Marlborough House, Surry Hills

SSD Noise & Vibration Impact Assessment

M House Surry Pty Ltd

Report Reference: 250574 – Marlborough House, Surry Hills – SSD Noise & Vibration Impact Assessment – R3

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1 INTRODUCTION

This report has been prepared to support a State Significant Development Application (**SSDA**) SSD- 78545225 for the site at 47 – 97 Marlborough Street, Surry Hills.

The Minister for Planning, or their delegate, is the consent authority for the SSDA and this application is lodged with the NSW Department of Planning, Housing and Infrastructure (**DPHI**) for assessment.

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (**SEARs**) dated 19 December 2024 (SSD- 78545225). Specifically, this report has been prepared to respond to the following SEARs:

1.1 SEARs Satisfaction Table

In addressing the requirements of SEARs item 10 above, each item is addressed in the following section:

Table 1 SEARs Satisfaction Table

Acoustic Assessment SEARs Satisfaction Table		
SEAR	**SEAR Requirements**	**Document Reference**
10	*Provide a noise and vibration assessment prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines*	Refer to section 3.
	The assessment must detail construction and operational noise and vibration impacts on nearby sensitive receivers and structures…	Refer to section 5 for operational noise. Refer to section 6 for construction noise and vibration.
	…. and outline the proposed management and mitigation measures that would be implemented	Refer to section 5 and 6.

1.2 Relevant Guidelines

Acoustic criteria that have been adopted in this assessment include requirements from the following guidelines or legislative documents:

- NSW EPA Noise Policy for Industry (*NPfI*) 2017.
- NSW EPA Road Noise Policy (*RNP*) 2011.
- NSW EPA Interim Construction Noise Guideline (*ICNG*) 2009.
- NSW EPA (formerly, Department of Environment and Climate Change) *Assessing Vibration: a technical guideline 2006 (AV-TG)*.
- Australian Standard AS 2670.2 1990 - *Evaluation of Human Exposure to Whole Body Vibration - Part 2: Continuous and Shock Induced Vibration in Buildings (1 Hz to 80 Hz).*
- British Standard BS 6472 - 2008 - *Evaluation of Human Exposure Vibration in Buildings (1 Hz to 80 Hz).*
- German DIN 4150: Part 3 – 1999 "*Effects of Vibration on Structure*" (DIN 1999).

1.3 Project Description

The application seeks development consent for the redevelopment of the site for an in-fill affordable housing residential development comprising 172 market and affordable housing dwellings. The works will involve the adaptive reuse of the heritage listed warehouse building known as the 'Former David Jones Factory'. Specifically, this application seeks approval for the following:

- Demolition of the existing car park on the northern portion of the site.
- Site preparation works including:
    - Tree removal.
    - Excavation on the northern portion of the site.
- Alterations and additions to the existing warehouse building for the purposes of a residential flat building comprising:
    - Heritage conservation works to the warehouse building and alterations to the warehouse roof profile on level 8.
    - Four level addition to the warehouse building on the central portion of the site.
    - 134 residential apartments across 9 levels.
    - Indoor communal resident amenity and rooftop communal open space.
    - Service vehicle access from Goodlet Street to an at-grade loading dock.
    - Lower ground storage, plant and services area.
- Construction of a new residential flat building on the northern portion of the site comprising:
    - Basement car stacker and vehicular access from Landsdowne Street.
    - Retail tenancy on ground level on the corner of Marlborough Street and Landsdowne Street.
    - 38 residential apartments across 9 levels.
- Landscaping and associated public domain works including a private pedestrian link along the western site boundary.
- Provision of 15% affordable housing to be managed by a community housing provider for a period of 15 years from date of the Occupation Certificate.
- Extension and augmentation of physical infrastructure and utilities as required.

Refer to Architectural Plans prepared by Wardle appended to the Environmental Impact Statement.

1.4 The Site

The site is located at 47-97 Marlborough Street, Surry Hills and is legally described as Lot 1 in DP225393 and Lot 1 in DP251056. It is regular in shape and has an area of approximately 3,413 sqm.

The site is located in the City of Sydney local government area (**LGA**) in Surry Hills, which is well-serviced by public amenities such as a supermarket, cafes, destination retail shops and a library. Community facilities such as swimming pools, tennis courts, and active open space are easily accessible. The southern portion of the site comprises a locally listed heritage item (the former David Jones Warehouse building) and the northern portion of the site accommodates a car park. The area to the east and south of the site is a Heritage Conservation Area.

The site is in a highly accessible area with the nearest Light Rail Station (Surry Hills) 200m to the north of the site. The site is also close to regular bus services in the immediate vicinity.

The existing building is built to the site boundaries. There are existing street trees along Marlborough Street, as well as some planter boxes containing vegetation on the site's north-eastern frontage to Marlborough Street.

The location of the site is illustrated in Figure 1.

Figure 1 Aerial Image of Site

Land Uses surrounding the site can be described as follows:

- **North:** Located along the northern boundary of the site is Lansdowne Street which is an existing road that carries a low volume of daily traffic. Further beyond Lansdowne Street is Ward Park, see Figure 2 below.
- **North-west:** Located along the northern west corner of the site is an existing Ausgrid sub-station. See Figure 2 below.
- **East:** Located along the eastern boundary of the site is Marlborough Street which is an existing road that carries a low volume of daily traffic. Further beyond Marlborough Street is residential type receivers. See Figure 2 below.
- **South:** Located along the southern boundary of the site is Goodlet Street which is an existing road that carries a low to medium volume of daily traffic. Further beyond Eveleigh Street is residential type receivers as well, see Figure 2 below.
- **West:** Situated along the western boundary of the block is an existing residential type building which is not part of the site. See Figure 2 below.

1.5 Surrounding Receivers

The nearest sensitive noise receivers to the site are identified below.

Receiver 1: Ausgrid Sub Station building recently completed along the common northwestern boundary of the site, situated at 490-506 Riley Street, Surry Hills.

Receiver 2: Ward Park to the north on the corner of Marlborough Street and Lansdowne Street, Surry Hills

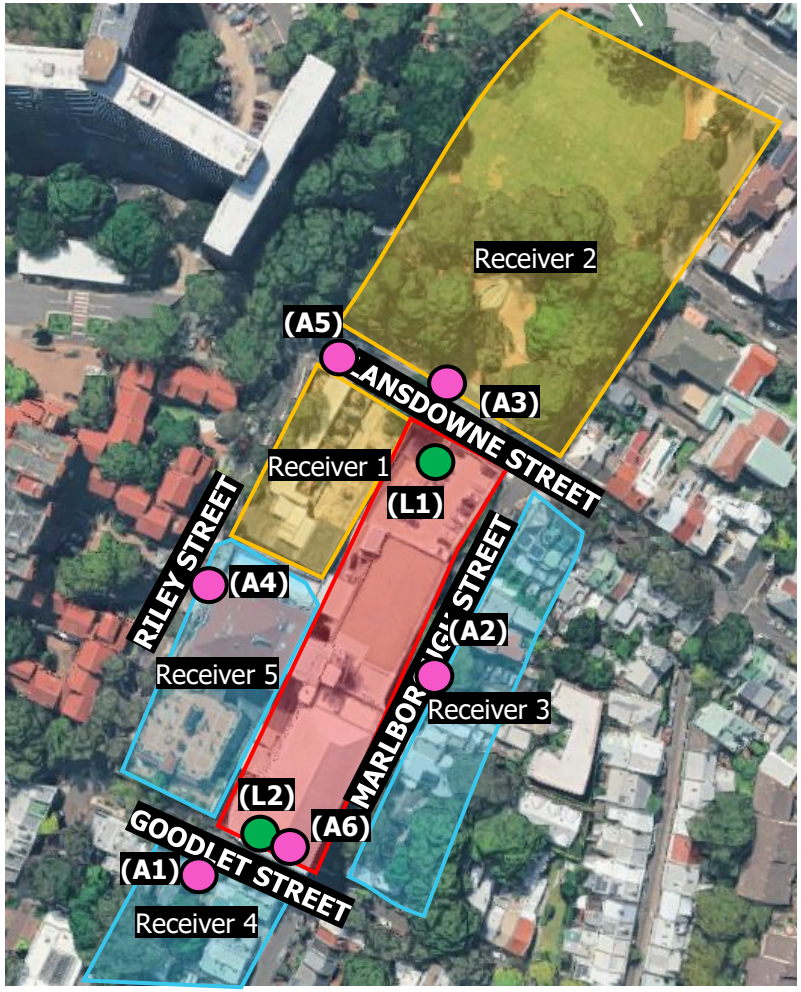
Receiver 3: Single and Two (2) storey residential dwellings situated to the east of the site across Marlborough Street, situated at 52-82 Marlborough Street, Surry Hills and 25-29 Lansdowne Street, Surry Hills.

Receiver 4: Two (2) storey residential dwellings situated to the south of the site across Goodlet Street, situated at 99 Marlborough Street, Surry Hills and 113-119 Goodlet Street, Surry Hills .

Receiver 5: Edgeview Tower Apartments which is a multi storey residential dwelling located to the west of the site, situated at 508 Riley Street, Surry Hills.

A map showing the site location and all measurement locations as well as nearest receivers is provided in Figure 2 below.

Figure 2 - Project Site Location - Sourced Google Maps



Legend

- Project Site
- Residential Receivers
- Commercial Receivers
- Unattended Noise Monitor (L"x")
- Attended Noise Measurment (A"x")

NORTH

2 ACOUSTIC NOISE SURVEY

Measured noise levels from the onsite noise survey are outlined below.

2.1 Unattended Noise Monitoring

Two unattended noise monitors were deployed to the site to survey existing background noise levels as well as ambient L_{Aeq} noise levels.

The monitoring location included one (1) unattended noise monitor along the southern façade of the existing building along Goodlet Street, referred to as 'L1' in the Figure 2 above. This location was used for determining existing acoustic environment for the receivers across Goodlet Street that will be most affected by traffic noise form Cleveland St approximately 75 metres to the south of the site. The monitor was located on level 7 of the site facing south.

The second location was along the southern boundary of the site along Lansdowne Street, referred to as 'L2' in the Figure 2 above. This location was used for determining existing background noise levels as well as ambient noise levels for the receivers along Lansdowne Street.

Onsite acoustic noise survey was conducted from Monday 15th September 2025 until Friday 26th September 2025 (L1 & L2), All data in the graphs presented in Appendix B have not been corrected (i.e., raw data is presented).

Instrumentation for the survey comprised two (2) Rion NL-43 sound level meter (serial number 00653004 and 00653006). Calibration of the monitors were checked prior to and following the measurements. Drift in calibration did not exceed ±0.5 dB. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

Charts presenting summaries of the measured daily noise data are attached in Appendix B for Location 1 and Appendix C for location 2. The charts present each 24-hour period and show the L_{A10}, L_{Aeq} and L_{A90} noise levels for the corresponding 15-minute periods. This data has been filtered to remove periods affected by adverse weather conditions based on weather information.

Based on the unattended noise measurements, the results of the survey have been presented below.

2.1.1 Results in accordance with the NSW EPA Noise Policy for Industry (NPfI) 2017 (RBL's)

In order to assess the acoustical implications of the development at nearby noise sensitive receivers, the measured background noise data of the logger was processed in accordance with the NSW EPA's Noise Policy for Industry (NPfI, 2017).

The Rating Background Noise Level (RBL) is the background noise level used for assessment purposes at the nearest potentially affected receiver. It is the 90th percentile of the daily background noise levels during each assessment period, being day, evening and night. RBL $L_{A90\ (15minute)}$ and L_{Aeq} noise levels are presented in Table 2

Data affected by adverse meteorological conditions and by spurious and uncharacteristic events have been excluded from the results, and also excluded from the data used to determine the noise emission criteria. Meteorological information has been obtained from the Observatory Hill (ID 066214) which is located within 30km. Levels presented below are processed results with extraneous weather events removed.

Table 2 Measured Ambient Noise Levels corresponding to the NPfI's Assessment Time Periods

Measurement Location [4]	Daytime[1] 7:00 am to 6:00 pm		Evening[1] 6:00 pm to 10:00 pm		Night-time[1] 10:00 pm to 7:00 am	
	L_{A90}[2] (dBA)	L_{Aeq}[3] (dBA)	L_{A90}[2] (dBA)	L_{Aeq}[3] (dBA)	L_{A90}[2] (dBA)	L_{Aeq}[3] (dBA)
Location 1 – Southern Façade level 7 – Goodlet Street (see Figure 2)	52	59	51	57	45	56
Location 2 – Northern Boundary – Lansdowne Street (see Figure 2)	44	55	44	51	41	52

Note 1 *For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 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.*

Note 2 *The LA90 noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.*

Note 3 *The LAeq is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.*

Based on analysis of the measured noise levels and onsite observations we note:

- Measured L_{A90} noise levels during the day, evening and night periods are above the minimum prescribed noise levels outlined in the NPfI (i.e., 35dBA $L_{A90\ (7:00am\ to\ 6:00pm)}$ and 30 dBA $L_{A90\ (6:00pm\ to\ 10:00pm)}$). As such project trigger noise levels will be based on the onsite measured noise levels, oppose to a minimum.
- Ambient L_{Aeq} noise levels are like those typically found in a suburban type area.
- Similarities between the two unattended noise monitors are measured, in particular the L_{A90} parameter.

2.1.2 Results in accordance with the NSW Department of Planning, Housing and Infrastructure (DPHI) "Road Noise Policy"

In determining the noise impact from the generation of additional traffic on public roads, in accordance with the internal noise level requirements of Department of Planning, Housing and Infrastructure (DPHI) "Road Noise Policy", measured noise levels are shown based on the time periods defined by the SEPP below.

Table 3 Measured Ambient Noise Levels corresponding to the "Road Noise Policy" Assessment Time Periods

Measurement Location	Daytime [1] 7:00 am to 10:00 pm $L_{Aeq\ (whole\ period)}$ [2] (dBA)	Night-time [1] 10:00 pm to 7:00 am $L_{Aeq\ (whole\ period)}$ [2] (dBA)
Location 1 – Southern Façade – Goodlet Street (see Figure 2)	58[3]	55[3]
Location 2 – Northern Boundary - Lansdowne Street (see Figure 2)	53[3]	52[3]

Note 1 For Monday to Sunday, Daytime 7:00 am – 10:00 pm; Night-time 10:00 pm – 7:00 am.

Note 2 *The LAeq is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.*

Note 3 Determined based on the differences between the attended and unattended noise measurements at other locations during similar times.

2.2 Attended Noise Survey

In addition to the unattended noise surveys detailed above, an onsite attended noise surveys have being undertaken around the site to support the measurements above.

Locations of the attended noise measurements are detailed in the figure above. Noise measurements have been undertaken along all boundaries adjacent to existing receivers.

Attended noise level testing was undertaken using a Bruel and Kjaer 2270 Class 1 Type 1 Sound Level Meter (SLM). The meter was calibrated before and after testing and no significant drift was recorded. The attended and unattended noise locations were selected to obtain suitable noise levels for the assessment of background noise levels ($L_{90\ (t)}$) as well as the impact from traffic movements ($L_{Aeq(Perod)}$).

The attended noise survey was undertaken on Monday 15th September 2025 between 4:30pm and 6:00pm, and 10:00pm and 11:30pm. Results from this survey are presented below.

Table 4 Measured Attended Noise Level Measurements

Measurement Location	Measured Noise Level (dBA)	
	$L_{A90\ (15\text{-}minutes)}$ 1 (dBA)	$L_{Aeq\ (15\text{-}minutes)}$ 2 (dBA)
Day Survey – 4:30pm to 6:00pm		
Location A1 – Goodlet Street (see Figure 2)	48	50
Location A2 – Marlborough Street (see Figure 2)	43	52
Location A3 – Lansdowne Street (see Figure 2)	43	49
Location A4 – Riley Street (see Figure 2)	42	53
Location A5 - Zone Substation (see Figure 2)[3]	40	52
Location A6 – Goodlet Street – Level 8 window on facade (see Figure 2)	50	55
Night Survey – 10:00pm and 11:30pm		
Location A1 – Goodlet Street (see Figure 2)	45	47
Location A2 – Marlborough Street (see Figure 2)	40	51
Location A3 – Lansdowne Street (see Figure 2)	40	46

Location A4 – Riley Street (see Figure 2)	39	50
Location A5 – Zone Substation (see Figure 2)[3]	41	51

Note 1 *The LA90 noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.*

Note 2 *The LAeq is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.*

Note 3 Measurements are inclusive of the zone substation on the corner of Rile St and Lansdowne St to the north western corner of the site

2.3 Summary of Measured/Assumed RBLs

Based on the measured noise levels obtained above, the following table outlines the relevant Rating Background Noise Level (RBL) at each receiver location. These are formulated based on the unattended noise monitoring, attended noise survey and onsite observations.

Table 5 Assumed Noise Levels vs. Receiver Locations (RBL's)

Measurement Location [4]	Daytime[1] 7:00 am to 6:00 pm		Evening[1] 6:00 pm to 10:00 pm		Night-time[1] 10:00 pm to 7:00 am	
	L_{A90}[2] (dBA)	L_{Aeq}[3] (dBA)	L_{A90}[2] (dBA)	L_{Aeq}[3] (dBA)	L_{A90}[2] (dBA)	L_{Aeq}[3] (dBA)
Receivers 1 and 2	44	55	44	51	41	52
Receiver 3	45[4]	56[4]	45[4]	52[4]	42[4]	53[4]
Receiver 4	48[4]	54[4]	47[4]	53[4]	41[4]	52[4]
Receiver 5	46[4]	57[4]	44[4]	51[4]	41[4]	51[4]

Note 1 *For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 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.*

Note 2 *The LA90 noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.*

Note 3 *The LAeq is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.*

Note 4 *Determined based on the differences between the attended and unattended noise measurements at other locations during similar times.*

3 NOISE AND VIBRATION CRITERIA

All relevant noise and vibration criteria for the project is presented below. It has been separated in to four main components: external noise emission criteria, building envelope criteria (façade), vibration criteria and construction noise/vibration criteria. Each are discussed in detail below.

3.1 External Noise Emission Criteria

3.1.1 NSW EPA Noise Policy for Industry (NPfI) 2017

In NSW, the control of noise emissions is the responsibility of Local Governments and the NSW Environment Protection Authority (NSW EPA).

The NSW EPA has recently released a document titled Noise Policy for Industry (NSW NPfI) which provides a framework and process for determining external noise criteria for the assessment of noise emission from industrial developments. The NSW NPfI criteria for industrial noise sources have two components:

- Controlling the intrusive noise impacts for residents and other sensitive receivers in the short term; and
- Maintaining noise level amenity of particular land uses for residents and sensitive receivers in other land uses.

3.1.1.1 Intrusive Noise Impacts (Residential Receivers)

The NSW NPfI states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (L_{Aeq}), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB(A). This is often termed the Intrusiveness Criterion.

The 'Rating Background Level' (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in the NSW NPfI. Using the rating background noise level approach results in the intrusiveness criterion being met for 90% of the time. Adjustments are to be applied to the level of noise produced by the source that is received at the assessment point where the noise source contains annoying characteristics such as tonality or impulsiveness.

3.1.1.2 Protecting Noise Amenity (All Receivers)

To limit continuing increase in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.2 of the NSW NPfI. That is, the ambient LAeq noise level should not exceed the level appropriate for the locality and land use. This is often termed the 'Background Creep' or Amenity Criterion.

