

Road Traffic Noise Assessment

**Lots 800 and 239 Wilkins Street, Bellevue –
Robinson Grove Estate**

Reference: 24069111-02

Prepared for:
Satterley Property Group

Reference: 24069111-02

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Date	Rev	Description	Author	Verified
5-Sep-24	-	Issued to Client as Draft for Comment	Terry George	Matt Moyle
15-Sep-24	0	Minor text changes	Terry George	-

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1. INTRODUCTION

Satterley Property Group is project managing the subdivision of Lots 800 and 239 Wilkins Street, Bellevue, referred to as Robinson Grove Estate. The general locality is shown in *Figure 1-1* showing the proposed Phase 1 and future Phase 2. The Phase 1 subdivision plan is also provided in *Figure 1-2*.



Figure 1-1: Subject Site General Location (Source: DPLH PlanWA)

The site adjoins Roe Highway, which is considered a 'Strategic Freight/Major Traffic Route' as shown on PlanWA Maps, such that a noise assessment is required in accordance with *State Planning Policy No. 5.4 Road and Rail Noise* (SPP 5.4), being the subject of this report.

It is noted that previous work was undertaken for this subdivision, dating back to 2014. Since that time the subdivision design has been modified, the SPP 5.4 criteria updated and a proposed upgrade to Roe Highway, such that this report supersedes previous advice.

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

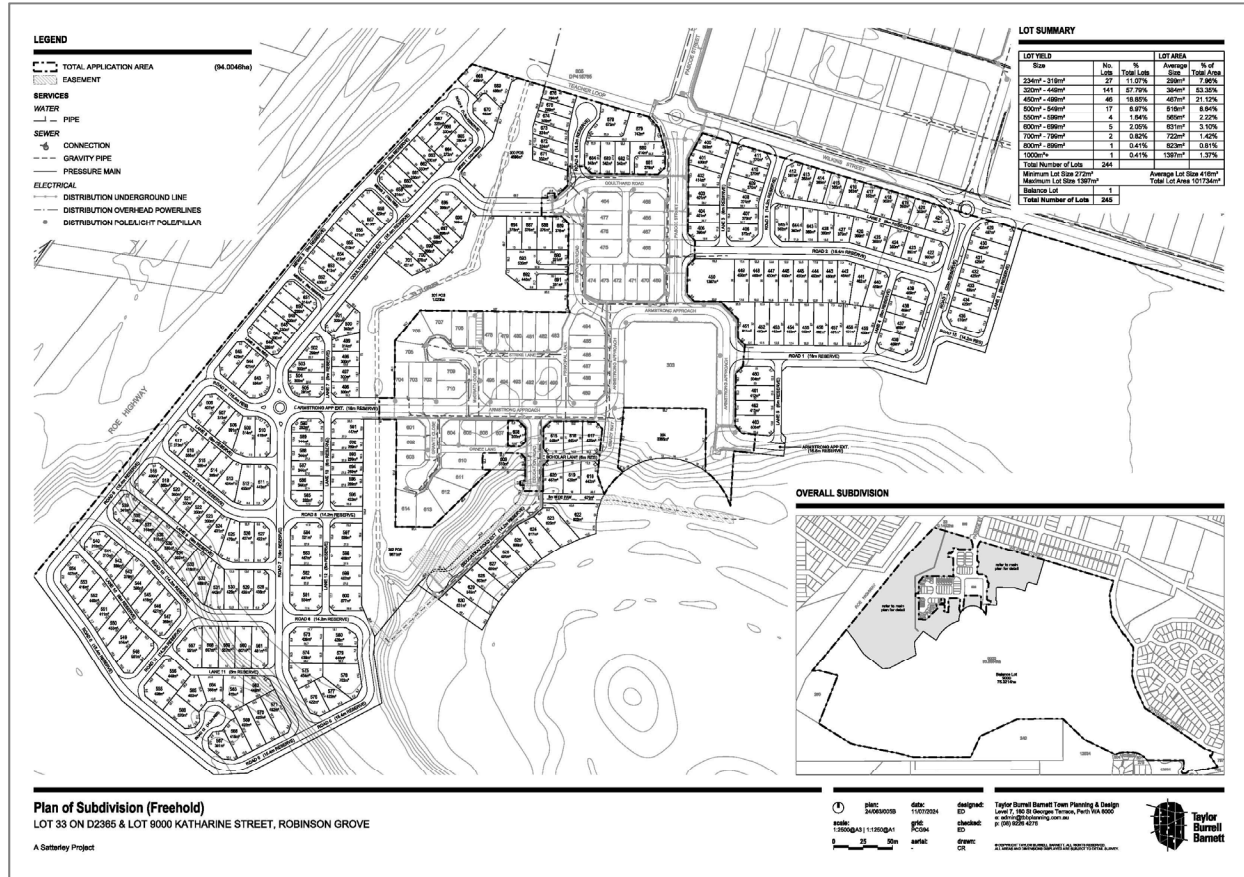


Figure 1-2: Subdivision Layout

2. CRITERIA

The criteria relevant to this project 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	
	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)
Noise-sensitive land-use and/or development				

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, habitable¹ 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.

¹ 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.

3. METHODOLOGY

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. Site Measurements

Noise monitoring was undertaken on site using an Acoustic Research Type 316 Noise Data Logger (S/N: 15-301-468) (refer *Figure 3-1*). The logger was programmed to record hourly L_{A1} , L_{A10} , L_{A90} , and L_{Aeq} levels. The logger complies with the instrumentation requirements of *Australian Standard 2702-1984 Acoustics – Methods for the Measurement of Road Traffic Noise*. The logger was field calibrated before and after the measurement session and found to be accurate to within ± 1 dB. Lloyd George Acoustics holds current laboratory calibration certificate for the logger.

The microphone was approximately 1.4 metres above existing ground level and approximately 22 metres from the edge of Roe Highway main carriageway. The measurements were recorded between 6-August-2024 and 19-August-2024.



