



ACOUSTIC REPORT FOR DEVELOPMENT APPLICATION

Gran Central Granville

134-142 Parramatta Road, Granville NSW 2142

PREPARED FOR

Starryland NSW Pty Ltd
Suite 26.04, Level 26,
25 Bligh St, Sydney NSW 2000
Tel: (02) 9223 0685

Ref: SY191237-00-AUR01
Rev: C
Date: 10.02.2020

Acoustic Report for Development Application

Revision Schedule

Date	Revision	Issue	Prepared By	Approved By
28.08.2019	A	Draft	I. Adlington	R. Osman
31.10.2019	B	For Review	I. Adlington	
10.02.2020	C	Updated	I. Adlington	

Northrop Consulting Engineers Pty Ltd

ACN 064 775 088 | ABN 81 094 433 100

Level 11, 345 George Street, Sydney NSW 2000

02 9241 4188 | sydney@northrop.com.au | www.northrop.com.au

© 2020 Northrop Consulting Engineers Pty Ltd. All rights reserved.

This document has been prepared on behalf of and for the exclusive use of Starryland NSW Pty Ltd, and is subject to and issued in accordance with the agreement between Starryland NSW Pty Ltd and Northrop Consulting Engineers. Northrop Consulting Engineers accepts no liability or responsibility whatsoever for it in respect of any use of or reliance upon this document by any third party. Copying this document without the permission of Starryland NSW Pty Ltd or Northrop Consulting Engineers is not permitted.

Table of Contents

1. Executive summary.....	3
2. Referenced documents.....	4
3. Site and project description	5
4. Environmental noise criteria	6
4.1 City of Parramatta Council DCP 2011	6
4.2 State Environmental Planning Policy	6
4.3 NSW EPA Noise Policy for Industry (2017)	7
4.4 NSW EPA Interim Construction Noise Guideline.....	8
5. National Construction Code Building Code of Australia 2019	11
6. Site measurements	12
6.1 Instrumentation.....	12
6.2 Operator attended measurements	12
6.3 Long-term noise logging.....	13
7. Determination of Noise Policy for Industry criteria.....	14
8. Acoustic assessment	15
8.1 Road traffic noise intrusion.....	15
8.2 Mechanical and building services noise.....	15
8.3 Construction noise	20
9. Conclusion	25
Appendix A – long term noise monitoring	26

1. Executive summary

Northrop Consulting Engineers Pty Ltd (Northrop) Acoustics have been engaged by Starryland NSW Pty Ltd to provide an acoustic report for development application for high-density mixed-use development “Gran Central” (the Project) to be located at 134-142 Parramatta Road, Granville NSW 2142 (the Site).

This report provides a statement of compliance with the relevant statutory criteria for the proposed development within the vicinity of the nearest potentially affected receivers and recommendations for noise mitigation measures for the proposed development for compliance with the relevant criteria.

This assessment has been prepared using acoustic data collected on site using long term noise loggers and a hand-held sound level meter for spectral analysis.

2. Referenced documents

This assessment has been prepared considering the following documentation:

Project documents:

- Architectural DA drawings issued by PBD Architects on 23rd August 2019
- Mechanical Spatial Sketches (SY191237-MSK01-3) issued by Northrop on 22nd August 2019

Consent authority, design guidelines and standards:

- *City of Parramatta Council Development Control Plan (DCP)*, 2011
- *Parramatta Local Environment Plan (LEP) Land Zoning Map – Sheet LZN_010*, 2011, issued by NSW Government
- *NSW Noise Policy for Industry (NPfI)*, 2017, issued by NSW Environmental Protection Authority
- *Noise Guide for Local Government*, 2013, issued by NSW Environmental Protection Authority
- *State Environmental Planning Policy (Infrastructure)*, 2007, issued by NSW Government
- *Development near Rail Corridors and Busy Roads Interim Guideline*, 2008, issued by NSW Government
- *NSW Interim Construction Noise Guideline (ICNG)*, 2009, issued by NSW Department of Environment, Climate Change and Water
- *AS 2436:2010: Guide to Noise and vibration control on construction demolition sites*, 2010, issued by Standards Australia
- *AS 2670:2001: Vibration and shock – Guide to the evaluation of human exposure to whole body vibration*, 2001, issued by Standards Australia
- *Update of Noise Data Base for the Prediction of Noise on Construction Sites*, 2005, issued by UK Department for Environment Food and Rural Affairs
- *National Construction Code Building Code of Australia, (BCA)*, 2019, issued by Australian Building Codes Board

3. Site and project description

The Site (shown in red) in Figure 1 is located at 134-142 Parramatta Road, Granville NSW 2142. The nearest affected residential receivers are 60-64 and 65-71 Cowper Street, shown outlined in orange in Figure 1. Figure 1 also shows the locations of the long-term noise monitor, and the locations of the operator attended measurements.

The Project is proposed to be a high-density mixed-use development comprising residential apartments above ground level retail, with a basement car park.

