achieve $R_w + C_{tr} \geq 25$: – 35mm Solid timber core hinged door and frame system certified to R_w 28 including seals; – Glazed sliding door with 10mm glass and weather seals.
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less.	
	Opposite	No specific requirements	
External Walls	All	• $R_w + C_{tr} \geq 45$: – Two leaves of 90mm thick clay brick masonry with minimum 20mm cavity; or – Single leaf of 150mm brick masonry with 13mm cement render on each face; or – One row of 92mm studs at 600mm centres with: ▪ Resilient steel channels fixed to the outside of the studs; and ▪ 9.5mm hardboard or fibre cement sheeting or 11mm fibre cement weatherboards fixed to the outside; ▪ 75mm thick mineral wool insulation with a density of at least 11kg/m^3; and ▪ 2 x 16mm fire-rated plasterboard to inside.	
Roofs and Ceilings	All	• $R_w + C_{tr} \geq 35$: • Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard.	
Outdoor Living Areas		At least one outdoor living area located on the opposite side of the building from the transport corridor or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum 2 metres height above ground level.	

Quiet House Package B

59-62 dB $L_{Aeq(Day)}$ & 54-57 dB $L_{Aeq(Night)}$

Element	Orientation	Room	
		Bedroom	Indoor Living and Work Areas
External Glazing	Facing	• Up to 40% floor area ($R_w + C_{tr} \geq 31$): – Fixed sash, awning or casement with minimum 6mm glass or 6mm-12mm-6mm double insulated glazing. • Up to 60% floor area ($R_w + C_{tr} \geq 34$): – Fixed sash, awning or casement with minimum 10mm glass or 6mm-12mm-10mm double insulated glazing.	• Up to 40% floor area ($R_w + C_{tr} \geq 28$): – Sliding or double hung with 6mm-12mm-10mm double insulated glazing; – Sealed awning or casement windows with minimum 6mm glass. • Up to 60% floor area ($R_w + C_{tr} \geq 31$); • Up to 80% floor area ($R_w + C_{tr} \geq 34$).
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less or max % area increased by 20%.	
	Opposite	As above, except $R_w + C_{tr}$ values may be 6 dB less or max % area increased by 20%.	
External Doors	Facing	• Fully glazed hinged door with certified $R_w + C_{tr} \geq 31$ rated door and frame including seals and 10mm glass.	• Doors to achieve $R_w + C_{tr} \geq 28$: – 40mm Solid timber core hinged door and frame system certified to R_w 32 including seals; – Fully glazed hinged door with certified $R_w + C_{tr} \geq 28$ rated door and frame including seals and 6mm glass.
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less or max % area increased by 20%.	
	Opposite	As above, except $R_w + C_{tr}$ values may be 6 dB less or max % area increased by 20%.	
External Walls	All	• $R_w + C_{tr} \geq 50$: – Two leaves of 90mm thick clay brick masonry with minimum 50mm cavity between leaves and 25mm glasswool or polyester (24kg/m³). Resilient ties used where required to connect leaves. – Two leaves of 110mm clay brick masonry with minimum 50mm cavity between leaves and 25mm glasswool or polyester insulation (24kg/m³). – Single leaf of 220mm brick masonry with 13mm cement render on each face. – 150mm thick unlined concrete panel or 200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face. – Single leaf of 90mm clay brick masonry with: ▪ A row of 70mm x 35mm timber studs or 64mm steel studs at 600mm centres; ▪ A cavity of 25mm between leaves; ▪ 50mm glasswool or polyester insulation (11kg/m³) between studs; and ▪ One layer of 10mm plasterboard fixed to the inside face.	
Roofs and Ceilings	All	• $R_w + C_{tr} \geq 35$: – Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard ceiling with R3.0+ fibrous insulation.	
Outdoor Living Areas		At least one outdoor living area located on the opposite side of the building from the transport corridor or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum 2.4 metres height above ground level.	

