Environmental Noise Assessment - Private-Use Multi-Storey Carpark

Lot 196 (#7) Milford Street, East Victoria Park

Reference: 251211029-01

Prepared for:

Reference: 251211029-01

Contacts	
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Date	Rev	Description	Author	Verified
19-Mar-23	0	Issued to Client		

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EXECUTIVE SUMMARY

Lloyd George Acoustics was engaged by PARKD to undertake a noise assessment for a proposed multi-storey carpark at Lot 196 (#7) Milford Street, East Victoria Park in relation to a Development Application (DA). The nearest noise sensitive premises identified in this assessment are to the north/northwest along Oats Street. Industrial premises are observed to the east and west along Milford Street.

This report considered noise emissions to surrounding properties by way of noise modelling of car door closings and propulsion/braking/engine idling from the proposed new carpark.

The outcome of the assessment showed that with the noise control recommendations as per *Section 5* of this report, noise related to the new carpark can be shown to comply at all times.

1. INTRODUCTION

Lloyd George Acoustics was engaged by PARKD to undertake an environmental noise assessment for a proposed multi-storey carpark to be located at Lot 196 (#7) Milford Street, East Victoria Park - refer *Figure 1-1*. The car park will be for the use of church patrons only, and as such will not be open to the general public.

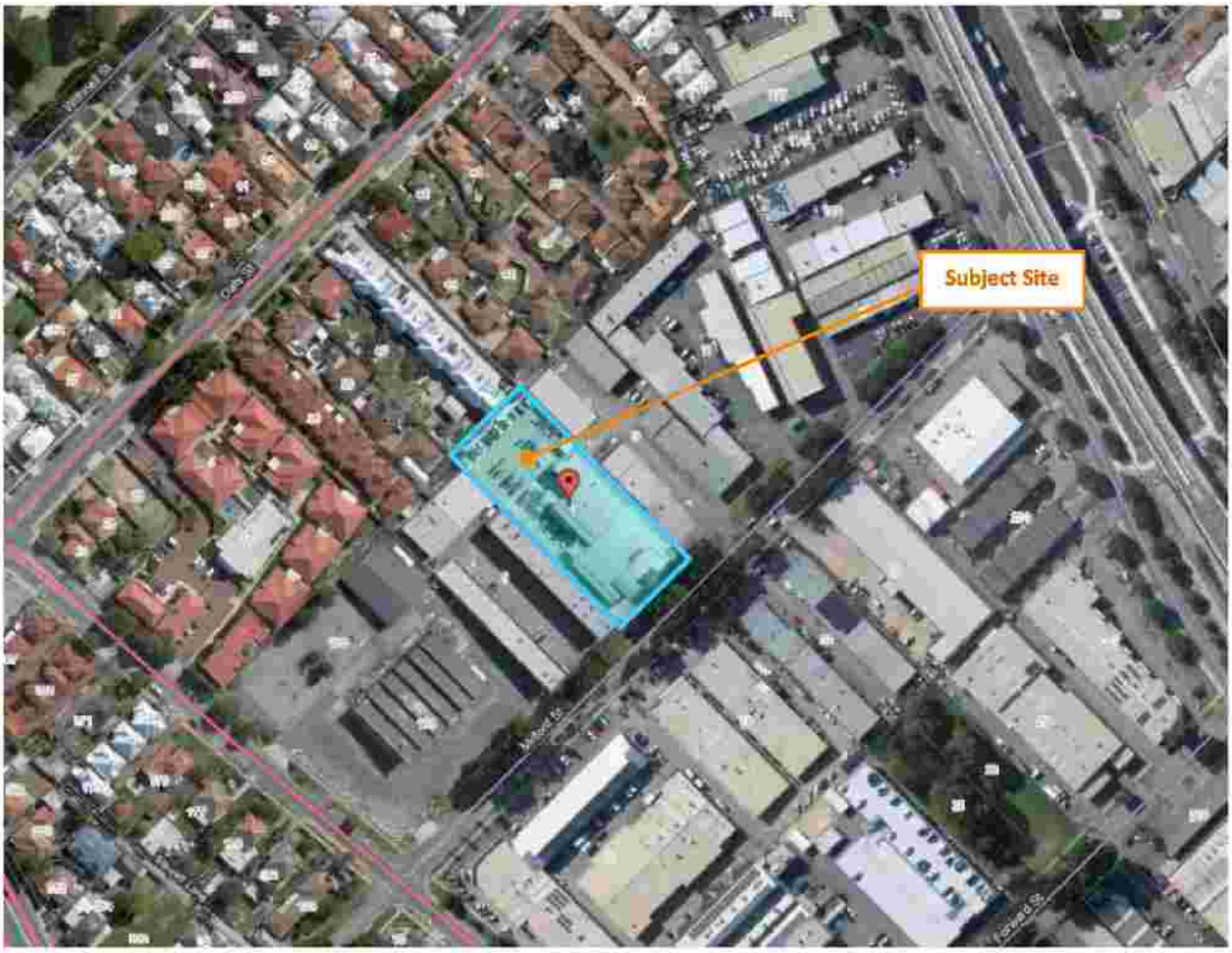


Figure 1-1: Subject Site Location (Source: DPLH PlanWA)

With regard to noise emissions, consideration is given to noise from closing car doors and car propulsion/braking/engine idling at neighbouring properties, against the prescribed standards of the *Environmental Protection (Noise) Regulations 1997*.

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

2. CRITERIA

Environmental noise in Western Australia is governed by the *Environmental Protection Act 1986*, through the *Environmental Protection (Noise) Regulations 1997* (the Regulations) as follows:

"7. Prescribed standard for noise emissions

(1) Noise emitted from any premises or public place when received at other premises –

(a) must not cause, or significantly contribute to, a level of noise which exceeds the assigned level in respect of noise received at premises of that kind; and

(b) must be free of –

(i) tonality; and

(ii) impulsiveness; and

(iii) modulation,

when assessed under regulation 9.

(2) For the purposes of subregulation (1)(a), a noise emission is taken to significantly contribute to a level of noise if the noise emission … exceeds a value which is 5 dB below the assigned level at the point of reception."

Tonality, impulsiveness and modulation are defined in regulation 9 (refer *Appendix C*). Under regulation 9(3), *"Noise is taken to be free of the characteristics of tonality, impulsiveness and modulation if -*

(a) the characteristics cannot be reasonably and practicably removed by techniques other than attenuating the overall level of noise emission; and

(b) the noise emission complies with the standard prescribed under regulation 7(1)(a) after the adjustments in the table [Table 2-1] … are made to the noise emission as measured at the point of reception."

Table 2-1: Adjustments Where Characteristics Cannot Be Removed

Where Noise Emission is Not Music*			Where Noise Emission is Music	
Tonality	Modulation	Impulsiveness	No Impulsiveness	Impulsiveness
+ 5 dB	+ 5 dB	+ 10 dB	+ 10 dB	+ 15 dB

* These adjustments are cumulative to a maximum of 15 dB.

The assigned levels (prescribed standards) for all premises are specified in regulation 8(3) and are shown in *Table 2-2*. The L_{A10} assigned level is applicable to noises present for more than 10% of a representative assessment period, generally applicable to "steady-state" noise sources. The L_{A1} is for short-term noise sources present for less than 10% and more than 1% of the time. The L_{Amax} assigned level is applicable for incidental noise sources, present for less than 1% of the time.

