

Environmental Noise Assessment

Proposed Hammond Park Shopping Centre

Hammond Park

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Aigle Royal Group

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1 INTRODUCTION

This report has been prepared to consider the potential noise impacts associated with the proposed mixed use development on parts of Lots 9042, 9052 Wattleup Road and Lot 305 Whadjuk Drive, Hammond Park - refer *Figure 1-1*.



Figure 1-1 Project Locality

The proposed development (refer *Figure 1-2*) is comprised of:

- Supermarket;
- Liquor and Specialty Stores, including future stores to the northeast; and
- Fast Food outlets.

The main noise sources associated with such a development are from mechanical plant (air-conditioning and refrigeration), refrigerated delivery trucks and car door closings. As the project is at Development Application (DA) Stage only, design and selections of plant has not been undertaken and therefore this assessment uses file data.

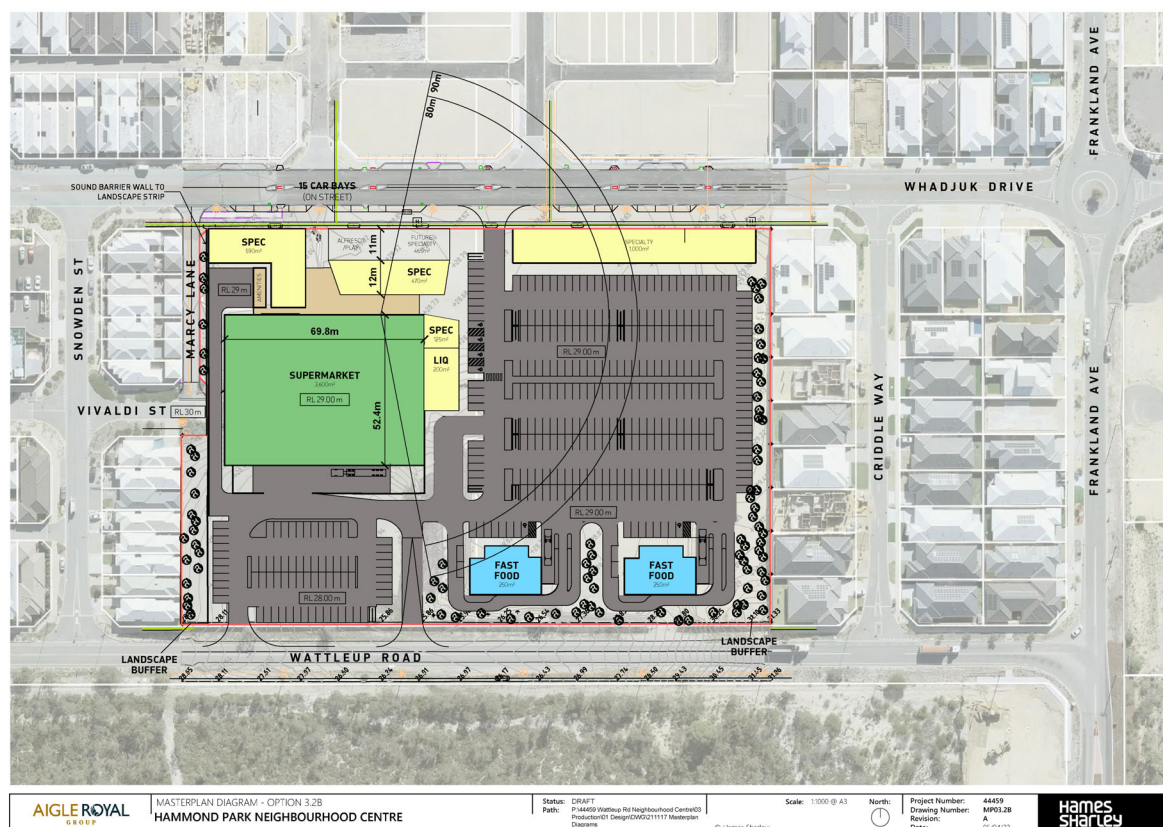


Figure 1-2 Overall Site Plan

Surrounding the site are existing residences to the west, north and east. To the south is Frankland Park, part of which is being developed as a recreation centre.

Appendix A 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).

Regulation 7 defines the prescribed standard for noise emissions as follows:

“7. (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;
 - ii. impulsiveness; and
 - iii. modulation,

when assessed under regulation 9”

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...”

Tonality, impulsiveness and modulation are defined in Regulation 9. Noise is to be taken to be free of these characteristics 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 after the adjustments of *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

Note: The above are cumulative to a maximum of 15dB.

The baseline assigned levels (prescribed standards) are specified in Regulation 8 and are shown in *Table 2-2*.

