378-390 Pacific Highway, Crows Nest

Acoustic Pre-Planning Report

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Revision

Revision	Date	Comment	Prepared By	Approved By
001	27/05/2021	For comment	Julia Knight	Elle Hewett
002	09/07/2021	Updated based on comments	Julia Knight	Elle Hewett
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004	23/08/2021	Update to reflect 378-390 Pacific Highway only	Julia Knight	Elle Hewett

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1. General Introduction

The proposed mixed-use development at 378-390 Pacific Highway, Crows Nest is a 24 storey building consisting of a 4 storey podium and 20 storey residential tower.

The purpose of this report is to provide an early exploration into the acoustic risks and opportunities for the proposed Development located opposite the Crow's Nest Metro Station at 378 to 390 Pacific Highway, Crow's Nest. The high-level assessment of the following is discussed:

- The potential noise and vibration impact of the surrounding environment on the development:
  - Target internal sound levels in different living spaces including the living room and bedrooms
  - Modes of ventilation and the need for mechanical and or natural ventilation, along with a discussion on partially enclosed balconies/wintergardens
  - Managing groundborne vibration for human comfort
  - Managing vibration for building/cosmetic damage
  - Noise control in terms of sleep disturbance
- Noise impact of the development on its surroundings
  - Potential noise from mechanical plant and equipment
  - Noise from operational activities
  - Noise from increased traffic generated from the development

2. Project Overview

2.1 Site Description

The site location is at 378 to 390 Pacific Highway in Crows Nest opposite the Metro station currently under construction. See Figure 1 for the site location and Figure 2, Figure 3 and Figure 4 showing a view indicating the future development, indicative tower envelope and sections respectively.

Figure 1: Site location

Figure 2 Architectural rendering showing proposed building looking west from Hume Street across Pacific Highway

