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PEAT ISLAND REZONING

Environmental Noise Assessment

4 August 2021

NSW Department of Planning, Industry & Environment

TL432-01F02 Environmental Noise Assessment (r4)

35 1982-2017 ACOUSTIC ENGINEERING EXCELLENCE

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1 Introduction

Renzo Tonin & Associates was engaged to conduct an environmental noise assessment of the proposed rezoning of surplus government owned land at Mooney Mooney and Peat Island (the site). This report quantifies the noise impacts from road traffic noise from nearby roads affecting the concept plan of potential future land uses. Specifically, this report identifies the compliance capability of the proposal with the NSW Environment Protection Authority's (EPA) 'Road Noise Policy' (RNP); the NSW 'State Environmental Planning Policy (Infrastructure)' 2007 (ISEPP), with regard to road traffic noise impact from the M1 Pacific Motorway.

In-principle design measures and noise controls are provided to show that future development envisaged as a result of the concept plan is capable of complying with nominated traffic noise goals.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

2 Project Description

This Planning Proposal has been prepared on behalf of Property & Development NSW that seeks amendments to the Gosford Local Environmental Plan 2014 (GLEP 2014) for surplus Government owned land at Peat Island and Mooney Mooney (the Site).

The aim of the Planning Proposal is to facilitate the future redevelopment of the site, for a mix of residential, community, tourism and employment generating land uses.

This Planning Proposal was first submitted to Central Coast Council in November 2016. Gateway Determination was issued by the Department of Planning, Industry and Environment (DPIE) on 10 August 2017 (PP_2017_CCPAS_006_00 (17/06254). The Gateway Determination stated that while the supporting studies were sufficient, a number of conditions are required to be addressed prior to progressing the Planning Proposal further. Since August 2017, Property & Development NSW has undertaken a significant amount of consultation with public authorities and Central Coast Council (Council), including the submission of a revised Planning Proposal to Council in December 2018 for review and comments.

Post the 2018 submission, Property & Development NSW has engaged technical consultants to undertake further environmental investigations to respond to Council's and public authorities' feedback.

The indicative Concept Plan has been revised in accordance with the additional technical investigations post 2018 submission. The revised indicative Concept Plan comprehensively evaluated the additional environmental and physical constraints, and responded to site's context, future amenity and connectivity.

The revised indicative Concept Plan is shown in Figure 1..

Lot 9 DP 863305 is excluded from the Planning Proposal, given it is under the care, control and management of Central Coast Council and will be retained as RE1 Public Recreation Zone. The indicative Concept Plan identifies a proposed Rural Fire Services (RFS) at this location. This RFS facility does not form part of this Planning Proposal and is subject to further stakeholder consultation and a separate planning proposal.

The indicative Concept Plan also identifies a proposed location for a Marine Rescue NSW facility. This facility is subject to further stakeholder consultation and a separate proposal.

A land-based marina is shown on the Indicative Concept Plan located on the foreshore of the Hawkesbury River adjacent to Peat Island. It does not form part of the planning proposal and would be subject to a separate future planning proposal if it is to proceed. This would include a detailed environmental assessment of the impacts.

This part of the site is currently zoned partly RE1 Public Recreation and partly SP2 Infrastructure (for the purpose of hospital) under GLEP 2014 and is proposed to be rezoned to RE2 Private Recreational

Zone. A car park is proposed to be an Additional Permitted Use under Schedule 1 of GLEP 2014 on a portion of the site as part of the Planning Proposal.

This Environmental Noise Assessment Report has been prepared based on the revised indicative Concept Plan and the draft LEP zoning maps.

2.1 Proposed planning control amendments

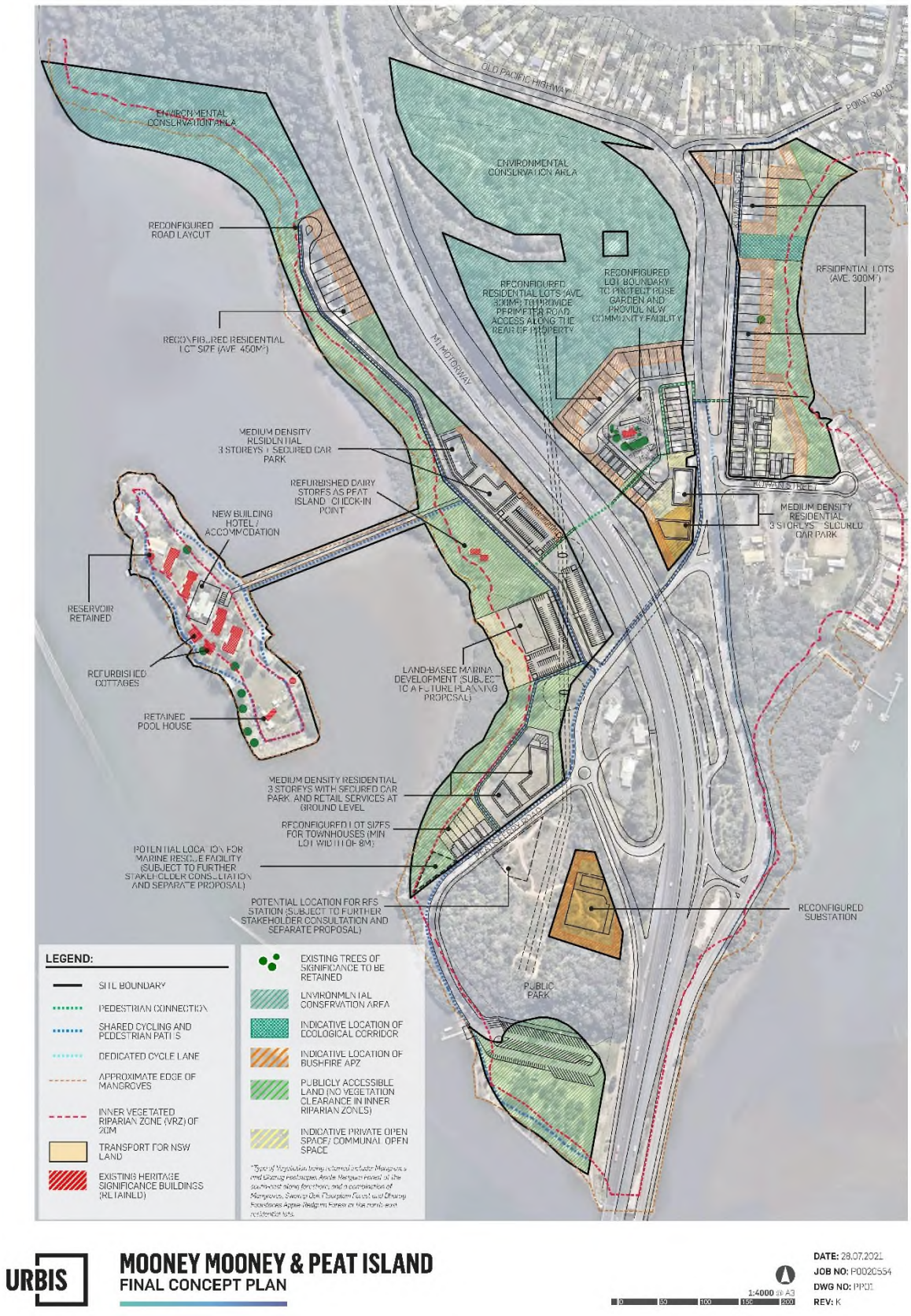
The Planning Proposal is seeking to amend the following provisions of the GLEP 2014:

- Amend Clause 2.1 Land Use Zones of the GLEP 2014 to include SP3 Tourist zone listed under Special Purpose Zones. The proposed SP3 Tourist Zone objectives and proposed permissible uses are consistent with the draft SP3 Tourist zone within the draft Consolidated Central Coast Consolidated Local Environmental Plan (CCLEP). Therefore, this Planning Proposal will be consistent with draft CCLEP, subject to gazettal.
- Amend the GLEP 2014 Land Zoning Map applicable to the site, and rezone SP2 Infrastructure and RE1 Public Recreation zones to E2 Environmental Conservation, R1 General Residential, R2 Low Density Residential, RE1 Public Recreation, RE2 Private Recreation, and SP3 Tourist zones.
- Amend the GLEP 2014 Height of Buildings Map to reflect the maximum height of the buildings proposed (8.5m, 12m and 15m) across selected areas of the site as indicated on the proposed Height of Buildings Map.
- Amend the GLEP 2014 Lot Size Map to allow minimum lots size of 150sqm, 220sqm, 300sqm and 450sqm across selected areas of the site as indicated on the proposed Minimum Lot Size Map.
- Amend the GLEP 2014 Additional Permitted Uses Map and amend the GLEP 2014 Schedule 1 Additional permitted uses to include the use of certain land at Mooney Mooney, including:
  - RE2 Private Recreation zoned land, being portion of Lot 11, DP 1157280 and Lot 12, DP 1158746 as identified on the Additional Permitted Uses Map.
    - To include ‘car parks’ as additional permitted use on this part of the site.
  - R1 General Residential zoned land, being the southern portion of Lot 14, DP1158746 as identified on the Additional Permitted Uses Map.
    - Development for the purposes of emergency services facility is permitted with development consent. The proposed emergency services facility is permissible with consent within the proposed R1 General Residential zone under the draft CCLEP. Therefore, this Planning Proposal will be consistent with draft CCLEP, subject to gazettal).

- RE1 Public Recreational zoned land, being the southern portion of lot 4 DP239249 as identified on the Additional Permitted Uses Map.
    - Development for the purposes of emergency services facility is permitted with development consent. The proposed emergency services facility is permissible with consent within the proposed RE1 zone under the draft CCLEP. Therefore, this Planning Proposal will be consistent with draft CCLEP, subject to gazettal.
- R1 General Residential zoned land, being the south eastern portion of lot 12, DP1158746 located along Peats Ferry Road, lot 12, DP863305 and the southernmost portion of lot 14DP1158746, as identified on the Additional Permitted Uses Map:
    - Development for the purpose of 'food and drink premises' and 'shops' are permitted with development consent.
    - The indicative Concept Plan comprises local shops/restaurants and cafes in the form of shop top housing within the Southern Foreshore precinct and the Chapel precinct, which has an area of approximately 200sqm. The proposed shops and food and drinks premises are of a scale that is better suited for this local area. Shops. Restaurants and cafes are prohibited under the R1 zone of the Gosford LEP and the draft CCLEP. Given the proposal no longer includes a service station and a neighbourhood centre, it is proposed to include food and drink premises and local shops to provide sufficient and much needed local retail services for exiting and incoming residents.
- RE1 Public Recreation zoned land, being Lot 11 DP863305 as identified on the Additional Permitted Uses Map.
    - Development for the purpose of electricity generating works is permitted with development consent.

In addition, consistent with the recommendation of the CMP, this Planning Proposal includes the proposed LEP amendment to include Peat Island as an Item of Environmental Heritage (Item - General) under Part 1 - Heritage Items, Schedule 5 of the Gosford LEP.

Figure 1 – Location of Subject Site and Final Indicative Concept Plan



3 Road Traffic Noise Criteria

3.1 NSW Road Noise Policy (RNP)

The NSW 'Road Noise Policy' (RNP) was introduced in July 2011 and replaced the NSW 'Environmental Criteria for Road Traffic Noise' (ECTRN). Table 3 of the RNP outlines criteria to be applied to particular types of road development and land use. The criteria apply when assessing noise impact and determining mitigation measures for existing developments that are potentially affected by road traffic noise, with the aim of preserving the amenity appropriate to the land use.

Unlike the ECTRN, the RNP no longer stipulates noise criteria for new land use developments potentially impacted by road traffic noise. Criteria for new residential developments affected by existing roads are now addressed through the 'State Environmental Planning Policy (Infrastructure)' 2007 ('ISEPP') and the associated NSW Department of Planning 'Development Near Rail Corridors and Busy Roads – Interim Guideline'.

3.2 State Environmental Planning Policy (Infrastructure) 2007 (ISEPP)

The NSW 'State Environmental Planning Policy (Infrastructure)' 2007 (known as 'ISEPP') is used to facilitate the effective delivery of infrastructure across the State. The aim of the policy includes identifying the environmental assessment category into which different types of infrastructure and services development fall and identifying matters to be considered in the assessment of development adjacent to particular types of infrastructure.

