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37 ARCHER STREET, CHATSWOOD

Noise and Vibration Assessment for SSDA (SSD-73277714)

8 May 2025

Hyecorp

TP197-01F02 Noise and Vibration Assessment for SSDA (r1)

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1 Introduction

Renzo Tonin & Associates was engaged to undertake a Noise Impact Assessment for a proposed mixed-use development with affordable housing in-fill at 37 Archer Street, Chatswood.

The application seeks consent for the demolition of existing structures on the site and the development of a residential apartments (including affordable housing), commercial office space, food and beverage uses and retail tenancies with servicing areas and parking contained within the building's basement. A publicly accessible through site-link is also proposed providing a direct connection between Archer and Bertram Streets and allowing opportunities for outdoor dining and passive recreation.

Specifically, the SSDA seeks development consent for:

- Demolition of existing buildings, structures and trees.
- Excavation of the site to a basement depth of RL RL71.85mm.
- Construction of a mixed-use building to 28 storeys (RL184.25m) comprising residential and commercial uses.
- The development of 125 apartments (including 28 affordable housing units) with residential amenities and services, commercial office space, food and beverage tenancies and retail uses.

The proposal is for a 28-storey building with 6-levels of basement below. The development contains the following uses:

- Residential apartments: A total of 125 apartments (including 28 affordable housing units) comprising 29 x 1 bed apartments, 55 x 2 bed apartments, 30 x 3 bed apartments and 11 x 4 bed apartments with recreational facilities at Level 8.
- Office tenancies: occupying levels 2 and 3.
- Retail tenancies: double storey retail units fronting Bertram Street.
- Food and beverage tenancies: ground level.
- Basement parking: 154 car spaces, 9 motorbike spaces, 28 bicycle spaces and end of trip facilities.
- Servicing and plant equipment.
- Publicly accessible landscaped through site link.
- The gross floor area (GFA) for the proposed development is described below:
- Total GFA: 14,230sqm
- Residential GFA: 12,318sqm
- Non-residential GFA: 1,912sqm

Affordable housing will be provided in the form of a monetary contribution and floorspace within the proposed development.

The purpose of the project is to provide a high-quality mixed-use development in an accessible location within the Chatswood CBD, providing new market and affordable housing opportunities complemented by commercial and retail uses within this well serviced location.

This noise and vibration impact assessment investigates the effects of external noise and vibration intrusion onto the development site from road traffic (Archer Street – classified road). The advice is based on a detailed study of noise and vibration measurements on the site using both long term logging and attended measurements.

In addition:

- This report will identify operational noise goals and provide in-principle examination of noise emission from the site.

- This report will provide an assessment of noise and vibration created during the construction phase of the development.

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) dated 12 July 2024 and issued for the SSDA (SSD-73277714). Specifically, this report has been prepared to respond to the SEARs requirement issued below.

SEAR 12, relates to acoustics, and states:

Table 1: SEARs Requirements

Item	Description Requirement	Section Reference
Sear 12	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.	SEPP Transport and Infrastructure and Development Near Rail Corridors and Busy Roads – Sections 4 and 5 EPA Noise Policy for Industry (operational noise emissions) – Section 6. EPA Interim Construction Noise Guidelines (construciton noise vibration) – Section 7.

The report is based on architectural plans from Fuse Architects issued for SSDA on 24th April 2025.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

Appendix A contains a glossary of acoustic terms used in this report.

2 Site description

The site is located at 37 Archer Street, Chatswood within the Willoughby Local Government Area (LGA). The site is legally described as SP 38065 and has an area of 2,201m^2. The existing development includes two buildings (multi-unit housing) of up to three storeys in height which accommodate a total of 14 dwellings. The existing development includes an inground swimming pool fronting Archer Street and single level of basement parking which is accessed from Bertram Street. Pedestrian entries are available from Bertram and Archer Street. Vegetation within the site includes planter boxes through the central circulation spaces and established trees around the site's perimeter. Street trees, comprising native species, along the site's western frontage form part of an attractive and distinctive avenue of trees.

The site is situated on the southern edge of the Chatswood CBD. The immediately surrounding area has been zoned for more intensive development and is intended to support mixed use development including high density residential uses. The existing character of the area is evolving.
The urban context surrounding the site is characterised by a mix of residential, commercial, and retail uses. The surrounding locality is described below:

North: The site is bounded to the north by low scale residential development including townhouses and single dwelling properties. This land is zoned to support high-rise mixed use development including buildings with heights up to RL246.8m. Along Archer Street proposals for mixed use towers have been lodged for properties at 51-55 Archer Street and 57-61 Archer Street.

East: The site is bound to the east by Bertram Street which comprises a two-way local road and borders the western edge of the South Chatswood Heritage Conservation Area. A locally listed heritage item at 34 Neridah Street is situated directly opposite.

South: A development application for a 14-storey mixed use development has been lodged for 31-44 Archer Street which is situated immediately to the south of the site. This area provides a transition to low scale residential uses contained within the South Willoughby Conservation Area located on the southern side of Johnson Street. There is a locally significant heritage item at 27 Archer Street.

West: To the west the site is bound by Archer Street which comprises a four-lane classified road. Existing development on Archer Street comprises medium density residential towers of 7 storeys and higher. The area has been zoned for taller buildings of up to 90m. Further to the west is the Chatswood transport interchange and Pacific Highway, linking to the CBD and wider Greater Sydney region.

The site benefits from excellent access to public and active transport and is within walking distance of the Chatswood Interchange, which provides rail and metro connections to North Sydney, Macquarie Park, and the Sydney CBD. Bus services run along Archer Street and provide connections to Chatswood and Crows Nest.

An aerial photograph showing the site and surrounds is presented below.

Figure 1 – site location and surrounds

3 External noise intrusion criteria

3.1 Road Traffic Noise Criteria

The Standards, Government Policies, Guidelines and Council Development Control Plans (DCP) relevant to this development are as follows:

1. Willoughby City Council Development Control Plan 2023
2. State Environment Planning Policy (Transport & Infrastructure) or SEPP T&I 2021
3. Department of Planning publication "Development Near Rail Corridors & Busy Roads – Interim Guideline" 2008
4. Australian Standard AS/NZS 2107:2016 "Acoustics – Recommended design sound pressure levels and reverberation times for building interior"

Archer and Bertram Streets are not identified as roads requiring a mandatory assessment on the Service NSW Traffic Volume Maps for SEPP in accordance with the State Environment Planning Policy (Transport & Infrastructure) and the Department of Planning's Guideline, however, Archer Street is identified as a classified road, and Willoughby City Council's DCP 2023 reference to the State Environmental Planning Policy (Transport & Infrastructure) 2021, the acoustic criteria is Clause 2.120 and the Department of Planning's Interim guideline are considered the most appropriate for this site. The relevant criteria is outlined in Table 2 below.

Table 2: Recommended Maximum Internal Traffic Noise Level

Type of Occupancy	Windows Condition	Maximum Design Noise Level	
		Day[2], L_{Aeq} (15hour)	Night[2], L_{Aeq} (9hour)
Bedrooms	Closed	-	35dB(A)
Open-plan Living/Dining/Kitchen including studies	Closed	40dB(A)	40dB(A)
Lobby[1]	Closed	50dB(A)	-
Retail tenancies[1]	Closed	50dB(A)	-
Commercial (general office areas)	Closed	45dB(A)	

Notes:

1. Occupancies not covered under SEPP (T&I) are based on Australia Standard AS2107 "Acoustics – Recommended design sound pressure levels and reverberation times for building interior"

2. Day is defined as 7am to 10pm. Night is defined as 10pm to 7am next day.

Relevant sections of the SEPP (T&I), Department of Planning Documentation and Council DCP are presented in Appendix B of this report. Results of the background and ambient noise monitoring conducted on site are presented in Appendix C.

4 Measured and predicted noise levels

4.1 Noise and Vibration Surveys

4.1.1 Long-term Noise Survey

One unattended long-term noise monitor was installed on site from Wednesday 5th February to Wednesday 12th February 2025 to determine the existing level of ambient and background noise surrounding the site. The monitor was positioned at the centre of the site of the existing residences 37 Archer Street, Chatswood.

The noise logger records noise levels on a continuous basis and stores data every fifteen minutes. The noise logger was 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 C.

4.1.2 Short term traffic noise survey

Short term measurements were also undertaken at the midpoint of the Archer Street and Bertram Street boundaries of the proposed development at ground level in order to determine traffic noise impacts on the site on Wednesday 12th February, 2025. The locations are shown in Figure 1.

4.1.3 Road traffic noise

The traffic noise levels have been taken from the representative $L_{Aeq(15/9hr)}$ for the week for both daytime (7am to 10pm) and night-time (10pm to 7am) periods. The design noise levels are presented below.