Figure 3-1: Noise Logger Location

3.2. Noise Modelling

The computer program *SoundPLAN 9.0* 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).

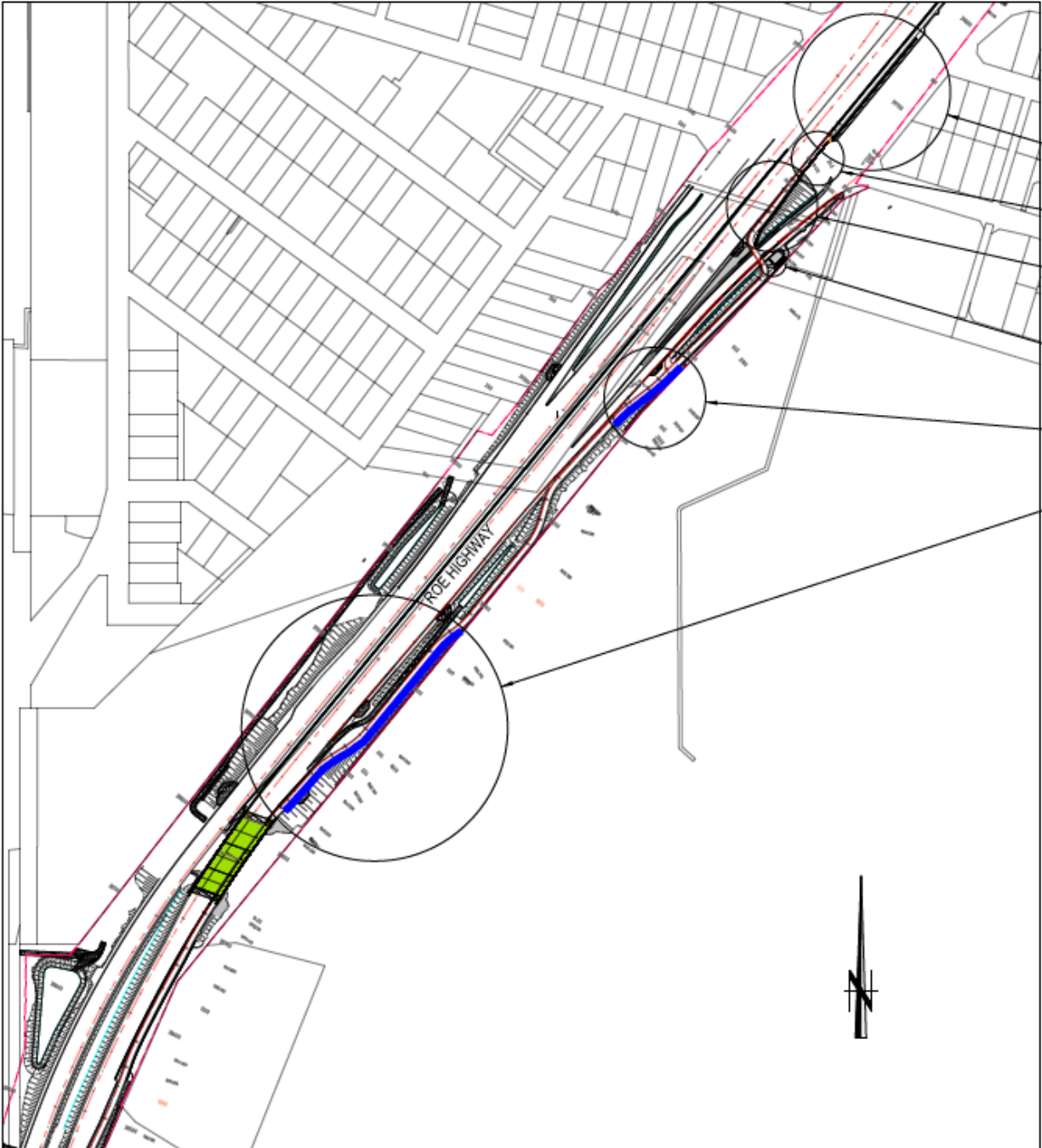


Figure 3-3: Screen Wall Locations

3.2.2. Road Surface

The corrections applied for different road surface finishes are provided in *Table 3-1*.

Table 3-1: 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 is provided in *Table 3-2* and assumed to remain unchanged in the future, with reference to Straight Line Kilometre (SLK).

Table 3-2: Roe Highway Existing and Future Road Surfaces

Road	SLK	Road Surface
Northbound Traffic		
H018 – Roe Hwy	38.49 to 39.21	SMA
	39.21 to 39.40	OGA
H578 – Roe Hwy (NB) off to Clayton Street	0.00 to 0.37	DGA
Southbound Traffic		
H018 – Roe Hwy	39.24 to 38.00	SMA
H579 – Clayton Street to Roe Hwy (SB)	0.00 to 0.38	DGA

3.2.3. Vehicle Speed

The posted speeds are provided in *Table 3-3*, noting these are expected to remain the same in the future.

Table 3-3: Roe Highway Posted Speeds

Road	SLK	Posted Speed (km/hr)
Northbound Traffic		
H018 – Roe Hwy	38.30 to 40.28	100
H578 – Roe Hwy (NB) off to Clayton Street	0.00 to 0.37	60
Westbound Traffic		
H018 – Roe Hwy	40.21 to 38.3	100
H579 – Clayton Street to Roe Hwy (SB)	0.00 to 0.38	60

3.2.4. Traffic Volumes

Existing traffic volumes (where available) were obtained from Main Roads WA Traffic Map. A modelled Validation Plot, forecast 2041 and Ultimate traffic volumes were obtained from Main Roads WA (Scott Hazebroek, Traffic Modelling Analyst, Reference: #43004, dated 13 August 2024). The validation plot allows the forecast volumes (in this case from the Ultimate Scenario) to be calibrated with *Table 3-4* providing the traffic volumes used in the noise modelling, Note that the percentage heavy vehicles are assumed to be the same in the future as existing being 19.8% northbound and 12.1% southbound.

