Barings Compass Centre Bankstown

Noise Impact Assessment

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E-LAB Consulting

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Document QA and Revisions

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Authorised by:

E-LAB Consulting

Brandon Notaras | Director

Acoustics & Vibration

Table of Content

1 INTRODUCTION

This Noise Impact Assessment (NIA) is submitted to the City of Canterbury-Bankstown Council (Council) on behalf of Barings Real Estate Australia (Barings) in support of a development application (DA) for a mixed use development at the Compass Centre site, located at 83-99 North Terrace, Bankstown (the site).

This DA seeks approval for:

- Site preparation and early works, including demolition of all existing structures, bulk excavation, any required remediation and tree removal.
- Construction and use of a five (5) storey mixed use podium and three towers, comprising:
  - a 19 storey hotel tower in the south-west corner of the site;
  - a 24 storey residential tower in the south-east corner of the site;
  - a 24 storey residential tower in the north-east corner of the site;
  - ground floor retail activating the ground plane;
  - a gym at the south eastern corner of levels 1 and 2;
  - a metro supermarket at the west of level 1;
  - provision of residential amenity spaces at the north of levels 1 to 3;
  - a childcare use at the north eastern corner of the podium rooftop;
  - a function centre and medical suites along the south of the podium rooftop;
  - provision of a through site link connecting The Mall in the north to North Terrace in the south, as well as additional links from Fetherstone Street and The Appian Way, providing connections to both The Mall and North Terrace; and
  - Car parking on levels 1, 2 and 3 of the podium, which are to be appropriately sleeved through façade activation, active uses, landscaping and active mezzanine floors.
- Construction and use of a two (2) level basement car park accommodating car, bicycle, motorcycle and loading spaces.
- Vehicular access from Fetherstone Street to the west of the site.
- Inclusion of landscaping throughout the site.
- Extension and augmentation of services and utilities to the development as required.

The following operational noise assessments were conducted as part of this report:

- Airborne noise intrusion from traffic/rail noise sources surrounding the site
- Ground borne noise and vibration impact from the rail corridor near the site
- Noise emissions associated with the development's carpark
- Noise emissions associated with the development's loading dock and service vehicles
- Noise emissions associated with the development's communal outdoor areas
- Noise emissions associated with the development's retail tenancies
- Noise emissions associated with the development's medical suites
- Noise emissions associated with the development's gyms
- Noise emissions associated with the development's hotel function areas
- Noise emissions associated with the development's childcare centre
- Noise emission from mechanical plant and equipment serving the development

The following construction noise and vibration assessments were conducted as part of this noise and vibration impact assessment:

- Noise generated during the construction of the development and associated impacts on the surrounding noise sensitive receivers
- Vibration generated during the construction of the development and associated impacts on the surrounding vibration sensitive receivers

The acoustic, noise and vibration legislation, standards and guidelines referred within this report include:

- Canterbury-Bankstown Development Control Plan 2023 (DCP)
- Canterbury-Bankstown Local Environmental Plan 2023 (LEP)
- NSW EPA's Noise Policy for Industry 2017, dated October 2017 (NPI)
- NSW EPA's Road Noise Policy, dated March 2011 (RNP)
- NSW's State Environmental Planning Policy (Transport and Infrastructure) 2021 (SEPP 2021)
- NSW EPA's Development Near Rail Corridors and Busy Roads – Interim Guideline, dated December 2008 (Interim Guideline)
- NSW EPA's Assessing Vibration: a technical guideline, dated February 2006 (AVTG)
- AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors (AS/NZS 2107)
- AAAC's Guideline for Child Care Centre Acoustic Assessment, Version 3.0 (AAAC Guideline)
- NSW EPA's Interim Construction Noise Guideline, dated July 2009 (ICNG)
- British Standard BS5228 – Part 1:1997 "Noise and Vibration Control on Construction and Open Sites."
- British Standard BS7358:1993 "Evaluation and Measurement for Vibration in Buildings"
- German Standard DIN4150 – Part 3: "Structural vibration in buildings – Effects on structures"

2 PROJECT OVERVIEW

2.1 SITE LOCATION AND CONTEXT

The site is located at 83-99 North Terrace, Bankstown within the City of Canterbury Bankstown local government area (LGA). It is located to the north of Bankstown railway station, to the south of Paul Keating Park and forms part of the street block bounded by The Mall (north), The Appian Way (east), North Terrace (south), and Fetherstone Street (west), however does not comprise a street frontage to The Mall, given that its northern boundary interfaces with the former Bankstown City Library site and Phil Engisch Reserve.

It is located within the Bankstown City Centre, surrounded by a mix of civic, retail, office, business and residential uses. It is situated in a location that is highly serviced by public transport, being approximately 60m to the north of Bankstown railway station and the future Bankstown metro station, and within the immediate proximity of the Bankstown bus interchange. It is also situated directly south of Paul Keating Park, Western Sydney University Bankstown Campus, the contemporary Bankstown Library and Knowledge Centre, Bryan Brown Theatre and Function Centre, and immediately west of the Bankstown Central Shopping Centre.

The site's locational context is shown in Figure 1. An aerial photograph of the site is also provided at Figure 2**.**

Figure 1: Site context map (source: Hatch)

Figure 2: Site aerial map (source: Nearmap, Ethos Urban)

2.2 MONITORING LOCATIONS AND SURROUNDING RECEIVERS

The location of the proposed development, noise monitoring and measurement locations, and surrounding noise-sensitive receivers are presented in Figure 3. Noise-sensitive receivers have been delineated into receiver catchments (RCs) as indicated in Figure 3, where the permissible land-uses within each of the receiver catchments are outlined below:

- RC1 – Residential receivers along Fetherstone Street and adjacent to the site
- RC2 – Commercial receivers along Fetherstone Street / The Mall and adjacent to the site
- RC3 – Commercial receivers across The Appian Way and east of the site
- RC4 – Commercial receivers across North Terrace and south-west of the site
- RC5 – Commercial receivers across Fetherstone Street and west of the site

Figure 3: Acoustic site plan identifying the surrounding noise-sensitive receivers and noise monitoring locations

3 NOISE SURVEYS

3.1 INSTRUMENTATION

The following instrumentation was used for noise measurement and analysis:

- Bruel and Kjaer 2250 Integrating Sound Level Meter (S/N: 3031115)
- Bruel and Kjaer type 1 microphone – comprising of:
  - ZC 0032 preamplifier (S/N: 31930)
  - 4189 capsule (S/N: 3334640)
- Bruel and Kjaer Sound calibrator Type 4231 (S/N: 3029638)
- NSRT Sentry Noise Loggers, with S/N:
  - CPh+jHUSW1W9CjNCQ4jZHD
  - CFD+rl2SUXcVKBtiZ0D5nD
  - CNlcBl0YWf8foDFQy8pRND

All instrument systems are laboratory calibrated using instrumentation traceable to Australian National Standards and certified within the last two years thus conforming to International Standards. The measurement system was also field calibrated prior to and after noise surveys. Calibration drift was found to be less than 0.2dB during measurements. No adjustments for instrument drift during the measurement period were warranted.

3.2 SHORT-TERM NOISE MONITORING

Attended noise measurements were conducted at positions ST1 to ST3 as shown in Figure 3 on 29 November 2023. The results of the short-term noise monitoring have been summarised in Table 1.