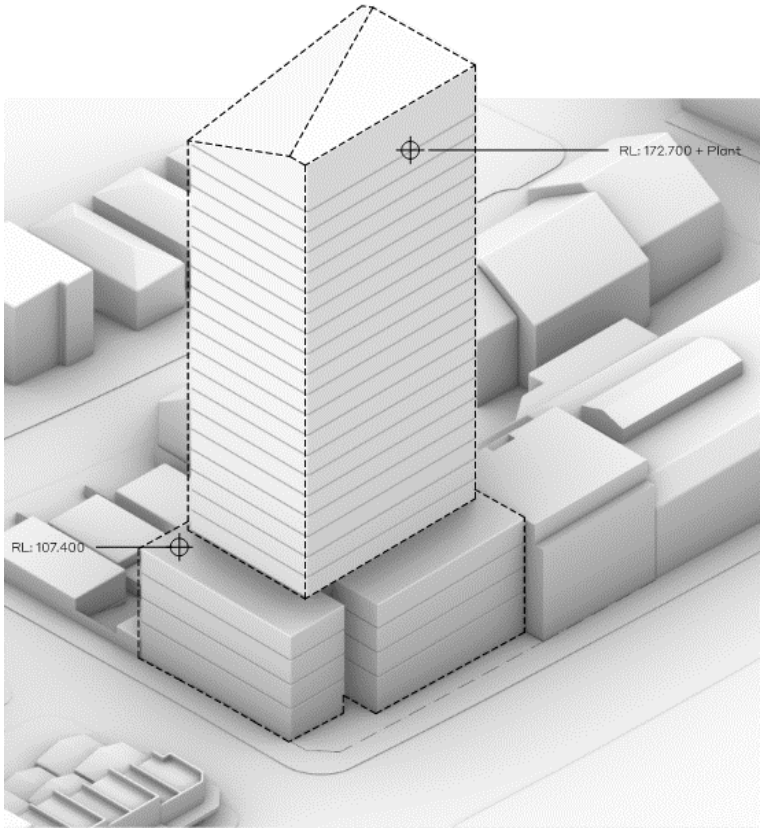


Figure 3 Indicative Tower Envelope

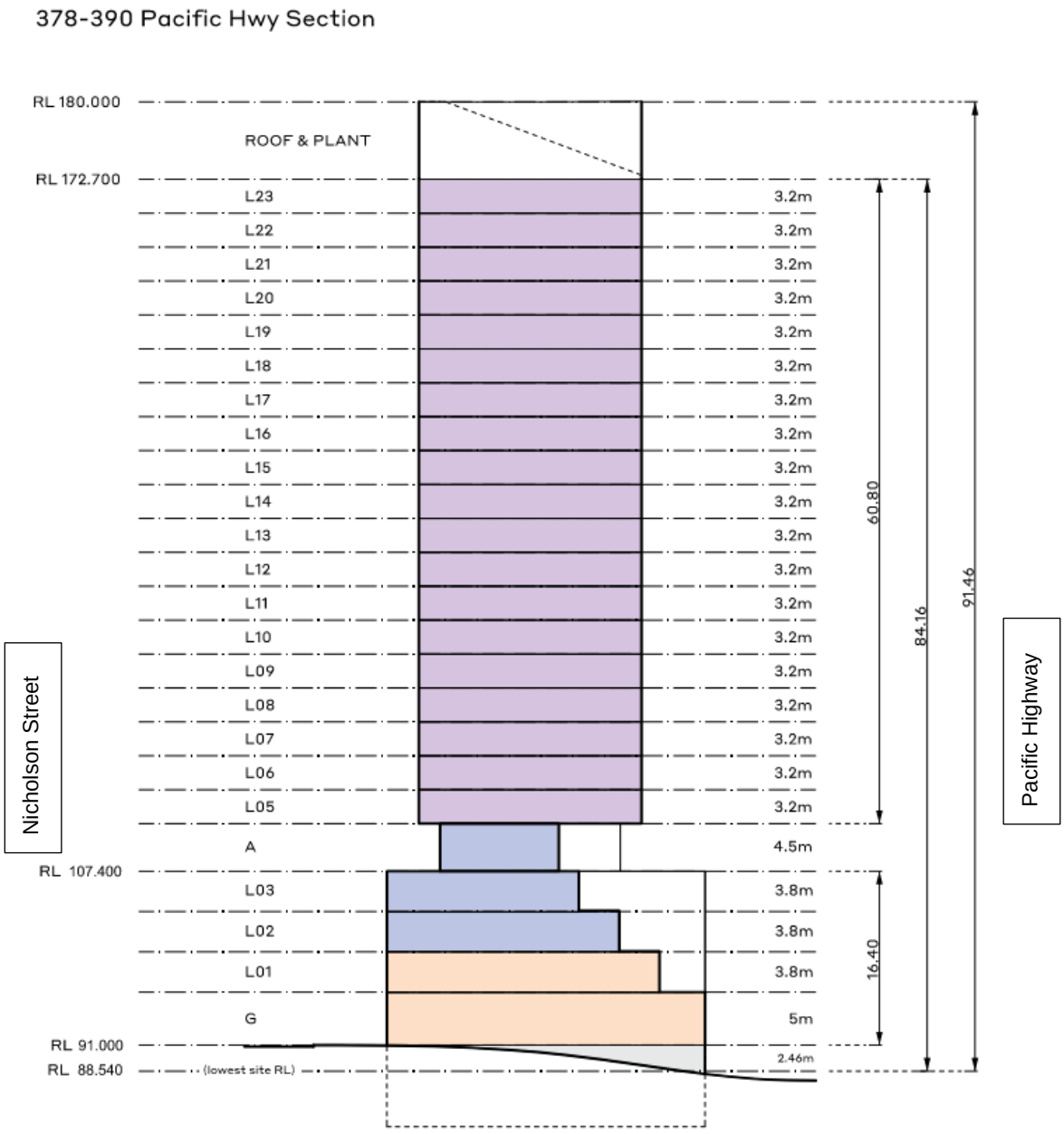


Figure 4 Podium and Tower Section (E-W)

2.2 Guidelines and Criteria

The following guidelines and standards are applicable for the development with further detail provided in Appendix B:

- Development Near Rail Corridors and Busy Roads Interim Guideline (Department of Planning, Industry and Environment)
- Noise Policy for Industry, 2017 (NSW Environment Protection Authority)
- Apartment Design Guide (Department of Planning, Industry and Environment)
- AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors
- Assessing Vibration – A Technical Guideline (Environmental Protection Authority)

- BS7385-1993 – Evaluation and measurement for vibration in building - Structural vibration in buildings – Part 2: Guide to damage levels from groundborne vibration
- NSW Road Noise Policy – Department of Environment, Climate Change and Water NSW.

3. Impact from the surrounding environment on the development

3.1 Acoustic Constraints - High level acoustic assessment of road noise

As the site is located adjacent to Pacific Highway and across from Crows Nest Metro Station, the primary challenge will be to control the internal noise for the residents while achieving fresh air ventilation of the apartments without the use of mechanical assistance. *The Apartment Design Guide* specifies that “at least 60% of apartments are naturally cross ventilated in the first 9 storeys of the building”.

It is expected that the north-eastern façade fronting the Pacific Highway and potentially some corner apartments of the adjacent facades will be most impacted by traffic noise. For these apartments achieving a natural ventilation solution that meets the requirements of the *Development Near Rail Corridors and Busy Roads Interim Guideline* simply by having openable windows or sliding balcony doors is unlikely.

Therefore, a desktop assessment has been undertaken to determine the likely extent of mitigation required to the façade and balconies.

As long-term unattended noise logging is yet to be undertaken at the site, this assessment is based on data from long term noise logging undertaken as part of the Crows Nest Metro Station SSDA assessment (2018). This data is pre Covid-19 and is therefore, representative of the typical noise environment. Although a new project specific noise survey is recommended when conditions allow and for Development Application.

The noise logger was installed at 420 Pacific Highway Crows Nest, which is approximately 70 metres from the proposed location of the Metro view development. The logger was positioned on Level 4 of the building, and on the façade facing Pacific Highway and therefore is expected to be a reasonable indication of the noise environment that may be expected at level 5 of the proposed development.

However, it should be noted that the noise logging data is 3 years old (2018) and was not obtained by Stantec. A complete assessment including new noise logging, and 3D modelling will be required as design progresses. The following assessment indicates the magnitude of the sound levels and acoustic mitigation that can be expected, although this may change pending a more detailed investigation.

Table 1 Noise logging data results from 420 Pacific Highway Crows Nest (2018)

Daytime (7am – 10pm) dB $L_{Aeq,15hour}$	Night time (10pm – 7am) dB $L_{Aeq,9hour}$
68 dB(A)	62 dB(A)

3.1.1 Acoustic mitigation guide

The following acoustic mitigation measures are recommended based on the level of traffic noise incident on the façade (Table 1).

Table 2 Acoustic mitigation guide based on predicted noise levels at the facade

Noise level predicted at facade		Acoustic Mitigation Measures
Daytime	Night time	
64 - 68 dB(A)	59 - 63 dB(A)	Partially open balcony with absorptive soffit (presented in Section 3.2)
60 - 64 dB(A)	55 - 59 dB(A)	Balcony with solid balustrade, and acoustically absorptive soffit
< 60 dB(A)	< 55 dB(A)	Windows may be operable without any additional treatment

3.1.2 Assessment results for balconies

Table 3 present the results of the desktop assessment of traffic noise in the living areas and bedrooms that lead off balconies. Note that for the mitigation option of a partially enclosed balcony, minimum open areas will apply, for the balcony not to be considered Gross Floor Area (GFA) and to comply with the natural ventilation requirements, as per Section 4, Part F4 of the Building Code of Australia (BCA).

There will also be maximum open areas for the partially enclosed balcony to allow for the required noise attenuation. It is our experience that typically, 25% of the enclosure face will need to be open for the balcony area to not qualify as GFA . However, this will need to be confirmed by Council.