The Site and surrounds is zoned B4 – Mixed Use and is surrounded by B2 – Local Centre and B6 Enterprise Corridor zoned land (Parramatta Local Environmental Plan 2011 Land Zoning Map - Sheet LZN_010). The residential receiver category would be classified as “Urban” with reference to Table 2.3 in the Noise Policy for Industry (2017) based on the measured noise levels.



Figure 1 Aerial view of site with nearest affected receivers and measurement locations

4. Environmental noise criteria

4.1 City of Parramatta Council DCP 2011

The following are excerpts from City of Parramatta Council Development Control Plan (2011) Part 3 – Development Principles:

3.3.4 Acoustic Amenity

Objectives

O.1 To ensure that the siting and design of buildings minimises noise impacts from abutting busy roads, rail corridors and other noise-generating land uses.

O.2 To ensure that commercial or industrial development does not unreasonably diminish the amenity of nearby residential uses from noise intrusion.

Design Principles

P.1 Where dwellings are proposed within proximity to noise-generating land uses such as major roads and rail corridors, entries, halls, storage rooms, bathrooms and laundries should be located on the noise affected side of each dwelling and should be able to be sealed off by doors from living areas and bedrooms where practicable.

P.2 Where dwellings are proposed within proximity to noise-generating land uses, appropriate materials with acoustic properties should be incorporated such as solid core doors with seal vents and insulation and suitably treated glazing.

P.3 Non-residential development is not to adversely affect the amenity of adjacent residential development as a result of noise, odour, hours of operation and/or service deliveries.

P.4 Council may require a report by an acoustic consultant to be submitted with development applications for noise generating developments or for residential developments on sites adjacent to noise generating sources such as busy roads and rail corridors.

P.5 The provisions of the State Environmental Planning Policy (Infrastructure) 2007 and Development near Rail Corridors and Busy Roads Interim Guideline must be taken into consideration, to minimise impacts of busy roads and railway corridors on residential and other sensitive development such as schools, child care centres, places of public worship and health services facilities.

Design Control

Residential Development

C.1 Internal habitable rooms of dwellings affected by high levels of external noise are to be designed to achieve internal noise levels of no greater than 50dBA.

NOTE: A busy road is defined as carrying an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data available on the Road and Traffic Authority's website).

4.2 State Environmental Planning Policy

The NSW State Environmental Planning Policy SEPP (Infrastructure) for the purposes of determining the impacts of a rail corridor and major roadway on noise sensitive developments under SEPP Clauses 87 and 102 have set the following conditions for compliance:

Clause 102: *This clause applies for any development for any of the following purposes that is on land in or adjacent to the road for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume of more than*

40,000 vehicles (based on the traffic volume data published on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:

- a building for residential use,
- a place of public worship,
- a hospital,
- an educational establishment or childcare centre.

For Clauses 87 (Rail) and 102 (Road): If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded:

- in any bedroom in the building – 35 dB(A) at any time between 10pm and 7am
- anywhere else in the building (other than a garage, kitchen, bathroom or hallway)-40 dB(A) at any time.

4.3 NSW EPA Noise Policy for Industry (2017)

The NSW Environment Protection Authority Noise Policy for Industry (NPI) 2017 sets out noise criteria to control the noise emission from industrial noise sources. Mechanical, building services and operational noise from the development shall be addressed following the guideline in the NSW EPA Noise Policy for Industry.

The determination of the criteria is based on the results of the ambient and background noise unattended monitoring, addressing two components:

- Controlling intrusive noise into nearby residences (Intrusiveness Criteria)
- Maintaining noise level amenity for particular land uses (Amenity Criteria)

Once both criteria are established the most stringent for each considered assessment period (day, evening, night) is adopted as the Project Noise Trigger Level (PNTL). The project noise trigger level becomes the benchmark for assessing the noise impact from the proposed site upon the surrounding noise-sensitive receivers for the external noise emissions from the development. The assessment periods are:

- Day: 7am – 6pm Monday – Saturday, 8am – 6pm Sunday
- Evening: 6pm – 10pm Monday – Sunday
- Night: 10pm – 7am Monday – Saturday, 10pm – 8am Sunday

The applicable parts of Table 2.2: Amenity noise levels from the Noise Policy for Industry which are relevant to the project are reproduced in Table 1 below:

Table 1 Amenity criteria for external noise levels

Receiver	Noise amenity area	Time of day	Recommended amenity noise level – $L_{Aeq, period}$ dB(A)
Residential	Urban	Day	60
		Evening	50
		Night	45
Commercial premises	All	When in use	65

4.4 NSW EPA Interim Construction Noise Guideline

Construction noise is a major environmental noise issue in NSW and it is well accepted that this activity can adversely affect, sleep, concentration and learning performance and mental and physical health. While construction noise is temporary in nature, its impacts need to be controlled.

The NSW Interim Construction Noise Guideline (ICNG) is specifically aimed at managing noise from construction works. From a regulatory perspective, the local Council is the appropriate regulatory authority for non-scheduled construction activities.