Pertinent to noise assessment, the ISEPP includes the following clauses:

"102 Impact of road noise or vibration on non-road development

1. *This clause applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data published on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:*
   a. *a building for residential use,*
   b. *a place of public worship,*
   c. *a hospital,*
   d. *an educational establishment or child care centre.*
2. *Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Director-General for the purposes of this clause and published in the Gazette.*

3. *If the development is for the purposes of a building for residential use, 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 LAeq levels are not exceeded:*

    e. in any bedroom in the building - 35 dB(A) at any time between 10 pm and 7am,

    f. anywhere else in the building (other than a garage, kitchen, bathroom or hallway) - 40 dB(A) at any time.

4. *In this clause, "freeway", "tollway" and "transitway" have the same meanings as they have in the Roads Act 1993"*

To support the ISEPP, the NSW Department of Planning released the '*Development Near Rail Corridors and Busy Roads – Interim Guideline*' (December 2008). The Guideline assists in the planning, design and assessment of developments in, or adjacent to, major transport corridors in terms of noise, vibration and air quality. While the ISEPP applies only to roads with an AADT greater than 40,000 vehicles, the guideline is also recommended for other road traffic noise affected sites.

The Guideline clarifies the time period of measurement and assessment. Section 3.4 '*What Noise and Vibration Concepts are Relevant*' and Table 3.1 of Section 3.6.1 confirms that noise assessment is based over the following time periods:

- Daytime 7:00am - 10:00pm LAeq(15hr)
- Night-time 10:00pm - 7:00am LAeq(9hr)

The noise criteria nominated in the ISEPP apply to internal noise levels with windows and doors closed. However, as this preliminary noise assessment is based on predictions at external locations, equivalent external noise criteria have been established. The equivalent external noise criterion is used to determine which areas of the development may require acoustic treatment in order to meet the internal noise requirements of the ISEPP. The equivalent external goals have been determined on the following basis:

- The ISEPP states:

    "*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*."

- The internal criteria with windows open is therefore 10dB(A) above the criteria explicitly outlined in the ISEPP.
- The generally accepted noise reduction through an open window from a free-field external position is 10dB(A). Windows/doors are assumed to be open no more than 5% of room floor area, in accordance with the Building Code of Australia (BCA) ventilation requirements.

Based on the above, Table 3.1 presents the ISEPP internal noise criteria along with the equivalent external noise criteria for residential premises.

Table 3.1 – ISEPP Noise Criteria for New Residential Developments

Room	Location	$L_{Aeq,\ 15hr}$ Day 7am – 10pm	$L_{Aeq\ 9hr}$ Night 10pm – 7am
Living rooms	Internal, windows closed	40	40
	Internal, windows open	50	50
	External free-field (allowing windows to remain open)[1]	60	60
Bedrooms	Internal, windows closed	40	35
	Internal, windows open	50	45
	External free-field (allowing windows to remain open)[1]	60	55

Notes: 1. ISEPP Guideline states that where internal noise criteria are exceeded by more than 10dB(A) with windows open mechanical ventilation is required. External goals have been calculated on the basis of nominal 10dB(A) reduction through an open window to a free-field position. Windows open to 5% of floor area in accordance with the BCA 2011 requirements.

Based on the above table, the most stringent criteria for the day and night time periods will be used for the assessment of road traffic noise impacting the proposal. That is, for the day period the external free-field noise criterion will be $L_{Aeq,15hr}$ **60dB(A)** and for the night period the external free-field noise criterion will be $L_{Aeq,9hr}$ **55dB(A)**.

4 Road Traffic Noise Sources

The opening year for the project is unknown at this stage and will be dependent on the final approval of the Planning Proposal. Consistent with the traffic assessment undertaken by Mott McDonald for this project, the assessment year was taken as 2030. The traffic volumes for the assessment year 2030 are presented in Table 4.1 below.

Table 4.1 – Predicted 2030 Traffic Volumes Used for Traffic Noise Assessment

Road	Period	Descriptor	Traffic Volumes	
			Total	Heavy Vehicle %
M1 Pacific Motorway	Daytime (7am to 10pm)	15 hour	81,815	12.3
	Night time (10pm to 7am)	9 hour	11,464	23.2

In addition to traffic volumes and compositions, traffic speeds are also required for noise predictions. For the predictions of traffic noise, the posted speed limit of 110km/h has been used.

5 Road Traffic Noise Assessment

5.1 Noise Modelling Methodology

The noise prediction model used to predict traffic noise levels for the proposal are contained within the calculation algorithms of the noise model developed by the United Kingdom Department of Environment entitled "Calculation of Road Traffic Noise (1988)" known as the CoRTN88 method. This method has been adapted to Australian conditions and extensively tested by the Australian Road Research Board.

The model predicts noise levels for free flowing traffic and a modified method has been developed which enables an accurate prediction of noise from high truck exhausts to be taken into account. The method predicts the $L_{10(1hour)}$ noise levels within the daytime 15 hour (7am to 10pm) and night-time 9 hour (10pm to 7am) periods and a correction of -3dB(A) is applied to obtain the $L_{eq(1hour)}$ noise levels for each period. The $L_{eq(1hour)}$ noise level for the time period 7am to 10pm is then equated to the daily $L_{eq(15hour)}$ noise level. Similarly, the $L_{eq(1hour)}$ noise level for the time period 10pm to 7am is then equated to the night time $L_{eq(9hour)}$ noise level.

The noise prediction model takes into account the following modelling inputs.

Table 5.1 – Summary of Noise Modelling Inputs

Input Parameters	Data Acquired From
Traffic volumes and mix	As described in Section 4
Vehicle speed	Existing – Based on traffic survey undertaken in previous study Future – 110km/h posted speed limit for the M1 Pacific Motorway
Ground topography at receiver and road	From 3D data provided by the NSW Department of Lands SIX Viewer and Urbis
Road Geometry	From 3D data provided by the NSW Department of Lands SIX Viewer and Urbis
Vehicle source height	The differing source heights of cars and trucks (3-source heights used) were used and detailed within the noise model as follows: • 0.5m for car exhaust • 1.5m for car and truck engines • 3.6m for truck exhaust
Receiver Heights	• 1.5m above ground level for ground floor level of proposed dwellings • 4.5m above ground level for first floor levels of proposed dwellings • 7.5m above ground level for second floor levels of proposed dwellings
Angles of view from receiver	Determined during site inspections and aerial photos
Air and ground absorption	Detailed within CORTN, ground absorption varied along route. Numeric values varied between 0 (hard surface) to 1 (100% absorptive).
Correction for Australian conditions	-0.7 dB(A) for 'free field' conditions
Acoustic properties of road surfaces	Assumed dense graded asphaltic (DGA) on M1 Pacific Motorway

5.2 Predicted Traffic Noise Levels

Road traffic noise levels are predicted across the site using noise contour maps. The predicted noise contour levels have been overlayed on the proposed land use locations to identify areas of exceedances.