Table 3 Assessment results showing acoustic mitigation measures for living spaces versus Daytime $L_{Aeq,15hour}$ traffic noise

Building Level	Internal noise level criteria, daytime, living spaces, open windows	Predicted noise level inside with no acoustic mitigation	Acoustic mitigation required	Resulting internal noise level	Meets Criteria ✗/✓
Façade facing Pacific Highway					
5 - 10	50	58	Partially enclosed balcony with an acoustically absorptive soffit expected to provide an 8 to 10 dB reduction. See section 3.2.	50 dB(A)	✓
10 - 15	50	57	Partially enclosed balcony with an acoustically absorptive soffit expected to provide an 8 to 10 dB reduction. See section 3.2.	49 dB(A)	✓
15 - 20	50	56	Partially enclosed balcony with an acoustically absorptive soffit expected to provide an 8 to 10 dB reduction. See section 3.2.	48 dB(A)	✓
20 - 23	50	55	Partially enclosed balcony with an acoustically absorptive soffit expected to provide an 8 to 10 dB reduction. See section 3.2.	47 dB(A)	✓

Building Level	Internal noise level criteria, daytime, living spaces, open windows	Predicted noise level inside with no acoustic mitigation	Acoustic mitigation required	Resulting internal noise level	Meets Criteria ×/✓
Façade facing Hume Street					
5 – 10	50	55	Partially enclosed balcony with an acoustically absorptive soffit expected to provide an 8 to 10 dB reduction. See section 3.2.	47 dB(A)	✓
10 - 15	50	54	Partially enclosed balcony with an acoustically absorptive soffit expected to provide an 8 to 10 dB reduction. See section 3.2.	46 dB(A)	✓
15 - 20	50	53	Balcony with solid balustrade, and absorptive soffit.	50 dB(A)	✓
20 - 23	50	52	Balcony with solid balustrade, and absorptive soffit.	49 dB(A)	✓

Table 4 Assessment results showing acoustic mitigation measures for bedrooms versus Night time $L_{Aeq,9hour}$ traffic noise

Building Level	Internal noise level criteria, night time, bedrooms spaces, open windows	Predicted noise level inside with no acoustic mitigation	Acoustic mitigation required	Resulting internal noise level	Meets Criteria ×/✓
Façade facing Pacific Highway					
5 - 10	45	52	Partially enclosed balcony with an acoustically absorptive soffit expected to provide an 8 to 10 dB reduction. See section 3.2.	44 dB(A)	✓
10 - 15	45	51	Partially enclosed balcony with an acoustically absorptive soffit expected to provide an 8 to 10 dB reduction. See section 3.2.	43 dB(A)	✓
15 - 20	45	50	Partially enclosed balcony with an acoustically absorptive soffit expected to provide an 8 to 10 dB reduction. See section 3.2.	42 dB(A)	✓
20 - 23	45	49	Partially enclosed balcony with an acoustically absorptive soffit expected to provide an 8 to 10 dB reduction. See section 3.2.	41 dB(A)	✓

Building Level	Internal noise level criteria, night time, bedrooms spaces, open windows	Predicted noise level inside with no acoustic mitigation	Acoustic mitigation required	Resulting internal noise level	Meets Criteria ×/✓
Façade facing Hume Street (Front apartments only, closest to Pacific Highway)					
5 – 10	45	49	Partially enclosed balcony with an acoustically absorptive soffit expected to provide an 8 to 10 dB reduction. See section 3.2.	41 dB(A)	✓
10 - 15	45	48	Balcony with solid balustrade, and absorptive soffit	45 dB(A)	✓
15 - 20	45	47	Balcony with solid balustrade, and absorptive soffit	44 dB(A)	✓
20 - 23	45	46	Balcony with solid balustrade, and absorptive soffit	45 dB(A)	✓

- No acoustic mitigation measures are expected for balconies for apartments to the rear of Hume Street closest to Nicholson Street and,
- balconies facing Nicholson Street.

Recommended Mitigation summary

Table 3 and Table 4 show that noise mitigation from the Pacific Highway is required for apartments on the entire façade directly facing the Pacific Highway and for those at the eastern end of the Hume Street façade, closest to the Pacific Highway. A summary of the requirements is as follows:

- All balconies on the façade facing pacific highway are to have a partially enclosed balcony/winter garden with an acoustically absorptive soffit
- On the Hume Street façade balconies on levels 5 to 15 are to have a partially enclosed balcony/winter garden with an acoustically absorptive soffit.
- On the Hume Street façade balconies on levels 16 to 23 are to have a balcony with solid balustrade, and absorptive soffit.

Project Precedents

We do not currently have final measured results of partially enclosed balcony/winter gardens with respect to achieving the internal noise level targets, however, a couple of projects where this approach has been incorporated into the design adjacent to a rail corridor and the M2 motorway are as follows:

- 6-14 Cambridge Street Epping, overlooking Rail corridor and Beecroft Road – At tender stage
- Lachlans Line, Macquarie Park, overlooking M2 motorway

3.1.3 Desktop Assessment results for windows on the façade (non-balcony)

If a window to a living room or bedroom exists on the façade and the external traffic noise is predicted to be greater than 60 dB(A) or 55 dB(A) respectively at that facade, it will need to be closed and an alternative means of ventilation will be required (See Table 2 and Section 3.2).

3.2 Acoustic Solutions - Typical strategies to achieve internal noise levels with respect to natural ventilation

The noise control options are presented in typical solution terms and listed in order of ability to control noise ingress to meet the relevant internal noise criteria from lowest to highest below:

3.2.1 Partially Enclosed Balconies/Winter Gardens

A semi enclosed balcony/winter garden can provide shielding from the street while still allowing airflow into the apartments. This type of solution can provide an additional 8-10 dB(A) façade sound transmission loss (Figure 5). Note, that it is important for the success of this arrangement that the inlet (open balcony section) and outlet (partially open sliding door of apartment) are offset from each other as shown by the yellow lines in Figure 5.