Table 3-4: Traffic Information Used in Noise Modelling

Road	Section	Existing (2021/22)		Future (2046)	
		Northbound / Eastbound	Southbound / Westbound	Northbound / Eastbound	Southbound / Westbound
H018 - Roe Highway	North of GEH Bypass	30,400 (19.8)	29,800 (12.1)	68,200 (19.8)	68,000 (12.1)
	North of on/off Ramp	25,800 (19.8)	25,500 (12.1)	57,200 (19.8)	57,000 (12.1)
H578 – Roe Hwy (NB) off to Clayton Street	South of Clayton Street	4,600 (19.8)	-	10,900 (19.8)	-
H579 – Clayton Street to Roe Hwy (SB)	South of Clayton Street	-	4,300 (12.1)	-	11,100 (12.1)

Note: Numbers shown in brackets are percentage heavy vehicles.

3.2.5. Ground Absorption

The ground absorption has been assumed to be 0.0 (0%) for the roads, 0.5 (50%) outside of the roads and 1.0 (100%) for public open spaces, noting that 0.0 represents hard reflective surfaces such as water and 1.0 represents absorptive surfaces such as grass.

4. RESULTS

4.1. Noise Monitoring

The results of the noise monitoring are summarised in *Table 4-1* and shown graphically in *Figure 4-1*. Note that whilst the logger was on site for a longer period, adverse conditions occurred such that only acceptable days are shown.

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
Thursday, 8 August 2024	68.1	65.8	66.8	62.2
Friday, 9 August 2024	67.6	65.2	66.3	61.7
Thursday, 15 August 2024	68.0	65.6	66.6	62.3
Friday, 16 August 2024	68.1	65.7	66.9	61.9
Average	67.9	65.6	66.7	62.0

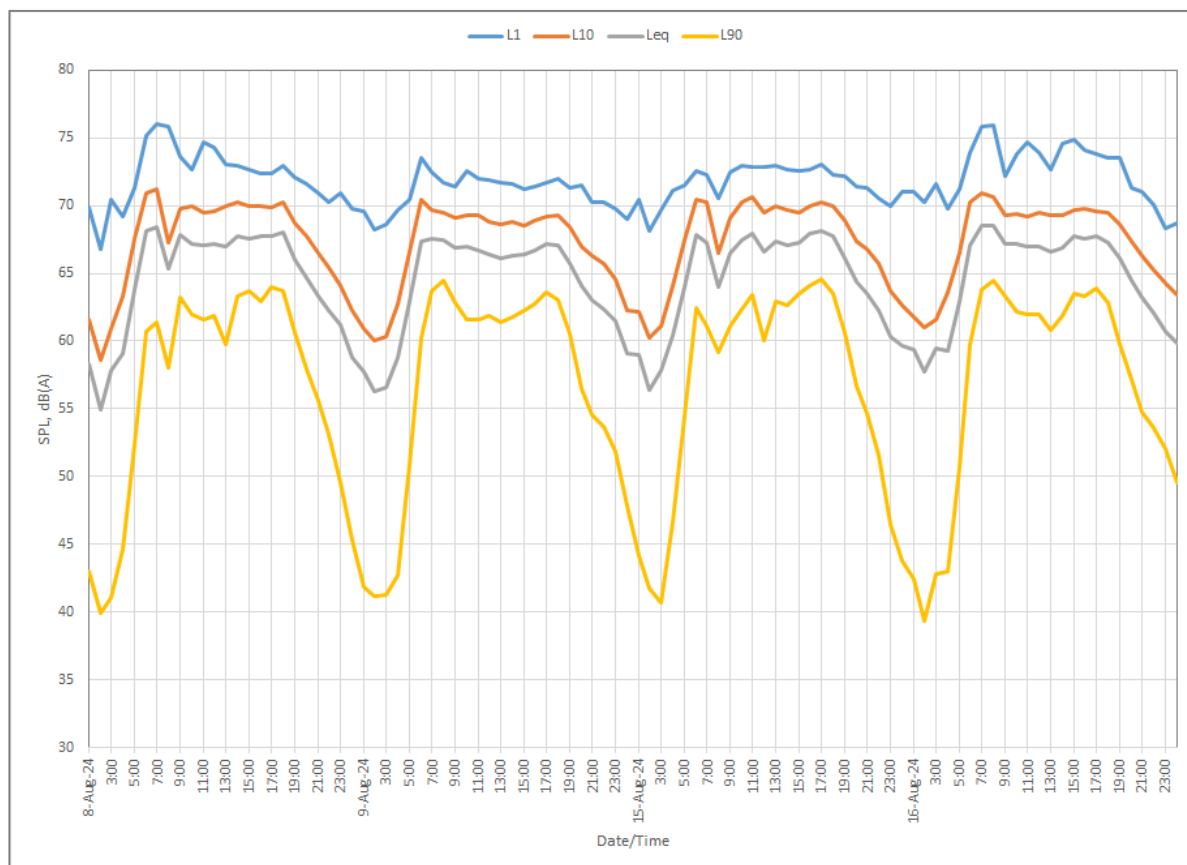
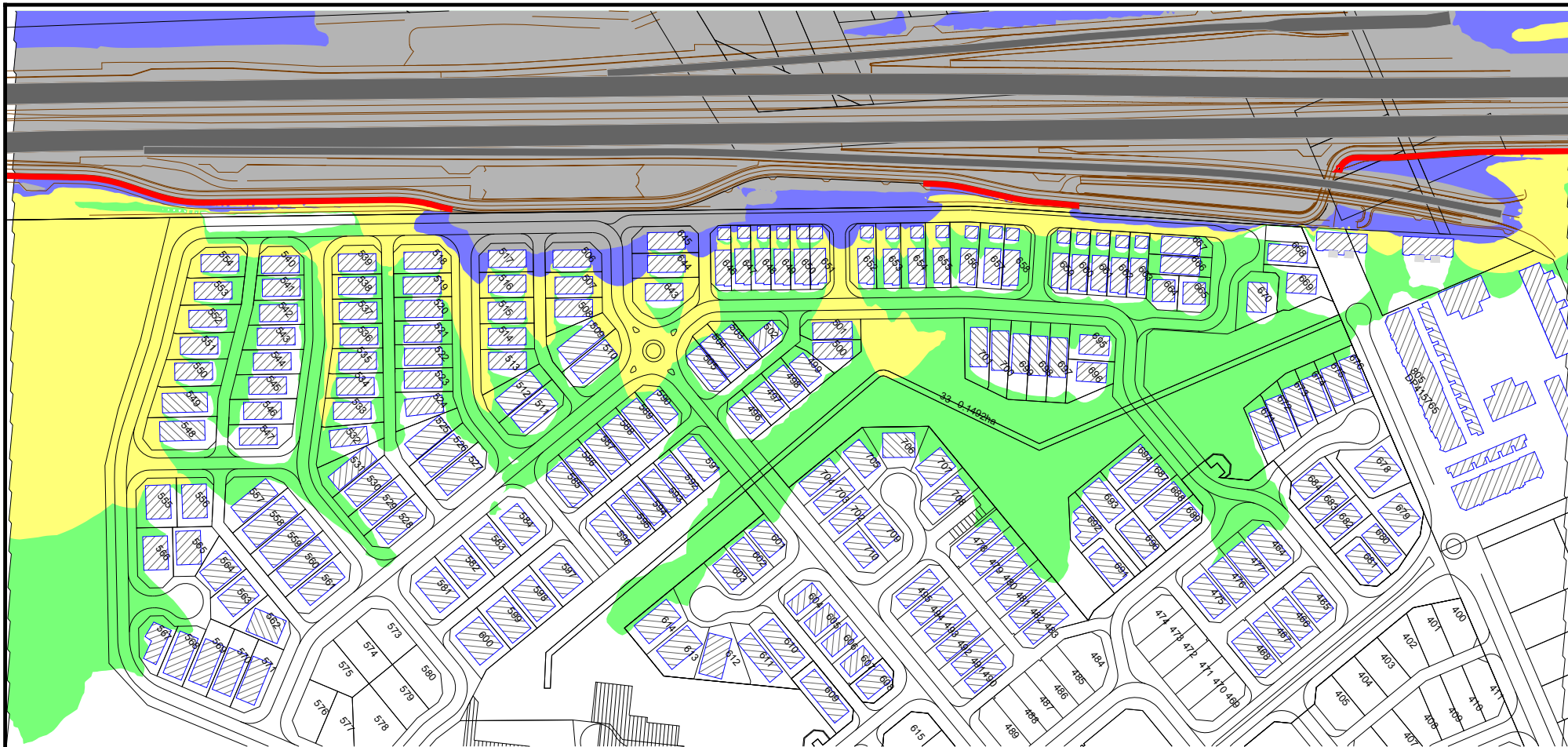