Table 3: Representative day and night traffic noise levels

Location	Period	Predicted traffic Noise Level $L_{Aeq,\,T}$ [1,2] at the Worst Affected Facade
Archer Street facade	Day time (7am to 10pm)	63 dB(A)
	Night time (10pm to 7am)	56 dB(A)
Bertram Street facade	Day time (7am to 10pm)	58 dB(A)
	Night time (10pm to 7am)	50 dB(A)

Notes:

Noise levels presented are façade corrected values.

Representative external noise levels, LAeq over 15 hour and 9 hour day and night period respectively,

Noise measurement data was then used to create a 3D noise model for the site to determine noise levels across all facades and levels within the proposed development.

4.1.4 Background noise

Table 4 below presents the results of the long-term unattended noise monitoring for background noise.

Table 4: Background noise levels from long-term noise monitoring

Noise Monitoring		Representative Background Noise Levels in dB(A)	Day[1]	Evening[2]	Night[3]
Location	Duration				
L1 - Noise monitor on existing driveway approx. 23m from Archer St curb	5-12 February 2025	L_{A90}	43	42	38
		L_{Aeq}	56	55	48

Notes:

Day, Evening & Night assessment periods are defined in accordance NSW EPA's Noise Policy for Industry as follows.

1. Day is defined as 7:00am to 6:00pm, Monday to Saturday; 8:00am to 6:00pm Sundays & Public Holidays.
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 External Noise Control Recommendations

5.1 Glazing

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

Table 5: Recommended acoustic performance of glazing assembly

Facade	Level(s)	Occupancy	Required Acoustic Rating of Glazing Assembly, Rw
Western façade facing Archer Street	Level 3-27	Apartment Bedrooms	Rw 32
		Apartment Living Areas	Rw 32
Eastern façade facing Bertram Street	Level 2-27	Apartment Bedrooms	Rw 28
		Apartment Living Areas	Rw 28
Northern facade	Level 2-27	Apartment Bedrooms	Rw 28
		Apartment Living Areas	Rw 28
Southern facade	Level 2-27	Apartment Bedrooms	Rw 28
		Apartment Living Areas	Rw 28

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 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 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.

Indicative Rw values for façade elements as follows:

- 6mm glass or 6mm/12mm airgap/6mm insulated glazed unit – Rw 28.
- 6.38mm laminated glass or 6mm/12mm airgap/6.38mm insulated glazed unit.– Rw 32

For all glazing systems, it is necessary to ensure that the acoustic performance of the window/sliding door frame does not downrate the acoustic performance of the glass. All operable window/door elements requiring an R_w rating of 30 are to have acoustic seals (equal to q-lon).

5.1.1 External Walls and Roof

External walls and roof are assumed to be masonry. If light weight external wall elements are used, these need to be reviewed in detail and may also impact the glazing requirements for that room (as the cumulative result of noise through window and external wall element needs to be considered).

5.1.2 Supplementary Ventilation

In accordance with the Department of Planning publication "Development Near Rail Corridors & Busy Roads – Interim 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

However, the Department of Planning's Apartment Design Guide, July 2015 Objective 4B-1 requires that all habitable rooms are naturally ventilated, within an apartment complex.

Section 4J, *Noise and Pollution*, of the Apartment Design Guide nominates design solutions that may assist with delivering both the natural ventilation requirements and the internal noise levels (windows open) through careful design solutions. These may include wintergardens with operable facades, partially shielded and insulated balconies, building design and orientation, apartment setbacks and selection of acoustic materials for the building construction. An outside air intake for the air conditioning system may also be a solution to providing natural ventilation.

It has long been industry standard to assume a 10dB loss of noise from external to internal through an opened window in a building facade. It is based on the average results of a number of test cases, experimental data and published papers. This assumption has been well documented in The Roads and Traffic Authority (RTA) publications, including the RTA's Environmental Noise Management Manual (ENMM), Table 4.2.

Recent studies on noise reduction through facades with open windows[1] have shown that noise transmission through an open window can vary greatly based on the construction of the facades and noise flanking paths, including exposed floors and roof constructions.

The study indicates that noise loss through an open window of a development consisting of masonry construction with no exposed flooring and a concrete roof will be in the range of 11-15dB.

Based on these assumptions, the windows opened criteria can be met within habitable rooms on all facades.

[1] Ryan, Lanchester and Pugh, 2011

6 Noise Emission Assessment

There are no specific noise emission goals for the site set out in the Willoughby Council's DCP. In the absence of this, the EPA Noise Policy for Industry is the most commonly adopted noise emission guideline for plant and equipment.

For commercial/retail/cafe tenancies, if proposed:

- In the event there was a retail tenant proposing a licenced premises, patron/music noise would be subject to Office of Liquor and Gaming acoustic criteria.

6.1 Criteria - EPA Noise Policy for Industry

The NSW Environment Protection Authority (EPA) sets out noise criteria in its Noise Policy for Industry (NPfI) to control the noise emission from industrial sources.

The NPfI sets noise emission goals based on two sets of acoustic criteria:

- Intrusive criteria and
- Amenity Criteria

6.1.1 Intrusiveness Criteria

These criteria require that industrial noise does not exceed the background noise level by an excessive margin, preventing significant changes in the noise characteristic pertinent to the development site and surrounds. This is commonly referred to as the 'background plus 5' criterion. That is, the noise level from new industrial development, assessed in periods of 15 minutes, should not exceed the existing background noise level (measured in the absence of that development) by more than 5dB(A).

Based on the background noise levels presented in section 3, the intrusiveness criteria are as follows:

Table 6: Noise Policy for Industry - Intrusiveness Noise Criteria

Receiver	Time of day	Rating Background Noise Level (dB(A)L_{90})	Intrusiveness Noise Criteria (dB(A)$L_{eq(15min)}$)
Residences	Day	43	48
	Evening	42	47
	Night	38	43

6.1.2 Amenity and Project Amenity Criteria

Amenity criteria serve primarily to avoid "noise creep" – for example, if a number of industrial noise sources are permitted to increase the background noise level by 5dB(A) (as permitted by the Intrusiveness Criteria) there would be a point where the cumulative noise level is unacceptable.

A limit on the ultimate acceptable noise level is therefore included in the NPfI as a way of ensuring that cumulative noise impact from industrial growth is curtailed. This limit is set using the Amenity and Project Amenity Criteria. These criteria are determined with reference to ambient noise conditions and the land use of nearby development (residential, commercial, industrial etc).

The Amenity Noise Level is found in table 2.2 of the Noise Policy for Industry.

It is the *Project* Amenity Criteria that sets a site-specific noise emission goal for a development. The Project Amenity Noise Level is typically 2dB(A) below the Amenity Noise level unless there is an exception (discussed in more detail after the following table).

Table 7: Noise Policy for Industry - Amenity and Project Amenity Noise Levels

Receiver	Noise amenity area	Time of day	Amenity Noise Level dB(A)$L_{eq(Period)}$	Project (Site Specific) Amenity Noise Level dB(A)$L_{eq(15min)}$
Residential	Urban	Day	55	53
		Evening	45	43
		Night	40	38
School classroom - internal	All	Noisiest 1 hour period when in use	35	35 (45 external at the façade assuming windows open)

Notes:

- Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am
- On Sundays and Public Holidays, Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am.
- The LAeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.
- The Project Amenity Noise Level is typically 2dB(A) below Recommended Amenity Noise Level, unless there is an exception, as detailed below.
- * Project Amenity noise goal adjusted given high traffic noise levels (Traffic Noise Level – 15dB(A))

6.1.3 Maximum noise level event assessment

The potential for sleep disturbance from maximum noise level events, from the proposed development, needs to be considered. Section 2.5 of the NPfI provides sleep disturbance trigger levels, summarised as shown in the table below.

Table 8: Sleep disturbance criteria

Receiver	Sleep Disturbance Trigger Levels, 10:00pm to 7:00am	
	$L_{Aeq,\ 15\ minute}$	L_{AFmax}
All residential	Greater than 40dB(A) or RBL plus 5dB, whichever is the greater	52dB(A) or RBL plus 15dB, whichever is the greater

On applying the on-site measured background noise levels, the triggers are as follows:

Table 9: Sleep disturbance noise trigger levels

Receiver	Sleep Disturbance Trigger Levels, 10:00pm to 7:00am	
	$L_{Aeq,\ 15\ minute}$	L_{AFmax}
Residential premises surrounding site	40dB(A)	52dB(A)

Where noise from the proposed development is predicted to exceed the sleep disturbance trigger levels above, a more detailed noise level assessment is required. The detailed assessment is required to cover the maximum noise level, the extent to which the maximum noise level exceeds the RBL, and the frequency of events occurring during the nighttime.