Table 1: Short-term noise measurements summary

MEASUREMENT LOCATION	MEASUREMENT TIME	L_{Aeq}, dB(A)	L_{A90}, dB(A)	COMMENTS
ST1	9:34pm – 9:49pm	63	54	Main sources of noise were traffic (including buses) along The Mall / The Appian Way, with general environmental noise (e.g. people chatter, birds chirping).
ST2	9:52pm – 10:07pm	54	50	Main sources of noise were traffic (including buses) along Fetherstone Street, with general environmental noise (e.g. people chatter, birds chirping), and distant but audible mechanical plant serving buildings in the area.
ST3	9:15pm – 9:30pm	67	52	Main sources of noise were traffic (including trucks and buses) along North Terrace, with general environmental noise (e.g. people chatter, birds chirping). Train noise was not Bankstown Station could be faintly heard intermittently, but was generally masked by the traffic along North Terrace.

3.3 LONG-TERM NOISE MONITORING – TRAFFIC AND RAIL NOISE

Long-term noise monitoring was conducted between 30 November to 7 December 2023 at locations LT1 and LT2 (indicated in Figure 3) to establish the traffic/rail noise levels for the site and have been summarised in Table 2 below.

Table 2: Unattended traffic noise monitoring results

LOCATION	MEASURED TRAFFIC NOISE LEVELS dB(A)	
	Day (7am - 10pm) $L_{Aeq,15hour}$	Night (10pm – 7am) $L_{Aeq,9hour}$
LT1	66	61
LT3	69	63

Please refer to Appendix B for the noise monitoring data.

3.4 LONG-TERM NOISE MONITORING – BACKGROUND NOISE

Background noise levels and subsequent Rating Background Noise Level (RBL) have been established in accordance with the Noise Policy for Industry 2017 using the results of the noise monitoring at location LT2. This location was chosen to provide representative background noise levels at the nearby residential receiver (RC1).

The description of time of day is outlined within the Noise Policy for Industry and described as follows:

- Day – the period from 7:00am to 6:00pm Monday to Saturday or 8am to 6pm on Sundays and public holidays
- Evening – the period from 6:00pm to 10:00pm
- Night – the period from 10:00pm – 7:00am

Table 3: Unattended noise monitoring results – LT2

LOCATION	MEASURED RATING BACKGROUND NOISE LEVELS L_{A90} dB(A)		
	DAY	EVENING	NIGHT
LT2	51	50	43

The local ambient noise environment is typical of an urban residential environment (as classified by the NPI).

Please refer to Appendix B for the noise monitoring data.

4 PROJECT NOISE AND VIBRATION CRITERIA

This section presents the regulatory requirements, and acoustic design criteria for the proposed development.

4.1 CANTERBURY-BANKSTOWN DCP & LEP 2023

It is noted that the DCP and LEP do not contain any quantitative acoustic requirements, apart from Section 6.7 of the LEP which states the following in relation to aircraft noise:

> *(4) Development consent must not be granted to development for the purposes of dual occupancies, multi dwelling housing, attached dwellings, boarding houses or centre-based child care facilities on land near Bankstown Airport in an ANEF contour over 25.*
>
> *(5) Development consent must not be granted to development involving the erection of hotel or motel accommodation, office premises or public administration buildings on land near Bankstown Airport in an ANEF contour over 25 unless the consent authority is satisfied the building meets the standards specified in AS 2021:2015.*

The proposed site does not lie within an ANEF contour of the Bankstown Airport and therefore an acoustic assessment for aircraft noise is not required.

4.2 INTERNAL NOISE LEVELS – TRAFFIC

4.2.1 AS/NZS 2107

It is noted that the roads surrounding the development are not categorised as SEPP affected road (i.e. does not carry an AADT of more than 20,000 vehicles) as per the Transport for NSW traffic volume maps. As such clause 2.120 of SEPP 2021 does not apply to this development.

To provide design guidance the recommended internal noise levels within AS/NZS 2107 have been referred to. Internal noise levels (with windows closed) have been summarised in Table 4 below.

Table 4: Summary of internal noise levels from AS/NZS 2107

TYPE OF SPACE	INTERNAL NOISE LEVEL dB(A)$L_{Aeq,t}$
Apartment Living Areas	35 to 45
Apartment Sleeping Areas (night time)	35 to 40
Apartment Common Areas	45 to 50
Hotel Sleeping Areas (night time)	35 to 40
Retail Stores	< 50
Supermarkets	< 55
General Office Areas	40 to 45

4.3 INTERNAL NOISE LEVELS – RAIL

4.3.1 SEPP (Transport and Infrastructure) 2021

For developments with residential accommodation which are adjacent to a rail corridor / transitway and that the consent authority considers is likely to be adversely affected by rail / road noise or vibration, SEPP 2021 provides the following acoustic criteria.

2.100 Impact of rail noise or vibration on non-rail development

(1) This section applies to development for any of the following purposes that is on land in or adjacent to a rail corridor and that the consent authority considers is likely to be adversely affected by rail noise or vibration—

(a) residential accommodation,

(b) a place of public worship,

(c) a hospital,

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

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

(3) If the development is for the purposes of residential accommodation, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded—

(a) in any bedroom in the residential accommodation—35 dB(A) at any time between 10.00 pm and 7.00 am,

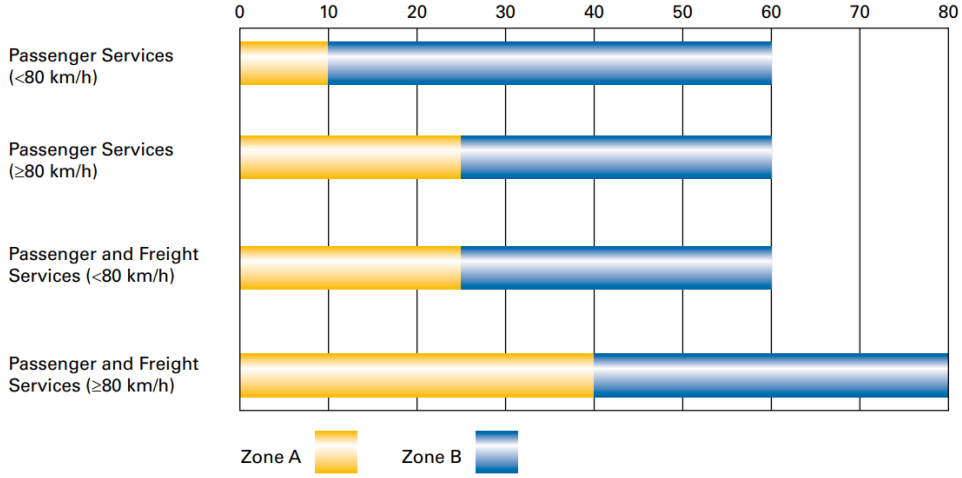
(b) anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway)—40 dB(A) at any time.

4.3.2 Development Near Rail Corridors and Busy Roads – Interim Guideline

The Interim Guideline provides guidance on designing residential developments which are adjacent to rail corridor and transitways by governing maximum internal noise levels averaged over certain periods within bedrooms and living areas.

Figure 4 which has been extracted from the Interim Guideline provides guidance as to the level of assessment required when noise sensitive developments are located in the vicinity of existing rail lines. Zones A and B are indicative acoustic assessment zones where sensitive land-uses are likely to be adversely affected.