Table 2 GCN noise criteria at residences, using quantitative assessment, L_{Aeq}

Time of Day	Management Level – L_{Aeq} (15min)	How to apply
Recommended Standard Hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm 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} (15min) 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 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining, 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 longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	A strong justification would typically be required for work 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(A) above the noise affected level, the proponent should negotiate with the community For guidance on negotiating agreements see Section 7.2.2 (NSW Interim Construction Noise Guideline)
Active Play Areas (Childcare Centres)	65 dB(A)	When in use

4.4.1 Construction Vibration Limits

Construction vibration levels depend on several factors. These include the activity, the equipment being used, the ground geology and the distance between the building and the source. In Australia there is no current specific standard for construction vibration. This methodology is equivalent to the guidelines issued in current international standards and described in 'AS 2670:2001 *Vibration and shock - Guide to the evaluation of human exposure to whole body vibration*', as shown below in Figure 2.

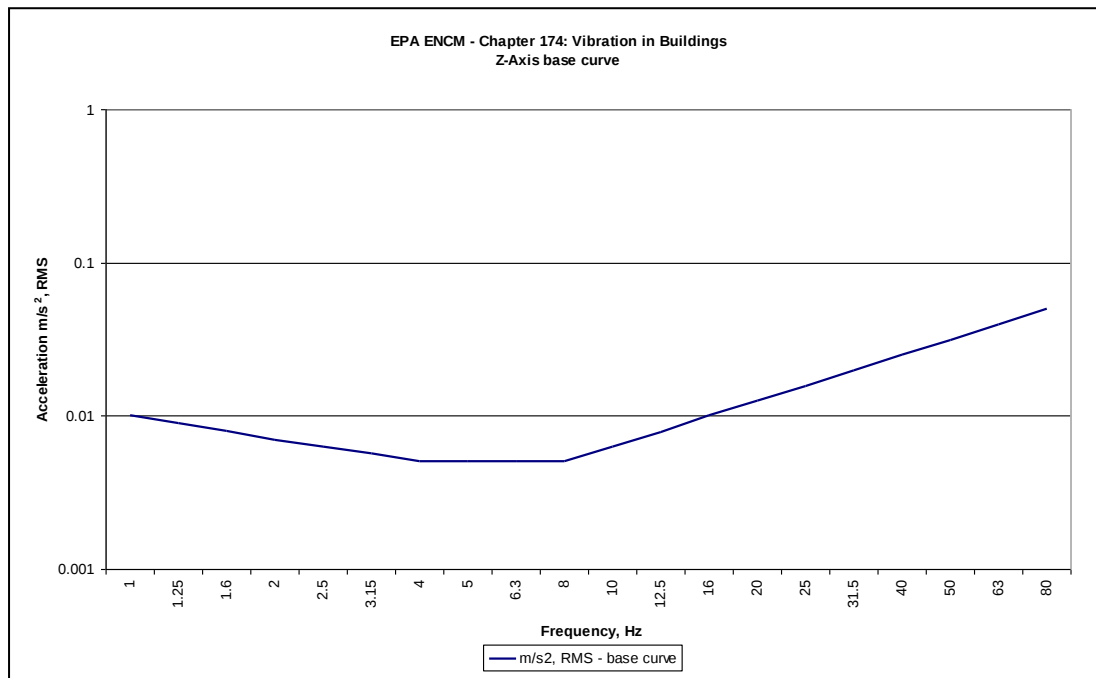


Figure 2 AS2670 Base Vibration Criteria

To assess vibration impact to different types of buildings, for example residential, multiplying factors shown in Table 3 need to be applied to the base criteria.

Table 3 Multiplying factors to obtain limit vibration levels

Receiver	Time	Multiplying factors	
		Continuous vibration	Intermittent or impulsive vibration
Residential	Day 7am – 10pm	2	60
	Night 10pm – 7am	1.4	20
Office	Day 7am – 10pm	4	128
	Night 10pm – 7am	4	128
Workshops	Day 7am – 10pm	8	128
	Night 10pm – 7am	8	128

The NSW Office of Environment and Heritage (OEH) does not directly relate to damage levels to buildings. The German DIN4150 and NSW OEH/British Standard BS6472 provide guidelines relevant to this assessment. These criteria are summarised below in Table 4.

Table 4 Typical vibration limit criteria (mm/s)

Criterion	Typical vibration velocity	Standard
Disturbance to persons (day: 7am – 10pm)	0.3 – 0.6 peak	BS6472
Disturbance to persons (night: 10pm – 7am)	0.2 peak	BS6472
Damage to dwellings	5 – 15 rms	DIN4150
Damage to heritage buildings	3 – 8 rms	DIN4150

Management of noise and vibration impacts during construction is best mitigated through the implementation of a site noise and vibration management plan by the prospective builder.

5. National Construction Code Building Code of Australia 2019

The development is classified as Class 2 under the Building Code of Australia (BCA):

“A building containing 2 or more sole-occupancy units each being a separate dwelling.”

As such, Part F5 of the BCA (summarised in Table 5 below) applies to building elements for acoustic insulation. Recommended constructions to achieve these ratings will be provided at the detailed design stage.

