



81-83 George St & 1 Barrack Ln, Parramatta

State Significant Development Application (SSDA) Noise and Vibration Impact Assessment

Freecity Parramatta Development No 1 Pty Ltd

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1 INTRODUCTION

Pulse White Noise Acoustics Pty Ltd (PWNA) has been engaged by Freecity Parramatta Development No 1 Pty Ltd to undertake a noise and vibration impact assessment for the proposed development to be located at 1 Barrack Lane and 81-83 George Street, Parramatta.

The proposed development seeks approval for the demolition of existing site structures and the construction of a 40 storey mixed use development including build to rent (BTR) housing.

This assessment will address the following:

- Potential surrounding environmental noise intrusion impacts on the development (i.e., traffic noise from George Street and other external noise sources).
- Noise emissions to nearby receivers from the operation of the base building services (i.e., electrical, hydraulic and mechanical plant) and communal areas.
- Construction noise and vibration assessment for both standard and out-of-hour work.

This report outlines the relevant acoustic criteria which have been adopted as well as the outcome of the assessment.

A list of acoustic terminology used in this report is included in Appendix A of this report.

1.1 Planning Secretary's Environmental Assessment Requirements (SEARs 79439459)

Table 1 Key issues and supporting documentation

Issue and Assessment Requirements	Supporting Documentation
Noise and Vibration Provide a noise and vibration impact assessment prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines. The assessment must detail construction and operational noise and vibration impacts on nearby sensitive receivers and structures and outline the proposed management and mitigation measures that would be implemented.	Noise and Vibration Impact Assessment (This document)

1.2 Site Description

The site is located at 1 Barrack Lane and 81-83 George Street, Parramatta and is legally described as DP1053914.

The site has frontages to George Street (5m) to the north and bounded by the Barrack Lane to the west. The eastern boundaries of the site adjoin a commercial property at 85 George Street, Parramatta.

The site is currently occupied by an existing three-story residential building, with car parking spaces on the ground level. Existing trees surround the boundaries of the site. Vehicular access is currently available from George Street.

1.3 Surrounding Context

Parramatta is characterised by its role as Sydney's Central River City, with significant landholdings including Westfield Parramatta, Parramatta Square, and a concentration of government, financial, and commercial offices.

The precinct also features cultural and civic institutions such as Parramatta Park, CommBank Stadium, and the Riverside Theatres.

The site benefits from excellent accessibility, being located within walking distance of Parramatta Railway Station and the Parramatta Light Rail (Stage 1), with bus services operating extensively along George Street and Church Street. Road access is provided via major regional connections including the M4 Motorway, James Ruse Drive, and Victoria Road.

The surrounding development includes:

- North: Across George Street is the Octagon in Parramatta at 110 George Street, Parramatta, a large-scale mixed-use precinct comprising commercial towers, Build-to-Rent (BtR). This is comprising 47-store with ground floor retail and three-story podium with co-working spaces.
- East: Immediately adjoining the site to the east is a mix of mid-rise commercial property at 85 George Street, Parramatta.
- South: To the south, is the Arthur Phillip High School.
- West: West of the site is an eight-story commercial building at 79 George Street, Parramatta, the building is permanently closed. This heritage-listed building is notable for its historical and architectural significance. It has strong ties to The King's School, having served as a school between 1916 and 1942.
- The Sydney Metro West alignment near Parramatta starts at the confirmed Westmead station, then proceeds to the Parramatta metro station located below the CBD. This part of the Metro West alignment is underground below the proposed development.

1.4 Detailed project descriptions

The SSDA seeks development consent for the demolition of existing structures and the construction of a 40 storey mixed use development with ground floor retail and a build-to-rent (BTR) tower. Specifically, the proposal comprises the following:

- The demolition of existing site structures and the removal of two trees,
- The construction of a forty (40) storey mixed-use development comprising:
 - Site preparation works including preparatory earthworks,
 - A three storey podium including:
 - Ground floor: a flexible retail area and a retail tenancy, a build-to-rent lobby and management area, services and waste rooms, separate vehicle entries for residential use and service use, 4 parking spaces for service vehicles, bike repair facilities and 40 bicycle parking spaces,
 - First level: 32 car parking spaces, inclusive of 2 accessible spaces, 214 bicycle parking spaces, 7 motorcycle parking space, a residential storage area and services,
 - Second level: 39 car parking spaces, inclusive of 2 accessible spaces, 170 bicycle parking spaces, 7 motorcycle parking spaces, a residential storage area and services,
 - Upper podium level providing communal open space and amenities.
 - A thirty-eight (37) storey residential tower incorporating 383 BTR units
- Installation of a new substation and infrastructure connections as required.
- Associated landscaping and public domain works.
- Proposed extended out-of-hour works associated with Volumetric Modular Construction (VMC) work.

1.5 Surrounding Receivers

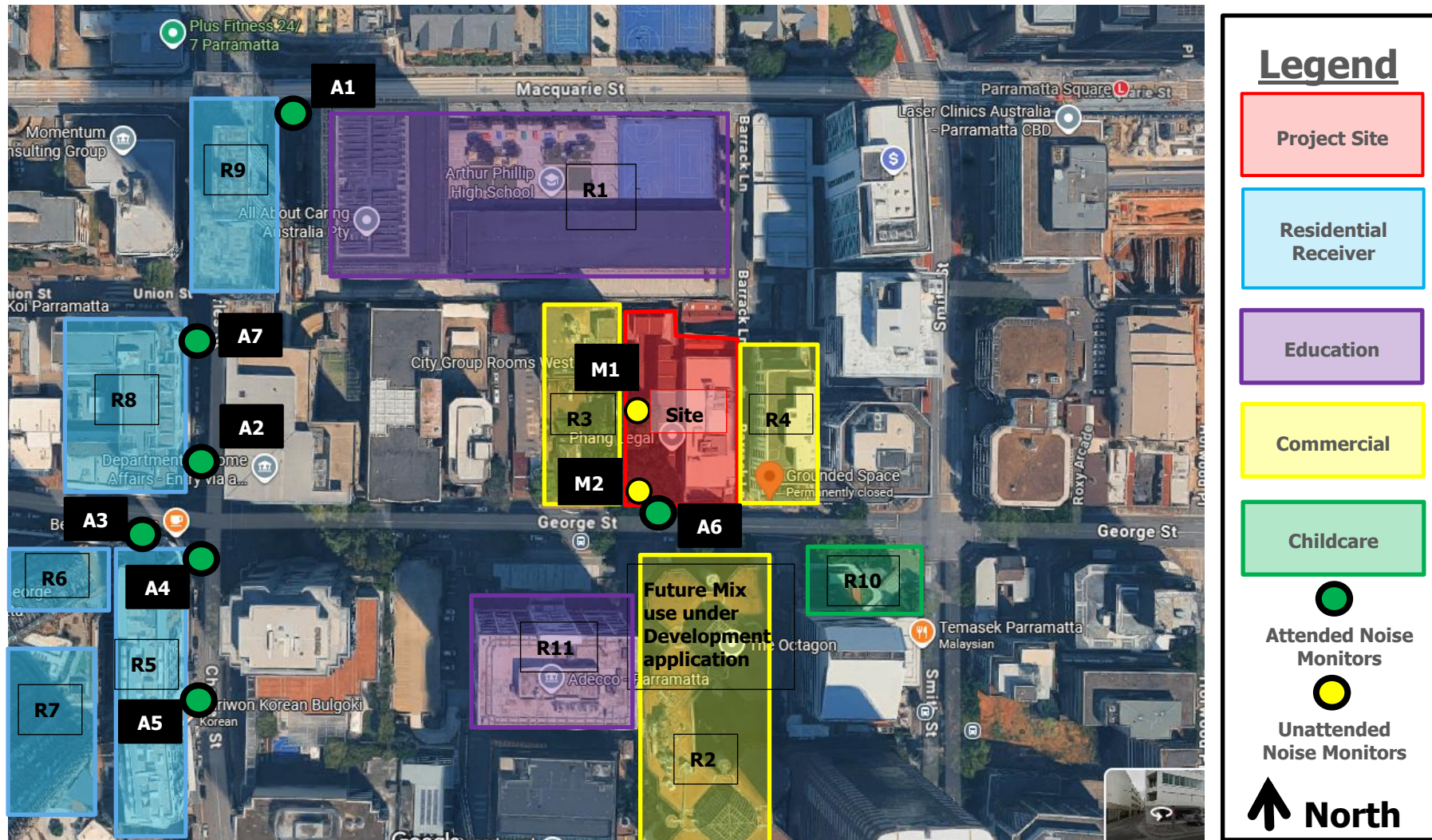
The site is located within the E2 Commercial Centre Zone pursuant to the Parramatta Local Environmental Plan 2023, as described in the NSW ePlanning Spatial Viewer Zoning Maps.

The nearest sensitive receivers to the site have been identified below.

- Receiver 1:** Educational receiver at 102-116 Macquarie St, Parramatta NSW 2150, Arthur Philip High School.
- Receiver 2:** The Octagon in Parramatta at 110 George Street, Parramatta, a large-scale mixed-use precinct comprising commercial towers, Build-to-Rent (BtR) under development application, assessed as commercial receiver.
- Receiver 3:** Commercial receiver at 85 George St, Parramatta NSW 2150
- Receiver 4:** Currently unused commercial receiver located at 81 George St, Parramatta NSW 2150
- Receiver 5:** Residential receiver located at 180A George Street, Parramatta with ground level commercial shop
- Receiver 6:** 180B George St, Parramatta NSW 2150, Meriton Suites George Street, Parramatta.
- Receiver 7:** 180C George St, Parramatta NSW 2150, Meriton Suites George Street, Parramatta
- Receiver 8:** 103 George St, Parramatta NSW 2150, residential receivers.
- Receiver 9:** 5–7 Charles Street, Parramatta, Build-to-Rent (BtR) mixed-use development. Classified as residential receiver.
- Receiver 10:** Reggio Emilia Early Learning centre classified as childcare centre receiver.
- Receiver 11:** Educational receiver, Australia College of Nursing.

A map showing the site location, measurement locations, and the nearest receiver is provided in Figure 1.

Figure 1 Site Map, Measurement Locations and Surrounding Receivers



2 EXISTING NOISE ENVIRONMENT

This section of the report details the acoustic survey which has been undertaken at the site for the purpose of obtaining existing background noise levels, as well as noise levels incident on the future building façades.

2.1 Unattended Noise Monitoring

As part of State Significant Development Application (SSDA) assessment for this project, an acoustic survey of the existing acoustic environment at the site and surrounding receivers was undertaken. The survey included long-term unattended noise logging between Thursday 28th August and Sunday 7th September 2025. 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 Sydney Olympic Park weather station (ID 066212).

Noise logging was undertaken at one location on the site using a Rion noise monitor with serial number 01000233. Calibration of the loggers 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.

One unattended noise monitor (M1) was located at the front of the site, along the northern boundary adjacent to George Street. The purpose of noise monitoring at this location was to characterise the existing background noise level for sensitive receiver around the site.

The location of the noise loggers are shown in Figure 1. The noise loggers were positioned in the free field such that they did not require façade corrections.

Charts presenting summaries of the measured daily noise data are attached to this report in Appendix B and Appendix C. The charts present each 24-hour period and show the L_{A1} , 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.

2.2 Attended Noise Monitoring

Attended Noise monitoring was undertaken for the existing acoustic environment at the site and surrounding sensitive receivers during the evening and night-time periods. The attended survey was conducted on the evening of the 18th September 2025. During the attended measurement, no adverse meteorological conditions were observed. The location of the attended noise monitoring is presented in Figure 1.

Attended noise survey was undertaken at six(6) locations at the most sensitive receivers using a Rion noise monitor and svantek 977 with serial number 81362 for svan and 00653005 for Rion. Calibration of the loggers 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.

The attended monitoring results are detailed in section 2.4.

2.3 Noise Descriptors & Terminology

Environmental noise constantly varies in level with time. Therefore, it is necessary to measure environmental noise in terms of quantifiable time periods and statistical descriptors. Typically, environmental noise is measured over 15-minute periods and relevant statistical descriptors of the fluctuating noise are determined to quantify the measured level.

Noise (or sound) consists of minute fluctuations in atmospheric pressure capable of detection by human hearing. Noise levels are expressed in terms of decibels, abbreviated as dB or dB(A), the "A" indicating that the noise levels have been frequency weighted to approximate the characteristics of normal human hearing. Because noise is measured using a logarithmic scale, 'normal' arithmetic does not apply, e.g., adding two sound sources of equal values result in an increase of 3dB (i.e., 60 dB(A) plus 60 dB(A) results in 63 dB(A)). A change of 1 dB or 2 dB in the sound level is difficult for most people to detect, whilst a 3 dB – 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change roughly corresponds to a doubling or halving in loudness.

The most relevant environmental noise descriptors are the LAeq, LA1, LA10 and LA90 noise levels. The LAeq noise level represents the equivalent energy average noise level. This parameter is derived by integrating the noise level measured over the measurement period. It represents the level that the fluctuating noise with the same acoustic energy would be if it were constant over the measured time period.

The LA1, LA10 and LA90 levels are the levels exceeded for 1%, 10% and 90% of the sample period. These levels can be considered as the maximum noise level, the average repeatable maximum and average repeatable minimum noise levels, respectively.

Specific acoustic terminology is used in this assessment report. An explanation of common acoustic terms is included as Appendix A.

2.4 Noise Monitoring Results

2.4.1 Ambient noise monitoring results

In order to assess the potential noise impacts of the development on nearby sensitive receivers the measured background noise data was processed in accordance with the Environmental Protection Authority (EPA) *Noise Policy for Industry* (NPI).

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. The RBL and LAeq noise levels for the assessment time periods are presented in Table 2.

The attended noise monitoring results are detailed below.

Table 2 Attended Noise Measurement Results – 18th September 2025

Measurement Location	Time & Date	LAeq ² 15 mins dB(A)	LA90 ¹ 15 mins dB(A)	Comments
Evening Period				
A1	8:25 pm to 8:40 pm	56	49	Background noise level dominant by the light rail traffic and light vehicle noise on Macquarie Street.
A2	7:30 pm to 7:45 pm	62	55	Background noise level dominant by the traffic noise on Charles Street and George Street. Busy traffic follows on George Street and Charles Street. Ambient noise level from commercial shop and nearby restaurant is audible.
A3	7:46 pm to 8:01 pm	64	58	Background noise level dominant by the traffic noise on Charles Street and George Street. Busy traffic follows on George Street

Measurement Location	Time & Date	L _{Aeq} ² 15 mins dB(A)	L _{A90} ¹ 15 mins dB(A)	Comments
				and Charles Street. Ambient noise level from commercial shop and nearby restaurant is audible.
A4	8:22 pm to 8:37 pm	65	58	Background noise level dominant by the traffic noise on Charles Street and George Street. Busy traffic follows on George Street and Charles Street. Ambient noise level from commercial shop and nearby restaurant is audible.
A5	9:45 pm to 10:00 pm	56	55	Background noise level dominant by the traffic noise on Charles Street and George Street. Busy traffic follows on George Street and Charles Street. Ambient noise level from commercial shop and nearby restaurant is audible.
A6 (Logger)	7:30 pm to 7:45 pm	56	51	Background noise level dominant by the traffic noise on George Street.
A6 (Logger)	7:45 pm to 8:00 pm	56	51	Background noise level dominant by the traffic noise on George Street.
A6 (Logger)	8:00 pm to 8:15 pm	55	51	Background noise level dominant by the traffic noise on George Street.
A6 (Logger)	8:15 pm to 8:30 pm	55	51	Background noise level dominant by the traffic noise on George Street.
A6 (Logger)	8:30 pm to 8:45 pm	57	50	Background noise level dominant by the traffic noise on George Street.
A6 (Logger)	8:45 pm to 9:00 pm	56	51	Background noise level dominant by the traffic noise on George Street.
A6 (Logger)	9:00 pm to 9:15 pm	56	50	Background noise level dominant by the traffic noise on George Street.
A6 (Logger)	9:15 pm to 9:30 pm	55	50	Background noise level dominant by the traffic noise on George Street.
A6 (Logger)	9:30 pm to 9:45 pm	54	50	Background noise level dominant by the traffic noise on George Street.
A6 (Logger)	9:45 pm to 10:00 pm	55	50	Background noise level dominant by the traffic noise on George Street.

Measurement Location	Time & Date	L _{Aeq} ² 15 mins dB(A)	L _{A90} ¹ 15 mins dB(A)	Comments
A7	8:06 pm to 8:21 pm	56	49	Background noise level dominant by the traffic noise on Charles Street and George Street. Busy traffic follows on George Street and Charles Street. Ambient noise level from commercial shop and nearby restaurant is audible.
Night Time Period				
A1	10:00 pm to 10:15 pm	55	49	Background noise level dominant by the light rail traffic and light vehicle noise on Macquarie Street.
A2	10:15 pm to 10:30 pm	61	54	Background noise level dominant by the traffic noise on Charles Street and George Street. Moderate traffic follows on George Street and Charles Street. Ambient noise level from nearby restaurant is audible.
A3	10:30 pm to 10:45 pm	63	58	Background noise level dominant by the traffic noise on Charles Street and George Street. Moderate traffic follows on George Street and Charles Street. Ambient noise level from nearby restaurant is audible.
A4	10:45 pm to 11:00 pm	65	57	Background noise level dominant by the traffic noise on Charles Street and George Street. Moderate traffic follows on George Street and Charles Street. Ambient noise level from nearby restaurant is audible.
A6 (Logger)	10:00 pm to 10:15 pm	54	50	Background noise level dominant by the traffic noise on George Street.
A6 (Logger)	10:15 pm to 10:30 pm	54	50	Background noise level dominant by the traffic noise on George Street.
A6 (Logger)	10:30 pm to 10:45 pm	55	50	Background noise level dominant by the traffic noise on George Street.
A6 (Logger)	10:45 pm to 11:00 pm	56	51	Background noise level dominant by the traffic noise on George Street.
A6 (Logger)	11:00 pm to 11:15 pm	55	50	Background noise level dominant by the traffic noise on George Street.

Measurement Location	Time & Date	L _{Aeq} ² 15 mins dB(A)	L _{A90} ¹ 15 mins dB(A)	Comments
A7	11:00 pm to 11:15 pm	54	49	Background noise level dominant by the traffic noise on Charles Street and George Street. light traffic follows on George Street and Charles Street. Ambient noise level from people walking on the street.
<i>Note 1: The L_{A90} noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.</i> <i>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.</i>				

The background noise levels (L₉₀) across the surveyed receivers show variation depending on their proximity to traffic corridors and late-evening commercial activity.

- A1, A5, and A7: Background levels were generally around 49–55 dB(A), reflecting typical urban background conditions. These locations are influenced by traffic along Charles Street, George Street, and Macquarie Street, with intermittent contributions from nearby restaurants and pedestrian activity.
- A2: Slightly higher background levels of 54–55 dB(A) were observed, consistent with stronger exposure to traffic on Charles/George Street and nearby restaurants.
- A3 and A4: These receivers recorded the highest background levels, consistently around 57–58 dB(A) during both evening and night periods. Their proximity to George Street and surrounding restaurants results in a noisier environment compared with other receivers.
- A6 (Logger): Unlike the other receivers, A6 shows a more stable and consistent background noise level, typically 50–51 dB(A) across the evening and night. The continuous logger data indicates less fluctuation and no distinct contribution from nearby restaurants, with noise dominated primarily by steady traffic on George Street.

While all receivers are influenced by traffic noise, A3 and A4 experience elevated background levels due to restaurant and late-night activity. In contrast, A6 shows a lower and more stable background, reflecting its relative separation from commercial frontage and predominance of consistent road traffic.

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

In order to assess the potential noise impacts of the development on nearby sensitive receivers the measured background noise data was processed in accordance with the Environmental Protection Authority (EPA) *Noise Policy for Industry* (NPI).

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. The RBL and L_{Aeq} noise levels for the assessment time periods are presented in Table 3 below.

Data affected by adverse meteorological conditions and by spurious and uncharacteristic events has 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 Sydney Olympic Park weather station (ID 066212).

Detailed 15-minute recorded noise level has been presented in Appendix B and C for location M1 and M2.

Table 3 Measured Ambient Noise Levels corresponding to the NPI's Assessment Time Periods

Measurement Location	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	
	LA ₉₀ ² (dBA)	LA _{eq} ³ (dBA)	LA ₉₀ ² (dBA)	LA _{eq} ³ (dBA)	LA ₉₀ ² (dBA)	LA _{eq} ³ (dBA)
81 -83 George Street, Parramatta (Background noise logging) M1	53	59	50	56	49	57

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 LA_{eq} 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 ACOUSTIC AND VIBRATION CRITERIA

The acoustic criteria which have been adopted for this assessment are outlined below. All criteria have been separated into the relevant assessment type, these are: *Noise Intrusion Criteria* (Assessment of building envelope), *Noise Emission Criteria* (Assessment of noise to surrounding receivers) and *Acoustic Separation Criteria* (Assessment of acoustic privacy within the apartment building and between attached dwellings).

3.1 Noise intrusion criteria

External noise intrusion into the building will generally be via the building envelope (External wall, glazing or external roof). The design of the building envelope should be such that the requirements listed below are achieved.

The following sub-sections address the criteria for the assessment of internal noise levels. These are summarised as follows:

- Section 3.1.2 discusses the criteria applicable to the assessment of noise intrusion generated by local road and rail traffic external to the site.
- Section 3.1.3 discusses the criteria for the assessment of noise emissions generated by steady state noise sources such as mechanical services.

3.1.1 City of Parramatta Development Control Plan (DCP) 2023

A review of the City of Parramatta Development Control Plan (DCP) 2023 has been undertaken with respect to noise emissions from multi-dwelling housing developments. The DCP does not specify numerical noise criteria for assessing impacts on the surrounding environment. In the absence of such criteria, the NSW Environment Protection Authority's Noise Policy for Industry (2017) is considered the appropriate guideline to adopt for this assessment.

3.1.2 NSW Government Legislation – State Environmental Planning Policy (Transport and Infrastructure) 2021 (SEPP Infrastructure)

Clause 2.119 of the SEPP Infrastructure states the following:

2.119 Impact of road noise or vibration on non-road development

- (1) *This section applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 20,000 vehicles (based on the traffic volume data published on the website of TfNSW) and that the consent authority considers is likely to be adversely affected by road noise or vibration—*

- (a) *residential accommodation,*
- (b) *a place of public worship,*
- (c) *a hospital,*
- (d) *an educational establishment or centre-based child care facility.*
- (2) *Before determining a development application for development to which this section applies, the consent authority must take into consideration any guidelines that are issued by the Secretary for the purposes of this section and published in the Gazette.*
- (3) *If the development is for the purposes of residential accommodation, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded—*
 - (a) *in any bedroom in the residential accommodation—35 dB(A) at any time between 10 pm and 7 am,*
 - (b) *anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway)—40 dB(A) at any time.*
- (4) *In this section, freeway, tollway and transitway have the same meanings as they have in the Roads Act 1993.*

3.1.3 Australian / New Zealand Standard AS/NZS 2107:2016 Acoustics - Recommended design sound levels and reverberation times for building interiors - (AS/NZS 2107:2016)

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 Table 4 below. In this report we will confine our recommendations to dB(A) 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).

If tonal components are significant characteristics of the sound within a measurement time interval, an adjustment shall be applied for that time interval to the measured A-weighted sound pressure level to allow for the additional annoyance. If the background sounds include spectral imbalance, then the RC (Mark II) levels indicated in Table 4 should be referenced (see also Appendix D of AS/NZ 2107:2016 for additional guidance).

The noise given in AS/NZ 2107:2016, indicated in Table 4 below, represent total internal noise levels and include both noise intrusion from road traffic as well as the noise of the mechanical equipment (such as air conditioning) that services the space.

Table 4 Recommended design sound levels as per standard AS/NZS 2107:2016

Type of Occupancy/Activity	Design sound level range (LAeq,t)	Project Design Noise Level ²	
		Approx. RC Mark II	dB(A)
Residential Buildings			
Houses and apartments in inner city areas or entertainment districts or near major roads			

Type of Occupancy/Activity	Design sound level range (LAeq,t)	Project Design Noise Level ²	
		Approx. RC Mark II	dB(A)
Apartment common areas (e.g. foyer, lift lobby)	45 to 50	45	50
Living areas	35 to 45	35	45
Sleeping areas (night time)	35 to 40	35	40
Work areas	35 to 45	35	45
Miscellaneous areas			
carparks	< 65	60	65
Toilets	45 to 55	50	55

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.

3.1.4 Project Specific Noise Intrusion Criteria Summary

The noise intrusion summary for the development, in accordance with above mentioned legislation and recommendation below:

- Common areas (e.g. foyer, lift lobby) 55 LAeq,15 hour
- Residential - Living areas 40 LAeq,15 hour
- Residential - Sleeping areas (night-time) 35 LAeq,9 hour

Note: The relevant time-period for bedrooms includes the period of 10pm to 7am.

3.2 Noise Emission Criteria (Operational Criteria)

Noise emissions from the operation of the site impacting on the adjacent land users are outlined below. Noise emissions expected from the use of the site include those from mechanical services.

3.2.1 City of Parramatta Development Control Plan (DCP) 2023

Following a review of the current City of Parramatta Development Control Plan (DCP) 2023, we note that the document does not contain any applicable acoustic criteria for the assessment of noise emissions from mechanical plant for developments of this kind. As such, in the absence of any applicable requirements, objectives listed in the NSW EPA Noise Policy for Industry (NPfI) 2017 below will be adopted.

3.2.2 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 EPAs Noise Policy for Industry (NSW NPI) 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.

3.2.2.1 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 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.

3.2.2.2 Protecting Noise Amenity (All Receivers)

To limit continuing increases 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 L_{Aeq} noise level should not exceed the level appropriate for the particular locality and land use. This is termed the 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 $L_{Aeq,15min}$ 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 industrial noise level, the project amenity noise levels can be set at 10 dB below existing industrial noise levels.

3.2.2.3 Area Classification

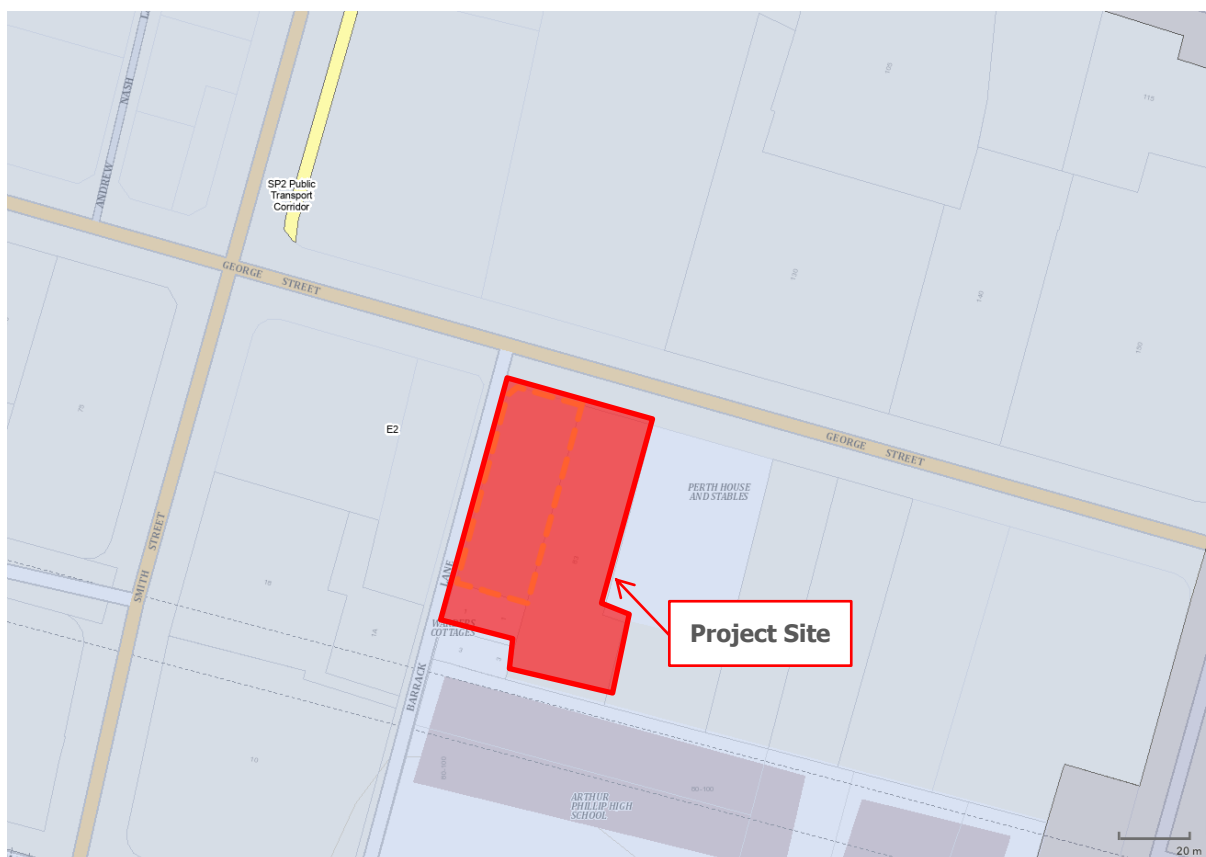
The NSW NPI characterises the "Urban Residential" noise environment as an area that has the following characteristics:

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 flows during peak periods*
- *is near commercial districts or industrial districts*
- *has any combination of the above.*

Figure 2 is obtained from the NSW Planning ePlanning Spatial Viewer Zoning Maps and shows the land zoning map of the proposed development and the nearest sensitive receivers.