Figure 2, Figure 3 and Figure 4 presents the day time noise contours representing road traffic noise generated by the M1 Pacific Motorway for the Design Year 2030 for development on site at ground level, first floor level and second floor level, respectively. Figure 5, Figure 6 and Figure 7 presents the night time noise contours representing road traffic noise generated by the M1 Pacific Motorway for the Design Year 2030 of the site at ground level, first floor level and second floor level, respectively.

Figure 2 – 2030 Daytime $L_{Aeq\ (15hr)}$ Noise Contour (Ground Floor)

Figure 3 – 2030 Day-time $L_{Aeq\ (15hr)}$ Noise Contour (First Floor)

Figure 4 – 2030 Day-time $L_{Aeq\ (15hr)}$ Noise Contour (Second Floor)

Figure 5 – 2030 Night Time $L_{Aeq\ (9hr)}$ Noise Contour (Ground Floor)

Figure 6 – 2030 Night-time $L_{Aeq\ (9hr)}$ Noise Contour (First Floor)

Figure 7 – 2030 Night-time $L_{Aeq\ (9hr)}$ Noise Contour (Second Floor)

5.3 Assessment of Impacts

The red shaded contour areas shown in Figure 2, Figure 3 and Figure 4 for the day period indicate the locations within the noise contours where road traffic noise levels from the M1 Pacific Motorway, for the design year 2030, would exceed the ISEPP road traffic noise criteria for the day period [ie. > $L_{Aeq,(15hr)}$ 60dB(A)]. Therefore, it is recommended that for residential lots located within the red shaded areas, appropriate acoustic mitigation measures should be incorporated in the design of the residential lots (see Section 6 following).

Similarly, the red shaded areas shown in Figure 5, Figure 6 and Figure 7 for the night period indicate the locations within the noise contours where road traffic noise levels from the M1 Pacific Motorway, for the design year 2030, would exceed the IESPP road traffic noise criteria for the night period [ie. > $L_{Aeq,(9hr)}$ 55dB(A)]. Therefore, it is recommended that for residential lots located within the red shaded area, appropriate acoustic mitigation measures should be incorporated in the design of the residential lots (see Section 6 following).

6 Recommendations

The following recommendations provide typical noise control solutions commonly used to reduce noise impacts to residential buildings within a subdivision. This information is presented for the purpose of planning proposal assessment only and shall not be used in more detailed design unless otherwise approved in writing by the acoustic consultant. Future development applications should undertake a detailed acoustic assessment and confirm the final acoustic mitigation measures applicable to the development.

6.1 Noise Barriers

For residential properties constructed within the $L_{Aeq(15hr)}$ 60dB(A) and/or $L_{Aeq(9hr)}$ 55dB(A) contours (ie. red shaded areas shown in Figure 2 to Figure 7), the use of noise barriers should be considered to reduce traffic noise impacts. Noise barriers can be noise screens, acoustic walls or fences constructed in between the traffic sources and residences, which shield the residences from traffic noise. Noise barriers can usually reduce noise levels by at least 5dB(A) when they are high enough to break line-of-sight and 10-15dB(A) in the acoustic 'shadow zone' (region in which there is no line-of-sight), with a maximum total noise reduction of 20dB(A).

Noise barriers can be effective for mitigating traffic noise where residences are closely grouped and there are no breaks / gaps in the barrier. Where proposed dwellings are of double storey or multi-storey construction, high noise barriers (>5m) would be required to mitigate noise to the upper levels and may not be a feasible option given the structural requirements for high barriers. Where noise barriers are determined to be not feasible for upper levels during a detailed acoustic assessment, appropriate building treatment will need to be determined to reduce traffic noise levels to within the criteria.

Furthermore, noise barriers are only feasible where the barriers do not cause access difficulties to properties and where they are visually acceptable. Where driveway access is required for residential properties it is preferred not to use noise barriers as the overall noise reduction provided by the barrier is compromised by the need to install an access gate. Where noise barriers are determined to be not feasible during a detailed acoustic assessment, appropriate building treatment will need to be determined to reduce traffic noise levels to within the criteria.

The effectiveness and location of any noise barriers will need to be investigated during the detailed design stage when final development layout and density distribution have been determined.

6.2 Building Treatment

Residential properties constructed within the $L_{Aeq(15hr)}$ 60dB(A) and/or $L_{Aeq(9hr)}$ 55dB(A) contour (ie. red shaded areas shown in Figure 2 to Figure 7) should be designed to satisfy the internal noise requirements of the ISEPP.

The dwellings in the proposed development will require facade treatment to achieve suitable internal noise levels. The facade treatment recommendations are shown in Figure 8 to Figure 13. The recommendations are for ground, first and second floor levels, and are applicable to bedrooms and living areas of the affected dwellings.

Figure 8 – Building Treatment Categories: Living Areas on Ground Floor

Figure 9 – Building Treatment Categories: Living Areas on First Floor

Figure 10 – Building Treatment Categories: Living Areas on Second Floor

Figure 11 – Building Treatment Categories: Bedrooms on Ground Floor

Figure 12 – Building Treatment Categories: Bedrooms on First Floor

Figure 13 – Building Treatment Categories: Bedrooms on Second Floor

The table below details the facade treatment categories nominated in the above figures, and the corresponding recommended constructions. The facade recommendations assume room volumes and areas as per Table B1 of the ISEPP Guideline.

