Lloyd George Acoustics
PO Box 717
Hillarys WA 6923
T: 9401 7770
www.lgacoustics.com.au

Transportation Noise Assessment

Lots 52 & 53 Victoria Road, Dayton

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Prepared for:
GM Property Group (Aust)

Report: 19014798-01A

Lloyd George Acoustics Pty Ltd

ABN: 79 125 812 544

PO Box 717
Hillarys WA 6923

www.lgacoustics.com.au

T: 9401 7770

Contacts	Daniel Lloyd	Terry George	Matt Moyle	Olivier Mallié	Ben Hillion	Rob Connolly
E:	daniel@lgacoustics.com.au	terry@lgacoustics.com.au	matt@lgacoustics.com.au	olivier@lgacoustics.com.au	ben@lgacoustics.com.au	rob@lgacoustics.com.au
M:	0439 032 844	0400 414 197	0412 611 330	0439 987 455	0457 095 555	0410 107 440

Date:	Rev	Description	Prepared By	Verified
27/03/19	-	Final Report	Daniel Lloyd	Terry George
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1 INTRODUCTION

This report has been prepared to assess the traffic noise impacts to the proposed residential development to be located on 52 & 53 Victoria Road, Dayton. This subdivision is adjacent to Reid Highway and therefore requires an assessment of the traffic noise impacts.

The results of the assessment are compared against the *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* and recommendations are provided on noise mitigation requirements under this policy.

For a general locality map, refer to *Figure 1-1*and the subdivision layout is shown in *Figure 1-2*.