Table 5 BCA required acoustic insulation performance

Building element separating:			Required acoustic performance
Floors	Sole-occupancy unit (including ensuite)	Sole-occupancy unit (SOU), plant room, lift shaft, stairway, public corridor, public lobby or the like; parts of a different classification.	Min. $R_w + C_{tr}$ 50 Max. $L_{n,w} + C_i$ 62
Walls	Sole-occupancy unit	Sole-occupancy unit	Min. $R_w + C_{tr}$ 50
		Stairway, public corridor, public lobby or the like; parts of a different classification.	Min. R_w 50, with min. R_w 30 door
		Plant room, lift shaft	Min. R_w 50 Discontinuous construction
	Habitable room (other than a kitchen)	Bathroom, sanitary compartment, laundry or kitchen in an adjoining unit	Min. $R_w + C_{tr}$ 50 Discontinuous construction
Services	Habitable room in a sole-occupancy unit	Duct, soil pipe, waste pipe, water supply pipe, storm water pipe, including a duct or pipe that is located in a wall or floor cavity, serves or passes through more than one SOU	Min. $R_w + C_{tr}$ 40
	Non-habitable room or kitchen in a sole-occupancy unit		Min. $R_w + C_{tr}$ 25

6. Site measurements

6.1 Instrumentation

The survey was conducted with the following instruments:

- Rion NL-52 Type 1 noise logging sound level meter
- NTI Precision Integrating Octave Band Sound Level Meter, Type XL2 with 1/3 Oct band filter unit, which conforms to applicable standards of IEC 61672-1:2002-05 CLASS1 & IEC 60651 TYPE1.

All equipment was calibrated before and after the measurements using a Brüel & Kjær Acoustic Calibrator. No calibration deviations were recorded.

6.2 Operator attended measurements

15 minute attended measurements were conducted to verify unattended background noise levels, to establish the octave band noise levels and to characterise the acoustic environment around the site. Operator attended noise measurement survey was conducted with an integrating Type 1 sound level meter and windshield. Measurements were taken continuously, and the microphone was set to receive direct frontal sound and facing the direction of sound emission.

The operator attended noise measurements were performed on 14th August 2019 at locations *M1-M3*, shown in blue in Figure 1. Results are presented in Table 6 below.

Table 6 Operator attended measurement 14th August 2019

Location	Measurement date and time	L _{Aeq} , 15 minute – dB(A)	L _{A10} , 15 minute – dB(A)	L _{A90} , 15 minute – dB(A)	Notes
<i>M1</i>	14.08.2019 12:17pm – 12:32pm	60	62	54	Significant traffic noise
<i>M2</i>	14.08.2019 12:49pm – 1:04pm	74	77	65	Significant traffic noise
<i>M3</i>	14.08.2019 1:05pm – 1:20pm	77	81	65	Significant traffic noise



Figure 3 Operator attended measurement M3

6.3 Long-term noise logging

Automatic logging noise measurements were performed at the site to document the existing acoustic environment.

Long-term noise monitoring was conducted between Monday 5th August 2019 and Wednesday 14th August 2019 at Logger location shown in Figure 1 above. Detailed results of the logger measurements are shown in Appendix 1. Meteorological data was retrieved from a Bureau of Meteorology station located within 30km of the site.

The results of the automatic logging measurements are shown in Table 7 below.

Table 7 Long-term noise monitoring results

Period	Equivalent Continuous Noise Level	Rating Background Noise Level RBL
	$L_{Aeq,15min} - dB(A)$	$L_{A90,15min} - dB(A)$
Day	61	48
Evening	57	45
Night	54	40

The L_{A90} rating background noise levels were determined using the methodology as described in the Noise Policy for Industry.

7. Determination of Noise Policy for Industry criteria

The NSW EPA Noise Policy defines the following noise descriptors:

- The **Intrusiveness Criterion** states that the $L_{Aeq, 15 \text{ minute}}$ generated from the operation of the development cannot exceed the rating background noise level (RBL) plus 5 dB.
- The **Project Amenity Noise Level** is the ANL (Table 3) minus 5 dB, plus 3 dB to convert from a period level to a 15 minute level.
- The **Project Noise Trigger Level** (PNTL) is the more stringent (lowest) value of the intrusiveness and amenity noise levels, which becomes the benchmark for assessing the noise impact from the proposed site upon the surrounding noise-sensitive receivers. Note: RBL is used if measured L_{A90} exceeds ANL criteria.

Table 8, below, shows the project specific noise levels that have been determined in accordance with the requirements of the NSW Noise Policy for Industry. The PNTL (in bold) shall be assessed at the boundary of the nearest affected receiver.

Table 8 EPA Noise Policy noise criteria for residential receivers

Period	Intrusiveness Criteria $L_{Aeq,15min} - \text{dB(A)}$	Project Amenity Noise Level $L_{Aeq,15min} - \text{dB(A)}$	Project Noise Trigger Level $L_{Aeq,15min} - \text{dB(A)}$
Day	61 (56+5)	58 (60–5+3)	58
Evening	60 (55 +5)	48 (50–5+3)	55*
Night	57 (52 +5)	43 (45–5+3)	52*

* RBL used because measured L_{A90} exceeds ANL criteria.