Table 6.1 – Treatment categories

Category No.	Building Element	Required Acoustic Rating of Building Element, Rw	Construction Recommendation		
1	Windows / Sliding Doors	24+	Openable with minimum 4mm monolithic glass and standard weather seals		
	Facade	38+	Cladding Construction: 9mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm timber stud, R2 insulation batts in wall cavity, 10mm standard plasterboard internally.	Brick Veneer Construction: 110mm brick, 90mm timber stud, minimum 40mm clearance between masonry and stud frame, R2 insulation batts in wall cavity, 10mm standard plasterboard internally.	Cavity Brick Construction: 2 leaves of 110mm brickwork separated by 50mm gap.
	Roof	40+	Pitched concrete or terracotta tile or metal sheet roof, 10mm plasterboard ceiling fixed to ceiling joists, bulk insulation in roof cavity.		
	Door	28+	35mm solid core timber door fitted with full perimeter acoustic seals		
2	Windows / Sliding Doors	27+	Openable with minimum 6mm monolithic glass and full perimeter acoustic seals		
	Facade	45+	Cladding Construction: 9mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm timber stud, R2 insulation batts in wall cavity, 10mm standard plasterboard internally.	Brick Veneer Construction: 110mm brick, 90mm timber stud, minimum 40mm clearance between masonry and stud frame, R2 insulation batts in wall cavity, 10mm standard plasterboard internally.	Cavity Brick Construction: 2 leaves of 110mm brickwork separated by 50mm gap.
	Roof	43+	Pitched concrete or terracotta tile or metal sheet roof, 10mm plasterboard ceiling fixed to ceiling joists, bulk insulation in roof cavity.		
	Door	30+	40mm solid core timber door fitted with full perimeter acoustic seals		

Category No.	Building Element	Required Acoustic Rating of Building Element, Rw	Construction Recommendation	
3	Windows / Sliding Doors	32+	Openable with minimum 6.38mm laminated glass and full perimeter acoustic seals	
	Facade	52+	Brick Veneer Construction: 110mm brick, 90mm timber stud, minimum 40mm clearance between masonry and stud frame, R2 insulation batts in wall cavity, 10mm standard plasterboard internally.	Cavity Brick Construction: 2 leaves of 110mm brickwork separated by 50mm gap.
	Roof	48+	Pitched concrete or terracotta tile or sheet metal roof, 1 layer of 13mm sound-rated plasterboard fixed to ceiling joists, bulk insulation in roof cavity.	
	Door	33+	45mm solid core timber door fitted with full perimeter acoustic seals	
4	Windows / Sliding Doors	35+	Openable with minimum 10.38mm laminated glass and full perimeter acoustic seals	
	Facade	55+	Brick Veneer Construction: 110mm brick, 90mm timber stud, minimum 40mm clearance between masonry and stud frame, R2 insulation batts in wall cavity, 10mm standard plasterboard internally.	Cavity Brick Construction: 2 leaves of 110mm brickwork separated by 50mm gap.
	Roof	52+	Pitched concrete or terracotta tile or sheet metal, 2 layers of 13mm sound-rated plasterboard fixed to ceiling joists, bulk insulation in roof cavity.	
	Door	33+	45mm solid core timber door fitted with full perimeter acoustic seals	
5	Windows / Sliding Doors	43+	Openable Double Glazing with separate panes: 5mm monolithic glass, 100mm air gap, 5mm monolithic glass with full perimeter acoustic seals.	
	Facade	55+	Cavity Brick Construction: 2 leaves of 110mm brickwork separated by 50mm gap with cement render to the external face of the wall and cement render or 13mm plasterboard direct fixed to internal faces of the wall.	
	Roof	55+	Pitched concrete or terracotta tile or sheet metal roof with sarking, 2 layers of 10mm sound-rated plasterboard fixed to ceiling joist using resilient mounts, R2 insulation batts in roof cavity.	
	Door	40+	Special high performance acoustic door required. Consult and Acoustic Engineer	

Notes:

- Where a room has different category recommendations on two or more facades, the roof recommendation for the highest category applies.
- Any wall, roof or ceiling penetrations shall be acoustically sealed so as not to reduce the acoustic performance of the element.
- The acoustic performance of glazed doors should be in accordance with the window glazing requirement of the applicable category.
- Development Near Rail Corridors and Busy Roads – Interim Guideline recommends solid core timber doors of 45mm thickness for treatment categories 3 and 4. To align with current industry construction methods, solid core door recommendations have been limited to no more than 40mm thickness.

The required acoustic rating is for the entire system. For example, for windows this includes the glass, frame and seals including the perimeter seal at the wall junction.

By way of explanation, the Sound Insulation Rating Rw is a measure of the noise reduction property of the glazing assembly, a higher rating implying a higher sound reduction performance.

Note that the Rw rating of systems measured as built on site (R'w Field Test) may be up to 5 points lower than the laboratory result.

Category No.	Building Element	Required Acoustic Rating of Building Element, Rw	Construction Recommendation
The client is advised not to commence detailing or otherwise commit to systems which have not been tested in an approved laboratory or for which an opinion only is available. Testing of systems and assemblies is a component of the quality control of the design process and should be viewed as a priority because there is no guarantee the forecast results will be achieved. No responsibility is taken for use of or reliance upon untested systems, estimates or opinions. The advice provided here is in respect of acoustics only.			
The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.			
NOTES FOR GLAZING CONSTRUCTIONS: All openable glass windows and doors shall incorporate full perimeter acoustic seals equivalent to Q-Lon, which enable the Rw rating performance of the glazing to not be reduced. The above glazing thicknesses should be considered the minimum thicknesses to achieve acoustical ratings. Greater glazing thicknesses may be required for structural loading, wind loading etc.			