Figure 4: Acoustic assessment zones based on distance (m) of noise-sensitive development from operation track (not corridor)



Given the proposed development boundary is estimated to be within 60 metres from the nearest operational track, an assessment of rail noise to the facades of the proposed development is required.

The Interim Guideline details the application of the SEPP 2007, which we note has been superseded by SEPP 2021. In addition, the Interim Guideline also recommends the following in relation to the assessment of ventilation by means of opened windows or doors:

> *If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia.*

Table 5 provides a summary of the criteria established in accordance with the Interim Guideline and SEPP 2021.

Table 5: Summary of internal noise criteria from the Interim Guideline and SEPP 2021

TYPE OF HABITABLE SPACE	APPLICABLE TIME PERIOD	INTERNAL NOISE LEVEL CRITERIA – WINDOWS/DOORS CLOSED	INTERNAL NOISE LEVEL CRITERIA – WINDOWS/DOORS OPEN
Sleeping areas (bedrooms)	10:00pm – 7:00am	35 dB(A)$L_{Aeq(9hour)}$	45 dB(A)$L_{Aeq(9hour)}$
Living rooms	At any time	40 dB(A)$L_{Aeq(15hour)}$	50 dB(A)$L_{Aeq(15hour)}$

4.4 GROUNDBORNE NOISE AND VIBRATION

Internal ground/structure borne noise and vibration levels to the proposal should be controlled to within the requirements of the Interim Guideline and the AVTG.

As per the Interim Guideline, a detailed ground borne noise and vibration impact assessment of the existing railway corridor is required as the distance from the project site boundary to the nearest operational track is within 60m.

Recommended Vibration Dose Values (VDVs) for intermittent vibration as scheduled in the AVTG are summarised in Table 6.

Table 6: Acceptable vibration dose values for intermittent vibration

LOCATION	PREFERRED VALUES		MAXIMUM VALUE	
	DAY	NIGHT	DAY	NIGHT
Residential areas	0.20 $m/s^{1.75}$	0.13 $m/s^{1.75}$	0.40 $m/s^{1.75}$	0.26 $m/s^{1.75}$

Furthermore, the Interim Guideline states in Section 3.6.2:

> *Generally, ground borne noise is associated more closely with rail operations than roads. Where buildings are constructed over or adjacent to land over tunnels, ground-borne noise may be present without the normal masking effect of airborne noise. In such cases, residential buildings should be designed so that the 95th percentile of train pass-bys complies with a ground-borne L_{Amax} noise limit of 40dBA (daytime) or 35dBA (night-time) measured using the "slow" response time setting on a sound level meter.*

4.5 EXTERNAL NOISE EMISSIONS

4.5.1 NSW EPA Noise Policy for Industry (NPI) 2017 – Industrial Noise (Plant and Equipment)

The NSW EPA's Noise Policy for Industry (NPI) 2017 has been implemented to assess the noise impacts of mechanical plant and equipment, as well as other industrial noise sources on the surrounding receiver catchments.

The NPI sets out a framework for the derivation of project noise trigger levels that are used to assess the potential impacts of noise from industry (and industrial noise sources) and indicate the noise level at which feasible and reasonable noise management measures should be considered.

This policy applies to noise sources from activities listed in Schedule 1 of the POEO Act and those regulated by the EPA. This includes noise sources from mechanical plant and equipment within the proposed development, for which this policy will be applied.

The project noise trigger level provides a benchmark for assessing a proposal, where if exceeded, indicates a potential noise impact on the community and so triggers a management response such as additional mitigation measures. The project noise trigger level is the lower (the more stringent) value of the project intrusiveness noise level and project amenity noise level determined in Sections 2.3 and 2.4 of the NPI, respectively.

Project Intrusiveness Noise Level

The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (in terms of L_{Aeq}) measured over a 15-minute period does not exceed the background noise level by more than 5 dB when beyond a minimum threshold. The project intrusiveness noise level is only applicable to surrounding residential receivers.

To account for the temporal variation of background noise levels, the method outlined in Fact Sheet A of the NPI establishes a method in determining the Rating Background Noise Level (RBL) to be used in the assessment.

The intrusiveness noise level is determined as follows:

$L_{Aeq,15min}$ (Intrusiveness Criteria) = Rating Background Noise Level (RBL) + 5 dB(A)

Where the RBLs established in accordance with Fact Sheet A are lower than the values presented in Table 7 for each assessment period, the values presented in Table 7 shall be used for that particular assessment period. These result in the minimum intrusiveness noise levels provided in Table 7.

Table 7: Minimum assumed RBLs and project intrusiveness noise levels

TIME OF DAY	MINIMUM ASSUMED RBL - dB(A)	MINIMUM PROJECT INTRUSIVENESS NOISE LEVELS - $L_{Aeq,15min}$ dB(A)
Day	35	40
Evening	30	35
Night	30	35

Table 8 provides the project intrusiveness noise levels applicable to each of the surrounding residential noise-sensitive receivers.

Table 8: Project intrusiveness noise level criteria for residential receiver catchments

RECEIVER CATCHMENT	TIME OF DAY	MEASURED RBL - dB(A)[1]	PROJECT INTRUSIVENESS NOISE LEVELS - $L_{Aeq,15min}$ dB(A)
RC1	Day	51	56
	Evening	50	55
	Night	43	48

Project Amenity Noise Level

The recommended amenity noise levels represent the objective for total industrial noise at a receiver location, whereas the project amenity noise level represents the objective for noise from a single industrial development at a receiver location.

To ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows:

Project Amenity Noise Level = Recommended Amenity Noise Level (see Table 9) – 5 dB(A)

The following exceptions to the above method to derive the project amenity noise level apply:

- In areas with high traffic noise levels. Where the level of transport noise, road traffic noise in particular is high enough to make noise from an industrial source inaudible, the project amenity noise level shall be set at 15 dB(A) below the measured $L_{Aeq,period(traffic)}$ for the particular assessment period;
- In proposed developments in major industrial clusters;
- Where the resultant project amenity noise level is 10 dB(A) or more lower than the existing industrial noise level. In this case the project amenity noise levels can be set at 10 dB(A) below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time; and
- Where cumulative industrial noise is not a necessary consideration because no other industries are present in the area, or likely to be introduced into the area in the future. In such cases the relevant amenity noise level is assigned as the project amenity noise level for the development.

The recommended amenity noise level, project amenity noise level, and converted project amenity noise level for comparison with the intrusiveness criteria (from time of day period to 15-minute) is provided for each surrounding receiver catchment in Table 9.

Table 9: Project amenity noise level criteria for each receiver catchment

RECEIVER CATCHMENT	RECEIVER TYPE	TIME OF DAY	RECOMMENDED AMENITY NOISE LEVEL - $L_{Aeq,period}$ dB(A)	PROJECT AMENITY NOISE LEVEL - $L_{Aeq,period}$ dB(A)	PROJECT AMENITY NOISE LEVEL - $L_{Aeq,15min}$ dB(A)
RC1	Residential (Urban)	Day	60	55	58
		Evening	50	48[1]	51
		Night	45	40	43
RC2 to RC5	Commercial	When in use	65	60	63

Note 1: The evening time project amenity noise level has been adjusted per Section 2.4.1 of the NPI (amenity noise levels in areas of high traffic noise)

Sleep Disturbance and Maximum Noise Level Assessment

Where the proposed development night-time noise levels generated at a residential location exceed either:

- $L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB(A), whichever is greater, and/or
- L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB(A), whichever is greater.

a detailed maximum noise level event assessment should be undertaken.

