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Development Application - Noise Assessment

Lot 4131 Smiths Beach Road, Yallingup

Reference: 21046280-01e

Prepared for:
Smiths 2014 Pty Ltd

Report: 21046280-01e

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1 INTRODUCTION

Lloyd George Acoustics was commissioned by Smiths 2014 Pty Ltd to prepare a Noise Assessment for the proposed development ("the Project") located at Lot 4131 Smiths Beach Road, Yallingup in the City of Busselton ('the Site'). The Project consists of the following components:

- Tourist development comprising hotel accommodation, restaurant and wellness centre;
- Campground;
- Community hub comprising cafe, reception hall, surf lifesaving club, Cape to Cape Welcome Centre and general store/bakery; and
- Holiday Homes.

The general locality is shown in *Figure 1-1*, along with the adjacent land uses. The area in blue border is the Site. The area shown in orange focuses on the neighbouring premises of Canal Rocks Apartments at 97 Smiths Beach Road and Smiths Beach Resort at 67 Smiths Beach Road. *Figure 1-2* shows the overall Master Plan.

The Project is only at Development Application (DA) Stage and therefore specific details (e.g. mechanical plant) have not yet been fully coordinated. This report considers noise emissions relating to potential patron noise, music and car door closings as well as management of waste collection and service deliveries.