Figure 4-1: Hourly Noise Measurement Results at Noise Logger

The average difference between the weekday $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$ is 4.6 dB. With increased traffic volumes in the future, it is expected that the day would increase compared to the night so that the difference would be at least 5.0 dB. With the difference expected to be similar to the difference in the criteria (refer *Section 2*), this report presents the $L_{Aeq(Day)}$ noise levels.

4.2. Noise Modelling

The noise model was initially set-up for existing conditions and calibrated to the noise measurement location. The model is then updated to include the proposed subdivision, indicative buildings and future traffic volumes, maintaining the same model calibration. The results of the noise modelling are provided as a noise contour plot in *Figure 4-2* representing noise levels at ground floor, including the 2.4-metre high screen walls proposed by Main Roads WA.



Lots 800 and 239 Wilkins Street, Bellevue - Robinson Grove Estate including MRWA 2.4m High Screen Walls

**L_{Aeq}(Day) Noise Level Contours Based on Future Conditions
Ground Floor Level**

**SoundPLAN v8.2
CoRTN Algorithms**

Signs and symbols

- Future Roe Highway
- Indicative Buildings
- Provided Road Design
- 2.4m Screen Wall

Noise levels L_{Aeq}(Day) dB

- <= 55
- <= 56 Exposure A
- <= 57
- <= 58
- <= 59 Exposure B
- <= 60
- <= 61
- <= 62
- <= 63 Exposure C
- <= 64
- <= 65
- <= 66
- > 66 Exposure D

SPP 5.4 (Sep 2019)

4 September 2024



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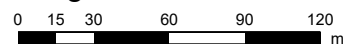


Figure 4-2



5. ASSESSMENT

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.

