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Acoustic Assessment for SSDA

10 June 2026

The Sir Moses Montefiore Jewish Home c/ - EDM

TQ094-01F02 Acoustic Assessment SSDA (r3)

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Executive Summary

This Noise and Vibration Impact Assessment (NVIA) report has been prepared by Renzo Tonin & Associates (RTA) to accompany a State Significant Development Application (SSDA) for the development of seniors housing accommodation at 19 - 25 College Crescent, St Ives, NSW, in the Ku-ring-gai Local Government Area (LGA). The site is legally described as Lot 2 and Lot 3 in DP616326.

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) (SSD-98363228) issued by the Department of Planning, Housing and Infrastructure on 10th November 2025.

This report concludes that the proposed seniors housing is suitable and warrants approval subject to the implementation of the following mitigation measures.

Table 8-1: Mitigation Measures

Item	Stage of Project	Mitigation measure	Relevant Section
1	Operational noise and vibration impacts	Minimum sound insulation ratings for building façade elements.	Section 4.2.
2	Operational noise and vibration impacts	Building services to be designed to meet targets.	Section 5.1.1.
3	Construction noise and vibration	A detailed Construction Noise and Vibration Management Plan (CNVMP) should be prepared for the site prior to the issue of Construction Certificate	Section 7

Following the implementation of the above mitigation measures, the remaining impacts are appropriate.

Authors

This report has been prepared by Cynthia Nguyen and quality assurance undertaken by Rebecca Corbett. Rebecca and Cynthia are members of the Association of Australian Acoustical Society (MAAS).

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1 Introduction

This report presents an acoustic assessment of the proposed aged care facility located at 19-25 College Crescent, St Ives, NSW, legally known as Lots 2 & 3 in DP616326. A State Significant Development Application (SSDA) has been prepared in support of the proposed seniors housing development at 19-25 College Crescent, St Ives. The proposed development comprises:

- Site preparation and demolition of existing structures.
- Construction of four buildings ranging in heights from five to eight storeys comprising:
  - Approximately 126 Independent Living Units (ILUs) to be distributed across Buildings A, C and D.
  - Approximately 48 residential care beds within Building B - Residential Care Facility (RCF), with associated care services and back of house facilities.
  - A range of resident amenities and facilities including; gym, pool, cinema, club lounge and multi-purpose rooms.
  - External open space with a variety of passive and active uses.
  - Basement car parking with approximately 260 spaces.
- Vehicular and pedestrian access from Link Road and College Crescent
- Associated landscaping works.

Figure 1-1 below presents the architectural concept layout of the development.

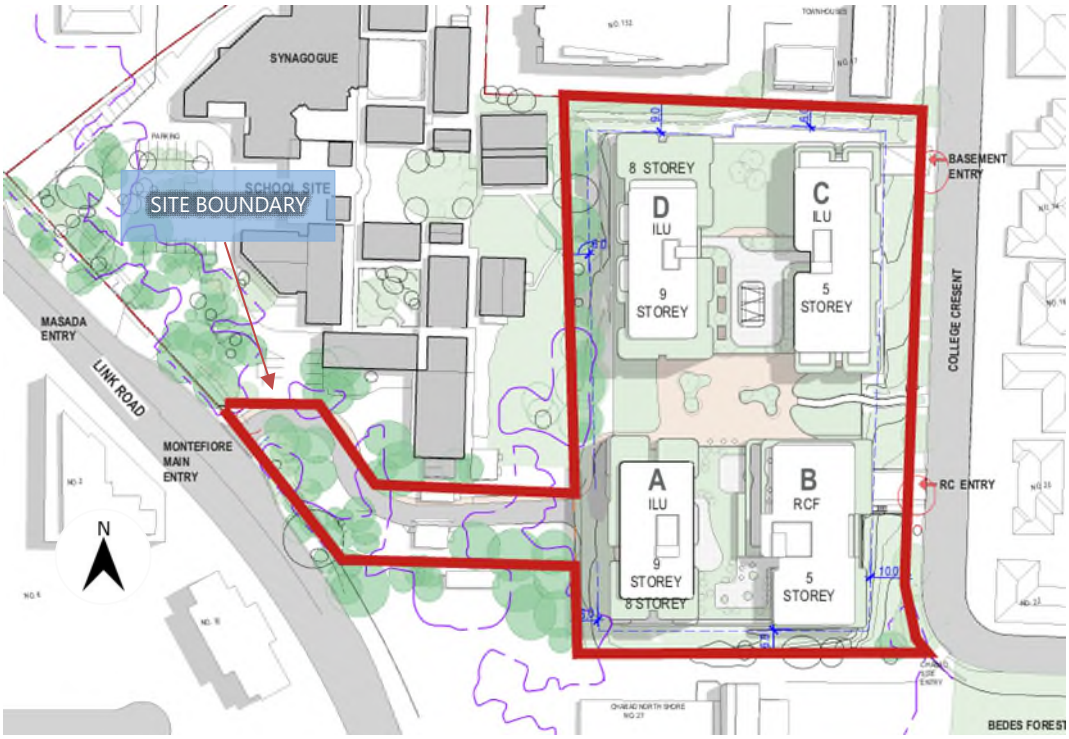


Figure 1-1: Architectural concept layout of the development (Ref: Jackson Teece)

This report examines the noise and vibration impacts from the proposed development, and noise intrusion from the surrounding environment, this report also sets up the framework for the internal acoustic separation and the management of potential construction noise and vibration impacts. Indicative measures are proposed for the mitigation of noise emissions, noise intrusion and internal acoustic separation, but these will be further developed during detailed design.

Assessments conducted for this report was based on architectural drawing set prepared by Jackson Teece dated 20th April 2026.

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.

1.1 Planning Secretary's Environmental Assessment Requirements (SEARs)

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) and accompanying cover letter issued for the project (Ref: SSD-98363228), dated 10/11/2025. Specifically, this report has been prepared to respond to the SEARs requirement issued in the table below.

Table 1-1: Relevant acoustic requirements per SEARs SSD-98363228

Item	Description of requirement	Section reference
10. Noise and Vibration Provide a noise and vibration assessment prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines. The assessment must detail construction and operational noise and vibration impacts on nearby sensitive receivers and structures and outline the proposed management and mitigation measures that would be implemented.	Operational noise and vibration impacts on nearby sensitive receivers. Outline the proposed management and mitigation measures that would be implemented	Section 5
	Construction noise and vibration impacts on nearby sensitive receivers. Outline the proposed management and mitigation measures that would be implemented	Section 7

Noise surveys were conducted on site by Renzo Tonin & Associates (RTA) between Tuesday the 17th of March 2026 to Tuesday 24th March 2026 to determine the existing traffic and ambient noise levels at the development site. These levels were used to set the project noise emission goals.

As a result of our assessment, the following potential acoustic items were identified:

1. Noise emission targets from proposed mechanical plant impacting on existing residences;
2. Noise emissions from use of the site including use of the on-site loading dock;
3. External noise from road traffic on Link Road impacting the development; and
4. Noise from traffic generated by the development impacting existing residential receivers.

This report presents an assessment of the above acoustic components in terms of the NSW State Environmental Planning Policy (Housing) 2021 [1], NSW State Environmental Planning Policy (Transport & Infrastructure) 2021 (SEPP T&I) [2], NSW Environmental Protection Authority (EPA) Noise Policy for Industry (NPfI), 2017 [3], Australian Standard AS2107:2016 [4] and NSW EPA Interim Construction Noise Guideline (ICNG) (2009) [5].

In regard to acoustic privacy, this is generally satisfied through the requirements set by the National Construction Codes (NCC) [6]- Building Code of Australia with which all new residential aged care developments would need to comply.

2 Site and Surrounds

The primary area of the site is located at 19-25 College Crescent, St Ives, within the Ku-ring-gai Local Government Area (LGA) and is approximately . The development is approximately 10km north of km north of Chatswood and 19km north of Sydney Central Business District (CBD). This primary site is legally described as Lot 3 in DP 616326.

A small part of the site to be developed is the adjoining lot upon which the Masada College is located at 9-15 Link Road, St Ives (legally described as part of Lot 2 in DP 616326). This part of the development site will specifically be used for access purposes and provide a direct connection from the proposal to the Link Road frontage.

On this basis, the site (for the purposes of this SSDA) comprises:

- The (primary) residual land being 14,480m^2 (accommodating the proposed buildings and associated spaces); and
- Part of the adjoining land, being 1,060m^2 (accommodating the proposed access driveway and pedestrian link from the proposed buildings to the Link Road frontage).

The site is zoned as SP2 Infrastructure under the Ku-ring-gai LEP 2015.

The surrounding area is characterised by residential flat buildings, aged care facilities, educational uses and commercial/retail uses within St Ives Town Centre, which is located approximately 400m west of the site on Mona Vale Road. Immediate surroundings are as follows:

- To the north of the site is 132-138 Killeaton Street, which comprises of a residential development with 6 residential flat buildings.
- To the east of this development (at 142 Killeaton Street) comprises town houses and further east (at 144-146 Killeaton Street on the corner of Yarrabung Road) exists an aged care facility (Estia Healthcare). The site is bounded to the east by College Crescent, with tall street trees providing partial screening of the site. On the eastern side of College Crescent are detached houses, set back from the road and generally below street level, with significant street-front planting.
- To the south of the site is Chabad North Shore. Further south are large, detached houses along Stanley Street and Lancaster Avenue, and residential flat buildings to the south-west along Stanley Street
- To the west of the site is Masada College, which includes early learning, junior and secondary schools. An easement will be created on the edge of the campus to provide vehicle access from Link Road for the development. Link Road, a four-lane regional road, runs west of the school campus and connects to Mona Vale Road. West of Link Road are residential buildings along Newhaven Place, and further west are medium and higher-density housing and

commercial premises in St Ives Town Centre. This includes five-six -storey buildings along Porters Lane, St Ives Shopping Centre and St Ives Village Green. The shopping centre precinct is expected to be subject to future major redevelopment.

A map of the regional context of the site is shown in Figure 2-1 below.

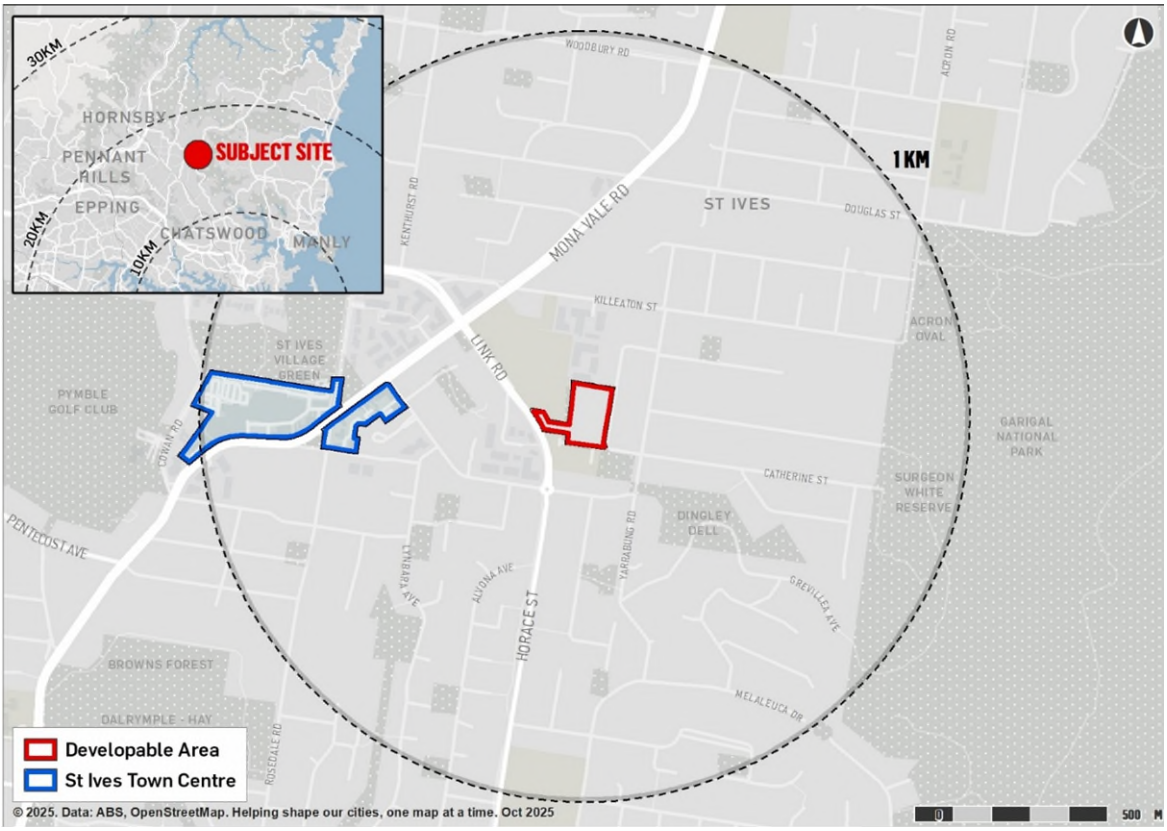
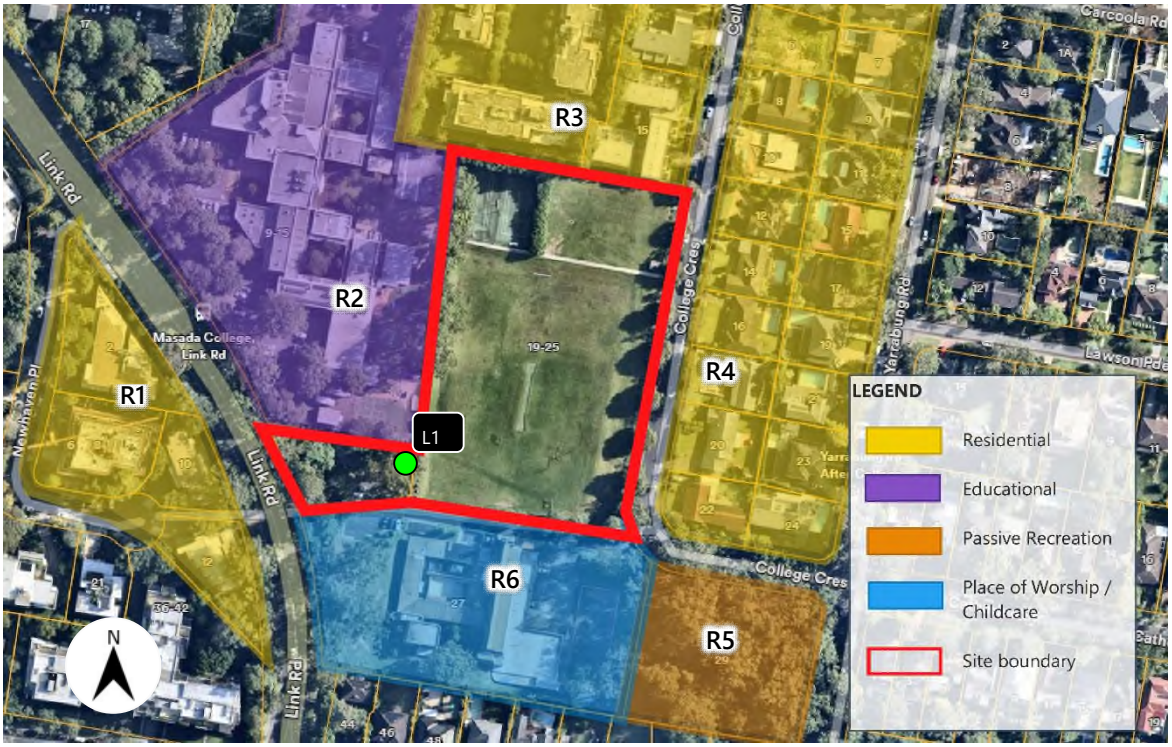


Figure 2-1: Regional map of the site (Source: Urbis)

Long-term noise monitoring has been undertaken at the site to determine the existing acoustic environment. Figure 2-2 below identifies the location of these monitors, as well as nearest sensitive receivers relative to the site.