8. Acoustic assessment

8.1 Road traffic noise intrusion

Minimum performance requirements for façade glazing have been provided for Gran Central. The minimum acoustic rating has been calculated for each level and façade to achieve the background noise criteria required by the NSW State Environmental Planning Policy SEPP (Infrastructure) Clauses 87 and 102. The Site is located adjacent to Parramatta Road, which has an annual average daily traffic volume of more than 40,000 vehicles, which the consent authority considers is likely to be adversely affected by road noise.

Weighted Sound Reduction Index (R_w) requirements have been calculated based on noise measurements taken on Site.

8.1.1 Criteria

The NSW State Environmental Planning Policy SEPP (Infrastructure) for the purposes of determining the impacts of a rail corridor and major roadway on noise sensitive developments under SEPP Clauses 87 and 102 have set the following conditions for compliance. To minimize impacts of traffic noise upon building occupants the façade glazing shall be designed to attenuate traffic noise such that the interior background noise levels shown in Table 9, below, are achieved.

Table 9 SEPP (Rail and Roads) Criteria

Room	Time	$L_{Aeq} - dB(A)$
In any bedroom	10pm – 7am	35
Other rooms (excluding garage, kitchen, bathroom or hallway)	Any time	40

8.1.2 Minimum acoustic performance requirements

The minimum R_w requirements depend on the distance from Parramatta Road. The building has two main sections, in this report named the “Eastern Section” and the “Western Section”. The façade of the Eastern Section is set back from Parramatta Road above Level 3, so the glazing performance is lower due to distance attenuation. The glazing requirements for each façade for the Eastern and Western Sections and for each room type are detailed in Tables 10 and 11. The Northern façade faces Parramatta Road, the Southern façade faces Cowper Street, The Eastern façade faces Good Street and the Western façade faces Bold Street. Clarification of the Eastern and Western Sections is shown in Figure 4 below.