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

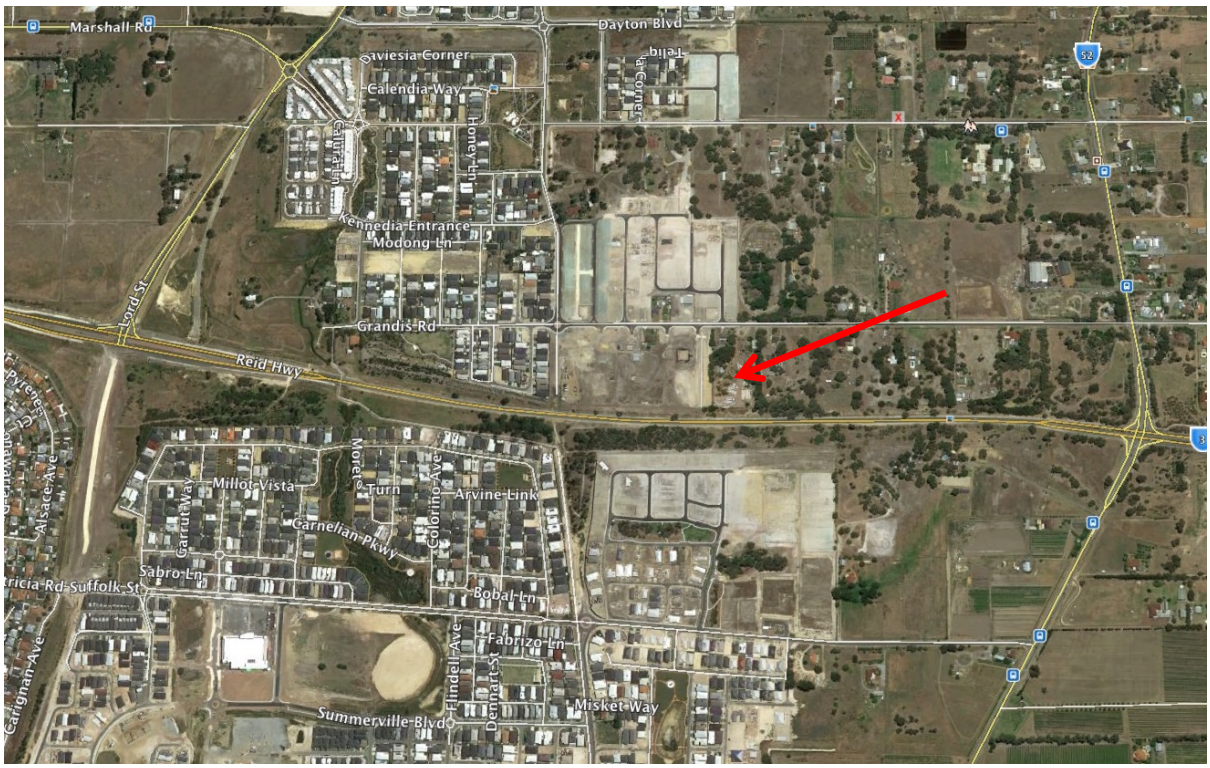


Figure 1-1 Project Locality

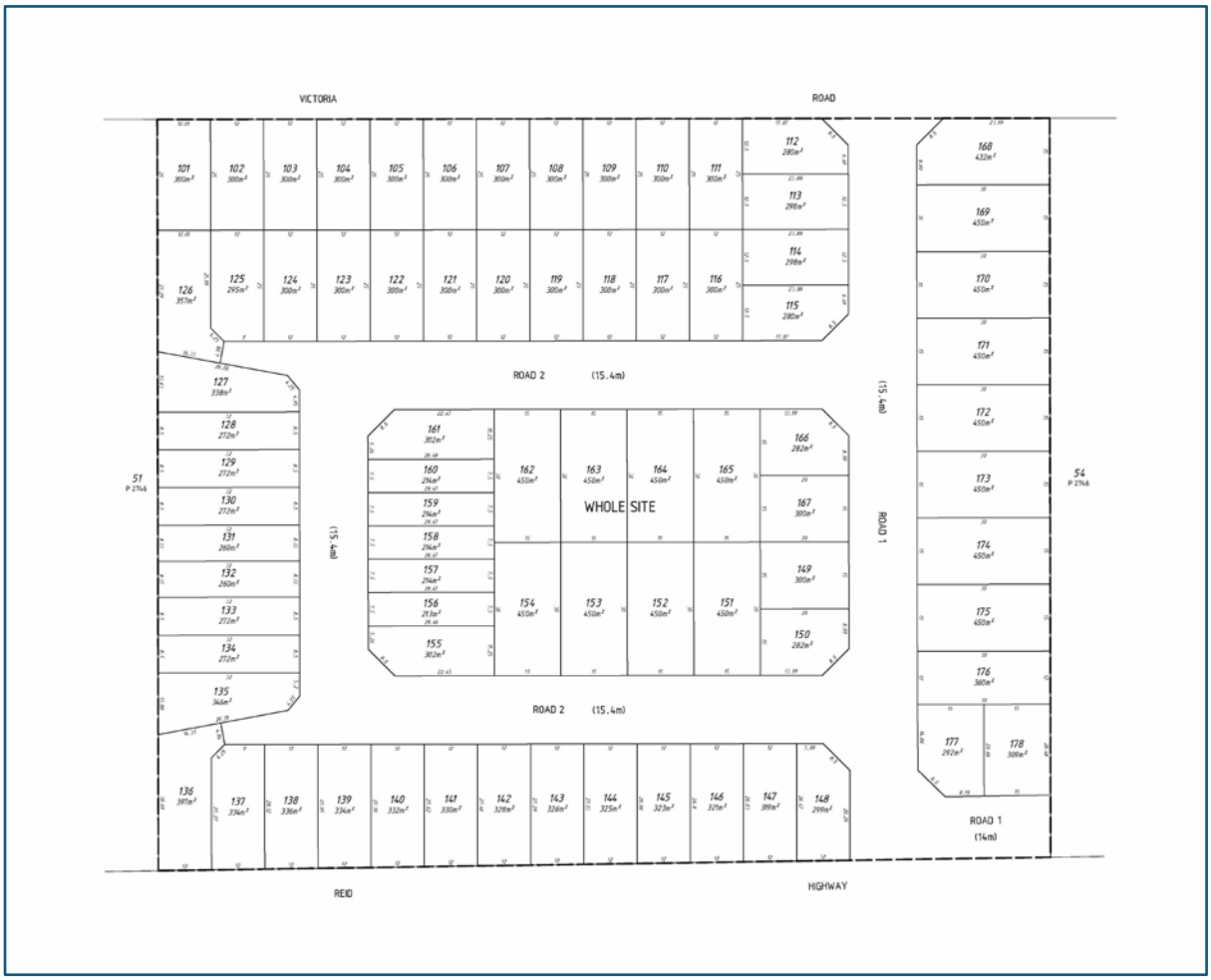


Figure 1-2 Subdivision Layout

2 CRITERIA

The criteria relevant to this assessment is the *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* (hereafter referred to as the Policy) produced by the Western Australian Planning Commission (WAPC). The objectives in the Policy are to:

- Protect people from unreasonable levels of transport noise by establishing a standardised set of criteria to be used in the assessment of proposals;
- Protect major transport corridors and freight operations from incompatible urban encroachment;
- Encourage best practice design and construction standards for new development proposals and new or redevelopment transport infrastructure proposals;
- Facilitate the development and operation of an efficient freight network; and
- Facilitate the strategic co-location of freight handling facilities.

The Policy's outdoor noise criteria are shown below in *Table 2-1*. These criteria apply at any point 1-metre from a habitable façade of a noise sensitive premises and in one outdoor living area.

Table 2-1Outdoor Noise Criteria

Period	Target	Limit
Day (6am to 10pm)	55 dB $L_{Aeq(Day)}$	60 dB $L_{Aeq(Day)}$
Night (10pm to 6am)	50 dB $L_{Aeq(Night)}$	55 dB $L_{Aeq(Night)}$

Note: The 5 dB difference between the target and limit is referred to as the margin.

In the application of these outdoor noise criteria to new noise sensitive developments, the objectives of this Policy is to achieve -

- acceptable indoor noise levels in noise-sensitive areas (e.g. bedrooms and living rooms of houses); and
- a 'reasonable' degree of acoustic amenity in at least one outdoor living area on each residential lot.

If a noise sensitive development takes place in an area where outdoor noise levels will meet the *target*, no further measures are required under this policy.

In areas where the *target* is exceeded, but noise levels are likely to be within the 5 dB margin (i.e. less than the *limit*), mitigation measures should be implemented by the developer with a view to achieving the *target* levels in at least one outdoor living area on each residential lot. Where indoor spaces are planned to be facing any outdoor area in the *margin*, mitigation measures should be implemented to achieve acceptable indoor noise levels in those spaces.

In areas where the *limit* is exceeded (i.e. above $L_{Aeq(Day)}$ of 60dB(A) or $L_{Aeq(Night)}$ of 55dB(A)), a detailed noise assessment is to be undertaken. Customised noise mitigation measures should be implemented with a view to achieving the *target* in at least one outdoor living area on each residential lot, or if this is not practicable, within the *margin*. Where indoor spaces are planned to be facing outdoor areas that are above the *target*, mitigation measures should be implemented to achieve acceptable indoor noise levels in those spaces.

3 METHODOLOGY

Noise measurements and modelling have been undertaken in accordance with the requirements of the Policy as described below in *Sections 3.1 and 3.2*.

3.1 Site Measurements

Noise monitoring was undertaken in December 2017 as part of the Main Roads assessment regarding the upgrade if Reid Highway between Altone Road and West Swan Road.

The instrument used was an ARL noise data logger, placed adjacent to a noise sensitive premises on Plumosa Crescent. Sound pressure levels were measured in accordance with Australian Standard 2702-1984: *Acoustics -Method For Measurement of Road Traffic Noise*. The logger was placed within bushland, 7 metres from the existing Reid Highway with the microphone height at 1.4 metres above ground floor level. The logger was field calibrated before and after the measurement session and

found to be accurate to within +/- 1 dB. Lloyd George Acoustics also holds current laboratory calibration certificate for the loggers.

From the hourly measurements, the $L_{A10,18\ hour}$, $L_{Aeq(Day)}$ and $L_{Aeq\ (Night)}$ values were determined for each complete measurement day. These results were averaged and the mean level reported.

Figure 3-1Typical Noise Data Logger

The noise data collected was verified by inspection and professional judgement. Where hourly data was considered atypical, an estimated value was inserted as required by MRWA.

3.2 Noise Modelling

The computer programme *SoundPLAN 8.0* 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 Classes 1 & 2) with non-heavy vehicles having a source height of 0.5 metres above road level and heavy vehicles having two sources, at heights of 1.5 metres and 3.6 metres above road level, to represent the engine and exhaust respectively. By splitting the noise source into three, allows for less barrier attenuation for high level sources where barriers are to be considered. Note that corrections are applied to the exhaust of –8.0 dB (based on *Transportation Noise Reference Book, Paul Nelson, 1987*) and to the engine source of –0.8 dB, so as to provide consistent results with the CoRTN algorithms;
- An adjustment of –1.7 dB has been applied to the predicted levels 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 1982.

Predictions are made at heights of 1.4 m above ground floor level for single storey houses and4.4 m for double storey. The noise is predicted at 1.0 metre from an assumed building facade resulting in a + 2.5 dB correction due to reflected noise.

Various input data are included in the modelling such as ground topography, road design, traffic volumes etc. These model inputs are discussed below.

3.2.1 Ground Topography, Road Design & Cadastral Data

Topographical data, was provided by Main Roads, with the contours being in 0.1 metre intervals. The new road design has been integrated into the existing topography. It should be noted that survey information that may contain existing earth bunds were not available at the time of this assessment and have not been taken into consideration when designing noise walls.

Buildings have also been included as these can provide barrier attenuation when located between a source and receiver, in much the same way as a hill or wall provides noise shielding. For modelling purposes all buildings are assumed to have a height of 4.0 metres. As this assessment considers the future scenario (15 years), it is assumed that the land to the east and west of this subdivision has been developed. All buildings are assumed to have a height of 4.0 metres.

3.2.2 Traffic Data

The existing road surface is assumed to be dense-graded asphalt and the future road surface is assumed to be stone mastic asphalt with intersection mix at intersections (equivalent to dense graded). The noise relationship between the various road surfaces is provided in *Table 3-1*. As a guide, 14 mm chip seal would be the noisiest surface and open-graded asphalt the quietest.