6.1.4 Summary of Noise Emission Requirements

Taking the more stringent of the intrusiveness and amenity criteria, and also incorporating the sleep disturbance criteria, noise emission goals become as set out below.

Table 17: Summary of Noise Emission Requirements

Location	Noise Trigger Levels – dB(A)$L_{eq(15min)}$		
	Day (7am-6pm)	**Evening (6pm-10pm)**	**Night (10pm-7am)**
Residential	48dB(A)$L_{eq(15min)}$	47dB(A)$L_{eq(15min}$	43dB(A)$L_{eq(15min)}$ and 52dB(A)L_{Max}

6.2 Recommended noise control measures

As details of mechanical plant will be finalised at Detailed Design phase (post DA) phase, the following in-principal recommendations are provided:

6.2.1 Plant and Equipment

Noise from plant and equipment is assessed with reference to the EPA Noise Policy for Industry (criteria as outlined in Section 6.1.4.

The details of the mechanical plant and equipment servicing this development are yet to be finalised at this stage of the development. Therefore, the noise impacts from mechanical plant and equipment should be undertaken during the Detailed Design stage of the project.

However, we note:

- It is likely that primary plant and equipment items consist of car park/basement ventilation plant, stair pressure fans, lobby supply utilities spaces fans and air-conditioner condensers.
- Major fans located either in the basement or roof level such as car park ventilation (typically 75dB(A) at 3m), and utilities fans (typically 65dB(A) at 3m distance) are likely to require induct acoustic treatment between fan and external intake/discharge. This will consist of lined ducting or acoustic attenuators. The extent of treatment will depend on fan selection and position relative to the nearest apartment.
- Condenser units are proposed to be a combination of floor mounted units (located on each apartment level) that will serve multiple apartments along with some roof top units. The proposed locations of the floor mounted units on each floor are well shielded from apartments within the development and are set back from the site boundaries, however, may still require some acoustic treatment to each condenser space given the reverberant nature of the space between apartment buildings. There are no significant noise issues anticipated with the roof mounted units. Acoustic screening would easily provide the required attenuation for the units.

6.2.2 Loading Dock

Loading docks create a risk of structure borne noise transmission to apartments above, in particular use of pallet jacks and stock trolleys that have nylon wheels or similar. This is particularly a risk at sites where a supermarket is proposed, given their will be a high volume of pallet jack use, and often late at night.

There is no supermarket retail proposed at the above site. As such, loading dock usage would be relatively low and unlikely to be necessary between 10pm and 7am.

The loading dock is located well within the building at Ground Level and does not incorporate a turntable. The loading dock can accommodate HRV sized vehicle.

Given the location of the loading dock and provided that loading dock use does not occur between 10pm and 7am, there should be no further acoustic treatment required to the loading dock.

6.2.3 Noise from Pool and common areas (Level 8 and rooftop)

The primary impact of the communal open space on Level 8 will be to future residents within the development itself. Noise also has the potential to impact existing and future residential receivers surrounding the site.

A 1.8m balustrade is proposed around the pool area. The balustrade is to be glazed or a combination of masonry and glazing. The balustrade should be installed without gaps between the panelling to also act as a noise barrier.

Typically, use of communal open space will be regulated by building management and strata by-laws to protect residents of that development. Typical building management requirements are:

- Setting limits on times of use of the outdoor communal spaces and amenities to day light hours (typically 7am-sunset).
- Prohibiting parties and use of amplified music.
- Prohibiting anti-social behaviour (shouting etc).
- Developing a management plan for the common outdoor areas that considers potential noise impacts on apartments and neighbouring receivers

6.3 Recommended noise control measures

As details of mechanical plant will be finalised at Detailed Design phase (post DA) phase, the following in-principal recommendations are provided:

6.3.1 Cafés/Restaurants

The primary noise generation associated with a café will be from use of outdoor dining areas. We assume that cafes will lodge CDC Applications for use of their tenancy. Uses will be managed in accordance with applicable standards.

6.4 Cumulative Impacts

The site is located within the CBD Planning and Urban Design Strategy 2036 zone and identified as B4 Mixed Use. This zone is consistent for the block bounded by Archer Street, Bertram Street, Albert Avenue and Johnson Street.

Therefore neighbouring premises may develop to a similar size and scale. This would in turn, increase traffic volumes and traffic noise along Archer and Bertram Streets, but would also have the potential to increase ambient noise levels in the vicinity of the site.

To address the potential for higher traffic noise levels surrounding the site over time, a worst case scenario of a doubling of the traffic volume on Archer and Bertram Streets has been considered. This would typically result in a 3dB increase in the traffic noise level impacting these facades. The glazing design presented in Table 5 accounts for the potential for traffic noise increases.

The NSW Noise Policy for Industry address background noise creep as a result of increased development. This assessment considers both intrusiveness criteria and amenity criteria when establishing noise emission criteria for the site, accounting for the potential of background noise creep over time.

7 Internal sound insulation

As a minimum requirement, walls and floors and separation of services shall comply with the National Construction Code - Building Code of Australia 2022 (BCA).

The development is mixed use, with the residences being Class 2, residential.

7.1 NCC BCA 2022 - 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.

8 Construction Noise and Vibration Assessment

A detailed Demolition, Excavation and Construction Management Plan is to be prepared for the site prior to the issue of Construction Certificate detailing the site-specific plant and equipment to be used, expected periods of construction, and noise and vibration management treatments and procedures to be implemented.

8.1 Environmental Protection Authority's Construction Noise Guidelines

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 L_{Aeq} over any other descriptor. As an energy average, L_{Aeq} provides ease of use when measuring or calculating noise levels since a full statistical analysis is not required as when using, for example, the L_{A10} descriptor.

Consistent with the latest guideline (ICNG) the use of L_{Aeq} 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 10 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 10: 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 $L_{Aeq\ (15\ min)}$ 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.

Sensitive Land Use

Table 11 below (reproduced from Table 2 of the ICNG) sets out the noise management levels for various sensitive land use developments.

Table 11: Noise at other sensitive land uses using quantitative assessment

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)
Hospital wards and operating theatres	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)
Community centres	Depends on the intended use of the centre. Refer to the 'maximum' internal levels in AS2107 for specific uses.

8.2 Criteria at established receivers

Table 12 presents the construction noise management levels established for the nearest noise sensitive residential receivers based on the noise monitoring undertaken in the vicinity of the site. Based on distances to receivers, the likely most impacted receivers will be the existing residents immediately surrounding the proposed development site. The table below is not an exhaustive assessment of residents in the area but establishes the likely noise impacts and requirements for amelioration treatment during construction. A full assessment will be undertaken at the Construction Certificate stage of the project.

Table 12: Construction noise management levels at residential receivers, dB(A)

Address	Day L_{A90} rating background level (RBL)	Day noise management level $L_{Aeq(15min)}$
Residential apartments to the north of the site	43	53
Single dwelling south of the site	43	53
Residential apartments to the west of the site	43	53
Single dwellings to the east of the site	43	53

8.2.1 Construction hours

The proposed construction works are expected to be undertaken during standard construction hours, as follows:

Mondays to Fridays:	7:00am to 6:00pm
Saturdays:	8:00am to 1:00pm
Sundays & Public Holidays:	No work performed

8.3 Construction noise assessment

A preliminary construction noise assessment has been undertaken with the highest expected sound power levels for plant and equipment typically used for excavation and construction.

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 13 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 development, where the range represents the noise levels from the plant item being at a location furthest away and at a location closest to each receiver location. Noise levels were calculated taking into consideration attenuation due to distance between the construction works and the receiver locations and any intervening structures.

Table 13: Predicted $L_{Aeq(15min)}$ noise levels for typical construction plant, dB(A) – no treatment

Plant item	Plant description	Predicted $L_{eq(15min)}$ construction noise levels at receiver location (external)			
		Residential apartments to the north of the site	Single dwelling south of the site	Residential apartments to the west of the site	Single dwellings to the east of the site
Noise Management Level		*53*	*53*	*53*	*53*
Demolition					
1.	Concrete saw	71-93	69-84	70-80	69-80
2.	Excavator mounted hydraulic breaker	71-93	69-84	70-80	69-80
Excavation					
3.	Rock breaker	71-93	69-84	70-80	69-80
4.	Rock saw	71-93	69-84	70-80	69-80
5.	40 tonne excavator with saw and hammer	71-93	69-84	70-80	69-80
Construction					
6.	Mobile crane	66-88	64-79	65-75	64-75
7.	Powered hand tools	66-88	64-79	65-75	64-75
8.	Grinder	65-87	63-78	64-74	63-74

Plant item	Plant description	Predicted $L_{eq(15min)}$ construction noise levels at receiver location (external)			
		Residential apartments to the north of the site	Single dwelling south of the site	Residential apartments to the west of the site	Single dwellings to the east of the site
9.	Truck – cement mixer	64-86	62-77	63-73	62-73

Based on the predicted construction noise levels presented in the table above, the construction management levels will generally be exceeded when works are conducted at the closest proximity to the nominated receiver locations.