Figure 2-2: Nearest noise sensitive receivers in relation to the site, and monitoring location (L1).



2.1 Noise sensitive receivers

Table 2-1 outlines the sensitive receiver locations surrounding the development along with the approximate distance to the site boundary, as shown in Figure 2-2.

Table 2-1: Noise sensitive receiver locations

Location ID	Receiver type	Description	Approx. distance to site, m
R1	Urban Residential	Multi-storey residential dwellings at 12 Newhaven Place, St Ives	30
R2	Educational / Active recreation	Masada College campus with outdoor areas classified as active recreational playgrounds.	< 5
R3	Urban Residential	Multi-storey apartment block at 132 Killeaton Street, St Ives.	< 5
R4	Suburban Residential	Row of detached dwellings facing College Crescent.	12
R5	Passive recreation	Bede Forest	10
R6	Place of Worship / Childcare*	Chadbad North Shore Synagogue with Ganeinu Long day care.	14

Note: * For the purposes of assessment, the receiver type R6 is identified as Educational as the NSW EPA criteria for educational developments are more stringent than place of worship.

2.2 Cumulative impacts

Future developments in proximity of the site have been considered to address potential cumulative impacts from the development and the following future developments:

- 5-9 Cowan Road, St Ives (SSD-88948458) – Residential flat building with in-fill adorable housing.
- 46 Cowan Road, St Ives (PPSSNH-729) – Residential flat building
- Opal St Ives Care (SSD-48028209) – Aged care facility

The above future developments, located approximately ≥480m from the project site, are not anticipated to influence the cumulative noise emissions at the assessment location. At this distance, noise from the forementioned development would be negligible, relative to other closer sources such as Mona Vale Road and immediate surroundings. Furthermore, the acoustic environments differ, the subject site is situated within a comparatively low ambient noise setting, whereas the forementioned residential developments are associated with the St Ives town centre where baseline noise levels are inherently high due to existing commercial and community activities. Therefore, it can be said, acoustically the impact of the proposed development will not affect the identified future developments.

However, traffic generated from the development have the potential to impact surrounding receivers and the future traffic expected from the distant new developments have been considered and discussed in the acoustic traffic generated assessment (Section 5.2.3).

3 Existing noise environment

Criteria for the assessment of operational and construction noise are typically derived from the existing noise environment of an area, excluding noise from the subject development. The NSW Environmental Protection Authority's (EPA) *Noise Policy for Industry* (NPfI) outlines the methods of determining the background noise levels of an area. For this assessment, long-term noise monitoring was carried out.

As the noise environment of an area varies over time due to changes in human activity, land uses, and traffic volumes, background and ambient noise levels need to be determined for the operational times of the proposed development. The NPfI defines standard time periods over which the background and ambient noise levels are to be determined for the purposes of an acoustic assessment, which is as follows:

Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays

Evening: 18:00-22:00 Monday to Sunday & Public Holidays

Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays

3.1 Long-Term Noise Survey

A RTA Technology Environmental Noise Logger was set up for the ambient noise survey, from Tuesday 17th March 2026 to Tuesday 24th March, 2026. The period at which the noise survey was conducted was representative of the typical noise environment, no public or school holidays were occurring during the survey. The logger was installed near the south-west of the site to capture the existing traffic noise on Link Road as well as the background noise at receivers, refer to Figure 2-2 for monitoring location.

The noise logger recorded noise levels on a continuous basis, storing data every fifteen minutes. The noise logger were calibrated before and after measurements and no significant deviation in calibration was noted. The noise monitoring equipment used here complies with Australian Standard 1259.2-1990 "Acoustics - Sound Level Meters" and is designated as Type 2 instruments suitable for field use. The dates of measurement and the results obtained from the logger survey are shown in Appendix B.

Results from the unattended noise survey were used to calculate noise emission goals.

3.1.1 Results of long-term noise survey

The results of the long-term noise monitoring have been summarised in accordance with the Noise Policy for Industry (NPfI) requirements published by NSW Environmental Protection Authority (EPA) and are presented in Table 3-1 below.

Table 3-1: Long-term noise monitoring results.

Monitoring location	Rating Background Level (RBL), L_{A90}			Ambient noise levels [4], $L_{Aeq,period}$		
	Day [1]	Evening [2]	Night [3]	Day [1]	Evening [2]	Night [3]
L1	45	42	35	59	57	46

Notes: (1) Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays
(2) Evening: 18:00-22:00 Monday to Sunday & Public Holidays
(3) Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays
(4) As required by the NPfI, the external ambient noise levels presented are free-field noise levels, i.e.. no façade reflection.

The representative background noise levels (L_{A90}) are used in defining external noise emission from the development such as mechanical ventilation and air-conditioning systems in accordance with the EPA NPfI (2017).

3.2 Assessment traffic noise levels

Based on the results of the noise survey Table 3-2 presents the assessment traffic noise levels with a 2.1dB correction to account for façade reflection.

Table 3-2: Assessment Road Traffic Noise Levels near North-West Boundary

Location	Day, $L_{Aeq\ (15hr)}$	Night, $L_{Aeq\ (9hr)}$
L1	60 dB(A)	50 dB(A)

Notes: Day is 7am to 10pm; Night is 10pm to 7am; Quoted values include 2.5dB façade correction

4 Noise Intrusion Assessment

This section addresses the intrusion of external noise on the development, primarily the adjacent road corridors surrounding the site, outlines the relevant internal noise criteria for the assessment, and provides recommendations on noise control through facade design.

4.1 Noise Intrusion Criteria

4.1.1 State Environmental Planning Policy (Housing) 2021.

Schedule 8, Section 2 of the State Environmental Planning Policy (Housing) 2021 (H-SEPP) relates to Seniors Living.

Schedule 8, Section 2 2 is as follows:

> *2 Visual and acoustic privacy*
>
> *Seniors housing should be designed to consider the visual and acoustic privacy of adjacent neighbours and residents by—*
>
> *(a) using appropriate site planning, including considering the location and design of windows and balconies, the use of screening devices and landscaping, and*
>
> *(b) ensuring acceptable noise levels in bedrooms of new dwellings by locating them away from driveways, parking areas and paths.*

4.1.2 State Environmental Planning Policy (Transport & Infrastructure) 2021

Part 20 of the Ku-ring-gai Development Control Plan (2026) (DCP) [7] requires all development that is in, or immediately adjacent to a busy road is to be design in accordance with the NSW State Environment Planning Policy (Transport & Infrastructure) 2021 (SEPP T&I). The DCP further identifies Link Road as a busy road (Refer to Figure 4-1), whilst the development does not have frontage to this road, upper floors of the development will have line of sight. As a result, upper floors of the development are to meet SEPP (T&I) regulations.

Figure 4-1: Approximate location of site in relation to TfNSW identified busy roads (Ref: Map 12B)

The SEPP T&I identifies 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.

Clause 2.120 applies to the subject site as it relates to noise impacts from a busy road on residential accommodation.

> *2.120 Impact of road noise or vibration on non-road development*
>
> *(1) This section 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 20,000 vehicles (based on the traffic volume data published on the website of TfNSW) and that the consent authority considers is likely to be adversely affected by road noise or vibration—*
>
> *(a) residential accommodation,*
>
> *(b) a place of public worship,*
>
> *(c) a hospital,*

(d) an educational establishment or centre-based child care facility.

(2) Before determining a development application for development to which this section applies, the consent authority must take into consideration any guidelines that are issued by the Planning Secretary for the purposes of this section and published in the Gazette.

(3) 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 LAeq levels are not exceeded—

(a) in any bedroom in the residential accommodation—35 dB(A) at any time between 10 pm and 7 am,

(b) anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway)—40 dB(A) at any time.

(3A) Subsection (3) does not apply to a building to which State Environmental Planning Policy (Housing) 2021, Chapter 3, Part 7 applies.

(4) In this section, freeway, tollway and transitway have the same meanings as they have in the Roads Act 1993.

Note: In respect of Item 3A above, H-SEPP, Chapter 3, Part 7 relates to serviced apartments and so the exclusion is not relevant to this project. The development shall be designed for compliance with Item 3 internal noise levels.

In respect of Item 2 above, under the previous SEPP (Infrastructure) 2007, the Department of Planning published the Developments Near Rail Corridors and Busy Roads – Interim Guideline (2008) [8] (DoP Guideline), which was published in the Gazette on 22/12/08. Planning Circular PS 21-018 was issued 02 December 2021 which requires a consent authority to "take into consideration this interim guideline to minimised the impacts of busy roads and railway corridors on residential and other sensitive developments". On that basis, the recommendations and clarifications contained within the DoP Guideline are valid and are used for the purpose of assessment in this report.

4.1.2.1 Development near rail corridors and busy roads- interim guideline

The DoP 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 $L_{Aeq(15hr)}$
- Night-time 10:00pm - 7:00am $L_{Aeq(9hr)}$

The noise criteria nominated in the SEPP (T&I) apply to internal noise levels with windows and doors closed. However as the preliminary noise assessment is based on measurements/predictions at external

locations, equivalent external noise criteria has 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 SEPP (T&I). The equivalent external goals have been determined on the following basis:

- The DoP Guideline 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 SEPP (T&I).
- 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 National Construction Code, Building Code of Australia (BCA) ventilation requirements.

Table 4-1 presents the SEPP (T&I) internal noise criteria along with the equivalent external noise criteria for residential premises.

Table 4-1: SEPP (T&I) noise criteria for new residential development

Room	Location	$L_{Aeq,\ 15hr}$ Day 7am – 10pm	$L_{Aeq\ 9hr}$ Night 10pm – 7am
Living rooms[1]	Internal, windows closed	40	40
	Internal, windows open	50	50
	External free-field (allowing windows to remain open)[2]	60	60
Bedrooms[1]	Internal, windows closed	40[3]	35
	Internal, windows open	50[3]	45
	External free-field (allowing windows to remain open) [2]	-	55

Notes: 1. Requisite for 20,000AADT Roads only under SEPP (T&I) 2021.

2.Department of Planning's 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 NCC/BCA requirements.

3. SEPP (T&I)does not define internal goals in Bedrooms during the daytime (only at night). In view of project quality, we have elected to apply the Living Room goals to Bedrooms during the daytime.

4.1.3 Australian Standard AS/NZS 2107:2016

For the residential portion, compliance with the SEPP (T&I) internal goals will also achieve compliance with AS2107:2016. The community facilities within the centre are not governed by the SEPP (T&I) and so guidance is sought from Australian Standard AS2107:2016. The applicable criteria shall be based on AS/NZS 2107:2016 are presented below in Table 4-2. These goals are applicable to both road traffic noise and mechanical services noise.

Table 4-2: Recommended design sound levels for different areas of occupancy in buildings

Type of occupancy/ activity	Design sound level (LAeq,t) range [2]
Place of worship – Without speech amplification	30 to 40
Cinemas [1],	30 to 35
Washrooms and toilets	45 to 55
Cafeterias	45 to 50
Common rooms	40 to 45
Games rooms	45 to 50
Kitchens and service areas	45 to 55
Indoor pools	50 to 60
Small retail stores (general)	< 50
Weight training / Fitness room	< 50
2-HEALTH BUILDINGS	
Corridors and lobby spaces	< 50
Consulting rooms	40 to 45
Dining areas	40 to 45
Geriatric rehabilitation	40 to 45
Kitchen, sterilizing and service areas	< 55
Maintenance workshops	< 60
Nurses' stations	40 to 45
Office areas	35 to 45
Patient lounge	40 to 45
Staff rooms	40 to 45
Surgeries/treatment/procedure rooms	40 to 45
Utility rooms	50 to 60
Board and conferences rooms	30 to 40
Executive office	35 to 40
General office areas	40 to 45
Undercover Carpark	<65

Notes:

(1) The overall sound pressure level in dB(A) should conform to the recommended design sound level given. In these spaces, a balanced sound pressure level across the full frequency range is essential. These spaces should therefore be evaluated in octave bands across the full frequency spectrum. The recommended maximum sound pressure levels for the individual octave bands corresponding to the overall dB(A) value are given in Appendix C of the NPfI.

(2) In situations where traffic noise levels may vary widely over a 24 h period, measurement to assess compliance with this Standard should be taken at the relevant time and for an appropriate measurement period according to the area of occupancy or activity in the building. Where traffic noise fluctuates rapidly with the passage of individual vehicles, the community reaction may not correlate well with the equivalent continuous noise level measured.

4.2 Recommendations

Noise calculations were performed using glazing design prediction spreadsheet developed by Renzo Tonin & Associates which take into account prediction methods as per AS3671 [9], external noise levels

measures (refer to Section 3), facade transmission loss and room sound absorption characteristics. The forms of constructions presented below are recommended to comply with the nominated acoustic criteria for the development.

To capture the impact of changes during detailed design, a review of environmental noise intrusion is to be undertaken during detailed design prior to construction documentation.

4.2.1 Glazing

To achieve the criteria outlined in Table 4-1 with windows closed, the following table presents the recommended glazing acoustic performances for the proposed development.