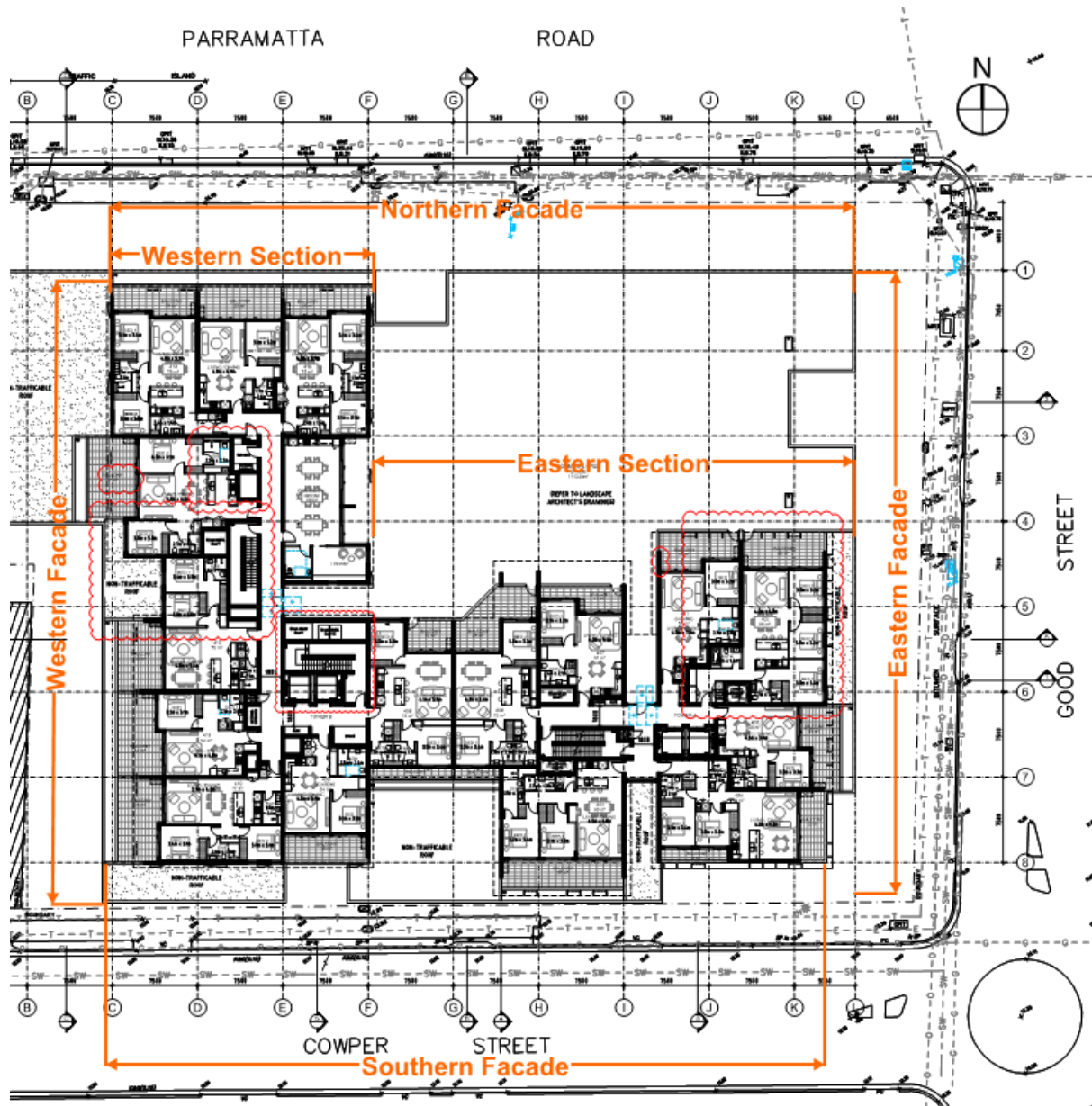


Figure 4 Clarification of Façade Sections

Table 10 Minimum glazing acoustic performance for bedrooms

Level	Western Section				Eastern Section			
	Façade				Façade			
	Northern	Southern	Eastern	Western	Northern	Southern	Eastern	Western
1	45	39	45	45	45	39	45	45
2	45	39	45	45	45	39	45	45
3	44	39	44	44	44	39	44	44
4	43	39	43	43	40	39	40	40
5	42	39	42	42	40	39	40	40
6	42	39	42	42	40	39	40	40
7	41	39	41	41	40	39	40	40
8	41	39	41	41	40	39	40	40
9	41	39	41	41	40	39	40	40
10	40	38	40	40	39	38	39	39
11	40	38	40	40	39	38	39	39
12	40	38	40	40	39	38	39	39
13	39	38	39	39	39	38	39	39
14	39	38	39	39	39	38	39	39
15	39	38	39	39	39	38	39	39
16	39	38	39	39	39	38	39	39
17	39	38	39	39	39	38	39	39
18	39	38	39	39	39	38	39	39
19	39	38	39	39	38	38	38	38
20	39	36	39	39	38	36	38	38
21	39	36	39	39	38	36	38	38
22	38	36	38	38	38	36	38	38
23	38	36	38	38	38	36	38	38
24	38	36	38	38	38	36	38	38

Table 11 Minimum glazing acoustic performance for all habitable rooms excluding bedrooms, garages, bathrooms or hallways

Level	Western Section				Eastern Section			
	Façade				Façade			
	Northern	Southern	Eastern	Western	Northern	Southern	Eastern	Western
1	40	32	40	40	40	32	40	40
2	40	32	40	40	40	32	40	40
3	40	32	40	40	40	32	40	40
4	39	32	39	39	33	32	33	33
5	38	32	38	38	33	32	33	33
6	38	32	38	38	33	32	33	33
7	36	32	36	36	33	32	33	33
8	36	32	36	36	33	32	33	33
9	36	32	36	36	33	32	33	33
10	33	32	33	33	32	32	32	32
11	33	32	33	33	32	32	32	32
12	33	32	33	33	32	32	32	32
13	32	32	32	32	32	32	32	32
14	32	32	32	32	32	32	32	32
15	32	32	32	32	32	32	32	32
16	32	32	32	32	32	32	32	32
17	32	32	32	32	32	32	32	32
18	32	32	32	32	32	32	32	32
19	32	32	32	32	32	32	32	32
20	32	32	32	32	32	32	32	32
21	32	32	32	32	32	32	32	32
22	32	32	32	32	32	32	32	32
23	32	32	32	32	32	32	32	32
24	32	32	32	32	32	32	32	32

8.1.3 Glazing recommendations

Glazing recommendations for each R_w rating are shown in Table 12 below.

Table 12 Glazing recommendations

R_w (C_{tr}) (dB)	Glazed unit (including frames and seals)
44 (-5)	10.5mm VLam Hush / 16mm air gap / 10mm monolithic
43 (-6)	10.5mm VLam Hush / 16mm air gap / 8mm monolithic
42 (-7)	8.5mm VLam Hush / 16mm air gap / 8mm monolithic
41 (-7)	8.5mm VLam Hush / 16mm air gap / 6mm monolithic
40 (-3)	12.5mm VLam Hush
39 (-3)	10.5mm VLam Hush
38 (-4)	8.5mm VLam Hush
36 (-4)	6.5mm VLam Hush
33 (-3)	6.38mm laminated (VLam)
32 (-3)	6mm monolithic

Airborne sound can propagate through any surface with an open area, regardless of the acoustic performance of the partition. To this end, all frames and seals associated with acoustically rated glazing shall have equal rating such they do not degrade the acoustic performance of the partition as a whole.

Glazing is generally the weakest component of the façade, and if not designed or installed properly would be a major transmission path.

Sometimes different glass configurations have the same R_w rating but they have different sound transmission loss characteristics at each frequency band. Our recommendations for glazing have been based on glass performance across frequency spectrum.