Table 2-2 Baseline Assigned Noise Levels

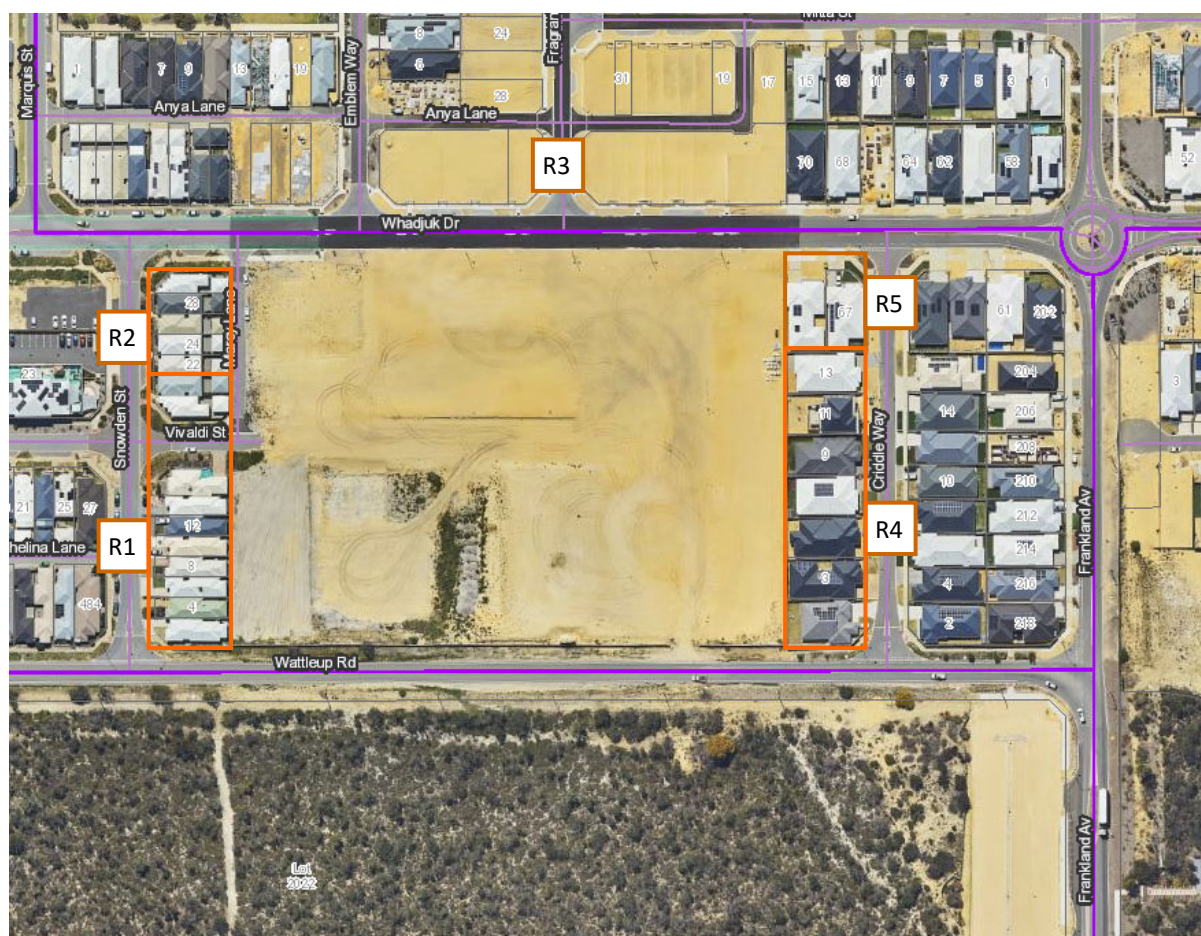
Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L _{A10}	L _{A1}	L _{Amax}
Noise sensitive premises: highly sensitive area ¹	0700 to 1900 hours Monday to Saturday (Day)	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays (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

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.

Each of the closest residences obtains a + 2 dB influencing factor due to the commercial nature of the proposed development. From a traffic count obtained from Main Roads WA, this shows in October 2020, 5,755 vehicles per day used Wattleup Road (west of Frankland Avenue) and 6,508 vehicles per day used Frankland Avenue (south of Wattleup Road). To be considered a secondary road, there is to be 6,000 vehicles per day. With the introduction of the shopping centre, as well as general growth in the area, traffic volumes on Wattleup Road are expected to exceed 6,000 vpd.

As such, residences within 100 metres of Wattleup Road also receive a + 2 dB traffic factor. *Figure 2-3* shows the residences considered with *Table 2-3* providing the assigned noise levels.



Location	Address
R1 (West)	2-20 Snowden Street
R2 (West)	22-30 Snowden Street
R3 (North)	72-112 Whadjuk Drive
R4 (East)	1-13 Criddle Way
R5 (Northeast)	69 Whadjuk Drive

Figure 2-1 Residential Assessment Locations

Table 2-3 Assigned Noise Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L _{A10}	L _{A1}	L _{Amax}
R2, R3, R5 Noise sensitive premises: highly sensitive area ¹	0700 to 1900 hours Monday to Saturday (Day)	47	57	67
	0900 to 1900 hours Sunday and public holidays (Sunday)	42	52	67
	1900 to 2200 hours all days (Evening)	42	52	57
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	37	47	57
R1, R4 Noise sensitive premises: highly sensitive area ¹	0700 to 1900 hours Monday to Saturday (Day)	49	59	69
	0900 to 1900 hours Sunday and public holidays (Sunday)	44	54	69
	1900 to 2200 hours all days (Evening)	44	54	59
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	39	49	59

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.

With regard to traffic volumes and associated factors, the City's planned road network is yet to be completed. In the future as traffic volumes change, there may also be increases to the assigned noise levels at certain residences.

The assigned noise levels above apply outside the receiving premises and at a point at least 3 metres away from any substantial reflecting surfaces. Where this was not possible to be achieved due to the close proximity of existing buildings and/or fences, the noise emissions were assessed at a point within 1 metre from building facades and a -2 dB adjustment was made to the predicted noise levels to account for reflected noise.

It is further noted the assigned noise 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*, which is 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 Environment 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.

2.1 Reversing Alarms on Vehicles

With regards to noise from reversing alarms, regulation 3(1)(h) states:

- (1) *Nothing in these regulations applies to the following noise emissions —*
- (h) *noise emissions from —*
 - (i) *a reversing alarm fitted to a motor vehicle, mobile plant, or mining or earthmoving equipment;*
 - If -*
 - (iii) *it is a requirement under another written law that such an alarm be fitted; and*
 - (iv) *it is not practicable to fit an alarm that complies with the written law under which it is required to be fitted and emits noise that complies with these regulations;*

It is considered that any reversing alarms fitted to commercial vehicles (e.g. delivery or rubbish trucks) are not necessarily exempt under the Regulations, since they are not specifically required under another written law. That is only a safe workplace must be provided, which can be undertaken in a variety of ways.