Corrections for Annoying Noise Characteristics – Noise Policy for Industry Fact Sheet C

Fact Sheet C contained within the Noise Policy for Industry outlines the correction factors to be applied to the source noise level at the receiver before comparison with the project noise trigger levels established within this report, to account for the additional annoyance caused by these modifying factors.

The modifying factor corrections should be applied having regard to:

- The contribution noise level from the premises when assessed/measured at a receiver location, and
- The nature of the noise source and its characteristics (as set out in Fact Sheet C).

Table C1 within Fact Sheet C sets out the corrections to be applied for any assessment in-line with the NPI. The corrections specified for tonal, intermittent and low-frequency noise are to be added to be added to the measured or predicted levels at the receiver before comparison with the project noise trigger levels. The adjustments for duration are to be applied to the criterion.

Project Noise Trigger Levels

Table 10 presents the project intrusiveness and project amenity noise levels for each period, and each receiver catchment, as well as the resultant project noise trigger levels (PNTLs) that shall be applied for any assessment of impacts of mechanical plant and equipment noise on the surrounding receiver catchments.

Table 10: Project noise trigger levels (PNTL) to be applied to each surrounding receiver catchment

RECEIVER CATCHMENT	RECEIVER TYPE	TIME OF DAY	PROJECT INTRUSIVENESS NOISE LEVEL - $L_{Aeq,15min}$ dB(A)	PROJECT AMENITY NOISE LEVEL - $L_{Aeq,15min}$ dB(A)	SLEEP DISTURBANCE NOISE LEVEL - dB(A)	PNTL - $L_{Aeq,15min}$ dB(A)
RC1	Residential	Day	56	58	N/A	**56**
		Evening	55	51	N/A	**51**
		Night	48	43	48 $L_{Aeq,15min}$ 58 L_{AFmax}	**43**
RC2 to RC5	Commercial	When in use	N/A	63	N/A	**63**

4.5.2 AAAC Guideline for Child Care Centre Acoustic Assessment v3.0

The AAAC Guideline sets out criteria for noise emissions from childcare centres.

Residential Receivers

Section 3.2.1 of the AAAC Guideline outlines the following outdoor play area noise requirements to residential receivers:

Background Greater Than 40 dB(A) *– The contributed $L_{eq,15min}$ noise level emitted from an outdoor play and internal activity areas shall not exceed the background noise level by more than 5 or 10 dB at the assessment location, depending on the usage of the outdoor play area. AAAC members regard that a total time limit of approximately 2 hours outdoor play per morning and afternoon period should allow an emergence above the background of 10 dB (ie background +10 dB if outdoor play is limited to 2 hours in the morning and 2 hours in the afternoon).*

Up to 4 hours (total) per day *– If outdoor play is limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed Leq,15 minute noise level emitted from the outdoor play shall not exceed the background noise level by more than 10 dB at the assessment location.*

More than 4 hours (total) per day *– If outdoor play is not limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed $L_{eq,15\ minute}$ noise level emitted from the outdoor play area shall not exceed the background noise level by more than 5 dB at the assessment location.*

The assessment location is defined as the most affected point on or within any residential receiver property boundary. Examples of this location may be:

- *1.5 m above ground level;*
- *On a balcony at 1.5 m above floor level;*
- *Outside a window on the ground or higher floors.*

Section 3.2.2 of the AAAC Guideline outlines the following noise requirements to residential receivers for other sources of noise emission:

The cumulative $L_{eq,15\ minute}$ noise emission level resulting from the use and operation of the child care centre, with the exception of noise emission from outdoor play discussed above, shall not exceed the background noise level by more than 5 dB at the assessment location as defined above.

Commercial Receivers

Section 3.3 of the AAAC Guideline outlines the following noise requirements to commercial receivers:

The cumulative $L_{eq,15\ minute}$ noise level emitted from the use and operation of the child care centre shall not exceed 65 dB(A), from all activities (including outdoor play), when assessed at the most affected point on or within any commercial property boundary.

Summary

A summary of the criteria for noise emissions from the childcare centre is provided in Table 11.

Table 11: Summary of childcare noise emission criteria

RECEIVER CATCHMENT	NOISE SOURCE	PERIOD	NOISE CRITERIA $L_{Aeq,15min}$ dB(A)
RC1	Outdoor Play (≤ 4 hours / day)	7am – 6pm	61
	Outdoor Play (> 4 hours / day)		56
	Other		56
RC2 to RC5	All	7am – 6pm	65

4.6 CONSTRUCTION NOISE CRITERIA

4.6.1 Interim Construction Noise Guideline (ICNG)

The noise criteria outlined within the ICNG has been adopted for the assessment of noise emissions from the construction of the proposed redevelopment.

Airborne Noise – Residential Receiver Catchments

The airborne noise criteria for surrounding residential receiver catchments have been extracted from Table 2 in the ICNG and is presented in Table 12 below.

Table 12: NSW ICNG construction noise criteria for surrounding residential receiver catchments

TIME OF DAY	MANAGEMENT LEVEL $L_{Aeq,15min}$[1]	HOW TO APPLY
Recommended Standard Hours: Monday – Friday 7am – 6pm Saturday 8am – 1pm No work on Sundays or public holidays	Noise Affected RBL + 10dB	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 residences 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 in, taking into account: – Times identified by the community when they are less sensitive to noise (such as before and after school, for works near schools, or mid-morning or mid-afternoon for works near residences) – If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside Recommended Standard Hours	Noise Affected RBL + 5dB	▪ 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.

Note 1: Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Airborne Noise – Commercial Receiver Catchments

The airborne noise criteria for surrounding commercial receiver catchments have been extracted from Table 3 in the ICNG and is presented in Table 13 below.

Table 13: NSW ICNG construction noise criteria for surrounding commercial receiver catchments

LAND USE	MANAGEMENT LEVEL (APPLIES WHEN PROPERTIES ARE BEING USED) $L_{Aeq,15min}$
Offices, Retail Outlets	70 dB(A)

Ground-borne Noise – Residential Receiver Catchments

Ground-borne noise is noise generated by vibration transmitted through the ground into a structure, such as an excavator with a hydraulic hammer attachment, or impact/bore piling. The following ground-borne noise levels for residences have been extracted from Section 4.2 of the ICNG and indicate when management actions should be implemented.

- Evening (6pm to 10pm) – Internal Noise Level: $L_{Aeq,15min}$ 40 dB(A); and
- Night-time (10pm to 7am) – Internal Noise Level: $L_{Aeq,15min}$ 35 dB(A).

An assessment of ground-borne noise to these levels is only required when the ground-borne noise levels are higher than airborne noise levels, and for surrounding residential receiver catchments. The ground-borne noise levels are for evening and night-time periods only. The levels shall be assessed at the centre of the most affected habitable room.

4.7 CONSTRUCTION VIBRATION CRITERIA

It is important for vibration emissions from vibration-intensive equipment utilised during the construction works be managed to maintain appropriate levels of human comfort, and to avoid both cosmetic and structural damage. The vibration limits proposed in the ensuing sub-sections aid in achieving this outcome.

4.7.1 Human Comfort

The office of Environment and Heritage (OEH) developed a document, "Assessing vibration: A technical guideline" in February 2006 to assist in preventing people from exposure to excessive vibration levels from construction and operation of a development within buildings. The guideline does not however address vibration induced damage to structures or structure-borne noise effects. Vibration and its associated effects are usually classified as continuous, impulsive or intermittent.