The amenity assessment is based on noise criteria specified for a particular land use and corresponding sensitivity to noise. The cumulative effect of noise from industrial sources needs to be considered in assessing the impact. These criteria relate only to other continuous industrial-type noise and do not include road, rail or community noise. If the existing (measured) industrial-type noise level approaches the criterion value, then the NSW NPfI sets maximum noise emission levels from new sources with the objective of ensuring that the cumulative levels do not significantly exceed the criterion.

Project amenity noise level for industrial developments is specified as the recommended amenity noise level (Table 2.2 of the NPfI) minus 5 dB(A). To standardise the time periods for the intrusiveness and amenity noise levels, this policy assumes that the LAeq,15min will be taken to be equal to the $L_{Aeq,period}$ + 3 decibels (dB).

Where the resultant project amenity noise level is 10 dB or more lower than the existing traffic noise level, the project amenity noise levels can be set at 15 dB below existing traffic noise levels (i.e. $L_{Aeq,period(traffic)}$ *minus 15 dBA*).

3.1.1.3 Residential Receivers – Area Classification

The NSW NPI characteristics the "Suburban Residential" noise environment as an area that has the following characteristics:

- *An area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristic: evening ambient noise levels defined by the natural environment and human activity*

Figure 3 – NSW ePlanning Spatial Viewer

As shown above, the site and its surrounding receivers are within an area made up of R1 type developments (Medium Density Residential). Based on classification of R1, using table 2.3 of the NPfI (see below), we believe that the most appropriate classification for the development site is suburban.

Figure 4 - NPfI Extract - Table 2.3 Determining which of the residential receiver categories applies

Table 2.3: Determining which of the residential receiver categories applies.

Receiver category	Typical planning zoning – standard instrument*	Typical existing background noise levels	Description
Rural residential	RU1 – primary production RU2 – rural landscape RU4 – primary production small lots R5 – large lot residential E4 – environmental living	Daytime RBL <40 dB(A) Evening RBL <35 dB(A) Night RBL <30 dB(A)	**Rural** – an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels. Settlement patterns would be typically sparse. Note: Where background noise levels are higher than those presented in column 3 due to existing industry or intensive agricultural activities, the selection of a higher noise amenity area should be considered.
Suburban residential	RU5 – village RU6 – transition R2 – low density residential R3 – medium density residential E2 – environmental conservation E3 – environmental management	Daytime RBL<45 dB(A) Evening RBL<40 dB(A) Night RBL <35dB(A)	**Suburban** – an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristic: evening ambient noise levels defined by the natural environment and human activity.
Urban residential	R1 – general residential R4 – high density residential B1 – neighbourhood centre (boarding houses and shop-top housing) B2 – local centre (boarding houses) B4 – mixed use	Daytime RBL> 45 dB(A) Evening RBL> 40 dB(A) Night RBL >35 dB(A)	**Urban** – an area with an acoustical environment that: • is dominated by 'urban hum' or industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources • has through-traffic with characteristically heavy and continuous traffic flows during peak periods • is near commercial districts or industrial districts • has any combination of the above.

Notes: *As cited in Standard Instrument – Principal Local Environmental Plan, New South Wales Government, Version 15 August 2014. RBL = rating background noise level.

Resultant amenity levels for suburban receivers are shown below.

Table 6 NSW NPfI – Recommended L_{Aeq} Noise Levels from Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day[1]	Recommended Amenity Noise Level ($L_{Aeq, period}$)[2] (dBA)
Residence	Suburban	Day	55
		Evening	45
		Night	40
Commercial	All	When in use	65
Active Recreation	All	When in use	55

Note 1 For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 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

Note 2 The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound

3.1.1.4 Maximum Noise Level Event (Sleeping Disturbance)

Section 2.5 of the NPI states the following:

> *The potential for sleep disturbance from maximum noise level events from premises during the night-time period needs to be considered. Sleep disturbance is considered to be both awakenings and disturbance to sleep stages.*
>
> *Where the subject development/premises night-time noise levels at a residential location exceed:*
>
> - *$L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
> - *L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,*
>
> *a detailed maximum noise level event assessment should be undertaken.*

Based on the requirements above as well as the onsite measured noise levels discussed above, the following maximum noise level event criterion applies as per below:

- **Receivers 1 and 2:**
  - N/A
- **Receiver 3:**
  - 45 dBA $L_{Aeq\ (15\text{-}minute)}$; and
  - 55 dBA L_{Max}
- **Receivers 4:**
  - 46 dBA $L_{Aeq\ (15\text{-}minute)}$; and
  - 56 dBA L_{Max}
- **Receivers 5:**
  - 46 dBA $L_{Aeq\ (15\text{-}minute)}$; and
  - 56 dBA L_{Max}

3.1.1.5 Project Specific External Noise Emission Criteria

The intrusive, amenity and maximum noise event criteria for noise emissions, derived from the measured data, are presented in Table 7. These criteria are nominated for the purpose of determining the operational noise limits for building services associated with the development which can potentially affect noise sensitive receivers.

For each assessment period, the lower (i.e., the more stringent) of the amenity or intrusive criteria are adopted. These are shown in bold text in Table 7.

Table 7 External noise level criteria in accordance with the NSW NPI

Receiver Type	Time of Day [1]	Project Amenity Noise Level, $L_{Aeq, period}$ [2 4] (dBA)	Measured $L_{A90, 15\ min}$ (RBL) [3] (dBA)	Measured $L_{Aeq, period}$ Noise Level [4] (dBA)	Intrusive $L_{Aeq, 15\ min\ Criterion}$ [4] for New Sources (dBA)	Amenity $L_{Aeq, 15\ min\ Criterion}$ [4 5] for New Sources (dBA)
Receiver 1 and 2 (Commercial- when in use)	When in use	65	-	-	**-**	**63**
Receiver 2 (Active Recreation open 7am to 9pm daily)	When in use	55	-	-	-	**53**
Receiver 3 (Residential)	Day	55	45	56	**50**	53
	Evening	45	45	52	50	**43**
	Night	40	42	53	47	**38**
Receivers 4 (Residential)	Day	55	48	54	**53**	53
	Evening	45	47	53	52	**43**
	Night	40	41	52	46	**38**
Receivers 5 (Residential)	Day	55	46	57	**51**	53
	Evening	45	44	51	49	**43**
	Night	40	41	51	46	**38**

Note 1 For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 1:00 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 – 7:00 am.

Note 2 Project Amenity Noise Levels corresponding to "Suburban" areas, equivalent to the Recommended Amenity Noise Levels minus 5 dBA.

Note 3 LA90 Background Noise or Rating Background Level.

Note 4 The LAeq is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound

Note 5 According to Section 2.2 of the NSW NPfI, the LAeq, 15 minutes is equal to the LAeq, period + 3 dB.

Note 6 Project Noise Trigger Levels are shown in bold.

In addition, a maximum noise level event criterion applies as per below:

- **Receivers 1 and 2:**
  - N/A
- **Receiver 3:**
  - 45 dBA $L_{Aeq\ (15\text{-}minute)}$; and
  - 55 dBA L_{Max}
- **Receivers 4:**
  - 46 dBA $L_{Aeq\ (15\text{-}minute)}$; and
  - 56 dBA L_{Max}
- **Receivers 5:**
  - 46 dBA $L_{Aeq\ (15\text{-}minute)}$; and
  - 56 dBA L_{Max}

3.1.2 NSW EPA (Formerly DECCW) NSW Road Noise Policy (RNP) 2011

For existing residences and other sensitive land uses affected by additional traffic on existing roads, the NSW Road Noise Policy states that for noise associated with increased road traffic generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB during both day and night-time periods. An increase of 2 dB represents a minor impact that is considered barely perceptible to the average person.

3.2 Noise Intrusion Criteria

3.2.1 NSW Department of Planning and Environments Development Near Rail Corridors and Busy Roads – Interim Guideline 2008

NSW Department of Planning's document DNRCBR adopts the same internal noise criteria outlined in the SEPP infrastructure (previous 2008, now updated 2021) see below. However, table 3.1 from the policy states:

Figure 5 Extract - DRCBR - Table 3.1

Table 3.1: Noise criteria

Residential Buildings		
Type of occupancy	Noise Level dBA	Applicable time period
Sleeping areas (bedroom)	35	Night 10 pm to 7 am
Other habitable rooms (excl. garages, kitchens, bathrooms & hallways)	40	At any time
Non–Residential Buildings		
Type of occupancy		Recommended Max Level dBA
Educational Institutions including child care centres		40
Places of Worship		40
Hospitals	- Wards	35
	- Other noise sensitive areas	45

Note: airborne noise is calculated as L_{eq} (9h) (night) and L_{eq} (15h)(day). Groundborne noise is calculated as L_{max} (slow) for 95% of rail pass-by events.

3.2.2 Australian/New Zealand Standard AS/NZS 2107:2016 – Acoustics – Recommended design sound levels and reverberation times for building interiors

In relation to design internal noise levels, standard AS/NZS 2107:2016 recommends a range with lower and upper levels (rather than "satisfactory" and "maximum" internal noise levels) for building interiors based on room designation and location of the development relative to external noise sources. This change has occurred due to the fact that sound levels below 'satisfactory' could be interpreted as desirable, but the opposite may in fact be the case. Levels below those which were listed as 'satisfactory' can lead to inadequate acoustic masking resulting in loss of acoustic isolation and speech privacy.

The levels for areas relevant to this development are given in the table below. In this report we will confine our recommendations to dBA levels, however, where the background noise appears to be unbalanced, standard AS/NZS 2107:2016 provides direction in terms of suitable diagnostic tools that can be used to assess the spectrum distribution of the background noise.

Section 6.18 of standard AS/NZ 2107:2016 notes that the presence of discrete frequencies or narrow band signals may cause the sound level to vary spatially within a particular area and be a source of distraction for occupants. Where this occurs, the sound level shall be determined as the highest level measured in the occupied location(s).

The Table below includes the recommended internal noise levels included within AS2107:2016 for various spaces.

Table 8 Recommended design sound levels as per standard AS/NZS 2107:2016

Type of Occupancy/Activity	Design sound level range (dBA $L_{Aeq,t}$)
Retail Areas	45 - 55
Corridors and Lobbies	45 – 50
Apartment common areas (e.g., foyer, lift lobby)	45 – 50
Residential – Living/working areas	35 – 45
Residential - Sleeping areas (night-time)	35 – 40

Note 1 The LAeq is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound

Generally, where the final noise levels are within +/- 2 dB of the specified level given above, the design criteria will be considered met. Both the upper and lower limits will need to be satisfied especially where privacy is important or where noise intrusion to be avoided.

3.2.3 Summary of Project Requirements

Based on the requirements listed in the sections above, the project resulting internal noise levels requirements are summarised in the table below.

Table 9 Summary of Internal Noise Level Criteria

Room Type	Project Internal Environmental Noise Level Requirements dBA $L_{Aeq,(Period)}$	Governing Document
Bedrooms	35 dBA $L_{Aeq\ 9\ hour\ (10pm\ -\ 7am)}$	SEPP/ DNRCBR
Habitable Spaces	40 dBA $L_{Aeq\ 15\ hour\ (7am\ –\ 10pm)}$	SEPP/ DNRCBR
Retail Areas	50 dBA $L_{Aeq\ anytime}$	AS/NZS 2107:2016
Corridors and Lobbies	50 dBA $L_{Aeq\ anytime}$	AS/NZS 2107:2016
Apartment common areas (e.g. foyer, lift lobby)	50 dBA $L_{Aeq\ anytime}$	AS/NZS 2107:2016

Note 1 The LAeq is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound

3.3 Construction Noise and Vibration Criteria

3.3.1 Construction Noise Criteria

Relevant construction noise criteria applicable to this project are outlined below.

3.3.1.1 NSW EPA (Former DECC) Interim Construction Noise Guideline (ICNG) 2009

Noise criteria for construction and demolition activities are discussed in the Interim Construction Noise Guideline (ICNG). The ICNG also recommends procedures to address potential impacts of construction noise on residences and other sensitive land uses. The main objectives of the ICNG are summarised as follows:

- Promote a clear understanding of ways to identify and minimise noise from construction works.
- Focus on applying all "feasible" and "reasonable" work practices to minimise construction noise impacts.
- Encourage construction to be undertaken only during the recommended standard hours unless approval is given for works that cannot be undertaken during these hours.
- Streamline the assessment and approval stages and reduce time spent dealing with complaints at the project implementation stage; and
- Provide flexibility in selecting site-specific feasible and reasonable work practices to minimise noise impacts.

The ICNG contains a quantitative assessment method which is applicable to this project. Guidance levels are given for airborne noise at residences and other sensitive land uses.

The quantitative assessment method involves predicting noise levels at sensitive receivers and comparing them with the Noise Management Levels (NMLs). The NML affectation categories for residential receivers have been reproduced from the guideline and are listed in the table below.

Table 10 NMLs for quantitative assessment at residences

Time of Day	Noise Management Level $L_{Aeq(15minute)}$ [1,2]	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 **(NAL)** RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq(15minute)}$ 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 **(HNAL)** 75 dBA	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: 1. 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. 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside the recommended standard hours above	Noise affected RBL + 5 dB	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 5 dB above the noise affected level, the proponent should notify the community.

Note 1 Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m 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.

*Note 2 The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW Industrial Noise Policy (EPA 2000) **(Now NSW EPA NPI 2017).***

Based on the measured background noise levels summarised in section 2, and the NMLs outlined above, the construction noise criteria to be used in this assessment are listed in section 2.

Table 11 NMLs as basis for the acoustic assessment

Receiver Types		NML, dB $L_{Aeq(15minute)}$	
		Standard Hours **Monday to Friday: 7:00am to 6:00pm** **Saturday: 8:00am to 1:00pm**	**Outside Standard Hours** **All hours not listed in the adjacent column.**
Residences (Measured externally)	Receivers 3	**NAL: 55** (RBL (45) + 10dB) **HNAL: 75**	RBL + 5dB
	Receiver 4	**NAL: 58** (RBL (48) + 10dB) **HNAL: 75**	RBL + 5dB
	Receivers 5	**NAL: 56** (RBL (46) + 10dB) **HNAL: 75**	RBL + 5dB
Commercial (Measured externally)	Receiver 1	**70**	
Active Recreation Area (Ward Park)	Receiver 2	**65**	

Note 1 The LAeq is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

3.3.2 Vibration Criteria

Effects of ground borne vibration on buildings may be segregated into the following three categories:

- Human comfort – vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building contents – where vibration can cause damage to fixtures, fittings, and other non-building related objects.
- Effects on building structures – where vibration can compromise the integrity of the building or structure itself.

3.3.2.1 Vibration Criteria – Human Comfort

Vibration effects relating specifically to the human comfort aspects of the project are taken from AV-TG. This type of impact can be further categorised and assessed using the appropriate criterion as follows:

- Continuous vibration – from uninterrupted sources.
- Impulsive vibration – up to three instances of sudden impact e.g., dropping heavy items, per monitoring period.
- Intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously.

Table 12 Continuous vibration acceleration criteria (m/s2) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
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	Anytime	0.020	0.014	0.04	0.028

Table 13 Impulsive vibration acceleration criteria (m/s2) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
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	Anytime	0.64	0.46	1.28	0.92

Table 14 Intermittent vibration impacts criteria (m/s1.75) 1 Hz-80 Hz

Location	Daytime		Night-time	
	Preferred Values	Maximum Values	Preferred Values	Maximum Values
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

3.3.2.2 Vibration Criteria – Building Contents and Structure

The vibration effects on the building itself are assessed against international standards as follows:

- For transient vibration: British Standard BS 7385: Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration" (BSI 1993); and
- For continuous or repetitive vibration: German DIN 4150: Part 3 – 1999 "Effects of Vibration on Structure" (DIN 1999).

3.3.2.2.1 British Standard BS 7385 Part 2 - 1993

For transient vibration, as discussed in standard BS 7385 Part 2-1993, the criteria are based on peak particle velocity (mm/s) which is to be measured at the base of the building. These are summarised in Table 15 and illustrated in Figure 6.

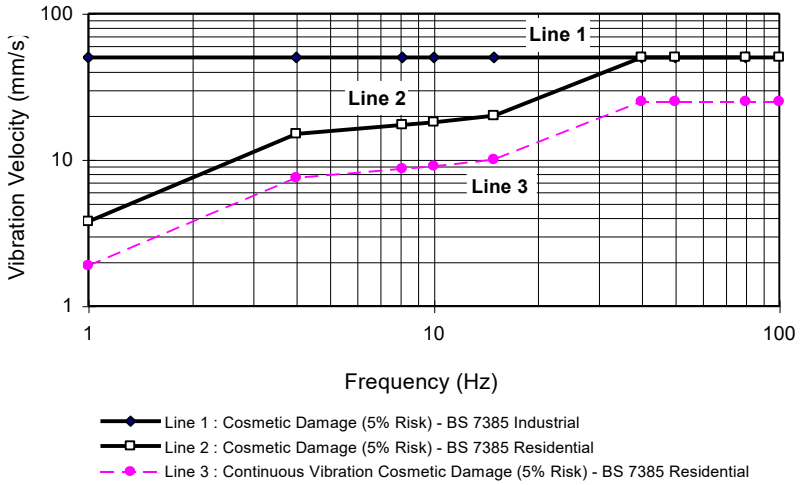
Table 15 Transient vibration criteria as per standard BS 7385 Part 2 – 1993

Line in Figure 6	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz and Above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Standard BS 7385 Part 2 – 1993 states that the values in Table 15 relate to transient vibration which does not cause resonant responses in buildings.

Where the dynamic loading caused by continuous vibration events is such that it results in dynamic magnification due to resonance (especially at the lower frequencies where lower guide values apply), then the values in Table 15 may need to be reduced by up to 50% (refer to Line 3 in Figure 6).

Figure 6 - BS 7385 Part 2 – 1993, graph of transient vibration values for cosmetic damage



In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the recommended values corresponding to Line 2 are reduced. Below a frequency of 4 Hz, where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.

The standard also states that minor damage is possible at vibration magnitudes which are greater than twice those given in , and major damage to a building structure may occur at values greater than four times the tabulated values.

Fatigue considerations are also addressed in the standard, and it is concluded that unless the calculation indicates that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the values in should not be reduced for fatigue considerations.

3.3.2.2.2 German Standard DIN 4150 Part 3 - 1999

For continuous or repetitive vibration, standard DIN 4150 Part 3-1999 provides criteria based on values for peak particle velocity (mm/s) measured at the foundation of the building; these are summarised in Table 16. The criteria are frequency dependent and specific to particular categories of structures.

Table 16 Structural damage criteria as per standard DIN 4150 Part 3 – 1999

Type of Structure	Peak Component Particle Velocity, mm/s			
	Vibration at the foundation at a frequency of			Vibration of horizontal plane of highest floor at all frequencies
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz [1]	
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
Structures that, because of their sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

3.3.3 Construction Traffic Noise Criteria

For existing residences and other sensitive land uses affected by additional traffic on existing roads, the NSW Road Noise Policy (RNP) states that for noise associated with increased road traffic generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB during both day and night-time periods. An increase of 2 dB represents a minor impact that is considered barely perceptible to the average person.

4 EXTERNAL NOISE INTRUSION ASSESSMENT

4.1 Façade Acoustic Treatments

Preliminary façade acoustic treatments based on the external levels measured above from surrounding roads and other environmental sources as discussed in section 2 above are provided below.

4.1.1 Glazing Recommendations

The recommended sound transmission loss requirement required to satisfy the specified internal noise level criteria outlined above are summarised in the table below.