The commonly used fixed noise output tonal reversing alarms also known as 'reversing beeper' emit, by their very nature, tonal and modulating noise at high levels. As such, this type of reversing alarm generally cannot comply with the Regulations even at distant receivers. Alternative alarms such as broadband alarms are commonly used to minimise the impact.

2.2 Drive Through Areas and Refrigerated Deliveries

Regulation 3 states the following with regards to vehicles:

- (1) *Nothing in these regulations applies to the following noise emissions —*
- (a) *noise emissions from the propulsion and braking systems of motor vehicles operating on a road;*

Since the development is open to the public, the carpark and associated like areas are considered to be a road and therefore vehicle noise (propulsion and braking) is not strictly assessed. However, vehicle propulsion noise in the drive-through areas are considered assessable.

Vehicle door closing noise is also assessable in any parts of the car park, as this does not form part of the 'propulsion or braking' systems.

Similarly, the refrigeration units on some delivery trucks is not part of the propulsion or braking system and therefore also assessable.

2.3 Waste Collection and Site Cleaning (Specified Works)

Regulation 14A provides requirements for such activities as the collection of waste, landscaped area maintenance and car park cleaning. Such activities can also be exempt from having to comply with Regulation 7, provided they are undertaken in accordance with regulation 14A(2) as follows:

- during daytime hours, defined as:
 - 07:00 to 19:00 Monday to Saturday (excluding public holiday), or
 - 09:00 to 19:00 on a Sunday or public holiday
- in the quietest reasonable and practicable manner; and
- using the quietest equipment reasonably available.

In the case where specified works are to be carried outside daytime hours and their noise emissions are likely not to comply with Regulation 7, the works also need to be carried out according to a Noise Management Plan which has been approved by the local government authority CEO.

3 METHODOLOGY

Computer modelling has been used to predict noise levels at each nearby receiver. The software used was *SoundPLAN 8.2* with the CONCAWE algorithms selected. These algorithms have been selected as they include the influence of wind and atmospheric stability. Input data required in the model are:

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

3.1 Meteorological Information

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	Night (1900-0700)	Day (0700-1900)
Temperature (°C)	15	20
Humidity (%)	50	50
Wind Speed (m/s)	3	4
Wind Direction*	All	All
Pasquil Stability Factor	F	E

* Note that the modelling package used allows for all wind directions to be modelled simultaneously.

It is generally considered that compliance with the assigned noise levels needs to be demonstrated for 98% of the time, during the day and night periods, for the month of the year in which the worst-case weather conditions prevail. In most cases, the above conditions occur for more than 2% of the time and therefore must be satisfied.

3.2 Topographical Data

Topographical data was based on a combination of Landgate data on file and survey data provided by the client. This was combined with the proposed development (assumed to be at a level of 28.6m) to create a 3-Dimensional noise model as shown in *Figure 3-1*. Initially the loading dock area for the supermarket is assumed to be an open structure.

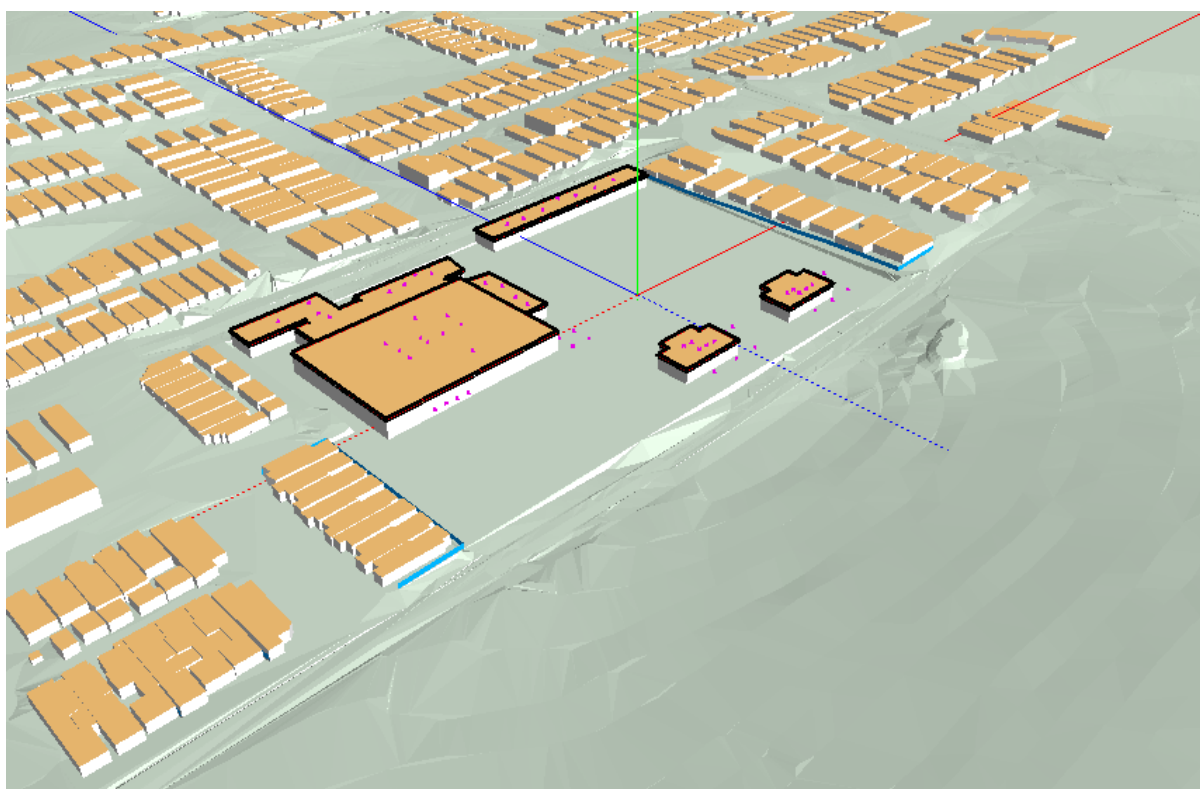


Figure 3-1 Image of Noise Model

3.3 Ground Absorption

Ground absorption varies from a value of 0 to 1. A value of 0 was used for acoustically reflective ground (e.g. water or bitumen), 0.6 for sandy areas and 1 for acoustically absorbent ground (e.g. grass).