Table 2-2: Baseline Assigned Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area[1]	0700 to 1900 hours Monday to Saturday (Day)	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays (Sunday)	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days (Evening)	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial Premises	All hours	60	75	80
Industrial and Utility Premises	All hours	65	80	90

1. ***highly sensitive area*** means that area (if any) of noise sensitive premises comprising —
   (a) a building, or a part of a building, on the premises that is used for a noise sensitive purpose; and
   (b) any other part of the premises within 15 metres of that building or that part of the building.

The influencing factor (IF), in relation to noise received at noise sensitive premises, has been calculated as 8 dB, as determined in *Appendix B*. *Table 2-3* shows the assigned levels including the influencing factor at the receiving locations.

Table 2-3: Assigned Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
+8 dB IF Noise sensitive premises: highly sensitive area[1]	0700 to 1900 hours Monday to Saturday (Day)	53	63	73
	0900 to 1900 hours Sunday and public holidays (Sunday)	48	58	73
	1900 to 2200 hours all days (Evening)	48	58	63
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	43	53	63
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Industrial and Utility Premises	All hours	65	80	90

1. ***highly sensitive area*** means that area (if any) of noise sensitive premises comprising —
   (a) a building, or a part of a building, on the premises that is used for a noise sensitive purpose; and
   (b) any other part of the premises within 15 metres of that building or that part of the building.

It must be noted the assigned levels above apply outside the receiving premises and at a point at least 3 metres away from any substantial reflecting surfaces.

The assigned levels are statistical levels and therefore the period over which they are determined is important. The Regulations define the Representative Assessment Period (RAP) as *"a period of time of not less than 15 minutes, and not exceeding 4 hours, determined by* an *inspector* or *authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission".* An inspector or authorised person is a person appointed under Sections 87 & 88 of the *Environmental Protection Act 1986* and include Local Government Environmental Health Officers and Officers from the Department of Water Environmental Regulation. Acoustic consultants or other environmental consultants are not appointed as an inspector or authorised person. Therefore, whilst this assessment is based on a 4-hour RAP, which is assumed to be appropriate given the nature of the operations, this is to be used for guidance only.

3. NOISE MODELLING METHODOLOGY

Computer modelling has been used to predict the noise emissions from the development to all nearby receivers. The software used was *SoundPLAN 9.1* with the ISO 9613-2:2024-01 algorithms selected, as they include the influence of meteorological conditions. Input data required in the model are listed below and discussed in *Section 3.1* to *Section 3.4*:

- Meteorological Information;
- Topographical data;
- Ground Absorption; and
- Source sound power levels.

3.1. Meteorological Conditions

Meteorological information utilised is provided in *Table 3-1* and is considered to represent worst-case conditions for noise propagation. At wind speeds greater than those shown, sound propagation may be further enhanced, however background noise from the wind itself and from local vegetation is likely to be elevated and dominate the ambient noise levels.

Table 3-1: Modelling Meteorological Conditions

Parameter	Day (7.00am to 7.00pm)	Night (7.00pm to 7.00am)
Temperature (°C)	20	15
Humidity (%)	50	50
Wind Speed (m/s)	Up to 5	Up to 5
Wind Direction*	All	All

* The modelling package allows for all wind directions to be modelled simultaneously.

Alternatives to the above default conditions can be used where one year of weather data is available and the analysis considers the worst 2% of the day and night for the month of the year in which the worst-case weather conditions prevail (source: *Draft Guideline on Environmental Noise for Prescribed Premises*, May 2016). In most cases, the default conditions occur for more than 2% of the time and therefore must be satisfied.

3.2. Topographical Data

Topographical data was adapted from publicly available information (e.g. *Google*) in the form of spot heights and combined with the site plan.

Surrounding existing buildings were also incorporated in the noise model, as these can provide noise shielding as well as reflection paths. Single storey buildings are modelled with a height of 3.5 metres and any double storey buildings identified assumed to be 7.0 metres in height with receivers 1.4 metres above ground.

The area is suburban in nature with boundary fencing assumed to be *Colorbond* unless noted otherwise from *Streetview*. Whilst *Colorbond* fencing is 1.8 metres high, it is modelled as 1.6 metres high to take into account

the lightweight nature of the product and potential lesser acoustic performance of a denser product. A 4-metre high retaining wall is also included in the model to the boundary with R1 as per the architectural drawings.

Figure 3-1 shows a 2D overview of the noise model with the location of all relevant receivers identified. *Figure 3-2* shows a 3D view of the noise model.

Figure 3-1: Overview of Noise Model

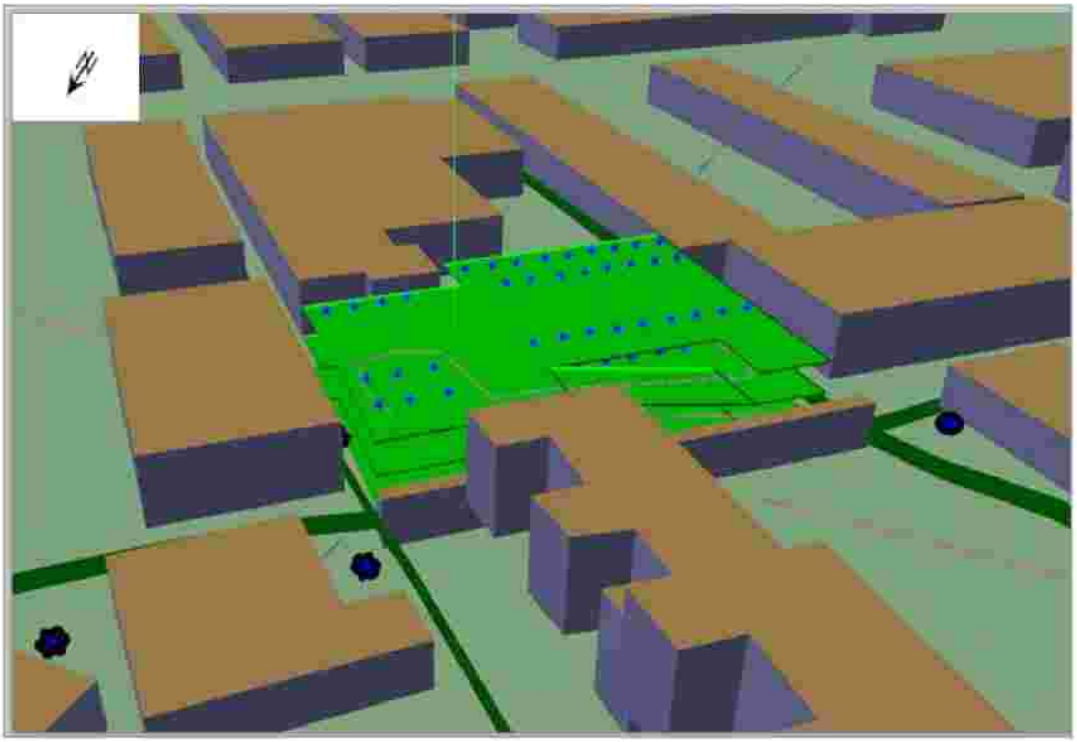


Figure 3-2: Overview of Noise Model

3.3. Ground Absorption

The ground attenuation has been assumed to be 0.5 (50%) across the assessment area, noting that 0.0 represents hard reflective surfaces such as water and 1.0 represents absorptive surfaces such as grass.

3.4. Source Sound Levels

The source sound power levels used in the modelling are provided in *Table 3-2*.