Quiet House Package C

63-66 dB $L_{Aeq(Day)}$ & 58-61 dB $L_{Aeq(Night)}$

Element	Orientation	Room	
		Bedroom	Indoor Living and Work Areas
External Glazing	Facing	• Up to 20% floor area ($R_w + C_{tr} \geq 31$): – Fixed sash, awning or casement with minimum 6mm glass or 6mm-12mm-6mm double insulated glazing. • Up to 40% floor area ($R_w + C_{tr} \geq 34$): – Fixed sash, awning or casement with minimum 10mm glass or 6mm-12mm-10mm double insulated glazing.	• Up to 40% floor area ($R_w + C_{tr} \geq 31$): – Fixed sash, awning or casement with minimum 6mm glass or 6mm-12mm-6mm double insulated glazing. • Up to 60% floor area ($R_w + C_{tr} \geq 34$): – Fixed sash, awning or casement with minimum 10mm glass or 6mm-12mm-10mm double insulated glazing.
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less or max % area increased by 20%.	
	Opposite	As above, except $R_w + C_{tr}$ values may be 6 dB less or max % area increased by 20%.	
External Doors	Facing	• Not recommended.	• Doors to achieve $R_w + C_{tr} \geq 30$: – Fully glazed hinged door with certified $R_w + C_{tr} \geq 31$ rated door and frame including seals and 10mm glass; – 40mm Solid timber core side hinged door, frame and seal system certified to R_w 32 including seals. Any glass inserts to be minimum 6mm.
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less or max % area increased by 20%.	
	Opposite	As above, except $R_w + C_{tr}$ values may be 6 dB less or max % area increased by 20%.	
External Walls	All	• $R_w + C_{tr} \geq 50$: – Two leaves of 90mm thick clay brick masonry with minimum 50mm cavity between leaves and 25mm glasswool or polyester insulation (24kg/m³). Resilient ties used where required to connect leaves. – Two leaves of 110mm clay brick masonry with minimum 50mm cavity between leaves and 25mm glasswool or polyester insulation (24kg/m³). – Single leaf of 220mm brick masonry with 13mm cement render on each face. – 150mm thick unlined concrete panel or 200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face. – Single leaf of 90mm clay brick masonry with: ▪ A row of 70mm x 35mm timber studs or 64mm steel studs at 600mm centres; ▪ A cavity of 25mm between leaves; ▪ 50mm glasswool or polyester insulation (11kg/m³) between studs; and ▪ One layer of 10mm plasterboard fixed to the inside face.	
Roofs and Ceilings	All	• $R_w + C_{tr} \geq 40$: – Concrete or terracotta tile roof with sarking, or metal sheet roof with foil backed R2.0+ fibrous insulation between steel sheeting and roof battens; – R3.0+ insulation batts above ceiling; – 2 x 10mm plasterboard ceiling or 1 x 13mm sound-rated plasterboard affixed using steel furring channel to ceiling rafters.	
Outdoor Living Areas		At least one outdoor living area located on the opposite side of the building from the transport corridor or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum 2.4 metres height above ground level.	

Mechanical Ventilation requirements

In implementing the acceptable treatment packages, fresh air requirements of the National Construction Code must be satisfied on the basis of windows closed. Whilst not the only solution, the most common is mechanical ventilation / air-conditioning is installed with the following considerations:

- Acoustically rated openings and ductwork to provide a minimum sound reduction performance of R_w 40 dB into sensitive spaces;
- Evaporative systems require attenuated ceiling air vents to allow closed windows;
- Refrigerant based systems need to be designed to achieve National Construction Code fresh air ventilation requirements;
- Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable.

Notification

Notifications on title advise prospective purchasers of the potential for noise impacts from major transport corridors and help with managing expectations.

The Notification is to state as follows:

This lot is in the vicinity of a transport corridor and is affected, or may in the future be affected, by road and rail transport noise. Road and rail transport noise levels may rise or fall over time depending on the type and volume of traffic.

Appendix B – Terminology

The following is an explanation of the terminology used throughout this report:

- **Decibel (dB)**

The decibel is the unit that describes the sound pressure levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

- **A-Weighting**

An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A, dB.

- **L_{eq}**

The L_{eq} level represents the average noise energy during a measurement period.

- **L_1**

The L_1 level represents the noise level exceeded for 1 percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

- **L_{10}**

The L_{10} level represents the noise level exceeded for 10 percent of the measurement period and is considered to represent the "intrusive" noise level.

- **L_{90}**

The L_{90} level represents the noise level exceeded for 90 percent of the measurement period and is considered to represent the "background" noise level.