Figure 2 NSW Planning ePlanning Spatial Viewer Zoning Maps



As shown above, the site and its nearest surrounding receivers are located in an area defined as E2 (Commercial Centre). The most appropriate zoning for the site and its surrounding receivers is *Urban Residential*.

For residential and non-residential receivers in an urban residential area, the recommended amenity criteria are shown in Table 5 below.

When the existing noise level from industrial noise sources is close to the recommended "Amenity Noise Level" (ANL) given above, noise from the new source must be controlled to preserve the amenity of the area in line with the requirements of the NSW NPfI.

Table 5 NSW NPfI – Recommended LAeq Noise Levels from Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day ¹	Recommended Amenity Noise Level (LAeq, period) ² (dB(A))
Residence	Urban	Day	60
		Evening	50
		Night	45
Childcare	-	When in use	50 (External) ³
Education	-	Noisiest 1-hour period when in use	35 (Internal)
Commercial	-	When in use	65
<i>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.</i> <i>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.</i> <i>Note 3: In accordance with AS 2107, the recommended internal noise level for childcare sleeping areas is 35 dB(A). On the assumption of a 15 dB(A) reduction from external to internal levels (typical for a closed façade with standard glazing), the corresponding external noise criterion is 50 dB(A).</i>			

3.2.2.4 Project Specific NPfI Noise Emission Criteria

The intrusive and amenity criteria for industrial noise emissions, derived from the measured data at the logger location toward the northern boundary of the site, are presented in Table 6. These criteria are nominated for the purpose of determining the operational noise limits for mechanical plant 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, which are shown in bold text in Table 6.

Table 6 External noise level criteria in accordance with the NSW NPI

Location	Time of Day ¹	Project Amenity Noise Level, LAeq, period ² (dB(A))	Measured LA90, 15 min (RBL) ^{3,4} (dB(A))	Measured LAeq, 15 min Noise Level (dB(A))	Intrusive LAeq, 15 min Criterion for New Sources (dB(A))	Amenity LAeq, 15 min Criterion for New Sources (dB(A))
Residential Receivers	Day	55	49	54	<u>54</u>	58
	Evening	45	48	55	53	<u>48</u>
	Night	40	47	52	52	<u>43</u>
Commercial Receivers	When in use	60	N/A	N/A	N/A	<u>63</u>
Education	Noisiest 1-hour period when in use	N/A	N/A	N/A	N/A	35 (Internal)

Note 1: For Monday to Saturday, Daytime 7:00 am – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 10:00 pm; Night-time 10:00 pm – 8:00 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: LA90 Background Noise or Rating Background Level.

Note 4: Project Noise Trigger Levels are shown in bold and underlined.

3.2.3 Sleep Disturbance

Regarding sleep awakening, ongoing research is still being undertaken to quantify an appropriate criterion. The NSW Road Noise Policy (NSW RNP) provides guidelines and a summary of current research being undertaken on this topic. According to the NSW RNP, an accurate representation of sleep disturbance impacts on a community from a noise source is particularly difficult to quantify mainly due to differing responses of individuals to sleep disturbance – this is found even within a single subject monitored at different stages of a single night's sleep or during different periods of sleep.

In addition, the differing grades of sleep state make a definitive definition difficult, and even where sleep disturbance is not noted by the subject, factors such as heart rate, mood and performance can still be negatively affected.

An assessment of sleep disturbance should consider the maximum noise level or LA1(1 minute), and the extent to which the maximum noise level exceeds the background level and the number of times this may happen during the night-time period. Factors that may be important in assessing the extent of impacts on sleep include:

- How often high noise events will occur;
- Time of day (normally between 10.00pm and 7.00am); and
- Whether there are times of day when there is a clear change in the existing noise environment (such as during early morning shoulder periods).

Currently the information relating to sleep disturbance impacts indicates that:

- Maximum internal noise levels below 50–55 dB(A) are unlikely to cause an awakening from a sleep state.
- One or two noise events per night with maximum internal noise levels of 65–70 dB(A) are not likely to affect health and wellbeing significantly.

As a result, the adopted sleep awakening criterion for the project is an internal noise level of 50–55 dB LAF_{max}. This criterion is applicable for noise emissions generated by short term events occurring during the night time period. Therefore, allowing for a 10 dB noise reduction for open windows, it is proposed that the noise screening criterion for sleep awakening should be 60–65 dB LAF_{max} external noise level at residential properties.

3.2.4 Emergency Plant / Infrequent Operational Activities

For emergency plant (such as fire pumps and associated mechanical services) or infrequent activities (such as waste collection), the NSW NPfI recognises that strict compliance with the external noise criteria may not always be reasonable. In these cases, duration corrections or alternative provisions outlined in the policy may be applied, rather than the standard project noise trigger levels. Modifying factors (where relevant) are added to predicted levels prior to assessment.

Under the assumption that each waste collection event has a duration of between 15 minutes and 1 hour, and occurs no more than once in a 24-hour period, the activity is considered infrequent in accordance with the NPfI. In this case, a modifying factor correction of +5 dB (intermittency) may be applied to the predicted noise level prior to comparison with the relevant external criterion. The NPfI recognises that for such short-duration, infrequent events, strict compliance with project noise trigger levels may not always be required.

Table 7 Modifying factors for duration

Allowable duration of noise (one event in any 24 hour period)	Allowable exceedance at receiver for the period of noise event	
	Daytime and Evening (7am – 10pm)	Night time (10pm – 7am)
1 to 2.5 hours	2	Nil
15 minutes to 1 hour	5	Nil
6 minutes to 15 minutes	7	2
1.5 minutes to 6 minutes	15	5
Less than 1.5 minutes	20	10

Note: Where the duration of the noise event is smaller than the duration of the project trigger noise level (PNTL), that is, less than 15 minutes, the allowable adjusted project noise trigger level (APNTL) is derived as follows:

$$APNTL = 10 \log \left(\left(10^{\frac{PNTL}{10}} \times \left(\frac{900 - \text{duration}}{900} \right) \right) + \left(10^{\frac{PNTL + \text{allowable exceedance in table above}}{10}} \times \text{duration} \right) \right)$$

3.3 Traffic Generating Development

The NSW Road Noise Policy (2011) outlines measures to minimise road traffic noise and its impacts. It applies to land-use developments and projects that generate additional traffic on existing roads. The policy provides guidance for determining authorities, regulators, planners, policymakers and acoustic specialists in assessing and mitigating traffic noise impacts on residential and other sensitive receivers

The noise assessment criteria contained in Table 4 of Section 2.3.2 of the RNP should be applied for assessing the impact and of a land use development with the potential to generate additional traffic on local, sub-arterial or arterial roads.

For existing residences affected by additional traffic from a new development on existing roads:

- Daytime (7 am – 10 pm): LAeq,15hr = 55 dB(A)

- Night-time (10 pm – 7 am): $L_{Aeq,9hr} = 50 \text{ dB(A)}$

Figure 3 Table 3 Road traffic noise assessment criteria for residential land uses

Road category	Type of project / land use	Assessment criteria – dBA	
		Day (7am–10pm)	Night (10pm–7am)
Local roads	4. Existing residences affected by noise from new local road corridors 5. Existing residences affected by noise from redevelopment of existing local roads 6. Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq(1hour)} 55$ (external)	$L_{Aeq(1hour)} 50$ (external)

Although a relative change in traffic noise levels to noise sensitive receivers, as recommended in the ECRTN, is not a specified criterion in the RNP, an assessment of this change will provide an indication of whether increased traffic noise levels are likely be noticeable or problematic.

3.4 Noise Emissions from Carpark

The assessment of car park noise impacts has been undertaken with reference to the NSW Noise Policy for Industry (NPfI, 2017). The applicable assessment criteria for car park noise emissions are those outlined in Section 3.2 of this report.

3.5 Construction Noise Criteria

3.5.1 Interim Construction Noise Guideline

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
- 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 Table 8 below.

Specific non-residential receivers in the vicinity of the proposed construction site, and their recommended 'management levels', are presented in Table 9.

Based on the measured background noise levels summarised in Section 2.4, the NMLs to be used in this assessment are listed in Table 10.

At this stage of our assessment, it is assumed all construction works will be undertaken during typical standard construction hours as per Table 8.

Table 8 NMLs for quantitative assessment at residences (from ICNG)

Time of Day	Noise Management Level $L_{Aeq}(15\text{-minute})^{1,2}$	How to Apply
Recommended standard hours: Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm No work on Sundays or public holidays	Noise affected 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 $L_{Aeq}(15\text{-minute})$ 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 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. - Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: - Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. - If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours (Refer to section 6.5)	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 negotiate with the community.
<i>Note 1</i> 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. <i>Note 2</i> 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).		

Table 9 NMLs for quantitative assessment at non-residential receivers

Land Use	LAeq(15-minute) Construction NML
Industrial premises	External noise level 75 dB(A)
Offices, retail outlets	External noise level 70 dB(A)
Education	Internal noise level 45 dB(A)
Note 1: External noise level criterion estimated from internal noise level criterion assuming a 10 dB noise level difference for open windows	

Table 10 NMLs as basis for the acoustic assessment

Receiver Types	NML, dB LAeq(15-minute)	
	Standard Hours Monday to Friday: 7 am to 6 pm Saturday: 8 am to 1 pm	Outside Standard Hours
Residences	59	Evening period: 58 Night-time period: 57
Industrial premises	75 (external)	75 (external)
Offices, retail outlets	70 (external)	70 (external)
Education	45 (Internal)	-

3.6 Construction Traffic Noise Criteria

For existing residences and other sensitive land uses affected by additional traffic on existing roads, the NSW Road Noise Policy (NSW RNP) states that for noise associated with increased road traffic generated by land use developments are required to be assessed based on the criteria derived in section 3.3.

Based on a review of the NSW Planning Portal, the proposed site is located within the E2 zone. The assessment indicates that construction traffic associated with the development is expected to have minimal impact on the nearest residential property situated along Charles Street.

3.7 Ground-Borne Noise and Vibration Criteria (Metro West)

3.7.1 Ground-Borne Noise

The Department of Planning's Development near Rail Corridors & Busy Roads – Interim Guideline" 2008 provides recommended criteria for ground-borne or regenerated rail noise.

Ground-borne noise is noise generated by vibration transmitted through the ground into a structure. The following ground-borne limits for residences are only applicable when ground-borne noise levels are higher than airborne noise levels. The ground-borne noise levels are for evening and night-time periods only, as the objectives are to protect the amenity and sleep of people when they are at home. Table 11 summaries the noise limits for sleeping and living spaces.

Table 11 Recommended internal Noise Criteria for Regenerated Rail Noise

Type of Occupancy/Activity	Design sound level range ($L_{A_{Max}}$ (Slow, 95%))	Time Period
Residential Buildings		
Sleeping areas (nighttime)	35	Night 10 pm to 7 am
Other habitable rooms (excl. garages, kitchens, bathrooms & hallways)	40	At any time
Note 1: Groundborne noise is calculated as L_{max} (slow) for 95% of rail passby events		

3.7.2 Rail Tactile Vibration

Section 3.6.3 of the Department of Planning Guideline provides recommended vibration criteria in accordance with the German Standard DIN4150 Part 3 1999 and British Standards BS 7385 Part 2 1993. Human comfort is normally assessed with reference to the above British Standard or Australian Standard AS 2670.2 1990.

After reviewing the aforementioned documents, the standards for evaluating the impact of train passby, tactile vibration on the proposed development have been determined according to the *Assessing Vibration: A technical guideline* (Department of Environment and Conservation, 2006).

The Department of Planning *Development Near Rail Corridor and Busy Roads – Interim Guideline* (DNRCBR) references to "Assessing Vibration – A Technical Guideline".

Vibration effects relating specifically to the human comfort aspects of the project are taken from the guideline titled "Assessing Vibration – A Technical Guideline". (AVTG). The AVTG recommends that habitable rooms should comply with the criteria therein which is in line with the requirements of British Standard BS 6472:1992 "Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)".

The British Standard shown in Table 12 details suitable criteria for the assessment of intermittent vibrations to prevent adverse impacts on future residence.

Table 12 Intermittent vibration impacts criteria (m/s^{1.75}) 1 Hz-80 Hz, Vibration Dose Values (VDV)

Measurement Location	Daytime		Night-Time	
	Preferred Values	Maximum Values	Preferred Values	Maximum Values
Residences	0.20	0.40	0.13	0.26

For the purpose of this assessment the *Preferred Values* detailed in the standard have been used as the criteria used in this assessment.

4 ACOUSTIC ASSESSMENT

In addressing all the criteria shown above, each component of the development is assessed and presented below.

4.1 Summary of Measured/Predicted Noise Level and Building Envelope Acoustic Criteria

The results of the monitoring that provides the façade noise levels of the proposed building are presented in section 2.4.2.

The relevant noise intrusion criteria for land-based noise intrusion sources are summarised in below together with the monitored external noise levels and the predicted noise levels on the relevant building façades.

Table 13 Summary of Facade Noise Levels and Relevant Assessment Criteria

Facade Location	Document/ Guideline/ Standard	Day Time ^{1, 2, 3} (dB(A))	Night Time ^{1, 2, 3} (dB(A))
		L _{Aeq} (Whole Period)	L _{Aeq} (Whole Period)
Measured/Predicted Noise Levels			
Western Façade (Barrack Lane)		56	53
Eastern Façade		56	53
Northern Façade (George Street)		59	56
Southern Façade		54	51
Noise Criteria Applicable (All Façades) – daytime and nighttime periods			
Apartment common areas	AS 2107 – Anytime	50	
Living areas	AS 2107 – Anytime	40	
Sleeping areas	AS 2107 – Night-time	N/A	35
Work areas	AS 2107 – Anytime	45	
Note 1: For Monday to Sunday, Daytime 7:00 am – 10:00 pm; Night-time 10:00 pm – 7:00 am.			
Note 2: For internal noise level criteria which are presented as a range, compliance is determined based on the highest level in the range.			
Note 3: For noise intrusion criteria which are presented for the daytime period and nighttime periods, these represent the L _{Aeq,15hr} and L _{Aeq,9hr} periods respectively.			

4.2 Building Envelope Assessment

4.2.1 Glazing Recommendations

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

Table 14 In-principle Glazing Recommendations

Location	Spaces	Minimum Glazing System Rating Requirements	Indicative Construction
Western Façade	Sleeping /Living Areas	Rw (C;Ctr): 31 (0;-3)	Windows with min. 6.38mm laminated glass.
	Common Areas	Rw (C;Ctr): 31 (0;-3)	Windows with min. 6.38mm laminated glass.
Eastern Façade	Sleeping /Living Areas	Rw (C;Ctr): 31 (0;-3)	Windows with min. 6.38mm laminated glass.
	Common Areas	Rw (C;Ctr): 29 (0;-3)	Windows with min. 6mm float glass.
Northern Façade (Facing George Street)	Sleeping /Living Areas	Rw (C;Ctr): 31 (0;-3)	Windows with min. 6.38mm laminated glass.
	Common Areas	Rw (C;Ctr): 29 (0;-3)	Windows with min. 6mm float glass.
Southern Façade	Sleeping /Living Areas	Rw (C;Ctr): 31 (0;-3)	Windows with min. 6.38mm laminated glass.
	Common Areas	Rw (C;Ctr): 29 (0;-3)	Windows with min. 6mm float glass.

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).

4.2.2 External Wall Construction

If external wall construction are constructed from a masonry construction, no further acoustic upgrading is required. 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.

Any light-weight external walls should be constructed from a construction with a minimum acoustic performance of R_w 50. Detailed review of the external wall construction to be undertaken by the principal acoustic engineer to confirm suitable acoustic performance is achieved during detailed design stage.

4.2.3 External Roof Construction

The required external roof and ceiling construction for the project are required to include the following:

1. Concrete external roof construction – no additional treatments required.
2. lightweight construction – Install acoustic insulation within the external roof/ceiling cavity similar to a 75 mm thick 14 kg/m³ insulation.

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.

Detailed review of the roof construction to be undertaken by the principal acoustic engineer to confirm suitable acoustic performance is achieved during detailed design stage.

4.2.4 External Openings and Penetrations

All openings and penetrations are required to be acoustically treated such that the performance of the building construction is not compromised. This may require lining of ductwork behind mechanical service openings/grills, treatments to ventilation opening and the like.

4.3 Noise from Engineering Services

At this stage of the project, indicative locations of key plant items have been selected, however, mechanical selections of items to be installed have not been made. As such, a detailed assessment of noise associated with engineering services cannot be undertaken. Review of the architecture drawings have shown that the proposed air condenser units are located on a transfer level between level 3 and level 4.

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.
- Residential Condensers – The project may include external residential condenser units which will likely be located on the roof-top. Providing condenser equipment is selected using suitable noise level data, then acoustic treatments can be implemented such as screening and treatment to exhaust to ensure that the relevant noise emission criteria will be achieved.

Details of the required mechanical services equipment and acoustic treatments to ensure the relevant noise level criteria is achieved will be provided as part of the CC submission of the project.

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.

A detailed acoustic assessment will be conducted during the detailed design stage as more information become available regarding performance data or specific mechanical equipment or any further mechanical design information.

4.4 Ground-borne noise and vibration impact from MetroWest

The proposed development is located within the close vicinity of MetroWest rail alignment as show in Figure 5 below.

The approximate metro alignment is shown in a section view as per below. The Metro train alignment is located underground at approximately 30m.

Figure 4 Location of the Sydney Metro west alignment in relation to proposed development

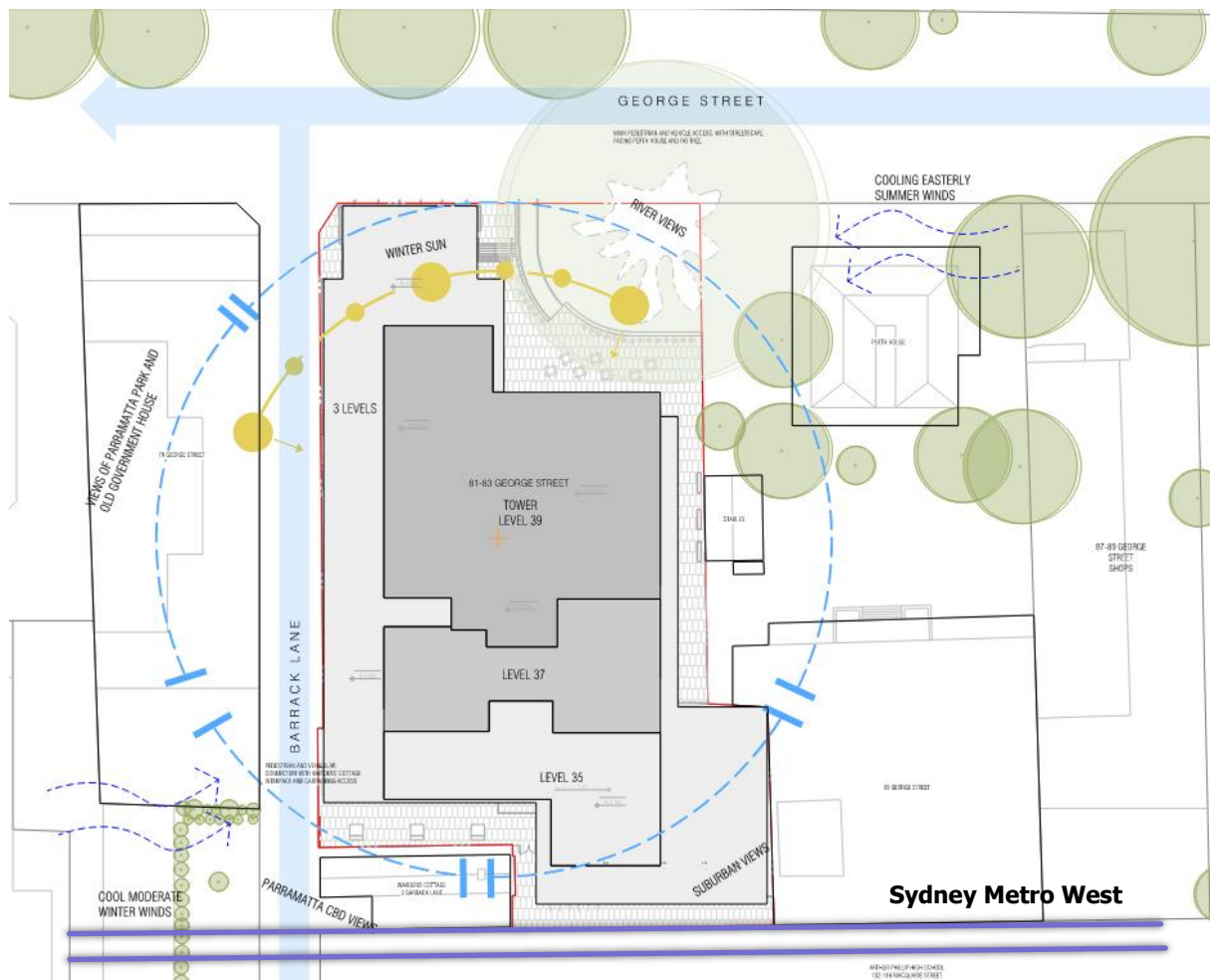
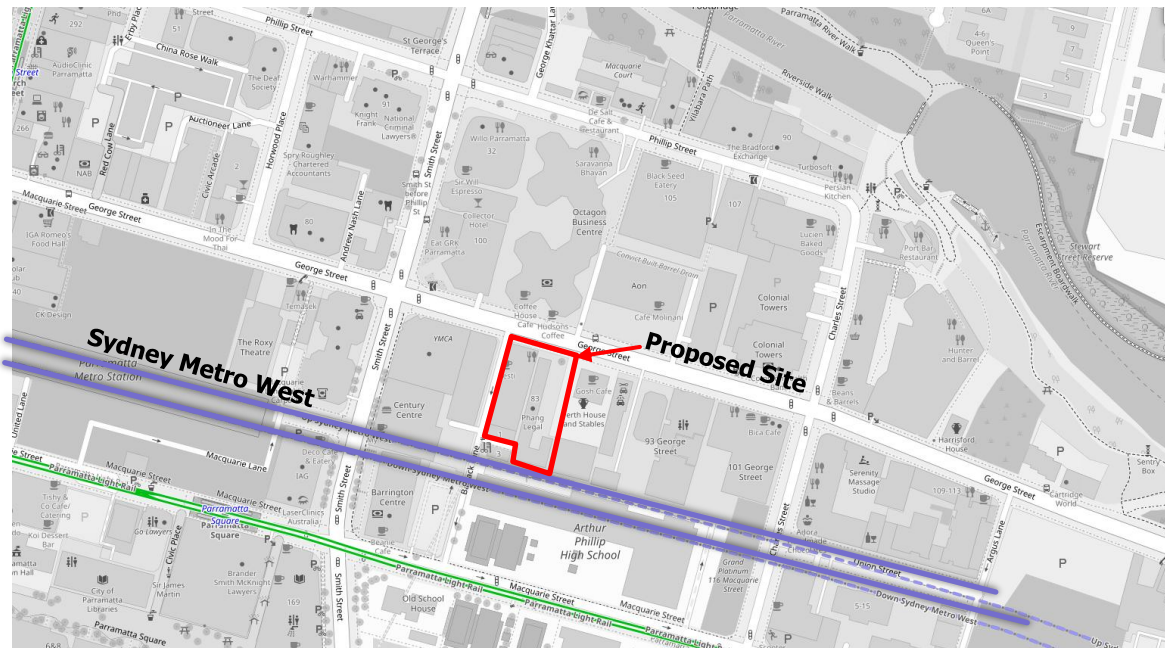


Figure 5 Location of the Sydney Metro west alignment in relation to proposed development



Review of the Sydney Metro West Environmental Impact Statement (EIS) for the proposed development located near the metro alignment. The review has specifically considered EIS Technical Paper 3 – Operational Noise and Vibration as the reference document.

Detailed vibration sources used in the prediction are detailed below Figure 6.

Figure 6 Vibration source spectra

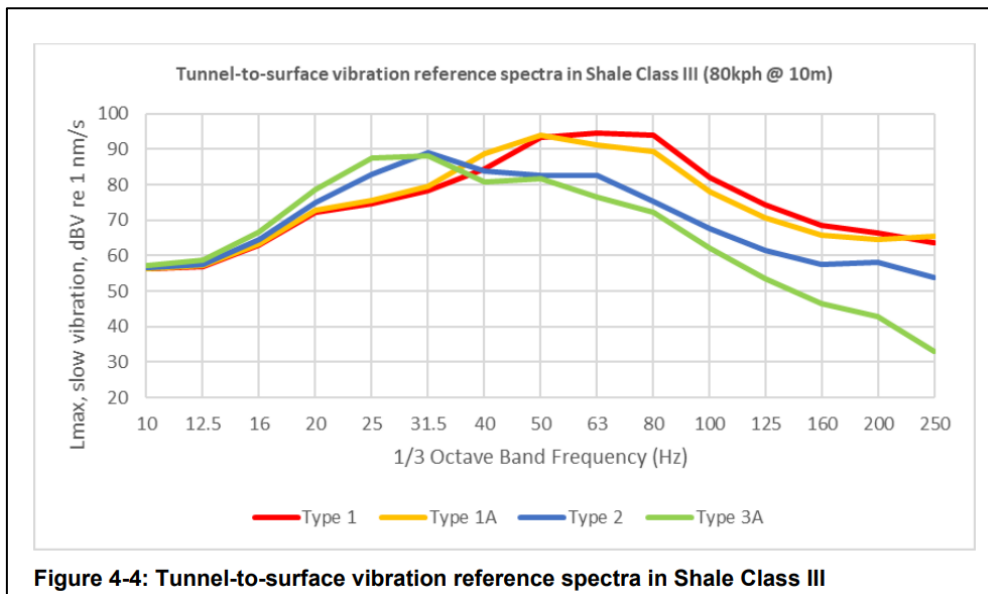


Figure 4-4: Tunnel-to-surface vibration reference spectra in Shale Class III

Based on the prediction levels provided in the EIS for ground-borne noise at the proposed development location, the predicted L_{max} at ground level is between 40–45 dB(A) when using Type 1 track with standard attenuation (rail fasteners with static stiffness of 22 kN/mm, dynamic stiffness of 26.4 kN/mm, and rail pad stiffness in the range of 450–500 kN/mm).

However, Section 6 of the *EIS Technical Paper 3 – Operational Noise and Vibration* identifies mitigation measures for the up and down track in proximity to the proposed development location, recommending the use of Type 2 track form, which provide high attenuation performance, as detailed below.

- **High Attenuation (Type 2):** Rail fasteners with static stiffness 6.5 kN/mm and dynamic stiffness 7.8 kN/mm. Rail pad stiffness in a range from 450 to 500 kN/mm. Shown in Figure 4-2 (i). Type 2A is a similarly performing system however constitutes a booted sleeper with similar stiffnesses. The system comprises Booted sleeper track form with mass of approximately 125 kg/block (approximately 250 kg/sleeper consisting of two blocks), in rigid plastic hulls. Block vertical support pads with a dynamic stiffness of 10 kN/mm per rails each. Rail pad stiffness in a range from 270 to 300 kN/mm. The fasteners are spaced at 650/700 mm centres. This system is illustrated in Figure 4-2 (j).

The EIS modelling indicates that within the section of the alignment between chainage 21,400 and 21,200, the predicted ground-borne noise levels do not exceed the ground borne noise criteria. Accordingly, no additional mitigation measures are required to be implemented for the proposed development.

Based on the existing predictions of ground-borne noise levels along sections of the alignment where exceedances of the criteria are identified, it is evident that Sydney Metro would need to adopt a higher-attenuation track form (such as Type 2 or equivalent) in order to achieve compliance with the EIS noise and vibration requirements. Therefore, no further consideration of vibration isolation is considered.