Table 3-1Noise Relationship Between Different Road Surfaces

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

Posted Speeds

The future posted speedthroughout the project area is assumed to be 100km/h.

Traffic Volumes

The future (2037) traffic volumes were extrapolated from the 2031 and 2051 traffic volumes provided by Main Roads. The traffic volumes used in the assessment are shown in *Table 3-2.*

Table 3-2 Traffic Volumes Used in the Assessment

Carriageway	2031 Volumes	2051 Volumes	2037 Volumes
Eastbound	35,500	51,200	40,210
Westbound	39,400	47,900	41,950

3.2.3 Ground Attenuation

The ground attenuation has been assumed to be 0.2 (20%) within the road reserve, 0.6 (60%) throughout the subdivision, except for the public open space, which was set to 1.00 (100%). Note 0.0 represents hard reflective surfaces such as water and 1.00 represents absorptive surfaces such as grass.

3.2.4 Parameter Conversion

The CoRTN algorithms used in the *SoundPLAN* modelling package were originally developed to calculate the $L_{A10,18hour}$ noise level. The Policy however uses $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$. The relationship between the parameters varies depending on the composition of traffic on the road (volumes in each period and percentage heavy vehicles) and this is calculated within the SoundPLAN software and compared against the measured data.

4 RESULTS

4.1 Noise Monitoring

The results of the noise monitoring are summarised below in *Table 4-1* and shown graphically in *Figure 4-1*.

Table 4-1Measured Average Noise Levels Adjacent to 30 Plumosa Crescent

Date	Average Weekday Noise Level, dB		
	$L_{A10,18hour}$	$L_{Aeq\ (Day)}$	$L_{Aeq\ (Night)}$
2/12/17	62.4	59.3	56.4
4/12/17	63.4	61.8	55.0
7/12/17	63.1	61.2	57.5
8/12/17	63.6	61.1	57.6
11/12/17	61.1	59.0	56.8
Weekday Average	**62.7**	**60.5**	**56.7**

The average differences between the weekday $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$ is less than 5 dB at all measurement locations. As such, it is the night period noise levels that will dictate compliance. Therefore the modelling will only consider the night period levels.

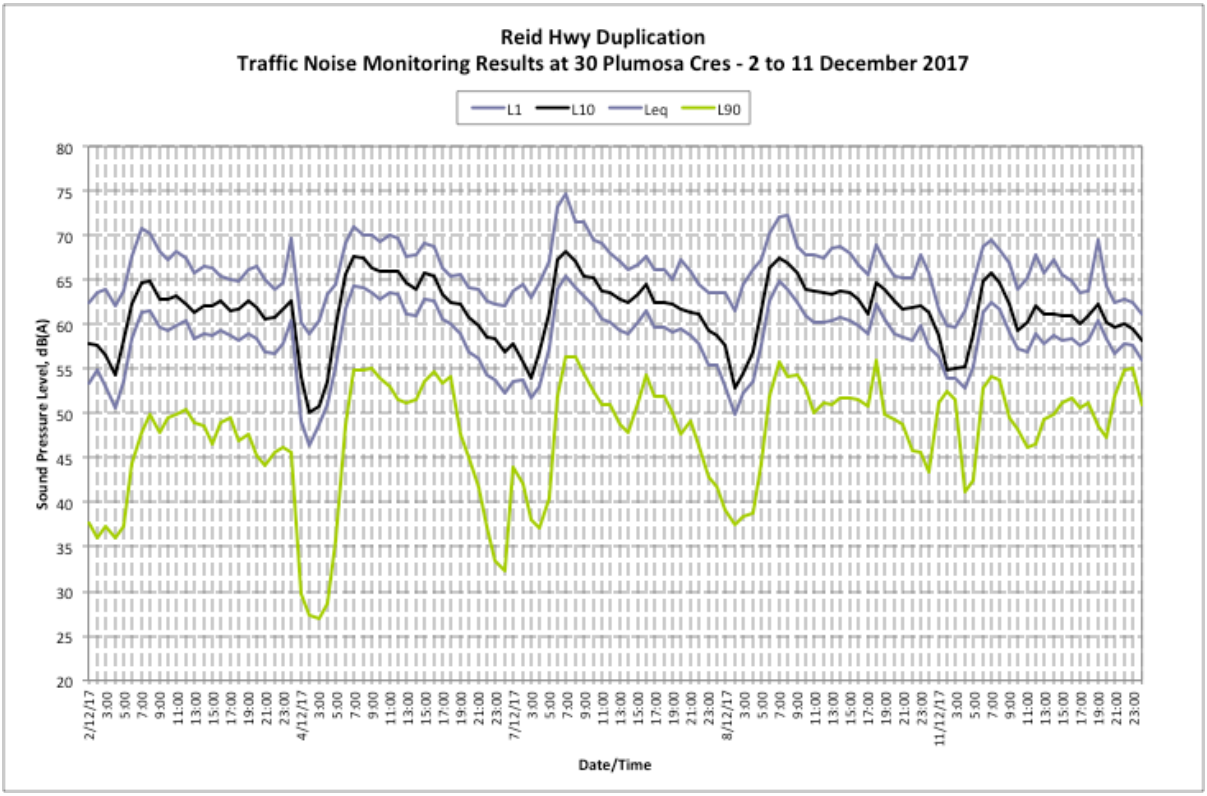


Figure 4-1 Noise Monitoring Results for 30 Plumosa Crescent

The measured noise levels are also used to calibrate the noise model, by comparing the measured traffic noise to the modelling the traffic noise at the same locations assuming the existing road design and traffic volumes. The variation between the two shows whether the model is either over or under-predicting the traffic noise for existing conditions and this difference is used for the future design and traffic volumes. The results of this comparison are presented below in *Table 4-2*.

Table 4-2 **Comparison Between Predicted and Measured Noise Levels**

Address	$L_{Aeq\ (Night)}$		Difference Between Measured & Predicted
	Measured	Predicted	$L_{Aeq\ (Night)}$
30 Plumosa Crescent	56.7	58.2	1.5

Notes: 1. Predicted Levels include the -1.7 dB NAASRA Correction

The results show that the traffic noise levels are being over-predicted by 1.5 dB. Therefore the noise prediction model will be adjusted accordingly.

4.2 Noise Modelling

The results of the noise modelling assuming no additional noise mitigation measures are provided in *Figure 4-2*.