Table 4-3: Recommended acoustic performance of indicative glazing assembly

Building	Room Description	Required Acoustic Rating of Glazing Assembly, R_w	Typical Configuration / Glazing thicknesses
A / D	**Bedrooms** (facing Link Rd)	R_w 28	6.38mm laminated glass in an aluminium sliding window frame. Q-Ion seals full perimeter seals shall be installed, or acoustic equivalent.
	Living Rooms (facing Link Rd)	R_W 26	6mm float or toughened glass in an aluminium sliding window frame. Q-on seals full perimeter seals shall be installed, or acoustic equivalent.
	Club Lounge / Lobbies (facing Link Rd)	R_W 26	4mm float or toughened glass in an aluminium sliding window frame, with weather seals.
	All other bedrooms	R_w 26	6mm float or toughened glass in an aluminium sliding window frame. Q-on seals full perimeter seals shall be installed, or acoustic equivalent.
	All other living rooms	R_w 26	4mm float or toughened glass in an aluminium sliding window frame, with weather seals.
	All other communal areas	R_w 26	4mm float or toughened glass in an aluminium sliding window frame, with weather seals.
All other Buildings and facades	Bedrooms	R_w 26	4mm float or toughened glass in an aluminium sliding window frame, with weather seals.
	Living rooms	R_w 26	4mm float or toughened glass in an aluminium sliding window frame, with weather seals.
	All other habitable spaces (i.e. Lounges, communal areas, staff rooms, admin spaces etc.)	R_w 26	4mm float or toughened glass in an aluminium sliding window frame, with weather seals.

Notes:

The client is advised not to commence detailing or otherwise commit to partition construction systems which have not been tested in an approved laboratory or for which an opinion only is available. Testing of partition construction systems 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 thereby

Building	Room Description	Required Acoustic Rating of Glazing Assembly, R_w	Typical Configuration / Glazing thicknesses
necessitating the use of an alternative which may affect the cost and timing of the project. No responsibility is taken for use of or reliance upon untested partition construction systems, estimates or opinions. The advice provided here is in respect of acoustics only.			
The information in this table is provided for the purpose of Council approvals process and cost planning and shall not be used for construction unless otherwise approved in writing by the acoustic consultant.			
The design in this table is preliminary and a comprehensive assessment shall be conducted prior to Construction Certification.			
Before committing to any form of construction or committing to any builder, advice should be sought from an acoustic consultant to ensure that adequate provisions are made for any variations which may occur as a result of changes to the form of construction where only an "estimate" is available for the sound insulation properties of recommended materials.			
The glazing supplier shall ensure that installation techniques will not diminish the Rw performance of the glazing when installed on site.			
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.			

The table presented above is intended as a guide only and should not be used for construction. The design of external glazing shall continue during detail design phase to confirm the above minimum R_W values are met. It is the responsibility of the sub-contractor to provide laboratory test reports for the glazed systems proposed for installation at the development site to show compliance with the acoustic ratings presented in Table 4-3.

4.2.2 External walls

To achieve the criteria outlined in Section 4.1 with windows closed, external walls of rooms facing Link Road should achieve a minimum acoustic rating 10-15 points higher than the corresponding glazed unit. Therefore, external walls facing Link Road should achieve a minimum acoustic rating of R_W 38-43.

4.2.3 Ventilation

In accordance with the DoP guideline, 2008:

> *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.*

Based on measured external noise levels and the building design, the internal noise goals with windows opened can be achieved without additional treatment.

5 Noise Emissions Assessment

Under the NSW Planning Secretary's Environmental Assessment Requirements, a noise and vibration assessment is required in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines. This section outlines the noise emission assessment.

5.1 Noise Emission Requirements

Noise emissions from vehicles being driven on the site and from mechanical plant and equipment, shall be managed in accordance with the NSW EPA Noise Policy for Industry 2017 (NPfI).

Noise from additional traffic on the public road will be assessed in accordance with the NSW EPA Road Noise Policy 2011 (RNP).

5.1.1 NSW EPA Noise Policy for Industry

The NSW EPA Noise Policy for Industry (2017) assessment has three main components:

- Controlling *intrusive* noise impacts in the short-term for residences;
- Maintaining noise level amenity for particular land uses for residences and other land uses (*amenity*); and

In the event that particular assessment is undertaken, and trigger levels are found to be exceeded even after application of feasible and reasonable treatments, additional analysis would be required to determine the impact of the residual.

5.1.1.1 Intrusive noise trigger level

The intrusiveness trigger level is applicable to residential premises only. According to the NPfI, the intrusiveness of a 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) does not exceed the background noise level measured in the absence of the source by more than 5dB(A).

The intrusiveness criterion is summarised as follows:

- $L_{Aeq,15minute} \leq$ Rating Background Level (RBL) plus 5dB

Table 5-1: Measured Site Background (L_{A90}) and associated NPfI Intrusive trigger. (Applicable to residential receivers only)

Receiver Location	Descriptor	Day[1]	Evening[2]	Night[3]
All residential receivers (R1 R3, R4)	Background L_{A90}	45	42	35

Receiver Location	Descriptor	Day[1]	Evening[2]	Night[3]
	Intrusive Trigger, Background + 5dB(A) $L_{Aeq(15min)}$	50	47	40

Notes: Day, Evening & Night assessment periods are defined in accordance NSW EPA's NPfI as follows.

1. Day is defined as 7:00am to 6:00pm, Monday to Saturday; 8:00am to 6:00pm Sundays & Public Holidays. As results were affected by construction noise weekend day and Saturday morning, Sunday results have been presented for the Day time period
2. Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays
3. Night is defined as 10:00pm to 7:00am, Monday to Saturday; 10:00pm to 8:00am Sundays & Public Holidays

5.1.1.2 Amenity noise trigger levels

The NPfI amenity trigger levels are designed to maintain noise level amenity for particular land uses, including residential and other land uses. The NPfI recommends base acceptable noise levels for various receivers, including residential, commercial, industrial receivers and other sensitive receivers in Table 2.2 of the NPfI. For this project, the neighbouring receivers are classified as Suburban residential receivers. Despite the heavy traffic noise, application of the Urban category is not appropriate due to the development mix and rating background noise level at night.

Table 5-2: NPfI Amenity Criteria - Recommended L_{Aeq} noise levels from industrial noise sources [NSW NPfI Table 2.2]

Type of receiver	Indicative Noise Amenity Area	Time of day	Recommended amenity noise level $L_{Aeq(Period)}$
Residence	Suburban (1)	Day	55
		Evening	45
		Night	40
	Urban(1)	Day	60
		Evening	50
		Night	45
Passive Recreation	-	When in use	50
Active Recreation (school playgrounds)	-	When in use	55
Place of Worship	-	When in use	50(2)
Education	-	When in use Nosiest 1-hour period	45(2)

Notes: The recommended amenity noise levels refer only to noise from industrial sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

Types of receivers are defined as follows:

Time of day is defined as follows:

- day – the period from 7 am to 6 pm Monday to Saturday or 8 am to 6 pm on Sundays and public holidays
- evening – the period from 6 pm to 10 pm
- night – the remaining periods.

(1) Refer to Table 2-1 for identification of which residential receivers are categorised as Urban or Suburban, per land zoning shown on NSW Planning Portal spatial viewer.

(2) A correction has been applied to the internal noise level as stated in NPfI to provide external amenity levels, in accordance with relevant NSW EPA guidelines.

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 (PANL) for industrial developments = Recommended Amenity Noise Level (RANL) (NPfI Table 2.2) minus 5 dB(A)
- Project Amenity Trigger Level (PATL) $L_{Aeq(15min)}$ = PANL $L_{eq(period)}$ plus 3dB(A). (Note: this is a screening test and the policy still permits period average assessment by review of particular operations)

The NPfI, Section 2.4.1 notes that the level of road traffic noise may provide acoustic masking to operational noise impacting receivers. It is only applicable where traffic noise is identified as the dominant noise source at the site; the existing traffic noise level is 10dB or more above the recommended amenity noise level for the area; and it is highly unlikely traffic noise levels will decrease in the future.

The Project Amenity Trigger Levels are as shown in the following table.

Table 5-3 - Determination of Project Amenity Noise Levels and Project Amenity Trigger Levels

Receiver Reference	Description	Time of day		
		Day	Evening	Night
R1, R3	Recommended amenity noise level $L_{Aeq(Period)}$	60	50	45
	Project amenity trigger level $L_{Aeq(15min)}$	60-5+3 =58	50-5+3=48	45-5+3 = 43
R4	Recommended amenity noise level $L_{Aeq(Period)}$	55	45	40
	Project amenity trigger level $L_{Aeq(15min)}$	55-5+3 =53	45-5+3=43	40-5+3 = 38

Notes: The recommended amenity noise levels refer only to noise from industrial sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

Time of day is defined as follows (These periods may be varied where appropriate, for example, see A3 in Fact Sheet A.):

- Day is defined as 7:00am to 6:00pm, Monday to Saturday; 8:00am to 6:00pm Sundays & Public Holidays. As results were affected by construction noise weekend day and Saturday morning, Sunday results have been presented for the Day time period
- Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays
- Night is defined as 10:00pm to 7:00am, Monday to Saturday; 10:00pm to 8:00am Sundays & Public Holidays

5.1.1.3 Project Noise Trigger Levels

In accordance with the NPfI the project noise trigger levels (PNTLs), which are the lower (i.e. more stringent) value of the project intrusiveness noise level (see Table 5-1)and project amenity noise level (Table 5-3), have been determined as shown in Table 5-4 below.

Table 5-4: Project noise trigger levels

Receiver	Project noise trigger level, $L_{Aeq,15min}$		
	Day [(1)]	Evening [(2)]	Night [(3)]
R1 R3 (Residential	50	47	40
R4 (Residential)	50	43	38

Receiver	Project noise trigger level, $L_{Aeq,15min}$		
	Day (1)	Evening (2)	Night (3)
R2/R6 -School classroom (external)	43 (Noisiest 1-hour period when in use) (4)		
R2 - Active recreation area (school playground)	53 (When in use)		
R5 - Passive recreation area	48 (When in use)		
R6 - Place of worship (external)	48 (When in use) (4)		

Notes: (1) Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays.

(2) Evening: 18:00-22:00 Monday to Sunday & Public Holidays.

(3) Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays.

(4) A +10 dB correction has been applied to the internal noise level to determine the equivalent external noise requirement in accordance with the NPfI.

5.1.2 NSW Road Noise Policy

This section presents the criteria for assessment of noise from traffic generated by the development.

Table 5-5 sets out the assessment criteria for residences to be applied to particular types of project, road category and land use. These criteria are for assessment against façade corrected noise levels when measured in front of a building façade. In Table 5-5, freeways, arterial roads and sub-arterial roads are grouped together and attract the same criteria.

Table 5-5: Road traffic noise assessment criteria for residential land uses

Road category	Type of project/land use		Assessment criteria – dB(A)	
			Day 7:00am-10:00pm	Night 10:00pm-7:00am
Freeway/ arterial/ sub-arterial roads	1.	Existing residences affected by noise from new freeway/arterial/sub-arterial road corridors	$L_{Aeq,(15\ hour)}$ 55 (external)	$L_{Aeq,(9\ hour)}$ 50 (external)
	2.	Existing residences affected by noise from redevelopment of existing freeway / arterial / sub-arterial roads	$L_{Aeq,(15\ hour)}$ 60 (external)	$L_{Aeq,(9\ hour)}$ 55 (external)
	3.	Existing residences affected by additional traffic on existing freeways / arterial / sub-arterial roads generated by land use developments	$L_{Aeq,(15\ hour)}$ 60 (external)	$L_{Aeq,(9\ hour)}$ 55 (external)
Local roads	4.	Existing residences affected by noise from new local road corridors	$L_{Aeq,(1\ hour)}$ 55 (external)	$L_{Aeq,(1\ hour)}$ 50 (external)
	5.	Existing residences affected by noise from redevelopment of existing local roads		
	6.	Existing residences affected by additional traffic on existing local roads generated by land use developments		

Note: Land use developers must meet internal noise goals in the Infrastructure SEPP (Department of Planning NSW 2007) for sensitive developments near busy roads (see Appendix C10).

Where existing traffic noise levels are above the noise assessment criteria (as is the case for this project), the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria. A secondary objective is to protect against excessive decreases in amenity as the result of a project by applying the relative increase criteria.

In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

For existing residences and other sensitive land uses affected by *additional traffic on existing roads generated by land use developments*, any increase in the total traffic noise level (where the assessment criteria cannot be achieved) should be limited to 2 dB above that of the corresponding 'no build option'.

5.2 Noise Emission Recommendations

5.2.1 Industrial noise – Mechanical plant and equipment

Where necessary, noise amelioration treatment will be incorporated in the design to ensure that noise levels comply with the recommended NPfI noise emission criteria noted in Table 5-4.

Although at this stage details of mechanical plant have not been finalised, the following in-principle advice is provided.

Acoustic assessment of mechanical services equipment will need to be undertaken during the detail design phase of the development to ensure that they shall not either singularly or in total emit noise levels which exceed the noise limits in NPfI and Council's requirements.

As noise control treatment can affect the performance of the mechanical services system, it is recommended that consultation with an acoustic consultant be made during the initial phase of mechanical services system design in order to reduce the need for revision of mechanical plant and noise control treatment;

Mechanical plant noise emission can be controllable by appropriate mechanical system design and implementation of common engineering methods that may include any of the following:

1. procurement of 'quiet' plant,
2. strategic positioning of plant away from sensitive neighbouring premises, maximising the intervening shielding between the plant and sensitive neighbouring premises,
3. commercially available silencers or acoustic attenuators for air discharge and air intakes of plant;
4. acoustically lined and lagged ductwork;
5. acoustic screens and barriers between plant and sensitive neighbouring premises; and/or
6. Partially-enclosed or fully-enclosed acoustic enclosures over plant.
7. Mechanical plant shall have their noise specifications and their proposed locations checked prior to their installation on site; and

8. Fans shall be mounted on vibration isolators and balanced in accordance with Australian Standard 2625 "Rotating and Reciprocating Machinery – Mechanical Vibration".

5.2.2 Loading Dock

The development proposes a loading dock on ground floor of Building A. Access to the loading dock is proposed to be via the new proposed access roadway, off of Link Road. Refer to figure below.