Table 3-2: Source Sound Power Levels, dB

Description	Octave Band Centre Frequency (Hz)								Overall dB(A)
	63	125	250	500	1k	2k	4k	8k	
Car Door Closing (L_{max})	67	64	64	61	58	54	49	41	**63**
Car Propulsion/Braking/Engine Idling	81	78	74	72	74	74	67	67	**79**

The following is noted in relation to *Table 3-2*:

- Car door closing events are located 0.5 metres above each relevant carpark floor level;
- Car propulsion/braking/idling is modelled at 1.0 metres above each relevant carpark floor level and ramp paths;
- All noise sources are modelled as point sources;
- All noise sources are assumed to be simultaneously operational; and
- All noise sources are assumed to be L_{A10} unless noted otherwise.

4. RESULTS & ASSESSMENT

Noise modelling was undertaken for the following scenarios, as the car park is considered a private area, as it will not be open to the general public, therefore vehicle noise (propulsion, braking & vehicle car doors are assessed). If the carpark was accessible to all the general public then it would be treated as a public road and regulaton 3 would be applicable, meaning that only the car door noise would need to be assessed.

- Scenario 1 : Car Doors Closing (L_{Amax}) – The L_{Amax} noise source of *Table 5-1*; and
- Scenario 2 : Car Propulsion/Braking/Engine Idling (L_{A10}) – The L_{A10} noise source of *Table 5-1*.

4.1. Scenario 1 – Car Doors Closing – All Times

Although the carpark may only be utilised on Sunday mornings for services, the usage is assessed across all time periods for compliance, particularly given it may operate prior to 9.00am on a Sunday being night-time in the Noise Regulations. The results are provided in *Table 4-1*.

Noise emissions may be considered impulsive and have therefore been adjusted by + 10 dB.

Table 4-1: Scenario 1 - Predicted Levels and Assessment, dB L_{A10}

Receiver	Floor	Predicted Noise Level	Adjusted Noise Level[1]	Daytime / Evening Assigned Level	Daytime / Evening Assessment	Night-time Assigned Level	Night-time Assessment
R1 - 42 Oats St	Ground	56	66	73	*Complies*	63	*+3 dB*
	1st	55	65		*Complies*		*+2 dB*
R2 - 44 Oats St	Ground	51	61		*Complies*		*Complies*
R3 - 48 Oats St	Ground	37	47		*Complies*		*Complies*
R4 - 38 Oats St	Ground	47	57		*Complies*		*Complies*
R5 - 36 Oats St	Ground	45	55		*Complies*		*Complies*
R6 - 5 Milford St	Ground	54	64	90	*Complies*	90	*Complies*
R7 - 9 Milford St	Ground	66	76		*Complies*		*Complies*

[1] Adjusted by + 10 dB for impulsiveness

From the above it is evident compliance is achieved at all identified noise sensitive receivers (NSR's) during the daytime, however there are exceedances at R1 for night-time, which includes any usage prior to 9.00am on Sundays, when services may be likely.

Multi-Storey Carpark - Car Door Closing - Lot 196 (#7) Milford Street, East Victoria Park - Predicted Noise Levels
L_{Amax} Noise Level Contours - Receivers @ 1.4 Metres Above Ground Height - No Noise Characteristics Included

4.2. Scenario 2 – Car Propulsion/Idling/Braking – All Times

Although the carpark may only be utilised on Sunday mornings for services, the usage is assessed across all time periods for compliance, again noting night usage (prior to 9.00am on Sundays) may occur. The results are provided in *Table 4-2*.

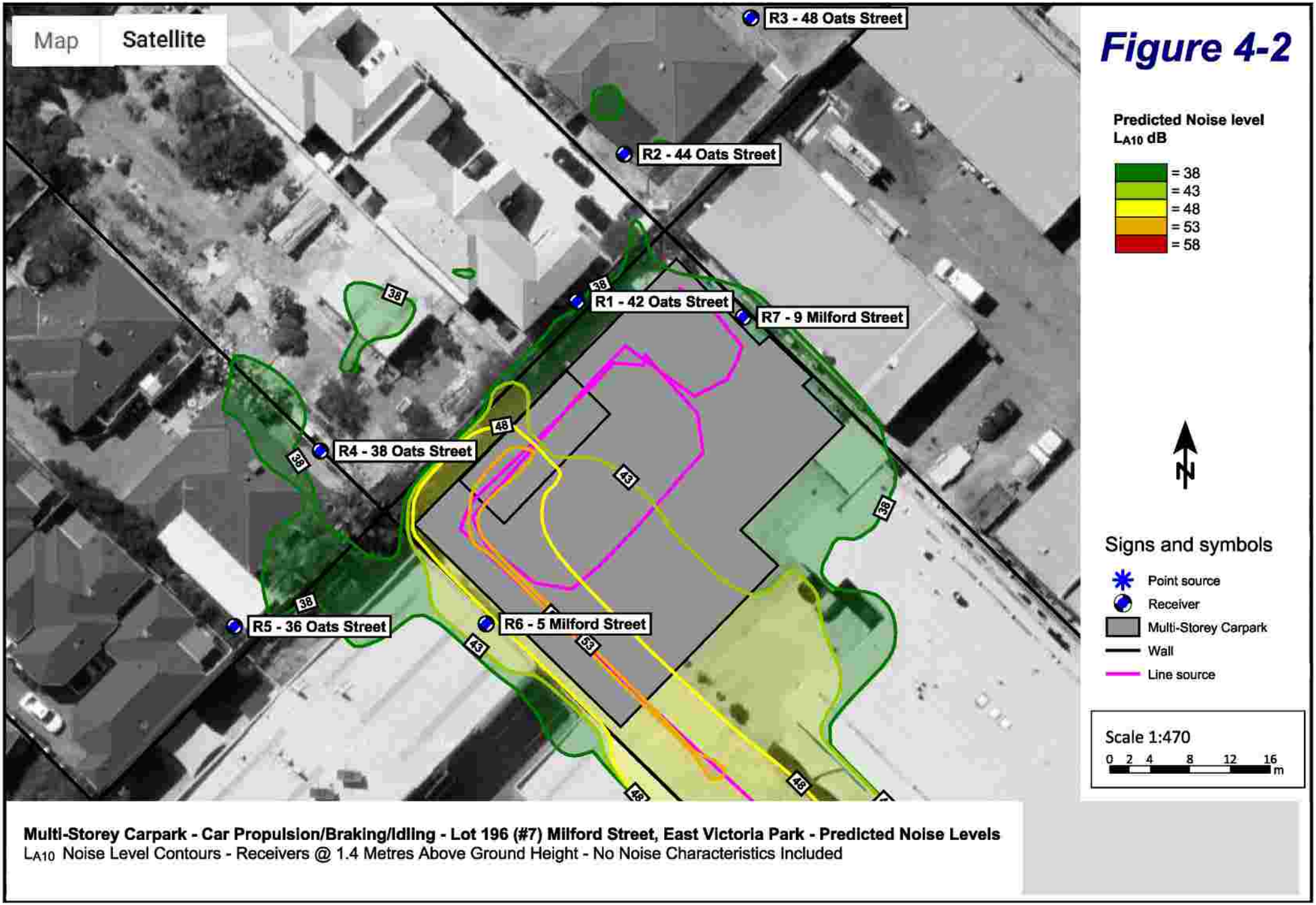
Noise emissions may be considered tonal and have therefore been adjusted by + 5 dB.