3.4 Source Sound Levels

The sound power levels used in the modelling are provided in *Table 3-2*. As the project is at DA stage, there is no information available on the specific type and number of mechanical plant items. Therefore file data has been used from similar past projects.

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	
Fast Food Store (Each)									
Air-conditioning (2x condensers on roof)	63	63	62	65	57	50	45	39	64
Toilet Exhaust Fan	66	64	62	59	52	49	46	40	60
Exhaust Fan	68	73	67	65	59	55	59	47	67
Kitchen Exhaust Fan	80	78	74	71	62	64	63	53	73
Car Idling	81	78	74	72	74	74	67	64	79
Drive-through loudspeaker	63	64	66	77	80	73	57	42	82
Small Refrigeration Delivery Truck	97	88	84	85	80	78	76	72	87
Supermarket									
Large Refrigeration Delivery Truck	91	84	97	95	97	96	90	81	101
Refrigeration Condensers (2x condensers)	89	90	85	83	83	78	71	68	87
Refrigeration Compressors (Plantroom Breakout 4x louvres)	82	82	82	78	78	72	66	58	82
Air-conditioning (3x condensers on roof)	97	97	84	79	73	69	62	54	84
Toilet Exhaust Fans (2x)	66	64	62	59	52	49	46	40	60
Kitchen Exhaust Fan	78	82	75	70	66	66	62	61	74
Office Air-conditioning	64	62	62	64	57	50	45	39	63
Staff Dining/Cashier Air-conditioning	61	63	58	59	57	50	45	40	61
Kitchen Supply Fan	74	74	71	62	61	56	53	49	67
Car Door Closing	71	74	77	81	80	78	72	61	84

Description	Octave Band Centre Frequency (Hz)								Overall dB(A)
	63	125	250	500	1k	2k	4k	8k	
Stand-Alone Retail Buildings									
Air-conditioning (11 in total)	63	63	62	65	57	50	45	39	64
Exhaust Fan (4 in total)	68	73	67	65	59	55	59	47	67
Toilet Exhaust Fan (4 in total)	59	64	62	59	52	49	46	40	60

With regards to the noise sources, the following is noted:

- All mechanical plant has been located on the roof of the buildings at a height of 0.5 metres for exhaust fans, and 1.0 metre for condensers and refrigeration plant;
- Parapets are initially assumed to be 1.0 metre high around proposed commercial buildings and are assumed to follow the building footprints;
- The supermarket plant room containing noisiest plant (e.g. compressors, and the like) to serve the supermarket is initially assumed to be located mid-façade to the south of the building near the loading dock;
- Refrigeration unit to supermarket delivery truck was modelled at 2.5 metres above ground.

3.5 Noise Modelling Scenarios

Scenario 1 (L_{10}) Night time : During the night time, only the refrigeration plant for the supermarket is in operation (AC and fans are “off” or in night mode) i.e. the plantroom and refrigeration condensers. All mechanical plant serving stand alone retail shops are “off”. All fast food mechanical plant is “on” including AC and fans. Five vehicles are idling in dedicated drive through area for each fast food outlet.

Scenario 2 (L_1) Night time : As above with 11x idling cars in dedicated drive through area for each the 2 fast food outlets, and drive-through speaker in operation for each outlet.

Scenario 3 (L_{10}) Daytime : All mechanical plant is “on” for all proposed commercial buildings (i.e. Supermarket, retail shops and fast food outlets). Five cars are idling in the dedicated drive through area for each of the 2 fast food outlets, and 4 cars are idling in the shopping centre pickup area.

Scenario 4 (L_{A1}) Refrigerated Delivery : A refrigerated truck is modelled in each of the 3 dedicated loading bays for C1, C2 and C3 with the refrigeration unit in operation with the highest resulting noise presented at each receiver.

Scenario 5 (L_{max}) Car Doors: Car doors closing events in each bay is modelled with the highest resulting noise presented at each receiver.

4 RESULTS & ASSESSMENT

Results of the noise modelling are discussed in *Section 4.1* to *Section 4.5*, being for the five critical modelling scenarios described in *Section 3.5*.