4.5 Carpark Noise Emissions

It is noted that the carpark is located on level 1 with open façade design. It is expected that noise emissions from the car park will have a negligible impact onto the nearest affected receivers. The driveway access is located on barrack Ln where location of the driveway access is bound by commercial receivers and back of house of Arthur Phillip High School. The noise impact to the surrounding commercial and education receiver are unlikely to be impact due to the usage of the driveway access.

The use of the car lift located on the south boundary the site facing Barrack Lane will be fully enclosed, the operational noise emission from the lift itself have been assessment based on a sound power level of 75 dB(A) Lw. The noise impact to the surrounding commercial and educational receiver will be comply to the established operational noise criteria stated in section 3.2.

The use of the bike lift locate on the south boundary of the site will be using the same driveway of the vehicle on barrack lane. The operational noise emission from the lift itself have been assessment based on a sound power level of 75 dB(A) Lw. The noise impact to the surrounding commercial and educational receiver will be comply to the established operational noise criteria stated in section 3.2.

4.6 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.

There is estimated to be a low level of traffic generation for the proposed development given the limited vehicle parking in the level 1 and 2 of the development. The proposal includes a total of 75 car spaces, is not expected to introduce a large volume of traffic in the area comparing the traffic volume on George Street.

Based on the review of the traffic engineering report for forecast traffic generation and road network impacts per below:

Residential

- AM Peak hour: 0.15 trips per car space
- PM Peak hour: 0.12 trips per car space

Based on the 83 car parking spaces provided it is forecast the proposal would generate the following levels of peak hour traffic movements:

- AM Peak hour: 12 vehicle movements
- PM Peak hour: 10 vehicle movements

This level of traffic generation is minimal – equivalent to one traffic movement every 5 to 6 minutes during peak hours and would not result in any adverse impacts on the surrounding road network nor any operational or safety issues on surrounding key intersections.

On this basis, it can be concluded that the predicted increase in traffic noise due to the proposed development will result in an adverse impact on surrounding receivers. It is expected that the increase in the forecast traffic number will be compliance with the additional traffic criteria derived from section 3.3.

4.7 Noise from use of Car to Barrack Lane

This section of the report details the assessment of potential noise impacts resulting from the use of the Barrack Lane access from vehicles accessing the site. As part of the proposed development there is an accessway which allows for the movement of vehicles into the parking areas and car lift of the project.

A review of the NSW Legislation *Protection of the Environment Operations (Noise Control) Regulation 2017* states the following:

"Division 2 Motor vehicles that emit offensive or other noise

Use of motor vehicles on residential premises

(1) A person is guilty of an offence if—

- (a) the person causes or permits a motor vehicle to be used on residential premises in such a manner that it emits noise that can be heard within any room in any other residential premises (that is not a garage, storage area, bathroom, laundry, toilet or pantry) whether or not any door or window to that room is open—*
 - (i) before 8 am or after 8 pm on any Saturday, Sunday or public holiday, or*
 - (ii) before 7 am or after 8 pm on any other day, and*
- (b) within 7 days of doing so, the person is warned by an authorised officer or enforcement officer not to cause or permit a motor vehicle to be used on residential premises in that manner, and*
- (c) the person again causes or permits a motor vehicle to be used on residential premises in that manner within 28 days after the warning has been given.*

Maximum penalty—100 penalty units in the case of a corporation or 50 penalty units in the case of an individual.

- (2) A person is not guilty of an offence under this clause merely because noise is emitted from the motor vehicle while the motor vehicle is entering or leaving residential premises."*

Therefore, based on the current NSW Legislation, the noise associated with the entering or exiting of motor vehicles within the site is not deemed offensive and does not warrant any additional assessment.

In addition to the review of the policy above a number of acoustic mitigations are recommended to minimise the potential impacts of noise from the proposed vehicle movements on the site to surrounding receivers:

1. There should not be any speed humps or uneven surfaces used for speed control.

2. Any required grates and drains should include fixings to prevent noise resulting from movement of surfaces.

Providing the proposed mitigations listed above are included in the design and construction of the proposed development, the resulting noise emissions from the proposed development will be minimised and the resulting noise emissions will be acoustically acceptable.

4.8 Noise from Communal Areas (Internal and External Spaces)

Noise associated with communal areas is not well addressed in NSW noise policy. The NSW EPA *Noise Policy for Industry* does not address noise from communal areas. As such, to ensure the acoustic amenity is reasonably maintained for the existing surrounding developments, PWNA believe that an $RBL + 5dB(A)$ as a L_{Aeq} approach is acceptable. Adoption of a background + 5 approach is similar to the criteria typically adopted in the assessments of external areas of a licensed venue during the daytime period (noted: NSW Liquor and Gaming use a L_{10} rather than a L_{Aeq}).

The proposed development has both internal and external communal areas including the following:

- Lounges and shared internal amenity spaces at upper podium level of the building.
- Outdoor courtyards at ground level

4.8.1 Assessment of Communal Areas

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

- Single person talking – 69dB(A) L_{Aeq} . Refers to Typical Speech L_w - *Klark Teknik*
- Background music (for internal areas only) – 65dB(A) L_{Aeq} .

4.8.2 Communal Area Acoustic Treatments

Operation of each of the internal and external communal spaces has been assessed at the nearest receivers against the criteria outlined above. To ensure compliance, the following treatments are recommended:

- Background music is only used within internal areas and does not exceed 65dB(A) within the space (i.e., SPL). No playing of amplified music is to be undertaken within the external communal areas after 10:00pm.

4.9 Gym

4.9.1 General Comments

The vibration isolation and operational procedures for the fitness facilities (i.e. gym), should be determined to achieve compliance with the following criteria:

- Vibration criteria discussed in Section 5.2 .
- Maximum allowed structure-borne noise level criteria summarised in Section 3.7.

4.9.2 Acoustic Treatments

As the gym is to be located on the level three (3), as the residential levels are located from level four (4), the need for vibration isolation to protect the amenity of the residential areas above are generally not required due to the transfer level between level 3 and level 4 are spreading the amenity area and residential levels.

Free weights should generally be confined to the gym space, which is below the plant room level, and does not have any residential areas located immediately above or below.

For areas where heavy free weights will be used, a raised floor construction is recommended. Details of the required construction of the isolated raised floor construction will be provided in the detailed design stage, if required.

All other floor areas of the gym should comprise 15mm rubber flooring provided the following is not permitted:

- Use of free weights and battle ropes
- Weight drops

Pin and plate loaded machines should be internally sprung with Embelton NXS-14 springs or equivalent vibration isolation product.

Finally, operational measure for the gym should be implemented whereby weights should not be dropped from heights exceeding 150mm. Nevertheless, in any case, weight drops should be actively discouraged.

The prohibition of operational activities listed above can be enforced as part of operational management procedures.

Detailed review of the construction for compliance with the airborne and impact ratings will be conducted at the Detailed Design stage of the development.

5 CONSTRUCTION VIBRATION ASSESSMENT

5.1 Construction 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.

5.1.1 Vibration Criteria – Building Contents & 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).

5.1.1.1 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 7.

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

Line in Figure 7	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.

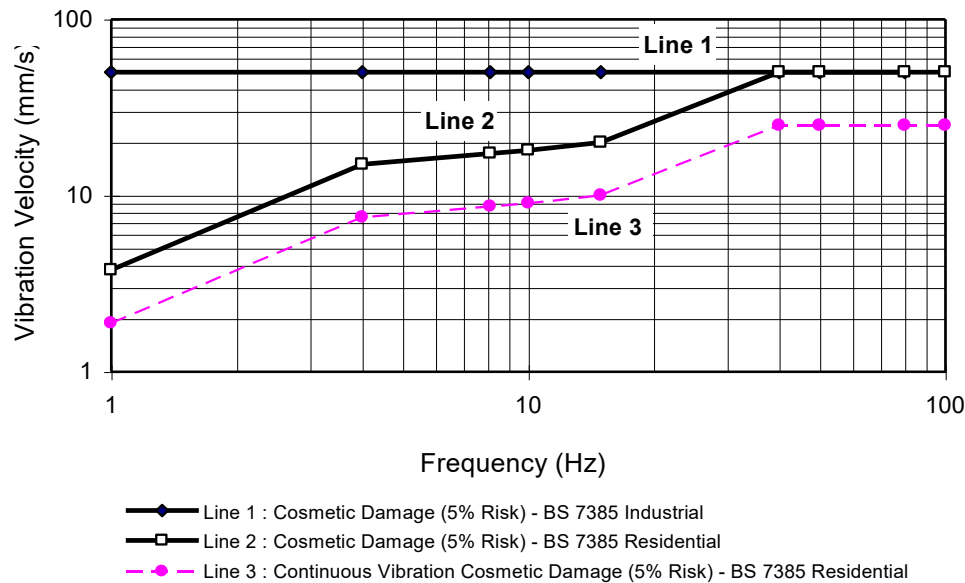
Where the dynamic loading caused by continuous vibration events is such as that results in dynamic magnification due to resonance (especially at the lower frequencies where lower guide values apply), then the values in Table 15 may need to be reduced by up to 50% (refer to Line 3 in Figure 7).

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 Figure 7 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 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 Table 15 should not be reduced for fatigue considerations.

Figure 7 BS 7385 Part 2 – 1993, graph of transient vibration values for cosmetic damage



5.1.1.2 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
<i>Note 1: For frequencies above 100Hz, at least the values specified in this column shall be applied.</i>				

5.2 Vibration Criteria – Human Comfort

Vibration effects relating specifically to the human comfort aspects of the project are taken from the guideline titled "Assessing Vibration – A Technical Guideline" (AVTG). 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 17 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	Day or night-time	0.020	0.014	0.040	0.028
		0.04	0.029	0.080	0.058
Workshops	Day or night-time	0.04	0.029	0.080	0.058

Table 18 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	Day or night-time	0.64	0.46	1.28	0.92
Workshops	Day or night-time	0.64	0.46	1.28	0.92

Table 19 Intermittent vibration impacts criteria (m/s^{1.75}) 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
Workshops	0.80	1.60	0.80	1.60

5.3 Vibration Assessment

In order to maintain compliance with the human comfort vibration criteria, it is recommended that the indicative safe distances listed in table below 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 5.1

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 CONSTRUCTION ACOUSTIC ASSESSMENT

6.1 Construction Noise Assessment

A separate development application has been submitted to Parramatta Council for the demolition works, and the project's construction is proposed to adopt volumetric construction method. As part of the SSDA submission, the noise and vibration impacts associated with the demolition phase have been assessed as part of the overall construction process. Noise and vibration from the demolition and construction works will, however, need to comply with the criteria specified in Section 3.5 of this report. The out-of-hour construction have been proposed for this development, the quantitative assessment for the proposed construction active are detailed in section 6.5.

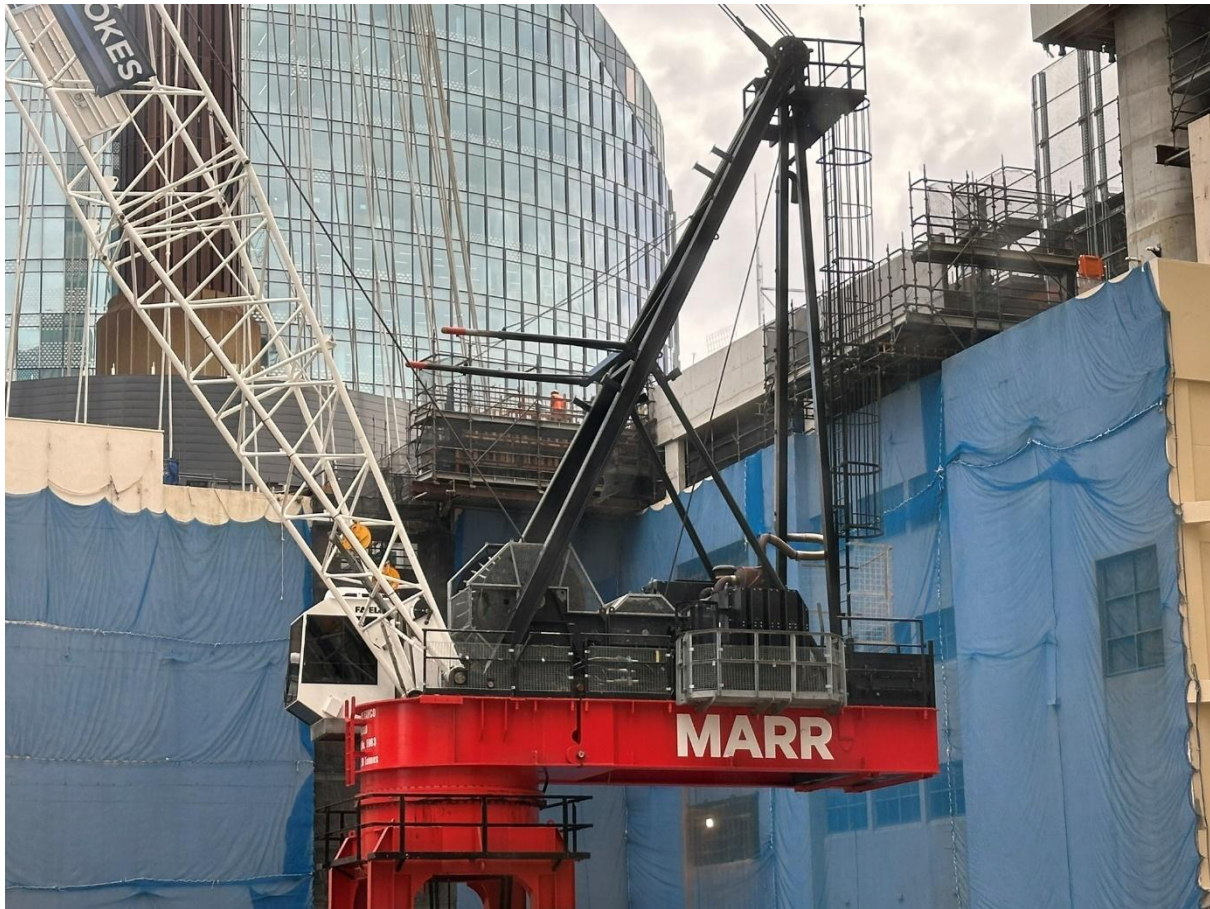
An assessment of demolition and construction activities should be undertaken by the appointed construction contractor. Noise and vibration mitigation measures should be detailed in the contractor's Noise and Vibration Management Plan (NVMP).

6.2 Tower Cranes (TC) Noise – VMC Construction Methodology

One diesel-powered crane will be used for the duration of the project. Noise levels and mitigation measures have been determined based on measurements of similar tower cranes from previous projects. The crane will facilitate the lifting of modular units during the construction of residential levels.

Modelling has indicated that the existing Sound Power Level (L_w) emitted from the crane when lifting and rotating is 115dB(A) L_{A10}.

Figure 8 Example of diesel crane photo from another project



6.3 Standard Construction Noise Scenarios

Sound power levels have been predicted for the construction tasks identified in the project program. The equipment anticipated for use in each task is based on previous project experience of similar development. The sound power levels for the equipment likely to be used for each of the listed tasks are provided in Table 21 below.

Table 21 Summary of predicted sound power levels, dB(A)

Tasks	Equipment	Sound power levels (dBA re 1pW)	Aggregate per task (dBA re 1pW)
Site Establishment Works	Mobile crane	110	113
	Power hand tools	109	
	Semi Rigid Vehicle ¹	105	
Ground Works	Excavator	112	120
	Hydraulic Hammer	118	

Tasks	Equipment	Sound power levels (dBA re 1pW)	Aggregate per task (dBA re 1pW)
	Piling Rig	110	
	Handheld jack hammer ¹	111	
	Dump truck ¹	104	
	Concrete saw ¹	114	
	Skid steer	110	
	Power hand tools	109	
Structure	Tower Crane	115	119
	Handheld jack hammer ¹	106	
	Concrete saw ¹	114	
	Power hand tools	109	
	Welder	101	
	Concrete pump truck	110	
	Concrete agitator truck	108	
Internal Works	Power hand tools (VMC Install)	109	109
Common and External Works	Concrete agitator truck	108	114
	Saw cutter ¹	104	
	Dump truck ¹	104	
	Concrete saw ¹	114	
	Power hand tools	109	
Note 1: An assumed time correction has been applied, this being 5 minutes of operation in any 15-minute interval.			

6.4 Predicted Standard Construction noise impacts

An assessment of the expected construction noise impacts has been assessed using the ISO9613 noise propagation algorithm. The assessment has been based on the expected noise levels to be generated on the site including those detailed in the Section above. Calculations of the resulting construction noise levels of the receivers within proximity to the site is detailed in the table below.

The predicted standard construction noise impacts have been assessed in accordance with the NSW Environment Protection Authority's (EPA) Noise Policy for Industry (NPI) and the Interim Construction Noise Guideline (ICNG). The assessment considers typical construction activities associated with the proposed volumetric construction methodology, which differs from conventional construction approaches in both duration and intensity of site activities.

Under the volumetric construction method, building modules are largely pre-fabricated off-site, reducing the need for prolonged on-site structural works, material handling, and large-scale concrete pouring. As a result, the overall construction duration is significantly shortened, and the on-site noise exposure period for surrounding receivers is reduced.

Overall, the adoption of volumetric construction is expected to result in lower cumulative construction noise impacts for the project, provided that standard best-practice noise management and scheduling measures are maintained. However, standard construction phase still applies for ground to level 3 where typical construction activities have been considered.

Table 22 Predicted construction noise impacts, $L_{Aeq,15min}$ dB(A) – Sensitive Receiver R1

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA L _{A10 15 minutes}	Predicted Combined Noise Level at Receiver dBA L _{Aeq 15 minutes}	Criteria dBA L _{A10 15 minutes}	Summary of Result
Site Establishment Works	Mobile crane	113	58 to 78	61 to 81	<u>Monday to Friday</u> and	Predicted noise levels indicate exceedances above formulated NML are likely. Recommended mitigation measures to minimise acoustic impacts are outlined below. Refer to section 6.9.
	Power hand tools		57 to 77			
	Semi Rigid Vehicle		48 to 68			
Ground Works	Excavator	120	60 to 80	65 to 85	<u>Saturday</u> 08:00-13:00 (applies when properties are being used). 45 dB(A) Internal 65 dB(A) External Active recreation areas	
	Hydraulic Hammer		66 to 86			
	Piling Rig		58 to 78			
	Handheld jack hammer		54 to 74			
	Dump truck		47 to 67			
	Concrete saw		57 to 77			
	Skid steer		58 to 78			
	Power hand tools		57 to 77			
Structure	Tower Crane	119	64 to 84	67 to 87		
	Handheld jack hammer		49 to 69			
	Concrete saw		57 to 77			
	Power hand tools		57 to 77			
	Welder		49 to 69			
	Concrete pump truck		58 to 78			
	Concrete agitator truck		56 to 76			
Internal Works	Power hand tools	109	52 to 72	52 to 72		
Common and External Works	Concrete agitator truck	114	56 to 76	62 to 82		
	Saw cutter		47 to 67			
	Dump truck		47 to 67			
	Concrete saw		57 to 77			

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted <u>Individual</u> Noise Level at Receiver dBA L_{A10} 15 minutes	Predicted <u>Combined</u> Noise Level at Receiver dBA L_{Aeq} 15 minutes	Criteria dBA L_{A10} 15 minutes	Summary of Result
	Power hand tools		57 to 77			

Table 23 Predicted construction noise impacts, $L_{Aeq,15min}$ dB(A) – Sensitive Receiver R3

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted <u>Individual</u> Noise Level at Receiver dBA L_{A10} 15 minutes	Predicted <u>Combined</u> Noise Level at Receiver dBA L_{Aeq} 15 minutes	Criteria dBA L_{A10} 15 minutes	Summary of Result
Site Establishment Works	Mobile crane	113	72 to 82	75 to 85	<u>Monday to Friday</u>	Predicted noise levels indicate exceedances above formulated NML are likely. Recommended mitigation measures to minimise acoustic impacts are outlined below. Refer to section 6.9
	Power hand tools		71 to 81		<u>07:00-18:00</u> (BG+10dBA) :	
	Semi Rigid Vehicle		63 to 72			
Ground Works	Excavator	120	74 to 84	79 to 89	and	
	Hydraulic Hammer		80 to 90		<u>Saturday</u>	
	Piling Rig		72 to 82		<u>08:00-13:00</u> (BG+10dBA) :	
	Handheld jack hammer		69 to 78		70 dBA	
	Dump truck		62 to 71			
	Concrete saw		72 to 81			
	Skid steer		72 to 82			
	Power hand tools		71 to 81			
Structure	Tower Crane	119	78 to 88	81 to 91		
	Handheld jack hammer		64 to 73			
	Concrete saw		72 to 81			
	Power hand tools		71 to 81			
	Welder		63 to 73			
	Concrete pump truck		72 to 82			
	Concrete agitator truck		70 to 80			

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted <u>Individual</u> Noise Level at Receiver dBA $L_{A10\ 15\ minutes}$	Predicted <u>Combined</u> Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{A10\ 15\ minutes}$	Summary of Result
Internal Works	Power hand tools	109	66 to 76	66 to 76		
Common and External Works	Concrete agitator truck	114	70 to 80	76 to 86		
	Saw cutter		62 to 71			
	Dump truck		62 to 71			
	Concrete saw		72 to 81			
	Power hand tools		71 to 81			

Table 24 Predicted construction noise impacts, $L_{Aeq,15min}$ dB(A) – Sensitive Receiver R4

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{A10\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{A10\ 15\ minutes}$	Summary of Result	
Site Establishment Works	Mobile crane	113	72 to 82	75 to 85	Monday to Friday	Predicted noise levels indicate exceedances above formulated NML are likely. Recommended mitigation measures to minimise acoustic impacts are outlined below. Refer to section 6.9.	
	Power hand tools		71 to 81		07:00-18:00 $(BG+10dBA)$		
	Semi Rigid Vehicle		63 to 72				
Ground Works	Excavator	120	74 to 84	79 to 89	and		
	Hydraulic Hammer		80 to 90		Saturday		
	Piling Rig		72 to 82				08:00-13:00 $(BG+10dBA)$
	Handheld jack hammer		69 to 78		70 dBA		
	Dump truck		62 to 71				
	Concrete saw		72 to 81				
	Skid steer		72 to 82				
	Power hand tools		71 to 81				
Structure	Tower Crane	119	78 to 88				

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA L _{A10 15 minutes}	Predicted Combined Noise Level at Receiver dBA L _{Aeq 15 minutes}	Criteria dBA L _{A10 15 minutes}	Summary of Result
	Handheld jack hammer		64 to 73	81 to 91		
	Concrete saw		72 to 81			
	Power hand tools		71 to 81			
	Welder		63 to 73			
	Concrete pump truck		72 to 82			
	Concrete agitator truck		70 to 80			
Internal Works	Power hand tools	109	66 to 76	66 to 76		
Common and External Works	Concrete agitator truck	114	70 to 80	76 to 86		
	Saw cutter		62 to 71			
	Dump truck		62 to 71			
	Concrete saw		72 to 81			
	Power hand tools		71 to 81			

Table 25 Predicted construction noise impacts, $L_{Aeq,15min}$ dB(A) – Sensitive Receiver R5,R6 and R7

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{A10\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{A10\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	113	56 to 57	59 to 60	Monday to Friday	Predicted noise levels indicate exceedances above formulated NML are likely. Recommended mitigation measures to minimise acoustic impacts are outlined below. Refer to section 6.9.
	Power hand tools		55 to 56		07:00-18:00 (BG+10dBA)	
	Semi Rigid Vehicle		46 to 47			
Ground Works	Excavator	120	58 to 59	63 to 64	and	
	Hydraulic Hammer		64 to 65		Saturday	
	Piling Rig		56 to 57		08:00-13:00 (BG+10dBA)	
	Handheld jack hammer		52 to 53		59 dBA	
	Dump truck		45 to 46			
	Concrete saw		55 to 56			
	Skid steer		56 to 57			
	Power hand tools		55 to 56			
Structure	Tower Crane	119	62 to 63	65 to 66		
	Handheld jack hammer		47 to 48			
	Concrete saw		55 to 56			
	Power hand tools		55 to 56			
	Welder		47 to 48			
	Concrete pump truck		56 to 57			
	Concrete agitator truck		54 to 55			
Internal Works	Power hand tools	109	50 to 51	50 to 51		
Common and External Works	Concrete agitator truck	114	54 to 55	60 to 61		
	Saw cutter		45 to 46			
	Dump truck		45 to 46			
	Concrete saw		55 to 56			

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted <u>Individual</u> Noise Level at Receiver dBA L_{A10} 15 minutes	Predicted <u>Combined</u> Noise Level at Receiver dBA L_{Aeq} 15 minutes	Criteria dBA L_{A10} 15 minutes	Summary of Result
	Power hand tools		55 to 56			

Table 26 Predicted construction noise impacts, $L_{Aeq,15min}$ dB(A) – Sensitive Receiver R8

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted <u>Individual</u> Noise Level at Receiver dBA L_{A10} 15 minutes	Predicted <u>Combined</u> Noise Level at Receiver dBA L_{Aeq} 15 minutes	Criteria dBA L_{A10} 15 minutes	Summary of Result		
Site Establishment Works	Mobile crane	113	55 to 57	58 to 60	<u>Monday to Friday</u>	Predicted noise levels indicate exceedances above formulated NML are likely. Recommended mitigation measures to minimise acoustic impacts are outlined below. Refer to section 6.9		
	Power hand tools		54 to 56		07:00-18:00 $(BG+10dBA)$:			
	Semi Rigid Vehicle		46 to 48					
Ground Works	Excavator	120	57 to 59	62 to 64	and			
	Hydraulic Hammer		63 to 65		<u>Saturday</u>			
	Piling Rig		55 to 57				08:00-13:00 $(BG+10dBA)$:	
	Handheld jack hammer		52 to 54					59 dBA
	Dump truck		45 to 47					
	Concrete saw		55 to 57					
	Skid steer		55 to 57					
	Power hand tools		54 to 56					
Structure	Tower Crane	119	61 to 63	64 to 66				
	Handheld jack hammer		47 to 49					
	Concrete saw		55 to 57					
	Power hand tools		54 to 56					
	Welder		46 to 48					
	Concrete pump truck		55 to 57					
	Concrete agitator truck		53 to 55					

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted <u>Individual</u> Noise Level at Receiver dBA $L_{A10\ 15\ minutes}$	Predicted <u>Combined</u> Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{A10\ 15\ minutes}$	Summary of Result
Internal Works	Power hand tools	109	49 to 51	49 to 51		
Common and External Works	Concrete agitator truck	114	53 to 55	59 to 61		
	Saw cutter		45 to 47			
	Dump truck		45 to 47			
	Concrete saw		55 to 57			
	Power hand tools		54 to 56			

Table 27 Predicted construction noise impacts, $L_{Aeq,15min}$ dB(A) – Sensitive Receiver R9

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted <u>Individual</u> Noise Level at Receiver dBA $L_{A10\ 15\ minutes}$	Predicted <u>Combined</u> Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{A10\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	113	59 to 60	62 to 63	<u>Monday to Friday</u>	Predicted noise levels indicate exceedances above formulated NML are likely. Recommended mitigation measures to minimise acoustic impacts are outlined below. Refer to section 6.9
	Power hand tools		58 to 59		<u>07:00-18:00</u> (BG+10dBA)	
	Semi Rigid Vehicle		49 to 50			
Ground Works	Excavator	120	61 to 62	66 to 67	and	
	Hydraulic Hammer		67 to 68		<u>Saturday</u>	
	Piling Rig		59 to 60		<u>08:00-13:00</u> (BG+10dBA)	
	Handheld jack hammer		55 to 56		59 dBA	
	Dump truck		48 to 49			
	Concrete saw		58 to 59			
	Skid steer		59 to 60			
	Power hand tools		58 to 59			
Structure	Tower Crane	119	65 to 66	68 to 69		
	Handheld jack hammer		50 to 51			

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted <u>Individual</u> Noise Level at Receiver dBA L_{A10 15 minutes}	Predicted <u>Combined</u> Noise Level at Receiver dBA L_{Aeq 15 minutes}	Criteria dBA L_{A10 15 minutes}	Summary of Result
	Concrete saw		58 to 59			
	Power hand tools		58 to 59			
	Welder		50 to 51			
	Concrete pump truck		59 to 60			
	Concrete agitator truck		57 to 58			
Internal Works	Power hand tools	109	53 to 54	53 to 54		
Common and External Works	Concrete agitator truck	114	57 to 58	63 to 64		
	Saw cutter		48 to 49			
	Dump truck		48 to 49			
	Concrete saw		58 to 59			
	Power hand tools		58 to 59			

Table 28 Predicted construction noise impacts, L_{Aeq,15min} dB(A) – Sensitive Receiver R10

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA L _{A10 15 minutes}	Predicted Combined Noise Level at Receiver dBA L _{Aeq 15 minutes}	Criteria dBA L _{A10 15 minutes}	Summary of Result	
Site Establishment Works	Mobile crane	113	58 to 65	61 to 68	<u>Monday to Friday</u>	Predicted noise levels indicate exceedances above formulated NML are likely. Recommended mitigation measures to minimise acoustic impacts are outlined below. Refer to section 6.9	
	Power hand tools		57 to 64		<u>07:00-18:00</u>		
	Semi Rigid Vehicle		49 to 55				
Ground Works	Excavator	120	60 to 67	65 to 72	and		
	Hydraulic Hammer		66 to 73		<u>Saturday</u>		
	Piling Rig		58 to 65		<u>08:00-13:00:</u>		
	Handheld jack hammer		55 to 61				
	Dump truck		48 to 54				

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{A10\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{A10\ 15\ minutes}$	Summary of Result
	Concrete saw		58 to 64		35 dB(A) Internal	
	Skid steer		58 to 65			
	Power hand tools		57 to 64			
Structure	Tower Crane	119	64 to 71	67 to 74		
	Handheld jack hammer		50 to 56			
	Concrete saw		58 to 64			
	Power hand tools		57 to 64			
	Welder		49 to 56			
	Concrete pump truck		58 to 65			
	Concrete agitator truck		56 to 63			
Internal Works	Power hand tools	109	52 to 59	52 to 59		
Common and External Works	Concrete agitator truck	114	56 to 63	62 to 69		
	Saw cutter		48 to 54			
	Dump truck		48 to 54			
	Concrete saw		58 to 64			
	Power hand tools		57 to 64			

Table 29 Predicted construction noise impacts, $L_{Aeq,15min}$ dB(A) – Sensitive Receiver R11

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted <u>Individual</u> Noise Level at Receiver dBA $L_{A10\ 15\ minutes}$	Predicted <u>Combined</u> Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{A10\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	113	59 to 73	62	<u>Monday to Friday</u> and	Predicted noise levels indicate exceedances above formulated NML are likely. Recommended mitigation measures to minimise
	Power hand tools		58 to 72			
	Semi Rigid Vehicle		49 to 64			

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA L _{A10 15 minutes}	Predicted Combined Noise Level at Receiver dBA L _{Aeq 15 minutes}	Criteria dBA L _{A10 15 minutes}	Summary of Result
Ground Works	Excavator	120	61 to 75	66	Saturday <u>08:00-13:00</u> (applies when properties are being used). 45 dB(A) Internal	acoustic impacts are outlined below. Refer to section 6.9
	Hydraulic Hammer		67 to 81			
	Piling Rig		59 to 73			
	Handheld jack hammer		55 to 70			
	Dump truck		48 to 63			
	Concrete saw		58 to 73			
	Skid steer		59 to 73			
	Power hand tools		58 to 72			
Structure	Tower Crane	119	65 to 79	68		
	Handheld jack hammer		50 to 65			
	Concrete saw		58 to 73			
	Power hand tools		58 to 72			
	Welder		50 to 64			
	Concrete pump truck		59 to 73			
	Concrete agitator truck		57 to 71			
Internal Works	Power hand tools	109	53 to 67	53		
Common and External Works	Concrete agitator truck	114	57 to 71	63		
	Saw cutter		48 to 63			
	Dump truck		48 to 63			
	Concrete saw		58 to 73			
	Power hand tools		58 to 72			

6.5 Out-of-Hour Work (OOH)

The proponent is seeking approval for additional out-of-hours (OOH) work to facilitate the installation of modular container units using a Modern Method of Construction (MMC) approach. The proposed development will adopt a Volumetric Modular Construction (VMC) methodology, a delivery method that utilises prefabricated modules constructed off-site and assembled on-site.