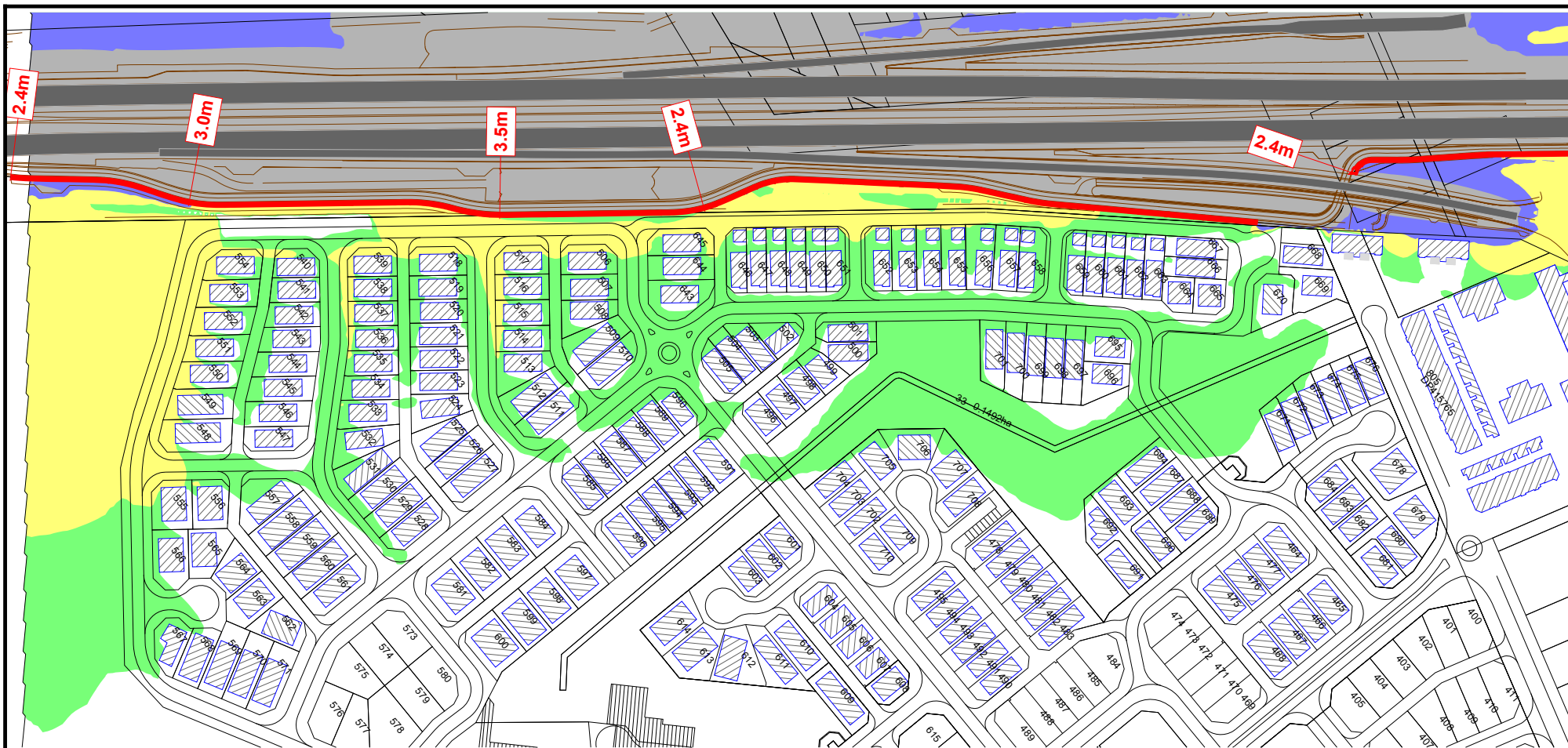
Where the outdoor noise targets of *Table 2-1* are achieved, no further noise controls are necessary. With reference to *Section 4.2*, it is evident the outdoor noise target will be exceeded at some lots.

Given screen walls are proposed as part of the road upgrade project it is logical for these to be more continuous than proposed. Furthermore, the road and PSP is generally at a higher level than the subdivision and as such, it is also logical to locate the walls at the screen wall positions, being relative to the PSP. With this in mind, a noise wall design is provided on *Figure 5-1*, along with the associated noise contours resulting in ground floors being within Exposure A and Exposure B. Increasing the height of the noise walls would further reduce noise levels such that that presented is considered to be a reasonable minimum. With the resultant noise levels remaining above the outdoor noise target, Packages A and B are required for single storey developments as shown on *Figure 5-2*. Where any dwelling within Stage 1 is to be double storey and within the outdoor noise target shown on *Figure 5-3*, a site specific assessment is required.

The below summarises the noise mitigation requirements:

- Developer to incorporate notification on lot titles for those lots identified on *Figure 5-2*.
- Local Development Plan (LDP) to be prepared identifying those lots within Exposure A or Exposure B as per *Figure 5-2* as well as the designated garage position for Lots 646 to 663. Deemed to Comply Packages (refer *Appendix A*) for these lots are to be provided as part of the LDP. Alternatives to the provided Packages can be accepted if supported by a report from a suitably qualified acoustical consultant (member firm of the Association of Australasian Acoustical Consultants (AAAC)) once the specific house plans for the lot are available.
- Any dwelling within the subdivision proposed to be double storey and within the outdoor noise target shown on *Figure 5-3*, is required to have a site specific assessment undertaken by a suitably qualified acoustical consultant.
- Noise wall to be provided with minimum heights (relative to the PSP) as shown on *Figure 5-2*. The noise wall is to be constructed of a material having a minimum surface mass of 15 kg/m². Noise wall is to be provided by Main Roads WA as part of the road project and/or as negotiated between Main Roads WA and the developer.

The above is in line with the requirements of *State Planning Policy No. 5.4 Road and Rail Noise* where a shared responsibility on noise mitigation is appropriate.



Lots 800 and 239 Wilkins Street, Bellevue - Robinson Grove Estate with Noise Walls as Shown

L_{Aeq}(Day) Noise Level Contours Based on Future Conditions
Ground Floor Level
Noise Wall Heights Relative to PSP and Read from Left to Right

SoundPLAN v9.0
 CoRTN Algorithms

4 September 2024



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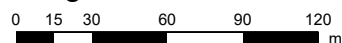
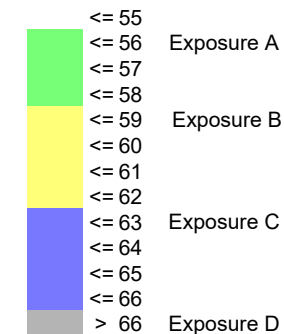