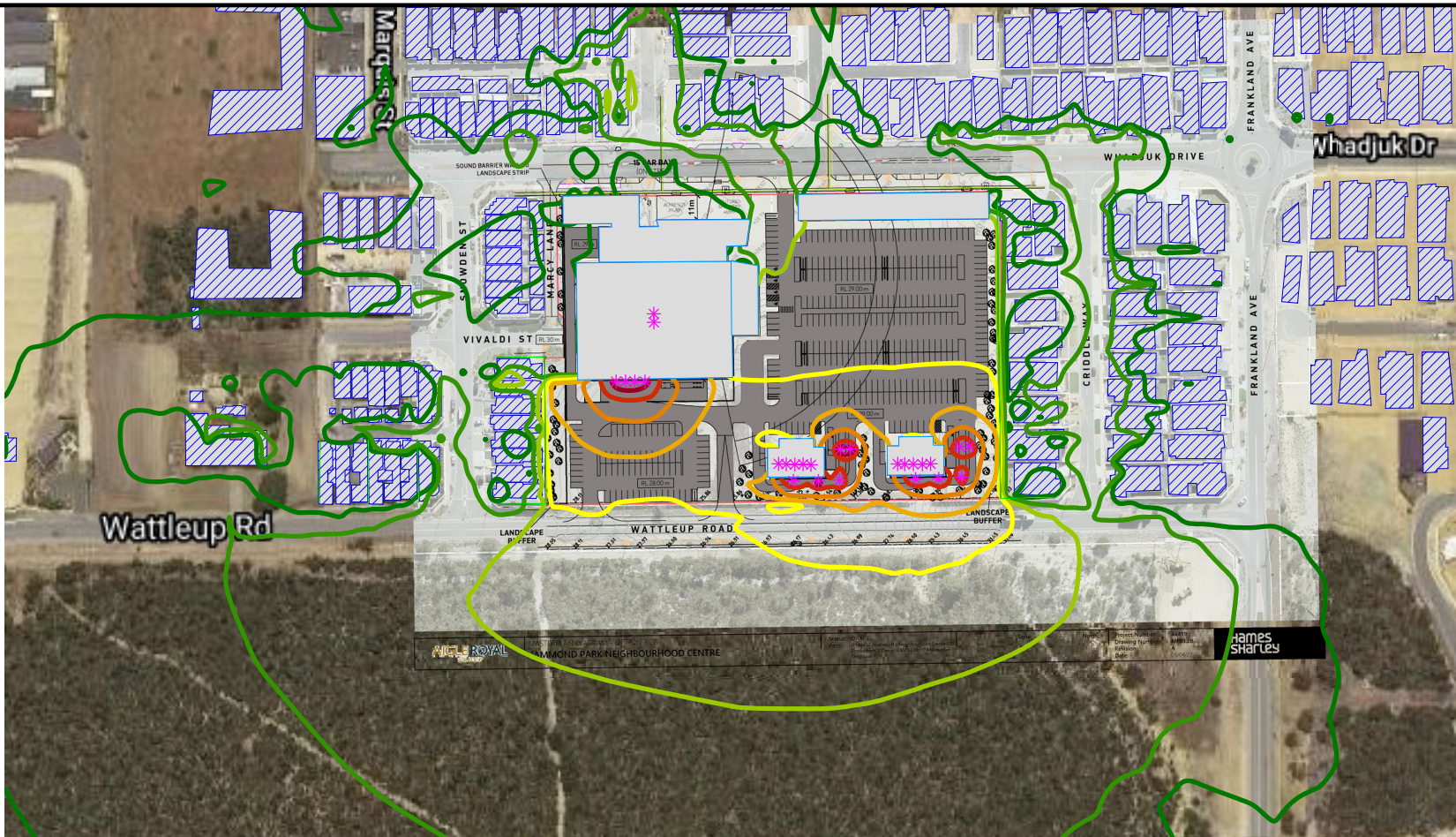
4.1 Scenario 1 – Night-time L_{A10}

The Scenario 1 night-time predicted L_{A10} noise levels are assessed in *Table 4-1* and provided as noise contours in *Figure 4-1*.

Table 4-1 Predicted and Assessed Night-time Noise Levels, dB L_{A10}

Receiver	Predicted	Adjusted ¹	Assigned	Exceedance	Highest Source
R1 (West) – Snowden Street	41	46	39	+ 7	Supermarket Compressors
R2 (West) Snowden Street	34	39	37	+ 2	Supermarket Refrigeration Condensers
R3 (North) Whadjuk Drive	40	45	37	+ 8	Supermarket Refrigeration Condensers
R4 (East) Criddle Way	39	44	39	+ 5	Supermarket Refrigeration Condensers
R5 (Northeast) Whadjuk Drive	36	41	37	+ 4	Supermarket Refrigeration Condensers

1. Where mechanical plant is dominant, noise levels are adjusted by + 5 dB for tonality. Where cars in drive thru are dominant, noise is not considered tonal due to varying engine idling speeds.



Proposed Shopping Centre - Hammond Park Scenario 1 - Night time L_{A10}

Ground Floor Noise Level Contours (1.5m AGL)

SoundPlan v8.2

CONCAWE Algorithms

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Length Scale 1:3000

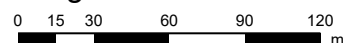


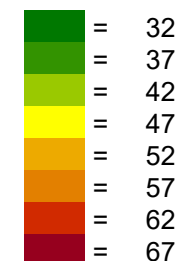
Figure 4-1

Signs and symbols

- * Point source
- Residential Building
- Commercial Building



Noise Level dB, L_{A10}



4.2 Scenario 2 – Night-time L_{A1}

The Scenario 2 night-time predicted L_{A1} noise levels are assessed in *Table 4-2* and provided as noise contours in *Figure 4-2*.

Table 4-2 Predicted and Assessed Night-time Noise Levels, dB L_{A1}

Receiver	Predicted	Adjusted ¹	Assigned	Exceedance	Highest Source
R1 (West) – Snowden Street	41	46	49	N/A	-
R2 (West) Snowden Street	34	39	47	N/A	-
R3 (North) Whadjuk Drive	40	45	47	N/A	-
R4 (East) Criddle Way	41	46	49	N/A	-
R5 (Northeast) Whadjuk Drive	36	41	47	N/A	-

1. Where mechanical plant is dominant, noise levels are adjusted by + 5 dB for tonality. Where cars in drive thru are dominant, noise is not considered tonal due to varying engine idling speeds.