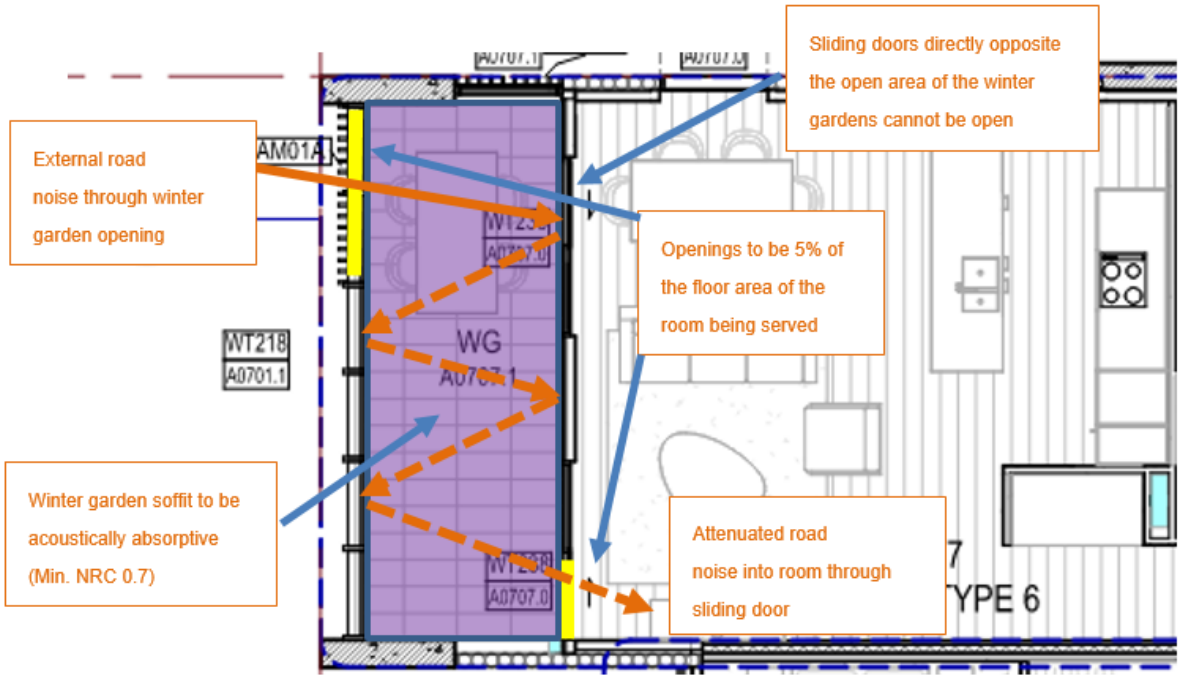
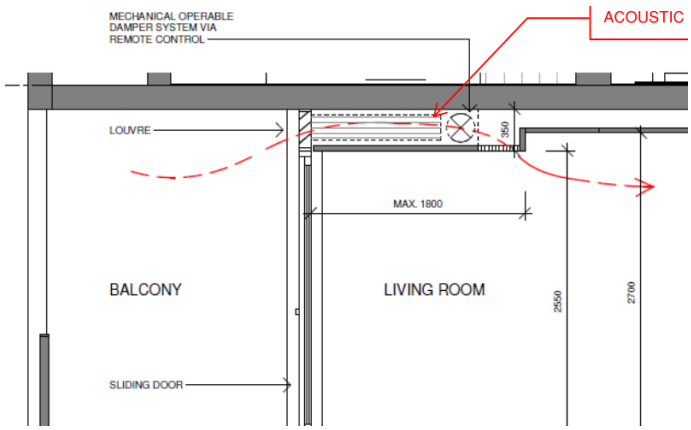
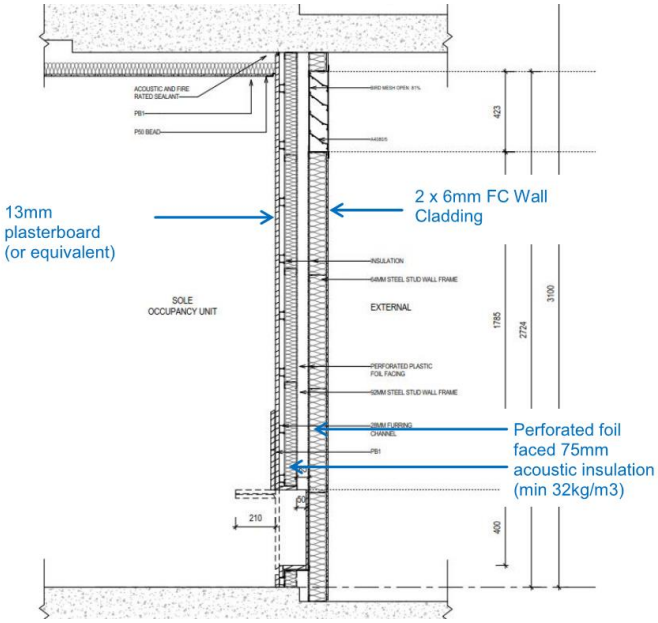


Figure 5 Example of naturally ventilated winter garden with fixed open section to achieve internal noise criteria

3.2.2 Passive Ventilator

Install a passive ventilator such as one of the examples included in Table 5. Please note that for these ventilators, specialist design advice would be required to model the air supply and required pressure drops achieved to ensure the ventilation requirements are met while also mitigating noise from the traffic.

Table 5 Passive ventilator options

Ventilator type	Ventilator diagram	Comments
Above Ceiling Ventilator		Passive method of achieving natural ventilation. Requires a bulkhead to accommodate acoustic attenuator. Relies on wind pressures on the façade. ESD/Wind consultant required to confirm airflows.
Bespoke in-wall ventilator		Passive method of achieving natural ventilation. Can be integrated in standard external wall design. Relies on wind pressures on the façade. ESD/Wind consultant required to confirm airflows

3.2.3 Acoustically Absorptive Balcony Soffit

Making the soffits of balconies absorptive through the application of acoustically absorptive materials such as, Pyrotek Reapor (an absorptive stone finish), or perforated metal or compressed fiber cement with a polyester blanket backing can provide a useful 3-4 dB(A) reduction depending also on the balcony depth and shielding from the balustrade (Figure 7and Figure 7).