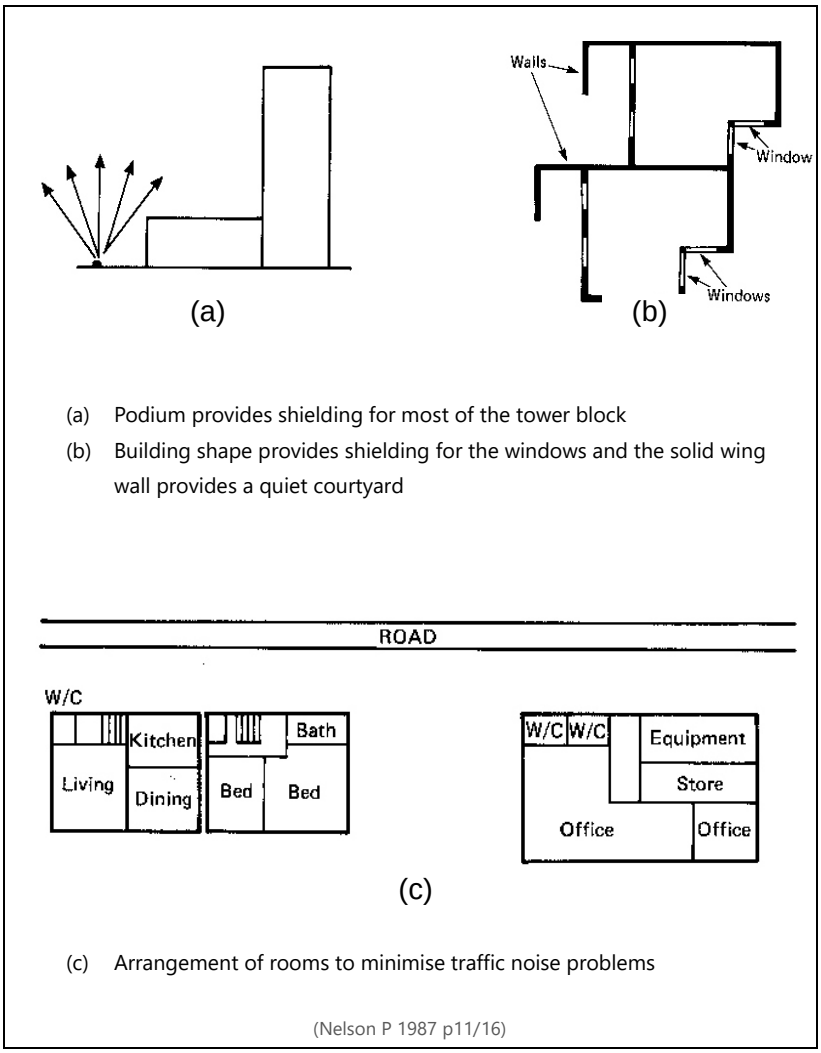
6.3 Building Design

Buildings to be constructed in areas affected by road traffic noise, as discussed above, should consider building layout design at the design stage to aid in achieving compliance with ISEPP requirements for internal noise levels.

Courtyards and open space areas can be located away from the road, using the building as a buffer to obtain a quiet outdoor environment. Within the building itself, locate less sensitive rooms closest to the road, so that these essentially form a barrier between the road and noise sensitive rooms such as bedrooms. Where possible, locate the building further away from the road, thereby reducing road traffic noise at the facade.

Figure 14 below provides examples of 'self-protecting' building design.

Figure 14 – Examples of 'Self-Protecting' Buildings



(a) Podium provides shielding for most of the tower block

(b) Building shape provides shielding for the windows and the solid wing wall provides a quiet courtyard

(c) Arrangement of rooms to minimise traffic noise problems

(Nelson P 1987 p11/16)

7 Conclusion

Renzo Tonin & Associates has completed an assessment of road traffic noise impact on the proposed concept plan associated with the planning proposal for the site adjacent to the M1 Pacific Motorway. Specifically, the road traffic noise impacts have been quantified and compared to the noise guidelines set by the NSW EPA and ISEPP.

This assessment has addressed relevant matters of consideration for the planning proposal stage and the recommendations included in this report are identified as further investigation at a later detailed design stage following gateway determination for the proposal.

Any noise mitigation recommendations included in this report are in-principle only. The assistance of an acoustic consultant should be sought at the detailed design stage of the project to provide more accurate design advice when there is more detailed information about building type, lot arrangement and traffic flow information available.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Absorption Coefficient α	The absorption coefficient of a material, usually measured for each octave or third-octave band and ranging between zero and one. For example, a value of 0.85 for an octave band means that 85% of the sound energy within that octave band is absorbed on coming into contact with the material. Conversely, a low value below about 0.1 means the material is acoustically reflective.
Adverse weather	Weather effects that enhance noise (particularly wind and temperature inversions) occurring at a site for a significant period of time. In the NSW INP this occurs when wind occurs for more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of nights in winter.
Air-borne noise	Noise which is fundamentally transmitted by way of the air and can be attenuated by the use of barriers and walls placed physically between the noise source and receiver.
Alternate Solution	An Alternative Solution is a design that complies with the relevant Performance Requirements of the National Construction Code other than by using Deemed-to-Satisfy Provisions.
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.
Amenity	A desirable or useful feature or facility of a building or place.
AS	Australian Standard
Assessment period	The time period in which an assessment is made. e.g. Day 7am-6pm, Evening 6pm-10pm, Night 10pm-7am.
Assessment Point	A location at which a noise or vibration measurement is taken or estimated.
Attenuation	The reduction in the level of sound or vibration.
Audible Range	The limits of frequency which are audible or heard as sound. The normal hearing in young adults detects ranges from 20 Hz to 20 kHz, although some people can detect sound with frequencies outside these limits.
A-weighting	A filter applied to the sound recording made by a microphone to approximate the response of the human ear.
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. 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 LA90 noise level if measured as an overall level or an L90 noise level when measured in octave or third-octave bands.
Barrier (Noise)	A natural or constructed physical barrier which impedes the propagation of sound and includes fences, walls, earth mounds or berms and buildings.
Berm	Earth or overburden mound.
Buffer	An area of land between a source and a noise-sensitive receiver and may be an open space or a noise-tolerant land use.
Bund	A bund is an embankment or wall of brick, stone, concrete or other impervious material, which may form part or all of the perimeter of a compound.
BS	British Standard