Figure 1-1 Project Locality

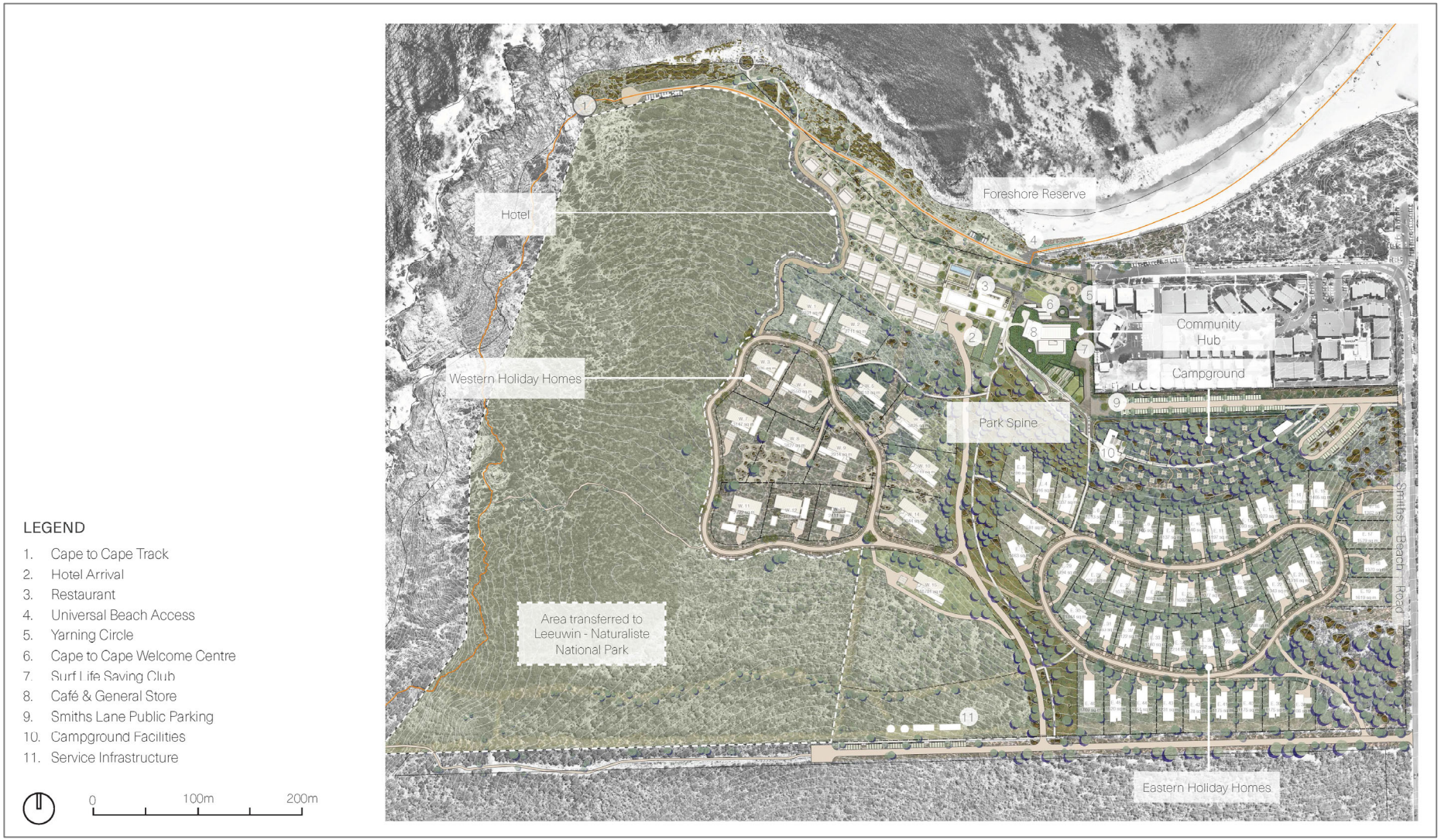

Figure 1-2 Project Master Plan

2 CRITERIA

2.1 Regulations 7 & 8

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
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80

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.

Adjoining the Site is Canal Rocks Beachfront Apartments at 97 Smiths Beach Road and Smiths Beach Resort at 67 Smiths Beach Road. These and the Site are zoned Tourism on the City of Busselton Local Planning Scheme No. 21. The western portion of the Site is zoned Recreation. Tourism zoning allows for accommodation as well as retail and service facilities. Given this, the highest area use of the Tourism zoning is considered to be commercial as permitted under Schedule 3 (2)(2A) of the Noise Regulations. All other land is assessed as noise sensitive.

The influencing factor, applicable at the neighbouring noise sensitive premises has been calculated as 5 dB, as shown in *Table 2-3*, with *Figure 2-1* providing the areas included as commercial land. The transport factor has been calculated as 0 dB, with no major or secondary roads within 450 metres.

Table 2-3 Influencing Factor Calculation

Description	Within 100 metre Radius	Within 450 metre Radius	Total
Industrial Land	0 %	0 %	0 dB
Commercial Land	74 %	22 %	4.8 dB
Transport Factor			0 dB
Total			**5 dB**