Figure 4-2

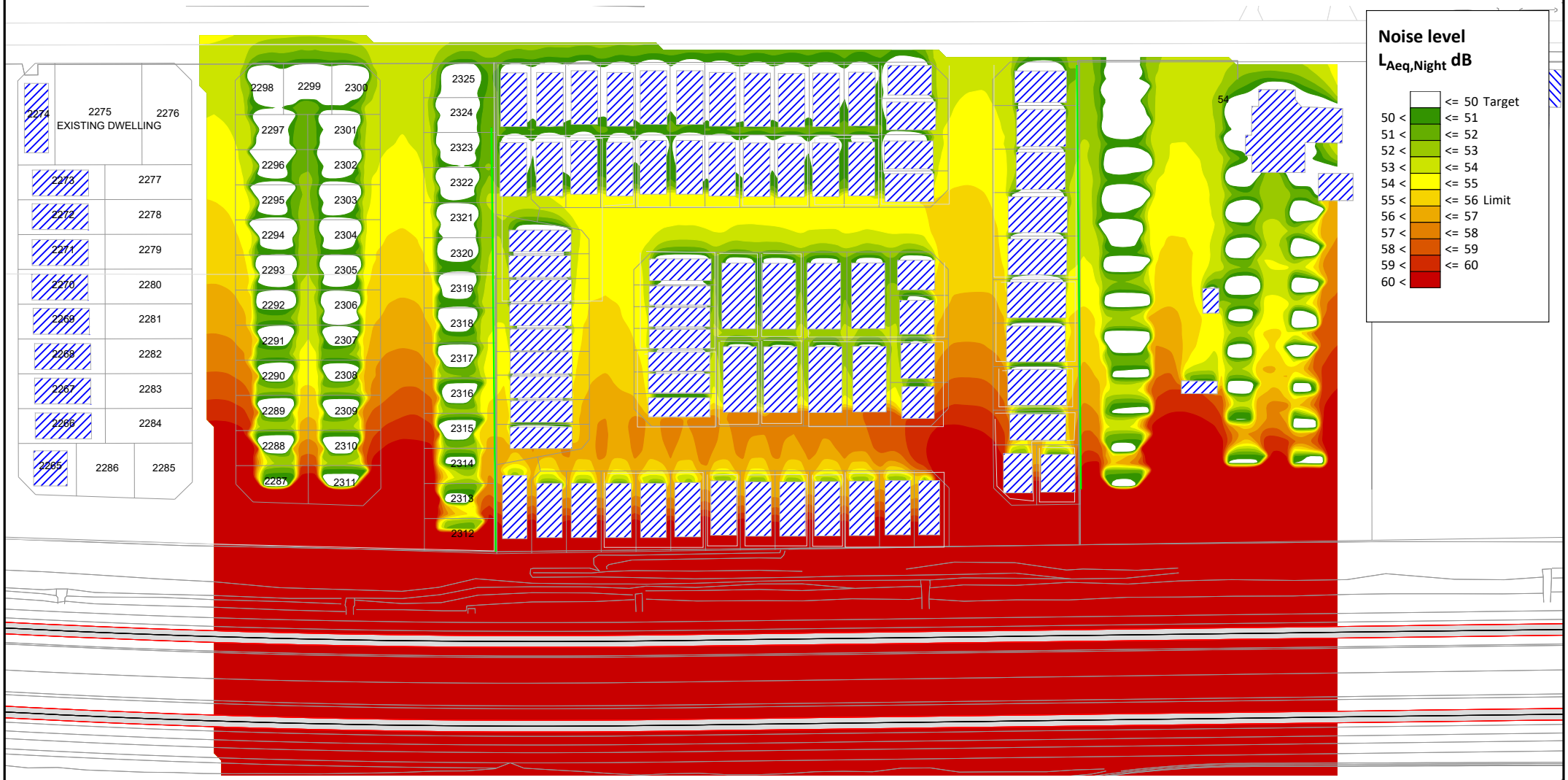
Scale

0 10 20 40 60 80 m

Signs and symbols

Emission line

Buildings



Lots 52 & 53 Victoria Road, Dayton

Future Noise Prediction Contours dB $L_{Aeq,Night}$ - Ground Floor - Assumes No Noise Walls

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

5 ASSESSMENT

The objectives of the Policy are for noise at all houses to be no more than the *limit* and preferably no more than the *target*. Where the *target* is achieved, no further controls are required. Where the noise levels exceed the *target,* noise control is to be incorporated into the design.

From *Figure 4-2*, it can be seen that assuming no noise control measures, there are a number lots predicted to receive a future road traffic noise level that will be above the *target* criteria at ground floor. Therefore noise mitigation measures must be considered in the development design. *Figure 5-1* provides details of the proposed noise wall for this development with *Figures 5-2and 5-3* providing the results assuming the proposed noise barrier for ground and first floor levels respectively.

Where noise mitigation measures, in the form of barriers or quieter road surfacing, is not practicable or does not result in the traffic noise being reduced to below the *target* level, noise impacts would need to be addressed using facade protection. The Policy states that "Customised noise mitigation measures should be implemented with a view to achieving the noise *target* in at least one outdoor living or recreation area on each noise-sensitive lot or, if this is not practicable, within the margin.

The Policy provides "deemed to comply" facade packages (Package A, B and C) where traffic noise is above the *target* but not more than 5 dB above the *limit*. These facade packages are provided at *Appendix A.* Noise levels that are more than 5 dB above the *limit* would require specialist acoustic advice.

It can be seen that even with the proposed noise barrier, lots are still above the *target* and therefore facade protection must also be incorporated into the house design. The required "deemed to comply" facade protection for ground and first floor facades is provided in *Figures 5-3 and 5-4* respectively. It should be noted that specialist advice could also be sought for any house design above the *target,* if desired, and can provide a customised facade design.

Additional requirements include:

- All affected lots are to have notifications on lot titles as per the Policy requirements – refer *Appendix A.*
- All affected lots are to provide one outdoor entertaining area where noise levels are below the target, or if not practicable, below the *limit*.