Please note for windows, this performance is not only subject to the glazing selection but also to the construction of the window frame and the frame seal selection. Therefore, it is recommended that the window manufacturer should confirm that the required sound insulation can be achieved. It is anticipated that the window system should comprise Q-Lon (or equivalent) or fin seals with deep C channels as part of the window track **(i.e., Performance levels outlined above need to be achieved with glazed panels + frame + seals).**

Table 17 Recommended Glazing Construction

Façade	Space	Indicative Construction[1]	Minimum System Rating Requirements
Northern Façade (Lansdowne Street)	Living Areas	6.38mm Laminate	≥Rw (C;Ctr): 31 (-1,-3)
	Sleeping Spaces	6.38mm Laminate	≥Rw (C;Ctr): 31 (-1,-3)
	Wet Areas	5mm Float	≥Rw (C;Ctr): 28 (-1,-3)
	Communal Areas	6.38mm Laminate	≥Rw (C;Ctr): 31 (-1,-3)
	Commercial	6.38mm Laminate	≥Rw (C;Ctr): 31 (-1,-3)
Eastern Façade (Marlborough Street)	Living Areas	6.38mm Laminate	≥Rw (C;Ctr): 31 (-1,-3)
	Sleeping Spaces	6.38mm Laminate	≥Rw (C;Ctr): 31 (-1,-3)
	Wet Areas	5mm Float	≥Rw (C;Ctr): 28 (-1,-3)
	Communal Areas	6.38mm Laminate	≥Rw (C;Ctr): 31 (-1,-3)
	Commercial	6.38mm Laminate	≥Rw (C;Ctr): 31 (-1,-3)
Southern Façade (Goodlet Street)	Living Areas	6.38mm Laminate	≥Rw (C;Ctr): 31 (-1,-3)
	Sleeping Spaces	6.38mm Laminate	≥Rw (C;Ctr): 31 (-1,-3)
	Wet Areas	5mm Float	≥Rw (C;Ctr): 28 (-1,-3)
	Communal Areas	6.38mm Laminate	≥Rw (C;Ctr): 31 (-1,-3)
Western Façade	Living Areas	6.38mm Laminate	≥Rw (C;Ctr): 31 (-1,-3)
	Sleeping Spaces	6.38mm Laminate	≥Rw (C;Ctr): 31 (-1,-3)
	Wet Areas	5mm Float	≥Rw (C;Ctr): 28 (-1,-3)
	Communal Areas	6.38mm Laminate	≥Rw (C;Ctr): 31 (-1,-3)
	Commercial	6.38mm Laminate	≥Rw (C;Ctr): 31 (-1,-3)

Note 1 These are preliminary selections will be confirmed in the detailed design stage once the layouts and façade orientations are finalised.

It is recommended prior to the issue of a Construction Certificate (CC) a further detailed review be undertaken one the final layouts and façade openings are confirmed, and façade detailing/systems has completed/being selected.

4.1.2 External Wall Construction

External wall constructions which are constructed from a concrete or masonry construction will be acoustically sufficient and no further acoustic upgrading is required.

However, for wall systems constructed from a lightweight cladding system, the following construction is recommended.

Table 18 Recommended Light Weight External Wall Construction

Façade	Space	Indicative Construction[1]	Minimum System Rating Requirements
Northern Façade (Hudson Street)	Living Areas	Architectural Lining as Documented + min. 64mm Steel Studwork + 50mm thick 14kg/m^3 glasswool insulation + 1 x 13mm Standard Plasterboard **OR** 6mm Fibre Cement Sheeting	≥Rw (C;Ctr): 42 (-1,-3)
	Sleeping Spaces		
	Wet Areas		
	Communal Areas		
	Commercial		
Eastern Façade (Eveleigh Street)	Living Areas	Architectural Lining as Documented + min. 64mm Steel Studwork + 50mm thick 14kg/m^3 glasswool insulation + 1 x 13mm Standard Plasterboard **OR** 6mm Fibre Cement Sheeting	≥Rw (C;Ctr): 42 (-1,-3)
	Sleeping Spaces		
	Wet Areas		
	Communal Areas		
	Commercial		
Southern Façade (Vine Street)	Living Areas	Architectural Lining as Documented + min. 64mm Steel Studwork + 50mm thick 14kg/m^3 glasswool insulation + 1 x 13mm Standard Plasterboard **OR** 6mm Fibre Cement Sheeting	≥Rw (C;Ctr): 42 (-1,-3)
	Sleeping Spaces		
	Wet Areas		
	Communal Areas		
	Commercial		
Western Façade (Evans Lane)	Living Areas	Architectural Lining as Documented + min. 64mm Steel Studwork + 50mm thick 14kg/m^3 glasswool insulation + 1 x 13mm Standard Plasterboard **OR** 6mm Fibre Cement Sheeting	≥Rw (C;Ctr): 42 (-1,-3)
	Sleeping Spaces		
	Wet Areas		
	Communal Areas		
	Commercial		

Note 2 These are preliminary selections will be confirmed in the detailed design stage once the layouts and façade orientations are finalised.

If penetrations through any external skin are required, all gaps remaining in the penetration are to be filled with an acoustic grade sealant which provides an equal or better performance to the system being penetrated.

It is recommended prior to the issue of a Construction Certificate (CC) a further detailed review be undertaken one the final layouts and façade openings are confirmed, and façade detailing/systems has completed/being selected.

4.1.3 External Roof Construction

External roof constructions which are constructed from a concrete construction will be acoustically sufficient and no further acoustic upgrading is required.

However, for roof systems constructed from a lightweight roofing system, the following construction is recommended.

Table 19 Recommended Light Weight Roof Construction

Space	Indicative Construction[1]	Minimum System Rating Requirements
Top Level Living Areas	Architectural Lining as Documented + Roof Structure + 50mm thick 14kg/m^3 glasswool insulation + 1 x 13mm Standard Plasterboard **OR** 6mm Fibre Cement Sheeting	≥Rw (C;Ctr): 45 (-1,-3)
Top Level Sleeping Spaces		
Top Level Wet Areas		
Top Level Communal Areas		

Note 1 These are preliminary selections will be confirmed in the detailed design stage once the layouts and façade orientations are finalised.

If penetrations through any external skin are required, all gaps remaining in the penetration are to be filled with an acoustic grade sealant which provides an equal or better performance to the system being penetrated.

It is recommended prior to the issue of a Construction Certificate (CC) a further detailed review be undertaken one the final layouts and façade openings are confirmed, and façade detailing/systems has completed/being selected.

4.1.4 Open Windows Assessment

The internal design sound levels detailed above are to be achieved with the external operable building openings closed. As internal noise levels with windows open will result in noise levels which are equal to or less than 10 dB(A) with windows open to 5% of the floor area for ventilation there is no requirement for an alternative method of providing outside air ventilation to all units as per the open window requirements of the Department of Planning *"Development Near Rail Corridors and Busy Roads – Interim Guideline" (DNRCBR*).

The requirement for an alternative source of outside air is only triggered when internal noise levels +10 dB(A) with windows open to 5% of the floor area for ventilation.

Based on the noise levels obtained at the site and detailed in this report, an alternative source of outside air is **not** required to be provided to all residential dwellings within the building along all facades, including all levels and all façade orientations.

The acoustic design of the building includes performance of glass and solid façade elements which will ensure internal noise levels with operable windows closed will achieve internal noise level requirements and ensure a suitable acoustic amenity for future residence.

Also as above, the operable windows and doors can be used to provide ventilation/cross ventilation to the units. This can be undertaken by opening the operable elements of the façade at the discretion of the future occupants.

5 OPERATIONAL NOISE EMISSION ASSESSMENT

Assessment of the potential noise emissions from the operation of the development and its potential for impacts on the adjacent land users are outlined below. Noise emissions expected from the operation of the building are mainly from any base building services (mechanical, electrical, hydraulic), vehicle movements around the site and on public roads and activity noise.

Each element is discussed in detail below.

5.1 External Noise Emissions from Engineering Services

At this stage of the project, the exact locations of key plant items, and the selection of items to be installed, have not been selected. As such, a detailed assessment of noise associated with engineering services cannot be undertaken.

All future plant and equipment are to be acoustically treated to ensure the noise levels at all surrounding receivers comply with noise emission criteria detailed within this report. Experience with similar projects indicates that it is both possible and practical to treat all mechanical equipment such that the relevant noise levels are achieved. Examples of the possible acoustic treatments to mechanical equipment includes the following:

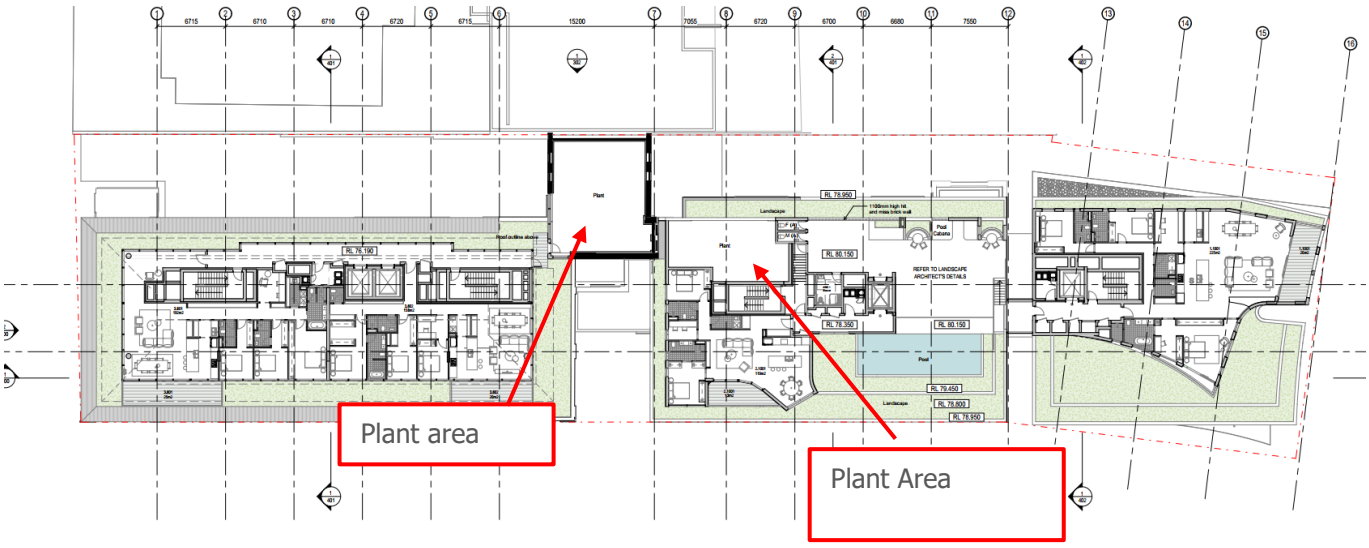
- Supply and Exhaust Fans – location of fans within the building and treated using internally lined ductwork or acoustic silencers.
- General supply and exhaust fans – general exhaust and supply fans such as toilet, kitchen, lobby and other small mechanical fans can be acoustically treated using acoustic flex ducting or internally lined ducting.
- External Chillers/Cooling Equipment – The project will likely include external chillers for the operation of the cooling of the building. Based on the likely location of the plant being on the rooftop of the building, acoustic mitigations will be both possible and practical to ensure the noise emission requirements detailed in Section **Error! Reference source not found.** of this report will be achieved.

Details of the selected mechanical equipment (including source noise levels) and the resulting acoustic treatments to ensure the relevant noise level criteria is achieved will be provided as part of the CC submission of the project. Possible acoustic treatments may include the following:

1. Internal acoustic lining of ductwork.
2. Acoustic silencers to fans.
3. Vibration isolation to services equipment.
4. Time control or Variable Speed Drives to equipment.
5. Acoustic Screening.
6. Other acoustic treatments specific to the selected plant and equipment once selected.

Experience with similar projects indicates that the acoustic treatment of whatever mechanical equipment is to be installed on the project is both possible and practical.

Figure 7 Level 10 Plant Areas



Note: Prior to the issue of the Construction Certificate the recommended acoustic treatments for the engineering services should be reviewed to ensure final selections and mechanical airflow requirements are achieved.

5.2 Carpark Noise Emissions

It is noted that the carpark is to be a auto-valet transfer lift system and will be fully enclosed and mechanically ventilated. As a result, it is expected that noise emissions from the car park will have a negligible impact onto the nearest affected receivers.

5.3 Noise from Additional Traffic

Noise impacts from the increase in vehicle movements along the surrounding roadways is to be assessed in accordance with the NSW EPA Road Noise Policy (RNP) 2011.

Based on the proposed development yield the site may generate the following levels of peak hour traffic:

- AM Peak Hour: 33 Vehicle Trips
- PM Peak Hour: 26 Vehicle Trips

A peak hour increase proposed for the number vehicles associated with the development will not exceed a 2dBA increase at the nearest residential receivers. As summarised in the NSW EPA RNP, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person and is therefore considered acoustically acceptable.

5.4 Acoustic Separation

As this project is still within the development approval phase, information regarding the proposed constructions that will be separating areas within the development is not known at this stage. As such, a detailed review of the constructions for compliance with the airborne and impact ratings from the National Construction Code cannot be undertaken. It is usual for such work to be conducted at the Construction Certificate (CC) stage of the development. The required airborne and impact ratings have been presented in Part F7 of the National Construction Code.

5.5 Retail Noise

At this stage the exact uses/activities of the retail tenancy are not known, therefore it is recommended that once details of each proposed tenancy are known an acoustic assessment is conducted assessing the individual impacts of each tenancy.

However, based on the location of the spaces and the façade constructions outlined in this report it is unlikely that these spaces will result in an impact on the existing acoustic amenity of the surrounding receivers.

Notwithstanding above, currently the site is used for commercial operations and has successfully done so the existing residential receivers for a long time. As such, we believe the proposal is acoustically acceptable.

5.6 Noise from Communal Open Spaces

The proposed development includes communal open spaces on level 4 of the project, including the area included in the figure below, which includes the use for residence and their guests only.

Figure 8 Level 1 Communal Area

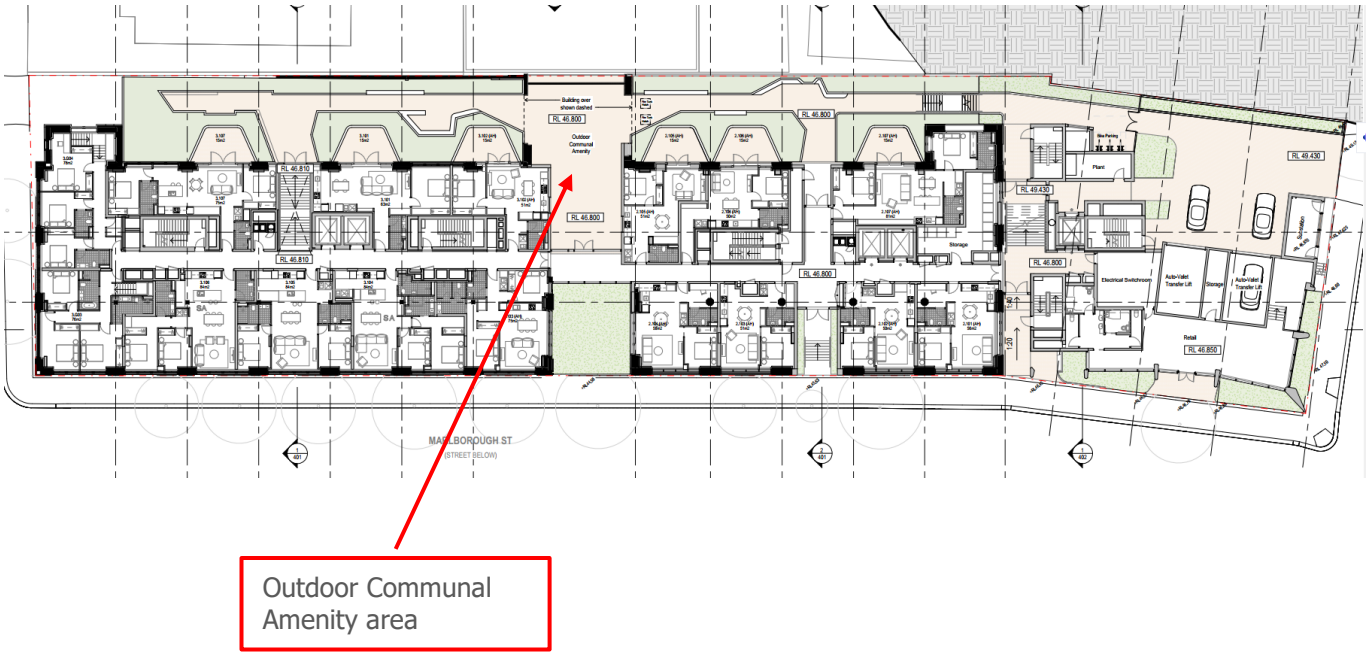
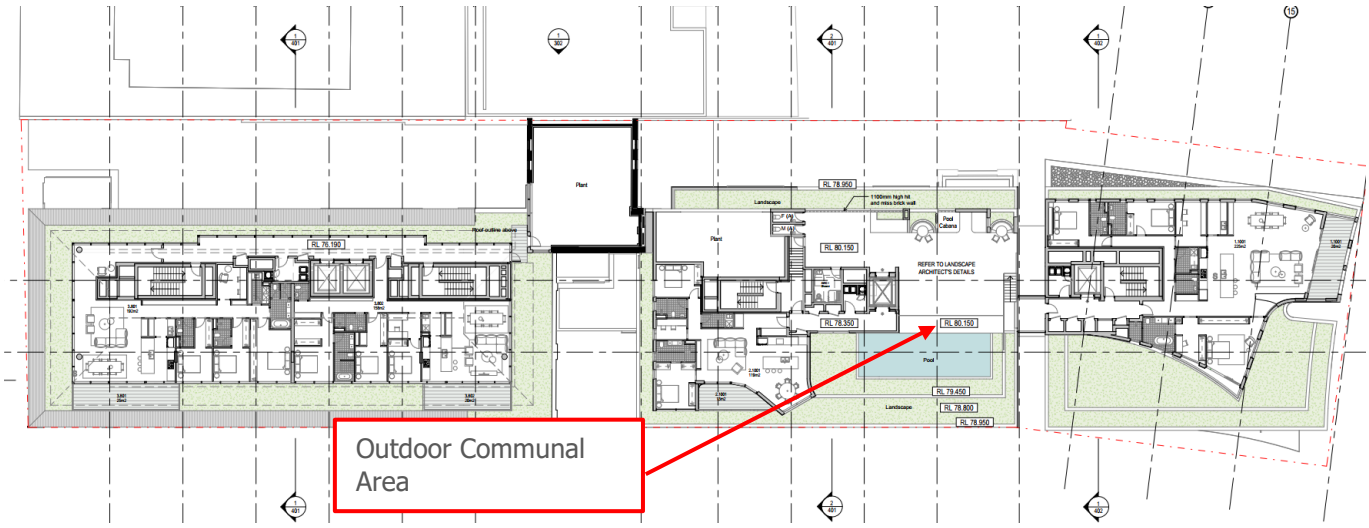


Figure 9 Rooftop Communal Areas



The NSW EPA *Noise Policy for Industry* does not address noise emissions from communal areas. As such to ensure the acoustic amenity is reasonably maintained for the existing surrounding developments Pulse White Noise Acoustics believe a RBL + 5 dBA as a L_{Aeq} approach is considered acceptable.