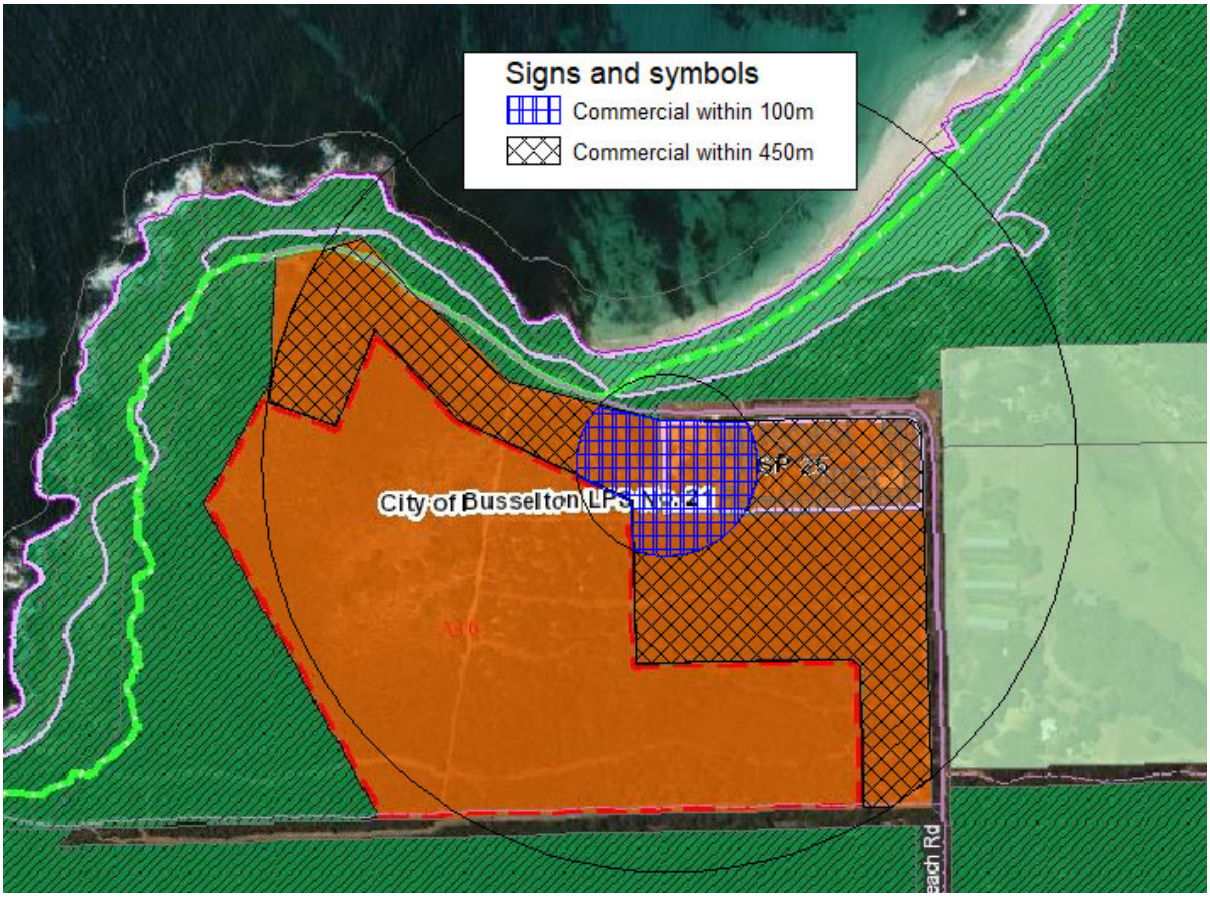

Figure 2-1 Commercial Zoning Map

Table 2-4 shows the assigned noise levels including the influencing factor and transport factor at the receiving locations.

Table 2-4 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)	50	60	70
	0900 to 1900 hours Sunday and public holidays (Sunday)	45	55	70
	1900 to 2200 hours all days (Evening)	45	55	60
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	40	50	60
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80

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 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 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.

2.2 Regulation 3

Under regulation 3, nothing in the Regulations applies to the following noise emissions –

(a) *noise emissions from the propulsion and braking systems of motor vehicles operating on a road.*

As such, vehicle noise from all publicly accessible roads, car parks or the like are not assessed. However, noise from car doors is considered, which is not part of the propulsion or barking system.

2.3 Regulation 14A

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 undertaken 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.

Such activities will be undertaken in accordance with regulation 14A and therefore noise modelling has not been specifically undertaken.

3 METHODOLOGY

Computer modelling has been used to predict noise levels at each nearby receiver. The software used was *SoundPLAN 8.2* with the ISO 9613 (ISO 17534-3 improved method) 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 (^{o}C)	15	20
Humidity (%)	50	50
Wind Speed (m/s)	Up to 5	Up to 5
Wind Direction*	All	All

* 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 that publicly available from *Google* in the form of spot heights and then combined with the proposed building plans as shown in *Figure 3-1* to create a 3D noise model. Also included was a 2.6m high boundary wall alongside the single storey Smiths Beach Resort units that adjoin the car park. The height of the wall is relative to the ground level of the units.