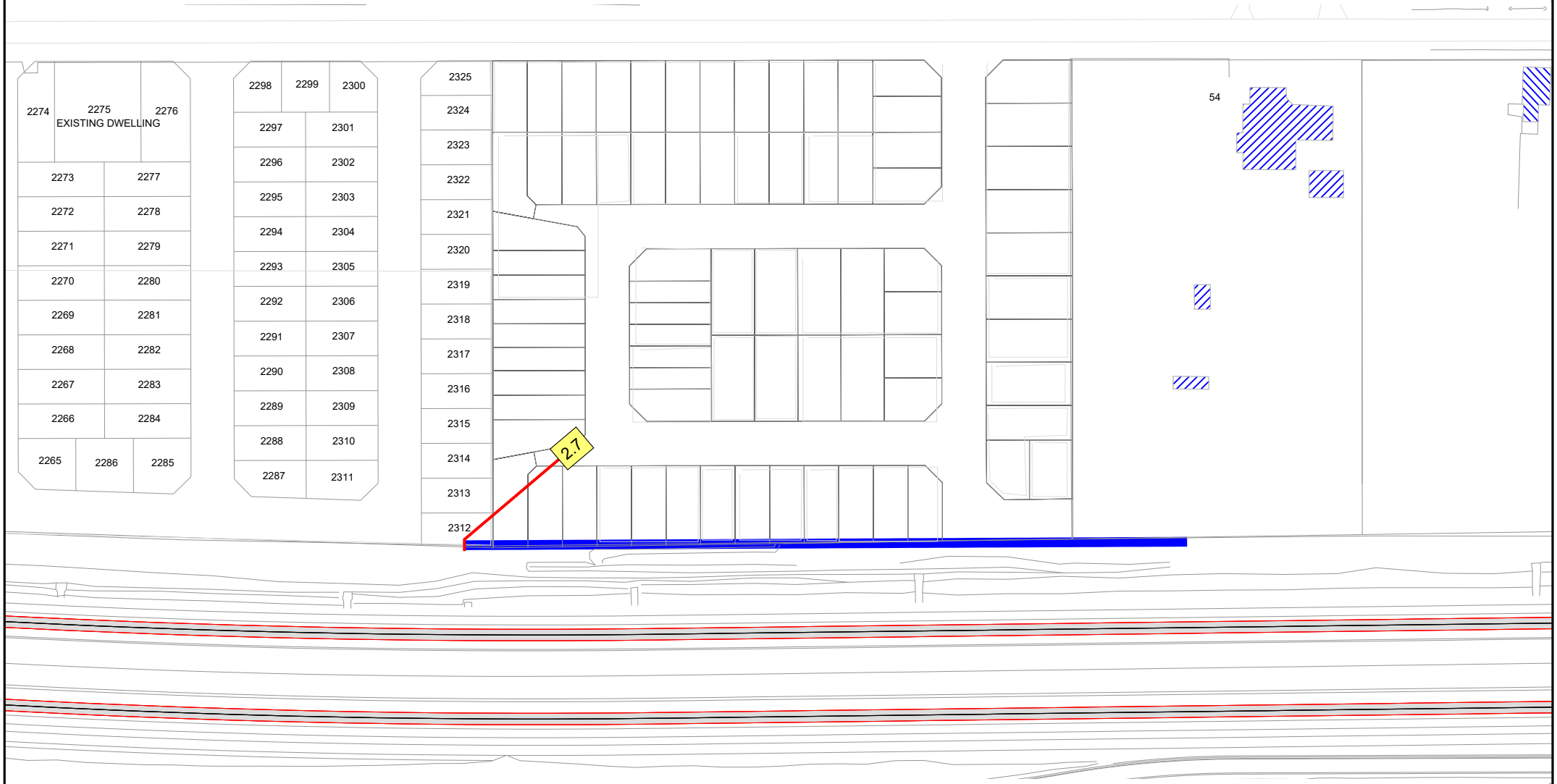
Figure 5-1

Scale

0 10 20 40 60 80 m

Signs and symbols

- Emission line
- Buildings
- Noise Wall



Lots 52 & 53 Victoria Road, Dayton
Proposed Noise Wall on Boundary

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

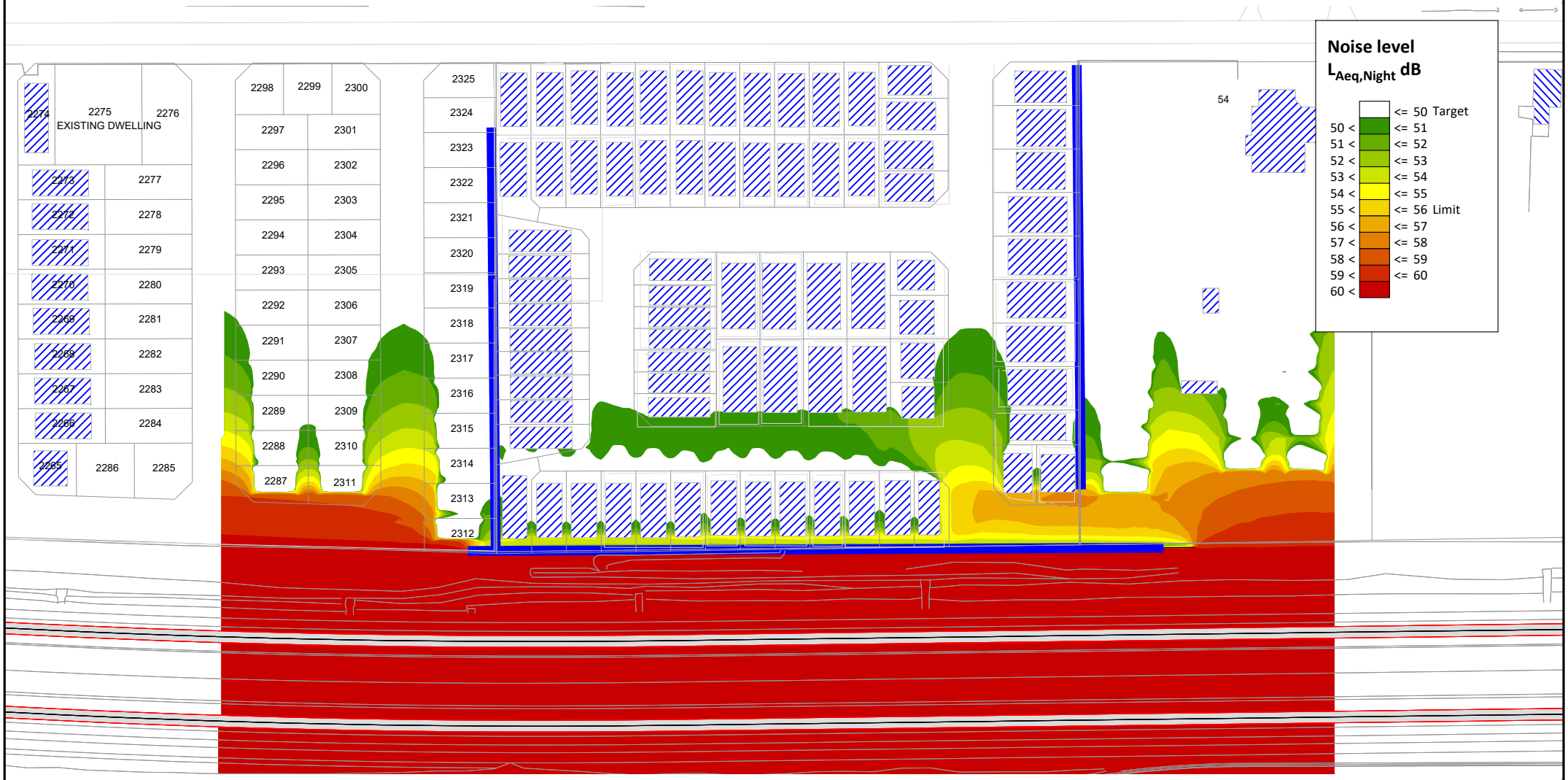
Figure 5-2

Scale

0 10 20 40 60 80 m

Signs and symbols

- Emission line
- Buildings
- Noise Wall



Lots 52 & 53 Victoria Road, Dayton

Future Noise Prediction Contours dB $L_{Aeq,Night}$ - Ground Floor - Assumes 2.7m High Noise Wall on Boundary