Continuous and Impulsive Vibration

Structural vibration in buildings can be detected by occupants and can affect them in many ways including reducing their quality of life and also their working efficiency. Complaint levels from occupants of buildings subject to vibration depend upon their use of the building and the time of the day.

Maximum allowable magnitudes of building vibration with respect to human response are shown in Table 14. It should be noted that the human comfort for vibration is more stringent than the building damage criteria.

Table 14: Preferred and maximum weighted RMS values for continuous and impulsive vibration acceleration (m/s^2) 1-80 Hz

LOCATION	ASSESSMENT PERIOD[1]	PREFERRED VALUES		MAXIMUM VALUES	
		Z-AXIS	X- AND Y-AXES	Z-AXIS	X- AND Y-AXES
Continuous vibration					
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day- or night time	0.020	0.014	0.040	0.028
Impulsive vibration					
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

Note 1: Daytime is 7:00am to 10:00pm and night time is 10:00pm to 7:00am

Intermittent Vibration Criteria

Disturbance caused by vibration will depend on its duration and its magnitude. This methodology of assessing intermittent vibration levels involves the calculation of a parameter called the Vibration Dose Value (VDV) which is used to evaluate the cumulative effects of intermittent vibration. Various studies support the fact that VDV assessment methods are far more accurate in assessing the level of disturbance than methods which is only based on the vibration magnitude.

Table 15: Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$)

LOCATION	DAYTIME[1]		NIGHT-TIME[1]	
	PREFERRED VALUE	MAXIMUM VALUE	PREFERRED VALUE	MAXIMUM VALUE
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80

Note 1: Daytime is 7:00am to 10:00pm and night time is 10:00pm to 7:00am

4.7.2 Cosmetic Damage

Structural vibration thresholds are set to minimize the risk of cosmetic surface cracks and lie below the levels that have the potential to cause damage to the main structure. Table 16 presents guide values for building vibration, based on the vibration thresholds above which cosmetic damage has been demonstrated outlined within BS7385-Part 2:1993. These values are evaluated to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as 95% probability of no effect.

Table 16: Transient vibration guide values for cosmetic damage – BS 7385-2:1993

TYPE OF BUILDING	PEAK PARTICLE VELOCITY IN FREQUENCY RANGE OF PREDOMINANT PULSE (PPV)	
	4 Hz TO 15 Hz	15 Hz AND ABOVE
Reinforced or framed structures Industrial or light commercial type buildings	50mm/s	N/A
Unreinforced or light framed structures Residential or light commercial type buildings	15mm/s	20mm/s (50mm/s at 40Hz and above)

4.7.3 Structural Damage

Ground vibration criteria is defined in terms of the levels of vibration emission from the construction activities which will avoid the risk of damaging surrounding buildings or structures. It should be noted that human comfort criteria are normally expressed in terms of acceleration whereas structural damage criteria are normally expressed in terms of velocity.

Most specified structural vibration levels are defined to minimize the risk of cosmetic surface cracks and are set below the levels that have the potential to cause damage to the main structure. Structural damage criteria are presented in German Standard DIN4150-Part 3 "Structural vibration in buildings – Effects on structures" and British Standard BS7385-Part 2: 1993 "Evaluation and Measurement for Vibration in Buildings". Table 17 indicates the vibration limits presented in DIN4150-Part 3 to ensure structural damage doesn't occur.

Table 17: Guideline value of vibration velocity, vi, for evaluating the effects of short-term vibration – DIN4150-3

LINE	TYPE OF STRUCTURE	VIBRATION VELOCITY, V_i, IN mm/s			
		FOUNDATION			PLANE OF FLOOR OF UPPERMOST FULL STOREY
		AT A FREQUENCY OF			
		LESS THAN 10HZ	10 TO 50HZ	50 TO 100HZ*	ALL FREQUENCIES
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that, because of their particular sensitivity to vibration, do not correspond to those listed in 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
*For frequencies above 100Hz, at least the values specified in this column shall be applied					

5 OPERATIONAL NOISE ASSESSMENT

5.1 TRAFFIC AIRBORNE NOISE INTRUSION

5.1.1 Noise Modelling and Assumptions

In order to provide acoustic amenity to the occupants of the proposed development and achieve the recommended internal noise limits, the noise impact of surrounding noise sources was assessed at the façade of the proposed development within the proposed development.

3D acoustic modelling for noise emissions from the surrounding roads was conducted using the software SoundPlan (Version 9.0). Noise emissions and impacts from vehicle movements on the surrounding roads were modelled in accordance with the CoRTN prediction techniques and calibrated to the measurements conducted for this assessment.

Attenuation due to distances, building shielding and environmental absorption, together with additional noise incident on the façade due to façade reflections are taken into account within the 3D model.

5.1.2 "Windows Closed" Assessment

The results of the 3D modelling are provided in Appendix A (in the form of façade noise contours), showing the incident noise levels on the façade (daytime and night-time) as a result of external noise sources (traffic). The incident noise levels are presented as $L_{Aeq,9h}$ and $L_{Aeq,15h}$ statistical metrics for the purpose of demonstrating compliance with the SEPP 2021 and Interim Guideline, and mitigation measures are presented in Section 6.1.

5.1.3 "Windows Open" Assessment

A preliminary "windows open" assessment has been conducted to assess whether the habitable spaces can meet the project internal noise limits established in Section 4.3.2 with windows open for natural ventilation (open in accordance with the natural ventilation requirements of the NCC).

If the project internal noise limits for windows/doors open is exceeded, the habitable area is considered noise-affected and an alternative means of ventilation is required in accordance with the requirements of the NCC (i.e. an alternative ventilation system complying with AS 1668.2 and AS/NZS 3666.1).

The assessment has been conducted under the assumption the occupant has opened their windows to achieve natural ventilation (and as recommended in the DoP Interim Guideline), that is, when the windows are open to 5% of the floor area of the room being ventilated, with a reduction of incident noise level to internal noise level of 10dB(A). Room loss has also been considered as part of this assessment.

In order to achieve the project internal noise limits established in Section 4.3.2 whilst simultaneously achieving the ventilation requirements, mitigation measures have been proposed in Section 6.2 for the proposed development.

5.2 RAIL GROUND BORNE NOISE

Section 3.6.2 of the Interim Guideline states the following in relation to ground borne noise impact on habitable rooms:

> *As a general guide, ground borne noise may be an issue in habitable rooms which are shielded from airborne noise from the railway. Examples are rooms that are not facing the railway, and where cuttings or noise barriers block the line of sight between the receiver room and the rail line.*

We note that the adjacent rail corridor is above ground and that noise impact to the development's residential areas facing the rail corridor will be masked and dominated by airborne noise. As such, the Interim Guideline ground borne noise requirement is expected to be capable of compliance without further acoustic assessment.

5.3 RAIL VIBRATION

Operator attended measurements of vibration levels from passenger carriage trains on ballast tracks have been undertaken at the project site boundary facing the rail corridor (locations V1 as indicated in Figure 3) on 4 April 2024.

Table 18 provides the worst-case overall VDV based on the undertaken measurements of train pass-by's and checks for compliance against the AVTG criteria.