Table 4-2: Night-time Scenario - Predicted Levels and Assessment, dB L_{A10}

Receiver	Floor	Predicted Noise Level	Adjusted Noise Level[1]	Daytime Assigned Level	Evening Assigned Level	Night-time Assigned Level	Assessment
R1 - 42 Oats St	Ground	43	48	53	48	43	*Complies/Complies /+5 dB*
	1st	44	49				*Complies/+1 dB /+6 dB*
R2 - 44 Oats St	Ground	34	39				*Complies/Complies/Complies*
R3 - 48 Oats St	Ground	22	27				*Complies/Complies/Complies*
R4 - 38 Oats St	Ground	38	43				*Complies/Complies/Complies*
R5 - 36 Oats St	Ground	35	40				*Complies/Complies/Complies*
R6 - 5 Milford St	Ground	46	51	65	65	65	*Complies/Complies/Complies*
R7 - 9 Milford St	Ground	36	41				*Complies/Complies/Complies*

[1] Adjusted by + 5 dB for tonality

From the above it is evident compliance is achieved at all identified noise sensitive receivers (NSR's) during Monday to Saturday daytime, however there is a marginal +1 dB exceedance at R1 for Sunday daytime / evening period and a +6 dB exceedance at R1 respectively during the night-time. Again this night-time period includes any usage prior to 9.00am on Sundays, when services may be likely.



Multi-Storey Carpark - Car Propulsion/Braking/Idling - Lot 196 (#7) Milford Street, East Victoria Park - Predicted Noise Levels
L_{A10} Noise Level Contours - Receivers @ 1.4 Metres Above Ground Height - No Noise Characteristics Included

5. RECOMMENDATIONS

To achieve compliance a 6 dB reduction is required to the overall L_{A10} noise level, which will also provide the 3 dB reduction to the L_{Amax} level. To achieve this the following options are presented:

The noise can be managed by:

- Staff ensuring that only the ground floor level of the carpark is to be utilised between 10.00 pm on any day to 7.00 am Monday to Saturday and 9.00am Sunday and public holidays (Night); with both Level 1 & Level 2 of the carpark is to remain closed during this timeframe. The critical time envisaged is if Mass occurs before 9.00am on Sundays. Also noting that time should be allowed for those attending services to have enough time to park before the service begins.
- A marginal +1dB exceedance is predicted at R1 for Evening time, however it is not envisaged that the carpark would be required during this time period. If it is then again the above stipulation would apply also.

Or to ensure operational compliance at all times by utilising noise mitigation and allowing for use of all 3 levels a solid barrier or acoustic louvre will be constructed/installed as follows:

- Barrier/Acoustic Louvre to start on ramp from ground to Level 1 at ramp height 17.8 metres above ground height;
- Barrier/Acoustic Louvre to run along northern side of carpark Level 1 and Level 2;
- Height of Barrier/Acoustic Louvre to enclose Level 1 floor slab to Level 2 slab (2.8 metres) and 1.6 metres above Level 2 slab with total surface area of 103 m^3;
- If it is a solid barrier then the wall will require a minimum surface mass of 12kg/m^2 (e.g. 9mm compressed fibre cement sheeting, 10mm Perspex, masonry etc);
- If it is an Acoustic Louvre, then the sound transmission loss will need to be a similar or same to that as presented in *Table 5-1* for an IAC *Slimshield* SL-150;
- A combination of the Barrier/Acoustic Louvre can be implemented; and
- All air gaps at joins to be sealed with acoustic sealant.

Figure 5-1 presents mark-up and a graphical representation of the finished construction.

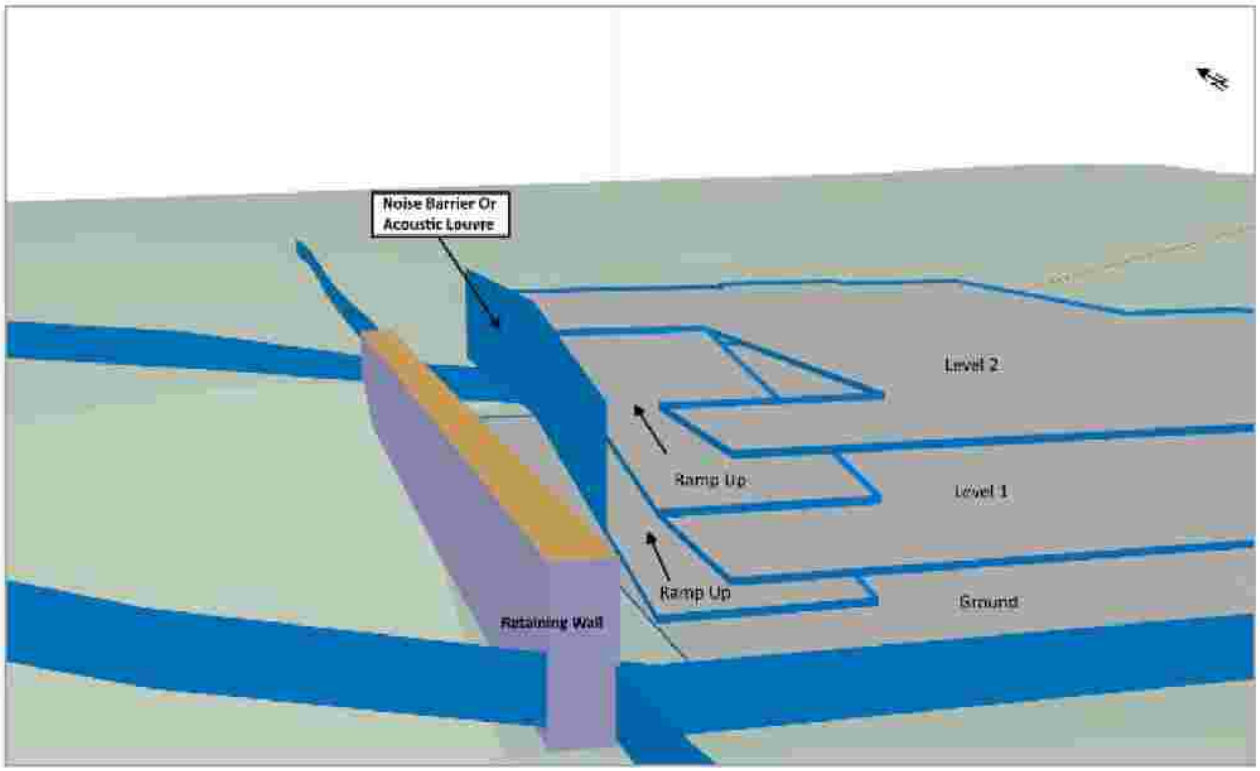


Figure 5-1: Noise Barrier/Acoustic Louvre Location

Table 5-1 provides the required minimum sound attenuator transmission loss.

Table 5-1: Minimum Sound Transmission Loss of Acoustic Louvre, dB

Description	Octave Band Centre Frequency (Hz)								Overall Rw dB
	63	125	250	500	1k	2k	4k	8k	
IAC *Slimshield-150* Acoustic Louvre	6	6	8	10	14	18	16	15	**15**

The following good practice is also recommended:

- Car Park Floor
  - Drainage grates and other trafficable panels are to be plastic or metal with rubber gasket and secure to avoid excess banging; and
  - Brushed concrete finish to avoid tyre squeal. Where the concrete is to be sealed, a product such as *Aquron 1000* by Markham is understood to be suitable and not contribute to tyre squeal.