Figure 5-1: Location of ground floor loading dock – red shaded (Ref: Jackson Teece)

The loading dock is proposed to be enclosed, with no allocated external waiting zones for trucks, therefore, it is expected that the noise due to operation of the loading dock will be contained within the loading dock building envelope and is not expected to affect the amenity of nearby receivers. ,

It is expected that the largest vehicles utilising the loading dock area will be Medium Rigid Vehicles.

It is expected that the loading area usage for deliveries and removalists would be unlikely to be used between 10pm and 7am. Garbage truck movements have the potential to occur within these hours.

5.2.3 Traffic generated

A traffic generation noise assessment has been undertaken to confirm whether NSW RNP criteria as discussed in Section 5.1.2 are met. This assessment has been based on predicted traffic volumes as provided by Urbis and detailed in the Transport Impact Assessment (TIA) report [10], dated May 2026.The report identifies that future developments near the site are situated approximately 1.5km and will not impact the key intersections relevant to the project. The TIA identifies intersections likely to be

impacted by the development, along with the existing and future 2030 traffic flows, these are shown in the table below, along with the predicted increase in noise.

Table 5-6: Predicted traffic generated noise assessment.

Intersection	Period	Existing peak hour traffic flows (Vehicles/hour) [1]	Predicted 2030 peak traffic flows, Vehicles/hour [1]		Predicted increase, dB	Complies?
			Without the development	With the development		
Link Rd / Horace St / Stanley St	AM	2563	2691	2707	< 1dB	Yes
	PM	2180	2289	2314	< 1dB	Yes
Yarrabung Rd / Stanely St	AM	1022	1074	1089	< 1dB	Yes
	PM	679	714	732	< 1dB	Yes
Yarrabung Rd / College Cres / Catherine St	AM	882	923	939	< 1dB	Yes
	PM	591	619	637	< 1dB	Yes
Yarrabung Rd / College Cres / Carcoola Rd	AM	735	769	775	< 1dB	Yes
	PM	466	489	494	< 1dB	Yes
Killeaton St / Yarrabung Rd / Dainton Ave	AM	735	772	776	< 1dB	Yes
	PM	488	514	518	< 1dB	Yes

Notes: (1) Peak hour traffic flows have been derived from Appendix C of the TIA report.

As noted in Section 5.1.2, when considering a new development and the impact onto sensitive land uses, the NSW RNP states that an increase up to 2dB in relation to the existing noise levels are anticipated to be insignificant. Based on the results as shown in Table 5-6, noise due to the increase in traffic from the development meets NSW RNP criteria.

6 Internal Acoustic Separation

As a minimum requirement, walls and floors and separation of services around sole occupancy units shall comply with the National Construction Code (NCC) / Building Code of Australia (BCA) 2022 or later, as relevant to the date of submission of the Construction Certificate. The development is expected to consist of both Class 9C and Class 2 residential dwellings, the following sections provide the requirements of these classes.

NCC 2022, Specification 28 outlines a number of different "Acceptable forms of constructions for walls and floors". Use of Acceptable forms of constructions is not mandatory. The design team will determine the particular constructions during the detailed design stage (to be finalised prior to Construction Certificate), however based on previous projects it is anticipated that internal partitions around sole occupancy units will likely be steel stud with plasterboard (or equivalent) linings and insulation in the cavity.

Internal partitioning for staff offices, breakout spaces, utilities, back of house, wellness etc are not governed by the NCC and will be determined/refined in consultation with the client during the detailed design phase.

6.1 NCC 2022 requirements - Class 9C

The National Construction Code Series (NCC) 2022 - Volume 1, Building Code of Australia sets out the following acoustic provisions for Class 9c buildings:

F7D5 Sound insulation rating of floors

2) A floor in a Class 9C aged care building separating sole-occupancy units must have an Rw not less than 45.

F7P3 A floor separating sole occupancy units must minimise the transmission of airborne and impact generated sound such that the separating floor, including the effect of services and their penetration, has -

- *a) A weighted standardised level (DnT,w) not less than 40 for airborne sound; and*
- *b) A weighted standardised impact sound pressure level (LnT,w) not more than 62 for impact generated sound.*

F7D6 Sound insulation rating of walls

3) A wall in a Class 9c aged care building must have an Rw not less than 45 if it separates –

- *a) sole-occupancy units; or*
- *b) a sole-occupancy unit from a kitchen, bathroom, sanitary compartment (not being an associated ensuite), laundry, plantroom or utilities room.*

4) In addition to 3), a wall separating a sole-occupancy unit in a Class 9c aged care building from a kitchen or laundry must comply with F7D4(2) [impact sound insulation]

F7D4(2) A wall in a building required to have an impact sound insulation rating must–

b) for a Class 9c building, must

(i) for other than masonry, be two or more separate leaves without rigid mechanical connection except at the periphery; or

(ii)be identical with a prototype that is no less resistant to the transmission of impact sound when tested in accordance with Specification 29 than a wall listed in S28C4 to S28C7

F7D7 Sound insulation rating of internal services

1) If a duct or soil, waste or water supply pipe, including a duct or pipe that is located in a wall or floor cavity, serves or passes through more than one sole-occupancy unit, the duct or pipe must be separated from the rooms of any sole-occupancy unit by construction with an Rw+Ctr (airborne) not less than –

a) 40 if the adjacent room is a habitable room (other than a kitchen); or

b) 25 if the adjacent room is a kitchen or non-habitable room.

2)If a storm water pipe passes through a sole-occupancy unit it must be separated in accordance with (1)(a) and (b).

F7D8 Sound isolation of pumps

A flexible coupling must be used at the point of connection between the service pipes in a building and any circulating or other pump.

6.2 NCC 2022 requirements - Class 2

The National Construction Code Series (NCC) 2022 - Volume 1, Building Code of Australia sets out the following acoustic provisions for Class 2 buildings:

F7D3 Determination of airborne sound insulation ratings

A form of construction required to have an airborne sound insulation rating must –

a) have the required value for weighted sound reduction index (Rw) or weighted sound reduction index with spectrum adaptation term (Rw + Ctr) determined in accordance with AS/NZS 1276.1 or ISO 717.1 using results from laboratory measurements; or

b) comply with Specification 28.

F7D4 Determination of impact sound insulation ratings

1) A floor in a building required to have an impact sound insulation rating must –

a) have the required value for weighted normalised impact sound pressure level (Ln,w) determined in accordance with AS/ISO 717.2 using results from laboratory measurements; or

b) comply with Specification 28

2) A wall in a building required to have an impact sound insulation rating must –

a) for a Class 2 or 3 building be of discontinuous construction;

3) For the purposes of this part, discontinuous construction means a wall having a minimum 20 mm cavity between 2 separate leaves, and

a) for masonry, where wall ties are required to connect leaves, the ties are of the resilient type; and

b) for other than masonry, there is no mechanical linkage between leaves except at the periphery.

F7D5 Sound insulation rating of floors

1) A floor in a Class 2 or 3 building must have an Rw + Ctr (airborne) not less than 50 and an Ln,w (impact) not more than 62 if it separates –

a) sole-occupancy units; or

b) a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification.

F7D6 Sound insulation rating of walls

1) A wall in a Class 2 or 3 building must –

a) have an Rw + Ctr (airborne) not less than 50, if it separates sole-occupancy units; and

b) have an Rw (airborne) not less than 50, if it separates a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification; and

c) comply with F7D4(2) if it separates:

(i) a bathroom, sanitary compartment, laundry or kitchen in one sole-occupancy unit from a habitable room (other than a kitchen) in an adjoining unit; or

(ii) a sole-occupancy unit from a plant room or lift shaft.

2) A door may be incorporated in a wall in a Class 2 or 3 building that separates a sole-occupancy unit from a stairway, public corridor, public lobby or the like, provided the door assembly has an Rw not less than 30.

5) Where a wall required to have sound insulation has a floor above, the wall must continue to –

a) the underside of the floor above; or

b) a ceiling that provides the sound insulation required for the wall.

F7D7 Sound insulation rating of internal services

1) If a duct or soil, waste or water supply pipe, including a duct or pipe that is located in a wall or floor cavity, serves or passes through more than one sole-occupancy unit, the duct or pipe must be separated from the rooms of any sole-occupancy unit by construction with an Rw+Ctr (airborne) not less than –

a) 40 if the adjacent room is a habitable room (other than a kitchen); or

b) 25 if the adjacent room is a kitchen or non-habitable room.

2)If a storm water pipe passes through a sole-occupancy unit it must be separated in accordance with (1)(a) and (b).

F7D8 Sound isolation of pumps

A flexible coupling must be used at the point of connection between the service pipes in a building and any circulating or other pump.

7 Construction noise and vibration

A detailed Construction Noise and Vibration Management Plan (CNVMP) should be prepared for the site prior to the issue of Construction Certificate detailing the site specific construction methodology, including plant and equipment to be used, expected periods of construction, and noise and vibration management treatments and procedures to be implemented.

7.1 Construction Noise Trigger Levels

The Environmental Protection Authority (EPA) released its Interim Construction Noise Guideline (ICNG) in 2009. This document is being referred to as EPA's standard policy for assessing construction noise on new projects.

The key components of the ICNG that can be incorporated into this assessment include:

1. Use of LAeq as the descriptor for measuring and assessing construction noise.

In recent years NSW noise policies including EPA's NSW Industrial Noise Policy (INP) and the NSW Environmental Criteria for Road Traffic Noise (ECRTN) have moved to the primary use of LAeq over any other descriptor. As an energy average, LAeq provides ease of use when measuring or calculating noise levels since a full statistical analysis is not required as when using, for example, the LA10 descriptor.

Consistent with the latest guideline (ICNG) the use of LAeq as the key descriptor for measuring and assessing construction noise may follow a 'best practice' approach.

2. Application of feasible and reasonable noise mitigation measures

As stated in the ICNG, a noise mitigation measure is feasible if it is capable of being put into practice, and is practical to build given the project constraints.

Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic and environmental effects, including the cost of the measure.

3. Quantitative and qualitative assessment

The ICNG provides two methods for assessment of construction noise, being either a quantitative or a qualitative assessment.

A quantitative assessment is recommended for major construction projects of significant duration, and involves the measurement and prediction of noise levels, and assessment against set criteria.

A qualitative assessment is recommended for small projects with a short-term duration where works are not likely to affect an individual or sensitive land use for more than three weeks in total. It focuses on

minimising noise disturbance through the implementation of feasible and reasonable work practices, and community notification.

Given the significant scale of the construction works proposed for this Project, a quantitative assessment is carried out herein, consistent with the ICNG's requirements.

4. Management Levels

Residences

Table 7-1 below (reproduced from Table 2 of the ICNG) sets out the noise management levels and how they are to be applied. The guideline intends to provide respite for residents exposed to excessive construction noise outside the recommended standard hours whilst allowing construction during the recommended standard hours without undue constraints.

The rating background level (RBL) is used when determining the management level. The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours).

Table 7-1: Noise at residences using quantitative assessment

Time of Day	Management Level $L_{Aeq\ (15\ min)}$*	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5dB(A)	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2.

* Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Table 7-2: Noise Management Levels for residential receivers- Standard Construction Hours

Receiver	RBL, L_{A90} Day (7am - 6pm)	Noise Management Level, $L_{Aeq(15min)}$
Residential receivers (R1, R3, R4)	45	RBL + 10 = 55

For non-residential receivers, Table 7-3 below (reproduced from Table 2 of the ICNG) sets out the noise management levels for various sensitive land use developments.

Table 7-3: Noise management levels for non-residential receivers.

Land use	Management level, $L_{Aeq\ (15\ min)}$ – applies when land use is being utilised
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A)
Places of worship	Internal noise level 45 dB(A)
Active recreation areas	External noise level 65 dB(A)
Passive recreation areas	External noise level 60 dB(A)

7.2 Expected construction noise sources

The schedule of items of plant and equipment likely to be used during the construction phases of the development is presented in the table below.

Table 7-4: Typical construction equipment & sound power levels, dB(A) re 1pW

Plant item	Plant description	No. of plant per 15 minutes	Sound power levels
Demolition			
1.	10 tonne Truck - Dump	1	100
2.	20 tonne Excavator with bucket	1	103
3.	Bob-cat	1	107
Excavation			
4.	Bulldozer	1	107
5.	35 tonne Excavator with hydraulic hammer	1	123*
6.	Delivery truck	1	103
Construction			
7.	Concrete pump truck	1	103
8.	Concrete agitator	1	108
9.	Hand tools - grinder	1	105

Note: * Sound power level provided includes corrections for annoyance in accordance with ICNG.

The sound power levels for the majority of construction plant and equipment presented in the above table are based on maximum noise levels given in Table A1 of Australian Standard 2436 - 2010 'Guide to Noise Control on Construction, Demolition and Maintenance Sites' [11], the Interim Construction Noise Guideline (ICNG), information from past projects and/or information held in our library files.

7.3 Construction noise assessment

Noise levels at any receiver locations resulting from construction works would depend on the location of the receiver with respect to the area of construction, shielding from intervening topography and structures, and the type and duration of construction being undertaken. Furthermore, noise levels at receivers would vary significantly over the total construction program due to the transient nature and large range of plant and equipment that could be used.

Table 7-5 presents noise levels likely to be experienced at the nearby affected receivers based on the construction activities, and plant and equipment associated with the proposed site compound at a range from the furthest to the closest proximity to each receiver location. Predicted results bolded in red indicate exceedances of highly noise affected trigger levels.

The predicted construction noise levels provided consider:

1. Attenuation due to distance between the construction works and the receiver locations.
2. Attenuation due to shielding of intervening structures.
3. Plant are operating continuously for the full 15min duration.
4. Quantities and sound power levels as per Table 7-4.

Table 7-5: Predicted $L_{Aeq\ (15min)}$ noise levels for typical construction plant, dB(A), with exceedances of highly noise affected shown bolded red.