The proposed communal open spaces are for the use of residents. The communal open spaces includes open areas which will include exposure of noise from surrounding environmental noise sources including surrounding roadways. Typically, it is assumed the level 1 communal space will also typically be used for transit as a link from carparks and amenities to apartments along the western boundary. Regardless, both areas have been assessed below.

For the purpose of this assessment, we have assumed the following noise levels:

- Single person talking – 69dBA and an assumption of up to 60 people using the level 1 or rooftop communal areas of the building with 1 in 3 talking at any one time.

To mitigate noise levels from the proposed common area to within the required noise emission criteria detailed in this report the following acoustic mitigations are recommended:

1) External common areas are only to be used during the daytime and evening time which are as follows:

   a) For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm.

   b) On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm

2) Use of the common area is permitted for communal activities. The area is not to be used for high noise generating activities such as large gatherings, playing of loud music or parties.

3) Amplified music is not permitted in the communal area at any-time.

4) Signs must be installed within the area outlining the recommendations above.

Providing the recommended acoustic mitigations detailed in the points above are included in the design and operation of the proposed development the resulting noise emissions from the use of the communal area will comply with the noise emission criteria detailed in this report and will be acoustically acceptable.

6 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

A preliminary acoustic assessment of the noise and vibrations impact during the construction of the development has been undertaken below.

6.1 Construction Activity Noise Assessment

A review of the noise levels likely to be emitted from the site because of the demolition and construction works has been undertaken. Based on the proximity of the surrounding receivers and the works area, we expect there is likely to be periods where noise emission are likely to exceed the *Noise Affected Level (NAL)* and in some cases the *Highly Noise Affected Level (HNAL)*. As such the works will require a site-specific *Construction Noise & Vibration Sub Plan (CNVMSP)* to be prepared for the site.

This plan should plan be undertaken in accordance with the relevant NSW EPA documents around noise and vibration (such as the ICNG and Assessing Vibration- a technical guideline.).

Outlined in sections 0 to 6.10 PWNA have provided detailed list of possible mitigation measures which could be implemented to reduce these expected noise levels at neighbouring properties. These are all to be considered as part of the preparation of this plan prior to the issue of a Construction Certificate (CC).

6.2 Construction Traffic Noise Assessment

From the criteria, it is noted that construction vehicle numbers on surrounding roads during approved construction hours would need to increase by around 60% from existing traffic flows, for a 2 dB increase in overall road traffic noise to occur. As noted previously, a 2 dB increase in road traffic noise is not considered to be noticeable.

Based on the number of vehicles projected over each of the construction phases, it is concluded that noise impacts from construction traffic is unlikely to have an impact at the nearest affected properties. As a result, no further assessment is required.

6.3 Vibration Assessment

In order to maintain compliance with the human comfort vibration criteria discussed in Section 3.3, it is recommended that the indicative safe distances listed in Table 20 should be maintained. These indicative safe distances should be validated prior to the start of construction works by undertaking measurements of vibration levels generated by construction and demolition equipment to be used on site.

Since the criteria for scientific or medical equipment (should any of these exist close to the site) can be more stringent than those required for human comfort, vibration validating measurements should be conducted at each site to determine the vibration level and potential impact onto this sensitive equipment.

Additionally, any vibration levels should be assessed in accordance with the criteria discussed in Section 3.3.2. This information should also be included as part of a Construction Noise Vibration Management Sub Plan (CNVMSP).

Table 20 Recommended indicative safe working distances for vibration intensive plant

Plant	Rating / Description	Safe Working Distances (m)	
		Cosmetic Damage (BS 7385: Part 2 DIN 4150: Part 3)	Human Comfort (AVTG)
Vibratory roller	< 50 kN (Typically 1 – 2 tonnes)	5	15 – 20
	< 100 kN (Typically 2 – 4 tonnes)	6	20
	< 200 kN (Typically 4 – 6 tonnes)	12	40
	< 300 kN (Typically 7 – 13 tonnes)	15	100
	> 300 kN (Typically more than 13 tonnes)	20	100
Small hydraulic hammer	300 kg, typically 5 – 12 tonnes excavator	2	7
Medium hydraulic hammer	900 kg, typically 12 – 18 tonnes excavator	7	23
Large hydraulic hammer	1600 kg, typically 18 – 34 tonnes excavator	22	73
Vibratory pile driver	Sheet piles	2 – 20	20
Jackhammer	Hand held	1	Avoid contact with structure and steel reinforcements

6.4 Acoustic Management Procedures

6.4.1 Summary of Management Procedures

Table 21 below summarises the management procedures recommended for airborne noise and vibration impact. These procedures are also further discussed in the report.

Table 21 Summary of mitigation procedures

Procedure	Abbreviation	Description
General Management Measures	GMM	Introduce best-practice general mitigation measures in the workplace which are aimed at reducing the acoustic impact onto the nearest affected receivers.
Project Notification	PN	Issue project updates to stakeholders, discussing overviews of current and upcoming works. Advanced warning of potential disruptions can be included. Content and length to be determined on a project-by-project basis.
Verification Monitoring	V	Monitoring to comprise attended or unattended acoustic surveys. The purpose of the monitoring is to confirm measured levels are consistent with the predictions in the acoustic assessment, and to verify that the mitigation procedures are appropriate for the affected receivers. If the measured levels are higher than those predicted, then the measures will need to be reviewed and the management plan will need to be amended.
Complaints Management System	CMS	Implement a management system which includes procedures for receiving and addressing complaints from affected stakeholders
Specific Notification	SN	Individual letters or phone calls to notify stakeholders that noise levels are likely to exceed noise objectives. Alternatively, contractor could visit stakeholders individually in order to brief them in regard to the noise impact and the mitigation measures that will be implemented.
Respite Offer	RO	Offer provided to stakeholders subjected to an ongoing HNAL impact.
Alternative Construction Methodology	AC	Contractor to consider alternative construction options that achieve compliance with relevant criteria. Alternative option to be determined on a case-by-case basis. It is recommended that the selection of the alternative option should also be determined by considering the assessment of on-site measurements (refer to Verification Monitoring above).

The application of these procedures is in relation to the exceedances over the relevant criteria. For airborne noise, the criteria are based on NMLs. The allocation of these procedures is discussed in Section 6.4.2.

For vibration, the criteria either correspond to human comfort, building damage or scientific and medical equipment. The application of these procedures is discussed in Section 6.4.3.

6.4.2 Allocation of Noise Management Procedures

For residences, the management procedures have been allocated based on noise level exceedances at the affected properties, which occur over the designated NMLs. The allocation of these procedures is summarised in Table 21 below.

Table 22 Allocation of noise management procedures – Residential Receivers

Construction Hours	Exceedance over NML (dB)	Management Procedures (see definition above)
Standard Hours Mon – Fri: 7:00 am to 6:00 pm Sat: 8:00 am – 1:00 pm	0 - 3	GMM, CMS, AC
	4 - 10	GMM, CMS, AC, V [1]
	11 - 20	GMM, CMS, PN, AC, V [1]
	≥ 21	GMM, CMS, PN, AC, SN, V [1]
	≥ 75dBA	GMM, CMS, PN, AC, SN, RO, V [1]
Outside Standard Hours (If applicable)	Specific NMP will be undertaken should this be required.	

Note 1 Verification monitoring to be undertaken upon complaints received from affected receivers.

6.4.3 Allocation of Vibration Management Procedures

Table 23 below summarises the vibration management procedures to be adopted based on exceedance scenarios (i.e., whether the exceedance occurs over human comfort criteria, building damage criteria, or criteria for scientific and medical equipment). Please note these management procedures apply for any type of affected receiver (i.e., for residences as well as non-residential receivers).

Table 23 Allocation of vibration management procedures

Construction Hours	Exceedance Scenario	Management Procedures
Standard Hours Mon – Fri: 7:00 am to 6:00 pm Sat: 8:00 am – 1:00 pm	Over human comfort criteria (refer to Section 6.3)	GMM, CMS, AC, SN, V [1]
	Over building damage criteria (refer to Section 6.3)	GMM, CMS, AC, SN, VM, RO, V [1]
Outside Standard Hours (If applicable)	Specific VMP will be undertaken should this be required.	

Note 1 Verification monitoring to be undertaken upon complaints received from affected receivers.

6.5 Site Specific Noise Mitigation Measures

6.5.1 General Comments

The contractor will, where reasonable and feasible, apply best practice noise mitigation measures. These measures shall include the following:

- Maximising the offset distance between plant items and nearby noise sensitive receivers.
- Preventing noisy plant working simultaneously and adjacent to sensitive receivers.
- Minimising consecutive works in the same site area.
- Orienting equipment away from noise sensitive areas.
- Carrying out loading and unloading away from noise sensitive areas.

In order to minimise noise impacts during the works, the contractor will take all reasonable and feasible measures to mitigate noise effects.

The contractor will also take reasonable steps to control noise from all plant and equipment. Examples of appropriate noise control include efficient silencers and low noise mufflers.

The contractor should apply all feasible and reasonable work practices to meet the NMLs and inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels, duration of noise generating construction works, and the contact details for the proposal.

6.5.2 Noise Monitoring

Noise measurements are an effective way of providing feedback to the contractor which acoustic mitigation measures are providing community benefit. As such the site-specific *Construction Noise and Vibration Management Sub Plan (CNVMSP)* should detail the strategy being proposed.

The survey methodology and any equipment should comply with the requirements discussed in Standard AS 1055.1-1997.

6.5.3 Alternate Equipment or Process

Exceedance of the site's NMLs should result in an investigation as to whether alternate equipment could be used, or a difference process could be undertaken.

In some cases, the investigation may conclude that no possible other equipment can be used, however, a different process could be undertaken.

6.5.4 Acoustic Enclosures/Screening

Typically, on a construction site there are three different types of plant that will be used: mobile plant (i.e., excavators, skid steers, etc.), semi mobile plant (i.e., hand tools generally) or static plant (i.e., diesel generators).

For plant items which are static it is recommended that, in the event exceedances are being measured due to operation of the plant item, an acoustic enclosure/screen is constructed to reduce impacts. These systems can be constructed from Fibre Cement (FC) sheeting or, if airflow is required, acoustic attenuators or louvres.

For semi mobile plant, relocation of plant should be investigated to either be operated in an enclosed space or at locations away from a receiver.

With mobile plant it is generally not possible to treat these sources. However, investigations into the machine itself may result in a reduction of noise (i.e., mufflers/attenuators etc).

6.6 Vibration Mitigation Measures

6.6.1 General Comments

As part of the CNVMP, the following vibration mitigation measures should be implemented:

- Any vibration generating plant and equipment is to be in areas within the site in order to lower the vibration impacts.
- Investigate the feasibility of rescheduling the hours of operation of major vibration generating plant and equipment.
- Use lower vibration generating items of construction plant and equipment; that is, smaller capacity plant.
- Minimise conducting vibration generating works consecutively in the same area (if applicable).
- Schedule a minimum respite period of at least 30 minutes before activities commence which are to be undertaken for a continuous 4-hour period.
- Use only dampened rock breakers and/or "city" rock breakers to minimise the impacts associated with rock breaking works.
- Conduct attended measurements of vibration generating plant at commencement of works to validate the indicative safe working distances advised in Table 20 and, consequently, to establish safe working distances suitable to the project. Measurements should be conducted at the nearest affected property boundary. These safe working distances should be defined by considering the vibration criteria discussed in Section 3.3.2 (i.e., criteria for structural damage and human comfort).

6.6.2 Vibration Monitoring

Vibration measurements are an effective way of providing feedback to the contractor which acoustic mitigation measures are providing community benefit. As such the site-specific *Construction Noise and Vibration Management Sub Plan (CNVMSP)* should detail the strategy being proposed.

6.7 Community Consultation

Key engagement methods include:

- Formal and information briefings and meetings
- Workshops.
- Door Knocks.
- Letterbox Drops.
- Email Notifications.

6.8 Complaints Management System

The Contractor is to establish a communication register for recording incoming complaints. The registration of a particular item will remain open until the complaint has been appropriately dealt with.

All complaints should be investigated by the Contractor in accordance with the procedures outlined in Australia Standard 2436-2010. In addition, the following procedures are an example of the procedures that are to be specifically adopted for complaints relating to noise.

Upon receipt of a complaint the Contractor is to:

- Try to ascertain from the complaint which appliance is causing the problem i.e., inside or outside the site and in what position.
- Establish from the monitoring equipment if the allowable noise levels have been complied with.
- Establish if the appliance positioning has previously been highlighted as a problem area. If not and the noise levels are above the allowable limit, then the equipment and its position shall be noted.
- Move machinery if the allowable levels have been exceeded or take other acoustic remedial action.
- The Site Supervisor is to ensure that a report of any incident is provided to the Project Manager.
- The Project Manager is to provide a report on the incident to the relevant stakeholders.
- The Contractor is to provide a 24-hour telephone contact number and this number is to be prominently displayed on the site.

6.9 Contingency Plans

Contingency plans are required to address noise or vibration problems if excessive levels are measured at surrounding sensitive receivers and/or if justified complaints occur. Such plans could include:

- Stop the onsite works.
- Identify the source of the main equipment within specific areas of the site which is producing the most construction noise and vibration at the sensitive receivers; and
- Review the identified equipment and determine if an alternate piece of equipment can be used or the process can be altered.
- In the event an alternate piece of equipment or process can be used, works can re-commence.
- In the event an alternate piece of equipment or process cannot be determined implement a construction assessment to be performed by a suitably qualified acoustic consultant.

6.10 General Mitigation Measures (Australia Standard 2436-2010)

As well as the above project specific noise mitigation controls, AS 2436-2010 *"Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites"* sets out numerous practical recommendations to assist in mitigating construction noise emissions. Examples of strategies that could be implemented on the subject project are listed below, including the typical noise reduction achieved, where applicable.

6.10.1 Adoption of Universal Work Practices

- Regular reinforcement (such as at toolbox talks) of the need to minimise noise and vibration.
- Regular identification of noisy activities and adoption of improvement techniques.
- Avoiding the use of portable radios, public address systems or other methods of site communication that may unnecessarily impact upon nearby sensitive receivers.
- Where possible, avoiding the use of equipment that generates impulsive noise.
- Minimising the need for vehicle reversing for example (particularly at night), by arranging for one-way site traffic routes.
- Use of broadband audible alarms on vehicles and elevated work platforms used on site.
- Minimising the movement of materials and plant and unnecessary metal-on-metal contact.
- Minimising truck movements.

6.10.2 Plant and Equipment

- Choosing quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks.
- Selecting plant and equipment with low vibration generation characteristics.
- Operating plant and equipment in the quietest and most efficient manner.

6.10.3 On Site Noise Mitigation

- Maximising the distance between noise activities and noise sensitive land uses.
- Installing purpose-built noise barriers, acoustic sheds and enclosures.

6.10.4 Work Scheduling

- Providing respite periods which could include restricting very noisy activities to time periods that least affect the nearby noise sensitive locations, restricting the number of nights that after-hours work is conducted near residences or by determining any specific requirements.
- Scheduling work to coincide with non-sensitive periods.
- Planning deliveries and access to the site to occur quietly and efficiently and organising parking only within designated areas located away from the sensitive receivers.
- Optimising the number of deliveries to the site by amalgamating loads where possible and scheduling arrivals within designated hours.
- Including contract conditions that include penalties for non-compliance with reasonable instructions by the principal to minimise noise or arrange suitable scheduling.

6.10.5 Source Noise Control Strategies

Some ways of controlling noise at the source are:

- Where reasonably practical, noisy plant or processes should be replaced by less noisy alternatives.
- Modify existing equipment: Engines and exhausts are typically the dominant noise sources on mobile plant such as cranes, graders, excavators, trucks, etc. In order to minimise noise emissions, residential grade mufflers should be fitted on all mobile plant utilised on site.
- Siting of equipment: locating noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area; or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise.
- Regular and effective maintenance.

6.11 Discussion of Resulting Construction Noise Levels with Mitigation

In sections 0 to 6.10 PWNA have provided detailed list of possible mitigation measures which could be implemented to reduce these expected noise levels at neighbouring properties. In some cases the noise levels expected with the some of the listed mitigation measures would be significant.

Regarding the acoustic benefit of some of the listed acoustic mitigation measures, the following would be expected:

- Implementation of acoustic enclosures/screening (section 6.5.4) for static/fix plant a reduction between 10 - 20dBA would be expected based on the scenario.
- When work scheduling (section 6.10.4) is implemented (i.e. noisy works occurring between certain times) will significantly reduce noise levels at surrounding receiver locations by greater than 20dBA.
- Use of broadband reversing alarms, or quackers (section 6.10) will provide an approximate 5dBA reduction.
- Through the selection of quieter plant (section 6.10.2) this can reduce noise levels by up to 10dBA, plant specific.
- Implementation of mufflers and silencers on motor engines can reduce noise levels by up to 8dBA.
- Ensuring good community consultation (section 6.7) would not necessarily have an associated noise reduction, however, provide the community awareness and confidence in the works being undertaken. This reduces community annoyance when noisy activities begin/occur.
- Through the successful management of construction traffic (section 6.10) and ensuring vehicles follow the dedicated traffic routes developed during the preparation of the site-specific management plans will ensure one way traffic movements have minimised acoustic impacts on neighbouring properties.

Like any other State Significant Development (SSD) approval, should the project be awarded approval a site-specific *Construction Noise Management Sub-Plan (CNVMSP)* would be prepared in conjunction with the client, managing contractor and other relevant design team members to further assess the impacts however more importantly determine the exact noise and vibration mitigation measures that are to be implemented.

Therefore, we would recommend in the event of project approval the preparation of a site-specific *Construction Noise Management Sub-Plan (CNVMSP)* be conditioned to ensure all mitigation measures are developed and implemented prior to construction works commencing onsite. Ensuring the site achieves a high standard of acoustic mitigation.

7 CONCLUSION

This Noise and Vibration Impact Assessment has been prepared by Pulse White Noise Acoustics Pty Ltd to support a State Significant Development Application (SSDA) SSD- 78545225 for the site at 47 – 97 Marlborough Street, Surry Hills.

This report has been prepared to review and assess the noise and vibration elements of the development including operational noise on surrounding existing developments, noise intrusion from external sources (surrounding roadways) and noise and vibration impacts associated with the construction of the development. This report also describes the relevant noise and vibration criteria and recommended acoustic mitigation measures required to ensure compliance.

A review of the existing onsite noise levels from the nearby roadways has resulted in recommended acoustic treatments to the future buildings facades to ensure internal noise levels are within permissible limits.

To control noise impacts at external receivers, recommended indicative treatments for major engineering services have been provided in section 5. From our review we have formulated the following opinion:

- At this stage of the project the exact selections/locations of plant items are not known. A preliminary assessment, however, has been carried out using our experience with similar types of developments and the typical plant items installed. Experience with similar projects indicates that the acoustic treatment of the likely mechanical equipment to be installed on the project is both possible and practical, in order to meet the relevant criteria at surrounding receivers, as well as the relevant noise intrusion criteria for internal receivers within the development.

- It is recommended that, prior to the issue of a Construction Certificate (CC), a detailed acoustic assessment is undertaken to ensure all cumulative noise from engineering services comply with the requirements as listed in this report.

An assessment of the impacts associated with the number of vehicles on surrounding public roads around the site predicted the impact to be less than 2dBA and is therefore compliant with the NSW EPA RNP.

Prior to the issue of the Construction Certificate it is recommended that a *Construction Noise and Vibration Management Sub Plan (CNVMSP)* be undertaken to formulate relevant compliance with the objectives detailed above.

If you have any additional questions, please contact us should you have any further queries.