Appendix A – Development Plans

1 GROUND LEVEL - 35 Bays
1 : 200

BAYS LOST 56
35 REPLACED (NET LOSS = 21)

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H	Issue for Client Review	24/02/26
G	Issue for Client Review	16/02/26
F	Issued for Client Approval	12/09/25
E	Issued for Client Review	25/08/25
Rev	Description	Date

SCHEMATIC DESIGN

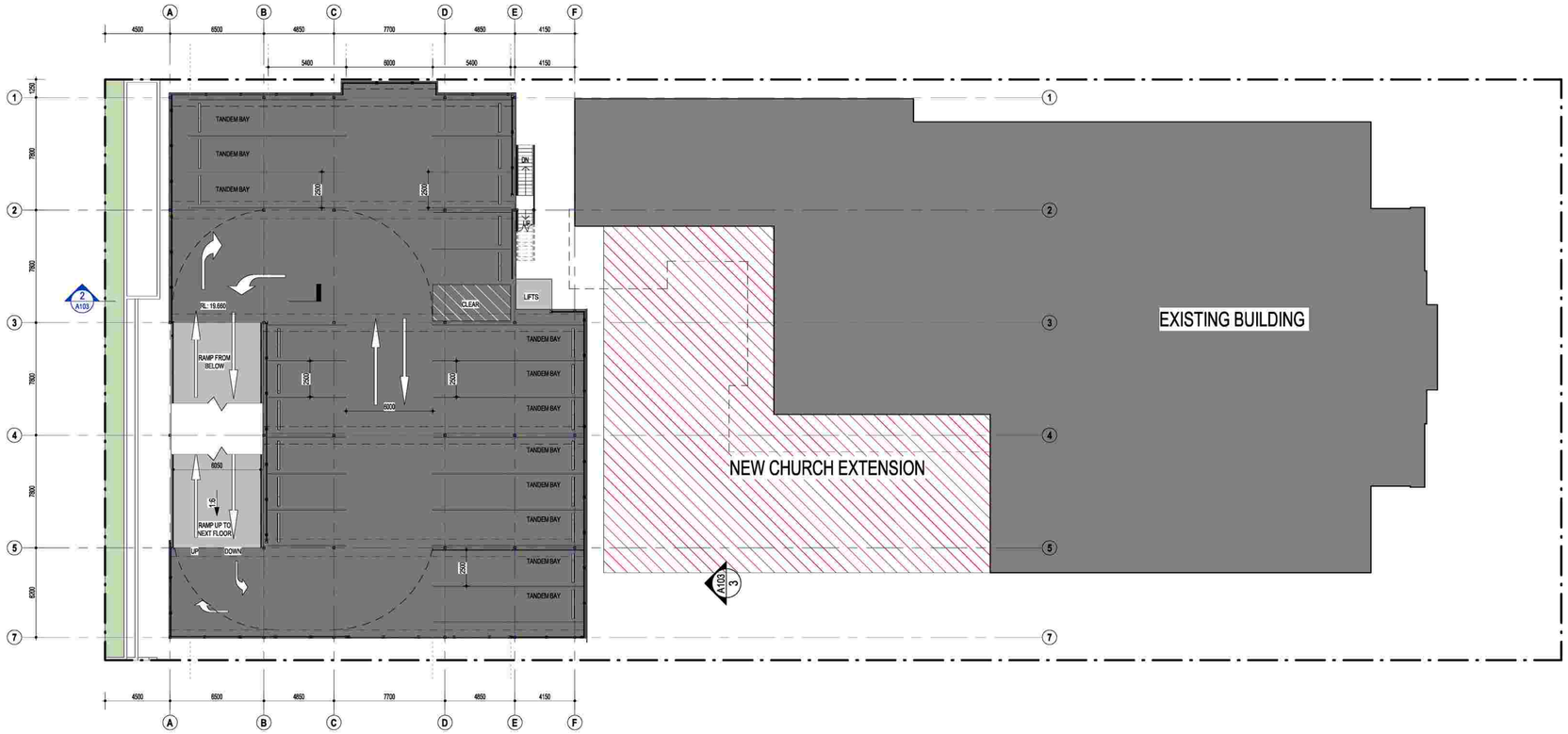
Project
BETHEL CHURCH PARKD

LOT 196 MILFORD STREET
EAST VICTORIA PARK

Drawing Title
GROUND FLOOR PLAN

Date	AUG 25	Drawn	CAD
Scale @ A1:	1 : 200	Approved	GA

Project No.	Drawing No.	Rev
25023	A100	H



1 LEVEL 1 - 33
1 : 200

33 LESS 21 = NET GAIN 12 BAYS

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SCHEMATIC DESIGN

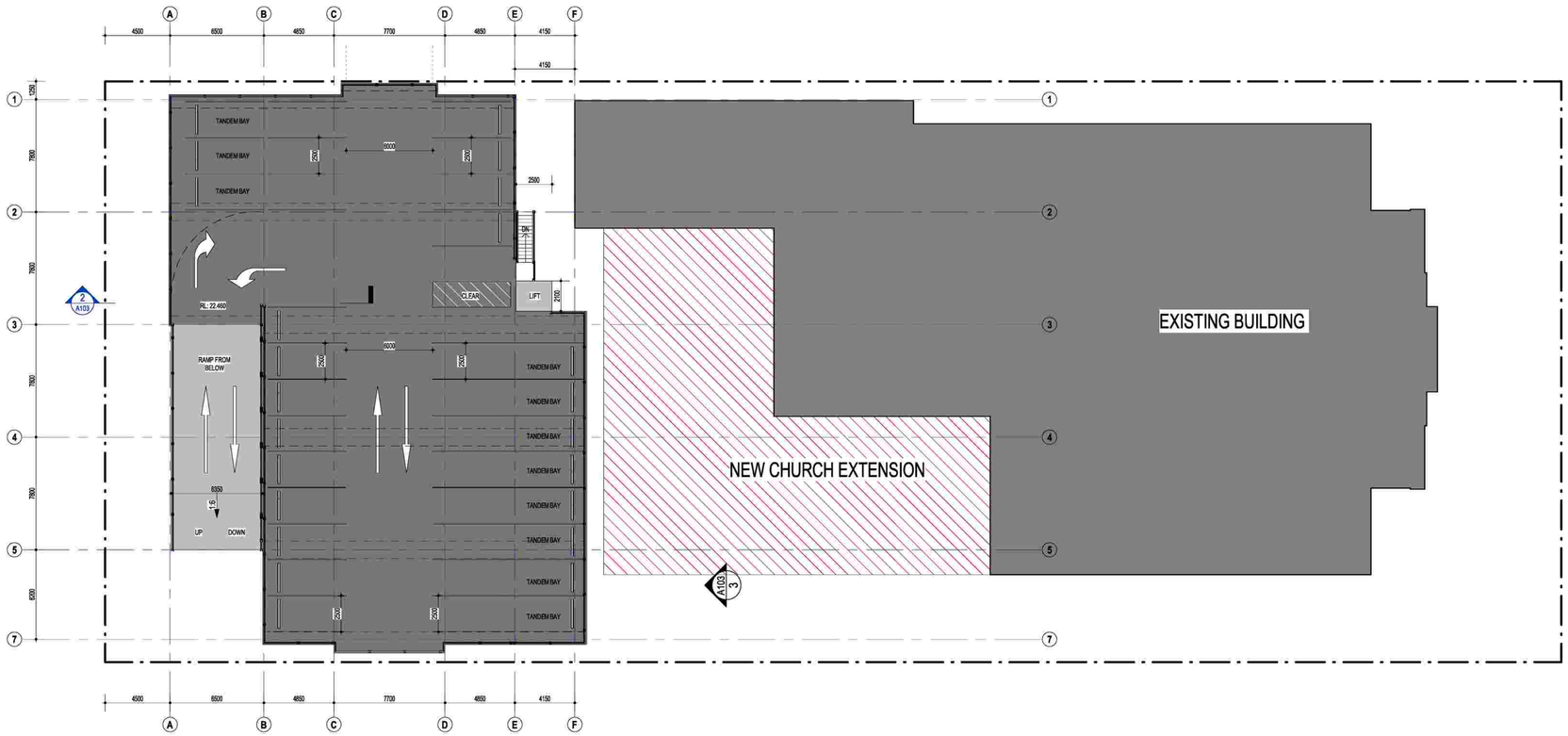
Project