Furthermore, construction noise levels at all receivers are predicted to be greater than the highly noise affected level of 75dB(A) for the operation of the noisiest individual construction plant and equipment in close proximity.

In light of the predicted noise levels above, it is recommended that a feasible and reasonable approach towards noise management measures 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.

8.4 General Construction Noise Control Methods

Implementation of noise control measures, such as those suggested in the Interim Construction Noise Guideline (ICNG) and 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 E2 in Appendix E presents typical examples of noise reductions achievable after treatment of various noise sources. Table E3 in Appendix E presents the relative effectiveness of various forms of noise control treatment.

Table 14: Relative Effectiveness of Various Forms of Noise Control, dB(A) below presents 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 14: Relative Effectiveness of Various Forms of Noise Control, dB(A)

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
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

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.
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.

Table 15: Noise Control Measures for Expected Construction Plant below identifies possible noise control measures which are applicable on the construction plant likely to be used on site.

Table 15: Noise Control Measures for Expected Construction Plant

Plant Description	Screening	Acoustic Enclosures	Silencing	Alternative Process
Concrete Saw	✔	✔	x	x
Jack hammers	✔	x	✔	x
Mobile Crane	✔	✔	✔	x
Front End Loader	✔	x	✔	x
Pneumatic Hand Tools (general)	✔	✔	✔	✔
Bulldozer	✔	x	✔	x
Tracked Excavator	✔	x	✔	x
Concrete Trucks	✔	x	✔	x
Delivery Trucks	✔	x	✔	x
Dump Trucks	✔	x	✔	x
Truck (> 20 tonne)	✔	x	✔	x
Welders	✔	✔	x	x
Cherry Picker	✔	x	✔	x
Concrete Pump	✔	✔	✔	✔
Power Generator	✔	✔	✔	x
Light commercial vehicles	✔	x	✔	x
Silenced Air Compressor	✔	✔	✔	✔

To ensure efficient noise attenuation performance is achieved using any of the methods listed above, it is recommended acoustic engineers work closely with the construction contractors and carry out preliminary testing prior to commencement of works.

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

- Plant and equipment should be properly maintained
- Provide special attention to the use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended

- Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel
- As much as possible, non-percussive demolition equipment (dozer with bucket,/saw of rock ripper) should be used in place of percussive equipment (dozer with hydraulic hammer).
- Use of electric cranes (as opposed to diesel) and bored piling (as opposed to vibrated) whenever feasible.
- Avoid any unnecessary noise when carrying out manual operations and when operating plant
- Any equipment not in use for extended periods during construction work should be switched off
- Plant used intermittently to be throttled down or shut down when not in use where practicable
- Notification to immediate surrounding residents (both single dwellings and apartment buildings) should be provided detailed estimated duration of demolition, excavation and construction.
- Noise compliance monitoring for all major equipment and activities on site should be undertaken prior to their commencement of work on site.
- 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. The person selected to liaise with the community must be adequately trained and experienced in such matters. **Complaints** - Owners and occupants of nearby affected properties are to be informed by direct mail of a direct telephone line and contact person where any noise and/or vibration complaints are to be reported.
- 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.

8.5 Vibration criteria

Construction vibration is associated with three main types of impact:

- disturbance to building occupants;
- potential damage to buildings; and
- 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.

- Displacement (x) measurement is the distance or amplitude displaced from a resting position. The SI unit for distance is the meter (m), although common industrial standards include mm.
- 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 meters 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.
- 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 meters per second squared (m/s2). Construction vibration goals are summarised below.

Construction vibration goals are summarised below.

8.5.1 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). 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 16 provides definitions and examples of each type of vibration.

Table 16: 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.

Type of vibration	Definition	Examples

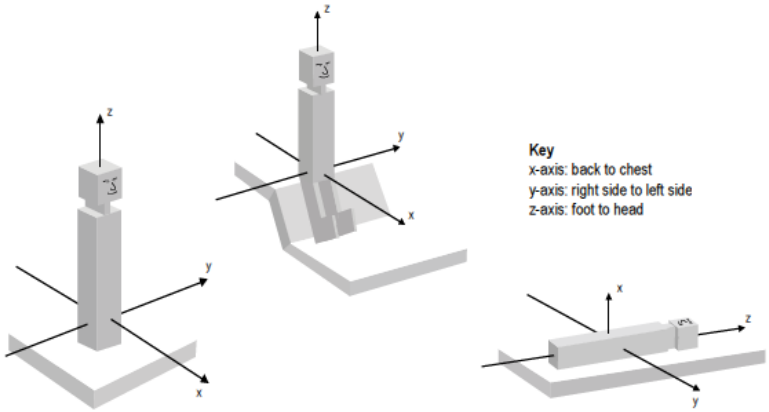
Source: Assessing Vibration; a technical guideline, Department of Environment & Climate Change, 2006

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 2. 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 2 – 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 the relevant values are reproduced in Table 17.

Table 17: 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)					
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
Impulsive vibration (weighted RMS acceleration, m/s^2, 1-80Hz)					
Residences	Daytime	0.30	0.21	0.60	0.42

Location	Assessment period[1]	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
	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

Notes: 4. Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am

The acceptable vibration dose values (VDV) for intermittent vibration are defined in Table 2.4 of the guideline and are reproduced in Table 18

Table 18: 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
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

Notes: 5. Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am

8.5.2 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 19 sets out the BS7385 criteria for cosmetic, minor and major damage.

Table 19: 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
		Major*2	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), 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 applicable to the nearest receivers are presented in Table 20.

Table 20: 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

8.6 Recommended minimum buffer distances

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 21 below presents the recommended minimum working distances for high vibration generating plant.

Table 21: Recommended minimum working distances for vibration intensive plant, m

Plant item	Rating / description	Minimum working distance	
		Cosmetic damage	Human response
Excavator[1]	<=30 Tonne (travelling/ digging)	10	15
Small hydraulic hammer[2]	300kg (5-12 tonne excavator)	2	7
Medium hydraulic hammer[2]	900kg (12-18 tonne excavator)	7	23
Large hydraulic hammer[2]	1600kg (18-34 tonne excavator)	22	73
Pile boring[2]	≤ 800 mm	2 (nominal)	N/A
Pneumatic jack hammer	Hand held	1	Avoid contact with structure
Truck movements[2]	Dump trucks, watercarts, tippers	-	10 m

Notes: 8. TCA Construction Noise Strategy (Rail Projects) November 2011
9. 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.

8.6.1 Damage to buried services

Section 5.3 of DIN 4150-3:2016 also sets out guideline values for vibration velocity to be used when evaluating the effects of vibration on buried pipework. These values, which apply at the wall of the pipe, are reproduced, and presented in Table 5 7 below.

Table 24: DIN 4150-3:1999 Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on buried pipework

Line	Pipe Material	Guideline values for vibration velocity measured on the pipe, mm/s
1	Steel (including welded pipes)	100
2	Vitrified clay, concrete, reinforced concrete, prestressed concrete, metal (with or without flange)	80
3	Masonry, plastics	50

For long-term vibration the guideline levels presented in Table should be halved.

Recommended vibration goals for electrical cables and telecommunication services such as fibre optic cables range from between 50 mm/s and 100 mm/s. It is noted however that although the cables may sustain these vibration levels, the services they are connected to, such as transformers and switch blocks, may not. It is recommended that should such equipment be encountered during the construction process an individual vibration assessment should be carried out. This may include a specific vibration impact statement addressing impact on the utility and consultation with the utility provider to confirm specific vibration requirements.

It is likely that reasonable and feasible vibration mitigation will be required. This would typically be addressed in a Construction Noise and Vibration Management Plan, prepared at CC stage. Indicative management measures are detailed below.

8.6.2 Vibration assessment

8.6.2.1 Minimum working distances

The recommended minimum working distances for vibration intensive plant are presented below

Table 27: Recommended minimum working distances for vibration intensive equipment

Plant item	Minimum working distance, m					
	Cosmetic damage			Human disturbance		
	Commercial and industrial buildings1	Dwellings and similar structures1	Sensitive structures (e.g., heritage)1	Residences Day2	Offices	Workshops
Excavator w/Hydraulic Breaker, Vibratory Compactor	5	5	10	20	15	10

Notes: 1. Vibration limits referenced from DIN 4150 Structural Damage - Safe Limits for Short-term Building Vibration.
2. Daytime is 7 am to 10 pm;

Site specific buffer distances for vibration significant plant items must be measured on site where plant and equipment is likely to operate close to or within the minimum working distances for cosmetic damage.