Regards,

Glen Campbell
Principal Acoustic Engineer
PULSE WHITE NOISE ACOUSTICS PTY LTD
AAS Member and AAAC Member Firm

APPENDIX A. APPENDIX TERMINOLOGY

Sound power level	The total sound emitted by a source
Sound pressure level	The amount of sound at a specified point
Decibel [dB]	The measurement unit of sound
A Weighted decibels [dB(A])	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:
	0dB(A) Threshold of human hearing 30dB(A) A quiet country park 40dB(A) Whisper in a library 50dB(A) Open office space 70dB(A) Inside a car on a freeway 80dB(A) Outboard motor 90dB(A) Heavy truck pass-by 100dB(A) Jackhammer/Subway train 110 dB(A) Rock Concert 115dB(A) Limit of sound permitted in industry 120dB(A) 747 take off at 250 metres
Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Ambient sound	The all-encompassing sound at a point composed of sound from all sources near and far.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
Reverberation	The persistence of sound in a space after the source of that sound has been stopped (the reverberation time is the time taken for a reverberant sound field to decrease by 60 dB)
Air-borne sound	The sound emitted directly from a source into the surrounding air, such as speech, television or music
Air-borne sound isolation	The reduction of airborne sound between two rooms.
Sound Reduction Index [R] *(Sound Transmission Loss)*	The ratio the sound incident on a partition to the sound transmitted by the partition.
Weighted sound reduction index [R_w]	A single figure representation of the air-borne sound insulation of a partition based upon the R values for each frequency measured in a laboratory environment.
C_{tr}	A value added to an R_w or $D_{nT,w}$ value to account for variations in the spectrum.
Energy Equivalent Sound Pressure Level [$L_{A,eq,T}$]	'A' weighted, energy averaged sound pressure level over the measurement period T.
Percentile Sound Pressure Level [$L_{Ax,T}$]	'A' weighted, sound pressure that is exceeded for percentile x of the measurement period T.
Speech Privacy	A non-technical term but one of common usage. Speech privacy and speech intelligibility are opposites and a high level of speech privacy means a low level of speech intelligibility. It should be recognised that acceptable levels of speech privacy do not require that speech from an adjacent room is inaudible.
Sound Pressure Level, LP dB	A measurement obtained directly using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound

	pressure level equals 20 times the logarithm to the base 10 of the ratio of the rms sound pressure to the reference sound pressure of 20 micro Pascals.
Sound Power Level, Lw dB	Sound power level is a measure of the sound energy emitted by a source, does not change with distance, and cannot be directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with appropriate corrections for distance and/or environmental conditions. Sound power levels is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt
Noise Reduction	The difference in sound pressure level between any two areas. The term "noise reduction" does not specify any grade or performance quality unless accompanied by a specification of the units and conditions under which the units shall apply
Audible Range	The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.
Background Sound Low	The average of the lowest levels of the sound levels measured in an affected area in the absence of noise from occupants and from unwanted, external ambient noise sources. Usually taken to mean the LA90 value
Character, acoustic	The total of the qualities making up the individuality of the noise. The pitch or shape of a sound's frequency content (spectrum) dictate a sound's character.
Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on
LMax	The maximum sound pressure level measured over a given period.
LMin	The minimum sound pressure level measured over a given period.
L1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L10	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L90	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).
Leq	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.

APPENDIX B. UNATTENDED NOISE MONITOR – LOCATION 1 SOUTHERN FAÇADE (GOODLET STREET)

61 Marlborough Street, Surry Hills

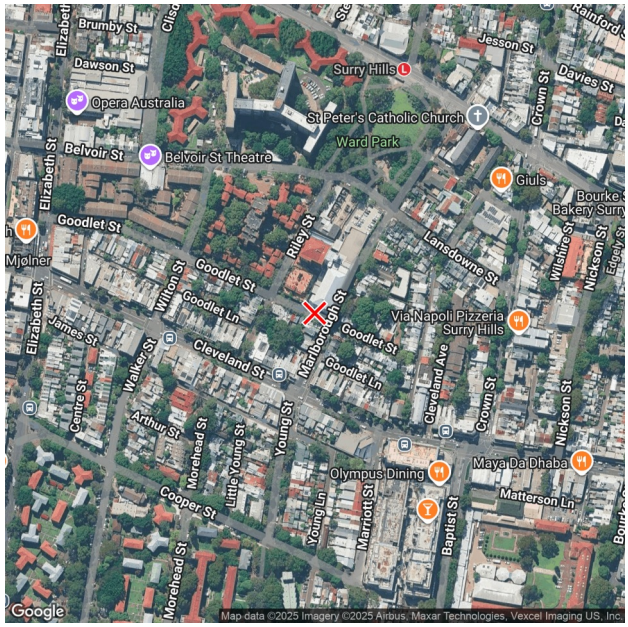
Ambient noise monitoring report

Item	Information
Logger Type	NL-43
Serial number	00653006
Address	61 Marlborough Street, Surry Hills
Location	Traffic
Facade / free field	facade
Environment	

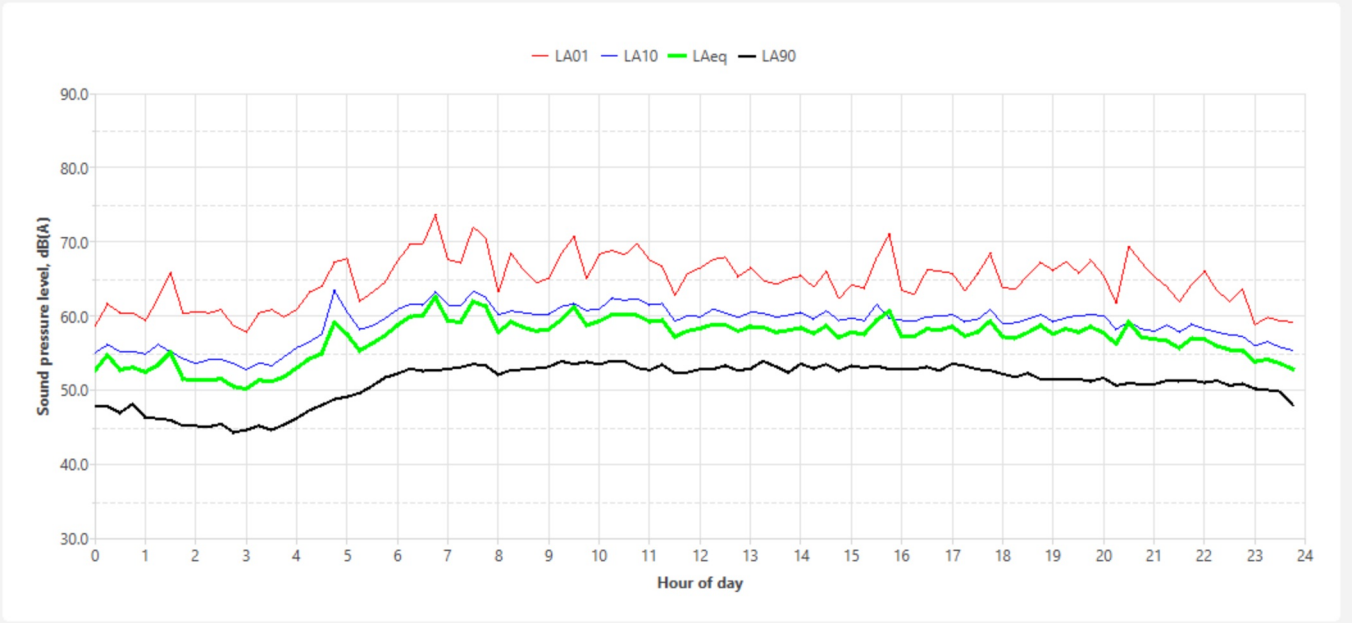
Measured noise levels

Logging date	Rating Background Level			$L_{Aeq,period}$		
	Daytime 7am-6pm	Evening 6pm-10pm	Night-time 10pm-7am	Daytime 7am-6pm	Evening 6pm-10pm	Night-time 10pm-7am
Mon 15 Sep 2025	-	49	-	-	57	-
Tue 16 Sep 2025	51	50	43	59	57	55
Wed 17 Sep 2025	52	51	44	59	56	57
Thu 18 Sep 2025	51	49	45	59	58	55
Fri 19 Sep 2025	51	50	44	59	58	57
Sat 20 Sep 2025	52	51	47	59	58	56
Sun 21 Sep 2025	50	51	47	58	58	55
Mon 22 Sep 2025	53	51	44	61	58	56
Tue 23 Sep 2025	52	50	45	59	58	55
Wed 24 Sep 2025	52	51	45	59	57	55
Thu 25 Sep 2025	52	51	44	60	58	55
Fri 26 Sep 2025	-	-	-	59	-	57
Summary	**52**	**51**	**45**	**59**	**57**	**56**

Note: Results with a '-' identify that there were not enough measurements available to correctly calculate the level, in accordance with the Noise Policy for Industry. The data has been excluded either from weather or manual exclusions. See the charts for more information

Logger location	Logger deployment photo
	

Typical Day



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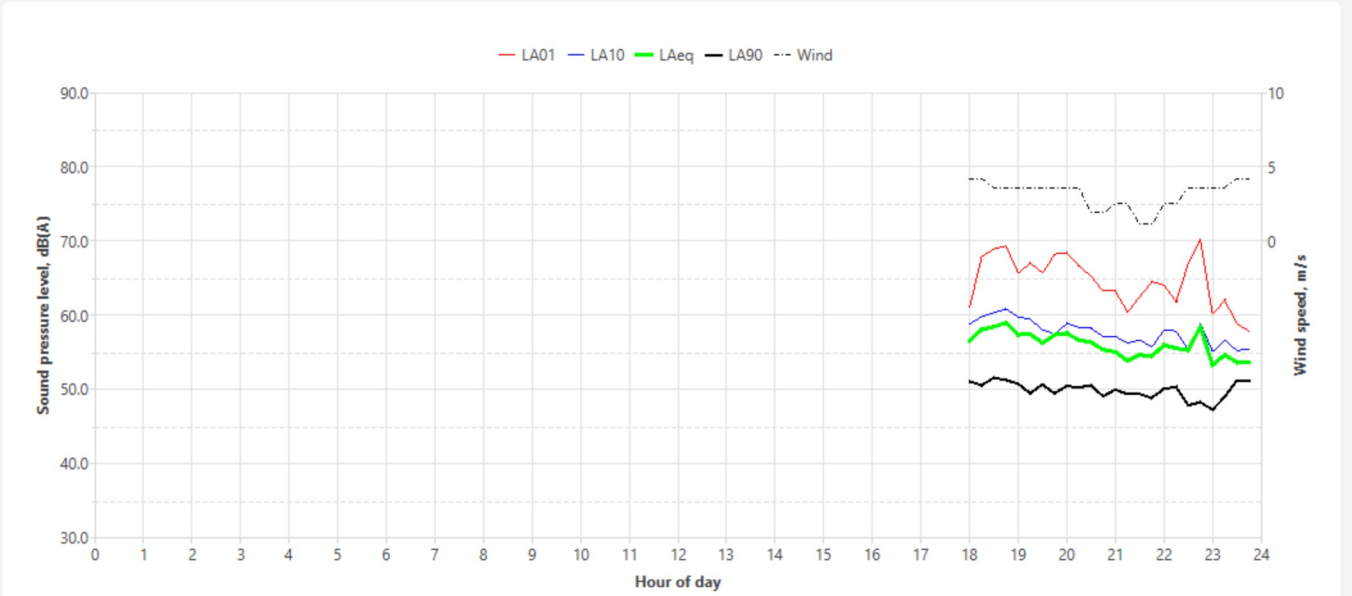

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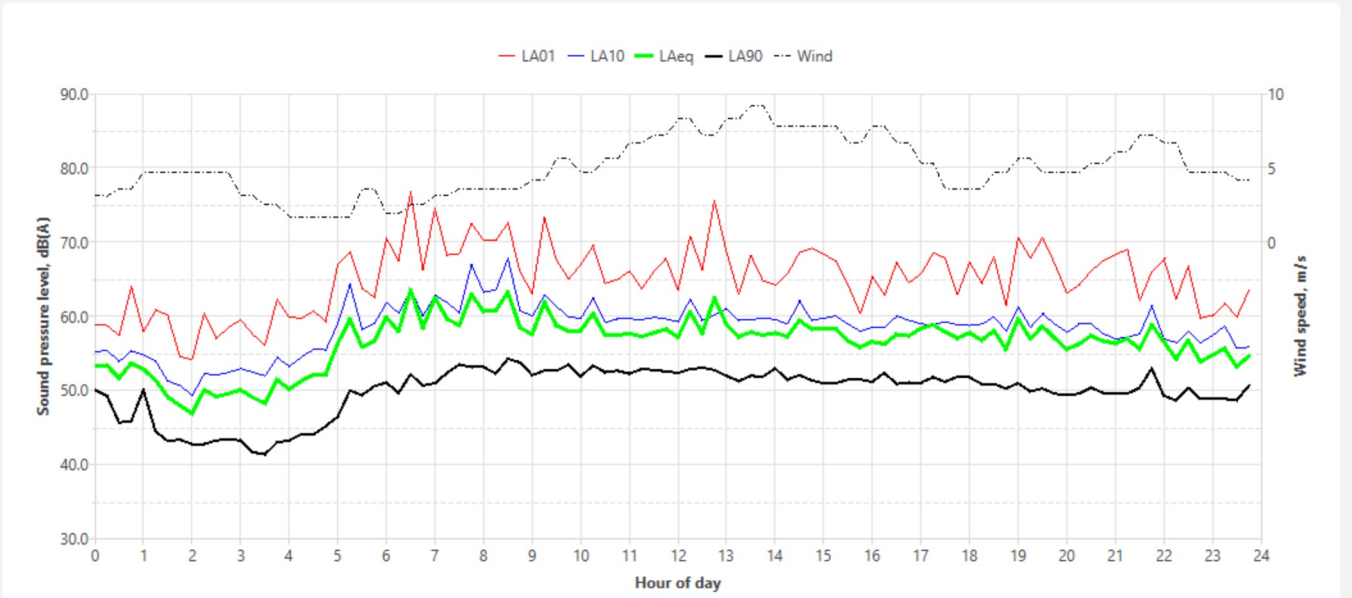

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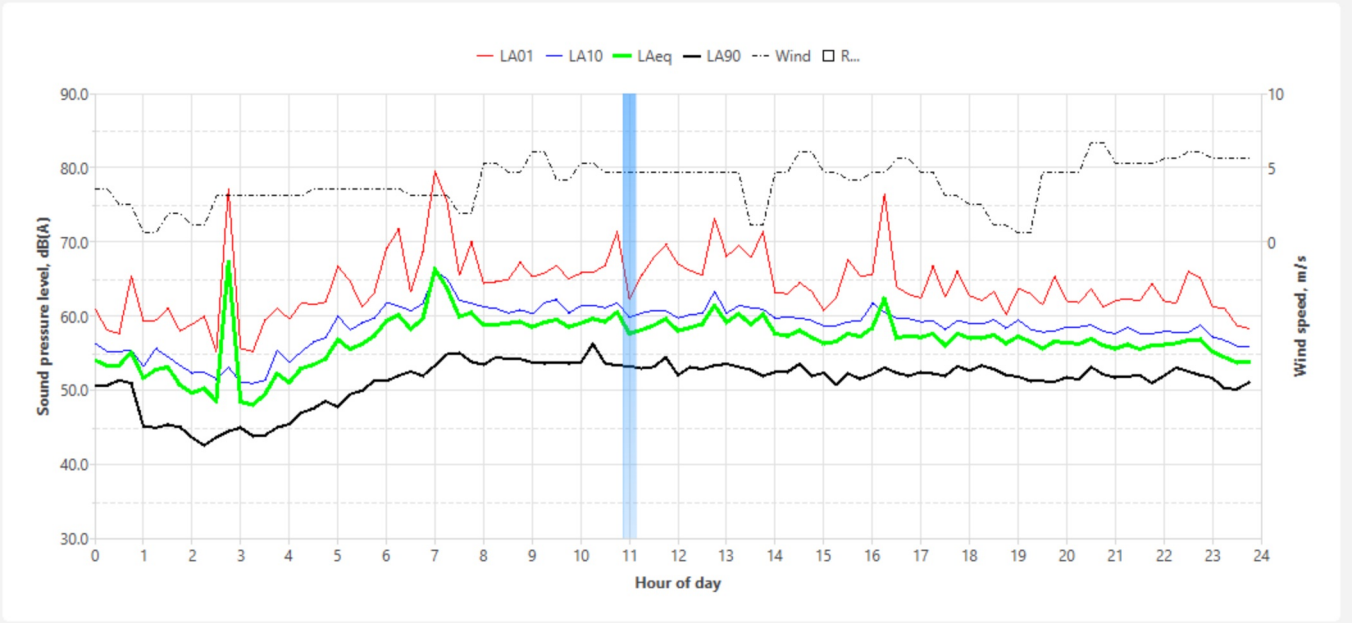

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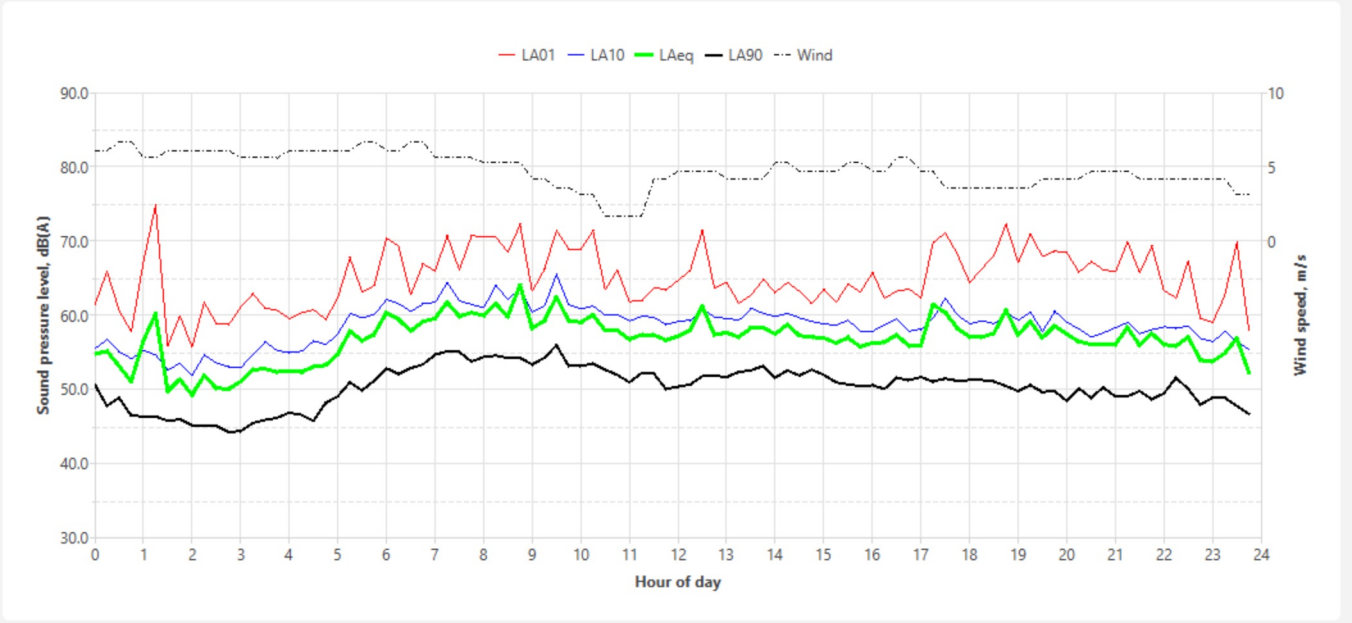