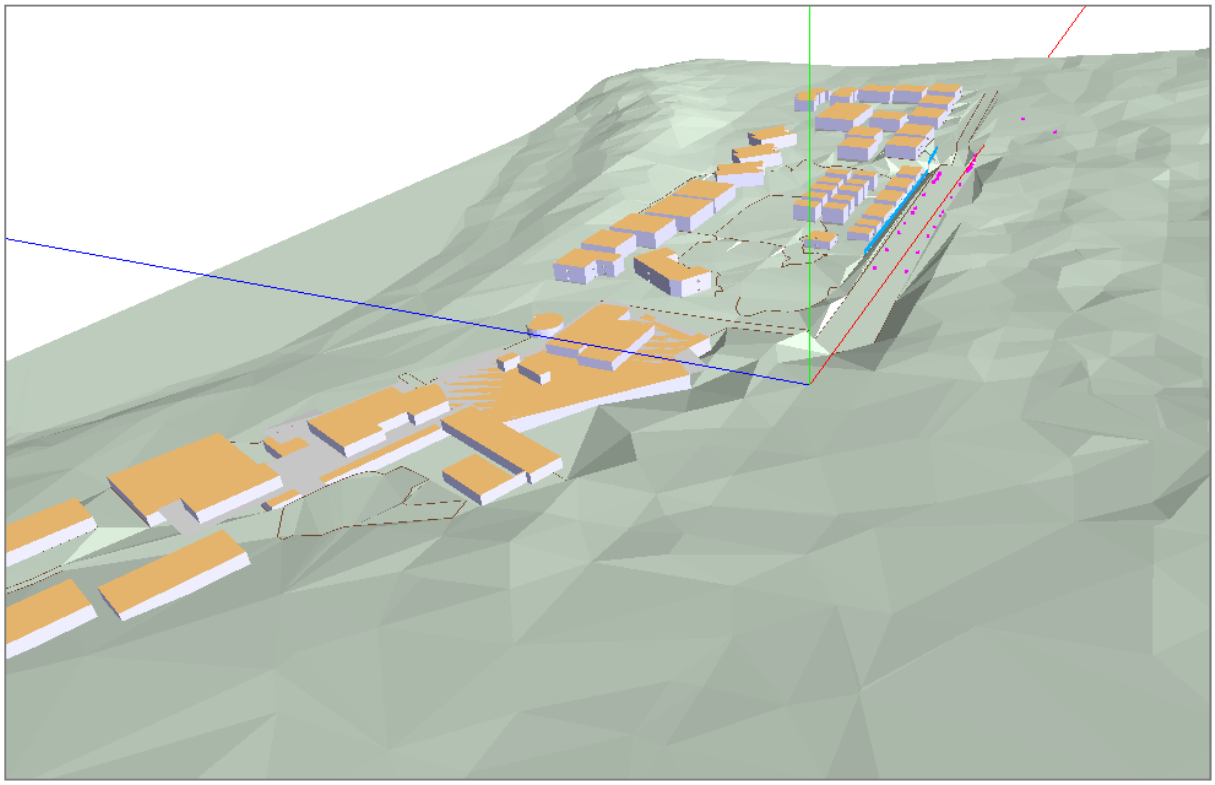

Figure 3-1 View of 3D Noise Model (from Southwest)

3.3 Ground Absorption

Ground absorption varies from a value of 0 to 1, with 0 being for an acoustically reflective ground (e.g. water or bitumen) and 1 for acoustically absorbent ground (e.g. grass). In this instance, a value of 0.0 has been used for roads, car parks and the ocean and 1.0 elsewhere.

3.4 Source Sound Levels

As stated in the introduction, this report will consider noise from patrons, music and car doors closing. With regard to patrons, the Association of Australasian Acoustical Consultants (AAAC) acknowledges that the prediction of such a noise is the least conclusive area of research amongst acoustic consultants. Variables such as the number of patrons, time of day, alcohol consumption etc can result in highly variable results. For the purpose of this study, dining/cafe type patrons are considered to have a sound power level of 70 dB(A). Patrons in more of a bar style area, are assumed to have a sound power level of 75 dB(A) each. For each area, it is the assumed that 1 in 3 persons will be talking.

For cafe/dining areas, it is assumed that music noise will be low level only, such that patron noise will dominate and the music would be inaudible at neighbouring noise sensitive premises. For the reception hall, it is assumed internally that music noise levels will be higher and this has been based on file data whereby the reverberant sound pressure level is used; with the model then calculating the sound power level of each acoustically weak element.

Similarly, noise from car doors closing is also based on file data.

The sound power levels used in the modelling are provided in *Table 3-2* where L_p is a sound pressure level and L_w is a sound power level. For patron noise, the same spectra is used in all cases, and simply increased and decreased to match the number of patrons and type of use. Patron numbers will vary depending on time of day and season. *Table 3-3* presents the estimated patron numbers provided by the client for different peak times of the day coinciding with time periods of the Noise Regulations and the associated overall sound power level.

Table 3-2 Source Sound Levels, dB

Description	Octave Band Centre Frequency (Hz)								Overall dB(A)
	63	125	250	500	1k	2k	4k	8k	
Reception Hall – Internal $L_{p,reverb}$	81	90	82	87	87	84	77	75	**91**
Car Door Closing - $L_{w,max}$	71	74	77	81	80	78	72	61	**84**
Patron Noise Dining – $L_{w,10}$	53	64	68	70	62	60	57	53	**70**
Patron Noise Bar – $L_{w,10}$	58	69	73	75	67	65	62	58	**75**

Table 3-3 Assumed Patron Numbers and Total Sound Power Levels

Space	Time of Day			
	Early Morning (Before 9am Sundays and public holidays and 7am other days)	Day (Up until 7pm on any day)	Evening (7pm to 10pm any day)	Night (after 10pm)
Patron Numbers				
Cafe (Indoors)	50	100	50	0
Cafe (Outdoors)	40	80	40	0
All Day Dining (Indoors)	150	150	150	150
All Day Dining (Outdoors)	50	50	50	50
Reception Hall (Weddings or similar)	0	150	150	150
Reception Hall (Corporate)	0	200	0	0
Third Space (Members Only)	50	50	50	50