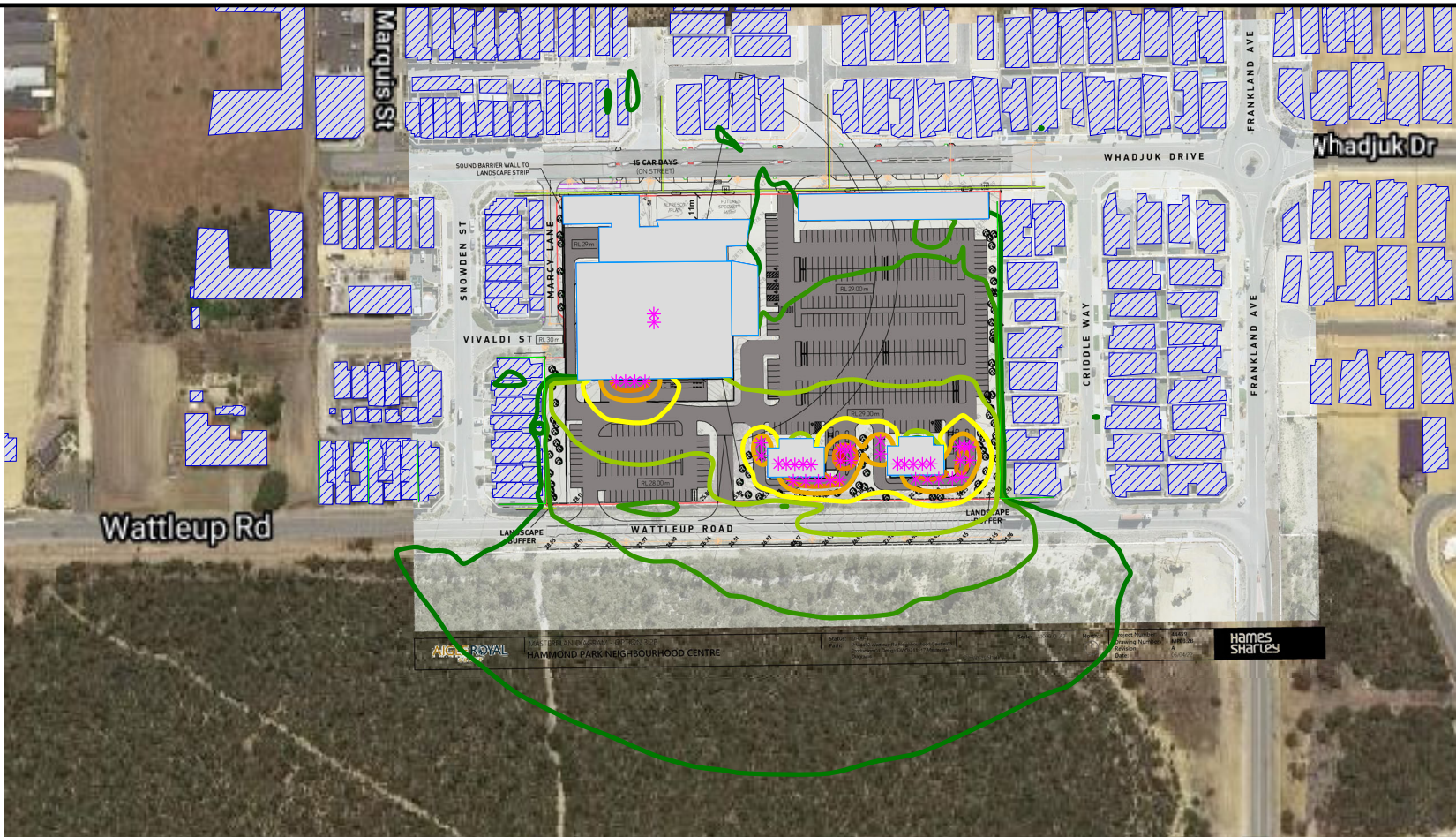
4.3 Scenario 3 – Daytime L_{A10}

The Scenario 3 daytime predicted L_{A10} noise levels are assessed in *Table 4-3* and provided as noise contours in *Figure 4-3*. The Sunday assigned level has been used for assessment.

Table 4-3 Predicted and Assessed Daytime Noise Levels, dB L_{A10}

Receiver	Predicted	Adjusted ¹	Assigned	Exceedance	Highest Source
R1 (West) – Snowden Street	42	42	44	N/A	-
R2 (West) Snowden Street	39	39	42	N/A	-
R3 (North) Whadjuk Drive	42	42	42	N/A	-
R4 (East) Criddle Way	40	45	44	+ 1	Supermarket Refrigeration Condensers
R5 (Northeast) Whadjuk Drive	38	43	42	+ 1	Supermarket Refrigeration Condensers

1. Due to increased background noise during the day, no adjustments are applied for tonality.



Proposed Shopping Centre - Hammond Park Scenario 2 - Night time L_{A1}

Ground Floor Noise Level Contours (1.5m AGL)

SoundPlan v8.2

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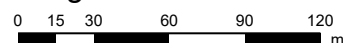


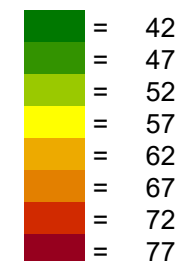
Figure 4-2

Signs and symbols

- * Point source
- Residential Building
- Commercial Building



Noise Level dB, L_{A1}





Proposed Shopping Centre - Hammond Park Scenario 3 - Daytime L_{A10}

Ground Floor Noise Level Contours (1.5m AGL)

SoundPlan v8.2

CONCAWE Algorithms

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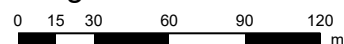


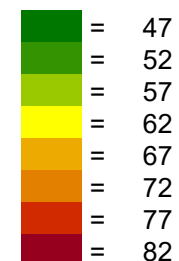
Figure 4-3

Signs and symbols

- * Point source
- Residential Building
- Commercial Building



Noise Level dB, L_{A10}



4.4 Scenario 4 – Daytime L_{A1}

The Scenario 4 daytime predicted L_{A1} noise levels are assessed in *Table 4-4* and provided as noise contours in *Figure 4-4*. The assessment initially considers daytime (Monday to Saturday) only.