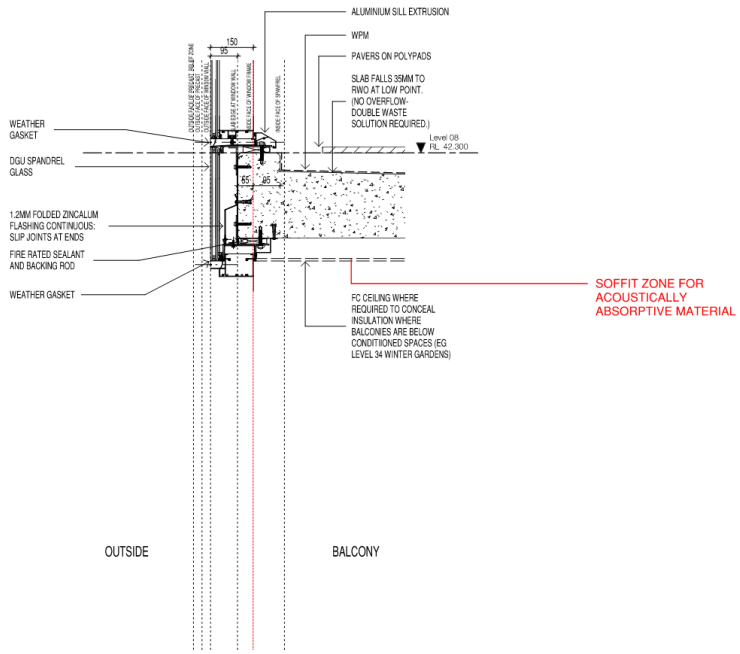


Figure 6 Typical absorptive balcony soffit detail

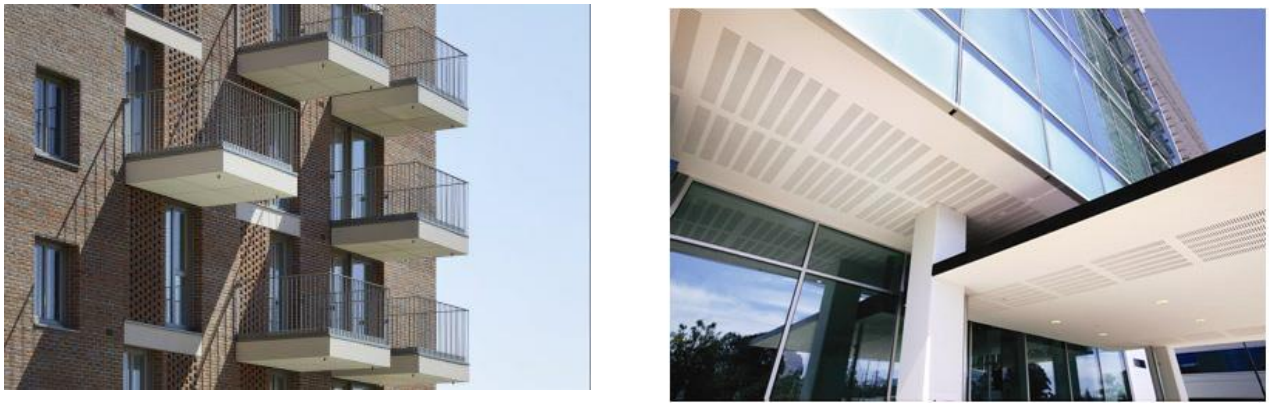
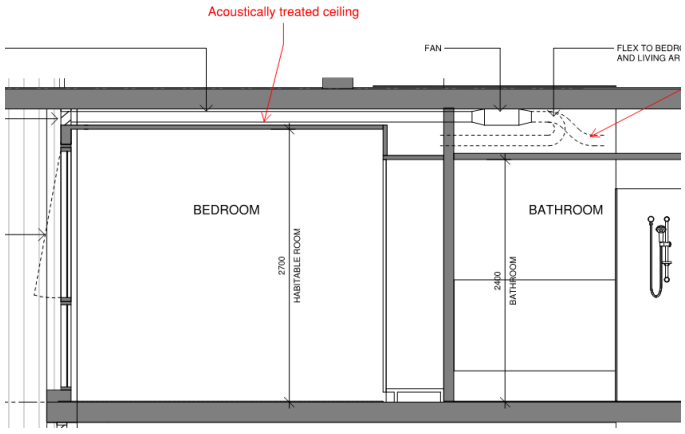


Figure 7 Example absorptive balcony soffit photographs

3.2.4 Mechanical Ventilation

Where none of the above systems can be used it will be necessary to install traditional mechanical ventilation consisting of an outside air mechanical fan as per Table 6 .

Table 6 Mechanical ventilation

Ventilator type	Ventilator diagram	Comments
Mechanical Outside Air Fan		This option requires less deign coordination than passive methods. Ventilation doesn't rely on wind pressures. Can also be powered by PV. Not considered as a means of natural ventilation by some councils.

3.3 Façade Glazing Recommendations

To meet internal design sound levels for rooms through sealed facades the façade glazing is typically the weakest component and the controlling sound insulating element. Given the high traffic volumes on the Pacific Highway, the glazing will likely require a high performance single or double glazed unit on the façade facing the Pacific Highway of Rw 36 to Rw 40. Other facades will likely require glazing in the order of Rw 30 to Rw 35. These acoustic performances are readily achievable and available from typical glazing suppliers. These recommendations will be further developed during the development application and design stages.