Extended construction hours are required to enable the efficient installation of these modules. The proposed out-of-hours work periods have been considered as part of this assessment and relate to construction activities undertaken outside standard construction hours, including the lifting and placement of fully finished volumetric modules using a tower crane.

The proponent is seeking construction hours as below:

Monday to Friday 7:00 am to 12:00 am midnight.

Saturday 8:00 am to 6:00 pm

Sunday 8:00 am to 6:00 pm

The proponent has addressed in this report prepared under the environmental impact assessment (EIA) process any expected need to undertake work outside the standard hours. This section of the report looks at the requirements under the EIA process allows community views to be considered and associated noise impact to be adequately justified.

A summarised OOH assessment criteria are detailed in below section.

6.5.1 Summary of relevant OOH assessment criteria

Outlined below is the summary of relevant acoustic criteria to be adopted for the proposed extended construction hours:

Table 30 Summary of relevant OOH criteria

Day	Time Period	Element	Criteria
Monday to Friday	From the approved standard hours through to midnight	Airborne Noise	Background Noise Level + 5dB(A), externally
		Construction Traffic	50 dB(A) LAeq (1-hour), External ¹
		Vibration	- Human Comfort Criteria, established in accordance with NSW DECC Assessing Vibration: A Technical Guideline (2006) - Structural Damage Criteria, established in accordance with German Standard DIN 4150-Part 3 and British Standard BS 7385-2:1993
Saturday	8:00am to 6:00pm	Airborne Noise	Background Noise Level + 5dB(A), externally
		Construction Traffic	50 dB(A) LAeq (1-hour), External
		Vibration	- Human Comfort Criteria, established in accordance with NSW DECC Assessing Vibration: A Technical Guideline (2006). - Structural Damage Criteria, established in accordance with German Standard DIN 4150-Part 3 and British Standard BS 7385-2:1993
Sunday	8:00 am to 6:00pm	Airborne Noise	Background Noise Level + 5dB(A), externally
		Construction Traffic	50 dB(A) LAeq (1-hour), External
		Vibration	Human Comfort Criteria, established in accordance with NSW DECC Assessing Vibration: A Technical Guideline (2006).

Day	Time Period	Element	Criteria
			Structural Damage Criteria, established in accordance with German Standard DIN 4150-Part 3 and British Standard BS 7385-2:1993.
Note 1: Table 3 Road Noise Policy: Road traffic noise assessment criteria for residential land uses for local roads (existing residences affected by additional traffic on existing local roads generated by land use developments)			

6.5.2 Construction Noise Assessment

The assessment of airborne noise from the operation of the proposed construction activities during the extended construction hours are detailed below. This section discusses the multiple construction scenarios which will occur for the remainder of the project as well as the assumed noise level for the proposed construction activities to be undertaken during the extended hours.

6.5.3 Construction Scenarios

In undertaking the extended of hours assessment detailed below the listed construction activities being proposed for the extension periods have been assessed at four (4) different building height to reflect the life of the project and its growth into the Parramatta skyline. The four (4) different scenarios are detailed below.

- **Scenario 1:**
 - Construction of Ground level to podium level 4.
 - Assumed highest RL is 36.5
- **Scenario 2:**
 - Construction of level 4 through to Level 15.
 - Assumed highest RL is 71.7.
- **Scenario 3:**
 - Construction of Level 15 through to Level 30.
 - Assumed highest RL is 119.7.
- **Scenario 4:**
 - Construction of Level 30 through to Level 42.
 - Assumed highest RL is 158.1.

6.5.4 Equipment Noise Levels

Outlined below are the assumed noise levels which form the basis of the construction noise assessment. The noise levels in the assessment are based on a combination of measured sample noise measurements of the onsite diesel tower cranes and sound pressure levels within the construction loading dock located along George Street. Each are discussed below.

6.5.5 Diesel Crane Noise Levels

On-site noise measurements were undertaken with one diesel Tower Crane (TC) in operation. The measurements were undertaken on the rooftop of the adjacent roof with a direct line of the site to the crane deck which contains the diesel engine, cable barrel and driver's compartment. Utilising the project drawings (architectural, survey and crane drawings) we were able to calculate accurately back to determine the resulting sound power levels for each of the listed activities below.

- Idle: 105dB(A) Lw
- Rotation (no barrel movement): 105dB(A) Lw
- Stationary, cable out (lowering): 111dB(A) Lw
- Stationary, cable in (lifting under load): 114dB(A) Lw
- Rotating, cable out (lowering): 111dB(A) Lw
- **Rotating, cable in (lifting under load): 115dB(A) Lw**

Noise measurements were undertaken using TC, which is a FAVCO M630D type crane. As such the measured noise levels from TC are considered a worst-case scenario.

6.5.6 Loading Dock Noise Level

Noise levels obtained on a similar project site during the use of the loading dock which included a truck within the loading dock and bobcat & forklift moving materials in and out results in a sound pressure level within the space of 90dB(A) L_{A10} .

6.5.7 Assessment Sound Power Levels

The sound power levels for the equipment likely to be used for each of the listed tasks are provided in Table 31 below.

Table 31 Summary of predicted sound power levels

Scenario	Equipment	Sound Power Levels - Lw dB(A)
Scenario 1 (S1) – Relative level 36.5	Diesel Tower Cranes (TC)	115 (single crane)
	Volumetric Module Installations (VMI)	106
	Erection and Movement of Jump Form (JF)	95
	Ground Level Construction Loading Dock (LD)	90
Scenario 2 (S2) Relative level 71.7	Diesel Tower Cranes (TC)	115 (single crane)
	Volumetric Module Installations (VMI)	106
	Erection and Movement of Jump Form (JF)	95
	Ground Level Construction Loading Dock (LD)	90
Scenario 3 (S3) Relative level 119.7	Diesel Tower Cranes (TC)	115 (single crane)
	Volumetric Module Installations (VMI)	106
	Erection and Movement of Jump Form (JF)	95
	Ground Level Construction Loading Dock (LD)	90
Scenario 4 (S4) Relative level 158.1	Diesel Tower Cranes (TC)	115 (single crane)
	Volumetric Module Installations (VMI)	106
	Erection and Movement of Jump Form (JF)	95
	Ground Level Construction Loading Dock (LD)	90

6.5.8 Predicted Construction Noise Levels

Noise generated by the site has been modelled using SoundPLAN v9.1, using the ISO9613 noise modelling algorithm. This algorithm was selected to calculate the worst-case downwind noise propagation, calculating the reasonable worst-case noise impacts.

3D façade noise mapping of each scenario for each sensitive receiver are provided in Appendix D (Façade noise mapping).

6.5.9 Result Summary of Noise Assessment

Based on the results presented in the assessment in sections 6.5.7 above, the proposed construction activities are compliant with the noise management levels established in this report. Noting that further acoustic treatment is required for the proposed Tower Crane.

Based on this, the following extended hours are proposed:

Table 32 Summary of Extended Construction Hours

Day	Proposed extended Construction Hours	Summary of Daily Extension
Monday	From the approved standard hours through to 12:00 am midnight	• 2 additional hours in the night period • 3 additional hours in the evening
Tuesday	From the approved standard hours through to 12:00 am midnight	• 2 additional hours in the night period • 3 additional hours in the evening
Wednesday	From the approved standard hours through to 12:00 am midnight	• 2 additional hours in the night period • 3 additional hours in the evening
Thursday	From the approved standard hours through to 12:00 am midnight	• 2 additional hours in the night period • 3 additional hours in the evening
Friday	From the approved standard hours through to 12:00 am midnight	• 2 additional hours in the night period • 3 additional hours in the evening
Saturday	8:00am to 6:00pm	• 5 additional hours in the day period
Sunday	8:00 am to 6:00pm	• 10 additional hours in the day period
Public Holidays	No work	No work

In conjunction with the proposed standard hours detailed above, the following list of construction activities are to only be during the proposed extended construction hours:

- Use of the tower crane.
- General materials handling within site.
- Use of the ground level loading dock area along George Street for the loading and unloading from trucks.
- Establishment and movement of the structural core jump form. This including climbing formwork systems.

In addition, the recommended noise and vibration mitigation measures detailed below in section 6.9 are to be implemented to ensure compliance with the project NML's.

Summary of the noise assessment for the proposed OOH work is presented below.

Table 33 Summary of predicted construction noise levels for OOH – dB(A)

Floor	Name	Criteria	S1 - TC1	S2 - TC1	S3 - TC1	S4 - TC1	S1 - VMI	S2 - VMI	S3 - VMI	S4 - VMI	S1 - JF	S2 - JF	S3 - JF	S4 - JF	S1 - LD	S2 - LD	S3 - LD	S4 - LD	Compliance?
F1	R1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Educational receiver (Not operational during OOH)
F1	R2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(future mix use under development application, not assessed)
F1	R3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Commercial (Not operational during OOH)
F1	R4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Commercial (Not operational during OOH)
F1	R5	BG+5	53	59	59	58	44	48	50	49	33	39	39	38	28	34	34	33	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F2	R5	BG+5	54	60	59	58	45	50	50	49	34	40	39	38	29	35	34	33	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F3	R5	BG+5	54	60	59	58	45	51	50	49	34	40	39	38	29	35	34	33	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F4	R5	BG+5	55	60	59	58	45	50	50	49	35	40	39	38	30	35	34	33	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F5	R5	BG+5	56	60	59	58	45	51	50	49	36	40	39	38	31	35	34	33	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F6	R5	BG+5	57	60	59	58	46	51	50	49	37	40	39	38	32	35	34	33	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F7	R5	BG+5	59	60	59	58	46	51	50	49	39	40	39	38	34	35	34	33	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F8	R5	BG+5	61	60	59	58	46	51	50	49	41	40	39	38	36	35	34	33	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F9	R5	BG+5	62	60	59	58	47	51	50	49	42	40	39	38	37	35	34	33	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F10	R5	BG+5	62	60	59	58	48	51	50	49	42	40	39	38	37	35	34	33	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F11	R5	BG+5	63	60	59	58	51	51	50	49	43	40	39	38	38	35	34	33	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F12	R5	BG+5	63	60	59	58	51	51	50	49	43	40	39	38	38	35	34	33	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7

Floor	Name	Criteria	S1 - TC1	S2 - TC1	S3 - TC1	S4 - TC1	S1 - VMI	S2 - VMI	S3 - VMI	S4 - VMI	S1 - JF	S2 - JF	S3 - JF	S4 - JF	S1 - LD	S2 - LD	S3 - LD	S4 - LD	Compliance?
F13	R5	BG+5	63	60	59	58	51	51	50	49	43	40	39	38	38	35	34	33	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F14	R5	BG+5	63	60	59	59	52	51	50	49	43	40	39	39	38	35	34	34	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F1	R6	BG+5	39	49	58	57	29	37	43	48	19	29	38	37	14	24	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F2	R6	BG+5	39	49	58	57	29	37	45	48	19	29	38	37	14	24	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F3	R6	BG+5	39	49	58	57	30	37	47	48	19	29	38	37	14	24	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F4	R6	BG+5	39	50	58	57	30	38	48	48	19	30	38	37	14	25	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F5	R6	BG+5	39	50	58	57	30	38	49	48	19	30	38	37	14	25	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F6	R6	BG+5	43	50	58	57	30	38	48	48	23	30	38	37	18	25	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F7	R6	BG+5	43	51	58	57	30	39	49	48	23	31	38	37	18	26	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F8	R6	BG+5	44	52	58	57	30	39	49	48	24	32	38	37	19	27	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F9	R6	BG+5	49	54	58	57	31	40	49	48	29	34	38	37	24	29	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F10	R6	BG+5	49	56	58	57	32	41	49	48	29	36	38	37	24	31	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F11	R6	BG+5	49	59	58	57	33	44	49	48	29	39	38	37	24	34	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F12	R6	BG+5	49	58	58	57	35	46	49	48	29	38	38	37	24	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F13	R6	BG+5	50	59	58	57	40	49	49	48	30	39	38	37	25	34	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7

Floor	Name	Criteria	S1 - TC1	S2 - TC1	S3 - TC1	S4 - TC1	S1 - VMI	S2 - VMI	S3 - VMI	S4 - VMI	S1 - JF	S2 - JF	S3 - JF	S4 - JF	S1 - LD	S2 - LD	S3 - LD	S4 - LD	Compliance?
F14	R6	BG+5	51	59	58	57	45	49	49	48	31	39	38	37	26	34	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F15	R6	BG+5	52	59	58	57	46	49	49	48	32	39	38	37	27	34	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F16	R6	BG+5	57	59	58	57	47	49	49	48	37	39	38	37	32	34	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F17	R6	BG+5	59	59	58	57	44	49	49	48	39	39	38	37	34	34	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F18	R6	BG+5	60	59	58	57	46	49	49	48	40	39	38	37	35	34	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F19	R6	BG+5	60	58	58	57	47	49	49	48	40	38	38	37	35	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F20	R6	BG+5	60	58	58	57	48	49	49	48	40	38	38	37	35	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F21	R6	BG+5	61	58	58	57	49	49	49	48	41	38	38	37	36	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F22	R6	BG+5	61	58	58	57	50	49	49	48	41	38	38	37	36	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F23	R6	BG+5	59	58	58	57	50	49	49	48	39	38	38	37	34	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F24	R6	BG+5	59	58	58	57	51	49	49	48	39	38	38	37	34	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F25	R6	BG+5	59	58	58	57	51	49	49	48	39	38	38	37	34	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F26	R6	BG+5	59	58	58	57	51	49	49	48	39	38	38	37	34	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F27	R6	BG+5	58	58	58	57	51	49	49	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F28	R6	BG+5	58	58	58	57	51	49	49	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7

Floor	Name	Criteria	S1 - TC1	S2 - TC1	S3 - TC1	S4 - TC1	S1 - VMI	S2 - VMI	S3 - VMI	S4 - VMI	S1 - JF	S2 - JF	S3 - JF	S4 - JF	S1 - LD	S2 - LD	S3 - LD	S4 - LD	Compliance?
F29	R6	BG+5	58	58	58	57	51	49	49	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F30	R6	BG+5	58	58	58	57	51	49	49	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F31	R6	BG+5	58	58	58	57	50	49	49	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F32	R6	BG+5	58	58	58	57	50	49	49	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F33	R6	BG+5	58	58	58	57	50	49	49	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F34	R6	BG+5	58	58	58	57	50	49	49	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F35	R6	BG+5	58	58	58	57	50	49	48	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F36	R6	BG+5	58	58	58	57	50	49	48	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F37	R6	BG+5	58	58	58	57	50	49	48	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F38	R6	BG+5	58	58	58	57	49	49	48	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F39	R6	BG+5	58	58	58	57	49	49	48	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F40	R6	BG+5	58	58	58	57	48	48	48	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F41	R6	BG+5	58	58	58	57	48	48	48	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F42	R6	BG+5	58	58	58	57	48	48	48	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F43	R6	BG+5	58	58	58	57	48	48	48	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7

Floor	Name	Criteria	S1 - TC1	S2 - TC1	S3 - TC1	S4 - TC1	S1 - VMI	S2 - VMI	S3 - VMI	S4 - VMI	S1 - JF	S2 - JF	S3 - JF	S4 - JF	S1 - LD	S2 - LD	S3 - LD	S4 - LD	Compliance?
F44	R6	BG+5	58	58	58	57	48	48	48	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F45	R6	BG+5	58	58	58	57	48	48	48	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F46	R6	BG+5	58	58	58	57	48	48	48	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F47	R6	BG+5	58	58	58	57	48	48	48	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F48	R6	BG+5	58	58	58	57	48	48	48	48	38	38	38	37	33	33	33	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F49	R6	BG+5	57	58	57	57	48	48	48	48	37	38	37	37	32	33	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F50	R6	BG+5	57	57	57	57	48	48	48	48	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F51	R6	BG+5	57	57	57	57	48	48	48	48	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F52	R6	BG+5	57	57	57	57	48	48	48	48	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F53	R6	BG+5	57	57	57	57	48	48	48	48	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F54	R6	BG+5	57	57	57	57	48	48	48	48	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F55	R6	BG+5	57	57	57	57	48	48	48	48	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F56	R6	BG+5	57	57	57	57	48	48	48	48	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F57	R6	BG+5	57	57	57	57	47	48	48	48	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F58	R6	BG+5	57	57	57	57	47	48	48	48	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7

Floor	Name	Criteria	S1 - TC1	S2 - TC1	S3 - TC1	S4 - TC1	S1 - VMI	S2 - VMI	S3 - VMI	S4 - VMI	S1 - JF	S2 - JF	S3 - JF	S4 - JF	S1 - LD	S2 - LD	S3 - LD	S4 - LD	Compliance?
F59	R6	BG+5	57	57	57	57	47	47	48	48	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F60	R6	BG+5	57	57	57	57	47	47	48	48	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F61	R6	BG+5	57	57	57	57	47	47	48	48	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F62	R6	BG+5	57	57	57	57	47	47	48	48	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F63	R6	BG+5	57	57	57	57	47	47	47	48	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F64	R6	BG+5	57	57	57	57	47	47	47	48	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F65	R6	BG+5	57	57	57	57	47	47	47	48	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F66	R6	BG+5	57	57	57	57	47	47	47	48	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F67	R6	BG+5	56	57	57	57	47	47	47	47	36	37	37	37	31	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F1	R7	BG+5	34	34	38	51	27	25	27	41	14	14	18	31	9	9	13	26	YES
F2	R7	BG+5	34	34	38	51	27	25	28	42	14	14	18	31	9	9	13	26	YES
F3	R7	BG+5	34	34	41	52	27	25	30	42	14	14	21	32	9	9	16	27	YES
F4	R7	BG+5	34	34	41	52	27	25	31	42	14	14	21	32	9	9	16	27	YES
F5	R7	BG+5	34	34	42	52	27	25	31	42	14	14	22	32	9	9	17	27	YES
F6	R7	BG+5	34	34	42	52	27	25	32	43	14	14	22	32	9	9	17	27	YES
F7	R7	BG+5	34	34	43	53	27	25	32	43	14	14	23	33	9	9	18	28	YES
F8	R7	BG+5	34	34	44	53	28	25	33	44	14	14	24	33	9	9	19	28	YES
F9	R7	BG+5	34	34	46	53	28	25	36	44	14	14	26	33	9	9	21	28	YES
F10	R7	BG+5	34	34	49	49	30	25	41	41	14	14	29	29	9	9	24	24	YES
F11	R7	BG+5	33	33	46	50	31	24	40	41	13	13	26	30	8	8	21	25	YES
F12	R7	BG+5	33	40	46	52	33	24	40	43	13	20	26	32	8	15	21	27	YES
F13	R7	BG+5	33	46	46	54	37	40	40	44	13	26	26	34	8	21	21	29	YES
F14	R7	BG+5	33	46	47	56	43	40	40	46	13	26	27	36	8	21	22	31	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F15	R7	BG+5	47	46	47	57	48	40	40	47	27	26	27	37	22	21	22	32	Compliance achieved with acoustic treatment. Refer to

Floor	Name	Criteria	S1 - TC1	S2 - TC1	S3 - TC1	S4 - TC1	S1 - VMI	S2 - VMI	S3 - VMI	S4 - VMI	S1 - JF	S2 - JF	S3 - JF	S4 - JF	S1 - LD	S2 - LD	S3 - LD	S4 - LD	Compliance?
																			Acoustic Treatment for TC. Section 6.9.7
F16	R7	BG+5	47	46	48	56	49	40	40	47	27	26	28	36	22	21	23	31	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F17	R7	BG+5	47	46	49	57	48	40	41	47	27	26	29	37	22	21	24	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F18	R7	BG+5	47	46	51	57	48	40	42	47	27	26	31	37	22	21	26	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F19	R7	BG+5	47	46	53	57	48	40	43	47	27	26	33	37	22	21	28	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F20	R7	BG+5	47	46	56	57	48	40	45	47	27	26	36	37	22	21	31	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F21	R7	BG+5	47	46	57	57	48	40	47	47	27	26	37	37	22	21	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F22	R7	BG+5	47	46	57	57	48	40	48	47	27	26	37	37	22	21	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F23	R7	BG+5	47	47	57	57	48	40	47	47	27	27	37	37	22	22	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F24	R7	BG+5	47	47	57	57	48	40	48	47	27	27	37	37	22	22	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F25	R7	BG+5	47	48	57	57	48	40	48	47	27	28	37	37	22	23	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F26	R7	BG+5	47	50	57	57	48	40	48	47	27	30	37	37	22	25	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F27	R7	BG+5	47	53	57	57	48	41	48	47	27	33	37	37	22	28	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F28	R7	BG+5	48	57	57	57	48	43	48	47	28	37	37	37	23	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F29	R7	BG+5	48	57	57	57	48	45	48	47	28	37	37	37	23	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F30	R7	BG+5	48	57	57	57	48	47	48	47	28	37	37	37	23	32	32	32	Compliance achieved with acoustic treatment. Refer to

Floor	Name	Criteria	S1 - TC1	S2 - TC1	S3 - TC1	S4 - TC1	S1 - VMI	S2 - VMI	S3 - VMI	S4 - VMI	S1 - JF	S2 - JF	S3 - JF	S4 - JF	S1 - LD	S2 - LD	S3 - LD	S4 - LD	Compliance?
																			Acoustic Treatment for TC. Section 6.9.7
F31	R7	BG+5	49	57	57	57	48	48	48	47	29	37	37	37	24	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F32	R7	BG+5	50	57	57	57	48	47	48	47	30	37	37	37	25	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F33	R7	BG+5	52	57	57	57	48	48	48	47	32	37	37	37	27	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F34	R7	BG+5	54	57	57	57	48	48	48	47	34	37	37	37	29	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F35	R7	BG+5	56	57	57	57	48	48	47	47	36	37	37	37	31	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F36	R7	BG+5	57	57	57	57	48	48	47	47	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F37	R7	BG+5	57	57	57	57	49	48	47	47	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F38	R7	BG+5	57	57	57	57	50	48	47	47	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F39	R7	BG+5	57	57	57	57	50	48	47	47	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F40	R7	BG+5	57	57	57	57	50	48	47	47	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F41	R7	BG+5	57	57	57	57	50	48	47	47	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F42	R7	BG+5	57	57	57	57	50	47	47	47	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F43	R7	BG+5	57	57	57	57	47	47	47	47	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F44	R7	BG+5	57	57	57	57	47	47	47	47	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F45	R7	BG+5	57	57	57	57	47	47	47	47	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to

Floor	Name	Criteria	S1 - TC1	S2 - TC1	S3 - TC1	S4 - TC1	S1 - VMI	S2 - VMI	S3 - VMI	S4 - VMI	S1 - JF	S2 - JF	S3 - JF	S4 - JF	S1 - LD	S2 - LD	S3 - LD	S4 - LD	Compliance?
																			Acoustic Treatment for TC. Section 6.9.7
F46	R7	BG+5	57	57	57	57	47	47	47	47	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F47	R7	BG+5	57	57	57	57	47	47	47	47	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F48	R7	BG+5	57	57	57	57	47	47	47	47	37	37	37	37	32	32	32	32	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F49	R7	BG+5	57	57	57	56	47	47	47	47	37	37	37	36	32	32	32	31	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F50	R7	BG+5	57	57	57	56	47	47	47	47	37	37	37	36	32	32	32	31	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F51	R7	BG+5	57	57	57	56	47	47	47	47	37	37	37	36	32	32	32	31	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F52	R7	BG+5	57	57	57	56	47	47	47	47	37	37	37	36	32	32	32	31	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F53	R7	BG+5	57	57	57	56	47	47	47	47	37	37	37	36	32	32	32	31	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F54	R7	BG+5	57	57	57	56	47	47	47	47	37	37	37	36	32	32	32	31	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F55	R7	BG+5	56	57	56	56	47	47	47	47	36	37	36	36	31	32	31	31	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F56	R7	BG+5	56	56	56	56	47	47	47	47	36	36	36	36	31	31	31	31	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F57	R7	BG+5	56	56	56	56	47	47	47	47	36	36	36	36	31	31	31	31	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F58	R7	BG+5	56	56	56	56	47	47	47	47	36	36	36	36	31	31	31	31	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F59	R7	BG+5	56	56	56	56	47	47	47	47	36	36	36	36	31	31	31	31	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F60	R7	BG+5	56	56	56	56	47	47	47	47	36	36	36	36	31	31	31	31	Compliance achieved with acoustic treatment. Refer to