Space	Time of Day			
	Early Morning (Before 9am Sundays and public holidays and 7am other days)	Day (Up until 7pm on any day)	Evening (7pm to 10pm any day)	Night (after 10pm)
Sound Power Levels, dB L_{A10}				
Cafe (Indoors)	82	85	82	-
Cafe (Outdoors)	81	84	81	-
All Day Dining (Indoors)	87	87	87	87
All Day Dining (Outdoors)	82	82	82	82
Reception Hall (Weddings or similar)	-	92	92	92
Reception Hall (Corporate)	-	88	-	-
Third Space (Members Only)	82	82	82	82

Noise from mechanical plant will require careful consideration in detailed design.

4 RESULTS AND ASSESSMENT

The results of the noise modelling are discussed in *Section 4.1* to *Section 4.3* as follows:

- *Section 4.1* – Considers noise from car door closings;
- *Section 4.2* – Considers noise from the reception hall at night-time; and
- *Section 4.3* – Considers patron noise for other areas at different times of the day with reference to *Table 3-3*.

4.1 Car Door Closings

Noise from car doors is a short-term event and therefore assessed against the L_{Amax} criteria, being 60 dB(A) or 70 dB(A) depending on the time of day. Such a noise is likely to be impulsive and therefore subject to a + 10 dB adjustment. The worst-case results of these calculations are provided in *Table 4-1* with *Figure 4-1* providing the noise level contours.

Table 4-1 Predicted Noise from Car Doors Closing

Location	Predicted Noise Level, dB L_{Amax}	Adjusted Noise Level, dB L_{Amax} [1]
Smiths Beach Resort	50	60
Canal Rocks Beachfront Apartments	44	54

1. Includes + 10 dB for impulsiveness.

As described, the most stringent assigned noise level is 60 dB L_{Amax}. The predicted noise levels are no more than the assigned noise level and therefore compliant at all times, noting this includes the 2.6m high boundary wall described in *Section 3.2*.

Lot 4131 Smiths Beach Road, Yallingup - Noise Level Contours

L_{Amax} Noise Level Contours for Car Door Closings
Ground Floor Level
Wall Height Relative to Smiths Beach Resort Ground Level

SoundPLAN v8.2
ISO 9613 Algorithms

23 May 2021

Legend
- New Buildings
- Car Door
- Receiver
- 2.6m High Wall

Noise levels L_{Amax} dB
- = 40
- = 45
- = 50
- = 55
- = 60
- = 65
- = 70

N

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Length Scale 1:2000
0 10 20 40 60 80 m

Figure 4-1

4.2 Reception Hall

For the purpose of the calculations, the following base construction is assumed for the Reception Hall:

- Roof/Ceiling – Metal deck with *Anticon*, 200mm cavity to 13mm thick sound-rated plasterboard ceiling (no penetrations or acoustically treated penetrations). Acoustically absorptive panels such as 25mm thick Autex *Quietspace* installed to the underside of the ceiling or acoustically equivalent.
- Floor – Acoustically hard such as timber or vinyl;
- Glazing – All glazing is minimum 6.38mm thick laminated glass with a minimum acoustic performance of $R_w + C_{tr} \geq 28$. The east window is fixed and has an area of 2.7 m^2. The west glazing is openable with an area of 16.5 m^2. The north glazing is openable with an area of 49 m^2.

Table 4-2 presents the calculated noise levels for each aspect of the reception hall. Note that patron noise is not considered to contain intrusive characteristics. Music noise however is adjusted by + 10 dB under the assumption it is not impulsive (no significant bass). The worst-case predicted noise level of 150 wedding patrons with music and all glazing open is provided as a noise contour plot in *Figure 4-2*.