Table 4-4 Predicted and Assessed Daytime Noise Levels, dB L_{A1}

Receiver	Predicted	Adjusted ¹	Assigned	Exceedance	Highest Source
R1 (West) – Snowden Street	51	56	59	N/A	Supermarket Refrigeration Truck
R2 (West) Snowden Street	33	38	57	N/A	Supermarket Refrigeration Truck
R3 (North) Whadjuk Drive	37	42	57	N/A	Fast Food refrigeration Truck
R4 (East) Criddle Way	47	52	59	N/A	Supermarket Refrigeration Truck
R5 (Northeast) Whadjuk Drive	34	39	57	N/A	Fast Food refrigeration Truck

1. Refrigeration unit may be tonal and therefore adjusted by + 5 dB for tonality.

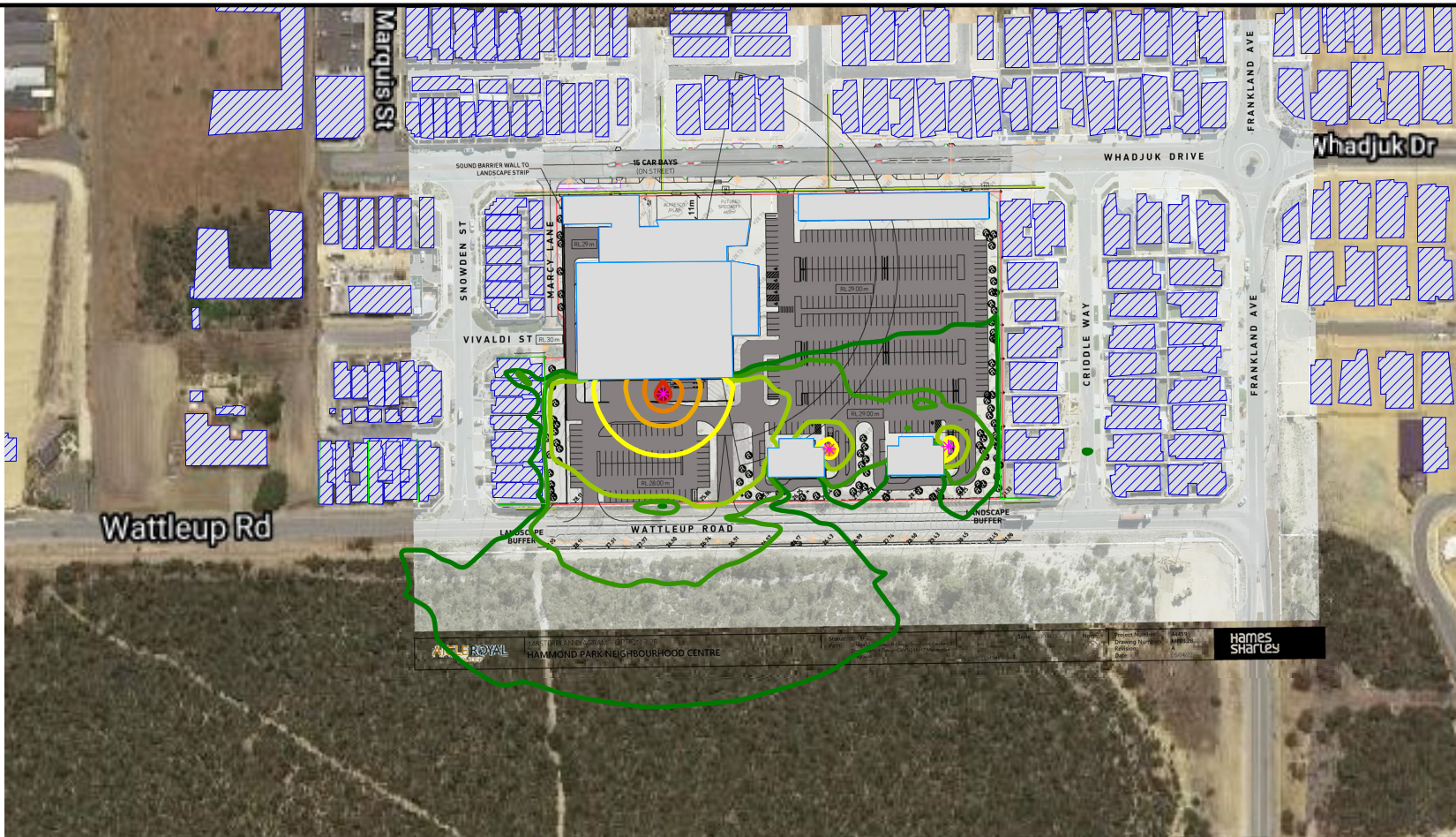
4.5 Scenario 5 – Night-time L_{Amax}

The Scenario 5 night-time predicted L_{Amax} noise levels are assessed in *Table 4-5* and provided as noise contours in *Figure 4-5*.

Table 4-5 Predicted and Assessed Night-time Noise Levels, dB L_{Amax}

Receiver	Predicted	Adjusted ¹	Assigned	Exceedance	Highest Source
R1 (West) – Snowden Street	42	52	59	N/A	-
R2 (West) Snowden Street	36	46	57	N/A	-
R3 (North) Whadjuk Drive	43	53	57	N/A	-
R4 (East) Criddle Way	39	49	59	N/A	-
R5 (Northeast) Whadjuk Drive	42	52	57	N/A	-

1. Car door noise adjusted by +10 dB for impulsiveness.



Proposed Shopping Centre - Hammond Park Scenario 4 - Daytime L_{A1}

Ground Floor Noise Level Contours (1.5m AGL)