Table 18: Rail vibration compliance

LOCATION	TIME OF DAY	VIBRATION DOSE VALUE VDV ($M/S^{1.75}$)			COMPLIANCE (YES / NO)
		MEASURED	PREFERRED	MAXIMUM	
V1	Day	0.13	0.20	0.40	Yes
	Night	0.11	0.13	0.26	

The measured VDV indicates compliance with the AVTG requirements for both day and night periods. We note that during the vibration measurements, it was observed that there were external vibration sources present around the project site (such as construction) which have likely contributed to the VDV readings presented above. As such, the VDVs from only train pass-bys are expected to be lower in reality.

5.4 CARPARK NOISE EMISSION

5.4.1 Details and Assumptions

An assessment of the noise generated by vehicular movements for the development's carpark has been conducted to determine the impacts on the surrounding noise-sensitive receivers. At the time of writing, E-LAB has not been advised of the operational constraints of the carpark. In this instance, we have used the following assumptions in our assessment:

- Sound power levels are as per Table 19
- Maximum capacity of carpark is per the Architectural Drawings, being;
  - 184 spaces on Basement 2
  - 96 spaces on Basement 1
  - 55 spaces on Level 1
  - 76 spaces on Level 2
  - 83 spaces on Level 3
- Carpark is accessible at all times, including the night time
- As a conservative estimate, 50% of the carpark capacity (244 cars) enters/exits the development in a 1-hour peak period during the day/evening
- Based on the above assumption, 61 cars enters/exits the development in a 15-minute period
- During the night time, it is assumed that carpark movements are 25% of that during daytime/evening, being 16 cars enters/exits the development in a 15-minute period
- Vehicles travel at no faster than 10km/h within the development
- The Level 1 carpark contains openings along the western façade which faces the residential receiver (RC1). All other carpark and ramp façades which surrounds and faces the RC1 is of solid masonry construction (such as concrete) and does not contain any openings (no line of sight from residential receiver to inside the ramp or carpark). These assumptions aligns with what is observed in the Architectural Drawings

Table 19 presents the typical sound power level (SWL) associated with carpark activities.

Table 19: Typical sound power levels

ACTIVITIES	SOUND POWER LEVEL – dB(A)
Car Manoeuvring @ 10km/hr – $L_{Aeq,period}$	85
Vehicle Door Close – L_{Amax}	84

5.4.2 Predicted Noise Levels

The noise generated by the activities during a 15-minute period and a maximum noise level during the night time have been predicted to the facades of the surrounding noise-sensitive receiver catchments and are summarised below in Table 20. Attenuation factors from distance, barriers, etc. have been applied where applicable.

Table 20: Predicted Noise Levels at Most Affected Façade of Receiver Catchment

RECEIVER CATCHMENT	PREDICTED NOISE LEVEL dB(A)		PROJECT NOISE TRIGGER LEVEL dB(A)			COMPLIES (YES/NO)
	DAY/ EVENING	NIGHT	DAY	EVENING	NIGHT	
RC1	40 $L_{Aeq,15min}$	37 $L_{Aeq,15min}$ 50 $L_{AF,max}$	56 $L_{Aeq,15min}$	51 $L_{Aeq,15min}$	43 $L_{Aeq,15min}$ 58 $L_{AF,max}$	Yes
RC2	52 $L_{Aeq,15min}$	49 $L_{Aeq,15min}$	63 $L_{Aeq,15min}$			Yes
RC3	54 $L_{Aeq,15min}$	51 $L_{Aeq,15min}$				Yes
RC4	< 40 $L_{Aeq,15min}$	< 40 $L_{Aeq,15min}$				Yes
RC5	54 $L_{Aeq,15min}$	51 $L_{Aeq,15min}$				Yes

5.5 LOADING DOCK NOISE EMISSION

5.5.1 Details and Assumptions

As documented on the architectural drawings, the loading docks are situated within Basement 1. As such, it is expected that noise generated by activities within the loading dock itself will not have an adverse noise impact on the surrounding noise-sensitive receivers and the project specific noise emission criteria is capable of being achieved without additional acoustic treatment.

Nonetheless, an assessment of the noise generated by service vehicle movements entering/existing the project site has been conducted. At the time of writing, a E-LAB has not been advised of the operational constraints of the loading dock. In this instance, we have used the following assumptions in our assessment:

- Sound power levels are as per Table 19
- Loading docks are accessible at all times, including the night
- 1 service vehicle (HRV/SRV) enters or exits the development in a 15-minute period at all times
- Service vehicle engines are switched off when parked
- HRV airbrakes are only released inside the loading dock

- The carpark and ramp façade which surrounds and faces the residential receiver (RC1) is of solid masonry construction (such as concrete) and does not contain any openings (no line of sight from residential receiver to inside the ramp or carpark). This assumption aligns with what is observed in the Architectural Drawings
- Vehicles travel at no faster than 10km/h within the development

Table 19 presents the typical sound power level (SWL) associated with general loading dock and carpark activities.

Table 21: Typical sound power levels

ACTIVITIES	SOUND POWER LEVEL – dB(A)
HRV Idling – $L_{Aeq,period}$	95
HRV Engine Start – $L_{Aeq,period}$	102
Air Brakes – $L_{Aeq,period}$	113
Reversing Alarm – $L_{Aeq,period}$	111
HRV Manoeuvring @ 10km/hr – $L_{Aeq,period}$	91

5.5.2 Predicted Noise Levels

The noise generated by the activities during a 15-minute period and a maximum noise level during the night time have been predicted to the facades of the surrounding noise-sensitive receiver catchments and are summarised below in Table 20. Attenuation factors from distance, barriers, etc. have been applied where applicable.

Table 22: Predicted Noise Levels at Most Affected Façade of Receiver Catchment

RECEIVER CATCHMENT	PREDICTED NOISE LEVEL dB(A)		PROJECT NOISE TRIGGER LEVEL dB(A)			COMPLIES (YES/NO)
	DAY/ EVENING	NIGHT	DAY	EVENING	NIGHT	
RC1	< 30 $L_{Aeq,15min}$	< 30 $L_{Aeq,15min}$ 37 $L_{AF,max}$	56 $L_{Aeq,15min}$	51 $L_{Aeq,15min}$	43 $L_{Aeq,15min}$ 58 $L_{AF,max}$	Yes
RC2	< 30 $L_{Aeq,15min}$	< 30 $L_{Aeq,15min}$	63 $L_{Aeq,15min}$			Yes
RC3	< 30 $L_{Aeq,15min}$	< 30 $L_{Aeq,15min}$				Yes
RC4	< 30 $L_{Aeq,15min}$	< 30 $L_{Aeq,15min}$				Yes
RC5	37 $L_{Aeq,15min}$	37 $L_{Aeq,15min}$				Yes

5.6 COMMUNAL OUTDOOR AREAS NOISE EMISSION

Based on the Architectural Drawings, it is noted that there are the following primary communal outdoor areas:

- Study / meeting area on Level 1
- Level 2 communal open space between 3-7 Fetherstone and 62 The Mall
- Terrace surrounding the hotel building on Level 4
- External pool area on Level 5
- Landscape area on rooftop of all 3 buildings

It is noted that the NSW NPI applies to industrial noise sources from activities listen in Schedule 1 of the POEO Act, which does not include domestic/neighbourhood noises, such as noise from people speaking in communal areas. Nonetheless, an assessment of the communal areas has been conducted to the project noise trigger levels, established in accordance with of the NSW NPI, to understand the impact on surrounding noise-sensitive receivers. The following assumptions and mitigation measures formed the basis of this assessment:

- Based on 1 person per 4m^2, the approximate amount of people in a given 15-minute period are:
  - 15 people in the Level 1 study /meeting area
  - 75 people in the Level 2 central landscape area
  - 35 people in the Level 4 terrace surrounding the hotel building
  - 60 people in the Level 5 external pool area
  - 20 people in the Building A rooftop
  - 30 people in the Building B rooftop
  - 50 people in the Building A rooftop
- 1 in 2 people will be talking at any one time (this is a conservative estimate)
- Of the people talking,
  - Half will be talking in a normal voice with an average sound power level of 68 dB(A)
  - Half will be talking in a raised voice with an average sound power level of 74 dB(A)
- The communal areas will not be accessible during the night time (10pm to 7am)
- There are no amplified speakers installed and no music from amplified speakers are allowed

Based on the above assumptions, the cumulative noise during a reasonably worst case 15-minute period has been predicted at the most-affected receivers. The results are shown in Table 23.