All windows/doors should be well sealed when closed with good seals such as Q-LON acoustic seals along the top and bottom sliders. Special attention should be given to balcony or slider doors to have good quality acoustic seals all around them. Any airgap will significantly reduce the acoustic performance or the ability to reduce noise. Mohair seals are not considered to be acoustic seals.

For service rooms such as toilets, kitchen or laundries where the glazing is not specified in the glazing schedule, a 4 mm standard glass with R_w 25 is considered sufficient.

8.2 Mechanical and building services noise

At the time of writing, the proposed mechanical plant and equipment has not been finalised for the project. The typical worst-case distances to the nearest affected residential receivers is 9m, therefore it is proposed that the aggregate sound power level (L_w) for the project is limited to 76 dB(A) so that existing background noise levels measured on site are not exceeded and compliance with the residential noise criteria can be achieved.

It is anticipated that in principle noise engineering measures can be utilised to meet the environmental noise criteria if required such as:

- Enclosures – housing of plant and equipment inside the plant room, typically 20 to 30 dB(A) reduction;

- Acoustic louvers and acoustically treated intakes and discharges – to acoustically treat air intakes into plant rooms using acoustic louvers, lined intakes/discharges and attenuators;
- Barriers – use of acoustic barriers or screens to shield sensitive receivers.

Hence it is anticipated for the mechanical plant noise can be controlled using standard engineering control measures for this project.

8.3 Construction noise

At this stage, the proposed nature of construction works and activity has not been finalised and will be subject to final input by the construction contractor. We have assumed typical plant and activity will entail the following stages and typical plant items as follows:

- Site establishment and excavation works – bump in, truck deliveries, site excavation works, spoil removal, screw piling;
- Structural works – main structural works, crane hoists, concrete pumps, concrete saws, grinding hammering;
- Fit out works – mainly enclosed finishing works. For the purposes of this assessment we have assumed a typical shielding loss of 20 dB.

Representative plant and plant sound power levels have been derived from the UK Department for Environment Food and Rural Affairs (DEFRA 2005) '*Update of Noise Data Base for the Prediction of Noise on Construction Sites*'.

The Interim Construction Noise Guideline proposes that noise levels not exceeding measured background noise levels (RBL for day, evening and night – see Table 7) by 10 dB are considered acceptable for construction works.

Table 13 Predicted construction noise from various works phases, $L_{Aeq,15minute} - dB(A)$

Plant	Octave band centre frequency								dB(A)
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	
1. Site establishment and excavation works									
Excavator,5t	99	99	94	87	87	86	82	76	93
Screw piler	114	110	105	102	98	94	90	83	104
Truck delivery/spoil	104	101	90	94	90	86	82	77	95
Hammer	94	94	96	96	91	85	83	79	97
Angle grinder	85	79	80	88	98	105	101	101	109
2. Structural works									
Excavator	99	99	94	87	87	86	82	76	93
Truck delivery	104	101	90	94	90	86	82	77	95
Concrete pump, 25kW	99	99	94	87	87	86	82	76	93
Concrete saws, 3kW	110	110	100	99	97	96	90	92	104
Mobile crane	113	101	95	99	100	97	91	84	104
Angle grinder	85	79	80	88	98	105	101	101	109
Hammer	94	94	96	96	91	85	83	79	97
3. Fit out works									
Angle grinder	85	79	80	88	98	105	101	101	109
Hammer	94	94	96	96	91	85	83	79	97
Truck delivery	104	101	90	94	90	86	82	77	95

Table 14 Predicted construction noise levels, $L_{Aeq, 15\text{minute}}$ dB(A) during standard hours

Residential receivers	Works phase		
	Site establishment and excavation works	Structural	Fit out
Typical operating distances, m	9		
Predicted construction noise levels, dB(A)	82	83	76
IGCN criteria, dB(A)	(58 + 10) = 68		
Complies?	No	No	No
Predicted exceedances	14	15	8

Predicted noise levels are defined as 'Noise Affected' under the NSW ICNG. This will require the application of feasible and reasonable work practices, e.g. AS 2436:2010.

8.3.1 Construction noise mitigation recommendations

Predicted noise emissions at the nearest affected residential receivers were predicted to comply with the standard hours criteria at the nearest affected residences at Location B. Australian Standards AS 2436:2010 'Guide to Noise and Vibration Control on Construction Demolition Sites' provides a list of measures for controlling noise from site related activity. Information in Table 15 referenced from AS 2436:2010 details the potential noise reduction of standard engineering mitigation measures, typically utilised on construction and demolition sites.

Table 15 AS 2436:2010 – Construction noise mitigation measures

Noise mitigation measure	Typical noise reduction, L_p – dB(A)
Distance attenuation	6 dB per doubling of distance
Screening and barriers	Typically, 5 to 10 dB(A) maximum 15 dB(A)
Enclosure	Typically, 15 to 25 dB(A) maximum 50 dB(A)
Silencing	Typically, 5 to 10 dB(A) maximum 20 dB(A)

Based upon predicted noise levels it is anticipated that the use of screens and acoustic rated hoardings with a minimum transmission loss of $>R_w$ 25 around the site could be utilized to minimize noise impacts from the site to residential receivers.