Figure 5-1

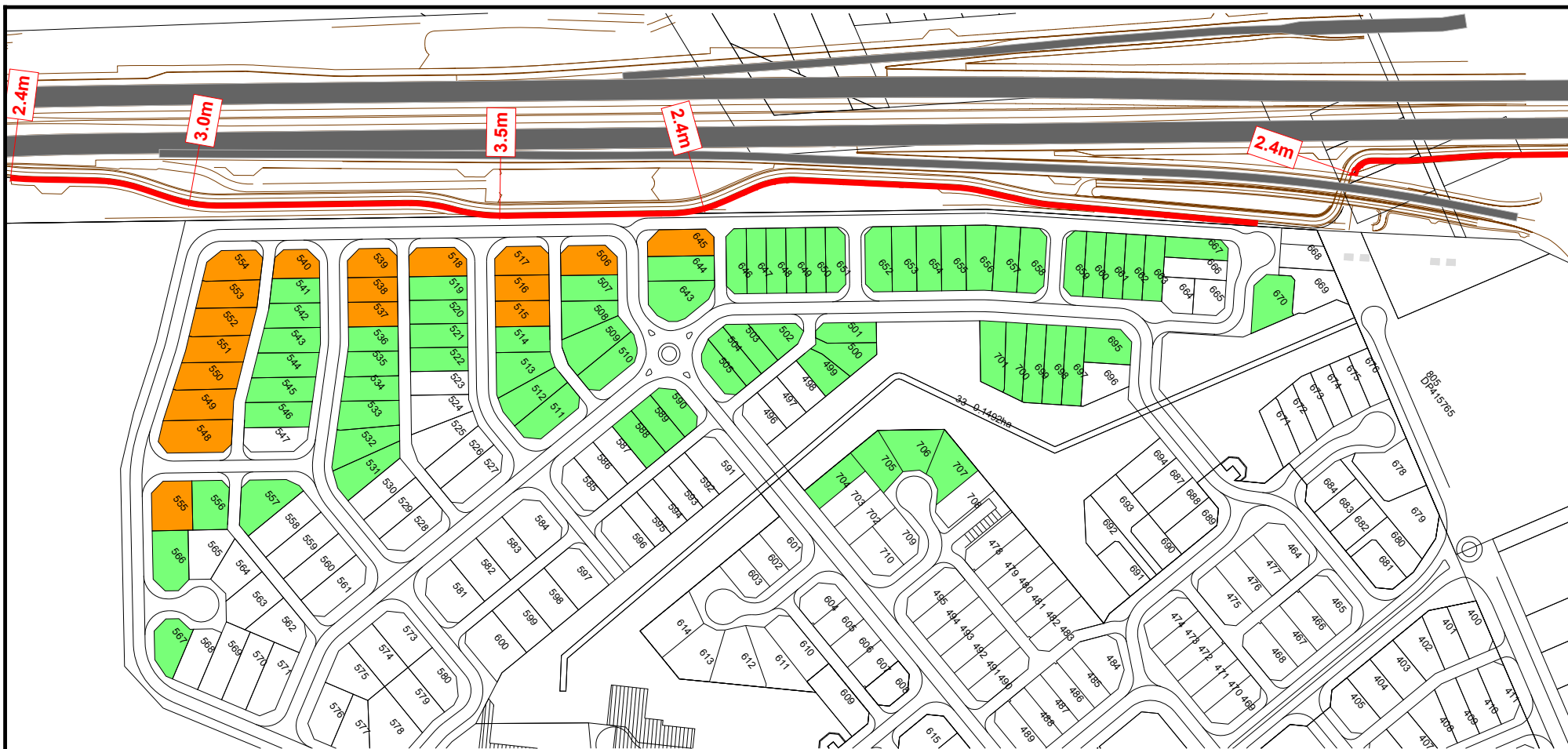
Signs and symbols

- Future Roe Highway
- Indicative Buildings
- Provided Road Design
- Noise Wall

Noise levels L_{Aeq}(Day) dB



SPP 5.4 (Sep 2019)



Lots 800 and 239 Wilkins Street, Bellevue - Robinson Grove Estate Noise Mitigation

Ground Floor Level
Noise Wall Heights Relative to PSP and Read from Left to Right

SoundPLAN v9.0
CoRTN Algorithms

5 September 2024



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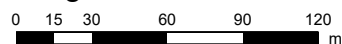
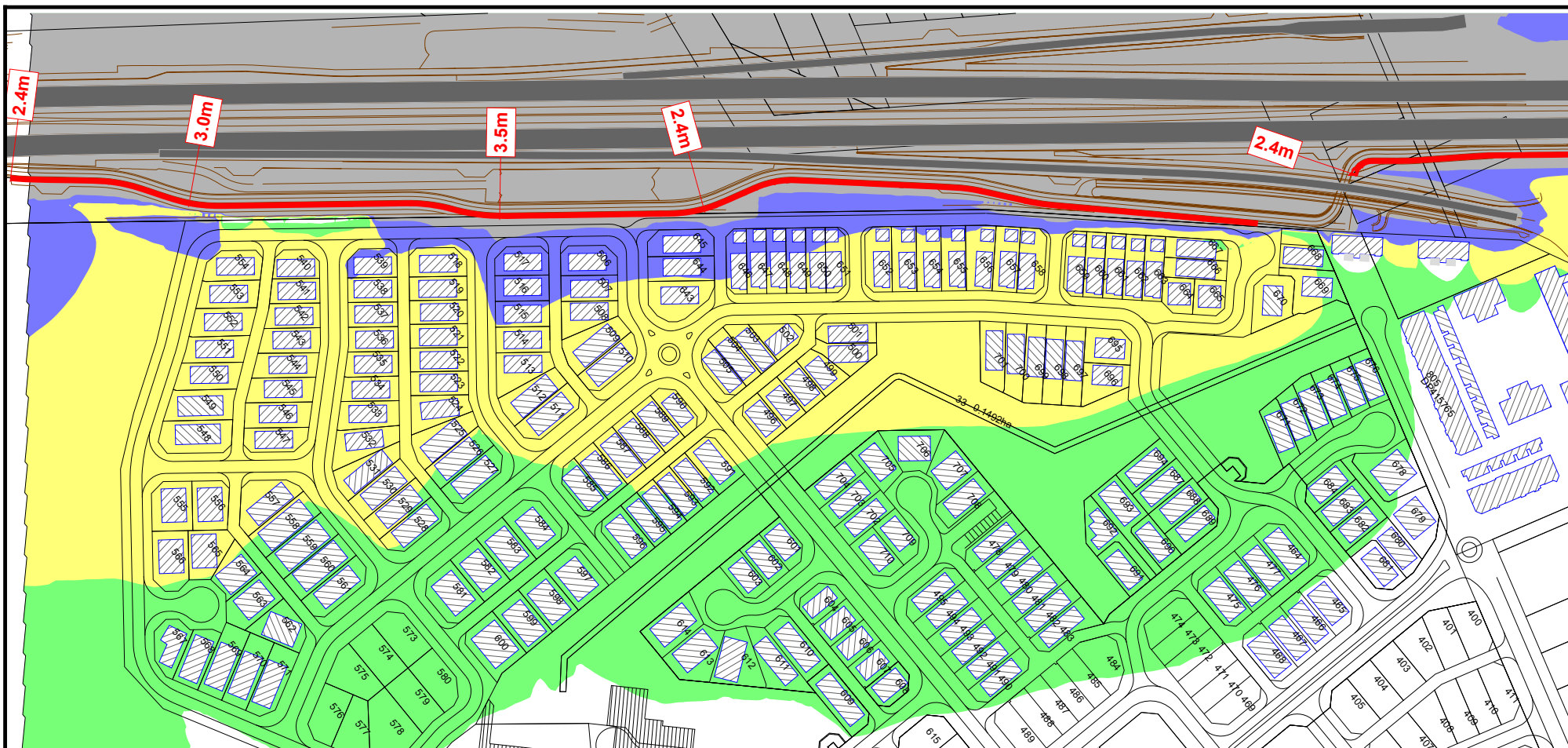