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

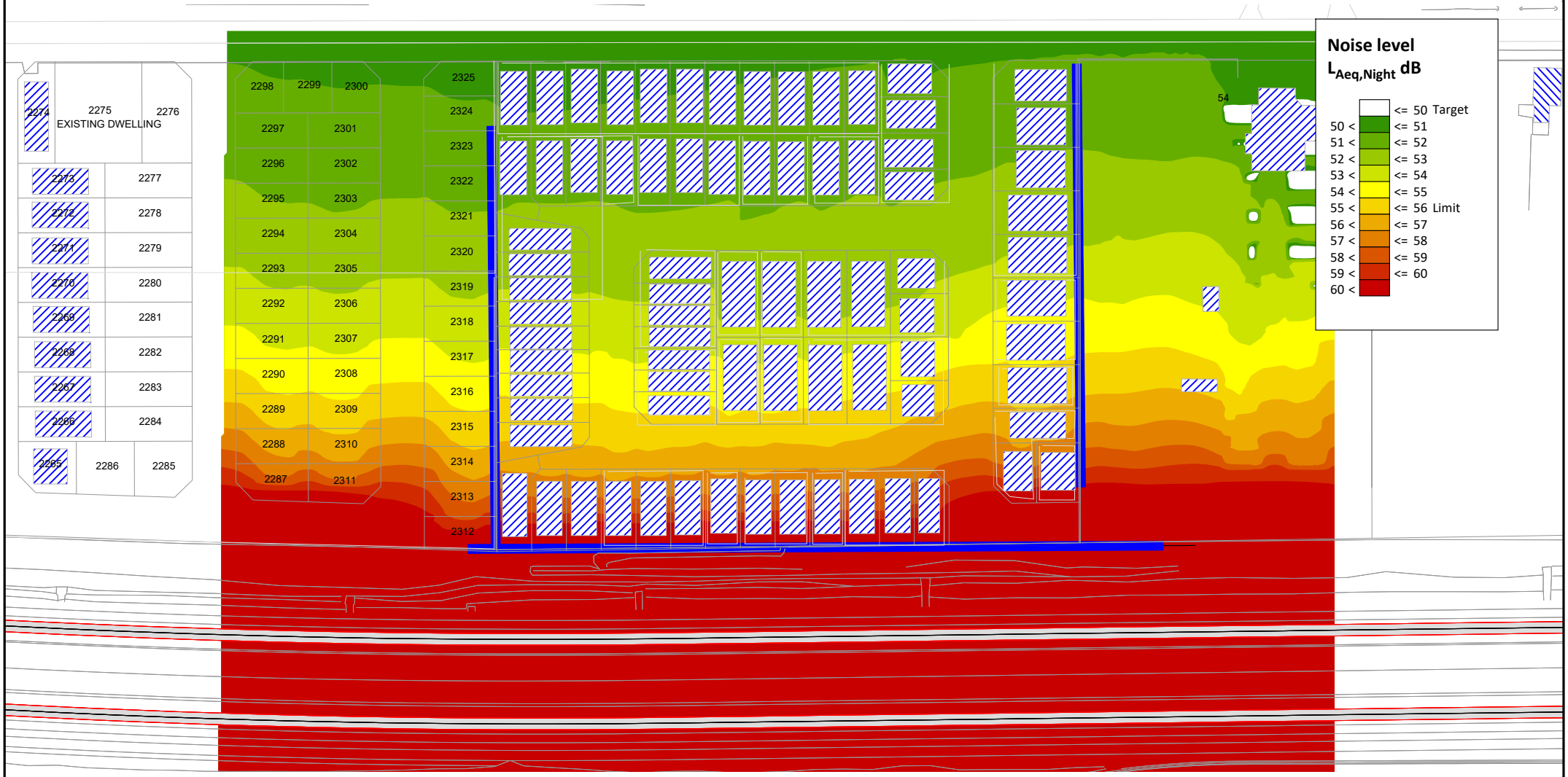
Figure 5-3

Scale

0 10 20 40 60 80 m

Signs and symbols

- Emission line
- Buildings
- Noise Wall



Lots 52 & 53 Victoria Road, Dayton

Future Noise Prediction Contours dB $L_{Aeq,Night}$ - Upper Floor - Assumes 2.7m High Noise Wall on Boundary

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

Figure 5-4

Lots 52 & 53 Victoria Road Dayton - Required Facade Treatment Ground Floor

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

Figure 5-5

Lots 52 & 53 Victoria Road Dayton - Required Facade Treatment Upper Floor

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

6 CONCLUSION

The results of this assessment show that assuming no noise control measures, there are a number of lots predicted to receive a future road traffic noise level that will be above the *target* criteria at ground floor and at upper floor level. Therefore under the requirements of the *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* noise mitigation measures are required as detailed in *Section 5* of this assessment.

Appendix A

Deemed to Comply Facade Packages

The packages and information provided on the following pages are taken from *ImplementationGuidelines for State Planning Policy 5.4 Road and Rail Transport Noise and freight Considerations in Land Use Planning*; December 2014.

Where outdoor noise levels are above the ***target*** level, excluding the effect of any boundary fences, the Guidelines propose acceptable treatment packages that may be implemented without requiring detailed review. The packages are also intended for residential development only. At higher noise levels or for other building usages, specialist acoustic advice will be needed.

The acceptable treatment packages are intended to simplify compliance with the noise criteria, and the relevant package should be required as a condition of development in lieu of a detailed assessment.

Transition between each package should be made on the basis of the highest incident $L_{Aeq(Day)}$ or $L_{Aeq(Night)}$ value to the nearest whole number determined for the building development under assessment.

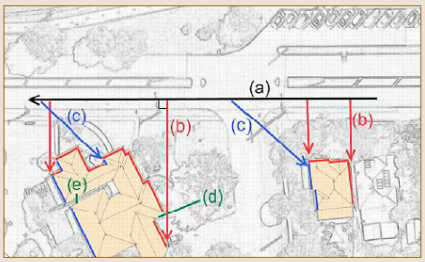
Any departures from the acceptable treatment specifications need to be supported by professional advice from a competent person that the proposal will achieve the requirements of the Policy.

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

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

Determining building face orientation

The following sketch shows two residences in proximity to a road.



'Facing' façades are identified by drawing straight lines (b) perpendicular (at a 90 degree angle) to the road (a). Where these lines intersect a façade – without obstruction – the façades are shown in red as 'facing' the road.

Façades shown in blue are not 'facing' but have clear lines (c) that intersect the road at any angle, and are therefore classed as 'side on' to the road.

The remaining façades are 'opposite' to the road.

Package A

Area	Orientation to Road or Rail Corridor	Package A (up to 60 dB $L_{Aeq(Day)}$ and 55 dB $L_{Aeq(Night)}$)
Bedrooms	Facing	• Windows systems: Glazing up to 40% of floor area (minimum $R_w + C_{tr}$ 28) – 6mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings. Doors to match glazing requirements.
	Side	• Windows systems: As above. Doors to match glazing requirements.
	Opposite	No requirements
Other Habitable Rooms Including Kitchens	Facing	• Windows and external door systems: Glazing up to 60% of floor area (minimum $R_w + C_{tr}$ 28) – 6mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings. Doors to be either 35mm thick solid timber core door with full perimeter acoustic seals. Glazed inserts to match the above. Sliding glass doors to be same performance including brush seals.
	Side	• Windows and external door systems: As above.
	Opposite	No requirements
General	Any	• Walls (minimum $R_w + C_{tr}$ 45) – Two leaves of 90mm thick brick with minimum 50mm cavity • Roof and ceiling (minimum $R_w + C_{tr}$ 35) – Standard roof construction with 10mm plasterboard ceiling and minimum R2.5 insulation between ceiling joists. • Eaves to be closed using 4mm compressed fibre cement sheet. • Mechanical ventilation – Refer following pages.
One Outdoor Living Area		• Screened using a solid continuous fence of minimum 2 metres high unless a noise wall greater than 2 metres high has been installed; or • Locate on the side of the building that is opposite to the corridor if practicable; or • Locate within alcove area so that the house shields it from corridor if practicable.