The predicted vibration levels indicate:

Based on the location of neighbouring premises surrounding the site along with the excavation required for the construction of the proposed development, vibration monitoring may be required during the excavation and construction period. Human disturbance is also likely to impact the closest residential receivers.

8.6.2.2 Vibration mitigation 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:

- Dilapidation surveys should be conducted at residents to the north and south of the site. This will inform if any of the adjacent residential development should be subject to vibration criteria different to those identified in section 8.2.2.2

- Where excavation in rock activity occurs within 15m of residential receivers, vibration monitoring is recommended during initial rock excavation to determine if vibration levels are such that they may cause building damage or excessive annoyance to occupants of the building.

- 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.

- Notification by letterbox drop would be carried out for all occupied buildings within 50m of the construction site. These measures are to address potential community concerns that perceived vibration may cause damage to property.

- 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.

8.6.3 Cumulative Impacts

The cumulative impacts of concurrent construction in terms of noise and vibration are to be considered when considering suitable noise and vibration mitigation measured.

- *Likely future development* include (but not limited to):

- 57-61 Archer Street & 34 Albert Avenue, Chatswood
- SSD-72891212
- Mixed-use, shop top housing development with the provision of affordable housing.

- 51-55 Archer Street, Chatswood
- SSD-75116211
- Construction of a 35-storey mixed use shop top housing development including in-fill affordable housing, comprising a two-storey non-residential podium, a 33-storey residential tower and a multi-level basement carpark.

- 31-33 Archer Street, Chatswood
- DA-2025/17
- Demolition of existing structures and construction of shop top housing buildings consisting of part 14 storeys and part 5 storey.

8.6.3.1 Mitigation measures

In order to manage the cumulative impacts of noise and vibration from construction, the following mitigation measured should be considered:

- Correspondence and coordination with developers of adjoining sites to offset high noise and vibration events (particularly excavation).
- Correspondence and coordination with developers of adjoining sites to offset truck and vehicle movements to and from the site
- Additional mitigation measures as recommended in Table 15 to account for cumulative construction noise impacts

9 Conclusion

Renzo Tonin & Associates has completed a Noise and Vibration Impact Assessment of the proposed mixed-use development with affordable in-fill housing at 37 Archer Street, Chatswood.

The assessment includes investigation of noise impacts onto the site from nearby roads and potential noise impacts from future mechanical plant servicing the development. The assessment has found that reasonable controls can be incorporated into the building design to comply with relevant standards (SEPP Transport and Infrastructure) for internal noise levels (to protect residents from road traffic noise).

Noise emission goals for the operation of mechanical plant and equipment have been set in accordance with the Noise Policy for Industry. A preliminary assessment has been undertaken and conclude it is feasible that noise emissions from the subject site can comply with these criteria, subject to detailed design for Construction Certificate.

An examination of noise and vibration from the construction phase of the development is presented in Section 7.

Cumulative impacts from the construction phase and the long term use of the development site have been considered and addressed in Sections 6 and 7 of this assessment.

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.

Authored by:

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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. 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 every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
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 Criteria and design methodology

B.1.1 Department of Planning publication 'Development near rail corridors and busy roads – Interim guideline'

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

B.1.2 Clarification of SEPP Trasnport and Infrastructure noise limits

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

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

The noise criteria nominated in the SEPP 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. The equivalent external goals have been determined on the following basis:

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

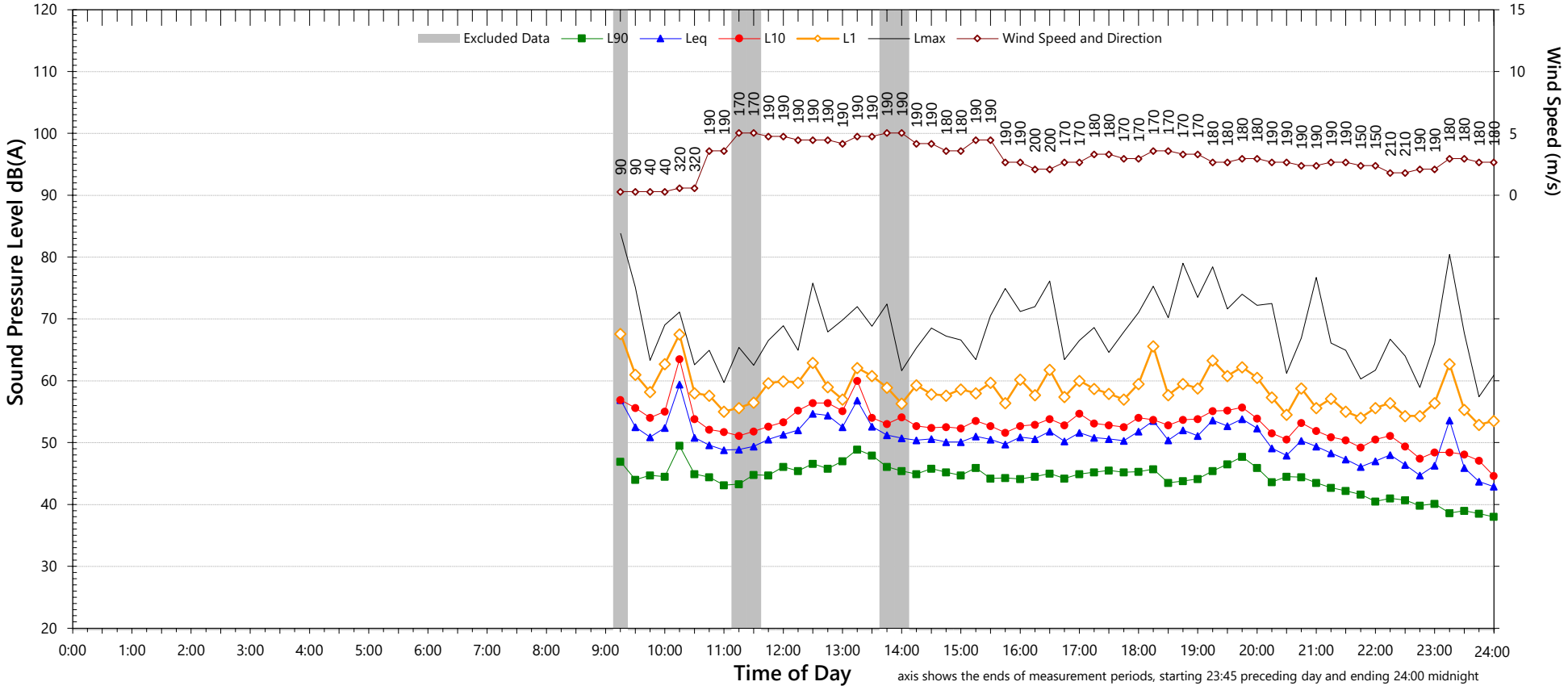
The SEPP internal noise criteria along with the equivalent external noise criteria for residential premises.

APPENDIX C Results of noise monitoring

Unattended Noise Monitoring Results

37 Archer street, Chatswood - Inside the Complex

Wednesday, 5 February 2025



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)				
Descriptor		Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL		-	42	37
L_{Aeq}	#N/A	-	51	46

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	66	to	80
L_{AFMax} - L_{Aeq} (Range)	18	to	31

NSW Road Noise Policy (1m from facade)	#N/A	
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	49
$L_{Aeq\ 1hr}$ upper 10 percentile	-	52
$L_{Aeq\ 1hr}$ lower 10 percentile	-	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.