Table 7: Typical glazing performances

Typical system assembly	Required Acoustic Rating of Glazing Assembly (min. Rw)
Single glazed units (6.38mm laminated)	33
Single glazed units (8.38mm laminated) or 6/12/6 DGU	35
Single glazed units (10.38mm laminated) or 6/12/8 DGU	36
Single glazed units (12.38mm laminated)	37
12.5mm vLam Hush	40

3.4 Internal vibration

3.4.1 Human comfort

As shown in Figure 8, the Rail Vibration graph provided in the *"Development near Rail Corridors and Busy Roads – Interim Guideline"*, the Metroview, will need assessment as the project progresses as it will be within 60 meters of the underground Metro tunnel. It should also be noted that the Metro tunnel and station will have measures in place to reduce the ground borne vibration through track design to protect its own Over Station Development, and therefore the vibration impact risk for the development is low.

Rail Vibration

The vibration assessment zone for typical development sites adjacent to rail corridors or above rail tunnels is shown in **Figure 3.2**. The assessment zone may need to be increased for specific areas where vibration issues are known to already exist. Refer to section 3.6.3 vibration criteria for additional information. Developments within this zone will need a vibration assessment.

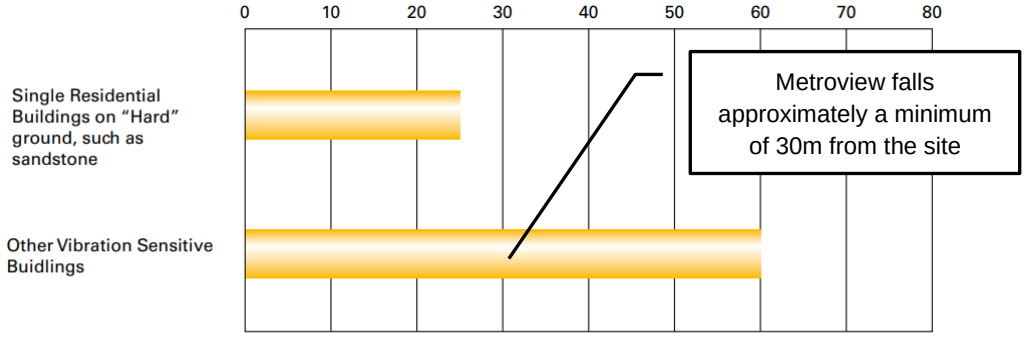


Figure 3.2: Distance from the nearest operational track (m)

Figure 8 – Excerpt from "Development near Rail Corridors and Busy Roads – Interim Guideline" Figure 3.2

3.4.2 Cosmetic or Structural Damage

The vibration criteria for human comfort are far more stringent than those for the cosmetic or structural damage. When the human comfort criteria are met, then the criteria for cosmetic and structural damage are also expected to be achieved.

4. Impact of the development on its surroundings

4.1 Noise Criteria and receivers

As long term unattended noise logging has not been competed for the site, the Noise Policy for Industry Intrusiveness and Amenity Criteria determined as part of the Crows Nest Metro Station acoustic assessment have been used for this assessment to inform early pre-planning advice.

The Intrusiveness and amenity criteria for the Crows Nest Metro Station – Over-station Development are presented in Table 8.

Table 8 Amenity Criteria as determined in the Crows Nest Metro Acoustic Report (2018)

	Day 07:00 – 18:00	Evening 18:00 – 22:00	Night 22:00 – 07:00
Intrusiveness Criteria $L_{Aeq\ 15\ min}$ dB(A)	59	55	50
Amenity Criteria $L_{Aeq\ 15\ min}$ dB(A)	56	55	50

The lowest of each intrusiveness and amenity criterion for each period apply at the boundary of residential receivers on or close to the Pacific Highway. A lower noise criterion will apply to residential receivers to the rear of the building where ambient noise levels will be lower.

4.2 Mechanical noise

Two levels of building services plant are proposed to be located on level 24 and 25 of the proposed development. Given the close proximity of residential receivers in adjacent buildings noise control methods are likely to be required.

Following are some typical practices to mitigate noise from operation of mechanical plant and equipment on rooftop plantrooms.

- Where possible, locate plant as far away from possible noise sensitive receivers as practical
- Select low noise mechanical equipment
- Acoustic louvres or solid barriers are likely to be required on the façade of the plant spaces on level 24 and 25.
- Cooling towers and air-cooled chillers may require acoustic attenuators on the exhaust fans and or a physical barrier
- Where possible, locate noisy plant within an enclosed plant space
- Carpark exhaust is to be included in the mechanical assessment. Carpark exhaust fans are typically located in a plant room in a basement allowing for sufficient ductwork to allow for acoustic internal lining or an attenuator or supply and exhaust to meet environmental noise criteria.
- If there is a generator on site, it is recommended to select an enclosed, containerised type to control noise emissions. It is likely that acoustic louvres would be required in the generator plant room. If the generator is not of the containerised type, then long 2.4-3m attenuators will likely be required on the intake and outlet of the cooling fans and a similar length muffler on the exhaust.

Further, assessment will take place during the design stage.

4.3 Noise from traffic generated by the development

The Road Noise Policy states that

> *"For existing residences affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise should be limited to 2 dB above that of the corresponding 'no build option'"*

Given that a 2dB increase represents approximately a 60% increase in traffic volumes around the site, it is unlikely that traffic generated by the development would increase traffic volumes to this extent given the already busy roads in the vicinity.

5. Conclusion

For the purposes of pre-planning an early high-level investigation has been undertaken into the acoustic risks and opportunities for the proposed Development located opposite the Crow's Nest Metro Station at 378 to 390 Pacific Highway.

Traffic noise ingress has been assessed and the following acoustic mitigation is recommended to achieve natural ventilation for the apartments:

- All balconies on the façade facing the Pacific Highway are to have a partially enclosed balcony with an acoustically absorptive soffit.
- On the Hume Street façade balconies on levels 5 to 15 are to have a partially enclosed balcony with an acoustically absorptive soffit.
- On the Hume Street façade balconies on levels 16 to 23 are to have a balcony with solid balustrade, and absorptive soffit.
- All other balconies do not require acoustic mitigation due to distance and shielding from the traffic noise on the Pacific Highway.