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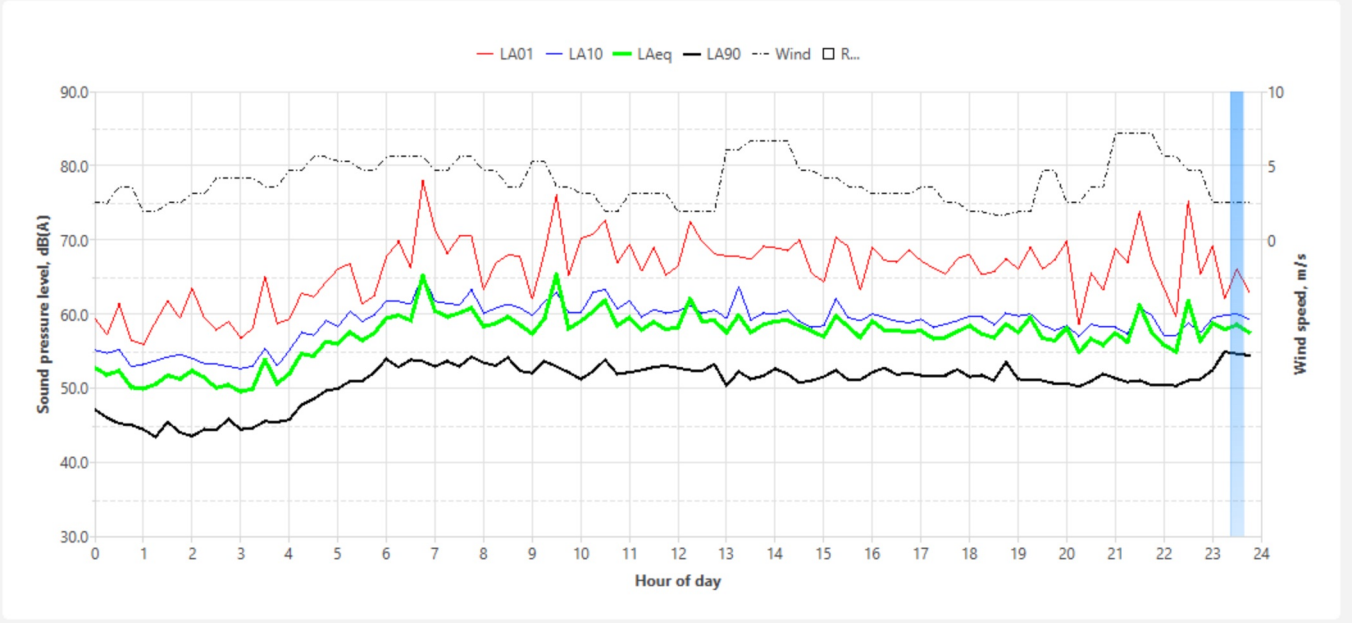

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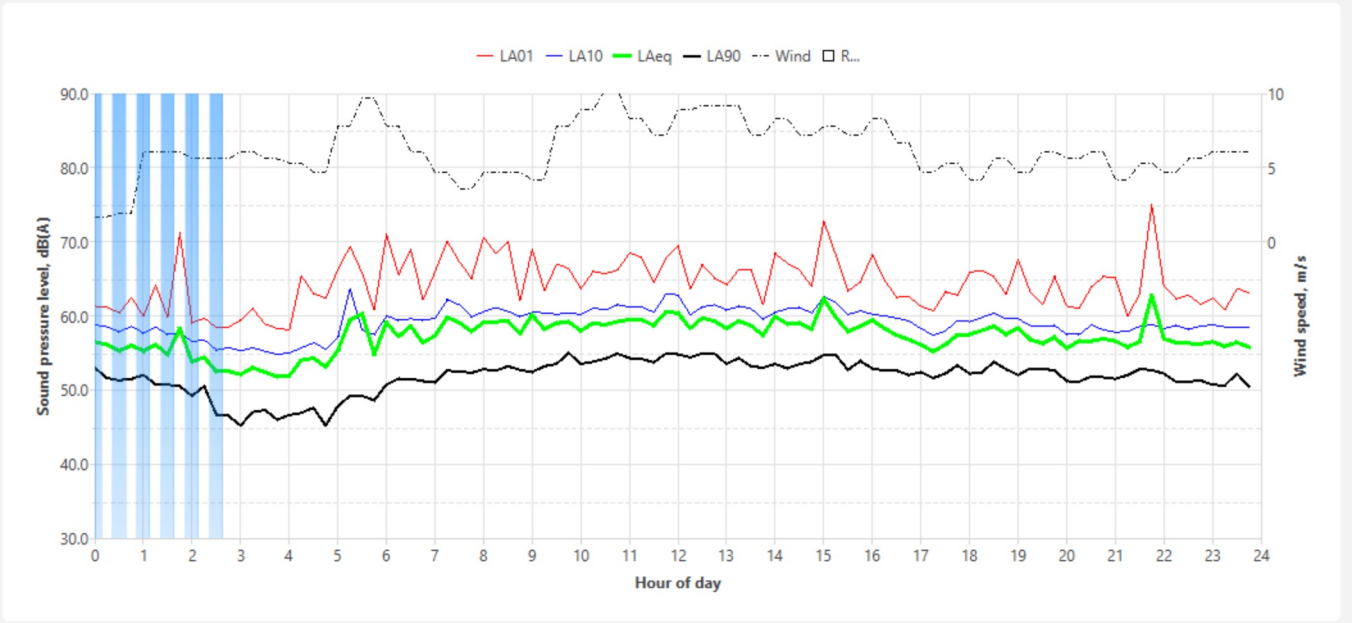
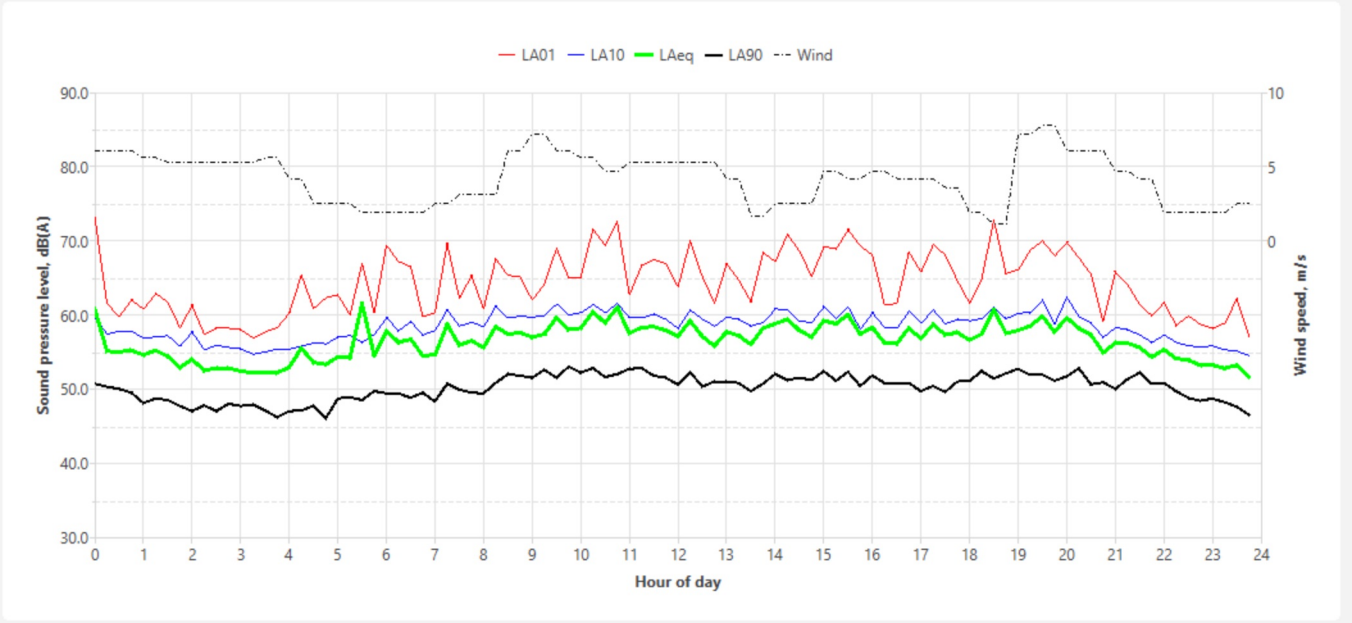
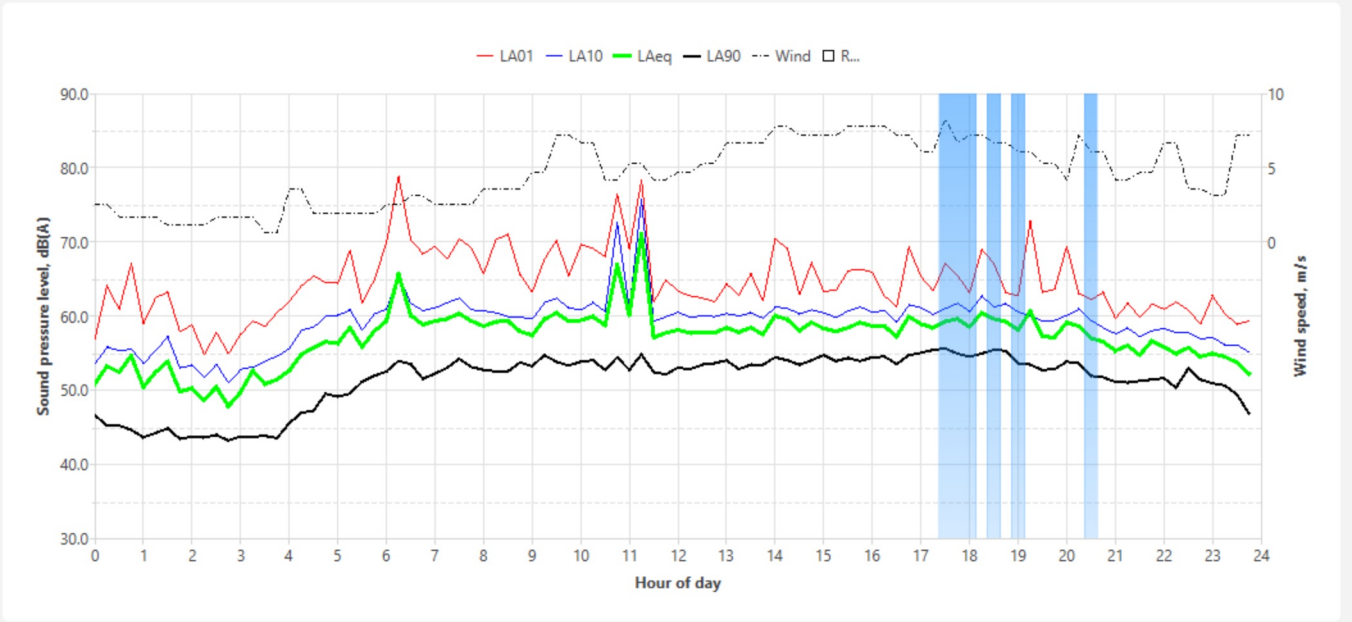