- **$L_{Aeq(Day)}$**

The $L_{Aeq(Day)}$ level is the logarithmic average of the L_{Aeq} levels from 6.00am to 10.00pm.

- **$L_{Aeq(Night)}$**

The $L_{Aeq(Night)}$ level is the logarithmic average of the L_{Aeq} levels from 10.00pm to 6.00am.

- **$L_{A10,18hour}$**

The $L_{A10,18hour}$ level is the arithmetic average of the hourly L_{A10} levels between 6.00am and midnight.

- **$L_{Aeq,24hour}$**

The $L_{Aeq,24hour}$ level is the logarithmic average of the L_{Aeq} levels from over an entire day.

- **Noise-sensitive land use and/or development**

Land-uses or development occupied or designed for occupation or use for residential purposes (including dwellings, residential buildings or short-stay accommodation), caravan park, camping ground, educational establishment, child care premises, hospital, nursing home, corrective institution or place of worship.

- **R_w**

This is the weighted sound reduction index. It is a single number rating determined by moving a grading curve in integral steps against the laboratory measured transmission loss until the sum of the deficiencies at each one-third-octave band, between 100 Hz and 3.15 kHz, does not exceed 32 dB. The higher the R_w value, the better the acoustic performance.

- **C_{tr}**

This is a spectrum adaptation term for airborne noise and provides a correction to the R_w value to suit source sounds with significant low frequency content such as road traffic or home theatre systems. A wall that provides a relatively high level of low frequency attenuation (i.e. masonry) may have a value in the order of – 4 dB, whilst a wall with relatively poor attenuation at low frequencies (i.e. stud wall) may have a value in the order of -12 dB.

- **About the Term 'Reasonable'**

An assessment of reasonableness should demonstrate that efforts have been made to resolve conflicts without comprising on the need to protect noise-sensitive land-use activities. For example, have reasonable efforts been made to design, relocate or vegetate a proposed noise barrier to address community concerns about the noise barrier height? Whether a noise mitigation measure is reasonable might include consideration of:

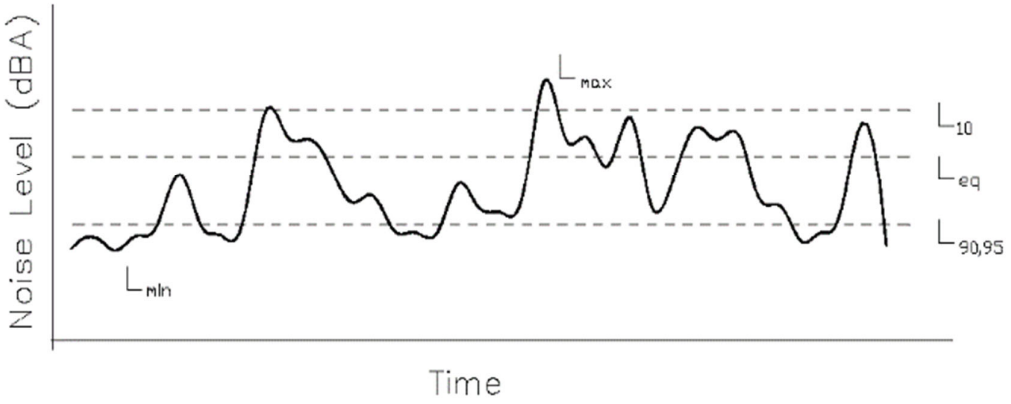
  - The noise reduction benefit provided;
  - The number of people protected;
  - The relative cost vs benefit of mitigation;
  - Road conditions (speed and road surface) significantly differ from noise forecast table assumptions;
  - Existing and future noise levels, including changes in noise levels;
  - Aesthetic amenity and visual impacts;
  - Compatibility with other planning policies;
  - Differences between metropolitan and regional situations and whether noise modelling requirements reflect the true nature of transport movements;
  - Ability and cost for mobilisation and retrieval of noise monitoring equipment in regional areas;
  - Differences between Greenfield and infill development;
  - Differences between freight routes and public transport routes and urban corridors;
  - The impact on the operational capacity of freight routes;
  - The benefits arising from the proposed development;
  - Existing or planned strategies to mitigate the noise at source.