Table 4-2 Predicted Noise from Reception Hall to Canal Rocks Apartments

Noise Source	Predicted Noise Level, dB L_{A10}	Adjusted Noise Level, dB L_{A10} [1]
150 Wedding Patrons on Terrace	48	48
150 Corporate Patrons on Terrace	43	43
200 Corporate Patrons – Glazing Open	46	46
200 Corporate Patrons – West Glazing Open	30	30
200 Corporate Patrons – Glazing Closed	19	19
150 Wedding Patrons with Music – Glazing Open	55	65
150 Wedding Patrons with Music – West Glazing Open	45	55
150 Wedding Patrons with Music – Glazing Closed	30	40

1. Includes + 10 dB for audible music.

The assigned level for these noise sources are 50 dB(A), 45 dB(A) and 40 dB(A) depending on the time of day, with the highest being daytime, then Sundays and evening and then night. The noise levels will vary depending on the number of people and volume of music so the predicted levels are considered upper limits.

Lot 4131 Smiths Beach Road, Yallingup - Noise Level Contours

L_{A10} Noise Level Contours for Wedding with Music and Glazing Open Ground Floor Level

SoundPLAN v8.2
ISO 9613 Algorithms

22 October 2021

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Length Scale 1:2000

0 10 20 40 60 80 m

Figure 4-2

Legend

- New Buildings
- Receiver
- Reception Hall

Noise levels L_{A10} dB

- = 40
- = 45
- = 50
- = 55
- = 60
- = 65
- = 70

N

What the above demonstrates however is that use of the northern terrace should be limited to daytime (Mondays to Saturdays) only. Compliance could be achieved on Sundays, public holidays and evenings if for instance, half the patrons were inside and half on the northern terrace, which may represent a realistic scenario. It is recommended that the western terrace of the Reception Hall be given preference and is to be used as a dedicated pre-function area.

A corporate event is likely to be daytime only. Mondays to Saturdays (7am to 7pm), these could operate with no restrictions. If corporate events occurred on Sundays, public holidays (9am to 7pm) or any evening (7pm to 10pm), the north opening would need to be 50% closed.

During a wedding whilst music is being played, all glazing would need to remain closed. Any access to the terrace (e.g. for smoking) should be via a west facade door.

4.3 Patrons Other Areas

Calculated noise levels from other proposed areas are provided in *Table 4-3*, noting all glazing is assumed to be 6.38mm thick laminated achieving $R_w + C_{tr} \geq 28$ acoustic performance and all rooms to have acoustically absorbent ceiling to achieve reverberation time of no more than 1-second. Again, patron noise is considered not to contain intrusive characteristics. In this scenario, any music is expected to be low level, background type only and inaudible at the neighbouring noise sensitive premises such that no music penalty is applied.

Table 4-3 Predicted Noise from Other Areas to Canal Rocks Apartments

Noise Source	Predicted Noise Level, dB L_{A10}	
	Glazing Open	Glazing Closed
Cafe Outdoor 40 Patrons (Morning/Evening)	34	N/A
Cafe Outdoor 80 Patrons (Day)	37	N/A
Cafe Indoors 50 Patrons (Morning/Evening) – North Glazing Open	38	12
Cafe Indoors 100 Patrons (Day) – North Glazing Open	41	15
All Day Dining Outdoors 50 Patrons	30	N/A
All Day Dining Indoors 150 Patrons	40	12
Third Space Indoors 50 Patrons	36	9

As for *Section 4.2*, the assigned level for these noise sources are 50 dB(A), 45 dB(A) and 40 dB(A) depending on the time of day, with the highest being daytime, then Sundays and evening and then night. The noise levels will vary depending on the number of people in each area and whether or not glazing to indoor areas is open. Example combined noise levels are provided in *Table 4-4*, to represent different times of the day.

Table 4-4 Predicted Combined Noise from Other Areas to Canal Rocks Apartments: Glazing Open

Area	Time of Day		
	Morning	Day	Night
Cafe Outdoor Patrons	34	37	-
Cafe Indoor Patrons	38	41	-
All Day Dining Outdoors	30	30	30
All Day Dining Indoors	40	40	40
Third Space Indoors	36	36	36
Total	**44**	**45**	**42**
Total Outdoor Areas Only	**35**	**38**	**30**
Assigned	40	45/50*	40