Floor	Name	Criteria	S1 - TC1	S2 - TC1	S3 - TC1	S4 - TC1	S1 - VMI	S2 - VMI	S3 - VMI	S4 - VMI	S1 - JF	S2 - JF	S3 - JF	S4 - JF	S1 - LD	S2 - LD	S3 - LD	S4 - LD	Compliance?
																			Acoustic Treatment for TC. Section 6.9.7
F61	R7	BG+5	56	56	56	56	47	47	47	47	36	36	36	36	31	31	31	31	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F1	R8	BG+5	40	44	54	53	32	34	44	44	20	24	34	33	15	19	29	28	YES
F2	R8	BG+5	40	44	54	53	32	34	44	44	20	24	34	33	15	19	29	28	YES
F3	R8	BG+5	41	45	54	53	32	34	44	44	21	25	34	33	16	20	29	28	YES
F4	R8	BG+5	41	46	54	53	33	35	44	44	21	26	34	33	16	21	29	28	YES
F5	R8	BG+5	41	48	54	53	34	36	44	44	21	28	34	33	16	23	29	28	YES
F6	R8	BG+5	41	49	54	53	35	37	44	44	21	29	34	33	16	24	29	28	YES
F7	R8	BG+5	42	52	54	54	36	39	44	44	22	32	34	34	17	27	29	29	YES
F1	R9	BG+5	47	62	61	60	32	53	52	51	27	42	41	40	22	37	36	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F2	R9	BG+5	49	62	61	60	31	53	52	51	29	42	41	40	24	37	36	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F3	R9	BG+5	51	62	61	60	33	53	52	51	31	42	41	40	26	37	36	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F4	R9	BG+5	52	62	61	60	33	53	52	51	32	42	41	40	27	37	36	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F5	R9	BG+5	52	62	61	60	34	53	52	51	32	42	41	40	27	37	36	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F6	R9	BG+5	53	62	61	60	35	53	52	51	33	42	41	40	28	37	36	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F7	R9	BG+5	53	63	61	60	36	54	52	51	33	43	41	40	28	38	36	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F8	R9	BG+5	55	63	61	59	38	54	52	51	35	43	41	39	30	38	36	34	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F9	R9	BG+5	57	63	61	59	41	54	52	51	37	43	41	39	32	38	36	34	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F10	R9	BG+5	59	63	61	59	46	54	52	50	39	43	41	39	34	38	36	34	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F11	R9	BG+5	61	63	61	59	49	54	52	50	41	43	41	39	36	38	36	34	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7

Floor	Name	Criteria	S1 - TC1	S2 - TC1	S3 - TC1	S4 - TC1	S1 - VMI	S2 - VMI	S3 - VMI	S4 - VMI	S1 - JF	S2 - JF	S3 - JF	S4 - JF	S1 - LD	S2 - LD	S3 - LD	S4 - LD	Compliance?
F12	R9	BG+5	63	63	61	59	49	54	52	50	43	43	41	39	38	38	36	34	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F13	R9	BG+5	63	63	61	60	50	54	52	50	43	43	41	40	38	38	36	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F14	R9	BG+5	63	63	61	60	50	54	52	50	43	43	41	40	38	38	36	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F15	R9	BG+5	64	63	61	60	51	54	52	50	44	43	41	40	39	38	36	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F16	R9	BG+5	64	63	60	60	51	54	52	50	44	43	40	40	39	38	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F17	R9	BG+5	64	63	60	60	52	54	51	50	44	43	40	40	39	38	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F18	R9	BG+5	65	63	60	60	52	54	51	50	45	43	40	40	40	38	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F19	R9	BG+5	64	63	60	60	52	54	51	50	44	43	40	40	39	38	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F20	R9	BG+5	64	63	60	60	52	54	51	50	44	43	40	40	39	38	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F21	R9	BG+5	63	63	60	60	52	54	51	50	43	43	40	40	38	38	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F22	R9	BG+5	63	63	60	60	52	54	51	51	43	43	40	40	38	38	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F23	R9	BG+5	63	63	60	60	52	54	51	51	43	43	40	40	38	38	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F24	R9	BG+5	63	63	60	60	52	54	51	51	43	43	40	40	38	38	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F25	R9	BG+5	63	61	60	60	52	54	51	51	43	41	40	40	38	36	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F26	R9	BG+5	63	61	60	60	52	53	51	51	43	41	40	40	38	36	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7

Floor	Name	Criteria	S1 - TC1	S2 - TC1	S3 - TC1	S4 - TC1	S1 - VMI	S2 - VMI	S3 - VMI	S4 - VMI	S1 - JF	S2 - JF	S3 - JF	S4 - JF	S1 - LD	S2 - LD	S3 - LD	S4 - LD	Compliance?
F27	R9	BG+5	63	61	60	60	53	53	51	51	43	41	40	40	38	36	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F28	R9	BG+5	63	61	60	60	53	53	51	51	43	41	40	40	38	36	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F29	R9	BG+5	63	61	60	60	53	53	51	51	43	41	40	40	38	36	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F30	R9	BG+5	63	61	60	60	54	53	51	51	43	41	40	40	38	36	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F31	R9	BG+5	62	61	60	60	53	53	51	51	42	41	40	40	37	36	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F32	R9	BG+5	62	61	60	60	53	52	51	51	42	41	40	40	37	36	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F33	R9	BG+5	62	61	60	60	52	52	51	51	42	41	40	40	37	36	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F34	R9	BG+5	62	61	60	60	52	52	51	51	42	41	40	40	37	36	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F35	R9	BG+5	62	61	60	60	52	52	51	51	42	41	40	40	37	36	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F36	R9	BG+5	62	61	60	60	53	51	51	51	42	41	40	40	37	36	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F37	R9	BG+5	62	61	60	60	53	51	51	51	42	41	40	40	37	36	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F38	R9	BG+5	62	61	60	60	53	51	51	51	42	41	40	40	37	36	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F39	R9	BG+5	62	61	60	60	53	51	51	51	42	41	40	40	37	36	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F40	R9	BG+5	62	61	60	60	53	51	51	51	42	41	40	40	37	36	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F41	R9	BG+5	62	60	60	60	53	51	51	51	42	40	40	40	37	35	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7

Floor	Name	Criteria	S1 - TC1	S2 - TC1	S3 - TC1	S4 - TC1	S1 - VMI	S2 - VMI	S3 - VMI	S4 - VMI	S1 - JF	S2 - JF	S3 - JF	S4 - JF	S1 - LD	S2 - LD	S3 - LD	S4 - LD	Compliance?
F42	R9	BG+5	62	60	60	60	53	51	51	51	42	40	40	40	37	35	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F43	R9	BG+5	62	60	60	60	53	51	51	51	42	40	40	40	37	35	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F44	R9	BG+5	62	60	60	60	53	51	51	51	42	40	40	40	37	35	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F45	R9	BG+5	62	60	60	60	53	51	51	51	42	40	40	40	37	35	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F46	R9	BG+5	61	60	60	60	53	51	51	51	41	40	40	40	36	35	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F47	R9	BG+5	61	60	60	60	53	51	51	51	41	40	40	40	36	35	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F48	R9	BG+5	61	60	60	60	52	51	51	51	41	40	40	40	36	35	35	35	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F1	R11	BG+5	38	54	55	54	42	44	45	45	18	34	35	34	13	29	30	29	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F2	R11	BG+5	39	54	55	54	42	44	45	45	19	34	35	34	14	29	30	29	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F3	R11	BG+5	40	54	55	54	42	44	45	45	20	34	35	34	15	29	30	29	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F1	R12	BG+5	31	36	55	55	22	23	45	45	11	16	35	35	6	11	30	30	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F2	R12	BG+5	31	37	55	55	22	23	45	45	11	17	35	35	6	12	30	30	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F3	R12	BG+5	31	37	55	55	22	23	45	45	11	17	35	35	6	12	30	30	Compliance achieved with acoustic treatment. Refer to Acoustic Treatment for TC. Section 6.9.7
F1	R13	BG+5	30	34	54	54	24	22	45	44	10	14	34	34	5	9	29	29	YES
F2	R13	BG+5	30	34	54	54	24	22	45	44	10	14	34	34	5	9	29	29	YES
F3	R13	BG+5	30	35	54	54	25	23	45	44	10	15	34	34	5	10	29	29	YES

6.5.10 Construction Sleep Disturbance Assessment

Sleep disturbance assessment was undertaken at the most affected sensitive receiver associated with the proposed out-of-hours construction activities is considered with the relevant sleep-disturbance criterion.

The following LAFmax Level associated with each proposed plant and equipment are used in the noise modelling process are stated in Table 34.

Table 34 Instantaneous Sound Level - LAFmax

Scenario	Equipment	LAFmax
Scenario 1 (S1) – Relative level 36.5	Diesel Tower Cranes (TC)	105 (With Acoustic Treatment)
	Volumetric Module Installations (VMI)	106
	Erection and Movement of Jump Form (JF)	95
	Ground Level Construction Loading Dock (LD)	100
Scenario 2 (S2) Relative level 71.7	Diesel Tower Cranes (TC)	105 (With Acoustic Treatment)
	Volumetric Module Installations (VMI)	106
	Erection and Movement of Jump Form (JF)	95
	Ground Level Construction Loading Dock (LD)	100
Scenario 3 (S3) Relative level 119.7	Diesel Tower Cranes (TC)	105 (With Acoustic Treatment)
	Volumetric Module Installations (VMI)	106
	Erection and Movement of Jump Form (JF)	95
	Ground Level Construction Loading Dock (LD)	100
Scenario 4 (S4) Relative level 158.1	Diesel Tower Cranes (TC)	105 (With Acoustic Treatment)
	Volumetric Module Installations (VMI)	106
	Erection and Movement of Jump Form (JF)	95
	Ground Level Construction Loading Dock (LD)	100

The predicted sleep disturbance noise level associated with the proposed out-of hour work is presented in Table 35 below.



Table 35 Predicted Sleep Disturbance Noise Level – dB(A)

Floor	Name	Criteria	S1 - TC1	S2 - TC1	S3 - TC1	S4 - TC1	S1 - VMI	S2 - VMI	S3 - VMI	S4 - VMI	S1 - JF	S2 - JF	S3 - JF	S4 - JF	S1 - LD	S2 - LD	S3 - LD	S4 - LD	Compliance?
F1	R1	65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F1	R2	65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F1	R3	65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F1	R4	65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F1	R5	65	43	49	49	48	59	59	58	44	48	50	49	33	38	44	44	43	YES
F2	R5	65	44	50	49	48	60	59	58	45	50	50	49	34	39	45	44	43	YES
F3	R5	65	44	50	49	48	60	59	58	45	51	50	49	34	39	45	44	43	YES
F4	R5	65	45	50	49	48	60	59	58	45	50	50	49	35	40	45	44	43	YES
F5	R5	65	46	50	49	48	60	59	58	45	51	50	49	36	41	45	44	43	YES
F6	R5	65	47	50	49	48	60	59	58	46	51	50	49	37	42	45	44	43	YES
F7	R5	65	49	50	49	48	60	59	58	46	51	50	49	39	44	45	44	43	YES
F8	R5	65	51	50	49	48	60	59	58	46	51	50	49	41	46	45	44	43	YES
F9	R5	65	52	50	49	48	60	59	58	47	51	50	49	42	47	45	44	43	YES
F10	R5	65	52	50	49	48	60	59	58	48	51	50	49	42	47	45	44	43	YES
F11	R5	65	53	50	49	48	60	59	58	51	51	50	49	43	48	45	44	43	YES
F12	R5	65	53	50	49	48	60	59	58	51	51	50	49	43	48	45	44	43	YES
F13	R5	65	53	50	49	48	60	59	58	51	51	50	49	43	48	45	44	43	YES
F14	R5	65	53	50	49	49	60	59	59	52	51	50	49	43	48	45	44	44	YES
F1	R6	65	29	39	48	47	49	58	57	29	37	43	48	19	24	34	43	42	YES
F2	R6	65	29	39	48	47	49	58	57	29	37	45	48	19	24	34	43	42	YES
F3	R6	65	29	39	48	47	49	58	57	30	37	47	48	19	24	34	43	42	YES
F4	R6	65	29	40	48	47	50	58	57	30	38	48	48	19	24	35	43	42	YES
F5	R6	65	29	40	48	47	50	58	57	30	38	49	48	19	24	35	43	42	YES
F6	R6	65	33	40	48	47	50	58	57	30	38	48	48	23	28	35	43	42	YES
F7	R6	65	33	41	48	47	51	58	57	30	39	49	48	23	28	36	43	42	YES
F8	R6	65	34	42	48	47	52	58	57	30	39	49	48	24	29	37	43	42	YES
F9	R6	65	39	44	48	47	54	58	57	31	40	49	48	29	34	39	43	42	YES
F10	R6	65	39	46	48	47	56	58	57	32	41	49	48	29	34	41	43	42	YES
F11	R6	65	39	49	48	47	59	58	57	33	44	49	48	29	34	44	43	42	YES
F12	R6	65	39	48	48	47	58	58	57	35	46	49	48	29	34	43	43	42	YES
F13	R6	65	40	49	48	47	59	58	57	40	49	49	48	30	35	44	43	42	YES
F14	R6	65	41	49	48	47	59	58	57	45	49	49	48	31	36	44	43	42	YES
F15	R6	65	42	49	48	47	59	58	57	46	49	49	48	32	37	44	43	42	YES
F16	R6	65	47	49	48	47	59	58	57	47	49	49	48	37	42	44	43	42	YES
F17	R6	65	49	49	48	47	59	58	57	44	49	49	48	39	44	44	43	42	YES
F18	R6	65	50	49	48	47	59	58	57	46	49	49	48	40	45	44	43	42	YES
F19	R6	65	50	48	48	47	58	58	57	47	49	49	48	40	45	43	43	42	YES
F20	R6	65	50	48	48	47	58	58	57	48	49	49	48	40	45	43	43	42	YES



Floor	Name	Criteria	S1 - TC1	S2 - TC1	S3 - TC1	S4 - TC1	S1 - VMI	S2 - VMI	S3 - VMI	S4 - VMI	S1 - JF	S2 - JF	S3 - JF	S4 - JF	S1 - LD	S2 - LD	S3 - LD	S4 - LD	Compliance?
F21	R6	65	51	48	48	47	58	58	57	49	49	49	48	41	46	43	43	42	YES
F22	R6	65	51	48	48	47	58	58	57	50	49	49	48	41	46	43	43	42	YES
F23	R6	65	49	48	48	47	58	58	57	50	49	49	48	39	44	43	43	42	YES
F24	R6	65	49	48	48	47	58	58	57	51	49	49	48	39	44	43	43	42	YES
F25	R6	65	49	48	48	47	58	58	57	51	49	49	48	39	44	43	43	42	YES
F26	R6	65	49	48	48	47	58	58	57	51	49	49	48	39	44	43	43	42	YES
F27	R6	65	48	48	48	47	58	58	57	51	49	49	48	38	43	43	43	42	YES
F28	R6	65	48	48	48	47	58	58	57	51	49	49	48	38	43	43	43	42	YES
F29	R6	65	48	48	48	47	58	58	57	51	49	49	48	38	43	43	43	42	YES
F30	R6	65	48	48	48	47	58	58	57	51	49	49	48	38	43	43	43	42	YES
F31	R6	65	48	48	48	47	58	58	57	50	49	49	48	38	43	43	43	42	YES
F32	R6	65	48	48	48	47	58	58	57	50	49	49	48	38	43	43	43	42	YES
F33	R6	65	48	48	48	47	58	58	57	50	49	49	48	38	43	43	43	42	YES
F34	R6	65	48	48	48	47	58	58	57	50	49	49	48	38	43	43	43	42	YES
F35	R6	65	48	48	48	47	58	58	57	50	49	48	48	38	43	43	43	42	YES
F36	R6	65	48	48	48	47	58	58	57	50	49	48	48	38	43	43	43	42	YES
F37	R6	65	48	48	48	47	58	58	57	50	49	48	48	38	43	43	43	42	YES
F38	R6	65	48	48	48	47	58	58	57	49	49	48	48	38	43	43	43	42	YES
F39	R6	65	48	48	48	47	58	58	57	49	49	48	48	38	43	43	43	42	YES
F40	R6	65	48	48	48	47	58	58	57	48	48	48	48	38	43	43	43	42	YES
F41	R6	65	48	48	48	47	58	58	57	48	48	48	48	38	43	43	43	42	YES
F42	R6	65	48	48	48	47	58	58	57	48	48	48	48	38	43	43	43	42	YES
F43	R6	65	48	48	48	47	58	58	57	48	48	48	48	38	43	43	43	42	YES
F44	R6	65	48	48	48	47	58	58	57	48	48	48	48	38	43	43	43	42	YES
F45	R6	65	48	48	48	47	58	58	57	48	48	48	48	38	43	43	43	42	YES
F46	R6	65	48	48	48	47	58	58	57	48	48	48	48	38	43	43	43	42	YES
F47	R6	65	48	48	48	47	58	58	57	48	48	48	48	38	43	43	43	42	YES
F48	R6	65	48	48	48	47	58	58	57	48	48	48	48	38	43	43	43	42	YES
F49	R6	65	47	48	47	47	58	57	57	48	48	48	48	37	42	43	42	42	YES
F50	R6	65	47	47	47	47	57	57	57	48	48	48	48	37	42	42	42	42	YES
F51	R6	65	47	47	47	47	57	57	57	48	48	48	48	37	42	42	42	42	YES
F52	R6	65	47	47	47	47	57	57	57	48	48	48	48	37	42	42	42	42	YES
F53	R6	65	47	47	47	47	57	57	57	48	48	48	48	37	42	42	42	42	YES
F54	R6	65	47	47	47	47	57	57	57	48	48	48	48	37	42	42	42	42	YES
F55	R6	65	47	47	47	47	57	57	57	48	48	48	48	37	42	42	42	42	YES
F56	R6	65	47	47	47	47	57	57	57	48	48	48	48	37	42	42	42	42	YES
F57	R6	65	47	47	47	47	57	57	57	47	48	48	48	37	42	42	42	42	YES
F58	R6	65	47	47	47	47	57	57	57	47	48	48	48	37	42	42	42	42	YES
F59	R6	65	47	47	47	47	57	57	57	47	47	48	48	37	42	42	42	42	YES
F60	R6	65	47	47	47	47	57	57	57	47	47	48	48	37	42	42	42	42	YES



Floor	Name	Criteria	S1 - TC1	S2 - TC1	S3 - TC1	S4 - TC1	S1 - VMI	S2 - VMI	S3 - VMI	S4 - VMI	S1 - JF	S2 - JF	S3 - JF	S4 - JF	S1 - LD	S2 - LD	S3 - LD	S4 - LD	Compliance?
F61	R6	65	47	47	47	47	57	57	57	47	47	48	48	37	42	42	42	42	YES
F62	R6	65	47	47	47	47	57	57	57	47	47	48	48	37	42	42	42	42	YES
F63	R6	65	47	47	47	47	57	57	57	47	47	47	48	37	42	42	42	42	YES
F64	R6	65	47	47	47	47	57	57	57	47	47	47	48	37	42	42	42	42	YES
F65	R6	65	47	47	47	47	57	57	57	47	47	47	48	37	42	42	42	42	YES
F66	R6	65	47	47	47	47	57	57	57	47	47	47	48	37	42	42	42	42	YES
F67	R6	65	46	47	47	47	57	57	57	47	47	47	47	36	41	42	42	42	YES
F1	R7	65	24	24	28	41	34	38	51	27	25	27	41	14	19	19	23	36	YES
F2	R7	65	24	24	28	41	34	38	51	27	25	28	42	14	19	19	23	36	YES
F3	R7	65	24	24	31	42	34	41	52	27	25	30	42	14	19	19	26	37	YES
F4	R7	65	24	24	31	42	34	41	52	27	25	31	42	14	19	19	26	37	YES
F5	R7	65	24	24	32	42	34	42	52	27	25	31	42	14	19	19	27	37	YES
F6	R7	65	24	24	32	42	34	42	52	27	25	32	43	14	19	19	27	37	YES
F7	R7	65	24	24	33	43	34	43	53	27	25	32	43	14	19	19	28	38	YES
F8	R7	65	24	24	34	43	34	44	53	28	25	33	44	14	19	19	29	38	YES
F9	R7	65	24	24	36	43	34	46	53	28	25	36	44	14	19	19	31	38	YES
F10	R7	65	24	24	39	39	34	49	49	30	25	41	41	14	19	19	34	34	YES
F11	R7	65	23	23	36	40	33	46	50	31	24	40	41	13	18	18	31	35	YES
F12	R7	65	23	30	36	42	40	46	52	33	24	40	43	13	18	25	31	37	YES
F13	R7	65	23	36	36	44	46	46	54	37	40	40	44	13	18	31	31	39	YES
F14	R7	65	23	36	37	46	46	47	56	43	40	40	46	13	18	31	32	41	YES
F15	R7	65	37	36	37	47	46	47	57	48	40	40	47	27	32	31	32	42	YES
F16	R7	65	37	36	38	46	46	48	56	49	40	40	47	27	32	31	33	41	YES
F17	R7	65	37	36	39	47	46	49	57	48	40	41	47	27	32	31	34	42	YES
F18	R7	65	37	36	41	47	46	51	57	48	40	42	47	27	32	31	36	42	YES
F19	R7	65	37	36	43	47	46	53	57	48	40	43	47	27	32	31	38	42	YES
F20	R7	65	37	36	46	47	46	56	57	48	40	45	47	27	32	31	41	42	YES
F21	R7	65	37	36	47	47	46	57	57	48	40	47	47	27	32	31	42	42	YES
F22	R7	65	37	36	47	47	46	57	57	48	40	48	47	27	32	31	42	42	YES
F23	R7	65	37	37	47	47	47	57	57	48	40	47	47	27	32	32	42	42	YES
F24	R7	65	37	37	47	47	47	57	57	48	40	48	47	27	32	32	42	42	YES
F25	R7	65	37	38	47	47	48	57	57	48	40	48	47	27	32	33	42	42	YES
F26	R7	65	37	40	47	47	50	57	57	48	40	48	47	27	32	35	42	42	YES
F27	R7	65	37	43	47	47	53	57	57	48	41	48	47	27	32	38	42	42	YES
F28	R7	65	38	47	47	47	57	57	57	48	43	48	47	28	33	42	42	42	YES
F29	R7	65	38	47	47	47	57	57	57	48	45	48	47	28	33	42	42	42	YES
F30	R7	65	38	47	47	47	57	57	57	48	47	48	47	28	33	42	42	42	YES
F31	R7	65	39	47	47	47	57	57	57	48	48	48	47	29	34	42	42	42	YES
F32	R7	65	40	47	47	47	57	57	57	48	47	48	47	30	35	42	42	42	YES
F33	R7	65	42	47	47	47	57	57	57	48	48	48	47	32	37	42	42	42	YES



Floor	Name	Criteria	S1 - TC1	S2 - TC1	S3 - TC1	S4 - TC1	S1 - VMI	S2 - VMI	S3 - VMI	S4 - VMI	S1 - JF	S2 - JF	S3 - JF	S4 - JF	S1 - LD	S2 - LD	S3 - LD	S4 - LD	Compliance?
F34	R7	65	44	47	47	47	57	57	57	48	48	48	47	34	39	42	42	42	YES
F35	R7	65	46	47	47	47	57	57	57	48	48	47	47	36	41	42	42	42	YES
F36	R7	65	47	47	47	47	57	57	57	48	48	47	47	37	42	42	42	42	YES
F37	R7	65	47	47	47	47	57	57	57	49	48	47	47	37	42	42	42	42	YES
F38	R7	65	47	47	47	47	57	57	57	50	48	47	47	37	42	42	42	42	YES
F39	R7	65	47	47	47	47	57	57	57	50	48	47	47	37	42	42	42	42	YES
F40	R7	65	47	47	47	47	57	57	57	50	48	47	47	37	42	42	42	42	YES
F41	R7	65	47	47	47	47	57	57	57	50	48	47	47	37	42	42	42	42	YES
F42	R7	65	47	47	47	47	57	57	57	50	47	47	47	37	42	42	42	42	YES
F43	R7	65	47	47	47	47	57	57	57	47	47	47	47	37	42	42	42	42	YES
F44	R7	65	47	47	47	47	57	57	57	47	47	47	47	37	42	42	42	42	YES
F45	R7	65	47	47	47	47	57	57	57	47	47	47	47	37	42	42	42	42	YES
F46	R7	65	47	47	47	47	57	57	57	47	47	47	47	37	42	42	42	42	YES
F47	R7	65	47	47	47	47	57	57	57	47	47	47	47	37	42	42	42	42	YES
F48	R7	65	47	47	47	47	57	57	57	47	47	47	47	37	42	42	42	42	YES
F49	R7	65	47	47	47	46	57	57	56	47	47	47	47	37	42	42	42	41	YES
F50	R7	65	47	47	47	46	57	57	56	47	47	47	47	37	42	42	42	41	YES
F51	R7	65	47	47	47	46	57	57	56	47	47	47	47	37	42	42	42	41	YES
F52	R7	65	47	47	47	46	57	57	56	47	47	47	47	37	42	42	42	41	YES
F53	R7	65	47	47	47	46	57	57	56	47	47	47	47	37	42	42	42	41	YES
F54	R7	65	47	47	47	46	57	57	56	47	47	47	47	37	42	42	42	41	YES
F55	R7	65	46	47	46	46	57	56	56	47	47	47	47	36	41	42	41	41	YES
F56	R7	65	46	46	46	46	56	56	56	47	47	47	47	36	41	41	41	41	YES
F57	R7	65	46	46	46	46	56	56	56	47	47	47	47	36	41	41	41	41	YES
F58	R7	65	46	46	46	46	56	56	56	47	47	47	47	36	41	41	41	41	YES
F59	R7	65	46	46	46	46	56	56	56	47	47	47	47	36	41	41	41	41	YES
F60	R7	65	46	46	46	46	56	56	56	47	47	47	47	36	41	41	41	41	YES
F61	R7	65	46	46	46	46	56	56	56	47	47	47	47	36	41	41	41	41	YES
F1	R8	65	30	34	44	43	44	54	53	32	34	44	44	20	25	29	39	38	YES
F2	R8	65	30	34	44	43	44	54	53	32	34	44	44	20	25	29	39	38	YES
F3	R8	65	31	35	44	43	45	54	53	32	34	44	44	21	26	30	39	38	YES
F4	R8	65	31	36	44	43	46	54	53	33	35	44	44	21	26	31	39	38	YES
F5	R8	65	31	38	44	43	48	54	53	34	36	44	44	21	26	33	39	38	YES
F6	R8	65	31	39	44	43	49	54	53	35	37	44	44	21	26	34	39	38	YES
F7	R8	65	32	42	44	44	52	54	54	36	39	44	44	22	27	37	39	39	YES
F1	R9	65	37	52	51	50	62	61	60	32	53	52	51	27	32	47	46	45	YES
F2	R9	65	39	52	51	50	62	61	60	31	53	52	51	29	34	47	46	45	YES
F3	R9	65	41	52	51	50	62	61	60	33	53	52	51	31	36	47	46	45	YES
F4	R9	65	42	52	51	50	62	61	60	33	53	52	51	32	37	47	46	45	YES
F5	R9	65	42	52	51	50	62	61	60	34	53	52	51	32	37	47	46	45	YES



Floor	Name	Criteria	S1 - TC1	S2 - TC1	S3 - TC1	S4 - TC1	S1 - VMI	S2 - VMI	S3 - VMI	S4 - VMI	S1 - JF	S2 - JF	S3 - JF	S4 - JF	S1 - LD	S2 - LD	S3 - LD	S4 - LD	Compliance?
F6	R9	65	43	52	51	50	62	61	60	35	53	52	51	33	38	47	46	45	YES
F7	R9	65	43	53	51	50	63	61	60	36	54	52	51	33	38	48	46	45	YES
F8	R9	65	45	53	51	49	63	61	59	38	54	52	51	35	40	48	46	44	YES
F9	R9	65	47	53	51	49	63	61	59	41	54	52	51	37	42	48	46	44	YES
F10	R9	65	49	53	51	49	63	61	59	46	54	52	50	39	44	48	46	44	YES
F11	R9	65	51	53	51	49	63	61	59	49	54	52	50	41	46	48	46	44	YES
F12	R9	65	53	53	51	49	63	61	59	49	54	52	50	43	48	48	46	44	YES
F13	R9	65	53	53	51	50	63	61	60	50	54	52	50	43	48	48	46	45	YES
F14	R9	65	53	53	51	50	63	61	60	50	54	52	50	43	48	48	46	45	YES
F15	R9	65	54	53	51	50	63	61	60	51	54	52	50	44	49	48	46	45	YES
F16	R9	65	54	53	50	50	63	60	60	51	54	52	50	44	49	48	45	45	YES
F17	R9	65	54	53	50	50	63	60	60	52	54	51	50	44	49	48	45	45	YES
F18	R9	65	55	53	50	50	63	60	60	52	54	51	50	45	50	48	45	45	YES
F19	R9	65	54	53	50	50	63	60	60	52	54	51	50	44	49	48	45	45	YES
F20	R9	65	54	53	50	50	63	60	60	52	54	51	50	44	49	48	45	45	YES
F21	R9	65	53	53	50	50	63	60	60	52	54	51	50	43	48	48	45	45	YES
F22	R9	65	53	53	50	50	63	60	60	52	54	51	51	43	48	48	45	45	YES
F23	R9	65	53	53	50	50	63	60	60	52	54	51	51	43	48	48	45	45	YES
F24	R9	65	53	53	50	50	63	60	60	52	54	51	51	43	48	48	45	45	YES
F25	R9	65	53	51	50	50	61	60	60	52	54	51	51	43	48	46	45	45	YES
F26	R9	65	53	51	50	50	61	60	60	52	53	51	51	43	48	46	45	45	YES
F27	R9	65	53	51	50	50	61	60	60	53	53	51	51	43	48	46	45	45	YES
F28	R9	65	53	51	50	50	61	60	60	53	53	51	51	43	48	46	45	45	YES
F29	R9	65	53	51	50	50	61	60	60	53	53	51	51	43	48	46	45	45	YES
F30	R9	65	53	51	50	50	61	60	60	54	53	51	51	43	48	46	45	45	YES
F31	R9	65	52	51	50	50	61	60	60	53	53	51	51	42	47	46	45	45	YES
F32	R9	65	52	51	50	50	61	60	60	53	52	51	51	42	47	46	45	45	YES
F33	R9	65	52	51	50	50	61	60	60	52	52	51	51	42	47	46	45	45	YES
F34	R9	65	52	51	50	50	61	60	60	52	52	51	51	42	47	46	45	45	YES
F35	R9	65	52	51	50	50	61	60	60	52	52	51	51	42	47	46	45	45	YES
F36	R9	65	52	51	50	50	61	60	60	53	51	51	51	42	47	46	45	45	YES
F37	R9	65	52	51	50	50	61	60	60	53	51	51	51	42	47	46	45	45	YES
F38	R9	65	52	51	50	50	61	60	60	53	51	51	51	42	47	46	45	45	YES
F39	R9	65	52	51	50	50	61	60	60	53	51	51	51	42	47	46	45	45	YES
F40	R9	65	52	51	50	50	61	60	60	53	51	51	51	42	47	46	45	45	YES
F41	R9	65	52	50	50	50	60	60	60	53	51	51	51	42	47	45	45	45	YES
F42	R9	65	52	50	50	50	60	60	60	53	51	51	51	42	47	45	45	45	YES
F43	R9	65	52	50	50	50	60	60	60	53	51	51	51	42	47	45	45	45	YES
F44	R9	65	52	50	50	50	60	60	60	53	51	51	51	42	47	45	45	45	YES
F45	R9	65	52	50	50	50	60	60	60	53	51	51	51	42	47	45	45	45	YES



Floor	Name	Criteria	S1 - TC1	S2 - TC1	S3 - TC1	S4 - TC1	S1 - VMI	S2 - VMI	S3 - VMI	S4 - VMI	S1 - JF	S2 - JF	S3 - JF	S4 - JF	S1 - LD	S2 - LD	S3 - LD	S4 - LD	Compliance?
F46	R9	65	51	50	50	50	60	60	60	53	51	51	51	41	46	45	45	45	YES
F47	R9	65	51	50	50	50	60	60	60	53	51	51	51	41	46	45	45	45	YES
F48	R9	65	51	50	50	50	60	60	60	52	51	51	51	41	46	45	45	45	YES
F1	R11	65	28	44	45	44	54	55	54	42	44	45	45	18	23	39	40	39	YES
F2	R11	65	29	44	45	44	54	55	54	42	44	45	45	19	24	39	40	39	YES
F3	R11	65	30	44	45	44	54	55	54	42	44	45	45	20	25	39	40	39	YES
F1	R12	65	21	26	45	45	36	55	55	22	23	45	45	11	16	21	40	40	YES
F2	R12	65	21	27	45	45	37	55	55	22	23	45	45	11	16	22	40	40	YES
F3	R12	65	21	27	45	45	37	55	55	22	23	45	45	11	16	22	40	40	YES
F1	R13	65	20	24	44	44	34	54	54	24	22	45	44	10	15	19	39	39	YES
F2	R13	65	20	24	44	44	34	54	54	24	22	45	44	10	15	19	39	39	YES
F3	R13	65	20	25	44	44	35	54	54	25	23	45	44	10	15	20	39	39	YES



6.6 Community Consultation

Active community consultation and the maintenance of positive relations with local residents and businesses would assist in alleviating concerns of demolition and construction activities, and thereby minimising complaint. It is common for construction projects to provide community consultation if an exceedance of noise goals has been predicted. This communication is commonly conducted in the form of a letter box drop or more active engagement with more highly impacted receivers.