Plant description	Predicted $L_{eq(15min)}$ construction noise levels, dB(A)					
	R1 (12 Newhaven Pl)	R2 (Masada College)	R3 (132 Kileaton St)	R4 (College Cres)	R5 (Bede Forest)	R6 (Chadbad Synagogue)
	220m – 30m	130m – 5m	155m -5m	175m -12m	195m – 10m	170m-14m
Noise Management Level (NML) – Standard construction hours	**55**	**55***	**55**	**55**	**60**	**55***
Demolition						
10 tonne Truck - Dump	45 - 62	49 - **78**	48 - **78**	47 - 70	46 - 72	47 - 69
20 tonne Excavator with bucket	48 - 65	52 - **81**	51 - **81**	50 - 73	49 - 75	50 - 72
Bob-cat	52 - 69	56 - **85**	55 - **85**	54 - **77**	53 - **79**	54 - **76**
Excavation						
Bulldozer	61 - **78**	65 - **94**	64 - **94**	63 - **86**	62 - **88**	63 - **85**
35 tonne Excavator with hydraulic hammer	68 - **85**	72 - **101**	71 - **101**	70 - **93**	69 - **95**	70 - **92**
Delivery truck	43 - 60	47 - **76**	46 - **76**	45 - 68	44 - 70	45 - 67
Construction						
Concrete pump truck	50 - 67	54 - **83**	53 - **83**	52 - 75	51 - **77**	52 - 74
Concrete agitator	53 - 70	57 - **86**	56 - **86**	55 - **78**	54 - **80**	55 - **77**
Hand tools	52 - 69	56 - **85**	55 - **85**	54 - **77**	53 - **79**	54 - **76**

Notes: *A correction has been applied to the internal noise trigger levels to determine external trigger levels.

Based on the predicted construction noise levels presented in the table above, the trigger levels as defined in Section 7.1 are expected to be exceeded, particularly when works are conducted at the boundary of the site.

Furthermore, construction noise levels at all receivers are predicted to be greater than the highly noise affected level of 75dba for the operation of the nosiest individual construction plant and equipment (i.e. excavator with hydraulic hammer) when used in close proximity to the receiver.

In light of the predicted noise levels above, it is recommended that a feasible and reasonable approach towards noise management measure be applied to reduce noise levels as much as possible to manage the impact from construction noise.

Further details on construction noise mitigation and management measures are provided below.

7.4 Construction noise mitigation and management measures

The following recommendations provide in-principle feasible and reasonable noise control solutions to reduce noise impacts to sensitive receivers. Where actual construction activities differ from those assessed in this report, more detailed design of noise control measures may be required once specific items of plant and construction methods have been chosen and assessed on site.

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.

7.5 General Engineering Noise Control

Implementation of noise control measures, such as those suggested in Australian Standard 2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites", are expected to reduce predicted construction noise levels. Reference to Australian Standard 2436-1981, Appendix E, Table E1 suggests possible remedies and alternatives to reduce noise emission levels from typical construction equipment.

Table 7-6 below present noise control methods, practical examples and expected noise reductions according to AS2436 and according to Renzo Tonin & Associates' opinion based on experience with past projects.

Table 7-6: Relative Effectiveness of Various Forms of Noise Control, dBA

Noise Control Method	Practical Examples	Typical noise reduction possible in practice		Maximum noise reduction possible in practice	
		AS 2436	Renzo Tonin & Assoc.	AS 2436	Renzo Tonin & Assoc.
Screening	Acoustic barriers such as earth mounds, temporary or permanent noise barriers	7 to 10	5 to 10	15	15

Noise Control Method	Practical Examples	Typical noise reduction possible in practice		Maximum noise reduction possible in practice	
		AS 2436	Renzo Tonin & Assoc.	AS 2436	Renzo Tonin & Assoc.
Acoustic Enclosures	Engine casing lagged with acoustic insulation and plywood	15 to 30	10 to 20	50	30
Engine Silencing	Residential class mufflers	5 to 10	5 to 10	20	20
Substitution by alternative process	Use electric motors in preference to diesel or petrol	15 to 25	15 to 25	60	40

The Renzo Tonin & Associates' listed noise reductions are conservatively low and should be referred to in preference to those of AS2436, for this assessment.

7.5.1 Physical noise controls

Physical noise control measures are recommended for implementation at the worst affected neighbouring receiver locations. The following in-principal noise mitigation measure is provided to reduce noise impacts to the neighbouring receivers.

Erect solid hoarding/ noise screens around the perimeter of the construction site to break the line of site between the high noise generating activities and the windows of the receiver locations.

7.5.2 Regular periodic noise monitoring

The following approach would be adopted with regard to noise monitoring procedures during the construction works.

Where potential noise impacts are predicted to be within 10 to 15dB(A) of the noise management level, the potential construction noise nuisance is considered to be moderate. Noise monitoring should be carried out to confirm predicted noise impacts within two weeks of commencement of construction. Reasonable and feasible noise reduction measures would be investigated, where necessary.

Where potential noise impacts are predicted to be more than 15dB(A) above the noise management levels, the potential construction noise nuisance is considered to be high. All reasonable and feasible noise control measures should be implemented prior to the commencement of construction works. Noise compliance monitoring for all major equipment and activities on the site should be undertaken prior to their commencement of work on site. Finally, noise levels during construction should be monitored and where exceeded, further noise reduction measures (where reasonable and feasible) should be implemented eg. restrict working hours, use silencing equipment, etc.

7.5.3 General noise management measures

In addition to physical noise controls, the following general noise management measures should be followed:

1. Use less noisy plant and equipment, where feasible and reasonable.
2. Plant and equipment should be properly maintained.
3. Provide special attention to the use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended.
4. Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel.
5. Avoid any unnecessary noise when carrying out manual operations and when operating plant.
6. Any equipment not in use for extended periods during construction work should be switched off.

In addition to the noise mitigation measures outlined above, a management procedure would need to be put in place to deal with noise complaints that may arise from construction activities. Each complaint would need to be investigated and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits. See Appendix D for an example of a complaint handling procedure and form.

Good relations with people living and working in the vicinity of a construction site should be established at the beginning of a project and be maintained throughout the project, as this is of paramount importance. Keeping people informed of progress and taking complaints seriously and dealing with them expeditiously is critical. The person selected to liaise with the community should be adequately trained and experienced in such matters.

Where noise level exceedances cannot be avoided, then consideration may be given to implementing time restrictions and/or providing periods of repose for residents, where feasible and reasonable. That is, daily periods of respite from noisy activities may also be scheduled for building occupants during business hours.

Some items of plant may exceed noise limits even after noise treatment is applied. To reduce the overall noise impact, the use of noisy plant may be restricted to within certain time periods, where feasible and reasonable and to be negotiated with Council and the residents. For example, between 10am and 3pm (with one-hour break for lunch between 12pm and 1pm), noisy activities could occur with no noise level restrictions over a limited time period. Residents would be notified of the potential noise impact during this time period so that they can organise their day around the noisy period. Allowing the construction

activities to proceed, despite the noise exceedance may be the preferred method in order to complete the works expeditiously.

7.6 Vibration management plan

7.6.1 Vibration criteria

Construction vibration is associated with three main types of impact:

1. disturbance to building occupants
2. potential damage to buildings, and
3. potential damage to sensitive equipment in a building.

Generally, if disturbance to building occupants is controlled, there is limited potential for structural damage to buildings.

Vibration amplitude may be measured as displacement, velocity, or acceleration.

1. Displacement (x) measurement is the distance or amplitude displaced from a resting position. The International System of Units (SI unit) for distance is the metre (m), although common industrial standards include mm.
2. Velocity ($v=\Delta x/\Delta t$) is the rate of change of displacement with respect to change in time. The SI unit for velocity is metres per second (m/s), although common industrial standards include mm/s. The Peak Particle Velocity (PPV) is the greatest instantaneous particle velocity during a given time interval. If measurements are made in 3-axis (x, y, and z) then the resultant PPV is the vector sum (i.e. the square root of the summed squares of the maximum velocities) regardless of when in the time history those occur.
3. Acceleration ($a=\Delta v/\Delta t$) is the rate of change of velocity with respect to change in time. The SI unit for acceleration is metres per second squared (m/s2).

7.6.2 Disturbance to buildings occupants

Assessment of potential disturbance from vibration on human occupants of buildings is made in accordance with the DECC '*Assessing Vibration; a technical guideline*' (DECC, 2006) [12]. The guideline provides criteria which are based on the British Standard BS 6472-1992 '*Evaluation of human exposure to vibration in buildings (1-80Hz)*'. Sources of vibration are defined as either 'Continuous', 'Impulsive' or 'Intermittent'. Table 7-7 provides definitions and examples of each type of vibration.

Table 7-7: Types of vibration

Type of vibration	Definition	Examples
Continuous vibration	Continues uninterrupted for a defined period (usually throughout the day-time and/or night-time)	Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery).
Impulsive vibration	A rapid build-up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading.
Intermittent vibration	Can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude	Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer, this would be assessed against impulsive vibration criteria.

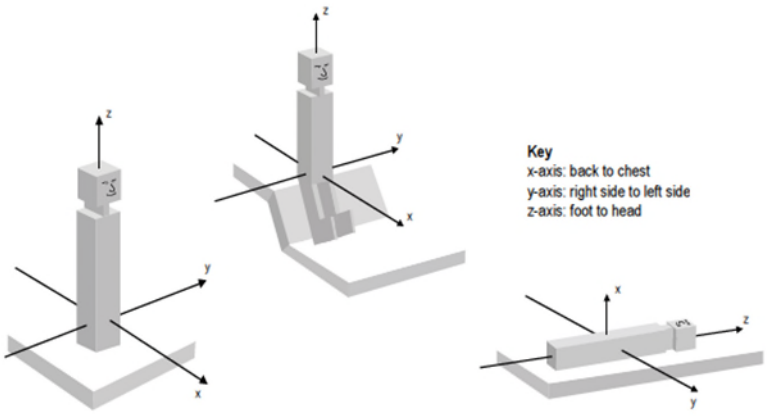
Source: Assessing Vibration; a technical guideline, Department of Environment & Climate Change, 2006

The vibration criteria are defined as a single weighted root mean square (rms) acceleration source level in each orthogonal axis. Section 2.3 of the guideline states:

> *'Evidence from research suggests that there are summation effects for vibrations at different frequencies. Therefore, for evaluation of vibration in relation to annoyance and comfort, overall weighted rms acceleration values of the vibration in each orthogonal axis are preferred (BS 6472).'*

When applying the criteria, it is important to note that the three directional axes are referenced to the human body, i.e. x-axis (back to chest), y-axis (right side to left side) or z-axis (foot to head). Vibration may enter the body along different orthogonal axes and affect it in different ways. Therefore, application of the criteria requires consideration of the position of the people being assessed, as illustrated in Figure 7-1. For example, vibration measured in the horizontal plane is compared with x- and y-axis criteria if the concern is for people in an upright position, or with the y- and z- axis criteria if the concern is for people in the lateral position.

Figure 7-1:Orthogonal axes for human exposure to vibration



The preferred and maximum values for continuous and impulsive vibration are defined in Table 2.2 of the guideline and are reproduced in Table 7-8.

Table 7-8: Preferred and maximum levels for human comfort

Location	Assessment period[1]	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration (weighted RMS acceleration, m/s^2, 1-80Hz)					
Critical areas[2]	Day- or night-time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day- or night-time	0.020	0.014	0.040	0.028
Workshops	Day- or night-time	0.04	0.029	0.080	0.058
Impulsive vibration (weighted RMS acceleration, m/s^2, 1-80Hz)					
Critical areas[2]	Day- or night-time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day- or night-time	0.64	0.46	1.28	0.92
Workshops	Day- or night-time	0.64	0.46	1.28	0.92

Notes:
2. Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am
3. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specify above. Stipulation of such criteria is outside the scope of their policy and other guidance documents (e.g. relevant standards) should be referred to. Source: BS 6472-1992

The acceptable vibration dose values (VDV) for intermittent vibration are defined in Table 2.4 of the guideline and are reproduced in Table 7-9.

Table 7-9: Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$)

Location	Daytime[1]		Night-time[1]	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical areas[2]	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Notes:
4. Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am
5. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous of impulsive criteria for critical areas.
Source: BS 6472-1992

7.6.3 Building damage

Potential structural damage of buildings as a result of vibration is typically managed by ensuring vibration induced into the structure does not exceed certain limits and standards, such as British Standard 7385 Part 2 and German Standard DIN4150-3. Currently there is no existing Australian Standard for assessment of structural building damage caused by vibration energy.

Within British Standard 7385 Part 1: 1990, different levels of structural damage are defined:

Cosmetic - The formation of hairline cracks on drywall surfaces, or the growth of existing cracks in plaster or drywall surfaces; in addition the formation of hairline cracks in mortar joints of brick/concrete block construction.

Minor - The formation of large cracks or loosening of plaster or drywall surfaces, or cracks through bricks/concrete blocks.

Major - Damage to structural elements of the building, cracks in supporting columns, loosening of joints, splaying of masonry cracks, etc.

The vibration limits in Table 1 of British Standard 7385 Part 2 (1993) are for the protection against cosmetic damage, however guidance on limits for minor and major damage is provided in Section 7.4.2 of the Standard:

> *"7.4.2 Guide values for transient vibration relating to cosmetic damage*
>
> *Limits for transient vibration, above which cosmetic damage could occur are given numerically in Table 1 and graphically in Figure 1. In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the guide values for the building types corresponding to line 2 are reduced. Below a frequency of 4 Hz, where a high displacement is associated with a relatively low peak component particle velocity value a maximum displacement of 0.6 mm (zero to peak) should be used.*
>
> *Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 1, and major damage to a building structure may occur at values greater than four times the tabulated values."*

Within DIN4150-3, damage is defined as "*any permanent effect of vibration that reduces the serviceability of a structure or one of its components*" (p.2). The Standard also outlines:

> *"that for structures as in lines 2 and 3 of Table 1, the serviceability is considered to have been reduced if*

cracks form in plastered surfaces of walls;

existing cracks in the building are enlarged;

partitions become detached from loadbearing walls or floors.

These effects are deemed 'minor damage. " (DIN4150.3, 1990, p.3)

While the DIN Standard defines the above damage as 'minor', based on the definitions provided in BS7385, the DIN standard is considered to deal with cosmetic issues rather than major structural failures.

British Standard

British Standard 7385: Part 2 '*Evaluation and measurement of vibration in buildings*', can be used as a guide to assess the likelihood of building damage from ground vibration. BS7385 suggests levels at which 'cosmetic', 'minor' and 'major' categories of damage might occur.

The cosmetic damage levels set by BS 7385 are considered 'safe limits' up to which no damage due to vibration effects has been observed for certain particular building types. Damage comprises minor non-structural effects such as hairline cracks on drywall surfaces, hairline cracks in mortar joints and cement render, enlargement of existing cracks and separation of partitions or intermediate walls from load bearing walls. 'Minor' damage is considered possible at vibration magnitudes which are twice those given and 'major' damage to a building structure may occur at levels greater than four times those values.