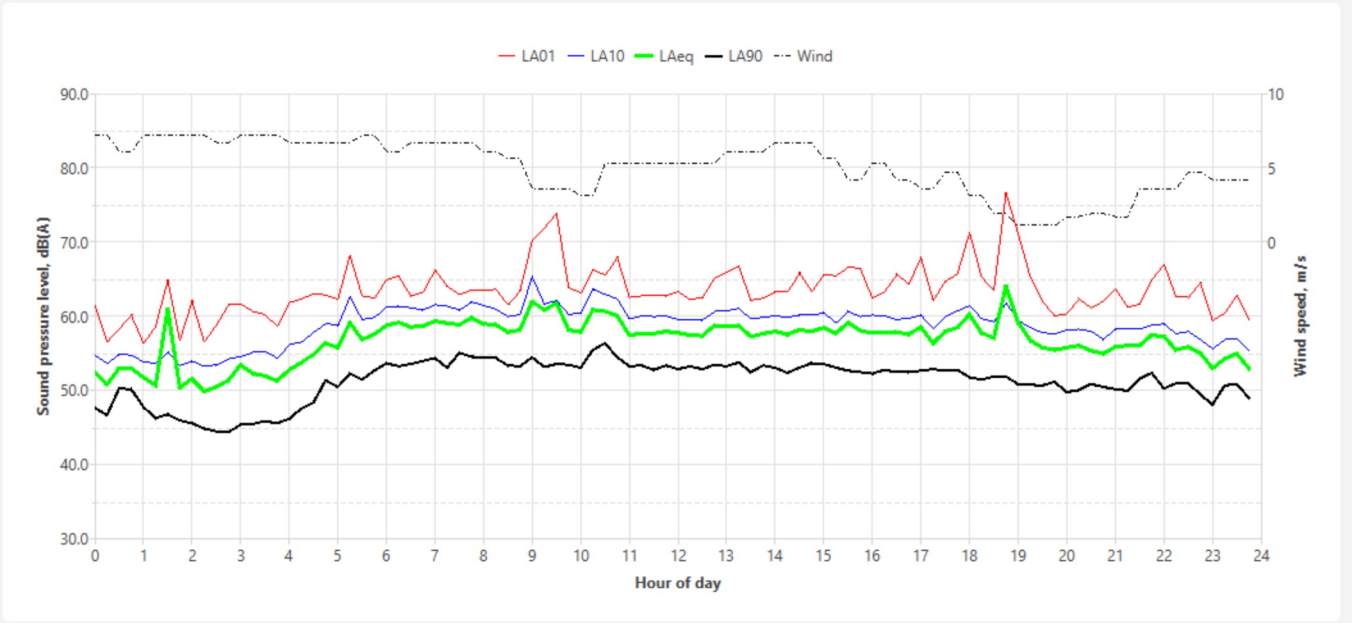
Sunday, 21 September 2025



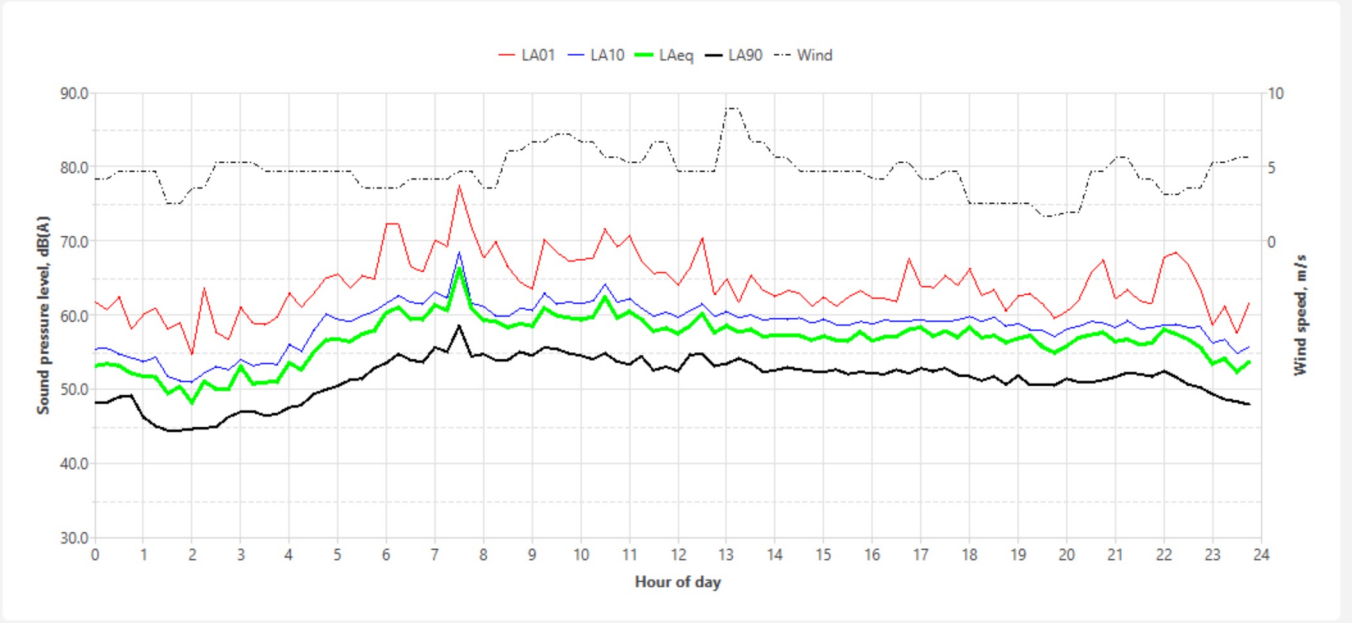
Monday, 22 September 2025



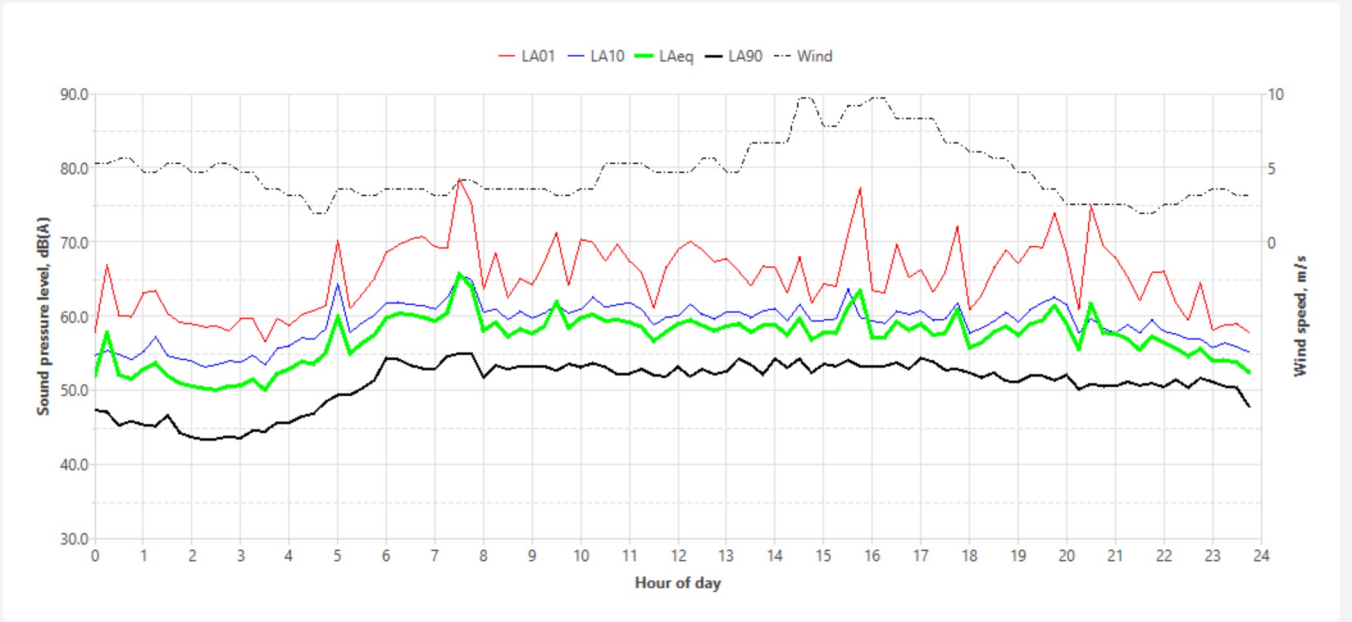
Tuesday, 23 September 2025



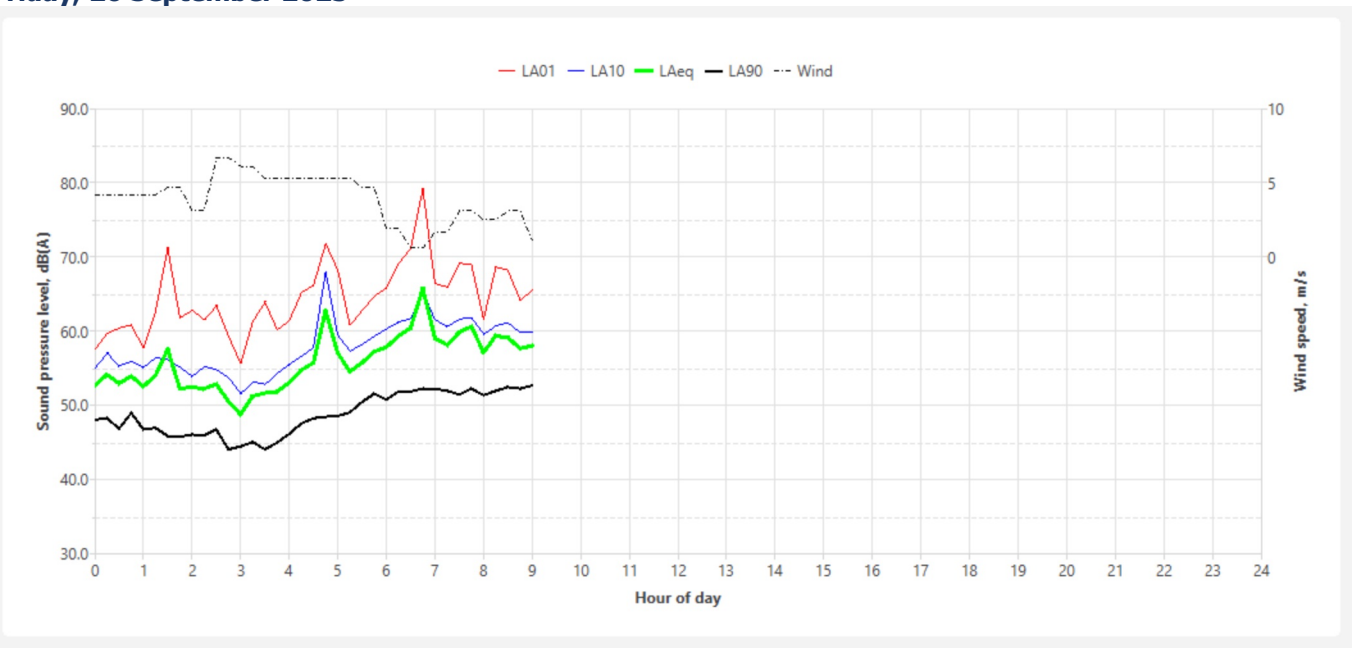
Wednesday, 24 September 2025



Thursday, 25 September 2025



Friday, 26 September 2025



APPENDIX C. UNATTENDED NOISE MONITOR – LOCATION 2 NORTHERN BOUNDARY – LANSDOWNE STREET

61 Marlborough Street, Surry Hills

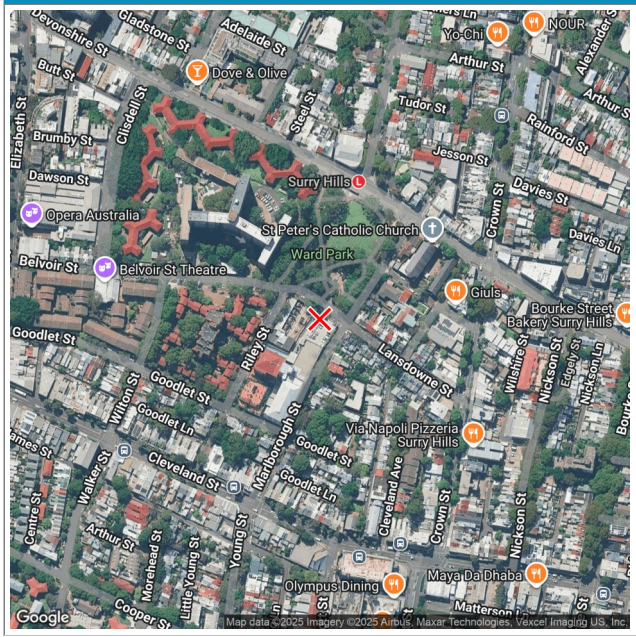
Ambient noise monitoring report

Item	Information
Logger Type	NL-43
Serial number	00653004
Address	61 Marlborough Street, Surry Hills
Location	Carpark RBL
Facade / free field	Free field
Environment	

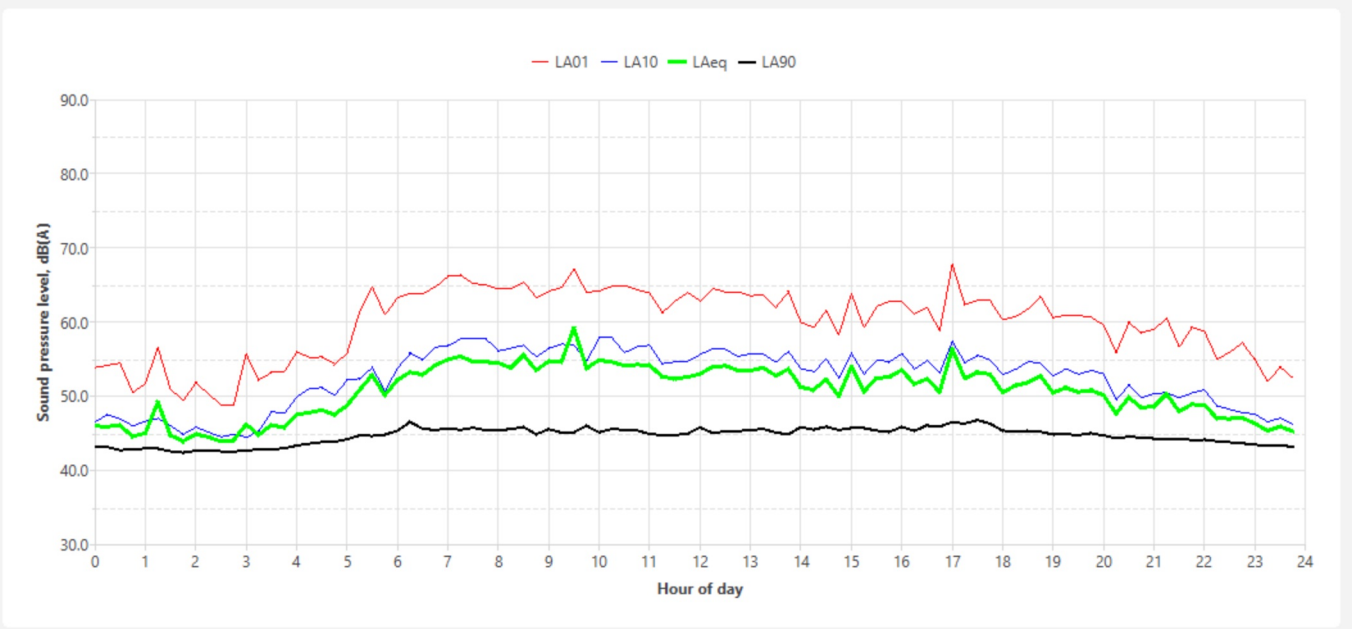
Measured noise levels

Logging date	Rating Background Level			$L_{Aeq,period}$		
	Daytime 7am-6pm	Evening 6pm-10pm	Night-time 10pm-7am	Daytime 7am-6pm	Evening 6pm-10pm	Night-time 10pm-7am
Mon 15 Sep 2025	-	45	-	-	51	-
Tue 16 Sep 2025	46	47	43	55	51	50
Wed 17 Sep 2025	43	44	41	53	50	57
Thu 18 Sep 2025	43	46	42	57	52	48
Fri 19 Sep 2025	44	45	41	55	52	56
Sat 20 Sep 2025	46	44	44	53	50	51
Sun 21 Sep 2025	43	44	41	52	51	48
Mon 22 Sep 2025	44	43	41	56	50	49
Tue 23 Sep 2025	44	43	42	53	49	48
Wed 24 Sep 2025	45	44	41	54	50	49
Thu 25 Sep 2025	44	44	41	55	51	49
Fri 26 Sep 2025	-	-	-	55	-	49
Summary	**44**	**44**	**41**	**55**	**51**	**52**

Note: Results with a '-' identify that there were not enough measurements available to correctly calculate the level, in accordance with the Noise Policy for Industry. The data has been excluded either from weather or manual exclusions. See the charts for more information

Logger location	Logger deployment photo
	

Typical Day



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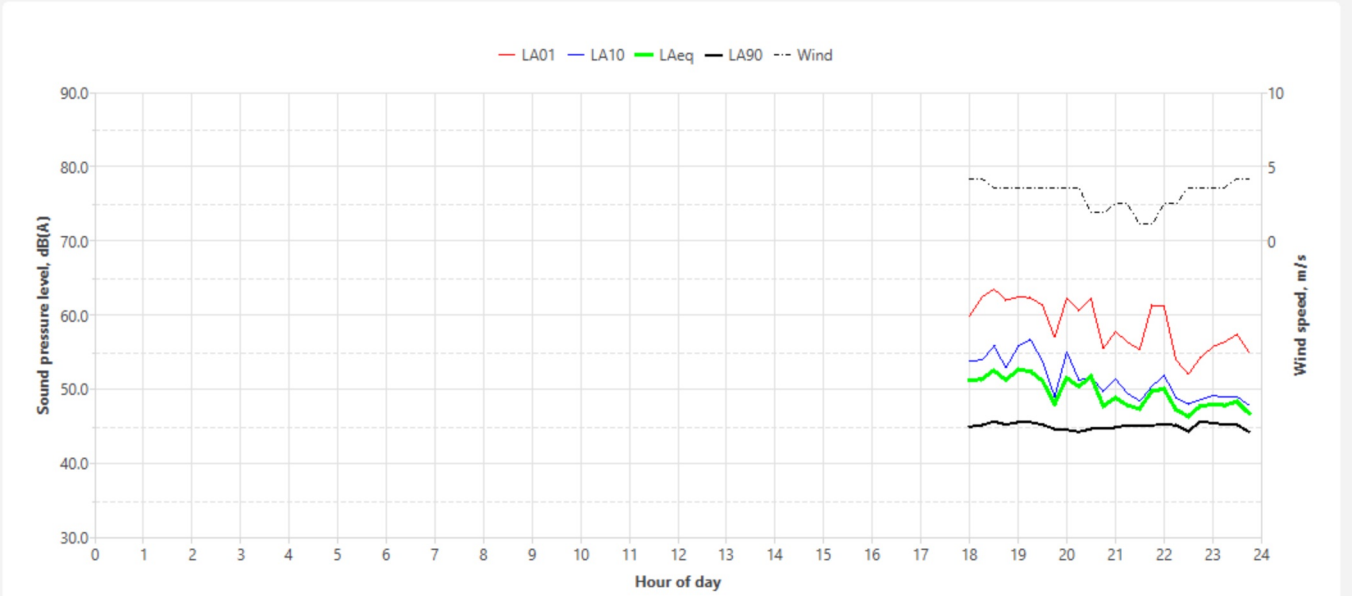
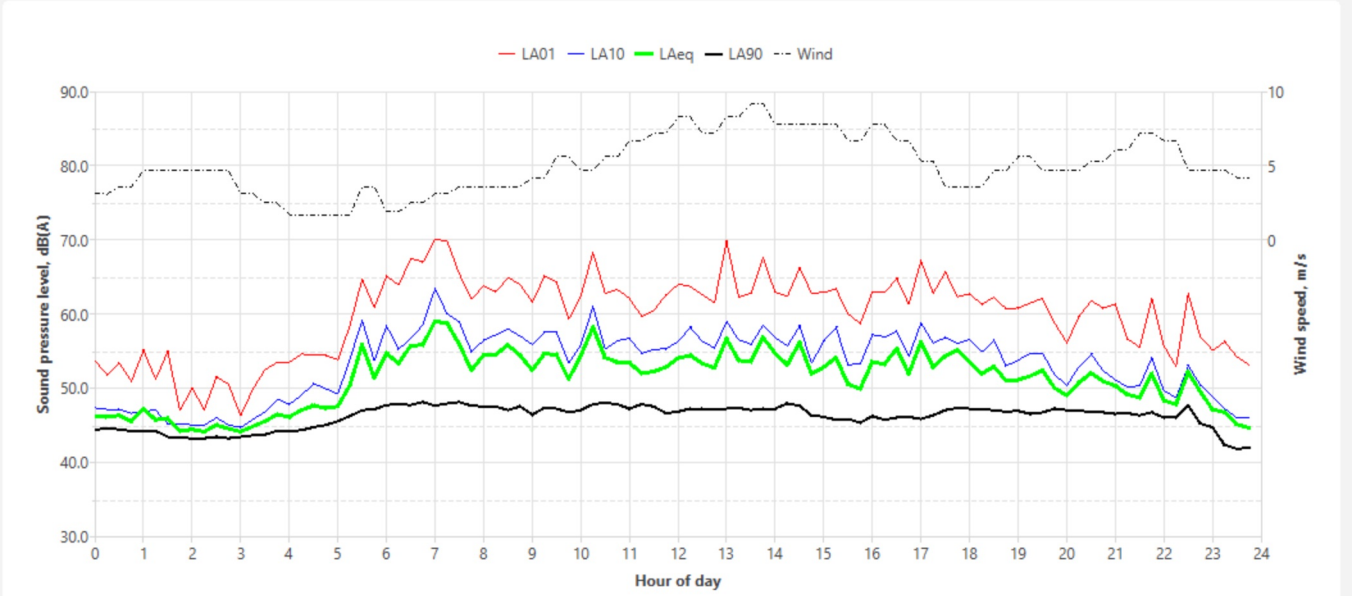


Tuesday, 16 September 2025



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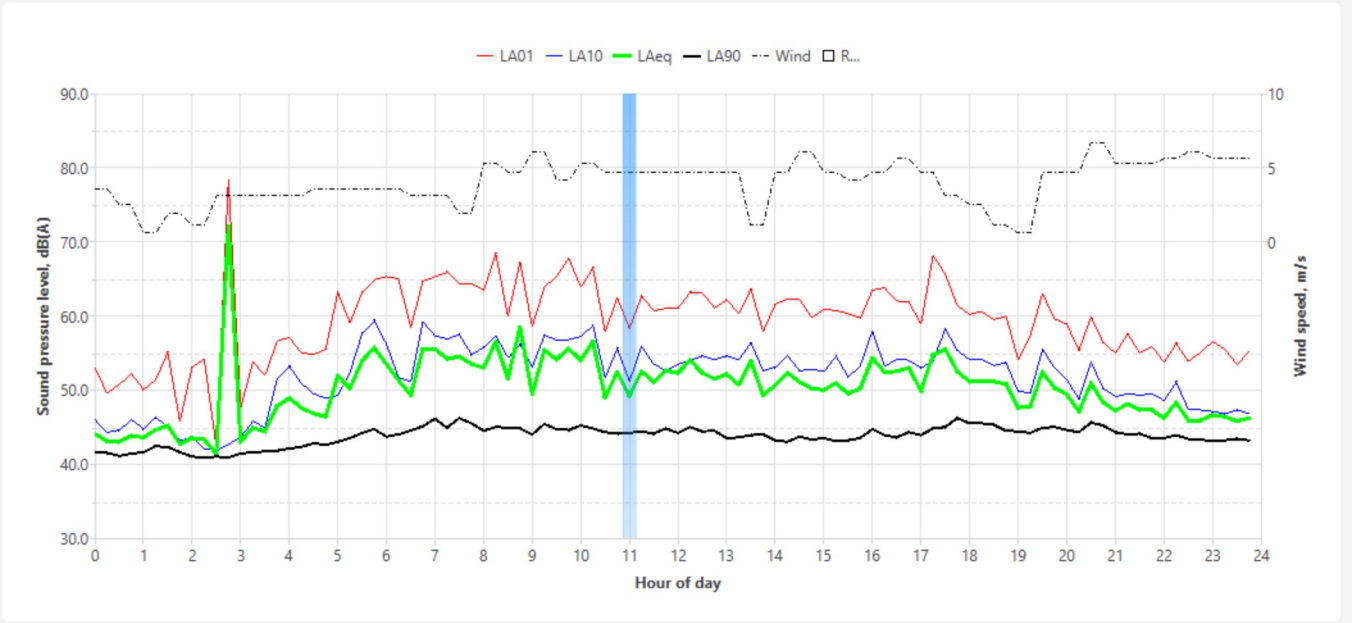

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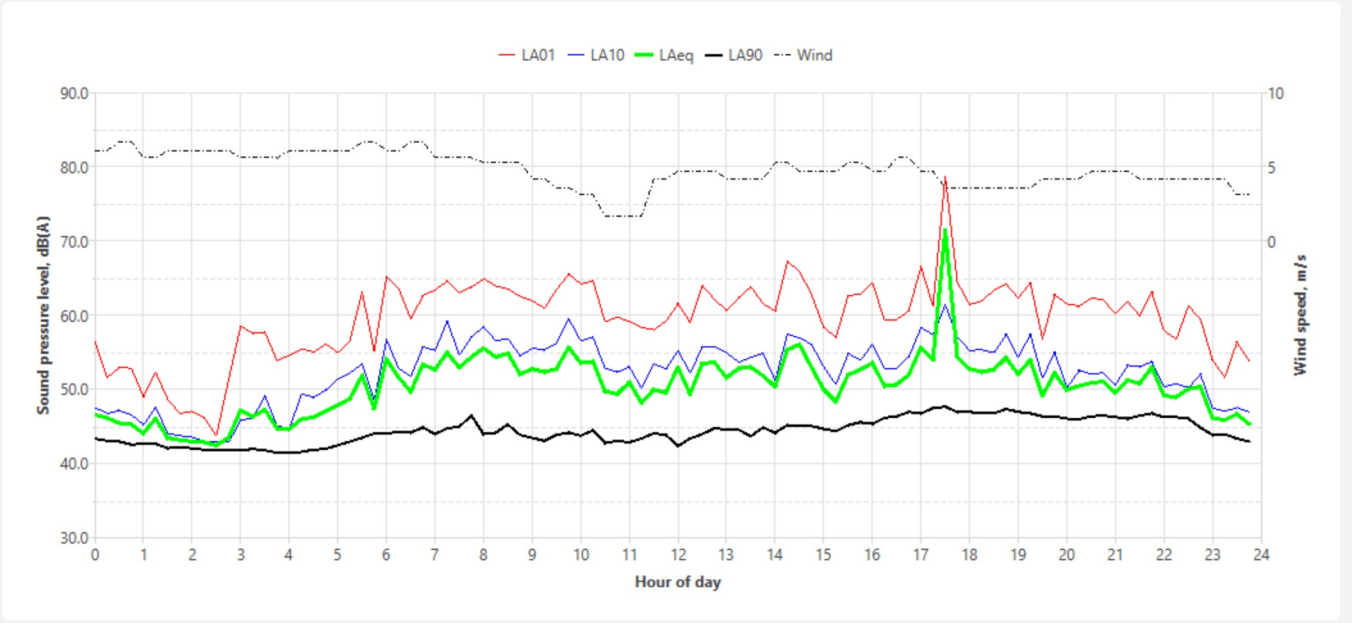