Note, that these recommendations have been based on the Crows Nest Metro OSD Development Application in absence of a current noise survey undertaken by Stantec. Therefore, the recommendations are preliminary in nature and the assessment provides the expected magnitude of noise control that may be required. Further analysis will be undertaken for Development Application including a new noise survey and 3Dcomputer modelling of the development. A variety of strategies to achieve internal noise levels with respect to natural ventilation are presented in Section 3.2.

Given the high traffic volumes on the Pacific Highway, the glazing will likely require a high performance single or double glazed unit on the façade facing the Pacific Highway of Rw 36 to Rw 40. Other less noise affected facades will likely require glazing in the order of Rw 30 to Rw 35.

A groundborne noise and vibration assessment will be undertaken for Development Application as the proposed development is within 60 meters of the Metro tunnel. However, it is likely that the Metro tunnel and station will have measures in place to reduce the groundborne noise and vibration through track design to protect its own Over Station Development, and therefore the groundborne noise and vibration impact risk for the development is low.

The potential noise impact from traffic generated by the development has been determined to be negligible.

From the high-level assessments undertaken in this report, Stantec believe that pre-planning approval should not be rejected on acoustic grounds as it is expected that acoustic criteria for the site are able to be achieved with reasonable and feasible noise mitigation measures.

Appendix A Glossary of Acoustic Terms

NOISE	
Acceptable Noise Level:	The acceptable LAeq noise level from industrial sources, recommended by the EPA (Table 2.1, INP). Note that this noise level refers to all industrial sources at the receiver location, and not only noise due to a specific project under consideration.
Adverse Weather:	Weather conditions that affect noise (wind and temperature inversions) that occur at a particular site for a significant period of time. The previous conditions are for wind occurring more than 30% of the time in any assessment period in any season and/or for temperature inversions occurring more than 30% of the nights in winter).
Acoustic Barrier:	Solid walls or partitions, solid fences, earth mounds, earth berms, buildings, etc. used to reduce noise.
Ambient Noise:	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment Period:	The period in a day over which assessments are made.
Assessment Location	The position at which noise measurements are undertaken or estimated.
Background Noise:	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level.
Decibel [dB]:	The units of sound pressure level.
dB(A):	A-weighted decibels. Noise measured using the A filter.
Extraneous Noise:	Noise resulting from activities that are not typical of the area. Atypical activities include construction, and traffic generated by holidays period and by special events such as concert or sporting events. Normal daily traffic is not considered to be extraneous.
Free Field:	An environment in which there are no acoustic reflective surfaces. Free field noise measurements are carried out outdoors at least 3.5m from any acoustic reflecting structures other than the ground
Frequency:	Frequency is synonymous to pitch. Frequency or pitch can be measured on a scale in units of Hertz (Hz).
Impulsive Noise:	Noise having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent Noise:	Level that drops to the background noise level several times during the period of observation.
LAmax	The maximum A-weighted sound pressure level measured over a period.
LAmin	The minimum A-weighted sound pressure level measured over a period.
LA1	The A-weighted sound pressure level that is exceeded for 1% of the time for which the sound is measured.
LA10	The A-weighted sound pressure level that is exceeded for 10% of the time for which the sound is measured.
LA90	The A-weighted level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
LAeq	The A-weighted “equivalent noise level” is the summation of noise events and integrated over a selected period of time.

LAeqT	The constant A-weighted sound which has the same energy as the fluctuating sound of the traffic, averaged over time T.
Reflection:	Sound wave changed in direction of propagation due to a solid object met on its path.
R-w:	The Sound Insulation Rating R-w is a measure of the noise reduction performance of the partition.
SEL:	Sound Exposure Level is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound Absorption:	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound Level Meter:	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound Pressure Level:	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound Power Level:	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise:	Containing a prominent frequency and characterised by a definite pitch.

Appendix B Criteria Details

5.1 Internal noise criteria

5.1.1 AS/NZS 2107:2016 Acoustics

Australian Standard AS/NZS 2107:2016 – *'Acoustics- Recommended design sound levels and reverberation times for building interiors'* specifies target noise levels for internal spaces to the development. Traffic noise intrusion AS 3671 refers to internal noise compliance with AS/NZS2107:2016. Refer to Table 9 for the values corresponding to residential spaces near minor roads.

Table 9: Recommended noise levels according to AS/NZS 2107:2016

Houses and apartments in suburban areas or near minor roads	Recommended Design Sound Level, $L_{Aeq,t}$, dB(A)	
	Satisfactory	Maximum
Sleeping areas	30	35
Living areas	30	40
Work Areas	35	40
Common Areas (lift lobby, foyer)	45	50

5.1.2 Development Near Rail Corridors and Busy Roads Interim Guideline

The DoP's Development near Rail Corridors and Busy Roads – Interim Guideline, governs the required maximum internal noise levels averaged over certain periods within bedrooms and living areas of apartments in the development. The guideline details the application of clause 87 and clause 102 of the State Environmental Planning Policy (SEPP) Infrastructure which states the following for residential developments:

> *"If the development is for the purposes of residential accommodation, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded:*
>
> *In any bedroom in the residential accommodation – 35 dB(A) at any time between 10.00 pm and 7.00 am,*
>
> *Anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway) – 40 dB(A) at any time."*

The DoP's Development near Rail Corridors and Busy Roads – Interim Guideline, also states the following regarding an open windows assessment:

> *"If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia."*

Table 10 provides a summary of the criteria established in the DoP's Interim Guideline below.

Table 10: Development near Rail Corridors and Busy Roads Interim Guideline Internal Noise Criteria

Type of habitable space	Applicable Time Period	Assessment Noise Metric	Windows/Doors Closed Criteria – dB(A)	Windows/Doors Open Criteria – dB(A)
Sleeping areas (bedrooms)	10:00pm – 7:00am	Airborne $L_{Aeq,9h(night)}$	35	45
		Groundborne L_{Amax} (95th Percentile)	35	N/A
Living rooms	At any time	Airborne L_{Aeq}	40	50
		Groundborne $L_{Amax(day)}$ (95th Percentile)	40	N/A

5.1.3 Sleep Disturbance Criteria

The NSW Noise Policy for Industry (NPI) establishes sleep disturbance criteria for residential receivers near industrial noise sources during the night-time period, such as vehicle movements and the train passing by. The criteria for protecting the amenity of surrounding residential receivers from sleep disturbance are:

- External - $L_{Aeq,15min}$ 40 dB(A) or prevailing RBL plus 5dB, whichever is greater, and/or
- External - L_{AFmax} 52 dB(A) or prevailing RBL plus 15dB, whichever is greater

The criteria will be determined based on results from acoustic noise logging as part of the SSDA.