Ci	Spectrum Adaptation Term for impact sound pressure level. A value used to modify the measured impact sound pressure level, Ln,w or L'nT,w. Impact sound is generated by a laboratory grade tapping machine placed on the floor to be tested. This tapping machine accurately is intended to simulate noise impact transmitted to the space below caused by a person's footsteps on a floor above. The value is defined in ISO 717-2. The Ln,w or L'nT,w alone is sufficient to characterise the sound from concrete floors. However the measured level does not correlate well with the perceived level for timber joist floors and so the Ci value was developed to compensate. Timber joist floors can have a Ci value slightly positive. Concrete floors with an effective covering such as carpet have Ci values approximately equal to 0dB. Concrete floors with a hard, or less effective covering, can have Ci values varying in between -15dB and 0dB. The Ci value is added to the impact sound pressure level, Ln,w or L'nT,w with positive Ci values being less favourable.
CoRTN	United Kingdom Department of Environment entitled "Calculation of Road Traffic Noise (1988)"
Ctr	Spectrum Adaptation Term for the sound reduction index. A value used to modify the measured sound insulation performance of a wall or floor measured in terms of the Rw or the DnT,w so as to more accurately account for low frequency noise transmission from the sound of modern stereo systems. The value is defined in ISO 717-1 which also sets out the test methodology for measuring the sound insulation properties of building elements. The Ctr of a building element varies according to its physical properties. For example, a 90mm cavity brick masonry wall as a Ctr value of -6, as does a wall constructed of 150mm core-filled concrete blocks. By contrast, a brick veneer wall might have a Ctr of -12. The value is added to the Rw or DnT,w. with positive Ctr values being more favourable.
Decibel [dB]	The units of sound measurement. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear, defined as 20 micro Pascal 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 110dB Operating a chainsaw or jackhammer 120dB Deafening
dB(A)	A-weighted decibel. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies. The dB(C) level is not widely used but has some applications.
Deemed-to-Satisfy Provisions	The Deemed-to-Satisfy Provisions are an optional means of achieving compliance with the mandatory Performance Requirements of the National Construction Code. (also see Alternate Solution)
Diffraction	The distortion of sound waves caused when passing tangentially around solid objects.
DIN	German Standard
Discontinuous Construction	A wall system having a minimum 20mm cavity between two separate leaves, where, for other than masonry there is no mechanical linkage between leaves except at the periphery.

DnT,w	Weighted Standardised Field Level Difference A measure of sound insulation performance of a building element. It is characterised by the difference in noise level on each side of a wall or floor. It is measured in-situ. It is a field measurement that relates to the Rw laboratory measured value but is not equal to it because an in-situ space is not of the same quality as a laboratory space. The value is indicative of the level of speech privacy between spaces. The higher its value the better the insulation performance.
ECRTN	Environmental Criteria for Road Traffic Noise, NSW, 1999
EPA	Environment Protection Authority
Field Test	A test of the sound insulation performance in-situ. See also 'Laboratory Test' The sound insulation performance between building spaces can be measured by conducting a field test, for example, early during the construction stage or on completion. A field test is conducted in a non-ideal acoustic environment. It is generally not possible to measure the performance of an individual building element accurately as the results can be affected by numerous field conditions.
FIIC	Field Impact Isolation Class. A measure of the noise impact performance of a floor. The value indicates the resistance of the floor to the transmission of impact sound and is measured using a standard tapping machine. It is measured in-situ and is therefore subject to the inherent accuracies involved in such a measurement. The term is defined in ASTM E492 and E1007. It is a field measure of the level of impact sound transmitted to a space via a floor. The equivalent measurement in a laboratory is termed the IIC. The higher the value the better the performance.
Flanking	Flanking is the transfer of sound through paths around a building element rather than through the building element material directly. For example, sound travelling through a gap underneath a door or a gap at the top of a wall.
Fluctuating Noise	Noise that varies continuously to an appreciable extent over the period of observation.
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. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
FSTC	Field Sound Transmission Class A measure of the sound insulation performance of a building element. . It is characterised by the difference in noise level on each side of a wall or floor. It is measured in the field and is therefore subject to the inherent inaccuracies involved in such a measurement. The term was referred to in older superseded versions of the Building Code of Australia and has now been replaced with the term DnT,w.
Ground-borne noise	Vibration propagated through the ground and then radiated as noise by vibrating building elements such as wall and floor surfaces. This noise is more noticeable in rooms that are well insulated from other airborne noise. An example would be vibration transmitted from an underground rail line radiating as sound in a bedroom of a building located above.
Habitable Area	Includes a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room, home theatre and sunroom. Excludes a bathroom, laundry, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, photographic darkroom, clothes drying room, and other spaces of a specialised nature occupied neither frequently nor for extended periods.
Heavy Vehicle	A truck, transporter or other vehicle with a gross weight above a specified level (for example: over 8 tonnes).
IGANRIP	Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects, NSW DEC 2007

IIC	Impact Isolation Class A measure of the noise impact performance of a floor. It is measured in very controlled conditions in a laboratory and is characterised by how much sound reaches the receiving room from the operation a standard tapping machine placed on the floor. The term is defined in ASTM E492 and E1007. The higher the number the better the performance.
Impact Noise	The noise in a room, caused by impact or collision of an object onto the walls or the floor. Typical sources of impact noise are footsteps on the floor above a tenancy and the slamming of doors on cupboards mounted on the common wall between tenancies.
Impulsive 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.
INP	NSW Industrial Noise Policy, EPA 1999
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
Intertenancy wall	Walls that separate buildings or units within a building. They may provide sound resistance or serve as a fire wall. Synonymous with 'party wall'.
Intrusive noise	Refers to noise that intrudes above the background level by more than 5 dB(A).
ISEPP	State Environmental Planning Policy (Infrastructure), NSW, 2007
ISEPP Guideline	Development Near Rail Corridors and Busy Roads - Interim Guideline, NSW Department of Planning, December 2008
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
$L_{10(1hr)}$	The L10 level measured over a 1 hour period.
$L_{10(18hr)}$	The arithmetic average of the L10(1hr) levels for the 18 hour period between 6am and 12 midnight on a normal working day.
L_{90}	The 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).
L_{Aeq} or L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time, which would produce the same energy as a steady sound level occurring over the same period of time. When A-weighted, this is written as the L_{Aeq}.
$L_{Aeq(1hr)}$	The L_{Aeq} noise level for a one-hour period. In the context of the NSW EPA's Road Noise Policy it represents the highest tenth percentile hourly A-weighted L_{eq} during the period 7am to 10pm, or 10pm to 7am (whichever is relevant).
$L_{Aeq(8hr)}$	The L_{Aeq} noise level for the period 10pm to 6am.
$L_{Aeq(9hr)}$	The L_{Aeq} noise level for the period 10pm to 7am.
$L_{Aeq(15hr)}$	The L_{Aeq} noise level for the period 7am to 10pm.
$L_{Aeq\ (24hr)}$	The L_{Aeq} noise level during a 24 hour period, usually from midnight to midnight.
L_{max}	The maximum sound pressure level measured over a given period. When A-weighted, this is usually written as the L_{Amax}.
L_{min}	The minimum sound pressure level measured over a given period. When A-weighted, this is usually written as the L_{Amin}.
Ln,w	Weighted Normalised Impact Sound Pressure Level A measure of the sound level transmitted from impacts on a floor to a tenancy below. It is measured in very controlled conditions in a laboratory and is characterised by how much sound reaches the receiving room from a standard tapping machine. A lower value indicates a better performing floor.