Note: Any penetrations in a part of the building envelope must be acoustically treated so as to not downgrade the performance of the building elements affected. Most penetrations in external walls such as pipes, cables or ducts can be sealed through caulking gaps with non-hardening mastic or suitable mortar.

Package B

Area	Orientation to Road or Rail Corridor	Package B (up to 63 dB $L_{Aeq(Day)}$ and 58 dB $L_{Aeq(Night)}$)
Bedrooms	Facing	• Windows systems: Glazing up to 40% of floor area (minimum $R_w + C_{tr}31$) – 10mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings. Doors to match glazing requirements.
	Side	• Windows systems: As above. Doors to match glazing requirements.
	Opposite	• Windows systems: Glazing up to 40% of floor area (minimum $R_w + C_{tr}$ 25) – 4mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings. Alternatively, 6mm thick glass (monolithic, toughened or laminated) in sliding frame.
Other Habitable Rooms Including Kitchens	Facing	• Windows and external door systems: Glazing up to 60% of floor area (minimum $R_w + C_{tr}31$) – 10mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings. Doors to be either 35mm thick solid timber core door with full perimeter acoustic seals. Glazed inserts to match the above. Sliding glass doors to have laboratory certificate confirming $R_w + C_{tr}$ 31 performance. Alternative, change to hinged door with perimeter acoustic seals and 10mm thick glass.
	Side	• Windows and external door systems: Glazing up to 60% of floor area (minimum $R_w + C_{tr}$ 28) – 6mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings. Doors to be either 35mm thick solid timber core door with full perimeter acoustic seals. Glazed inserts to match the above. Glass doors to be same performance ($R_w + C_{tr}$ 28) including brush seals.
	Opposite	No requirements
General	Any	• Walls (minimum $R_w + C_{tr}$ 50) – Two leaves of 90mm thick brick with minimum 50mm cavity. Cavity to include 25mm thick, 24kg/m^3 insulation and where wall ties are required, these are to be anti-vibration/resilient type. • Roof and ceiling (minimum $R_w + C_{tr}$ 35) – Standard roof construction with 10mm plasterboard ceiling and minimum R2.5 insulation between ceiling joists. • Eaves to be closed using 4mm thick compressed fibre cement sheet. • Mechanical ventilation – Refer following pages.
One Outdoor Living Area		• Locate on the side of the building that is opposite to the corridor; or • Locate within alcove area so that the house shields it from corridor.

Note: Any penetrations in a part of the building envelope must be acoustically treated so as to not downgrade the performance of the building elements affected. Most penetrations in external walls such as pipes, cables or ducts can be sealed through caulking gaps with non-hardening mastic or suitable mortar.

Package C

Area	Orientation to Road or Rail Corridor	Package C (up to 65 dB $L_{Aeq(Day)}$ and 60 dB $L_{Aeq(Night)}$)
Bedrooms	Facing	• Windows systems: Glazing up to 40% of floor area (minimum $R_w + C_{tr}$ 34) – 10.5mm thick VLam Hush glass in fixed sash, awning or casement opening with seals to openings. Doors to match glazing requirements.
	Side	• Windows systems: • Glazing up to 40% of floor area (minimum $R_w + C_{tr}$ 31) – 10mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings. Doors to match glazing requirements.
	Opposite	• Windows systems: Glazing up to 40% of floor area (minimum $R_w + C_{tr}$ 28) – 6mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings.
Other Habitable Rooms Including Kitchens	Facing	• Windows and external door systems: Glazing up to 40% of floor area (minimum $R_w + C_{tr}$ 31) – 10mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings. Doors to be either 40mm thick solid timber core door with full perimeter acoustic seals. Glazed inserts to match the above. Sliding glass doors to have laboratory certificate confirming $R_w + C_{tr}$ 31 performance. Alternatively, change to fully glazed hinged door with perimeter acoustic seals and 10mm thick glass.
	Side	• Windows and external door systems: Glazing up to 60% of floor area (minimum $R_w + C_{tr}$ 31) – 10mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings. Doors to be either 35mm thick solid timber core door with full perimeter acoustic seals certified to R_w 30. Glazed inserts to match the above. Sliding glass doors to have laboratory certificate confirming $R_w + C_{tr}$ 31 performance. Alternatively, change to hinged door with perimeter acoustic seals and 10mm thick glass.
	Opposite	• Windows systems: Glazing up to 60% of floor area (minimum $R_w + C_{tr}$ 28) – 6mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings.
General	Any	• Walls (minimum $R_w + C_{tr}$ 50) – Two leaves of 90mm thick brick with minimum 50mm cavity. Cavity to include 25mm thick, 24kg/m^3 insulation and where wall ties are required, these are to be anti-vibration/resilient type. • Roof and ceiling (minimum $R_w + C_{tr}$ 40) – Standard roof construction with 2 x 10mm plasterboard ceiling and minimum R3.0 insulation between ceiling joists. • Eaves to be closed using 6mm thick compressed fibre cement sheet. • Mechanical ventilation – Refer following pages.
One Outdoor Living Area		• Locate on the side of the building that is opposite to the corridor; or • Locate within alcove area so that the house shields it from corridor.

Note: Any penetrations in a part of the building envelope must be acoustically treated so as to not downgrade the performance of the building elements affected. Most penetrations in external walls such as pipes, cables or ducts can be sealed through caulking gaps with non-hardening mastic or suitable mortar.

Mechanical Ventilation requirements

It is noted that natural ventilation must be provided in accordance with F4.6 and F4.7 of Volume One and 3.8.5.2 of Volume Two of the National Construction Code.Where the noise *limit* is likely to be exceeded, a mechanical ventilation system is usually required.Mechanical ventilation systems will need to comply with AS 1668.2 – *The use of mechanical ventilation and air-conditioning in buildings*.

In implementing the acceptable treatment packages, the following must be observed:

- Evaporative air conditioning systems will meet the requirements for Packages A and B provided attenuated air vents are provided in the ceiling space and designed so that windows do not need to be opened.
- Refrigerant based air conditioning systems need to be designed to achieve fresh air ventilation requirements.
- External openings (e.g. air inlets, vents) need to be positioned facing away from the transport corridor where practicable.
- Ductwork needs to be provided with adequate silencing to prevent noise intrusion.

Notification

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

The area of land for which notification is required should be identified in the noise management plan and contain a description of major noise sources nearby (e.g. 24-hour freight rail).

Notification should be provided to prospective purchasers, and required as a condition of subdivision (including strata subdivision) for the purposes of noise sensitive development or planning approval involving noise sensitive development, where external noise levels are forecast or estimated to exceed the 'target' criteria as defined by the Policy.