SoundPlan v8.2

CONCAWE Algorithms

24 May 2022



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Length Scale 1:3000

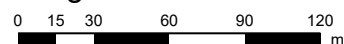


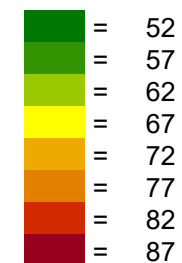
Figure 4-4

Signs and symbols

- * Point source
- Residential Building
- Commercial Building



Noise Level dB, L_{A1}



5 DISCUSSION

For mechanical plant, the most critical scenario is that during the night-time (Scenario 1) where exceedances are calculated based on nominal plant sound levels. The exceedances are considered manageable with further analysis during detailed design to consider:

- All plant shall be vibration isolated to achieve minimum 95% isolation efficiency;
- All plant shall be selected taking noise levels into consideration, so that when comparing different models, the quieter units are selected;
- Selection of plant that can operate at low speed during the night (e.g. supermarket refrigeration condensers);
- Acoustic screens to be incorporated around mechanical plant, particularly the supermarket refrigeration condensers and potentially other plant that will operate during the night;
- Exhaust fans and the like shall be in-line type fans where silencers can be incorporated if required, as opposed to roof mounted fans;
- Acoustic louvres to be incorporated in the design of the supermarket compressor plant room.

For the fast food delivery vehicles, compliance is calculated at all times.

For the supermarket delivery area, the analysis indicates compliance can be achieved by a range of options including management of delivery times, duration of refrigeration unit operation, partial or full enclosure of the service yard area. This will be further explored during detailed design to ensure compliance is achieved.

In addition to the above for the loading areas:

- Where a safe workplace can be provided, audible reversing alarms shall be turned off and alternative methods used such as spotters etc. Audible 'beeper' reversing alarms are only acceptable if it is deemed there is no other way to provide a safe workplace. Where an audible alarm is required, consideration should be given to the suitability of broadband type alarms i.e. "croakers", as these have less environmental noise impacts;
- Normal (non-refrigerated) delivery trucks to turn engines off whilst unloading;
- No external music should be played and loud behaviour from staff should be discouraged.

Whilst the assessment has shown the potential for exceedances, this is not uncommon in such a report. Compliance is considered readily achievable and practicable once further detail becomes available at subsequent stages of the design and development process.

Appendix A

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.

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 levels 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 as specified in IEC 61672-1:2002. 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 as specified in IEC 61672-1:2002. This is used when assessing the presence of modulation only.

L_{APeak}

This is the greatest absolute instantaneous sound pressure in decibels using the A frequency weighting as specified in IEC 61672-1:2002.

L_{Amax}

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

L_{A1}

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

L_{A10}

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

L_{A90}

An L_{A90} level is the A-weighted noise level which is exceeded for 90 percent of the measurement period and is considered to represent the “background” 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 20 000 Hz inclusive.

L_{Amax} assigned level

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

L_{A1} assigned level

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

L_{A10} assigned level

Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded for more than 10% 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;
- (b) is present for at least 10% of the representative.

Impulsive Noise

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

a variation in the emission of a noise where the difference between $L_{A \text{ peak}}$ and $L_{A \text{ Max slow}}$ 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.

Influencing Factor (IF)

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

where :

% Type A₁₀₀ = the percentage of industrial land within
a 100m radius of the premises receiving the noise

%TypeA₄₅₀ = the percentage of industrial land within
a 450m radius of the premises receiving the noise

% Type B₁₀₀ = the percentage of commercial land within
a 100m radius of the premises receiving the noise

%TypeB₄₅₀ = the percentage of commercial land within
a 450m radius of the premises receiving the noise

+ Traffic Factor (maximum of 6 dB)

= 2 for each secondary road within 100m

= 2 for each major road within 450m

= 6 for each major road within 100m

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.

Background Noise

Background noise or residual noise is the noise level from sources other than the source of concern. When measuring environmental noise, residual sound is often a problem. One reason is that regulations often require that the noise from different types of sources be dealt with separately. This separation, e.g. of traffic noise from industrial noise, is often difficult to accomplish in practice. Another reason is that the measurements are normally carried out outdoors. Wind-induced noise, directly on the microphone and indirectly on trees, buildings, etc., may also affect the result. The character of these noise sources can make it difficult or even impossible to carry out any corrections.

Ambient Noise

Means the level of noise from all sources, including background noise from near and far and the source of interest.

Specific Noise

Relates to the component of the ambient noise that is of interest. This can be referred to as the noise of concern or the noise of interest.

Peak Component Particle Velocity (PCPV)

The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and in one of the three orthogonal directions (x, y or z) measured as a peak response. Peak velocity is normally used for the assessment of structural damage from vibration.

Peak Particle Velocity (PPV)

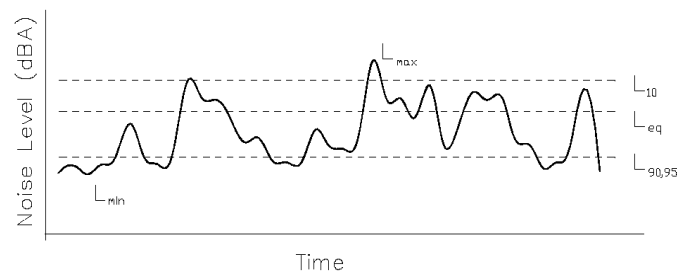
The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and is the vector sum of the PCPV for the x, y and z directions measured as a peak response. Peak velocity is normally used for the assessment of structural damage from vibration.

RMS Component Particle Velocity (PCPV)

The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and in one of the three orthogonal directions (x, y or z) measured as a root mean square (rms) response. RMS velocity is normally used for the assessment of human annoyance from vibration.

Peak Particle Velocity (PPV)

The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and is the vector sum of the PCPV for the x, y and z directions measured as a root mean square (rms) response. RMS velocity is normally used for the assessment of human annoyance from vibration.

Chart of Noise Level Descriptors**Typical Noise Levels**