This form of notification should provide specific notification of the duration and timing of the construction activities so that residents are informed about the proposed works ahead of time. The letter should also provide the community with a hotline number for a community liaison officer available to adequately respond to all project related enquiries.

Ideally the hotline number should provide concerned locals an opportunity to raise any concerns with the project proponent and provide an opportunity to determine the best method to satisfy all requirements.

6.7 Complaints Management System

Should complaints arise they must be dealt with in a responsible and uniform manner, therefore, a management system to deal with complaints is detailed below:

Local residents and land-owners should be informed by direct mail of a direct 24 hour telephone line where any noise complaints related to the construction will be recorded. The 24 hour telephone line number will be made available on the construction site signage.

All complaints should be investigated by the Contractor in accordance with the Noise Complaint Management Program's procedures section detailed in the Contractor's Noise and Vibration Management Plan.

6.8 Contingency Plans

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

- Stop the use of the main equipment within specific areas of the site which is producing the most construction noise at the noise sensitive receivers; and
- Implement a construction noise assessment to be performed by a suitably qualified acoustic consultant.

The Superintendent shall have access to view the Contractor's noise measurement records on request. The Superintendent may undertake noise monitoring if and when required.

6.9 General Mitigation Measures (Australia Standard 2436-2010)

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.

6.9.1 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 elevating work platforms used on site.
- Minimising the movement of materials and plant and unnecessary metal-on-metal contact.
- Minimising truck movements.

6.9.2 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.

6.9.3 On Site Noise Mitigation

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

6.9.4 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).

6.9.5 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.

6.9.6 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.

6.9.7 Tower Cranes Noise Mitigation Methodology

Over the span of the project a total of one diesel crane will be installed. Similar TC was measured to formulate the resulting noise level and required mitigation measures detailed below on different projects.

Based on previous experience from other projects, from onsite noise measurements and detailed noise modelling the noise emitted with TC does not comply with the extended hours NML's where this was predicted and detailed in section 6.5.8 of this report. As such further acoustic treatments are required to be installed to TC and to ensure full compliance at the most affected sensitive receiver locations.

Modelling has indicated that the existing Sound Power Level (L_w) emitted from the crane when lifting and rotating is 115dB(A) L_{A10}. To ensure compliance, noise levels will need to be reduced by approximately 10dB(A) to ensure compliance during the proposed OOH period.

The noise emitted from the crane is from the diesel engine and barrel. As such the following acoustic treatments are recommended.

- Acoustic treatment to the engine muffler is to include an acoustic silencer providing a minimum of 8dB(A) noise reduction.
- An acoustic enclosure is to be constructed on the crane deck which encloses the engine and cable barrel is to be constructed from 1 x 9mm Fibre Cement Sheeting (or similar), as per the plan/image below. If possible, internally line the inside of the acoustic enclosure with a 50mm thick acoustic absorbing material (equal to Megasorber FM panel). Noting there will be an opening required for the cable openings.

Figure 9 Crane Acoustic Enclosure

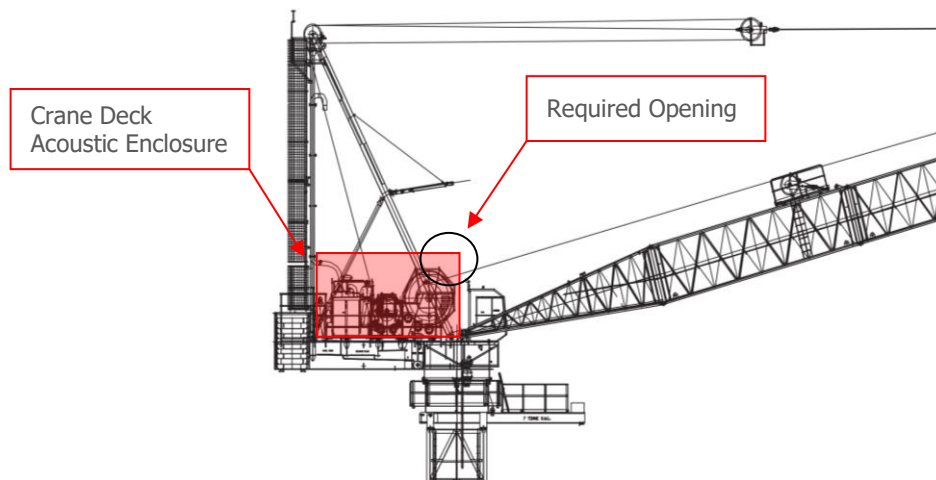
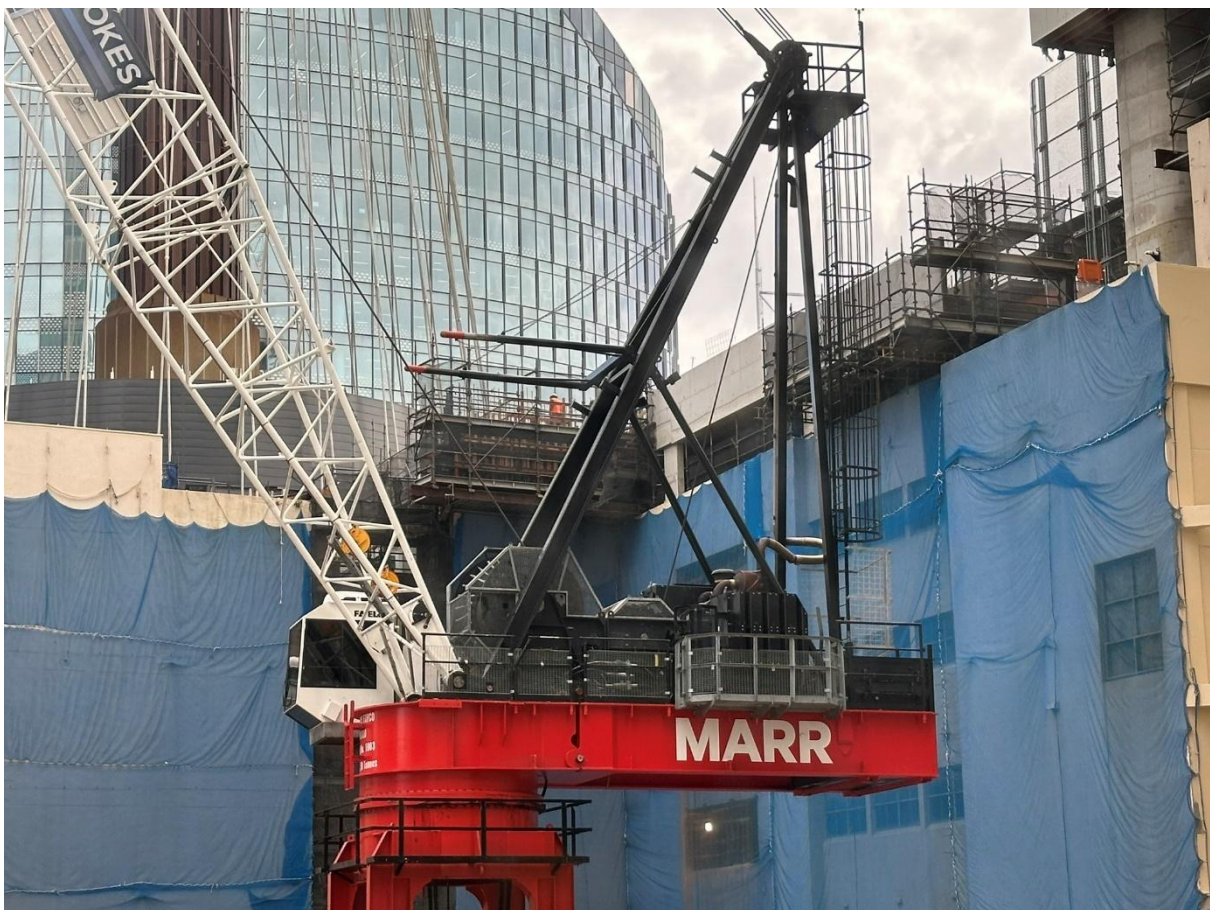


Figure 10 Example of diesel crane Photo from another project



Acoustic mitigation treatments for the proposed future cranes need to be co-ordinated with the crane contractor. It is in PWNA professional opinion that the acoustic mitigation measures detailed in this report are feasible and achievable.

6.10 Construction Noise and Vibration Management Plan

It is essential that the contractor develop a detailed Construction Noise and Vibration Management Plan (CNVMP) together once the details of the construction methodology associated with volume Matrix Construction (VMC), program and equipment selection has been determined to show how the criteria identified in the report will be met.

Details required include:

- Schedule of proposed activities
- Equipment selection
- Hours of operation
- Complaints handling procedure
- Contact details of who to contact in the event of a complaint
- Noise impact from volume Volumetric Modular Construction (VMC).

All noise complaints shall be investigated by the Building Contractor in accordance with the Contractor's Noise Complaint Management Program's procedures (established as part of CNVMP).

Noise complaint testing shall be conducted by the Contractor's qualified acoustic consultants at the complainant premises during the period of construction. The acoustic consultant shall be practising in the field of environmental noise with qualifications and experience suitable for full membership in the Australian Acoustical Society (AAS).

A noise complaint test report shall be prepared by the acoustic consultant inclusive of the following:

- Name and address of complainant;
- Measurement locations;
- Times of monitoring;
- Noise measurement results;
- Noise source details;
- Observations;
- Assessment against noise objectives;
- Conclusions; and
- Recommendations.

The report is to be submitted to the Building Contractor and Principal within one day of the noise testing.



7 CONCLUSION

Pulse White Noise Acoustics Pty Ltd (PWNA) was engaged to undertake a noise and vibration impact assessment for the proposed mixed used build to rent (BtR) development to be located on an amalgamated site at 1 Barrack Lane and 81-83 George Street, Parramatta. As part of this assessment, we have undertaken a review of the building envelope and noise emissions from the use of the site. From this assessment we note the following:

- Minimum acoustic performances and associated indicative construction for the building envelope have been provided in section 4.2 of this report. The recommended treatments have been provided to ensure compliance with the objectives presented in 3.1.
- To control noise impacts at external receivers, recommended indicative treatments for major engineering services have been provided in Section 4.3. From our review we have formulated the following opinion:
 - Preliminary assessment 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.
 - 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 section 3.2.
- It is recommended that a detailed review is undertaken at the Construction Certificate (CC) stage to ensure all requirements are achieved.
- An assessment of the impacts associated with the number of vehicles increase on surrounding public roads around the site predicted the impact to be compliant with the NSW EPA RNP.
- It is noted that the construction program for the development will be constructed using Volumetric Modular Construction method. It is advised that a detailed assessment should be undertaken in relation to the criteria discussed in Section 3.5 and 5.1. Noise and vibration mitigation measures should be detailed in the contractor's Noise and Vibration Management Plan (NVMP).
- Volumetric Modular Construction (VMC) methodology for the majority of the construction process is proposed. Assessment of the noise and vibration impact associated with the construction process have been addressed in this report. It is expected that overall construction process will reduce and provide that the duration of the noise impact is likely to be reduced with it.
- The assessment of the proposed extended construction hours has been undertaken with reference to the relevant ICNG (2007) criteria for airborne noise, construction traffic and vibration (refer to section 6.5). The proposed construction hour for the development as below:
 - Monday to Friday 7:00 am to 12:00 am midnight.
 - Saturday 8:00 am to 6:00 pm
 - Sunday 8:00 am to 6:00 pm
- Noise source levels were established from site-specific measurements of the diesel tower crane and loading dock operations, supported by project drawings and standard reference data. The predicted noise levels for the assessed construction scenarios (Scenarios 1–4) were modelled using SoundPLAN 9.1 to represent reasonable worst-case conditions. Results indicate that the construction activities during the proposed extended hours will comply with the applicable noise management levels, provided the recommended mitigation measures are implemented. Noting that further acoustic treatment is required for the tower crane. As such, we believe the proposed out-of-hour work for the development is considered acoustically acceptable.

The acoustic assessment for the proposed mixed used BTR development at 1 Barrack Lane and 81–83 George Street, Parramatta confirms that compliance with relevant criteria is feasible. Minimum building envelope requirements and indicative treatments for mechanical services have been identified, with detailed design reviews recommended prior to the issue of the Construction Certificate. Traffic noise impacts are expected to comply with the NSW EPA Road Noise Policy. A Noise and Vibration Management Plan (NVMP) should be prepared by the contractor to manage potential impacts during construction.

APPENDIX A: ACOUSTIC GLOSSARY

The following is a brief description of the acoustic terminology used in this report:

Ambient Sound	The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.
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.
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.
Decibel [dB]	The level of noise is measured objectively using a Sound Level Meter. The following are examples of the decibel readings of every day sounds; 0dB the faintest sound we can hear 30dB a quiet library or in a quiet location in the country 45dB typical office space. Ambience in the city at night 60dB Martin Place at lunch time 70dB the sound of a car passing on the street 80dB loud music played at home 90dB the sound of a truck passing on the street 100dB the sound of a rock band 115dB limit of sound permitted in industry 120dB deafening
dB(A)	<i>A-weighted decibels</i> The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter. The sound pressure level in dB(A) gives a close indication of the subjective loudness of the noise.
Frequency	Frequency is synonymous to <i>pitch</i> . Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
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 L ₉₀ 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.
dB (A)	'A' Weighted overall sound pressure level
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



APPENDIX B: UNATTENDED NOISE MONITORING RESULTS – M1

Weather Station: Sydney Olympic Park AWS

Weather Station ID: 066212

Coordinates: Lat: -33.83, Lon: 151.07, Height: 4.0 m

81-83 George St & 1 Barrack Ln, Parramatta NSW 2150

Ambient noise monitoring report



Item	Information
Logger Type	NL-42
Serial number	1000233
Address	81-83 George St & 1 Barrack Ln, Parramatta NSW 2150
Location	250439 - Freecity BtR - 81-83 George St & 1 Barrack Ln, Parramatta, Parramatta NSW 2150
Facade / free field	Free field
Environment	

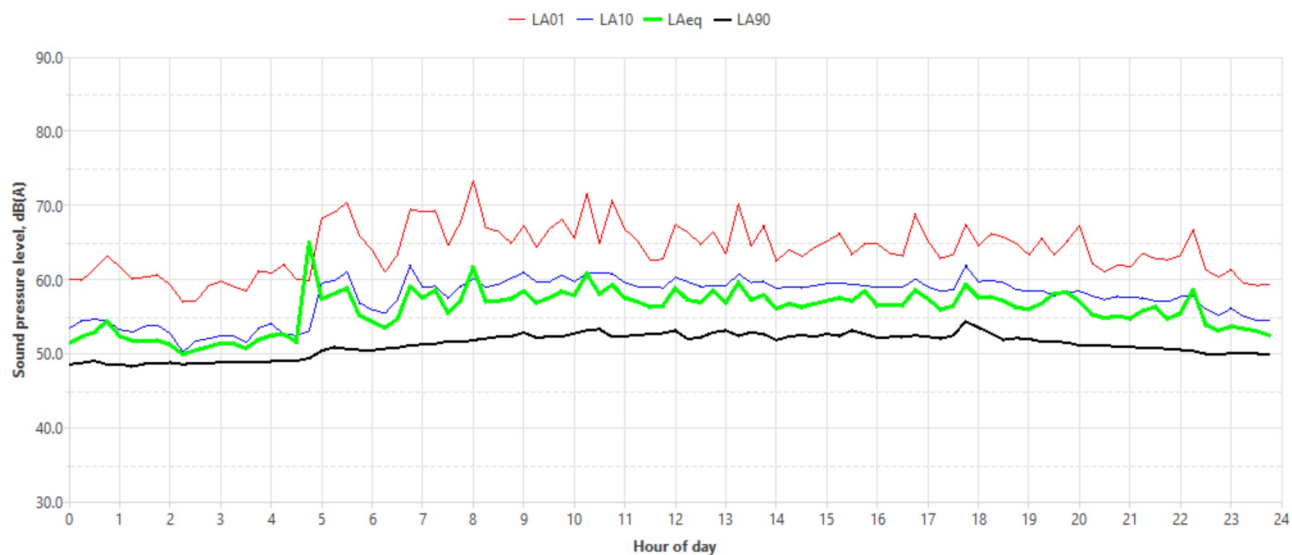
Measured noise levels

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
Thu 28 Aug 2025	54	50	-	60	56	-
Fri 29 Aug 2025	53	49	49	58	56	55
Sat 30 Aug 2025	50	50	48	57	57	55
Sun 31 Aug 2025	49	49	49	59	55	57
Mon 01 Sep 2025	54	50	49	59	55	59
Tue 02 Sep 2025	-	50	-	-	56	-
Wed 03 Sep 2025	54	49	49	60	59	56
Thu 04 Sep 2025	53	50	48	60	57	53
Fri 05 Sep 2025	54	50	49	62	57	54
Sat 06 Sep 2025	50	49	48	57	55	54
Sun 07 Sep 2025	51	52	48	58	57	63
Summary	53	50	49	59	56	57

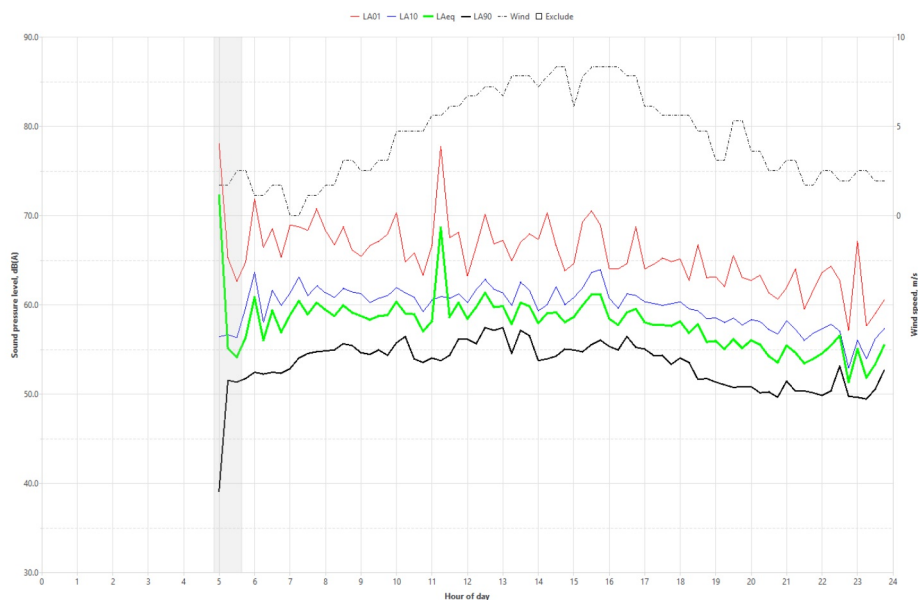
Note: Results with a '-' identify that there were not enough measurements available to correctly calculate the level, in accordance with the Noise Policy for Industry. The data has been excluded either from weather or manual exclusions. See the charts for more information