Figure 5-2

Signs and symbols

- Future Roe Highway
- Provided Road Design
- Noise Wall
- Package A
- Package B





Lots 800 and 239 Wilkins Street, Bellevue - Robinson Grove Estate with Noise Walls as Shown

L_{Aeq}(Day) Noise Level Contours Based on Future Conditions
First Floor Level
Noise Wall Heights Relative to PSP and Read from Left to Right

SoundPLAN v9.0
 CoRTN Algorithms

Signs and symbols

- Future Roe Highway
- Indicative Buildings
- Provided Road Design
- Noise Wall

Noise levels L_{Aeq}(Day) dB

<= 55	
<= 56	Exposure A
<= 57	
<= 58	
<= 59	Exposure B
<= 60	
<= 61	
<= 62	
<= 63	Exposure C
<= 64	
<= 65	
<= 66	
> 66	Exposure D

SPP 5.4 (Sep 2019)

5 September 2024



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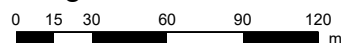


Figure 5-3



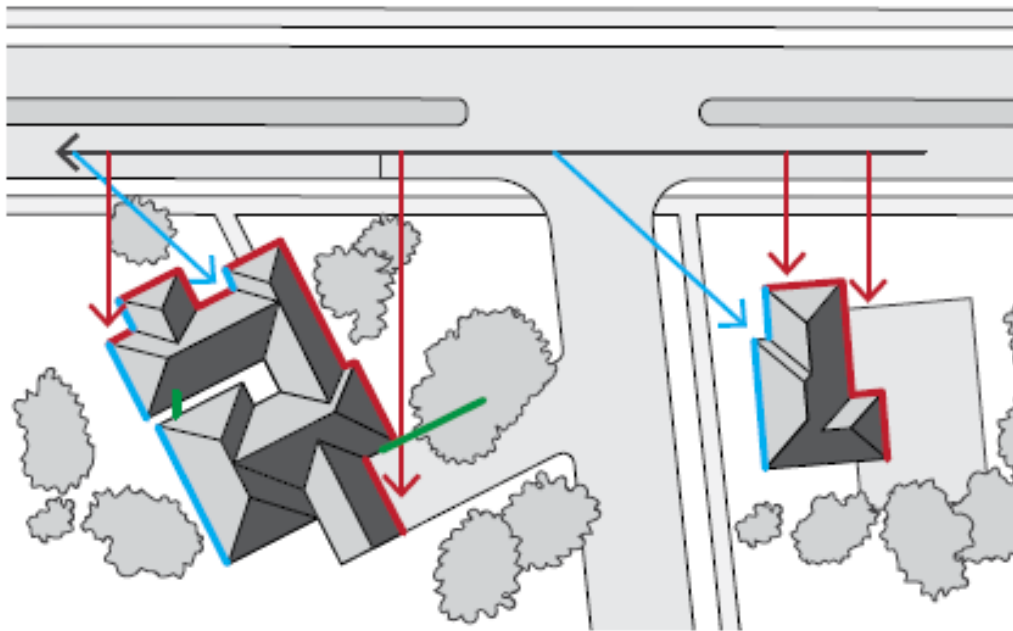
Appendix A – Quiet House Packages

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 $L_{Aeq}(\text{Day})$ & 51-53 dB $L_{Aeq}(\text{Night})$

Element	Orientation	Room	
		Bedroom	Indoor Living and Work Areas
External Glazing	Facing	<ul style="list-style-type: none"> Up to 40% floor area ($R_w + C_{tr} \geq 28$): <ul style="list-style-type: none"> 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 ($R_w + C_{tr} \geq 31$): <ul style="list-style-type: none"> Sealed awning or casement windows with minimum 6mm glass. 	<ul style="list-style-type: none"> Up to 40% floor area ($R_w + C_{tr} \geq 25$): <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Fully glazed hinged door with certified $R_w + C_{tr} \geq 28$ rated door and frame including seals and 6mm glass. 	<ul style="list-style-type: none"> Doors to achieve $R_w + C_{tr} \geq 25$: <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> $R_w + C_{tr} \geq 45$: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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/m³; and 2 x 16mm fire-rated plasterboard to inside. 	
Roofs and Ceilings	All	<ul style="list-style-type: none"> $R_w + C_{tr} \geq 35$: Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard. 	