BS7385 is based on peak particle velocity and specifies damage criteria for frequencies within the range 4Hz to 250Hz, being the range usually encountered in buildings. At frequencies below 4Hz, a maximum displacement value is recommended. The values set in the Standard relate to transient vibrations and to low-rise buildings. Continuous vibration can give rise to dynamic magnifications due to resonances and may need to be reduced by up to 50%.Table 7-10 sets out the BS7385 criteria for cosmetic, minor and major damage.

Table 7-10: BS 7385 structural damage criteria

Group	Type of structure	Damage level	Peak component particle velocity1, mm/s		
			4Hz to 15Hz	15Hz to 40Hz	40Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	Cosmetic	50		
		Minor2	100		
		Major2	200		
2	Un-reinforced or light framed structures Residential or light commercial type buildings	Cosmetic	15 to 20	20 to 50	50
		Minor2	30 to 40	40 to 100	100
		Major2	60 to 80	80 to 200	200

Notes: 6. Peak Component Particle Velocity is the maximum Peak particle velocity in any one direction (x, y, z) as measured by a tri-axial vibration transducer.

7. Minor and major damage criteria established based on British Standard 7385 Part 2 (1993) Section 7.4.2

German Standard

German Standard DIN 4150 - Part 3 '*Structural vibration in buildings - Effects on Structure*' (DIN 4150-3) [13], also provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are generally recognised to be conservative.

DIN 4150-3 presents the recommended maximum limits over a range of frequencies (Hz), measured in any direction, and at the foundation or in the plane of the uppermost floor of a building or structure. The vibration limits increase as the frequency content of the vibration increases. The criteria are presented in Table 7-11.

Table 7-11: DIN 4150-3 structural damage criteria

Group	Type of structure	Vibration velocity, mm/s			
		At foundation at frequency of			Plane of floor uppermost storey
		1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Group 1 or 2 and have intrinsic value (eg buildings under a preservation order)	3	3 to 8	8 to 10	8

7.6.4 Vibration management measures

The following vibration management measures are provided to minimise vibration impact from construction activities to the nearest affected receivers and to meet the relevant human comfort and building damage vibration limits:

- A management procedure should be implemented to deal with vibration complaints. Each complaint should be investigated and where vibration levels are established as exceeding the set limits, appropriate amelioration measures should be put in place to mitigate future occurrences.

- Where vibration is found to be excessive, management measures should be implemented to ensure vibration compliance is achieved. Management measures may include modification of construction methods such as using smaller equipment, establishment of safe buffer zones as mentioned above, and if necessary, time restrictions for the most excessive vibration activities. Time restrictions are to be negotiated with affected receivers.

- Where construction activity occurs in close proximity to sensitive receivers, vibration testing of actual equipment on site would be carried out prior to their commencement of site operation to determine acceptable buffer distances to the nearest affected receiver locations.

- Dilapidation surveys should be conducted at all residential and other sensitive receivers within 50 metres of the construction site. Notification by letterbox drop would be carried out for all occupied buildings within 100m of the construction site. These measures are to address potential community concerns that perceived vibration may cause damage to property.

7.7 Vibration sources

The vibration generated from construction works will vary depending on the level and type of activity carried out at each site during each activity.

Table 7-12 below identifies the dominant vibration generating plant and their typical vibration levels based on library data and measurements from past projects. Potential vibration generated to receivers for this project will be dependent on separation distances, the intervening soil and rock strata, dominant frequencies of vibration and the receiver structure.

Table 7-12: Typical ranges of construction plant vibration levels

Plant Noise Source	Typical PPV Vibration (mm/s) at distance from plant							
	5m	10m	15m	20m	30m	40m	50m	100m
Bobcat (Mustang 2054)	<1	-	-	-	-	-	-	-
Compactor (852G)	5.3	2.0	2.2	1.4	<1	-		
Dozer (D810) (with ripper)	<2	-	-	-	-	-		
Drilling machine – Pneumatic (Atlas Copco (ROC 812HC 20T)	3.2	1	-	-	<0.1	-	<0.1	-
Drilling Rig – Air Trac Rotary (Ingersoll/Rand CM350)	4.4	1.4	-	-	0.6	-	<0.1	-
Drilling Rig – Tracked (Samsung SE 240 LC3 18T)	<2	-	-	-	-	-	-	-
Excavator ≤30T (travelling)	8.0	3.4	1.6	-	-	-		
Excavator ≤30T (digging)	5.8	4.0	0.0	-	-	-		
Excavator & Rock Hammer (20T)	4.5	1.3	-	0.4	0.2	0.15		
Excavator & Rock Hammer (27T)	10.5	2.5	-	-	-	-		
Excavator & Heavy Rock Hammer (eg 1500 kg)	4.5	1.3	-	0.4	0.2	0.15	0.02	-
Grader (20 tonne)	2.0	-	0.2	-	-	-		
Jack hammers	2.0	1.0	0.2	0.1	0.0	0.1		
Piling Rig – Bored (Soilmec 60T) *	2.4	0.2	0.2	-	-	-		
Ripper (D10 D375A-2)	1-2	-	-	-	-	-	-	-
Rocksaw (Komatsu AVANCE PC300)	1.5	-	-	-	-	-	-	-
Timber Pole Drill	3.2	1	-	-	-	<0.2		
Truck & Trailer (45T net)	14.5	10.3	3.4	-	-	-		
Vibratory Roller ≤ 3T (Smooth Drum)#	8.7	5.4	-	-	-	-	-	-
Vibratory Roller ≤ 8T (Pad Footed)#	9-12	3.1						
Vibratory Roller ≤ 17T (Smooth Drum)	24.5	8.9	4.2	-	-	-		
Vibratory Roller ≤ 17T (Pad Footed)	15.1	10.3	3.2	-	-	-		

Notes: Source – Renzo Tonin & Associates database
* data based on sand/clay soil conditions
# Monitor mounted on plate in sands

Site specific buffer distances for vibration significant plant items (e.g. vibratory rollers, compactors, pile boring, pole drilling) must be measured on site. Unlike noise, vibration can't be 'predicted'. There are many variables from site to site, for example soil type and conditions; sub surface rock; building types and foundations; and actual plant on site. The data relied upon in this assessment (tabulated above) is taken from a database of vibration levels measured at various sites or obtained from other sources (e.g. BS5228-2:2009). They are not specific to this project as final vibration levels are dependent on many factors including the actual plant used, its operation and the intervening geology between the activity and the receiver.

7.8 Vibration mitigation

7.8.1 Recommended minimum buffer distances for residential/commercial properties

The pattern of vibration radiation is very different to the pattern of airborne noise radiation, and is very site specific as final vibration levels are dependent on many factors including the actual plant used, its operation and the intervening geology between the activity and the receiver. Accordingly, based on a database containing vibration measurements from past projects and library information, Table 7-13 below presents the recommended minimum working distances for high vibration generating plant.

Table 7-13: Recommended minimum working distances for vibration intensive plant

Plant item	Rating / description	Minimum working distance	
		Cosmetic damage	Human response
Vibratory Roller[1]	< 50 kN (Typically 1-2 tonnes)	5 m	15m – 20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	100 m
	> 300 kN (Typically 13-18 tonnes)	20 m	100 m
	> 300 kN (Typically > 18 tonnes)	25 m	100 m
Compactors[2]	-	15 m	100 m
Dozer[1]	(D810) with ripper	2 m (nominal)	10 m
Excavators[2]	< 30 Tonne (travelling/ digging)	10 m	15 m
Grader[1]	<= 20 tonne	2 m (nominal)	10 m
Loaders[2]	-	-	5 m
Small Hydraulic Hammer[2]	300kg (5-12 tonne excavator)	2 m	7 m
Medium Hydraulic Hammer[2]	900kg (12-18 tonne excavator)	7 m	23 m
Large Hydraulic Hammer[2]	1600kg (18-34 tonne excavator)	22 m	73 m
Jackhammer[2]	Hand held	1 m (nominal)	Avoid contact with structure
Truck Movements[2]	-	-	10 m

Notes: 1. TCA Construction Noise Strategy (Rail Projects) November 2011
2. Renzo Tonin & Associates project files, databases & library

Site specific buffer distances should be determined once vibration emission levels are measured from each plant item prior to the commencement of their regular use on site. Where construction activity occurs in close proximity to sensitive receivers, minimum buffer distances for building damage should be determined by site measurements and maintained.

8 Conclusion

Renzo Tonin & Associates have completed an assessment of the potential noise impacts to and from the proposed residential development known as Montefiore Aged Care Facility, St Ives.

The primary noise intrusion assessment related to road traffic noise on the proposed residential building. The study of external noise intrusion into the subject development has found that appropriate controls can be incorporated such as acoustic glazing into the building design to achieve compliance with acoustic requirements of Australian Standard AS/NZS 2107.

Noise emission goals for the operation of mechanical plant and equipment have been set in accordance with the Noise Policy for Industry.

In conclusion, the proposed site is capable of complying with all relevant acoustic criteria through means of standard acoustic treatment and management. All recommended mitigations in this report will be implemented as necessary through ongoing design development to ensure the applicable acoustic design requirements as satisfied.

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.

References

[1] NSW Government, *State Environmental Planning Policy (Housing),* ACT: NSW Government, 2021.

[2] New South Wales Government, State Environmental Planning Policy (Transport and Infrastructure), NSW: New South Wales Government, 2021.

[3] NSW Environmental Protection Authority, Noise Policy for Industry, Sydney: Environment Protection Authority, 2017.

[4] Australian Standard, AS2107:2016 Acoustics - Recommended design sound levels and reverberation times for building interiors, Australian Standard, 2016.

[5] Department of Environment & Climate Change NSW, "Interim Construction Noise Guideline," Department of Environment & Climate Change NSW, 2009.

[6] Australian Buildling Codes Board, Volume One - Building Code of Australia, ACT: Australian Buildling Codes Board, 2022.

[7] Ku-ring-gai Council, Ku-ring-gai Development Control Plan, Ku-ring-gai: Ku-ring-gai Council, 2026.

[8] NSW Government Department of Planning, "Development near Rail corridors and Busy roads - Interim Guideline," NSW Department of Planning, 2008.

[9] Australian Standard, "AS3671 Acoustics - Road traffic noise intrusion - Building siting and construction," Australian Standard, 1989.

[10] Urbis, "Transport Impact Assessment (v02)," Urbis, 2026.

[11] Australian Standard, "AS 2436-2010 - Guide to noise and vibration control on construction, demolition and maintenance sites," Australian Standard, 2010.

[12] Department of Environment and Conservation NSW, "Assessing Vibration: a technical guideline," DECC, 2006.

[13] German Standard, "DIN-4150-3 - Vibration in buildlings - Part 3: Effect on structures," German Standard, 2016.

[14] NSW Environmental Protection Authority, NSW Road Noise Policy, Sydney: Department of Environment, Climate Change and Water NSW, 2011.

[15] Transport for New South Wales, "Traffic Volume Maps for Transport and Infrastructure SEPP - MAP 12B," NSW Government, 2023. [Online]. Available: https://www.transport.nsw.gov.au/system/files/media/documents/2023/Traffic%20volume%20map%20-%2012B.pdf. [Accessed 11th May 2026].

[16] British Standard, "BS 6472-1:2008 - Guide to evalusation of human exposure to vibration in buildlings Part 1: Vibration sources other than blasting," British Standard, 2008.

[17] British Standard, "BS 7385: Part 1:1990 - Evaluation and measurement for vibration in Buildings," British Standard, 1990.

[18] British Standard, "BS 7385-2:1993 - Evaluation and measurement for vibration in buildings," British Standard, 1993.

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.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
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 Point	A point at which noise measurements are taken 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 (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our daytime environment:

threshold of hearing	0 dB	The faintest sound we can hear
	10 dB	Human breathing
almost silent	20 dB	
	30 dB	Quiet bedroom or in a quiet national park location
generally quiet	40 dB	Library
	50 dB	Typical office space or ambience in the city at night
moderately loud	60 dB	CBD mall at lunch time
	70 dB	The sound of a car passing on the street
loud	80 dB	Loud music played at home
	90 dB	The sound of a truck passing on the street
very loud	100 dB	Indoor rock band concert
	110 dB	Operating a chainsaw or jackhammer
extremely loud	120 dB	Jet plane take-off at 100m away
threshold of pain	130 dB	
	140 dB	Military jet take-off at 25m away

dB(A)	A-weighted decibels. 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 switched on 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.

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.
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.
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.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
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_{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_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
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.
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 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.

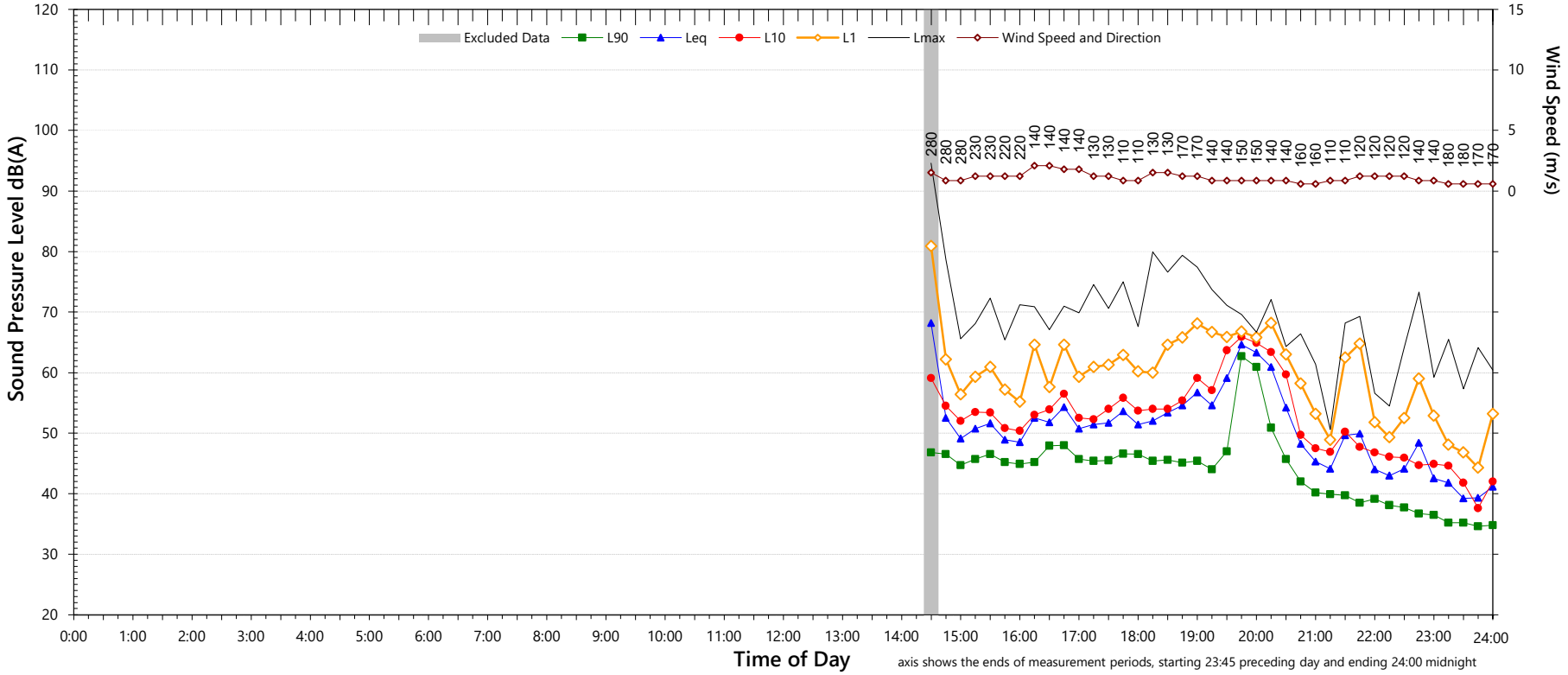
APPENDIX B Noise Monitoring Graphs

Monitor location as shown in Figure 2-2 of this report.