5.2 Internal vibration criteria

5.2.1 Vibration targets for human comfort

The NSW Environment Protection Authority (EPA) developed a document, “Assessing vibration: A technical Guideline” in February 2006 to assist in preventing human exposure to excessive vibration levels within buildings. Vibration and its associated effects are usually classified as continuous, impulsive, or intermittent.

Human Comfort – Continuous and Impulsive Vibration Criteria

Structural vibration in buildings can be detected by occupants and can affect them in many ways including reducing their quality of life, comfort levels, and their working efficiency. Typical Complaints from occupants of buildings subject to vibration depend upon their use of the building and the time of the day.

Maximum allowable magnitudes of building vibration with respect to human response are shown in Table 11. It should be noted that the human comfort vibration criteria are more stringent than those for building damage.

Table 11: Preferred and maximum weighted RMS values for continuous and impulsive vibration acceleration (m/s^2) 1-80Hz

Location	Assessment period[1]	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration					
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Impulsive vibration					
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14

Human Comfort – Intermittent Vibration Criteria

Disturbance caused by vibration will depend on its duration and its magnitude. This methodology of assessing intermittent vibration levels involves the calculation of a parameter called the Vibration Dose Value (VDV) which is used to evaluate the cumulative effects of intermittent vibration. Numerous studies support the fact that VDV assessment methods are far more accurate in assessing the level of disturbance than methods which is only based on the vibration magnitude.

Table 12: Acceptable Vibration Dose Values for Intermittent Vibration (m/s$^{1.75}$)

Location	Daytime (7:00am to 10:00pm)		Night-time (10:00pm to 7:00am)	
	Preferred value	Maximum value	Preferred value	Maximum value
Residences	0.20	0.40	0.13	0.26

5.3 Noise from mechanical plant and daily operation

The NPI sets out noise criteria to control the noise emission from industrial noise sources from activities listed in Schedule 1 of the POEO Act and regulated by the EPA. The external noise due to mechanical services from the proposed development is also addressed following the guideline in the NSW EPA's NPI.

The criteria determination will be based on the results of future ambient and background noise unattended monitoring, addressing two components:

- Controlling intrusive noise into nearby residences (Intrusiveness Criteria)
- Maintaining noise level amenity for particular land uses (Amenity Criteria)

Once both criteria are established the most stringent for each considered assessment period (day, evening, night) is adopted as the project-specific noise level (PSNL).

Intrusiveness Criteria

The NSW EPA NPI states the following:

> *"The intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB(A)."*

The intrusiveness criterion can be summarised as follows:

Table 13: EPA NPI Intrusiveness Criteria

Period	Noise Descriptor – dB(A)
Daytime 7am – 6pm	$L_{Aeq,15min} \leq$ RBL + 5
Evening 6pm – 10pm	$L_{Aeq,15min} \leq$ RBL + 5
Night 10pm – 7am	$L_{Aeq,15min} \leq$ RBL + 5

Amenity Criteria

The NSW NPI states the following:

> *"To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 2.2 where feasible and reasonable. The recommended amenity noise levels will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance. The recommended amenity noise levels have been selected on the basis of studies that relate industrial noise to annoyance in communities" (Miedema and Voss, 2004).*

To ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows:

> *"Project amenity noise level for industrial developments = recommended amenity noise level (Table 2.2) minus 5 dB(A)"*

The applicable parts of Table 2.2: Amenity noise levels which are relevant to the project are reproduced below:

Table 14: NSW NPI Table 2.2 amenity criteria for external noise levels

Type of Receiver	Noise Amenity Area	Time of Day	L_{Aeq} , dB(A) Project amenity noise level
Residential Receiver	Urban*	Day	60
	Urban*	Evening	50
	Urban*	Night	45
Commercial Receiver	All	When in use	65

*Urban area as defined in EPA NSW NPI Table 2.3

5.4 Noise from traffic generation from the site

The L_{Aeq} noise level or the "equivalent continuous noise level" correlates best with the human perception of annoyance associated with traffic noise. Road traffic noise impact is assessed in accordance with the NSW Road Noise Policy (RNP, Office of Environment and Heritage 2011). The criterion (Table 3 – Road Traffic Noise Assessment Criteria for Residential Land Uses) divides land use developments into distinct categories and lists the respective criteria for each case. The category that is relevant to the proposed use of the site is shown in Table 15.

Table 15: NSW Road Noise Policy – Traffic Noise Assessment Criteria

Road Category	Type of project/land use	Assessment Criteria – dB(A) (external)	
		Day (7am – 10pm)	Night (10pm – 7am)
Freeway/ arterial/ sub-arterial roads	4. Existing residences affected by noise from new freeway/arterial/sub-arterial road corridors 6. Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial road corridors generated by land use developments	$L_{Aeq, (1\ hour)}$ 60	$L_{Aeq, (1\ hour)}$ 55
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq,1\ hour}$ 55	$L_{Aeq,1\ hour}$ 50

In the event that the traffic noise at the site is already in excess of the criteria noted above, the NSW RNP states that the primary objective is to reduce the existing level through feasible and reasonable measures to meet the criteria above.

If this is not achievable, *Section 3.4.1 Process for applying the criteria – Step 4* states that for existing residences affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise should be limited to 2 dB above that of the corresponding 'no build option'. The inherent quality of noise from vehicles on public roads arriving to and departing from the site would be indistinguishable from other traffic noise on public roads.

Design with
community in mind

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