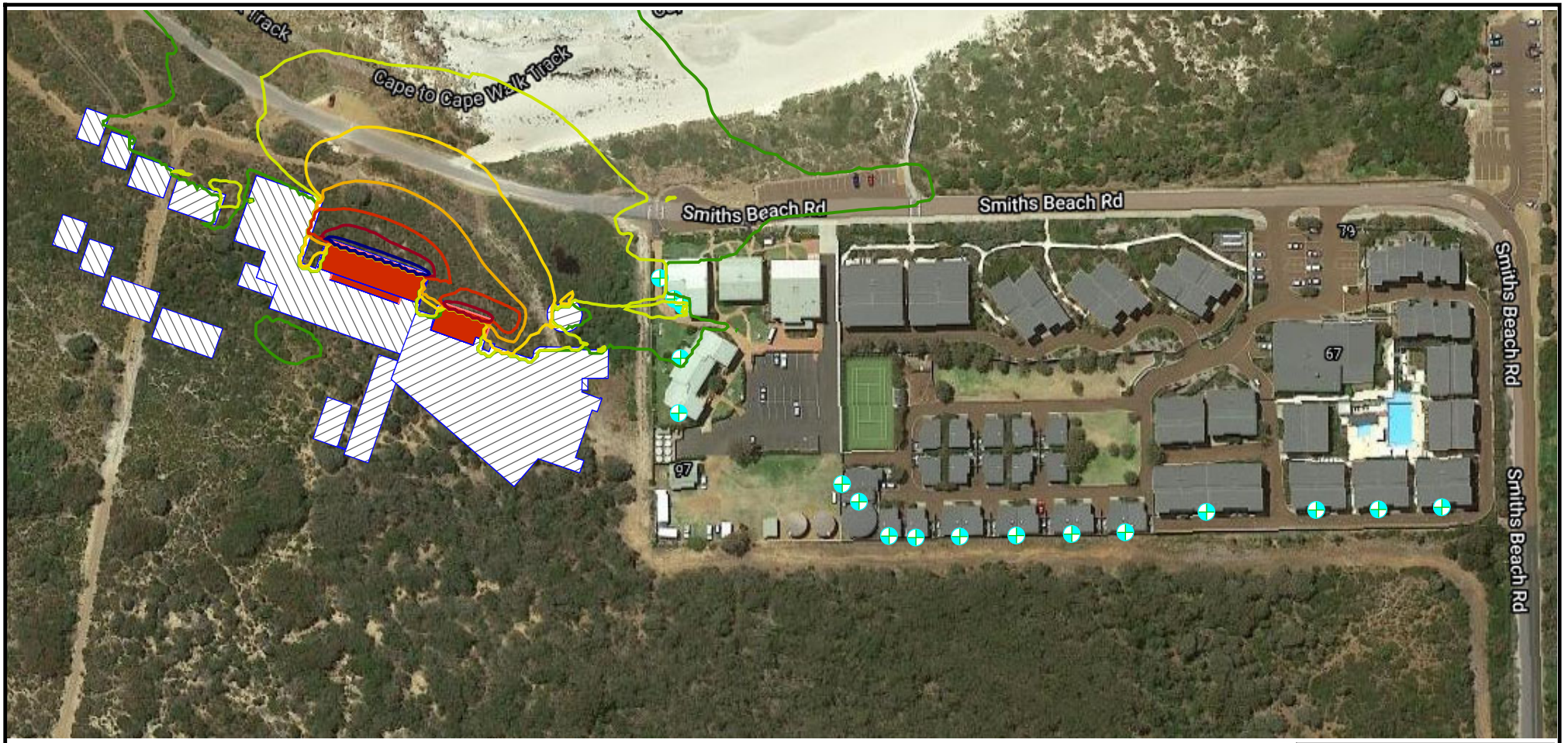
* Lower assigned level applicable on Sundays and public holidays.

The above demonstrates that should all spaces be at capacity in the morning (prior to 7am Mondays to Saturdays and prior to 9am Sundays and public holidays) with glazing open, then noise levels would be 4 dB above the assigned level. However, having all areas at capacity would be considered unlikely. If this were to occur, then closure of external glazing could reduce noise to a compliant level, with noise dominated by the outdoor areas at a level of 35 dB(A).

During the day and evening (7am to 10pm Mondays to Saturdays and 9am to 10pm Sundays and public holidays), compliance is calculated.

During the night, noise from areas (other than the Reception Hall discussed in *Section 4.2*) have the potential to exceed on the basis of All Day Dining at capacity with doors open being dominant. To achieve compliance, some or all of the glazing is to be closed to All Day Dining and/or the Third Space.

A noise contour plot of the morning scenario is provided in *Figure 4-3*.