In the case of subdivision and development, conditions of approval should include a requirement for registration of a notice on title, which is provided for under Section 165 of the Planning and Development Act 2005 and Section 70A of the Transfer of Land Act 1893. An example of a suitable notice is:

Notice:Thislotissituatedinthevicinityofatransportcorridorandiscurrentlyaffected,ormayinthefuturebeaffected,bytransportnoise.TransportationnoisecontrolsandQuietHousedesignstrategiesatpotentialcosttotheownermayberequiredtoachieveanacceptablelevelofnoisereduction.Furtherinformationisavailableonrequestfromtherelevantlocal governmentoffices.

The packages and information provided on the following pages are taken from *Implementation Guidelines for State Planning Policy 5.4 Road and Rail Transport Noise and freight Considerations in Land Use Planning*; December 2014.

Where outdoor noise levels are above the ***target*** level, excluding the effect of any boundary fences, the Guidelines propose acceptable treatment packages that may be implemented without requiring detailed review. The packages are also intended for residential development only. At higher noise levels or for other building usages, specialist acoustic advice will be needed.

The acceptable treatment packages are intended to simplify compliance with the noise criteria, and the relevant package should be required as a condition of development in lieu of a detailed assessment.

Transition between each package should be made on the basis of the highest incident $L_{Aeq(Day)}$ or $L_{Aeq(Night)}$ value to the nearest whole number determined for the building development under assessment.

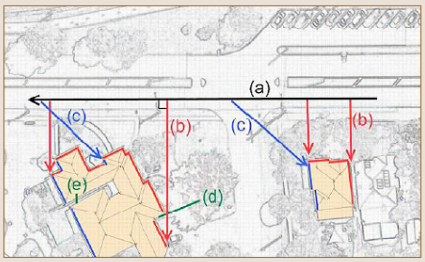
Any departures from the acceptable treatment specifications need to be supported by professional advice from a competent person that the proposal will achieve the requirements of the Policy.

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

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

Determining building face orientation

The following sketch shows two residences in proximity to a road.



'Facing' façades are identified by drawing straight lines (b) perpendicular (at a 90 degree angle) to the road (a). Where these lines intersect a façade – without obstruction – the façades are shown in red as 'facing' the road.

Façades shown in blue are not 'facing' but have clear lines (c) that intersect the road at any angle, and are therefore classed as 'side on' to the road.

The remaining façades are 'opposite' to the road.

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 and sound power 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_1
An L_1 level is the noise level which is exceeded for 1 per cent of the measurement period and is considered to represent the average of the maximum noise levels measured.

L_{10}
An L_{10} level is the noise level which is exceeded for 10 per cent of the measurement period and is considered to represent the "*intrusive*" noise level.

L_{90}
An L_{90} level is the noise level which is exceeded for 90 per cent of the measurement period and is considered to represent the "*background*" noise level.

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

$L_{A10,18hour}$
The $L_{A10,18\ hour}$ level is the arithmetic average of the hourly L_{A10} levels between 6.00 am and midnight. The *CoRTN* algorithms were developed to calculate this parameter.

$L_{Aeq,24hour}$
The $L_{Aeq,24\ hour}$ level is the logarithmic average of the hourly L_{Aeq} levels for a full day (from midnight to midnight).

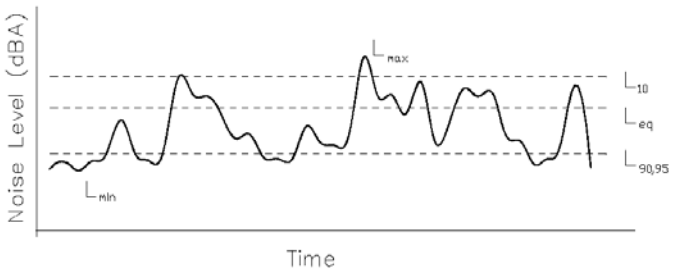
$L_{Aeq,8hour}$ / $L_{Aeq\ (Night)}$
The $L_{Aeq\ (Night)}$ level is the logarithmic average of the hourly L_{Aeq} levels from 10.00 pm to 6.00 am on the same day.

$L_{Aeq,16hour}$ / $L_{Aeq\ (Day)}$
The $L_{Aeq\ (Day)}$ level is the logarithmic average of the hourly L_{Aeq} levels from 6.00 am to 10.00 pm on the same day. This value is typically 1-3 dB less than the $L_{A10,18hour}$.

Satisfactory Design Sound Level
The level of noise that has been found to be acceptable by most people for the environment in question and also to be not intrusive.

Maximum Design Sound Level
The level of noise above which most people occupying the space start to become dissatisfied with the level of noise.

Chart of Noise Level Descriptors



Austroads Vehicle Class

AUSTROADS Vehicle Classification System

Level 1 Length (Indicative) Type	Level 2 Axles and Axle Groups Axles	Level 2 Axles and Axle Groups Groups	Level 3 Vehicle Type Typical Description	AUSTROADS Classification Class	Parameters	Typical Configuration
			LIGHT VEHICLES			
Short up to 5.5m		1 or 2	Short Sedan, Wagon, 4WD, Utility, Light Van, Bicycle, Motorcycle, etc	1	d(1) < 3.2m and axles = 2	
Medium 5.5m to 14.5m	3, 4 or 5	3	Short - Towing Trailer, Caravan, Boat, etc	2	groups = 3 d(1) > 2.1m, d(1) < 3.2m, d(2) > 2.1m and axles = 3, 4 or 5	
			HEAVY VEHICLES			
	2	2	Two Axle Truck or Bus	3	d(1) > 3.2m and axles = 2	
	3	2	Three Axle Truck or Bus	4	axles = 3 and groups = 2	
	> 3	2	Four Axle Truck	5	axles > 3 and groups = 2	
Long 11.5m to 19.0m	3	3	Three Axle Articulated Three axle articulated vehicle, or Rigid vehicle and trailer	6	d(1) > 3.2m, axles = 3 and groups = 3	
	4	> 2	Four Axle Articulated Four axle articulated vehicle, or Rigid vehicle and trailer	7	d(2) < 2.1m or d(1) < 2.1m or d(1) > 3.2m axles = 4 and groups > 2	
	5	> 2	Five Axle Articulated Five axle articulated vehicle, or Rigid vehicle and trailer	8	d(2) < 2.1m or d(1) < 2.1m or d(1) > 3.2m axles = 5 and groups > 2	
	≥ 6	> 2	Six Axle Articulated Six axle articulated vehicle, or Rigid vehicle and trailer	9	axles = 6 and groups > 2 or axles > 6 and groups = 3	
Medium Combination 17.5m to 36.5m	> 6	4	B Double B Double, or Heavy truck and trailer	10	groups = 4 and axles > 6	
	> 6	5 or 6	Double Road Train Double road train, or Medium articulated vehicle and one dog trailer (M.A.D.)	11	groups = 5 or 6 and axles > 6	
Large Combination Over 33.0m	> 6	> 6	Triple Road Train Triple road train, or Heavy truck and three trailers	12	groups > 6 and axles > 6	

Definitions: Group: Axle group, where adjacent axles are less than 2.1m apart
Groups: Number of axle groups
Axles: Number of axles (maximum axle spacing of 10.0m)
d(1): Distance between first and second axle
d(2): Distance between second and third axle

Typical Noise Levels