Table 23: Predicted noise level from communal outdoor areas to most-affected receivers

RECEIVER CATCHMENT	PREDICTED NOISE LEVEL, dB(A)	PROJECT NOISE TRIGGER LEVEL, dB(A)		COMPLIES (YES/NO)
	DAY / EVENING	DAY	EVENING	
RC1	51 $L_{Aeq,15min}$	56 $L_{Aeq,15min}$	51 $L_{Aeq,15min}$	Yes
RC2	55 $L_{Aeq,15min}$	63 $L_{Aeq,15min}$		Yes
RC3	48 $L_{Aeq,15min}$			Yes
RC4	< 45 $L_{Aeq,15min}$			Yes
RC5	45 $L_{Aeq,15min}$			Yes

The predicted noise levels presented in Table 23 indicate that cumulative noise from the communal outdoor areas are capable of complying with the project noise emission requirements.

It is noted that the above predicted noise levels are conservative as they do not include noise attenuation from barriers (such as shielding from the surrounding building forms) and that actual noise levels at surrounding receivers may be even less than those presented in Table 23 (especially receivers which do not have line of sight to the outdoor areas).

5.7 RETAIL TENANCIES NOISE EMISSION

At the time of writing, the tenants for the retail spaces (all located on ground floor) have not been determined and therefore the exact usage / type of activities for these spaces are unknown.

Generally, retail shops are not expected to create adverse noise impacts to surrounding noise-sensitive receivers due to their nature of usage and typical activities and are expected to be capable of complying project specific noise emission requirements without additional acoustic mitigation measures, such as high acoustic rated façades.

Future usage of each retail tenancy may be subject to a separate development application and detailed assessment of their expected operation and activities may be required by City of Canterbury Bankstown Council. The selected tenants may be required by Council to submit a separate Development Application based on use.

5.8 MEDICAL SUITES NOISE EMISSION

At the time of writing, the exact activities and equipment for the level 4 medical suites are unknown. Generally, medical centres and clinics are not expected to generate highly intrusive noise emissions by nature of usage. Noise from the medical suites are expected to be capable of complying with project specific noise emission requirements without additional acoustic mitigation measures, such as high acoustic rated façades.

5.9 GYM NOISE EMISSION

Based on the Architectural Drawings it is noted that there are 3 gyms proposed, being:

- Level 1-2 commercial gym
- Level 4 hotel gym
- Level 5 residential gym

It is noted that the NSW NPI applies to industrial noise sources from activities listen in Schedule 1 of the POEO Act, which does not include noise from gyms. Nonetheless, an assessment of the gyms have been conducted to the project noise trigger levels, established in accordance with of the NSW NPI, to understand the impact on surrounding noise-sensitive receivers.

The following assumptions and mitigation measures formed the basis of this assessment:

- Level 1-2 commercial gym is a 24-hour gym
- Level 4 hotel gym and Level 5 residential gym are closed during the night time
- All gyms are enclosed by a fixed façade which provides a minimum acoustic performance of R_w 32 (achievable with typical 6.38mm laminated glazing systems). Thicker glass or double-glazed systems are expected to provide an even higher acoustic performance
- Doors of gyms are closed during operation, with the exception for ingress/egress of gym users
- A representative average sound pressure level of 75 dB(A) will be used for the purpose of this assessment within the assessed 15-minute period. This is representative of an active and lively environment with people conversing, exercising and background music being played
- A maximum sound pressure level of 90dB(A) is assumed within the gyms for when weights are dropped or when barbells are racked

Based on the above assumptions, the noise during the worst case 15-minute period has been predicted at the surrounding noise-sensitive receivers. The results are shown in Table 24.

Table 24: Predicted noise level from gyms to noise-sensitive receivers

RECEIVER CATCHMENT	PREDICTED NOISE LEVEL, dB(A)		PROJECT NOISE TRIGGER LEVEL, dB(A)			COMPLIES (YES/NO)
	DAY / EVENING	NIGHT	DAY	EVENING	NIGHT	
RC1	< 30 $L_{Aeq,15min}$	< 30 $L_{Aeq,15min}$ < 30 L_{AFmax}	56 $L_{Aeq,15min}$	48 $L_{Aeq,15min}$	43 $L_{Aeq,15min}$ and 58 L_{AFmax}	Yes
RC2	< 30 $L_{Aeq,15min}$	< 30 $L_{Aeq,15min}$	63 $L_{Aeq,15min}$			Yes
RC3	< 30 $L_{Aeq,15min}$	< 30 $L_{Aeq,15min}$				Yes
RC4	< 30 $L_{Aeq,15min}$	< 30 $L_{Aeq,15min}$				Yes
RC5	< 30 $L_{Aeq,15min}$	< 30 $L_{Aeq,15min}$				Yes

The predicted noise levels presented in Table 24 indicate that noise from the gyms are capable of complying with the project noise emission requirements.

5.10 HOTEL FUNCTION AREAS NOISE EMISSION

Based on the Architectural Drawings, it is noted that the development's hotel is proposed to consist of the following indoor areas which may be used for functions and louder activities:

- All day dining room and medium function room on Level 4
- Bar (with balcony), medium function room, pre-function area and ballroom on Level 5
- Rooftop bar on Building A

It is noted that the NSW NPI applies to industrial noise sources from activities listen in Schedule 1 of the POEO Act, which does not include domestic/neighbourhood noises, such as noise from people speaking or music. Nonetheless, an assessment of the function areas has been conducted to the project noise trigger levels, established in accordance with of the NSW NPI, to understand the impact on surrounding noise-sensitive receivers. The following assumptions and mitigation measures formed the basis of this assessment:

- The indoor function and dining rooms have an average sound pressure level of 75 dB(A), which is a conservative estimate comparative to a busy restaurant with kitchen clatter
- The indoor bar has an average sound pressure level of 80 dB(A), which is a conservative estimate comparative to a busy bar with background music
- The indoor function rooms, dining rooms and bar have a maximum sound pressure level of 90 dB(A), which is a conservative estimate comparative to very loud shouting and cheering from a party of people
- The ballroom has an average sound pressure level of 90 dB(A), which is a conservative estimate comparative to an event with loud amplified music or live band
- The indoor function rooms, dining rooms and bar have a maximum sound pressure level of 100 dB(A), which is a conservative estimate comparative to peak noises from amplified music or instruments
- Façade construction of these areas have a minimum acoustic performance of R_w 32, which is achievable with typical 6.38mm laminated glass systems as a conservative estimate, and thicker systems will provide greater acoustic attenuation
- Façade glazing is fixed or aren't open whilst function areas are occupied and in use