Quiet House Package B

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

Element	Orientation	Room	
		Bedroom	Indoor Living and Work Areas
External Glazing	Facing	<ul style="list-style-type: none"> Up to 40% floor area ($R_w + C_{tr} \geq 31$): <ul style="list-style-type: none"> Fixed sash, awning or casement with minimum 6mm glass or 6mm-12mm-6mm double insulated glazing. Up to 60% floor area ($R_w + C_{tr} \geq 34$): <ul style="list-style-type: none"> Fixed sash, awning or casement with minimum 10mm glass or 6mm-12mm-10mm double insulated glazing. 	<ul style="list-style-type: none"> Up to 40% floor area ($R_w + C_{tr} \geq 28$): <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Fully glazed hinged door with certified $R_w + C_{tr} \geq 31$ rated door and frame including seals and 10mm glass. 	<ul style="list-style-type: none"> Doors to achieve $R_w + C_{tr} \geq 28$: <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> $R_w + C_{tr} \geq 50$: <ul style="list-style-type: none"> Two leaves of 90mm thick clay brick masonry with minimum 50mm cavity between leaves and 25mm glasswool or polyester (24kg/m^3). 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/m^3). 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: <ul style="list-style-type: none"> 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/m^3) between studs; and One layer of 10mm plasterboard fixed to the inside face. 	
Roofs and Ceilings	All	<ul style="list-style-type: none"> $R_w + C_{tr} \geq 35$: <ul style="list-style-type: none"> Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard ceiling with R3.0+ fibrous insulation. 	

Quiet House Package C

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

Element	Orientation	Room	
		Bedroom	Indoor Living and Work Areas
External Glazing	Facing	<ul style="list-style-type: none"> Up to 20% floor area ($R_w + C_{tr} \geq 31$): <ul style="list-style-type: none"> Fixed sash, awning or casement with minimum 6mm glass or 6mm-12mm-6mm double insulated glazing. Up to 40% floor area ($R_w + C_{tr} \geq 34$): <ul style="list-style-type: none"> Fixed sash, awning or casement with minimum 10mm glass or 6mm-12mm-10mm double insulated glazing. 	<ul style="list-style-type: none"> Up to 40% floor area ($R_w + C_{tr} \geq 31$): <ul style="list-style-type: none"> Fixed sash, awning or casement with minimum 6mm glass or 6mm-12mm-6mm double insulated glazing. Up to 60% floor area ($R_w + C_{tr} \geq 34$): <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Not recommended. 	<ul style="list-style-type: none"> Doors to achieve $R_w + C_{tr} \geq 30$: <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> $R_w + C_{tr} \geq 50$: <ul style="list-style-type: none"> Two leaves of 90mm thick clay brick masonry with minimum 50mm cavity between leaves and 25mm glasswool or polyester insulation (24kg/m^3). 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/m^3). 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: <ul style="list-style-type: none"> 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/m^3) between studs; and One layer of 10mm plasterboard fixed to the inside face. 	
Roofs and Ceilings	All	<ul style="list-style-type: none"> $R_w + C_{tr} \geq 40$: <ul style="list-style-type: none"> 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. 	

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:

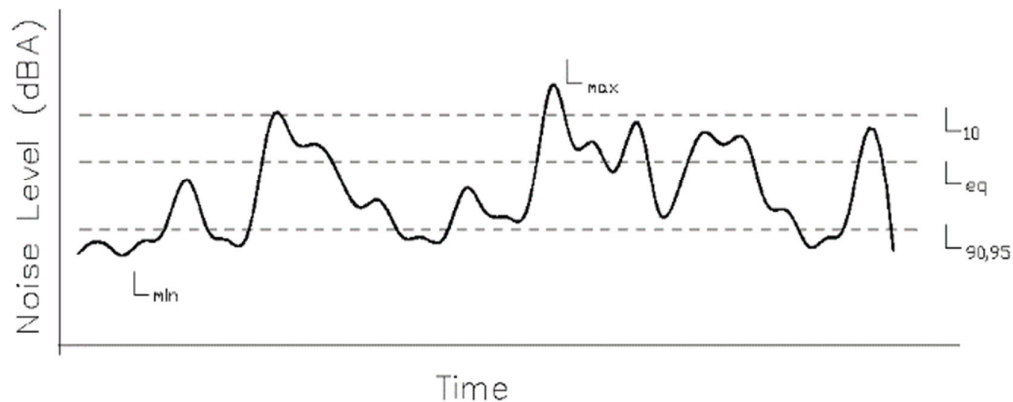
- The noise reduction benefit provided;
- The number of people protected;
- The relative cost vs benefit of mitigation;
- Road conditions (speed and road surface) significantly differ from noise forecast table assumptions;
- Existing and future noise levels, including changes in noise levels;
- Aesthetic 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**



- Austrroads Vehicle Class

VEHICLE CLASSIFICATION SYSTEM	
AUSTRROADS	
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 axle
4	THREE AXLE TRUCK OR BUS *3 axle, 2 axle groups
5	FOUR (or FIVE) AXLE TRUCK *4 (5) axle, 2 axle groups
6	THREE AXLE ARTICULATED *3 axle, 3 axle groups
7	FOUR AXLE ARTICULATED *4 axle, 3 or 4 axle groups
8	FIVE AXLE ARTICULATED *5 axle, 3+ axle groups
9	SIX AXLE ARTICULATED *6 axle, 3+ axle groups or 7+ axle, 3 axle groups
LONG VEHICLES AND ROAD TRAINS	
10	8 DOUBLE or HEAVY TRUCK and TRAILER *7+ axle, 4 axle groups
11	DOUBLE ROAD TRAIN *7+ axle, 5 or 6 axle groups
12	TRIPLE ROAD TRAIN *7+ axle, 7+ axle groups

- Typical Noise Levels