Logger location	Logger deployment photo

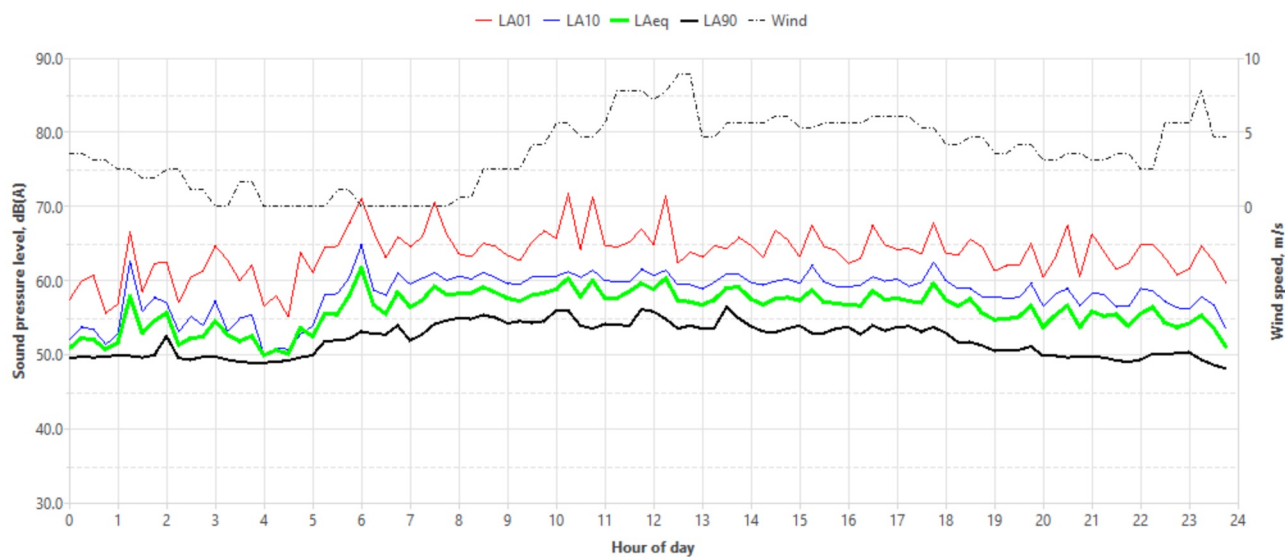
Typical Day



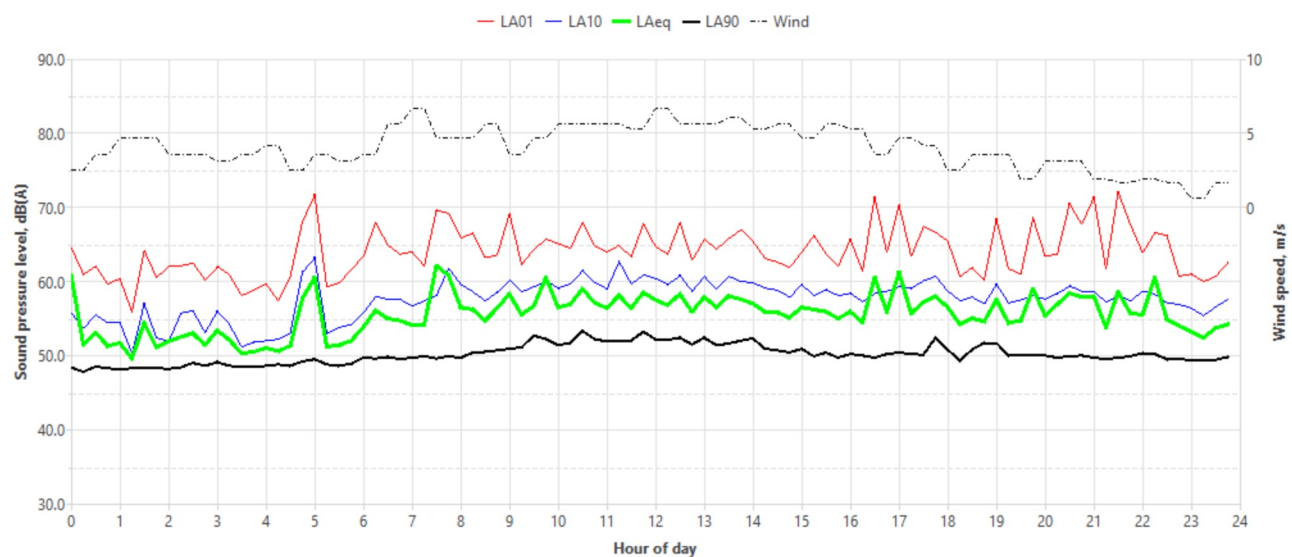
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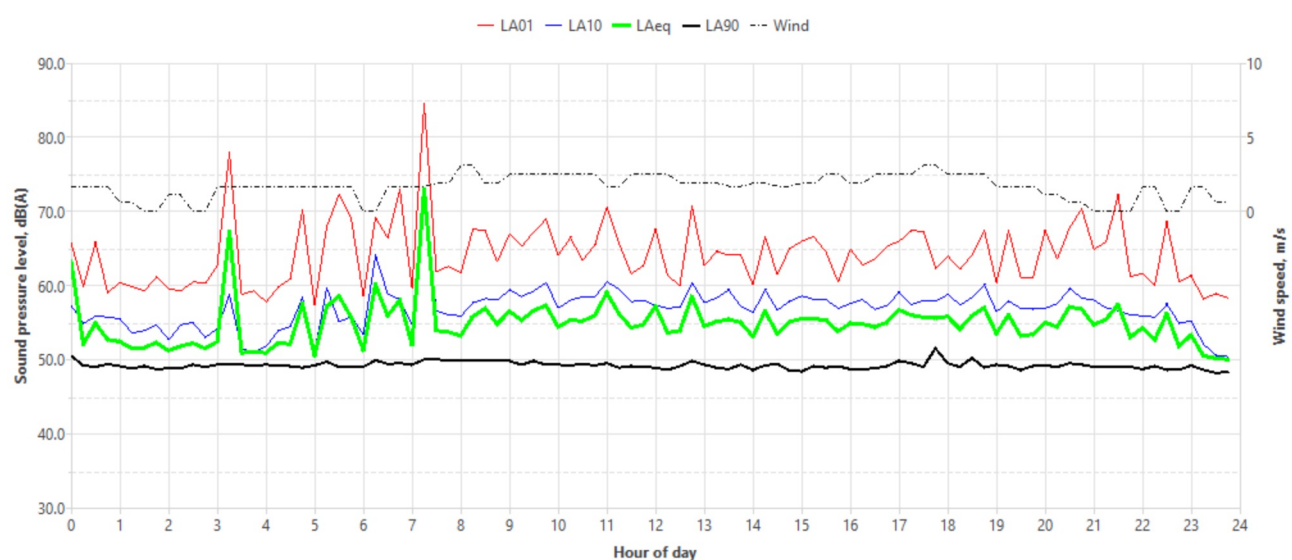
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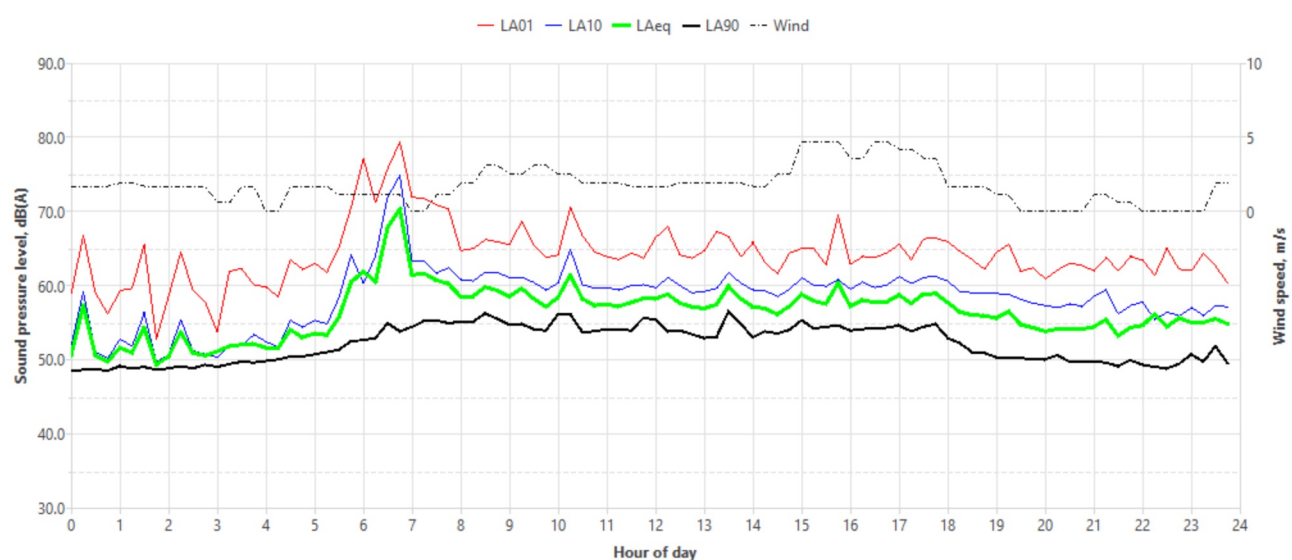
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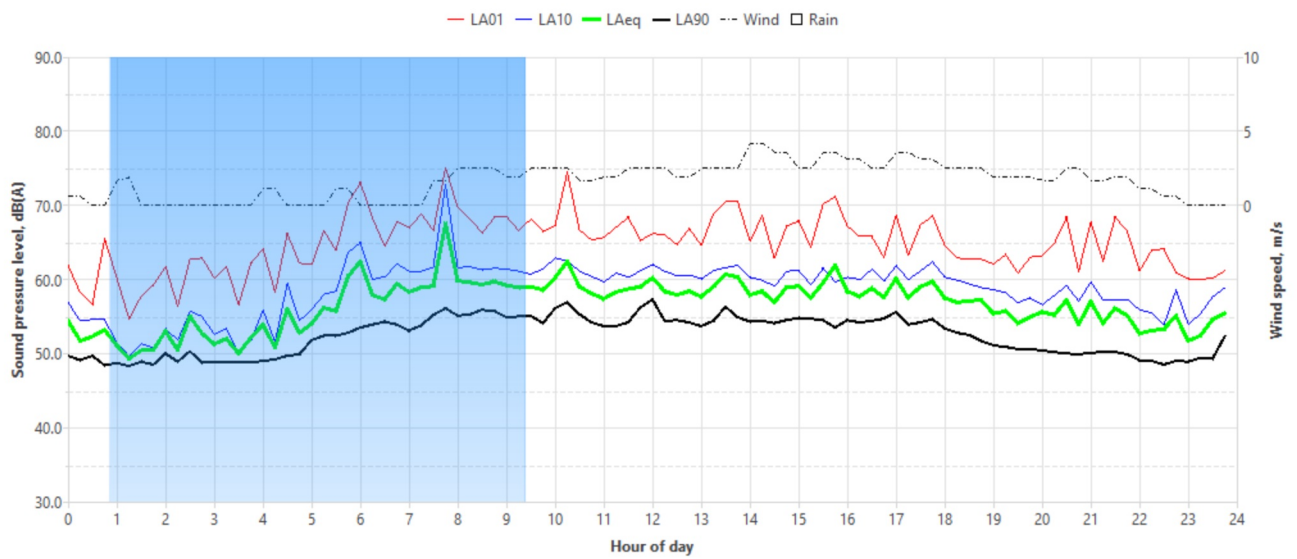
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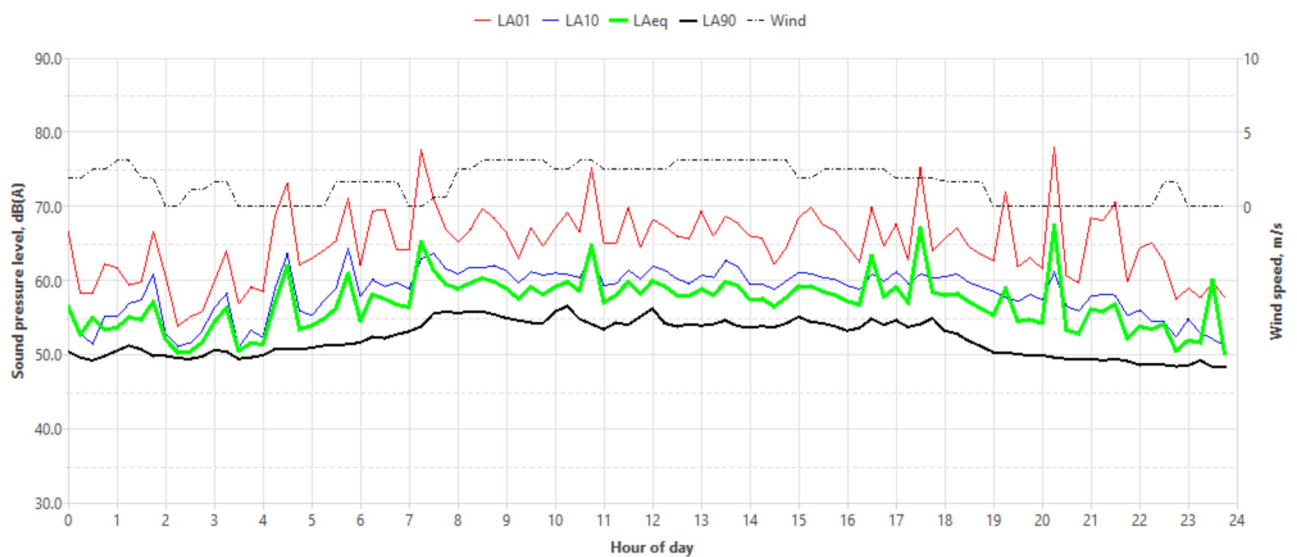
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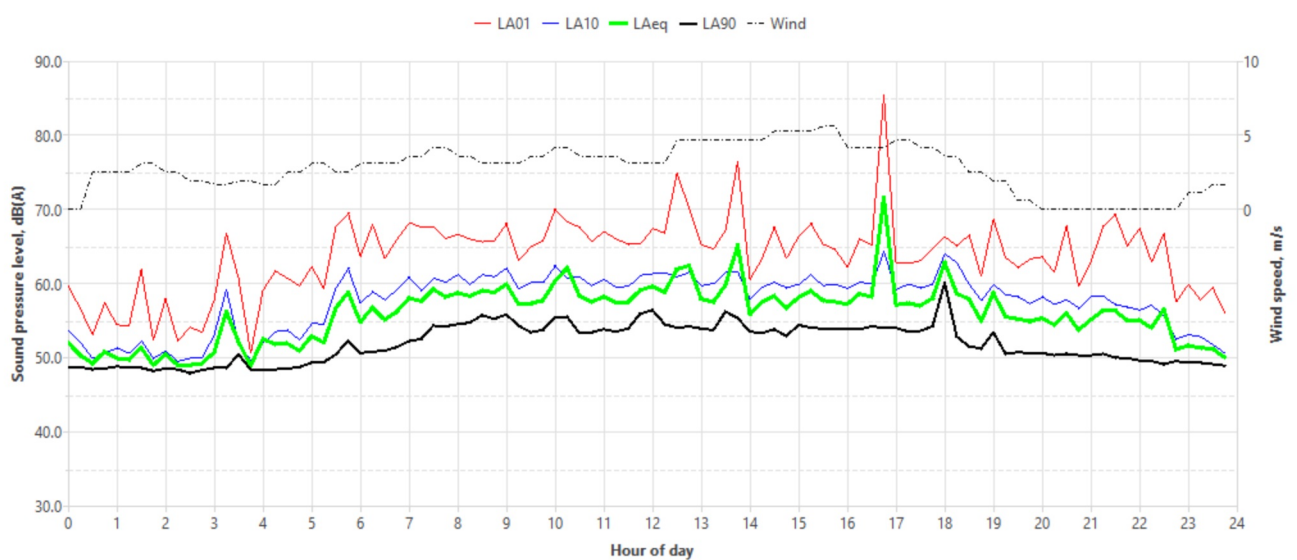
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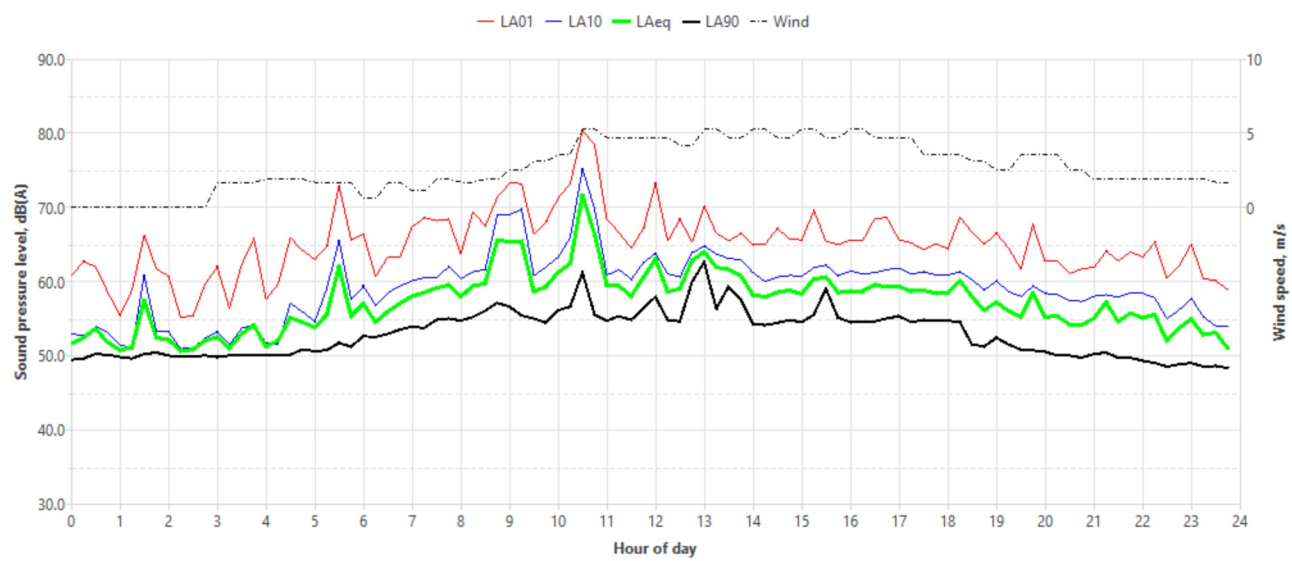
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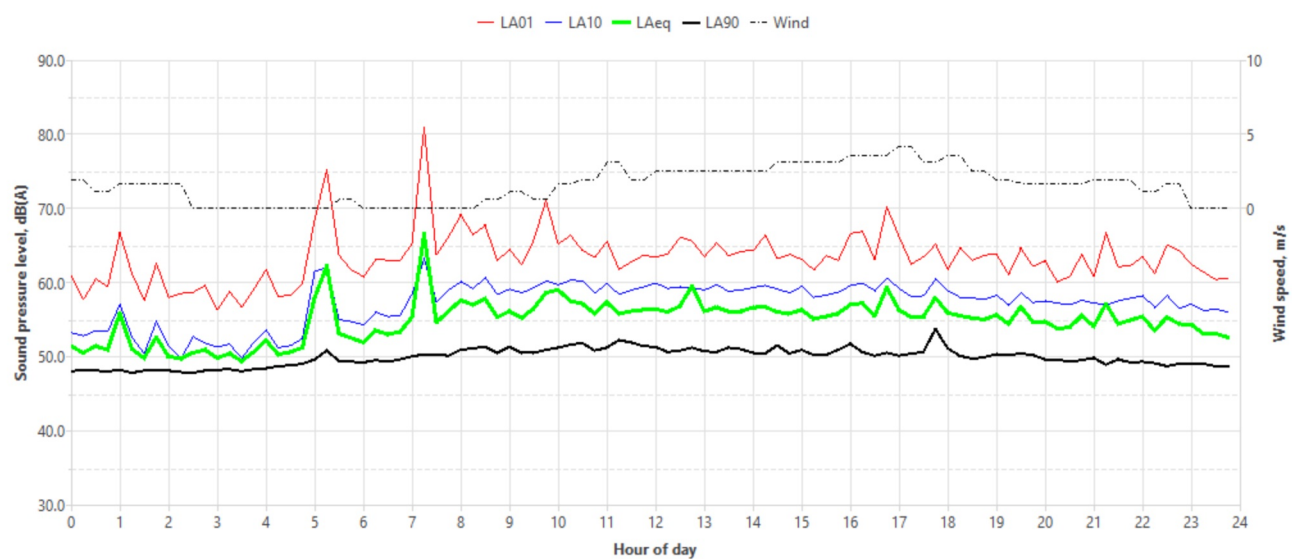
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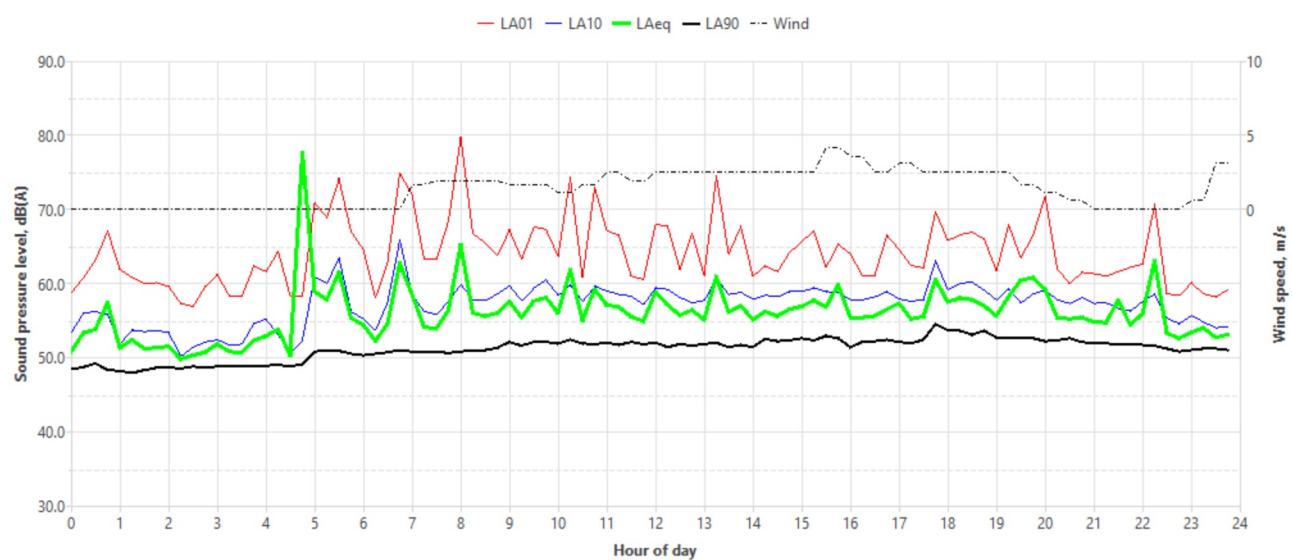
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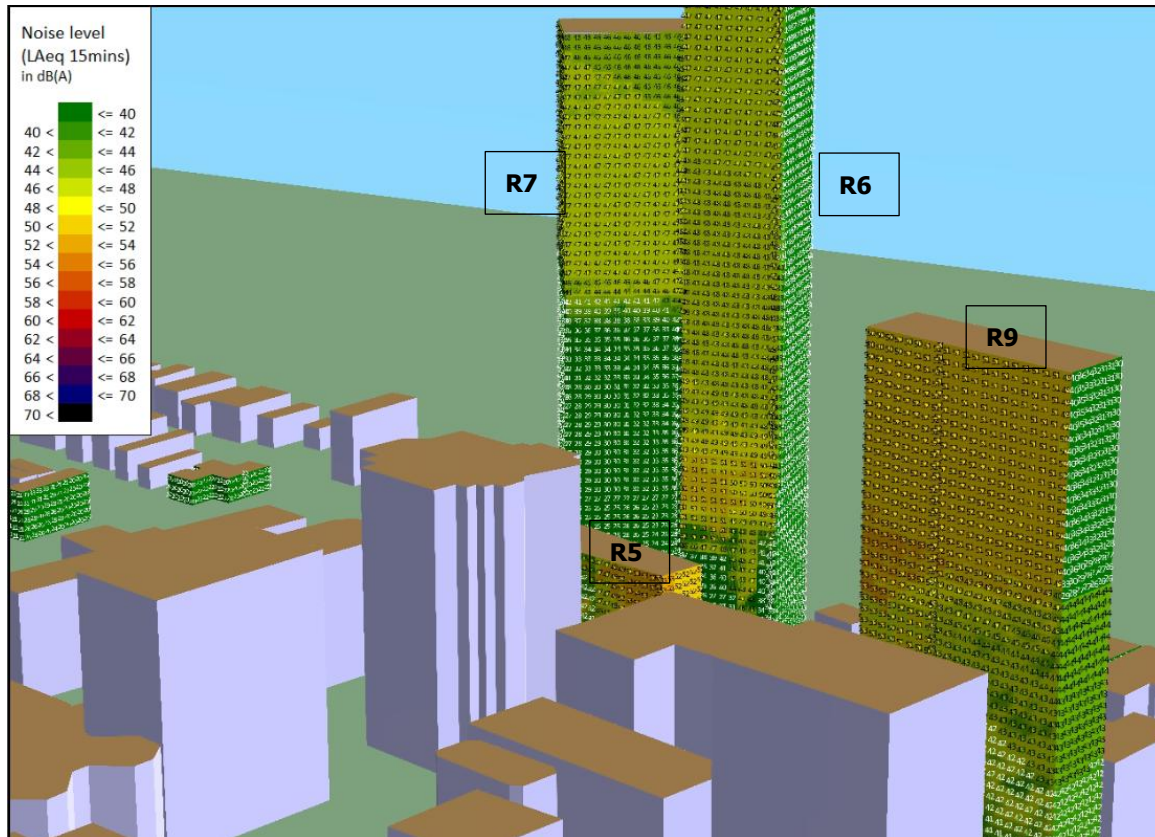


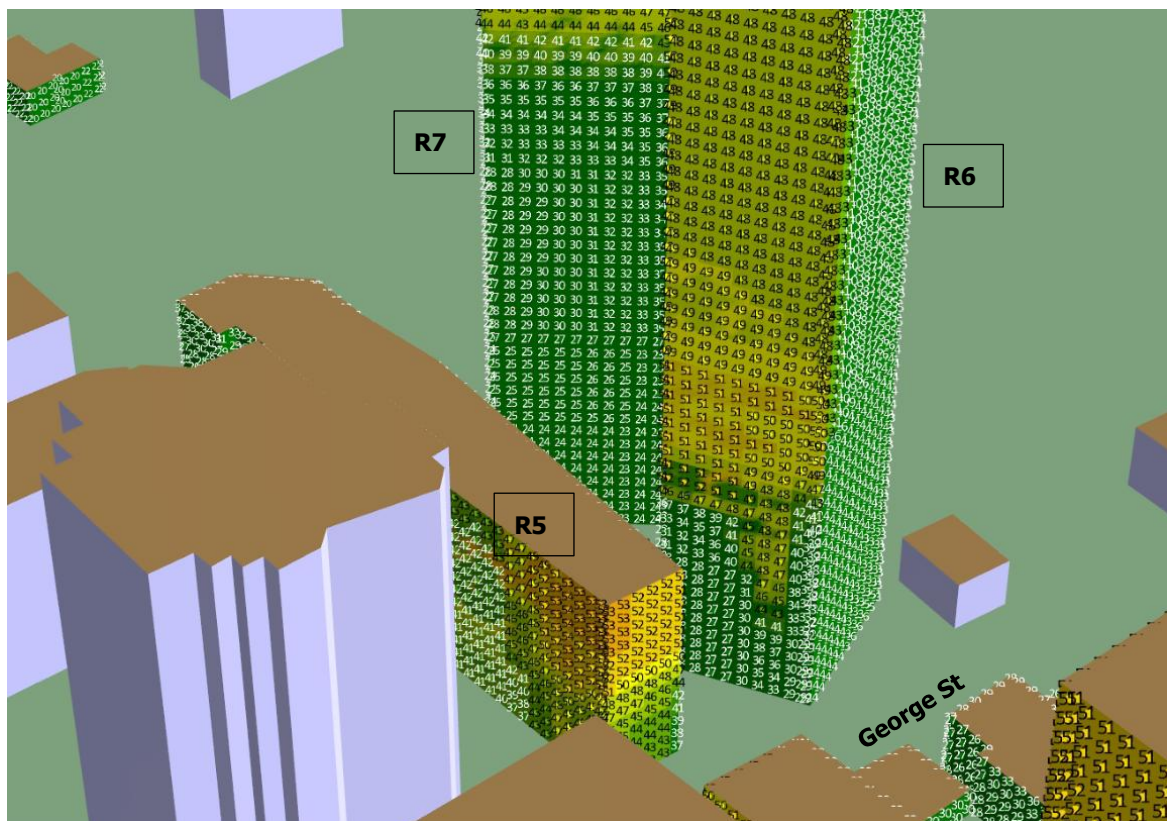
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APPENDIX C: 3D FAÇADE NOISE MAPPING