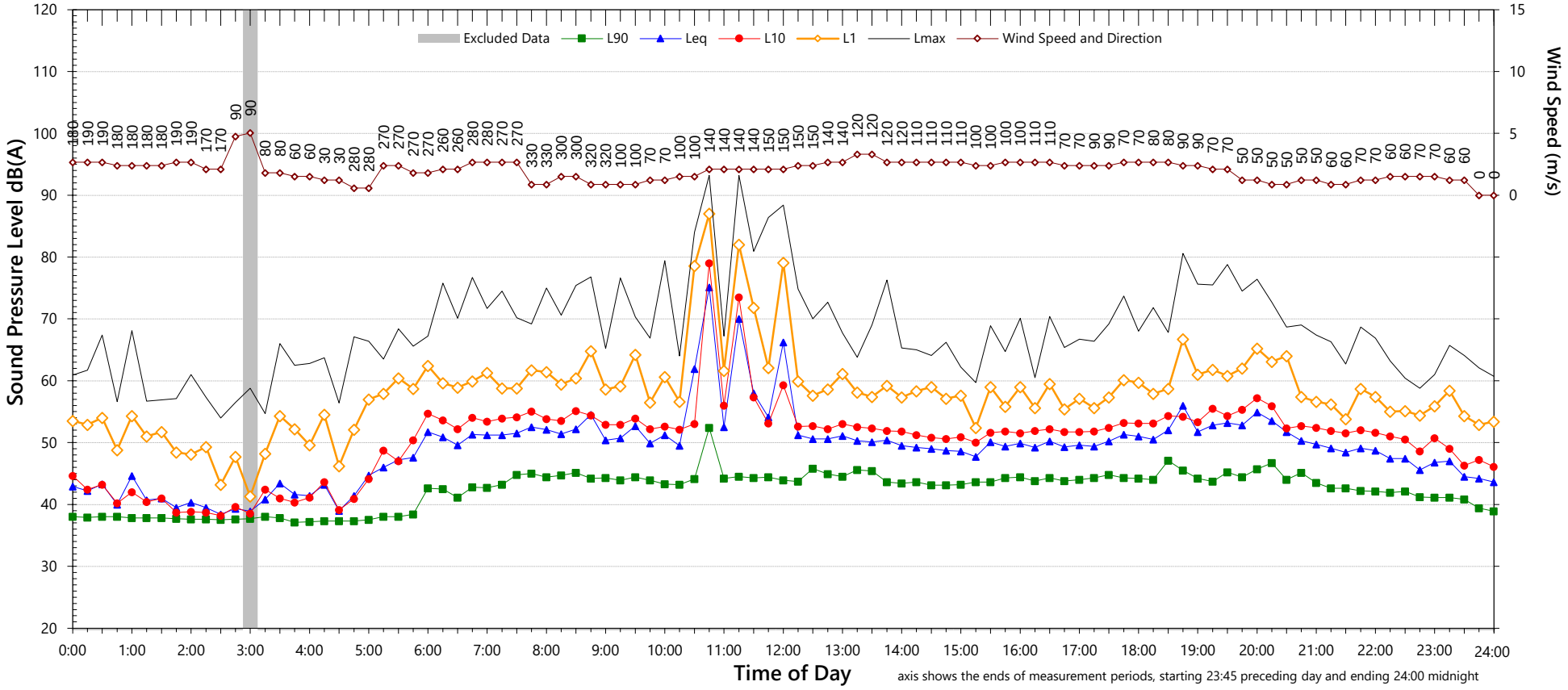
#N/A

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

37 Archer street, Chatswood - Inside the Complex

Thursday, 6 February 2025



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)				
Descriptor		Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL		43	42	38
L_{Aeq}	#N/A	61	52	47

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	66	to	76
L_{AFMax} - L_{Aeq} (Range)	16	to	26

NSW Road Noise Policy (1m from facade)	#N/A	
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	62	49
$L_{Aeq\ 1hr}$ upper 10 percentile	63	52
$L_{Aeq\ 1hr}$ lower 10 percentile	52	44

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.

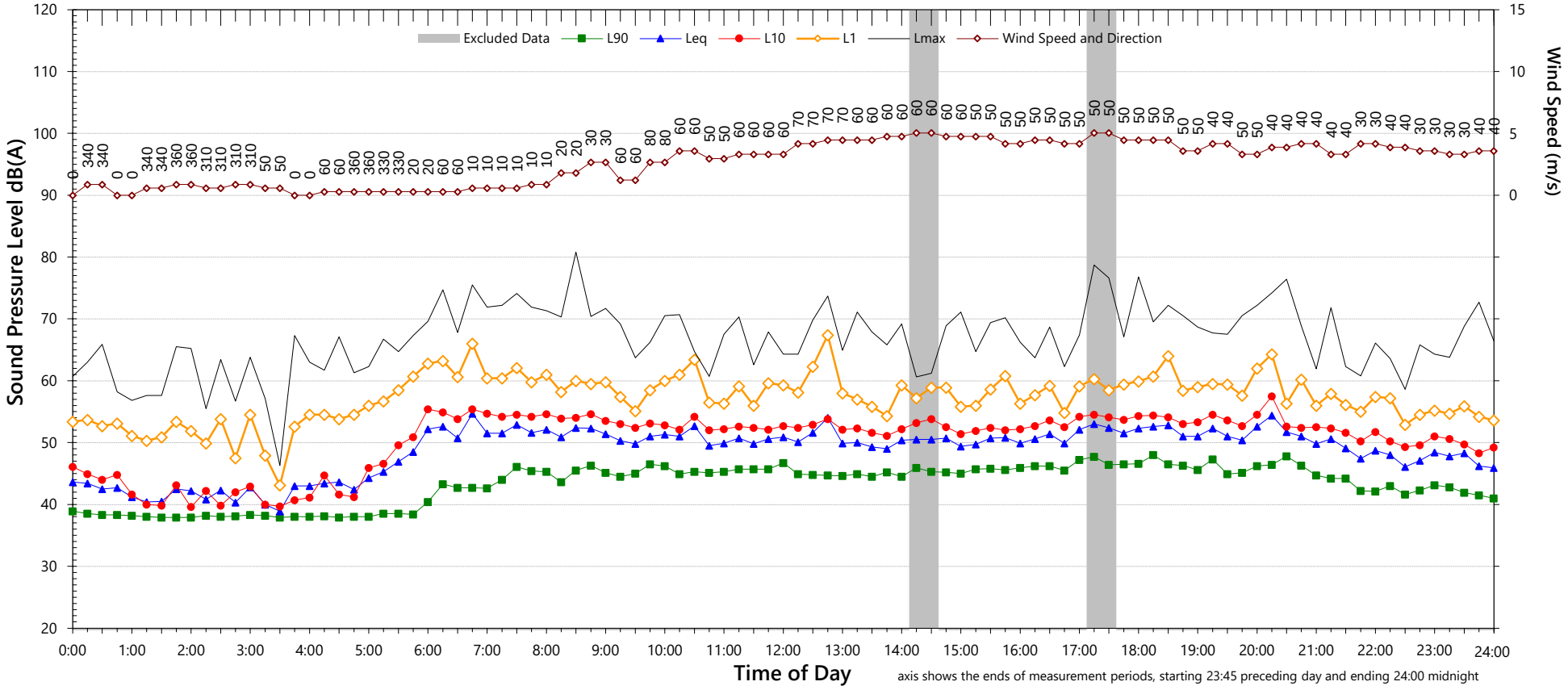
#N/A

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

37 Archer street, Chatswood - Inside the Complex

Friday, 7 February 2025



NSW Noise Policy for Industry (Free Field)				
Descriptor		Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL		45	43	38
L_{Aeq}	#N/A	51	51	49

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	66	to	90
L_{AFMax} - L_{Aeq} (Range)	18	to	35

NSW Road Noise Policy (1m from facade)	#N/A	
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	54	52
$L_{Aeq\ 1hr}$ upper 10 percentile	55	56
$L_{Aeq\ 1hr}$ lower 10 percentile	52	44

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.