LnT,w	Weighted Standardised Field Impact Sound Pressure Level As for Ln,w but measured in-situ and therefore subject to the inherent accuracies involved in such a measurement. The equivalent measurement in a laboratory is the Ln,w. A lower value indicates a better performing floor.
Laboratory Test	The performance of a building element when measured in a laboratory. The sound insulation performance of a building element installed in a building however can differ from its laboratory performance for many reasons including the quality of workmanship, the size and shape of the space in which the measurement is conducted, flanking paths and the specific characteristics of the material used which may vary from batch to batch.
Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on. That is, the sound of 85 dB is four times or 400% the loudness of a sound of 65 dB.
Microphone	An electro-acoustic transducer which receives an acoustic signal and delivers a corresponding electric signal.
NCA	Noise Catchment Area. An area of study within which the noise environment is substantially constant.
NCG	Roads and Maritime 'Noise Criteria Guideline'
NMG	Roads and Maritime 'Noise Mitigation Guideline'
Noise	Unwanted sound
Normalised	A method of adjusting the measured noise indices in a laboratory so that they are independent of the measuring space. The noise level in a room is affected by reverberation in the room. For example, the Ln,w impact sound pressure level measured in a laboratory is dependent upon the amount of absorptive material in the receiving room. The value is adjusted to what would be measured if the sound absorption in the receiving room is set at 10m2. This enables all laboratories to report the same value when measured under slightly different conditions. See also 'Standardised'.
NRC	Noise Reduction Coefficient. A measure of the ability of a material to absorb sound. The NRC is generally a number between 0 and 1 but in some circumstances can be slightly greater than 1 because of absorption at the edges of the material. A material with an NRC rating of 1 absorbs 100% of incoming sound, that is, no sound is reflected back from the material. The NRS is the average of the absorption coefficient measured in the octave bands 250Hz, 500Hz, 1kHz & 2kHz which correspond to the predominant frequencies associated with the human voice.
Partition wall	A wall dividing two rooms.
Party wall	A wall dividing two tenancies. Synonymous with 'Intertenancy Wall'.
Pre-construction	Work in respect of the proposed project that includes design, survey, acquisitions, fencing, investigative drilling or excavation, building/road dilapidation surveys, minor clearing (except where threatened species, populations or ecological communities would be affected), establishing ancillary facilities such as site compounds, or other relevant activities determined to have minimal environmental impact (e.g. minor access roads).
RBL	Rating Background Level is the representative LA90 background noise level for a period, as defined in the NSW EPA's noise ploicies.
Reflection	Sound wave reflected from a solid object obscuring its path.
Reverberation Time	The time (in seconds) it takes for a noise signal within a confined space to decay by 60dB. The longer the reverberation time (usually denoted as RT60), the more echoic a room. Longer reverberation times generally result in higher noise levels within spaces.
RING	Rail Infrastructure Noise Guideline, NSW, May 2013
RMS	Root Mean Square value representing the average value of a signal.

Rw	Weighted Sound Reduction Index A measure of the sound insulation performance of a building element. It is measured in very controlled conditions in a laboratory. The term supersedes the value STC which was used in older versions of the Building Code of Australa. Rw is measured and calculated using the procedure in ISO 717-1. The related field measurement is the DnT,w. The higher the value the better the acoustic performance of the building element.
R'w	Weighted Apparent Sound Reduction Index. As for Rw but measured in-situ and therefore subject to the inherent accuracies involved in such a measurement. The higher the value the better the acoustic performance of the building element.
RNP	Road Noise Policy, NSW, March 2011
Sabine	A measure of the total acoustic absorption provided by a material. It is the product of the Absorption Coefficient (alpha) and the surface area of the material (m2). For example, a material with alpha = 0.65 and a surface area of 8.2m2 would have 0.65 x 8.2 = 5.33 Sabine. Sabine is usually calculated for each individual octave band (or third-octave).
SEL	Sound Exposure Level (SEL) 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.
Sole-occupancy Unit	An area within a building for the exclusive use of the owner or occupier.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy by conversion to thermal energy.
Sound Insulation	Sound insulation refers to the ability of a construction or building element to limit noise transmission through the building element. The sound insulation of a material can be described by the Rw and the sound insulation between two rooms can be described by the DnT,w.
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 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 of 1 pico watt.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone referenced to 20 mico Pascal.
Spoil	Soil or materials arising from excavation activities.
Standardised	A method of adjusting the measured noise indices in-situ so that they are independent of the measuring space. The noise level in a room is affected by reverberation in the room. For example, the L'n,w impact sound pressure level measured in a room is dependent upon the amount of absorptive material in the receiving room. The value is adjusted to what would be measured if the reverberation time in the receiving room is set at 0.5 seconds. This enables the same value to be reported independent of whether the room contains carpet and furnishings and the like. See also 'Normalised'.
STC	Sound Transmission Class A measure of the sound insulation performance of a building element. It is measured in controlled conditions in a laboratory. The term has been superseded by Rw.

Structure-borne Noise	Audible noise generated by vibration induced in the ground and/or a structure. Vibration can be generated by impact or by solid contact with a vibrating machine. Structure-borne noise cannot be attenuated by barriers or walls but requires the isolation of the vibration source itself. This can be achieved using a resilient element placed between the vibration source and its support such as rubber, neoprene or springs or by physical separation (using an air gap for example). Examples of structure-borne noise include the noise of trains in underground tunnels heard to a listener above the ground, the sound of footsteps on the floor above a listener and the sound of a lift car passing in a shaft. See also 'Impact Noise'.
Tonal Noise	Sound containing a prominent frequency and characterised by a definite pitch.
Transmission Loss	The sound level difference between one room or area and another, usually of sound transmitted through an intervening partition or wall. Also the vibration level difference between one point and another. For example, if the sound level on one side of a wall is 100dB and 65dB on the other side, it is said that the transmission loss of the wall is 35dB. If the transmission loss is normalised or standardised, it then becomes the Rw or R'w or DnT,w.
Vibration	A mechanical phenomenon whereby oscillations occur about an equilibrium point; a periodic back-and-forth motion of an elastic body or medium, commonly resulting when almost any physical system is displaced from its equilibrium condition.
Wet Area	An area within a building that is supplied with water from a water supply including bathrooms, laundries and sanitary compartments. Excludes kitchens.