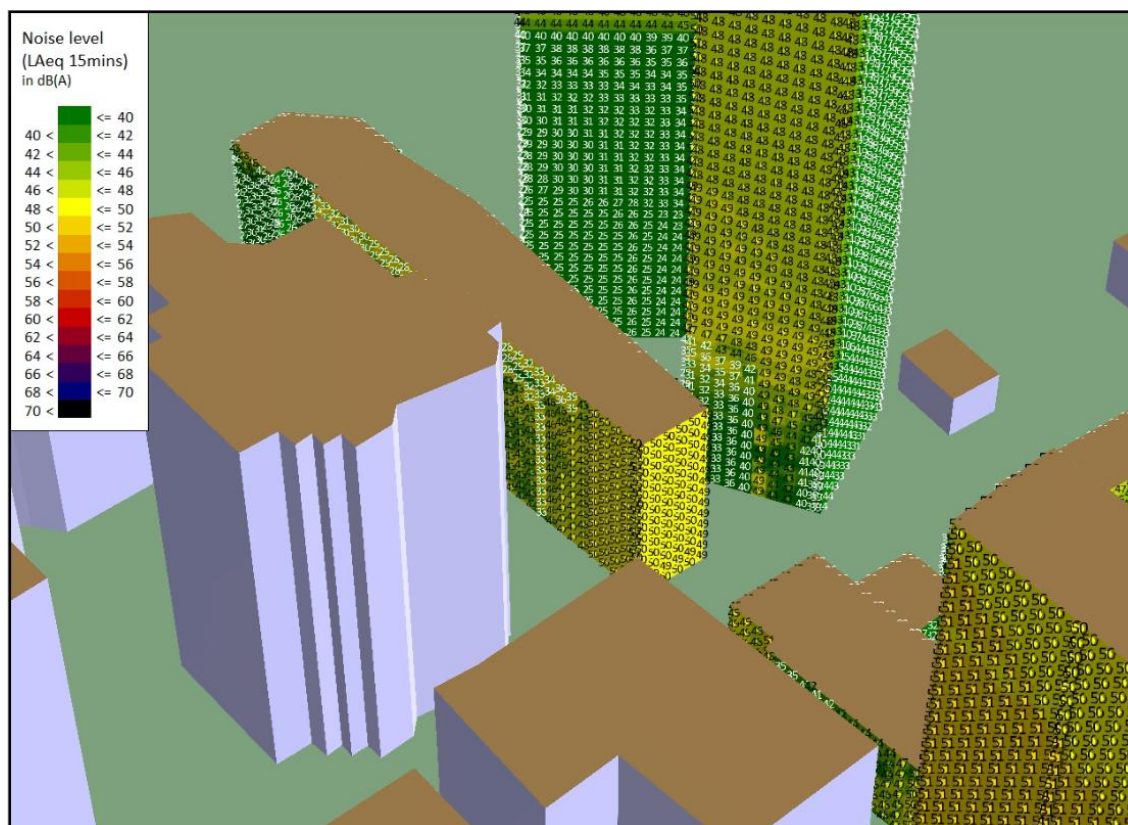
S1 - CT

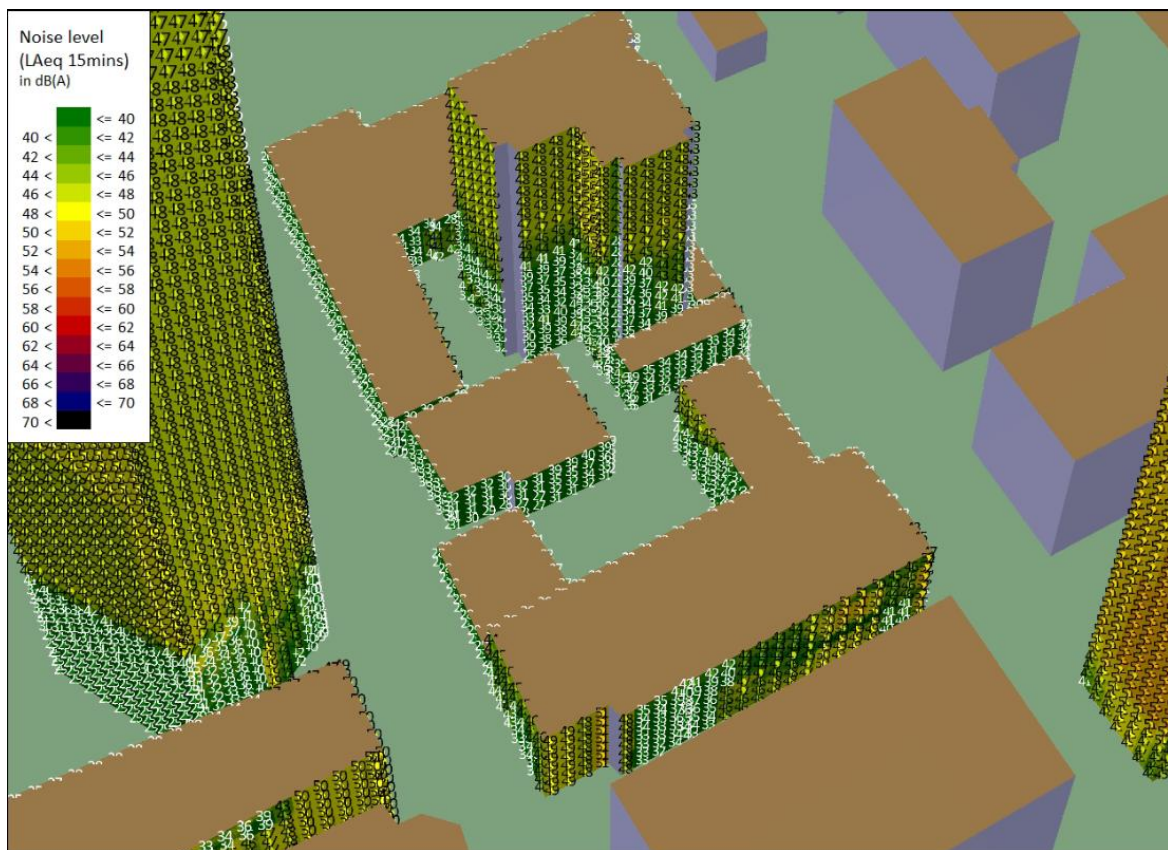




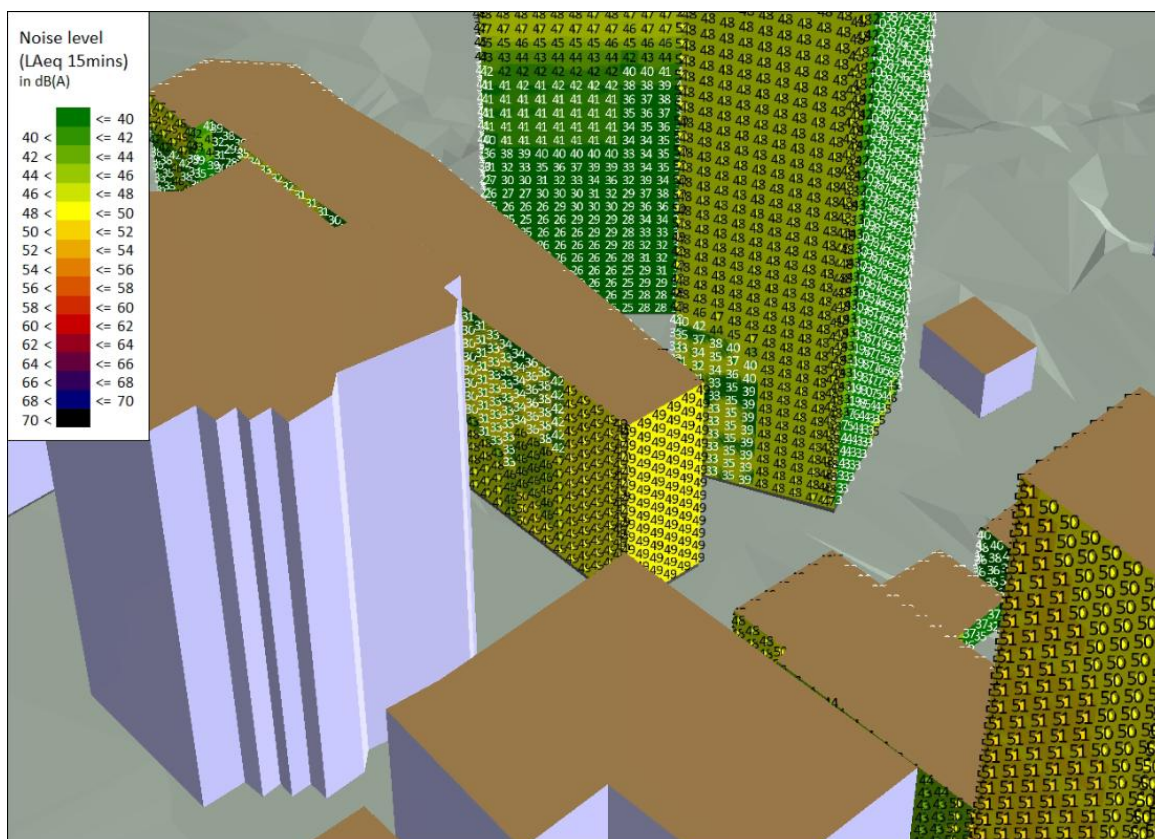


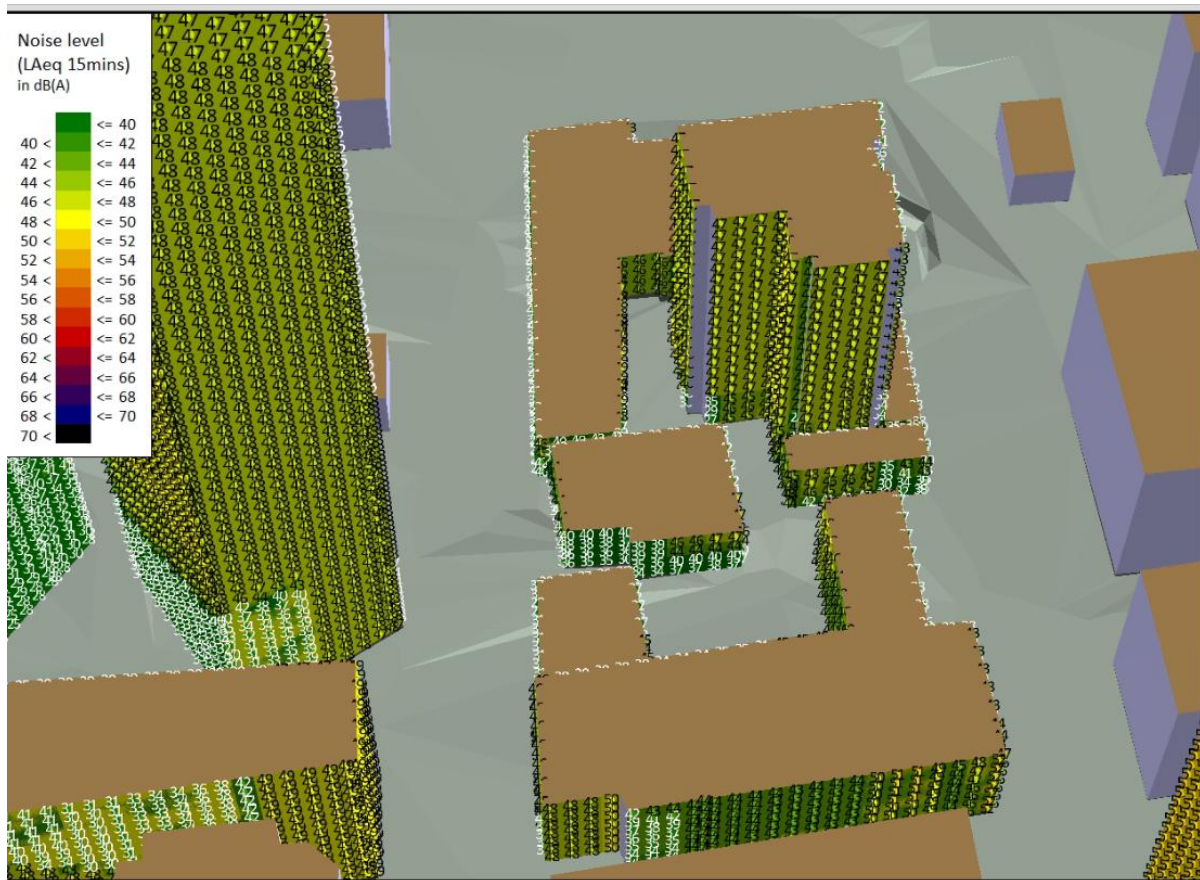
S2 – CT



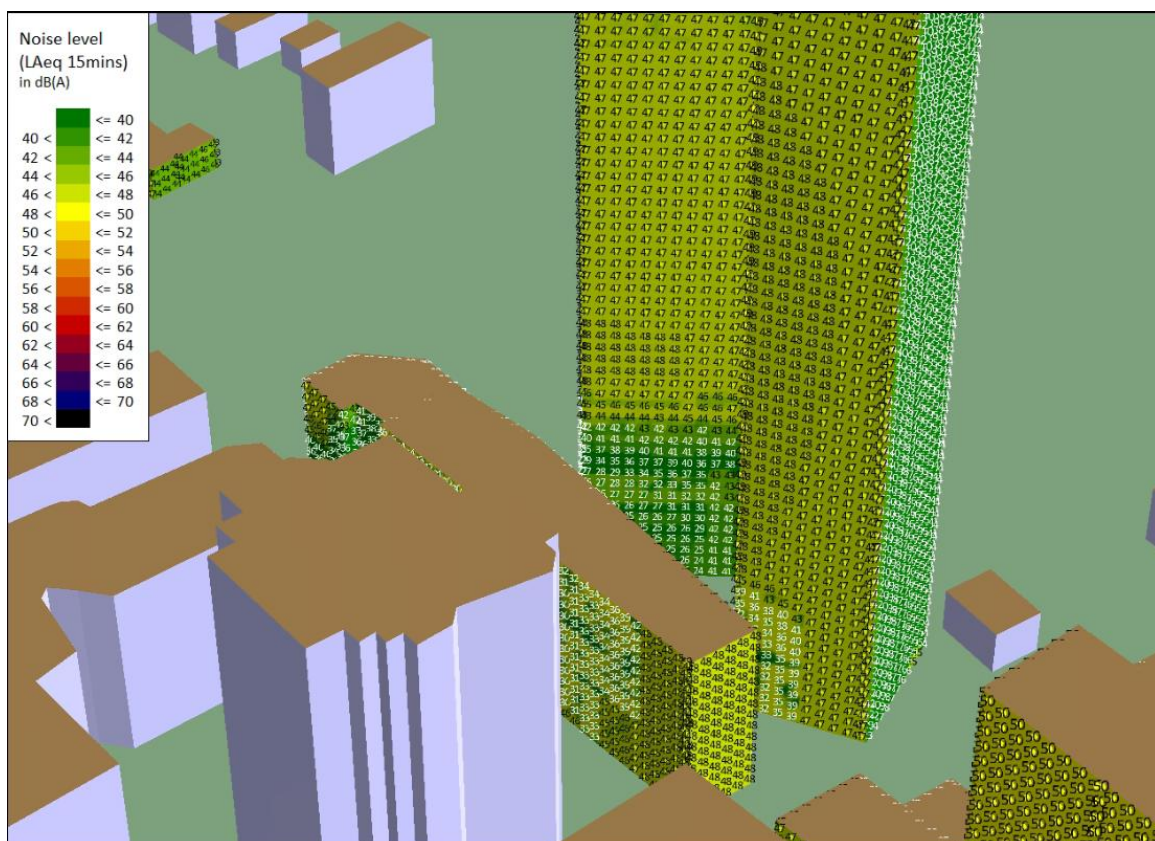


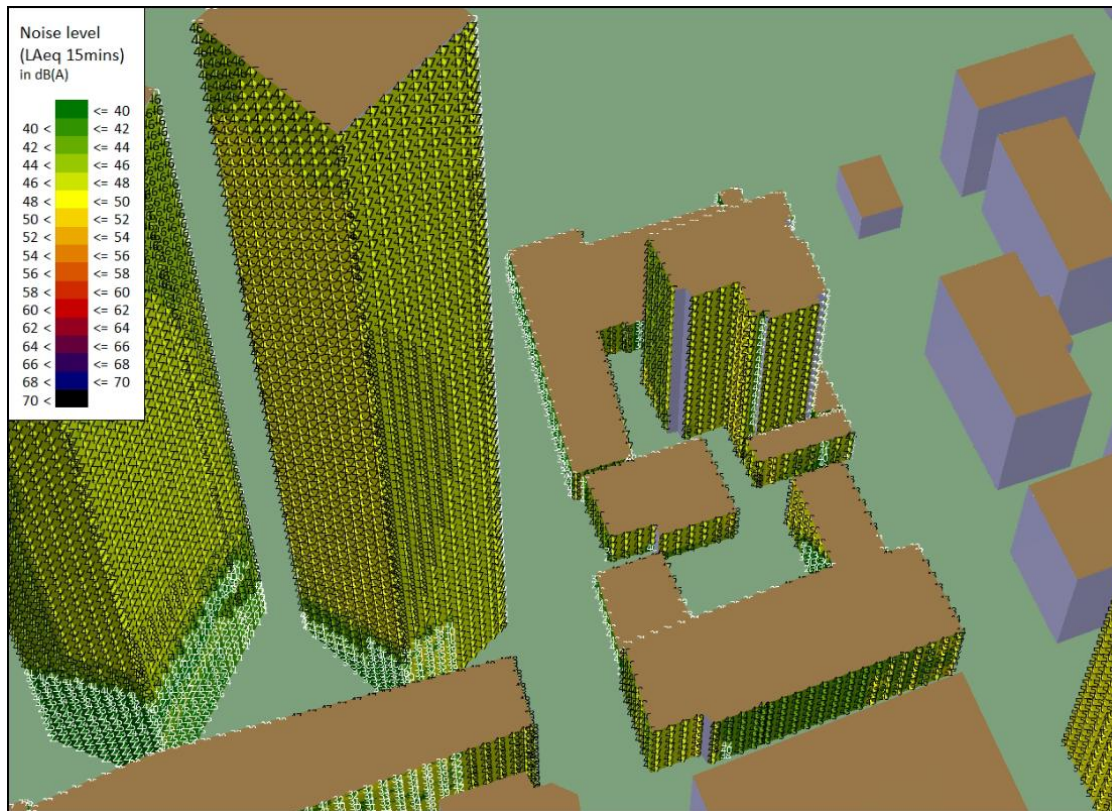
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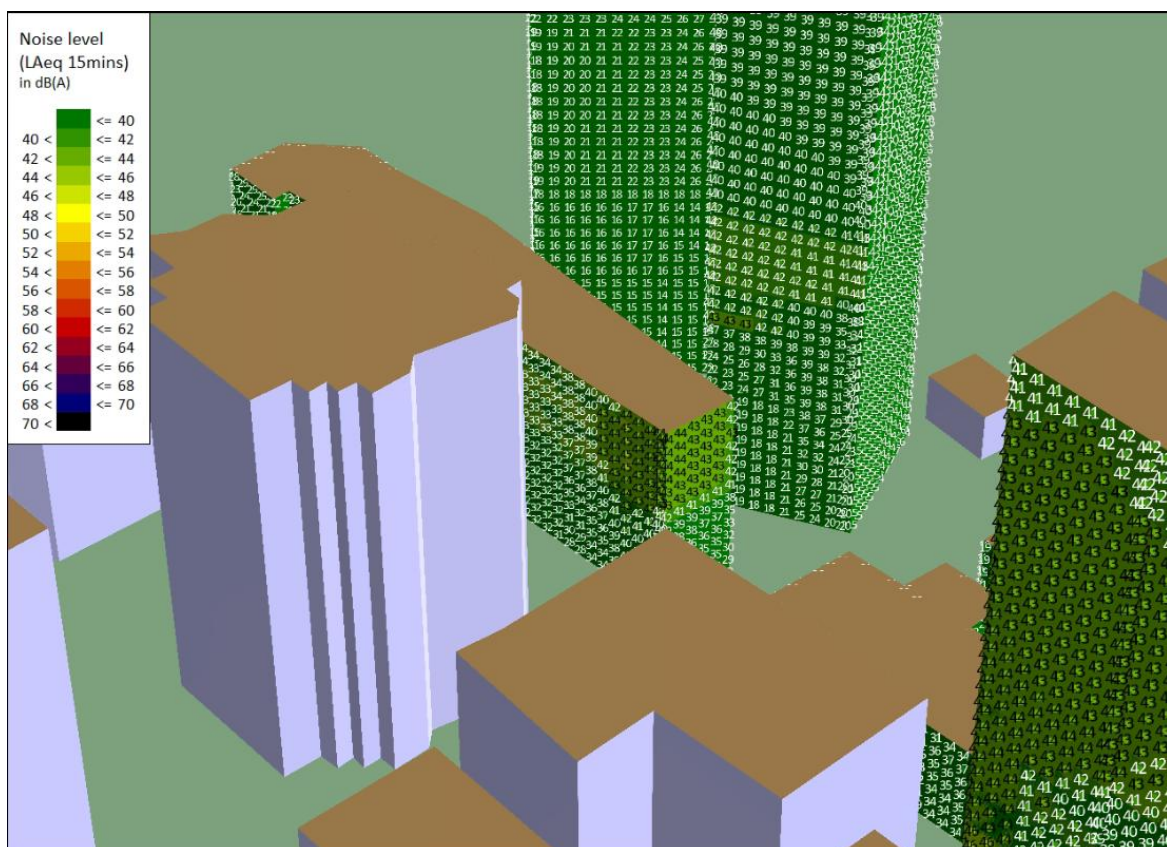


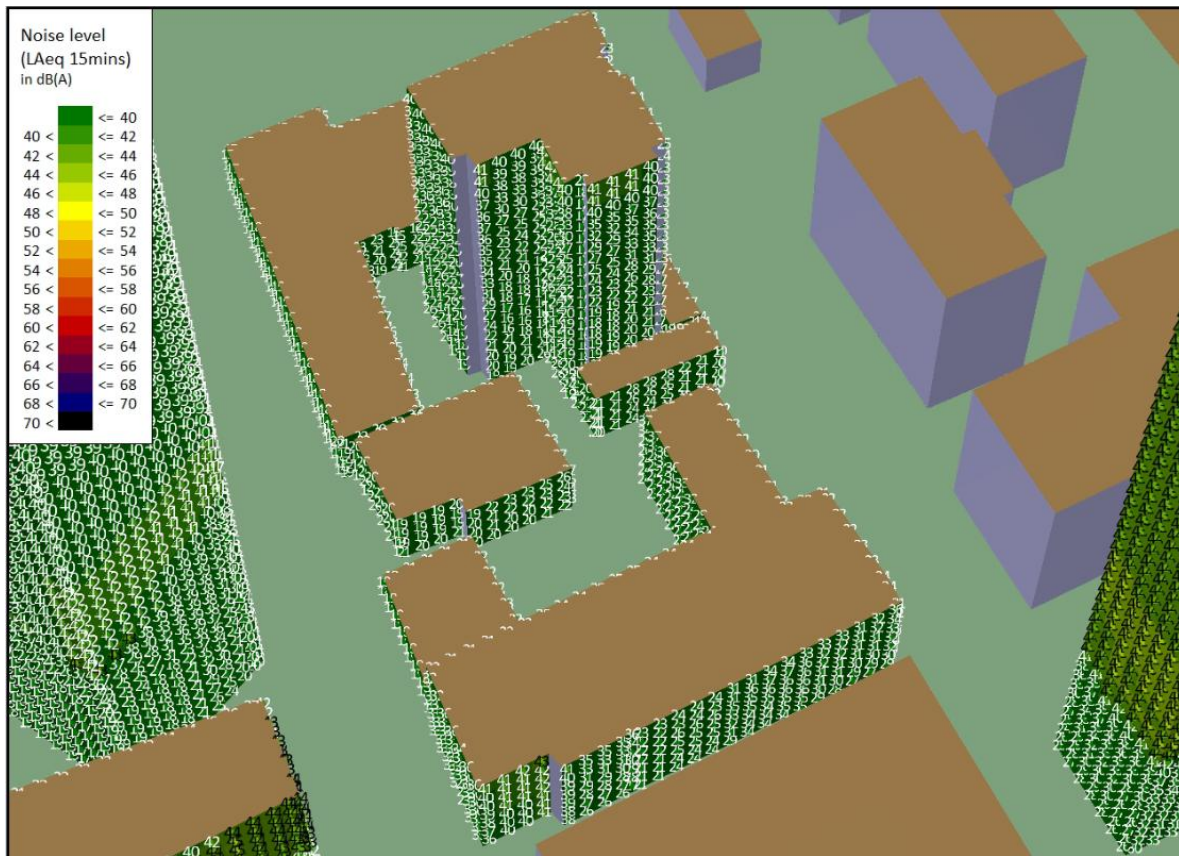
S4-CT





S1-VMI

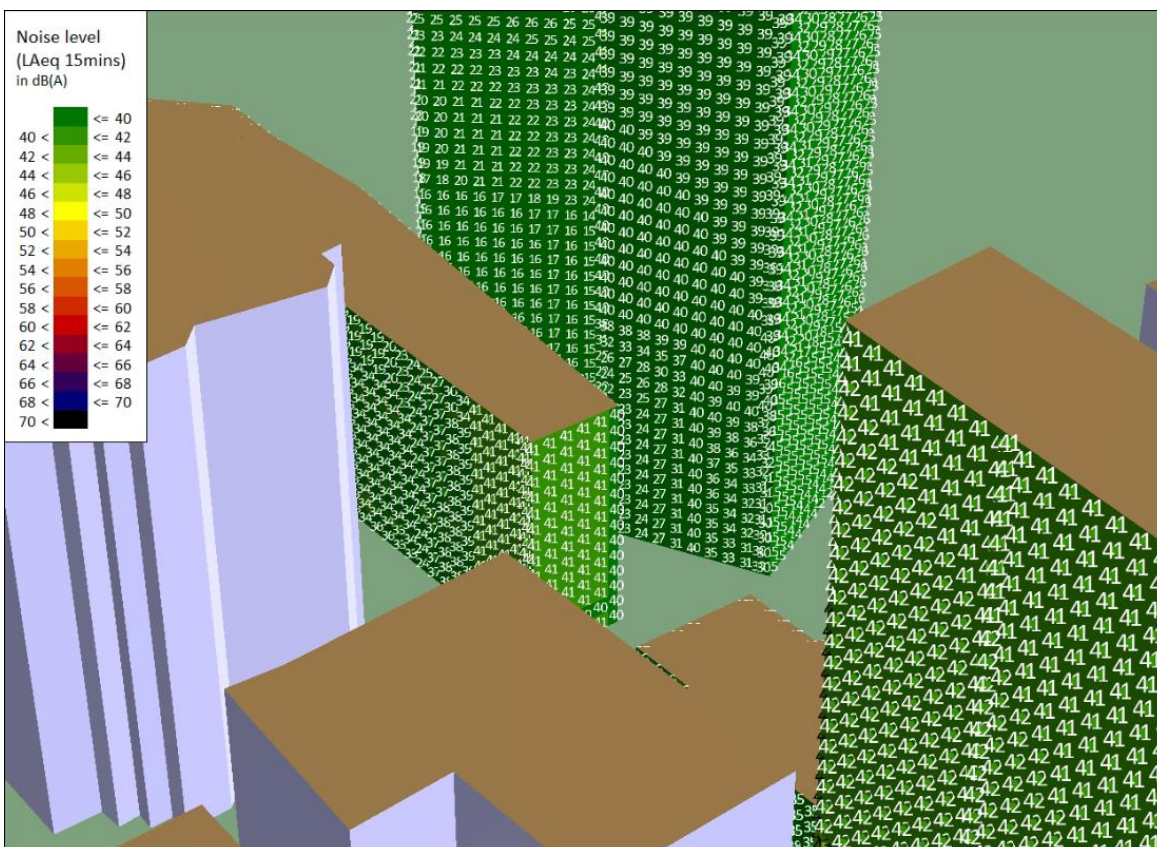




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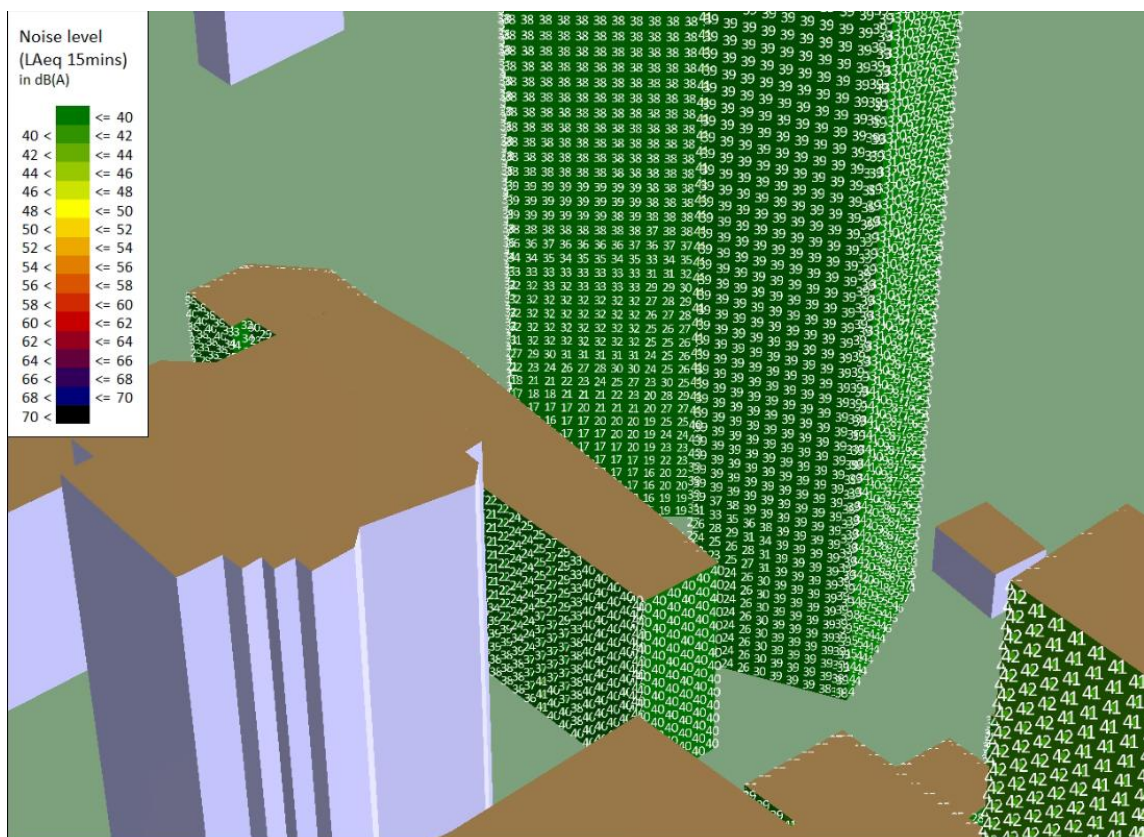
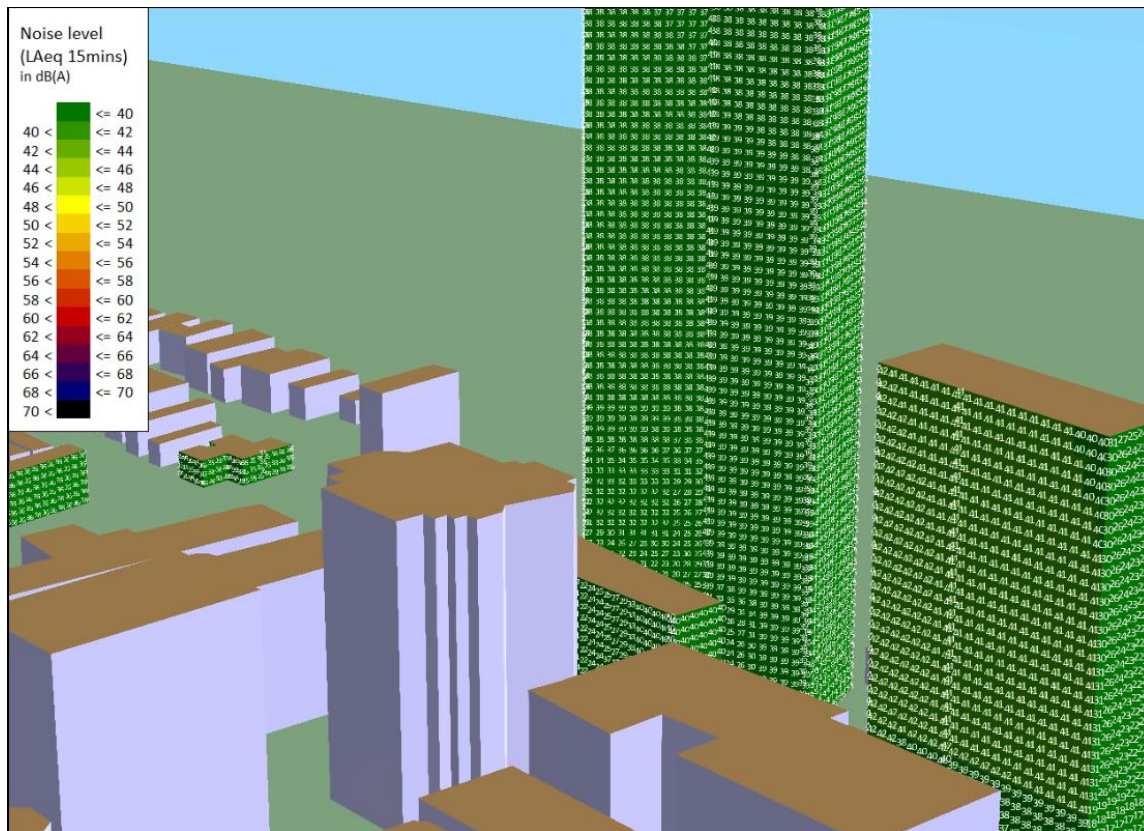


S2-VMI





S3-VMI





S3-VMI