Unattended Noise Monitoring Results

Masada College, St Ives (southern end of site) - Masada College, S

Tuesday, 17 March 2026



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	-	39	-
L_{Aeq}	-	58	-

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	66	to	79
L_{AFMax} - L_{Aeq} (Range)	24	to	28

NSW Road Noise Policy (1m from facade)		(See note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	52
$L_{Aeq\ 1hr}$ upper 10 percentile	-	54
$L_{Aeq\ 1hr}$ lower 10 percentile	-	40

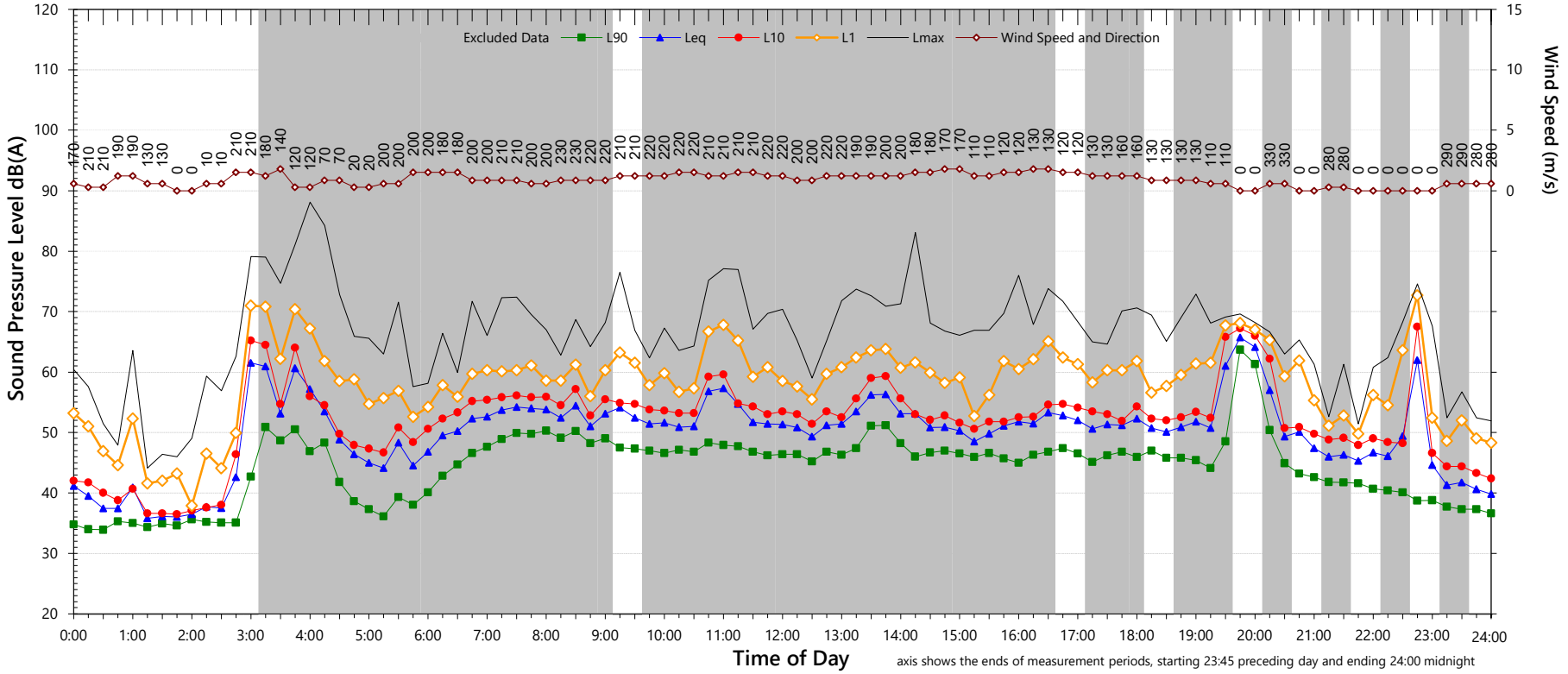
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Masada College, St Ives (southern end of site) - Masada College, S

Wednesday, 18 March 2026



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	-	-	-
L_{Aeq}	-	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	75	to	75
L_{AFMax} - L_{Aeq} (Range)	15	to	17

NSW Road Noise Policy (1m from facade)		(See note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	60	53
$L_{Aeq\ 1hr}$ upper 10 percentile	62	55
$L_{Aeq\ 1hr}$ lower 10 percentile	50	40

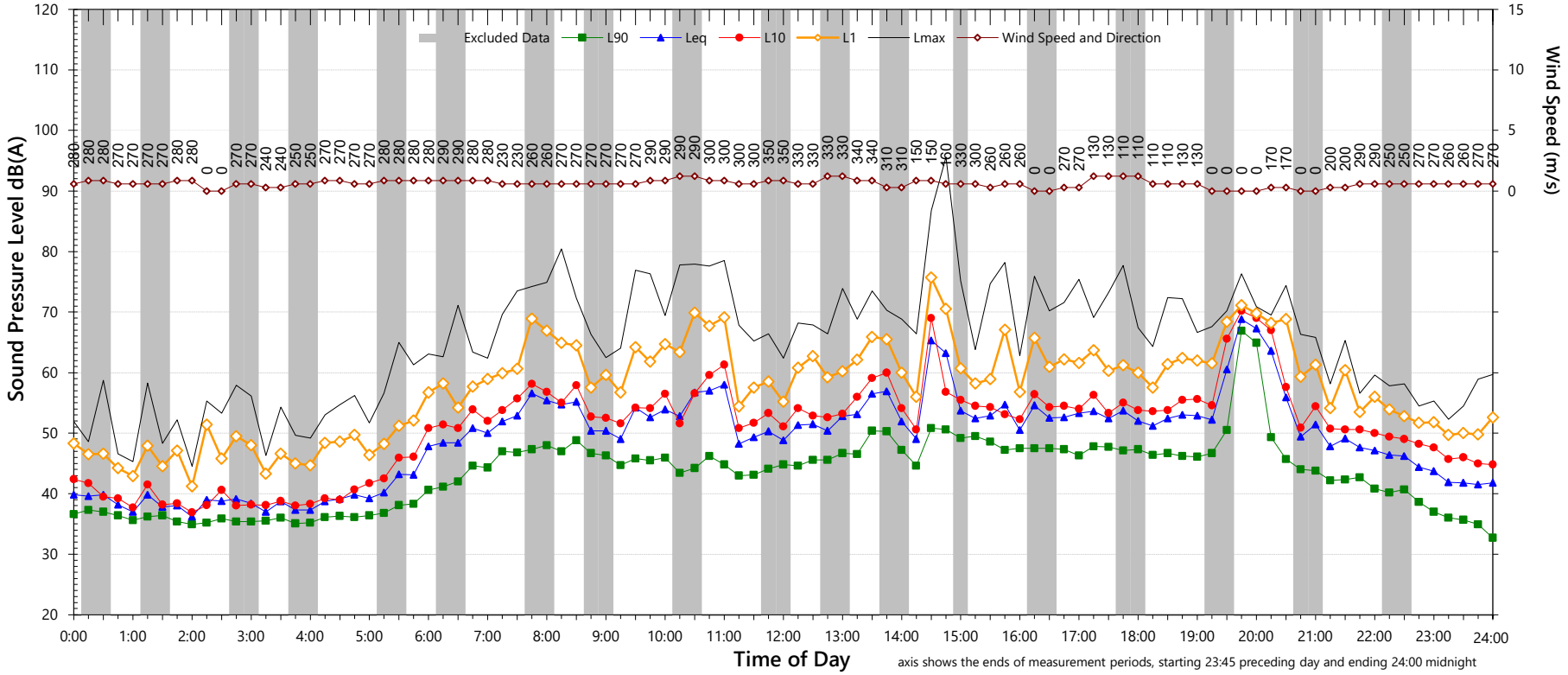
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Masada College, St Ives (southern end of site) - Masada College, S

Thursday, 19 March 2026



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	-	-	-
L_{Aeq}	-	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	75	to	82
L_{AFMax} - L_{Aeq} (Range)	15	to	25

NSW Road Noise Policy (1m from facade)		(See note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	61	50
$L_{Aeq\ 1hr}$ upper 10 percentile	65	56
$L_{Aeq\ 1hr}$ lower 10 percentile	52	39

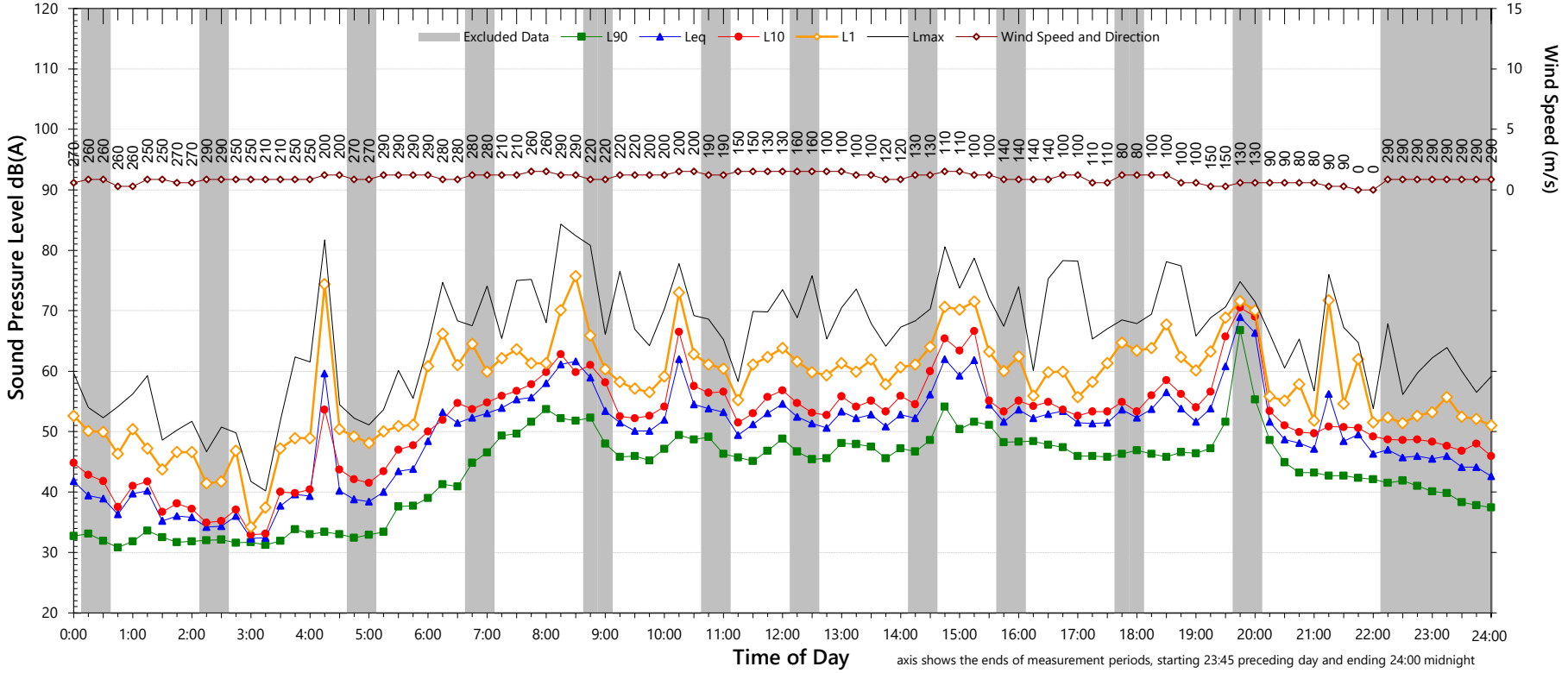
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Masada College, St Ives (southern end of site) - Masada College, S

Friday, 20 March 2026



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	-	42	-
L_{Aeq}	-	54	-

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	70	to	76
L_{AFMax} - L_{Aeq} (Range)	16	to	30

NSW Road Noise Policy (1m from facade)		(See note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	58	49
$L_{Aeq\ 1hr}$ upper 10 percentile	63	52
$L_{Aeq\ 1hr}$ lower 10 percentile	54	41