BETHEL CHURCH PARKD

LOT 196 MILFORD STREET
EAST VICTORIA PARK

Drawing Title
LEVEL 01 PLAN

Date: AUG 25	Drawn: CAD
Scale @ A1: 1 : 200	Approved: GA

Project No.	Drawing No.	Rev
25023	A101	H



1 LEVEL 2 - 38 Bays
1 : 200

38 BAYS + 12 = 50 BAYS NET GAIN
TOTAL BAYS: 106

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E	Issued for Client Review	25/08/25

SCHEMATIC DESIGN

Project
BETHEL CHURCH PARKD

LOT 196 MILFORD STREET
EAST VICTORIA PARK

Drawing Title
LEVEL 02 PLAN

Date: AUG 25	Drawn: CAD
Scale @ A1: 1 : 200	Approved: GA

Project No.	Drawing No.	Rev
25023	A102	H

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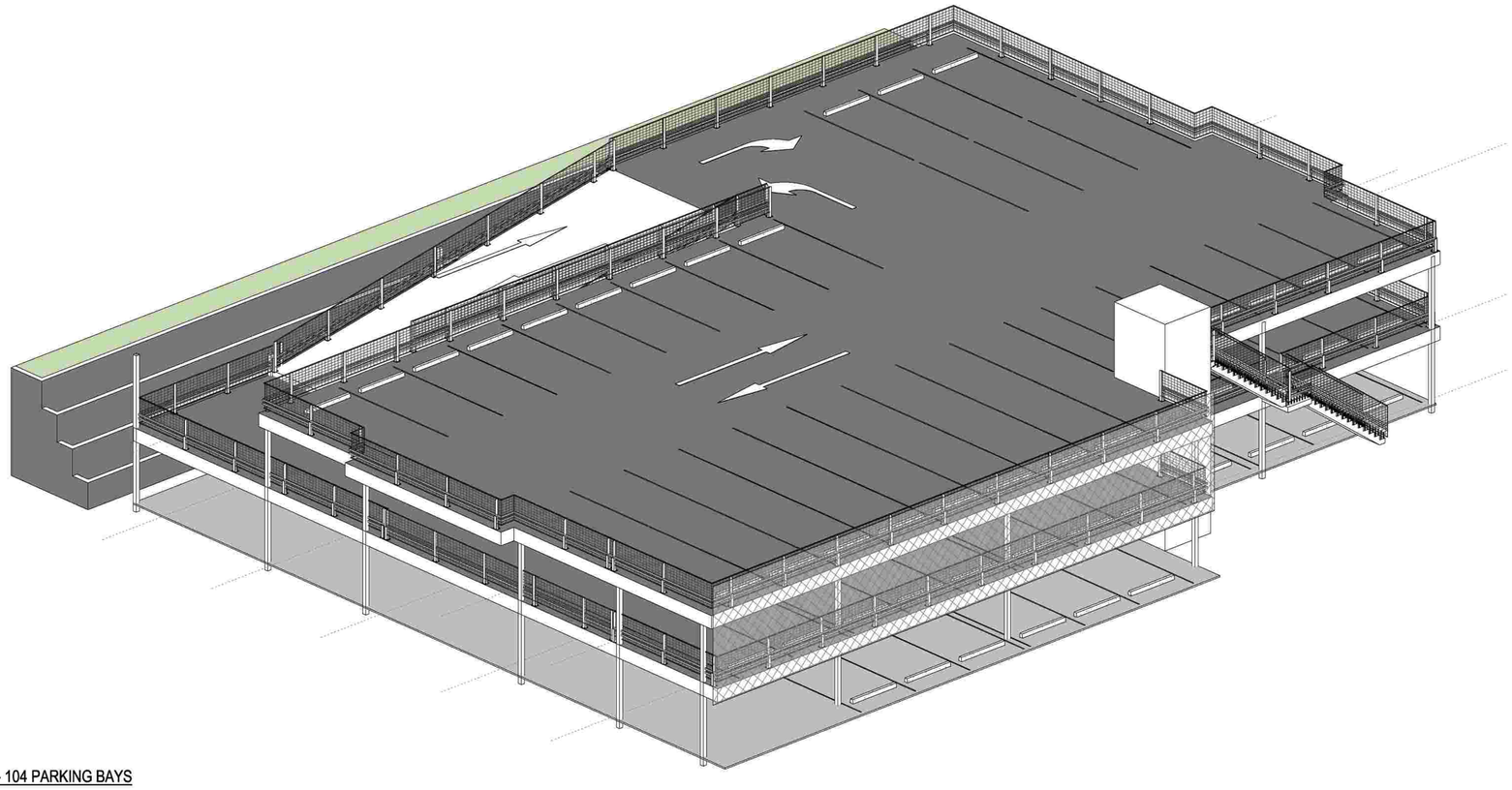
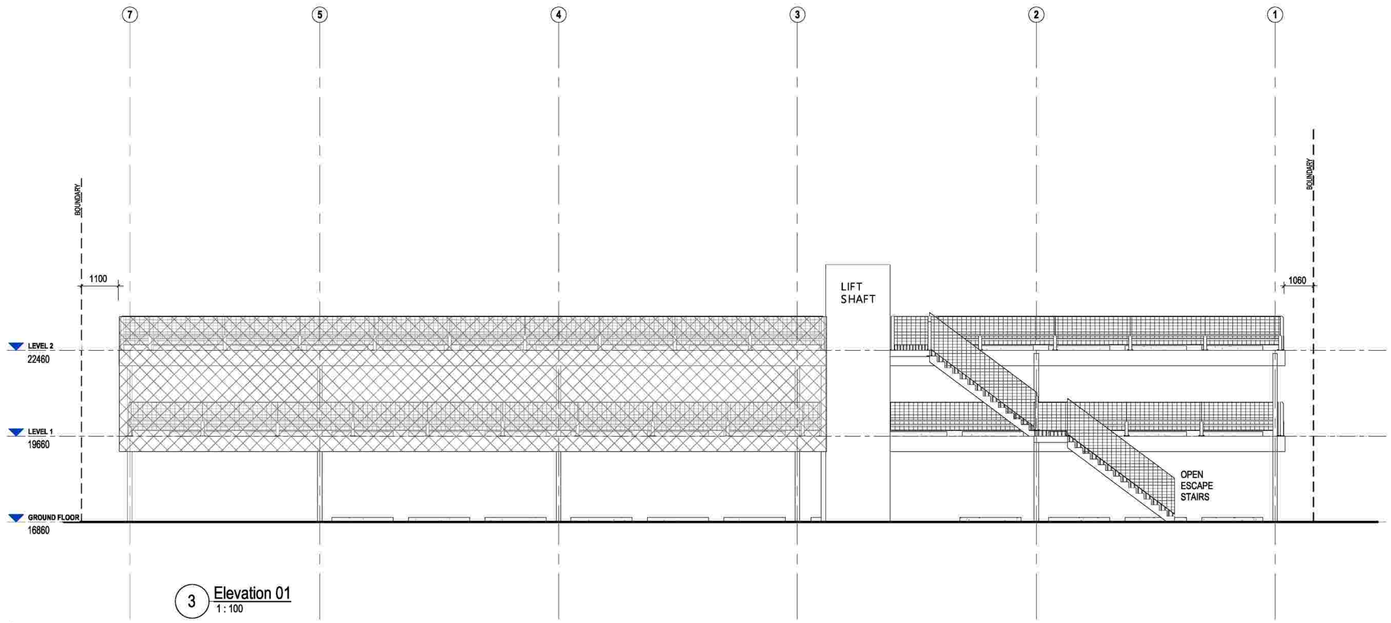
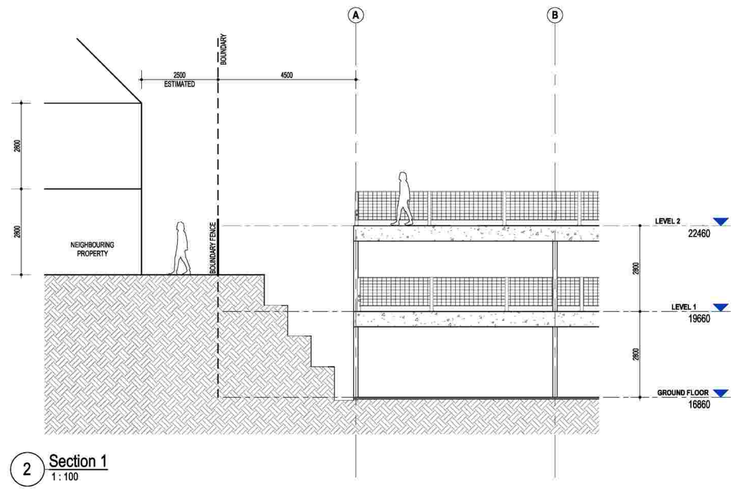