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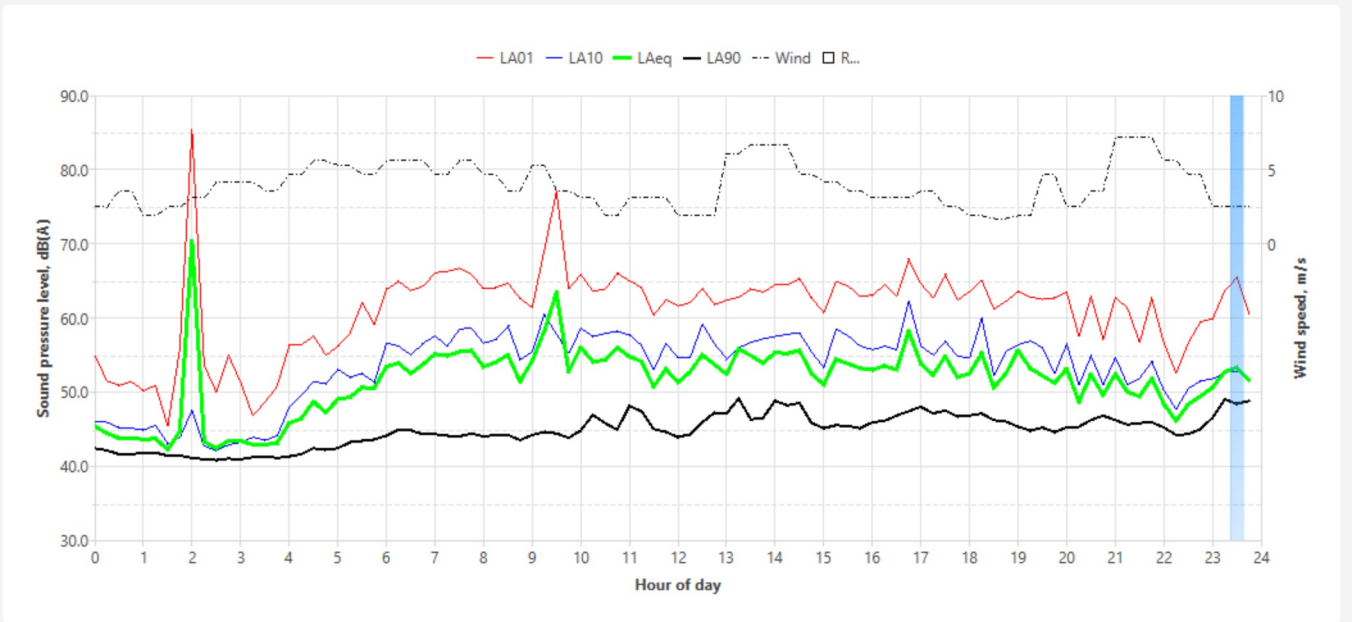

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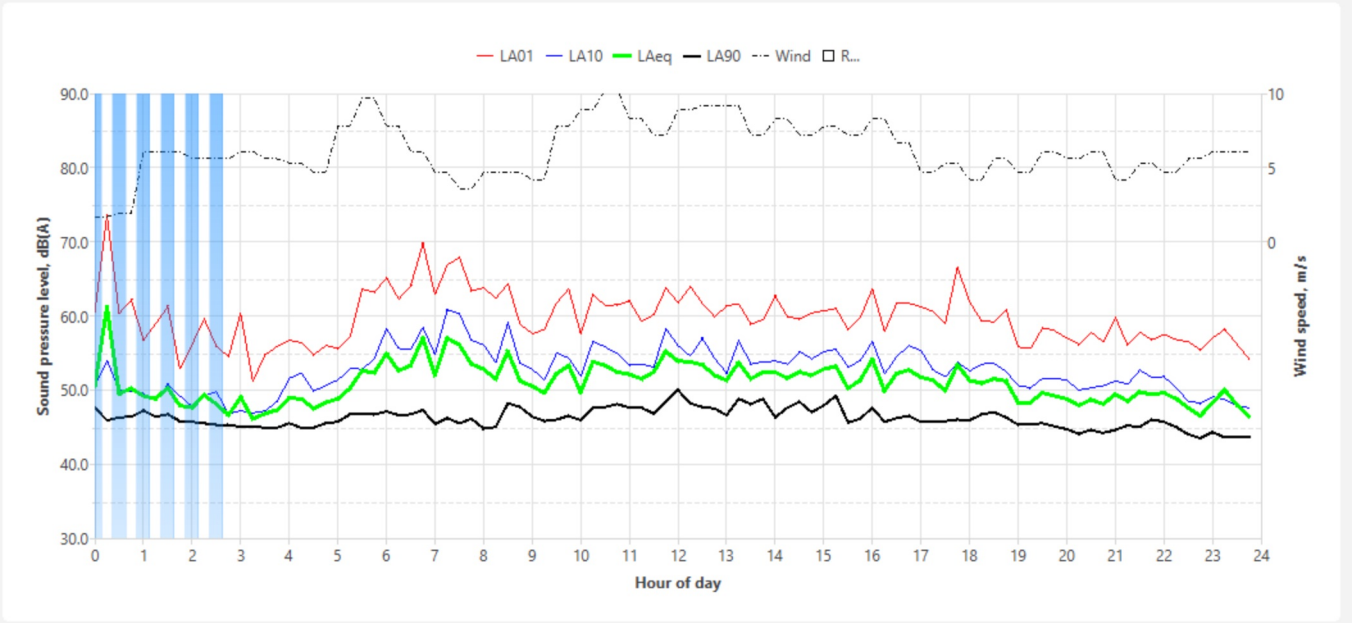

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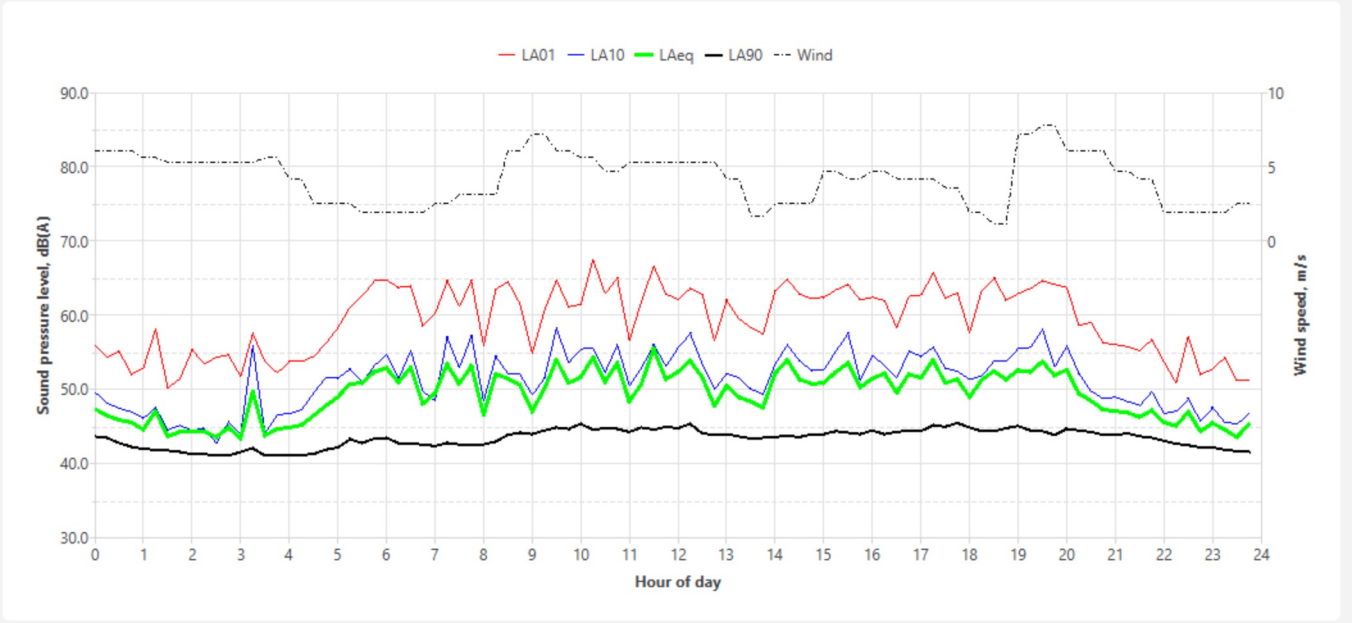

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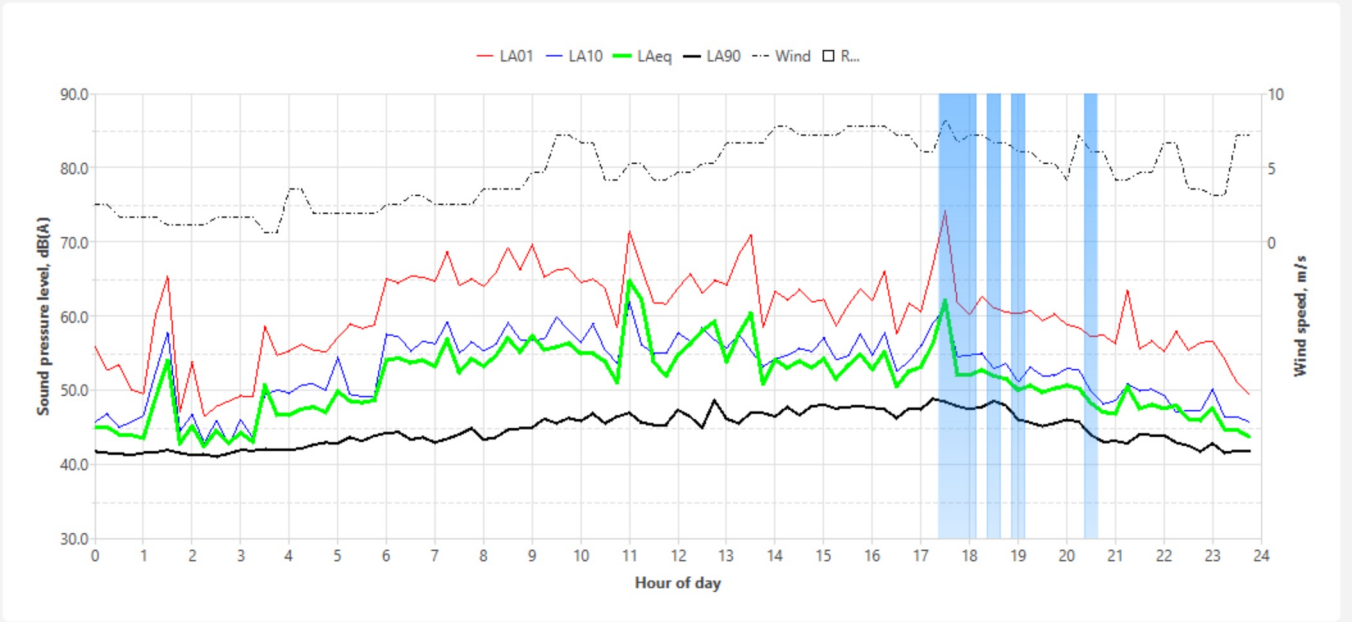

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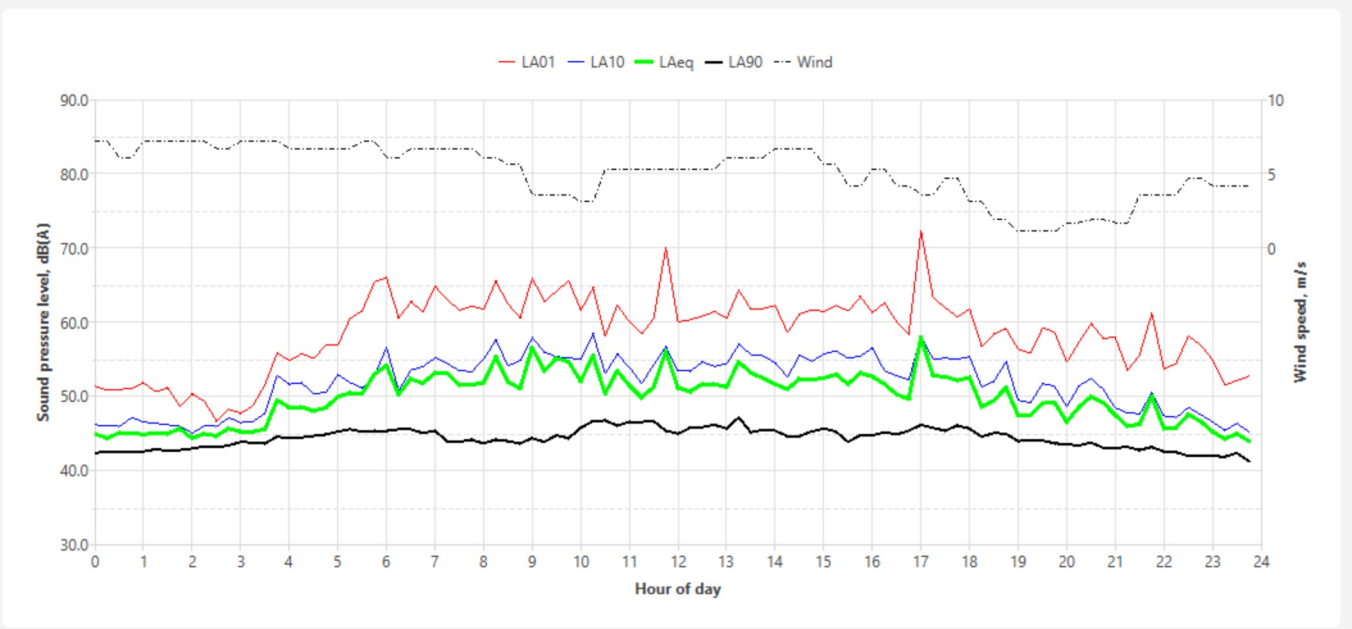

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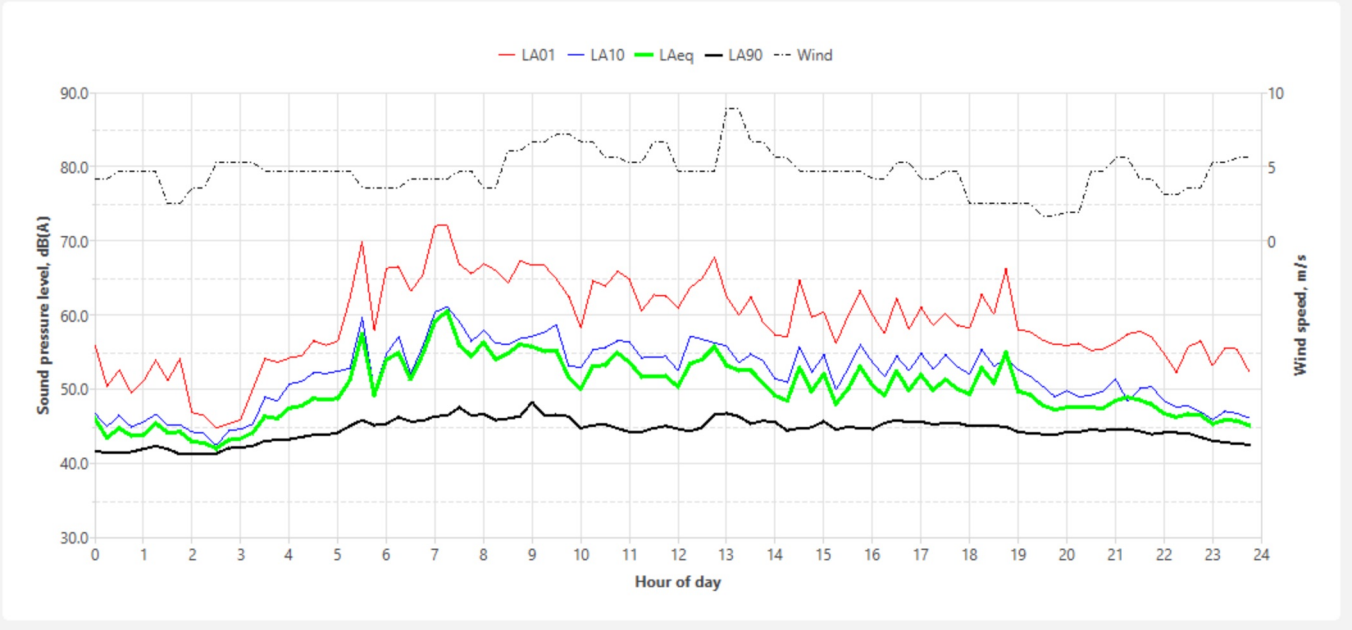

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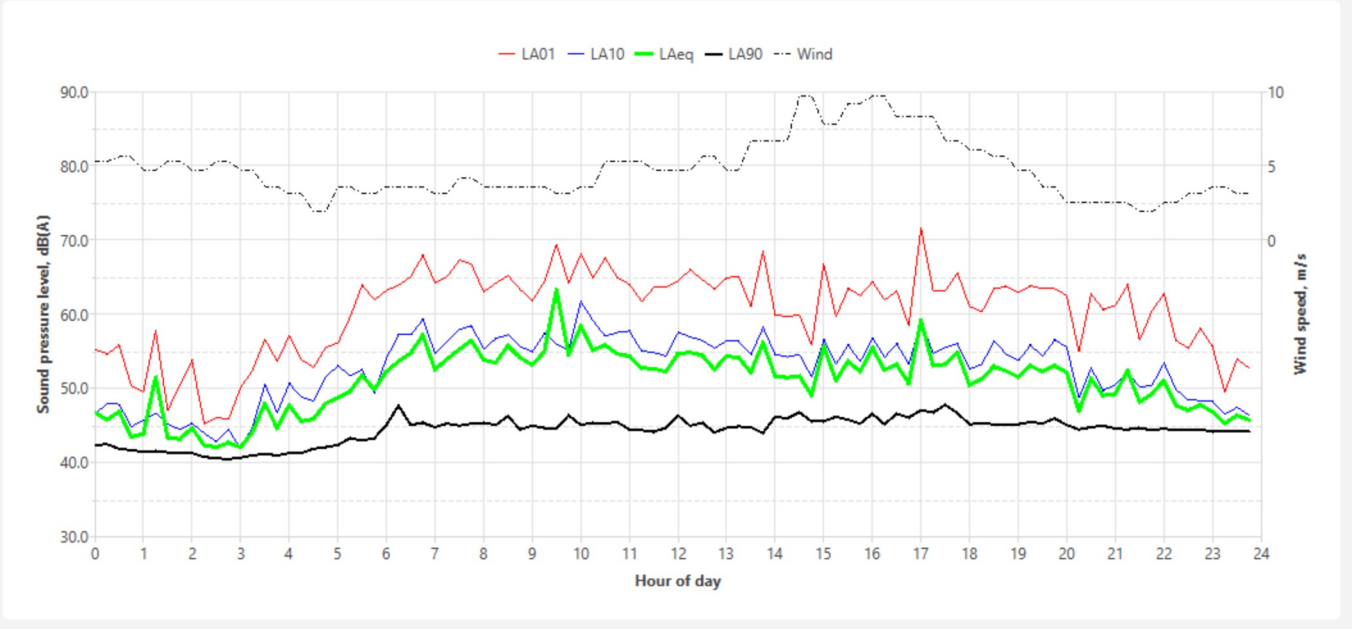

Friday, 26 September 2025