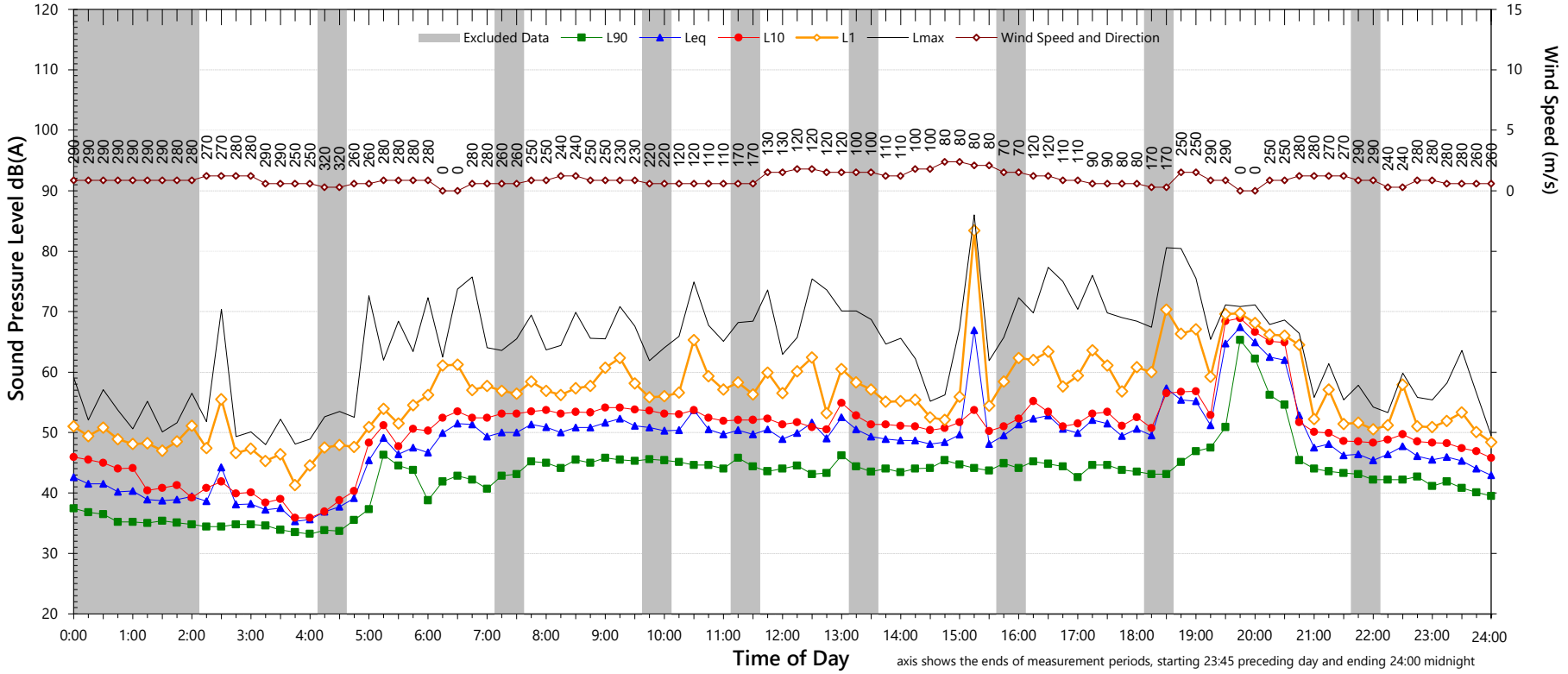
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Masada College, St Ives (southern end of site) - Masada College, S

Saturday, 21 March 2026



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	-	-	34
L_{Aeq}	-	-	45

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	67	to	73
L_{AFMax} - L_{Aeq} (Range)	15	to	24

NSW Road Noise Policy (1m from facade)		(See note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	60	47
$L_{Aeq\ 1hr}$ upper 10 percentile	65	49
$L_{Aeq\ 1hr}$ lower 10 percentile	51	41

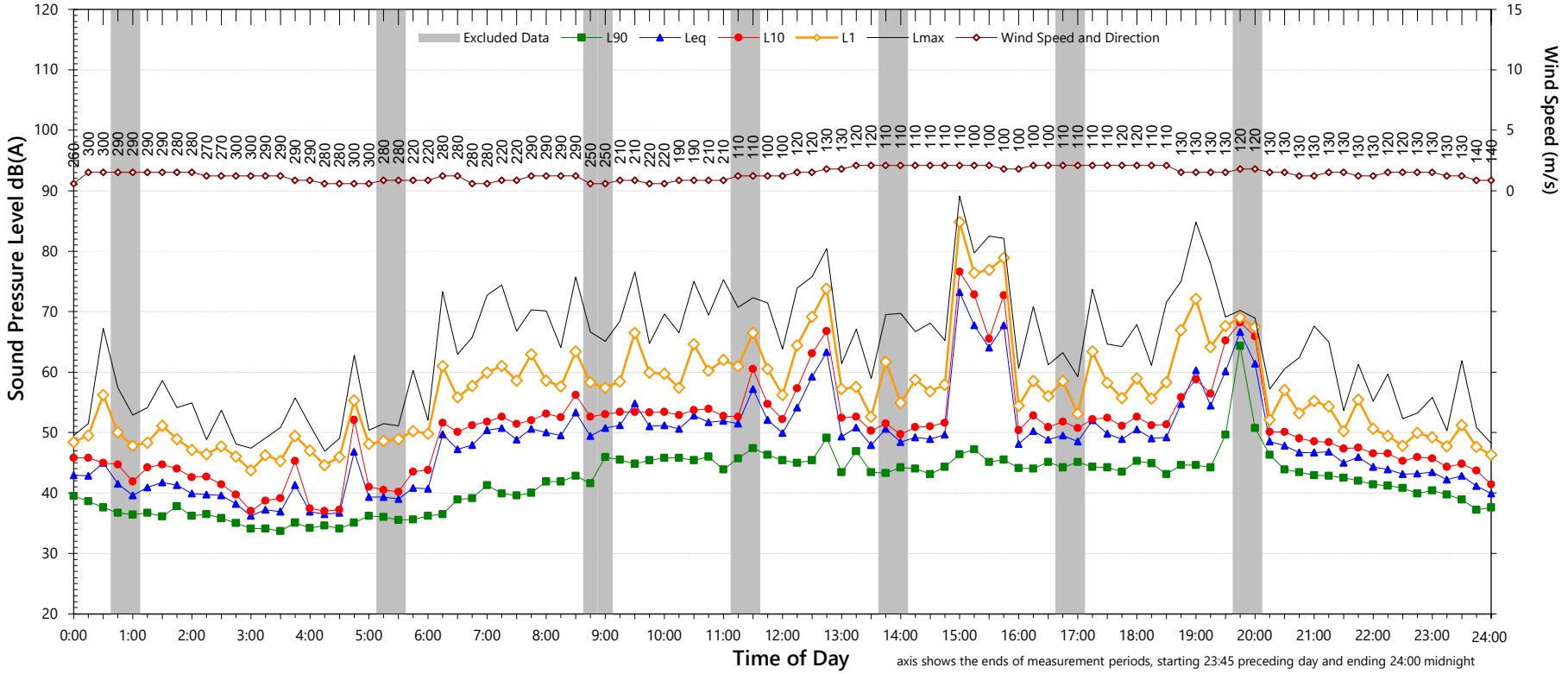
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Masada College, St Ives (southern end of site) - Masada College, S

Sunday, 22 March 2026



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	43	42	-
L_{Aeq}	61	54	-

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	66	to	80
L_{AFMax} - L_{Aeq} (Range)	16	to	25

NSW Road Noise Policy (1m from facade)		(See note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	62	51
$L_{Aeq\ 1hr}$ upper 10 percentile	66	54
$L_{Aeq\ 1hr}$ lower 10 percentile	51	43

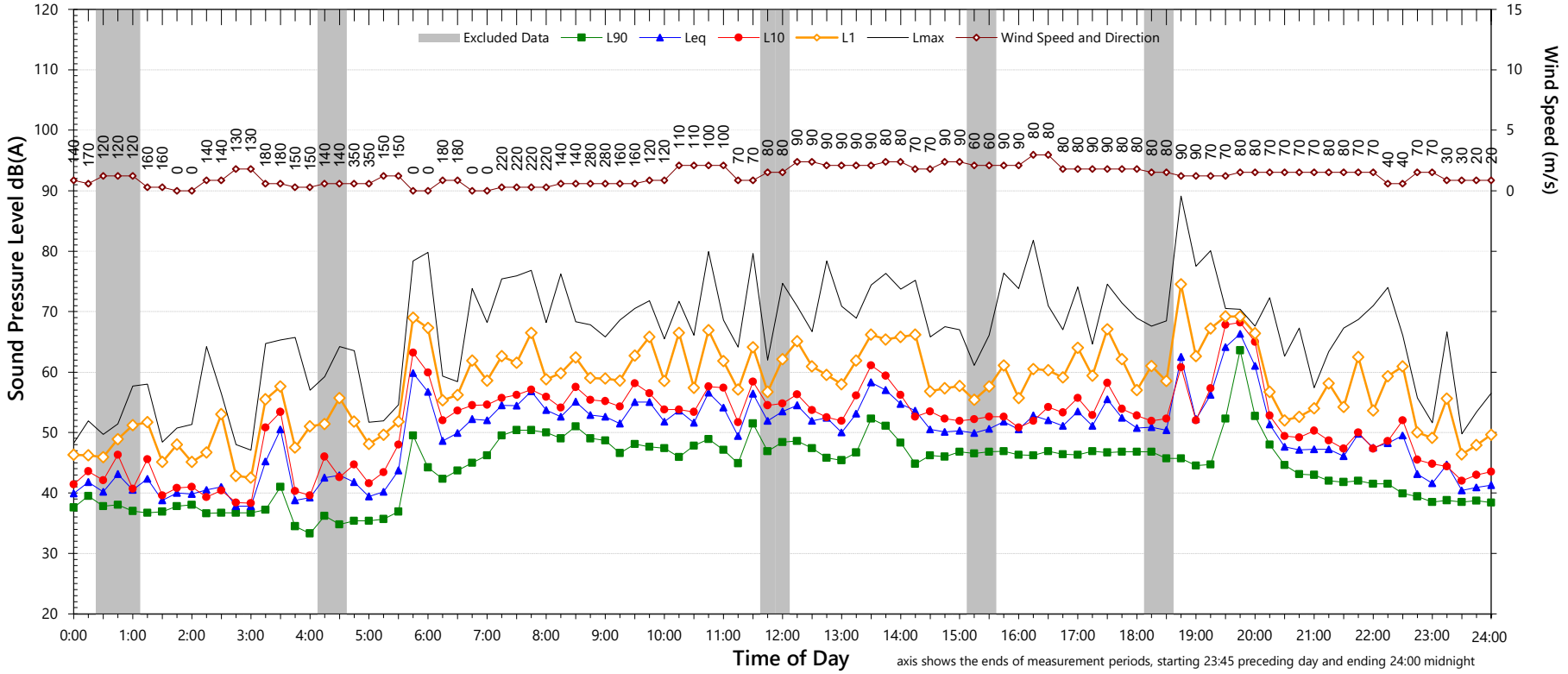
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Masada College, St Ives (southern end of site) - Masada College, S

Monday, 23 March 2026



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	46	42	36
L_{Aeq}	54	59	46

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	67	to	74
L_{AFMax} - L_{Aeq} (Range)	15	to	27

NSW Road Noise Policy (1m from facade)		(See note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	58	48
$L_{Aeq\ 1hr}$ upper 10 percentile	61	50
$L_{Aeq\ 1hr}$ lower 10 percentile	52	41

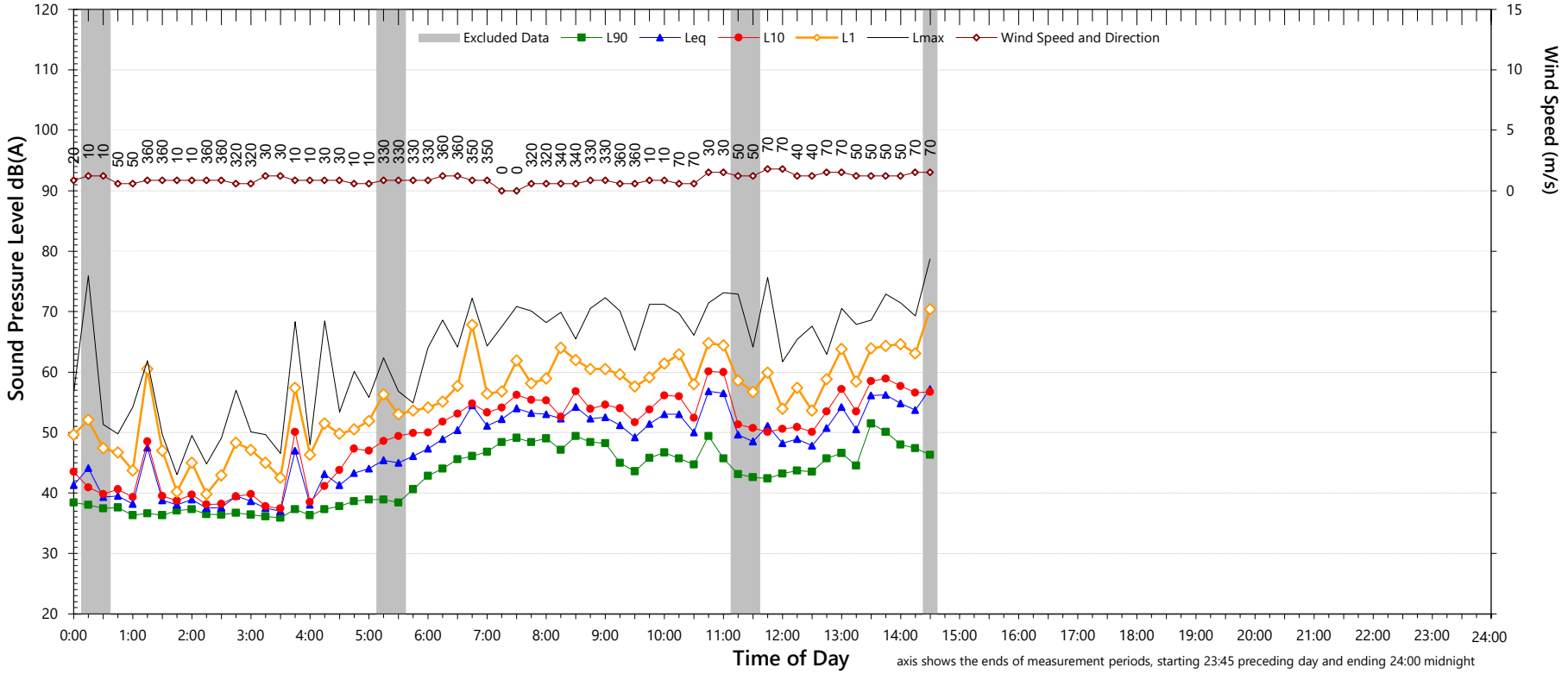
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Masada College, St Ives (southern end of site) - Masada College, S

Tuesday, 24 March 2026



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	-	-	-
L_{Aeq}	-	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	-	to	-
L_{AFMax} - L_{Aeq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(See note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	-
$L_{Aeq\ 1hr}$ upper 10 percentile	-	-
$L_{Aeq\ 1hr}$ lower 10 percentile	-	-

Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)