1 PROPOSED PARKING STRUCTURE - 104 PARKING BAYS



3 Elevation 01
1 : 100



2 Section 1
1 : 100

Rev	Description	Date
H	Issue for Client Review	24/02/26
G	Issue for Client Review	16/02/26
F	Issued for Client Approval	12/09/25
E	Issued for Client Review	25/08/25

SCHEMATIC DESIGN

Project
BETHEL CHURCH PARKD

LOT 196 MILFORD STREET
EAST VICTORIA PARK

Drawing Title
3D & SECTION

Date
AUG 25

Drawn
CAD

Scale @ A1:
1 : 100

Approved
GA

Project No.
25023

Drawing No.
A103

Rev
H

Appendix B – Influencing Factor Calculation

The assigned levels combine a baseline assigned level with an influencing factor, with the latter increasing the assigned level on the basis of the existence of significant roads and commercial or industrial zoned land within an inner circle (100 metre radius) and an outer circle (450 metre radius) of the noise sensitive premises. The calculation for the influencing factor is:

$$= \frac{1}{10}(\%\ \text{Type A}_{100} + \%\ \text{Type A}_{450}) + \frac{1}{20}(\%\ \text{Type B}_{100} + \%\ \text{Type B}_{450})$$

where:

$\%\ \text{Type A}_{100}$ = the percentage of industrial land within a100m radius of the premises receiving the noise

$\%\text{TypeA}_{450}$ = the percentage of industrial land within a 450m radius of the premises receiving the noise

$\%\ \text{Type B}_{100}$ = the percentage of commercial land within a100m radius of the premises receiving the noise

$\%\text{TypeB}_{450}$ = the percentage of commercial land within a 450m radius of the premises receiving the noise

+ Transport Factor (maximum of 6 dB)

= 2 for each secondary road (6,000 to 15,000 vpd) within 100m

= 2 for a major road (>15,000 vpd) within 450m

= 6 for a major road within 100m

The nearest noise sensitive premises are identified as:

- R1 - 42 Oats St
- R2 - 44 Oats St
- R3 - 48 Oats St
- R4 - 38 Oats St
- R5 - 36 Oats St
- R6 - 5 Milford St
- R7 - 9 Milford St

Table B-1 shows the percentage of industrial and commercial land within the inner (100 metre radius) and outer (450 metre radius) circles of the noise sensitive premises, with this also shown on *Figure B1* for Receiver R1.

Table B-2: Percentage of Land Types within 100m and 450m Radii

Receiver	Land Type	Within 100m	Within 450m
R1 – R5	Type A - Industrial and Utility	20	21
	Type B – Commercial	0	0