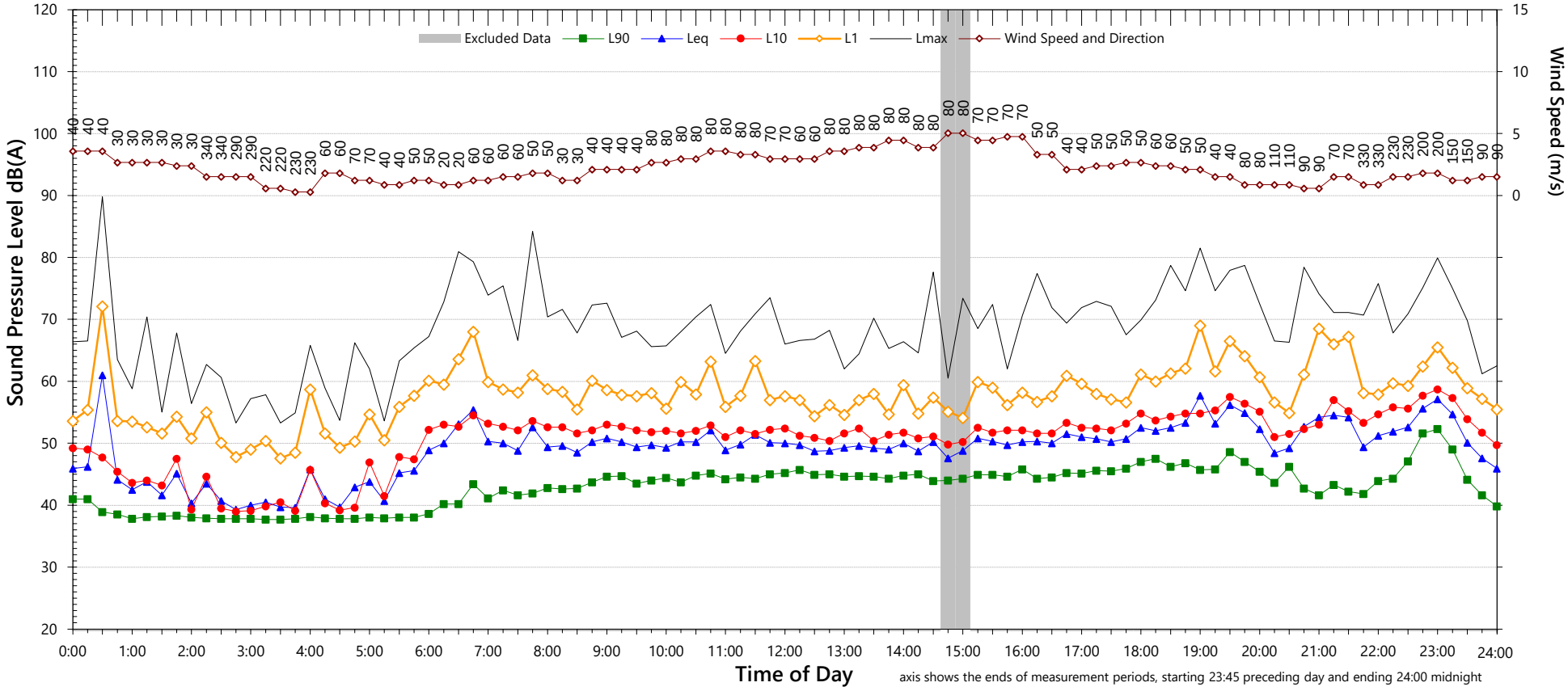
#N/A

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

37 Archer street, Chatswood - Inside the Complex

Saturday, 8 February 2025



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)				
Descriptor		Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL		43	42	39
L_{Aeq}	#N/A	50	54	49

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	66	to	80
L_{AFMax} - L_{Aeq} (Range)	17	to	27

NSW Road Noise Policy (1m from facade)	#N/A	
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	54	52
$L_{Aeq\ 1hr}$ upper 10 percentile	56	56
$L_{Aeq\ 1hr}$ lower 10 percentile	52	44

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.

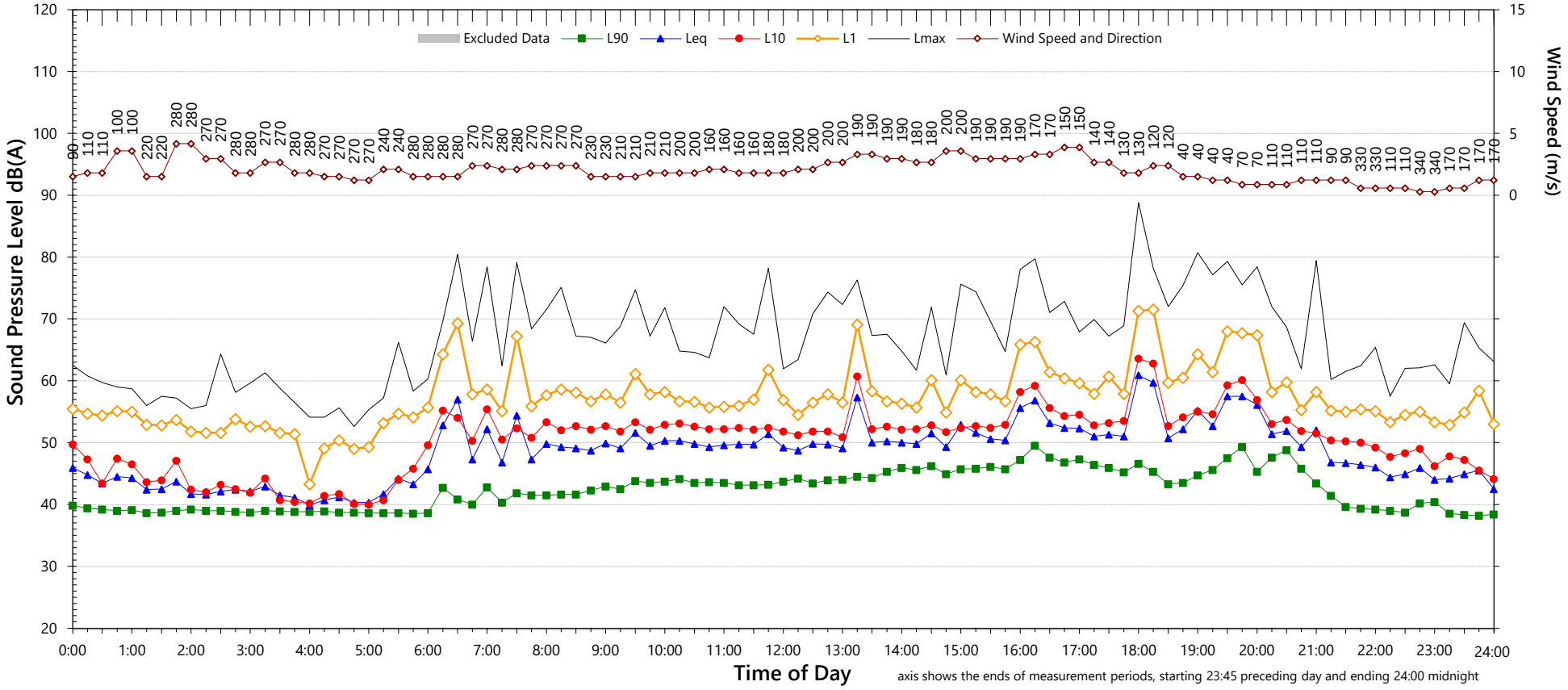
#N/A

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

37 Archer street, Chatswood - Inside the Complex

Sunday, 9 February 2025



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)				
Descriptor		Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL		43	39	38
L_{Aeq}	#N/A	52	54	46

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	65	to	75
L_{AFMax} - L_{Aeq} (Range)	18	to	25

NSW Road Noise Policy (1m from facade)	#N/A	
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	55	48
$L_{Aeq\ 1hr}$ upper 10 percentile	58	50
$L_{Aeq\ 1hr}$ lower 10 percentile	52	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.

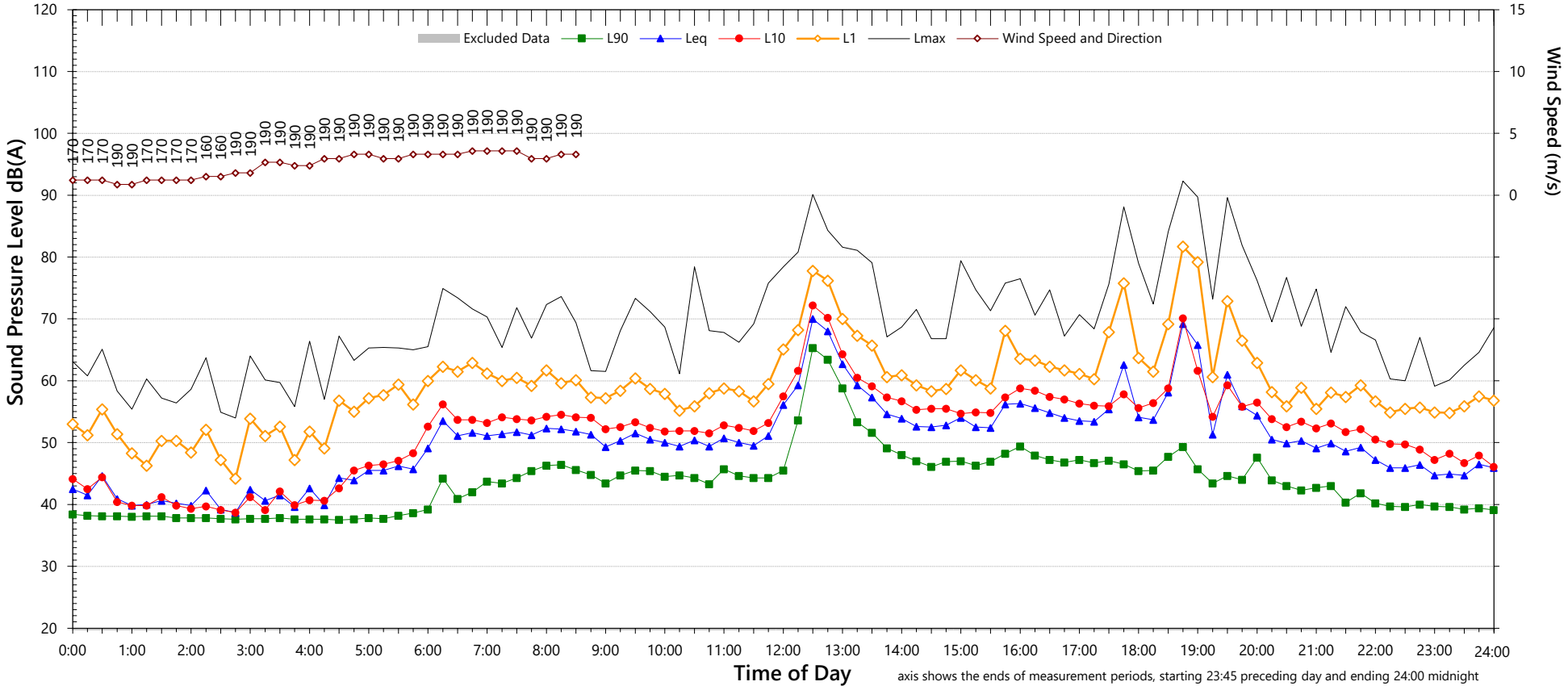
#N/A

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

37 Archer street, Chatswood - Inside the Complex

Monday, 10 February 2025



NSW Noise Policy for Industry (Free Field)				
Descriptor		Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL		44	41	39
L_{Aeq}	#N/A	58	60	46

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	67	to	71
L_{AFMax} - L_{Aeq} (Range)	19	to	26

NSW Road Noise Policy (1m from facade)	#N/A	
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	61	49
$L_{Aeq\ 1hr}$ upper 10 percentile	65	51
$L_{Aeq\ 1hr}$ lower 10 percentile	52	45

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.