Lot 4131 Smiths Beach Road, Yallingup - Noise Level Contours

L_{A10} Noise Level Contours for Cafe, All Day Dining and Third Space with Glazing Open and Patrons Outside
Ground Floor Level

SoundPLAN v8.2
ISO 9613 Algorithms

4 May 2021

Legend
- New Buildings
- Receiver
- Other Areas

Noise levels L_{A10} dB
- = 40
- = 45
- = 50
- = 55
- = 60
- = 65
- = 70

N

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Length Scale 1:2000
0 10 20 40 60 80 m

Figure 4-3

5 DISCUSSION

Noise from the car park areas is deemed compliant at all times, with the inclusion of a 2.6 metre high wall (relative to the ground level of the units) alongside the single storey units of the Smiths Beach Resort.

With regard to the Reception Hall, the following is recommended to minimise noise emissions:

- Construction to be:
    - Roof/Ceiling – Metal deck with *Anticon*, 200mm cavity to 13mm thick sound-rated plasterboard ceiling (no penetrations or acoustically treated penetrations). Acoustically absorptive panels such as 25mm thick Autex *Quietspace* installed to the underside of the ceiling or acoustically equivalent.
    - Floor – Acoustically hard such as timber or vinyl;
    - Glazing – All glazing is minimum 6.38mm thick laminated glass with a minimum acoustic performance of $R_w + C_{tr} \geq 28$. The east window is fixed and has an area of 2.7 m^2. The west glazing is openable with an area of 16.5 m^2. The north glazing is openable with an area of 49 m^2.
- Assuming corporate events are day and evening only (Monday to Saturday 7am to 10pm) and Sundays and public holidays (9am to 10pm), north glazing to be closed approximately 50% after 7pm Mondays to Saturdays and all the time Sunday and public holidays.
- The western terrace of the Reception Hall is preferred at all times and will be used as a dedicated pre-function area.
- For wedding type events, the north balcony is not to be used after 10pm and all glazing is to be closed whenever music is played or after 7pm.
- When glazing is required to be closed, terrace access (e.g. for smokers) shall be via door in the west facade. This door shall be fitted with automatic closer and not propped or held open.

With regard to other areas, noise emissions:

- During the day and evening, noise levels are compliant.
- Noise during the early mornings (prior to 7am Mondays to Saturdays and prior to 9am on Sundays) and night (after 10pm) may require some glazing to be closed during busy periods.

Other items that have not been specifically modelled but require consideration are:

- Management of the Campground will implement a noise management system to ensure no excessive noise from camp site area. This would be a condition of entry and persons not abiding by this will be required to leave. As well as assisting other campground users, this will also minimise noise disturbance to Smiths Beach Resort;
- Management of noise from the Surf Life Saving Club. This is located on the eastern side of the site and may consist of gathering of people early in the morning as well as wash-down and loading activities near the boat shed. Powered flushing is to occur inside the building with doors closed, during day time hours only and for short durations (no more than 2-3

minutes in any 4-hour period). The building is to incorporate absorptive lining (*Greenstuf soffit* or similar) and the doors shall be solid (no gaps) and reasonably well sealed.

- Delivery vehicles are also to be limited to daytime only, Mondays to Saturdays 7am to 7pm. Drivers are to be instructed to turn off engines and/or refrigeration units during unloading;
- Collection of waste, landscaped area maintenance and car park cleaning are to be undertaken:
    - 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 such activities are to be undertaken outside daytime hours, the works also need to be carried out according to a Noise Management Plan which has been approved by the local government authority CEO.
- All mechanical plant shall be selected for quiet operation, including allowance for attenuators in exhaust fans and the like and low speed operation at night. Preference should be given to locating plant as far west as possible (away from neighbouring accommodation). During detailed design, once equipment has been selected, this shall be subject to an acoustic assessment undertaken by a suitably qualified acoustical consultant.

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 $L_{A\ peak}$ and $L_{A\ Max\ slow}$ 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:

$\%\ \text{Type A}_{100}$ = 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

+ 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.

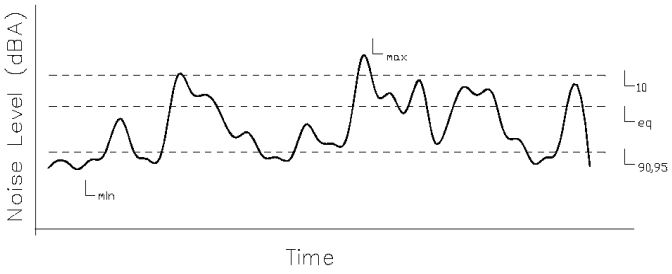
RMS Component Particle Velocity (PCPV)

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