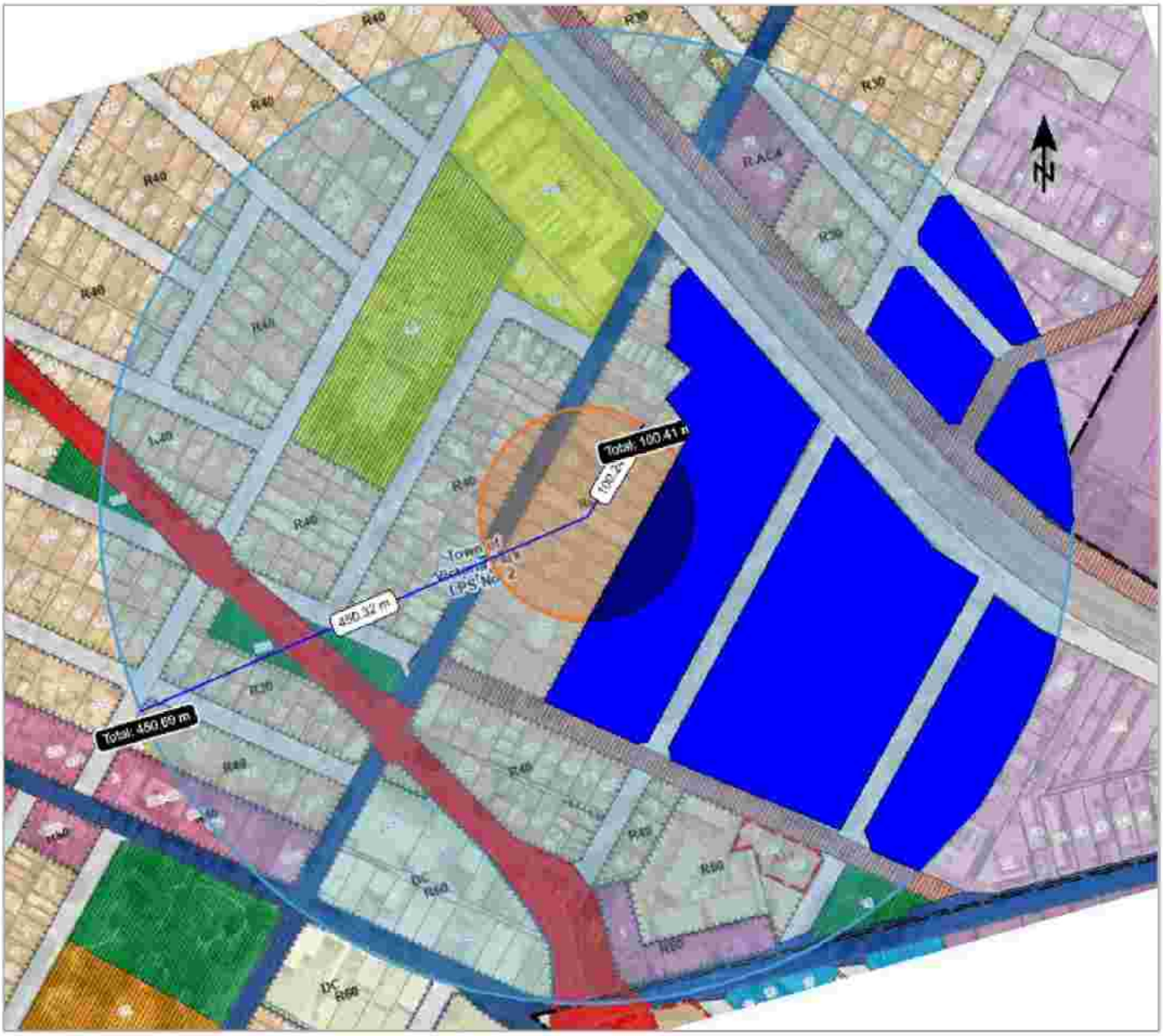


Figure B-2: Land Types within 100m and 450m Radii of R1

From the Main Roads WA Traffic Map (refer *Figure B-2*), *Table B-2* shows the relevant roads and their traffic counts within the inner (100 metre radius) and outer (450 metre radius) circles.

Table B-3: Relevant Roads within 100m and 450m Radii

Receiver	Within 100m		Within 450m
	Major Road (+ 6 dB)	Secondary Road (+ 2 dB)	Major Road Not Within 100m (+ 2 dB)
R1 – R5	-	Oats Street (9,144 20120/21 #0385)	Shepperton Road (29,155 vpd 202-/22 #0486); and Albany Hwy (16,230 vpd 202-/22 #0011)

Figure B-3: MRWA Published Traffic Data

Table B-3 combines the percentage land types and Transport Factor to calculate the influencing factor.

Table B-4: Influencing Factor Calculation, dB

Receiver	Industrial Land	Commercial Land	Transport Factor	Total
R1 – R5	4.1	0.0	4.0	**8**

The influencing factor calculated in *Table B-3* is combined with those baseline assigned levels of *Table 2-2*, resulting in the project assigned levels provided in *Table 2-3*.

Appendix C – 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.

- **Sound Power Level (L_w)**

Under normal conditions, a given sound source will radiate the same amount of energy, irrespective of its surroundings, being the sound power level. This is similar to a 1kW electric heater always radiating 1kW of heat. The sound power level of a noise source cannot be directly measured using a sound level meter but is calculated based on measured sound pressure level at known distances. Noise modelling incorporates source sound power levels as part of the input data.

- **Sound Pressure Level (L_p)**

The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc. and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

- L_{ASlow}

This is the noise level in decibels, obtained using the A-frequency weighting and the S (slow) time weighting. Unless assessing modulation, all measurements use the slow time weighting characteristic.

- L_{AFast}

This is the noise level in decibels, obtained using the A-frequency weighting and the F (fast) time weighting. This is used when assessing the presence of modulation.

- L_{APeak}

This is the greatest absolute instantaneous sound pressure level in decibels using the A-frequency weighting.

- L_{Amax}

An L_{Amax} level is the maximum A-weighted noise level during a particular measurement.

- L_{A1}

The L_{A1} level is the A-weighted noise level exceeded for 1 percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

- **L_{A10}**

The L_{A10} level is the A-weighted noise level exceeded for 10 percent of the measurement period and is considered to represent the "intrusive" noise level.

- **L_{A90}**

The L_{A90} level is the A-weighted noise level exceeded for 90 percent of the measurement period and is considered to represent the "background" noise level.

- **L_{Aeq}**

The equivalent steady state A-weighted sound level ("equal energy") in decibels which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the "average" noise level.

- **One-Third-Octave Band**

Means a band of frequencies spanning one-third of an octave and having a centre frequency between 25 Hz and 20000 Hz inclusive.

- **Representative Assessment Period**

Means a period of time not less than 15 minutes, and not exceeding four hours, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission.

- **L_{Amax} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded at any time.

- **L_{A1} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded for more than 1 percent of the representative assessment period.

- **L_{A10} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded for more than 10 percent of the representative assessment period.

- **Tonal Noise**

A tonal noise source can be described as a source that has a distinctive noise emission in one or more frequencies. An example would be whining or droning. The quantitative definition of tonality is:

– the presence in the noise emission of tonal characteristics where the difference between -

(a) the A-weighted sound pressure level in any one-third octave band; and

(b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as $L_{Aeq,T}$ levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as $L_{A\ Slow}$ levels.

This is relatively common in most noise sources.

- **Modulating Noise**

A modulating source is regular, cyclic and audible and is present for at least 10% of the measurement period. The quantitative definition of modulation is:

– a variation in the emission of noise that —

(a) is more than 3 dB $L_{A\ Fast}$ or is more than 3 dB $L_{A\ Fast}$ in any one-third octave band; and

(b) is present for at least 10% of the representative assessment period; and

(c) is regular, cyclic and audible.

- **Impulsive Noise**

An impulsive noise source has a short-term banging, clunking or explosive sound. The quantitative definition of impulsiveness means:

– a variation in the emission of a noise where the difference between L_{Apeak} and L_{Amax} is more than 15 dB when determined for a single representative event.

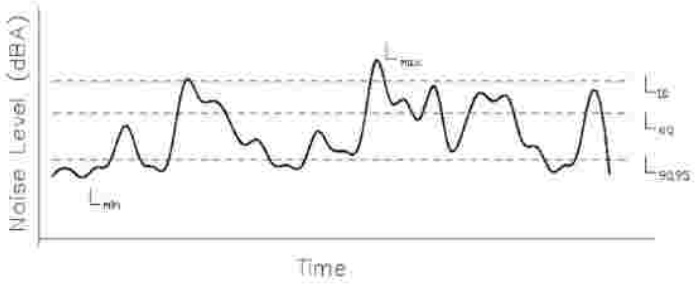
- **Major Road**

Is a road with an estimated average daily traffic count of more than 15,000 vehicles.

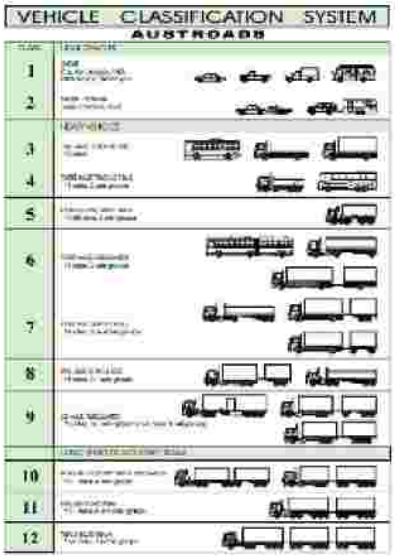
- **Secondary / Minor Road**

Is a road with an estimated average daily traffic count of between 6,000 and 15,000 vehicles.

- **Chart of Noise Level Descriptors**



- **Austroads Vehicle Class**



- **Typical Noise Levels**