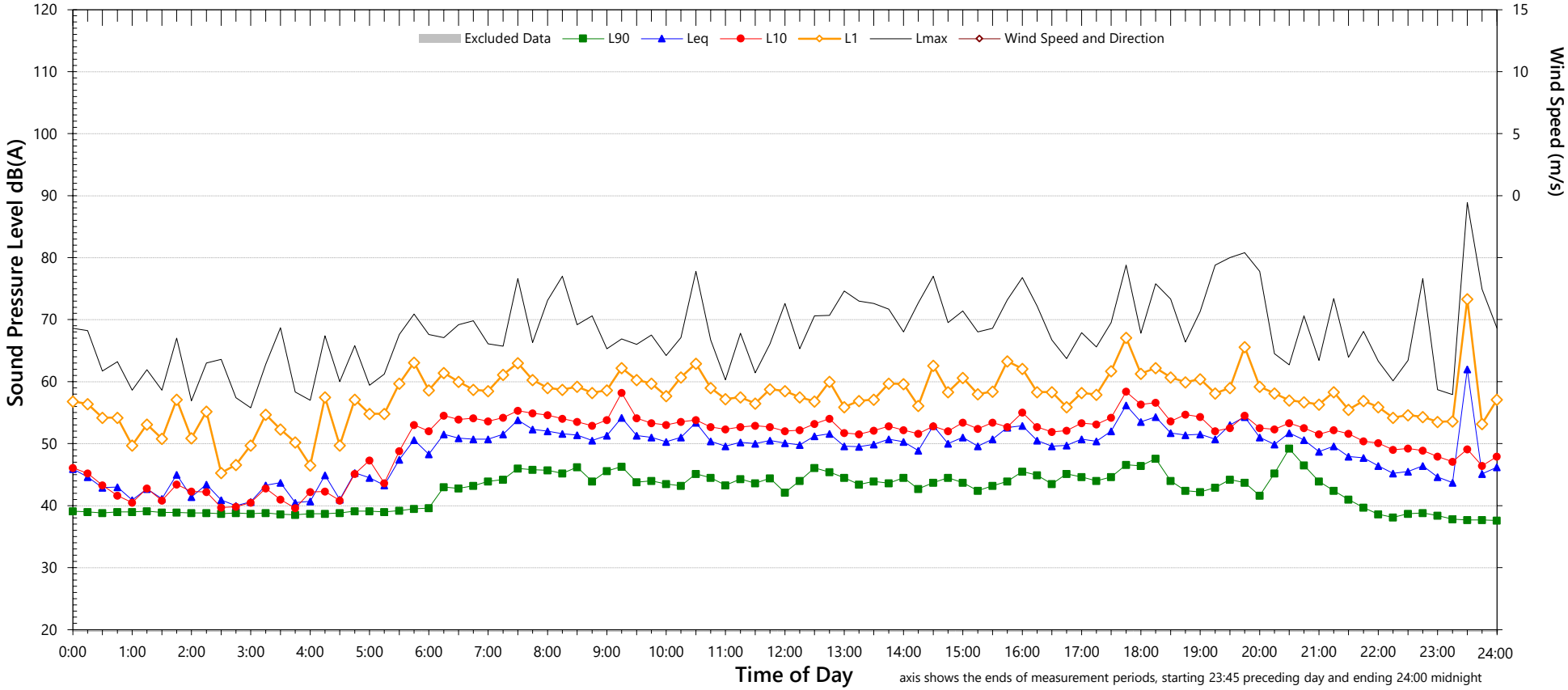
#N/A

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

37 Archer street, Chatswood - Inside the Complex

Tuesday, 11 February 2025



NSW Noise Policy for Industry (Free Field)				
Descriptor		Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL		43	40	37
L_{Aeq}	#N/A	51	51	49

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	66	to	89
L_{AFMax} - L_{Aeq} (Range)	20	to	33

NSW Road Noise Policy (1m from facade)	#N/A	
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	54	52
$L_{Aeq\ 1hr}$ upper 10 percentile	55	55
$L_{Aeq\ 1hr}$ lower 10 percentile	53	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.

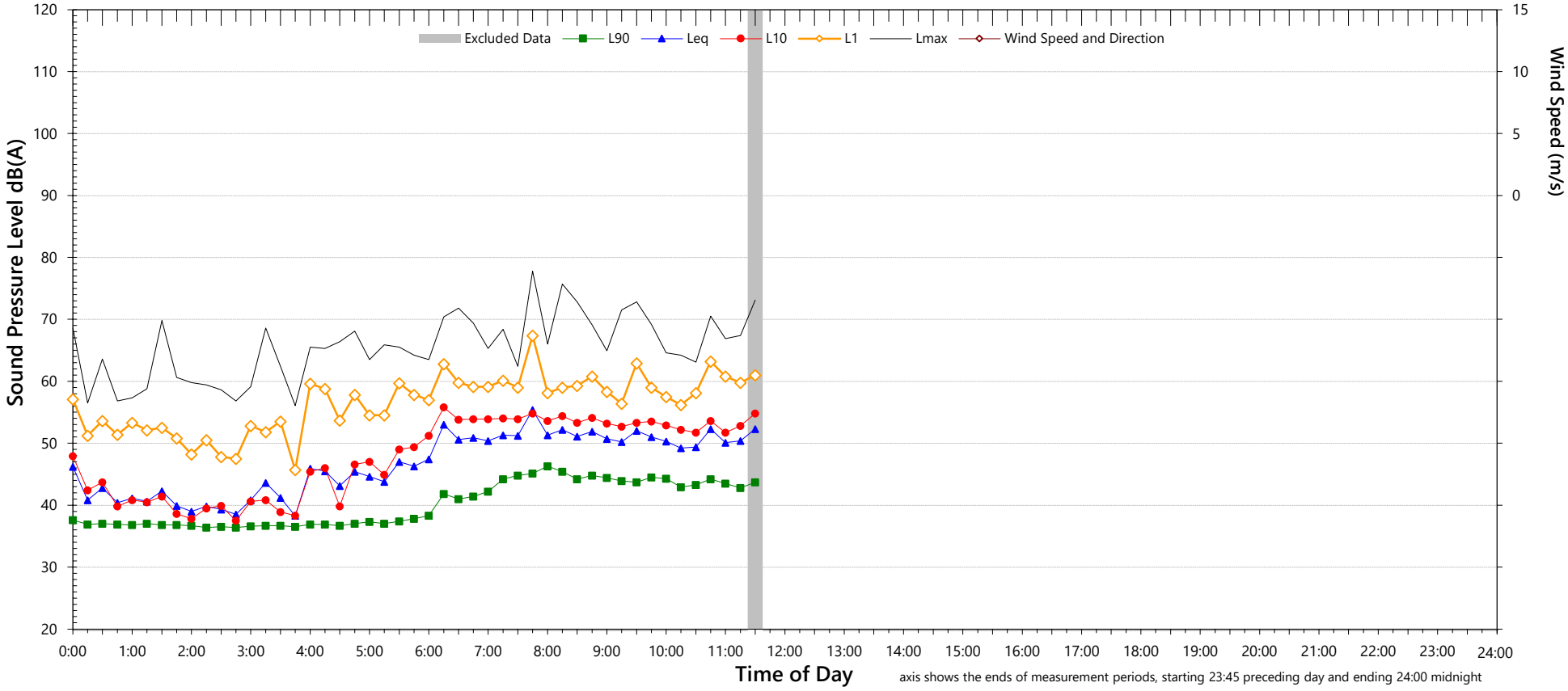
#N/A

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

37 Archer street, Chatswood - Inside the Complex

Wednesday, 12 February 2025



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

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)	#N/A	
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.

#N/A

7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)