- **About the Term 'Practicable'**

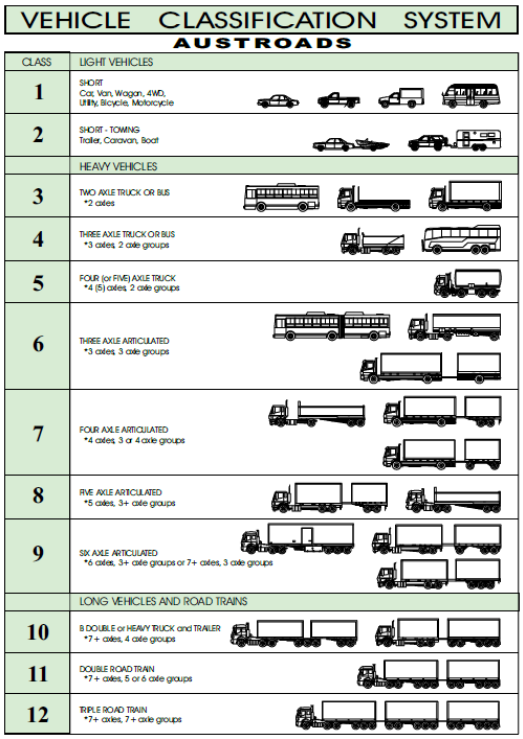
'Practicable' considerations for the purposes of the policy normally relate to the engineering aspects of the noise mitigation measures under evaluation. It is defined as "reasonably practicable having regard to, among other things, local conditions and circumstances (including costs) and to the current state of technical knowledge" (*Environmental Protection Act 1986*). These may include:

  - Limitations of the different mitigation measures to reduce transport noise;
  - Competing planning policies and strategies;
  - Safety issues (such as impact on crash zones or restrictions on road vision);
  - Topography and site constraints (such as space limitations);
  - Engineering and drainage requirements;
  - Access requirements (for driveways, pedestrian access and the like);
  - Maintenance requirements;
  - Bushfire resistance or BAL ratings;
  - Suitability of the building for acoustic treatments.

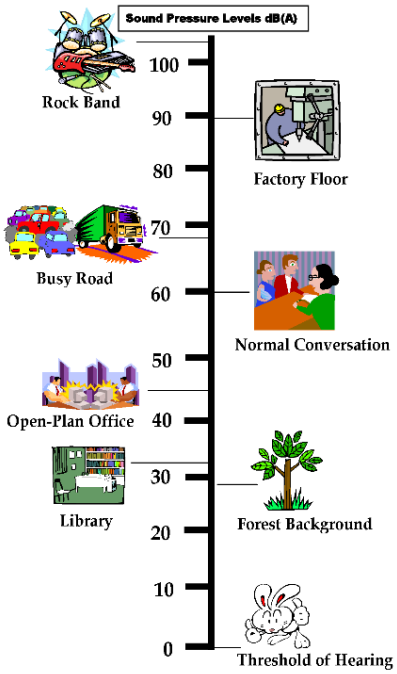
- **Chart of Noise Level Descriptors**



- **Austroads Vehicle Class**



VEHICLE CLASSIFICATION SYSTEM
AUSTROADS

CLASS	LIGHT VEHICLES
1	SHORT Car, Van, Wagon, 4WD, Utility, Bicycle, Motorcycle
2	SHORT - TOWING Trailer, Caravan, Boat
	HEAVY VEHICLES
3	TWO AXLE TRUCK OR BUS *2 axles
4	THREE AXLE TRUCK OR BUS *3 axles, 2 axle groups
5	FOUR (or FIVE) AXLE TRUCK *4 (5) axles, 2 axle groups
6	THREE AXLE ARTICULATED *3 axles, 3 axle groups
7	FOUR AXLE ARTICULATED *4 axles, 3 or 4 axle groups
8	FIVE AXLE ARTICULATED *5 axles, 3+ axle groups
9	SIX AXLE ARTICULATED *6 axles, 3+ axle groups or 7+ axles, 3 axle groups
	LONG VEHICLES AND ROAD TRAINS
10	B DOUBLE or HEAVY TRUCK and TRAILER *7+ axles, 4 axle groups
11	DOUBLE ROAD TRAIN *7+ axles, 5 or 6 axle groups
12	TRIPLE ROAD TRAIN *7+ axles, 7+ axle groups

- **Typical Noise Levels**