8.3.2 Construction noise management recommendations

The highly noise affected level represents the point above which there may be strong community reaction to noise. The construction noise mitigation measures detailed in Section 8.3.1 above do not provide sufficient attenuation to achieve construction noise levels compliant with the ICNG criteria, therefore, noise from construction activity must be managed to minimise the temporary loss of acoustic amenity on the nearest affected receivers and surrounding community. Noise management can be achieved through: scheduling, community engagement and operational practices to minimise noise impact.

Standard Hours for Construction Work

The recommended standard hours for construction (including demolition and excavation) work are as follows

- Monday to Friday 7 am to 6 pm
- Saturday 8 am to 1 pm
- No work on Sundays or public holidays

Section 2.2 of the “DECC Interim Construction Noise Guideline” (2009) specifies five categories of work that might be taken outside the standard hours. The categories relevant to this project are:

- The delivery of oversized plant or structures that police or other authorities determine require special arrangements to transport along public roads.
- Emergency work to avoid loss of life or damage to property, or to prevent environmental harm.
- Maintenance and repair of public infrastructure where disruption to essential services and/or consideration of worker safety do not allow work within the standard hours.

Blasting during the construction work is not permitted for this project due to the proximity of residences and heritage buildings.

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.

Community engagement

From a community point of view, there is a need for a range of actions and processes for the construction works that aim to reduce noise and vibration impacts from the construction activities while encouraging community involvement and providing clarity for the developer and builder on what is required of them.

As a project moves towards the construction phase more details normally becomes available on the planned work methods, location of plant and equipment, and scheduling. For the development construction works, contact with the nearest affected community is desirable once approval has been given to commence works and should be undertaken prior to any work beginning. The type of community engagement should relate to the likelihood and extent of noise and vibration impacts from the construction works.

The aim of community engagement is to:

- establish good working relationships between the developer, builder, the community and other stakeholders in relation to the construction project
- receive feedback on the project’s environmental performance, discuss community concerns and identify opportunities for the resolution of community complaints and concerns
- gain advice on how best to communicate relevant information on the project and its environmental performance to the broader community

- work cooperatively towards outcomes of benefit to the project, immediate neighbours and the local and regional community.

The Building Contractor shall nominate one of its staff as a community liaison officer for the project as a point of contact for the community regarding issues related to the construction of the development, including issues relating to noise and vibration. The secondary contact for the nearest affected community and other members of the public would be the site manager of the site. Any formal complaints received regarding noise and vibration matters at the construction site shall be passed on to the Building Contractor for the complaints to be addressed and resolved.

Being up-front with the noise affected community from the outset can assist in transferring information to the affected community. An example of being up-front is to present noise and vibration related information on the construction works to noise affected community before commencing works. The most noise sensitive properties likely to be most affected by site works and the operation of plant machinery particularly during the demolition and excavation phases are the residents at 60-64 and 65-71 Cowper Street.

Operational practices to minimise construction noise impacts

The best management practices involve adopting particular operational procedures that minimise noise while retaining production efficiency. Some common noise reduction strategies include:

- Changing the activity to reduce the noise impact or disturbance (e.g. reorganising the way the activity is carried out).
- Choosing a suitable time — schedule noisy activity to less sensitive times of the day. There are sensitive times of the day for different people, for example, schools during the day, times of religious services, and residences during evenings and night. Where several noisy pieces of equipment are used, their operation should be scheduled to minimise impacts.
- Keeping neighbours informed of a planned noisy activity, its duration and the reasons for the activity. Neighbours may be more accepting of temporary noise if they know when and why the noise is happening, and how long it will last.
- Educating staff and contractors about noise and quiet work practices. This could include signage, for example, some construction sites have signs reminding contractors to consider neighbours and be quiet, and to not start noisy work too early (e.g. before 7.30 am).

9. Conclusion

This report forms part of the development application submission for the proposed development of Gran Central at 134-142 Parramatta Road, Granville NSW 2142. Operator attended and long-term measurements were conducted at the site. The project criteria at the nearest affected receiver have been determined from the results of the measurements using NSW Noise Policy for Industry methodology and advice for acoustic compliance have been specified. Acoustic compliance with the Parramatta City Council, SEPP and the NSW EPA Noise Policy for Industry can be achieved.

Appendix A – long term noise monitoring

The details of the noise logging measurements are shown below. The measurements are in accordance with the NSW EPA Noise Policy for Industry (2017). The sections in blue have been omitted from the determination of the criteria due to rainfall.

To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are plotted in the graphs below, are here defined.

- L_{Amax} – The Maximum Noise Level (L_{Amax}) over a sample period is the maximum level, measured on fast response, during the sample period.
- L_{A10} – The noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.
- L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.
- L_{A90} – The noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level or RBL.
- L_{Amin} – The Minimum Noise Level (L_{Amin}) over a sample period is the minimum level, measured on fast response, during the sample period.