- The approximate amount of people in a given 15-minute period for the bar balcony is 7 people, based on 1 person per $4m^2$
- The approximate amount of people in a given 15-minute period for the rooftop bar is 28 people, based on seating arrangement
- 1 in 2 people will be talking at any one time (this is a conservative estimate)
- Of the people talking,
    - Half will be talking in a normal voice with an average sound power level of 68 dB(A)
    - Half will be talking in a raised voice with an average sound power level of 74 dB(A)
- The following proposed operating hours have been advised:
    - Hotel restaurant – Monday to Sunday, 6:30am to 9:30pm
    - Hotel restaurant terrace – Monday to Sunday, 8:00am to 8:30pm
    - Hotel bar – Monday to Sunday, 4:00pm to 10:00pm
    - Hotel rooftop bar – Monday to Sunday, 4:00pm to 11:00pm
    - MICE facilities– Monday to Sunday, 8:00am to 12:00am

Based on the above assumptions, the cumulative noise during a reasonably worst case 15-minute period during the night time has been predicted at the most-affected receivers, including the predicted maximum noise level to assess the sleep disturbance at residential receivers. It is noted that not all hotel areas will be operating during the night time (as per above proposed hours) and that noise emissions during the night time will likely be lower than that presented in Table 25.

Table 25: Predicted noise level from hotel function areas to most-affected receivers

RECEIVER CATCHMENT	PREDICTED NOISE LEVEL, dB(A)	PROJECT NOISE TRIGGER LEVEL dB(A)	COMPLIES (YES/NO)
	NIGHT	NIGHT	
RC1	40 $L_{Aeq,15min}$ and 50 L_{AFmax}	43 $L_{Aeq,15min}$ and 58 L_{AFmax}	Yes
RC2	< 40 $L_{Aeq,15min}$	63 $L_{Aeq,15min}$	Yes
RC3	< 40 $L_{Aeq,15min}$		Yes
RC4	< 40 $L_{Aeq,15min}$		Yes
RC5	44 $L_{Aeq,15min}$		Yes

The predicted noise levels presented in Table 25 indicate that noise from hotel function areas are capable of complying with the project noise emission requirements.

5.11 CHILDCARE NOISE EMISSION

Further to our review of the Architectural Drawings, it is noted that a childcare centre is proposed on Level 4 of Building C. At the time of writing, only the following details have been identified as part of the proposed childcare centre:

- The proposed operating hours are Monday to Friday, 7:00am to 6:30pm
- Indoor area of childcare is approximately 565m^2
- Outdoor area of childcare is 170m^2, which wraps around the indoor area
- Maximum capacity of childcare is approximately 100 children total. The breakdown of children located internally and externally is subject to the ultimate operation of the facility and will form part of an Operational Management Plan

We have been advised that the childcare centre operator is yet to be selected. The following aspects of the childcare centre will have an impact on the noise emission and require a separate assessment that would require Council approval:

- Breakdown and distribution of the age groups of the children
- Times of arrival and departure of the children
- Breakdown of internal and external play times
- Internal layout of the proposed Centre
- Location and zoning of outdoor play areas

With consideration of the current proposal and locations of surrounding noise-sensitive receivers, it is expected that the childcare centre is capable of achieving project specific noise emission targets presented in Section 4.5.2, though a detailed acoustic assessment may be requested by City of Canterbury Bankstown Council and the selected tenant may be required by Council to submit a separate Development Application once the design has progressed.

5.12 MECHANICAL PLANT AND EQUIPMENT NOISE EMISSION

At this stage of the proposed development, the design has not progressed enough for mechanical plant and equipment selections to be made. During the design development stage of the project, the mitigation measures outlined in Section 6.3 should be considered when preparing the mechanical services, to ensure compliance with the external noise emissions criteria established in Section 4.5.

6 OPERATIONAL MITIGATION MEASURES

6.1 EXTERNAL SOUND ISOLATION – BUILDING ENVELOPE

6.1.1 Glazed Façade Elements

In order to achieve the project internal noise limits established in Section 4, the glazing components of the façade of the proposed development must meet the acoustic façade type presented in Table 26 below, which is indicative of the glazing assembly in its entirety (glass, seal and frame).

Table 26: Acoustic façade type designation for glazed elements

OCCUPANCY TYPE	AREA	FAÇADE AND LEVEL	MIN. ACOUSTIC PERFORMANCE (R_w)	TYPICAL EQUIVALENT GLASS LITE
Residential	Bedrooms	All	30	6mm monolithic glass **OR** 6mm float / 12mm airgap / 6mm float
	Living Rooms			
	Common Areas			
Hotel	Sleeping Areas			
	Common Areas			
Retail Stores	All			

6.1.2 Non-Glazed Façade Elements

In addition to the required glazing systems outlined in Table 26, the solid/non-glazed elements of the façade shall be constructed to ensure the resulting internal noise levels within each space in the proposed development do not exceed the project internal noise limits outlined in Section 4.

Masonry constructions such as concrete or core-filled blockwork will be satisfactory with no additional acoustic treatment required.

Lightweight constructions are to have an indicative acoustic performance of no less than R_w 45 to ensure the resulting internal noise levels within each space in the proposed development do not exceed the recommended internal noise levels outlined in Section 4.

6.1.3 Roof

The roof of all project buildings are expected to be constructed of concrete slab and will be acceptable with no additional acoustic treatment required.

6.2 ALTERNATE MEANS OF VENTILATION

An open windows assessment has been conducted in order to determine whether the residential spaces are able to meet the internal noise level requirements of the Interim Guideline with windows open to achieve natural ventilation (open in accordance with the natural ventilation requirements of the NCC and ADG).

The Interim Guideline states:

> *If internal noise levels with windows or doors open exceeds the criteria by more than 10dB(A), the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia.*

If the project internal noise limits for windows/doors open is exceeded, alternative means of ventilation is required in accordance with the requirements of the NCC (i.e. alternative ventilation system complying with AS 1668.2 and AS/NZS 3666.1) to the noise-affected spaces (noise-affected as defined in Section 5.1.3).

The results of the incident façade noise levels presented in Appendix A indicate that:

- Sleeping areas (i.e. bedrooms) with an incident façade noise level of greater than 55dB(A)$L_{Aeq,9hour}$ will require an alternative means of ventilation to meet the aforementioned requirements
- Other habitable areas (i.e. living rooms) with an incident façade noise level of greater than 60dB(A)$L_{Aeq,15hour}$ will require an alternative means of ventilation to meet the aforementioned requirements

It should be noted that these zones are preliminary and may change as the design develops due to a change in the building form, form of the façade, internal finishes within each of the habitable spaces and location of openings.

6.3 MECHANICAL SERVICES

Mitigation measures for the mechanical plant should be considered during the design development stage to ensure compliance with the outlined criteria at the nearest sensitive receiver catchments. These mitigation measures could include but not limited to the following:

- Positioning mechanical plant away from nearby receivers
- Acoustic attenuators fitted to duct work
- Screening around mechanical plant
- Acoustic insulation within duct work

It should be noted that the noise reduction requirements will likely be refined and reduced once the mechanical plant and equipment selections and designs have been progressed further during the detailed design of the proposed development. The mitigation measures proposed at this stage of the development are conservative in nature.

7 CONSTRUCTION NOISE ASSESSMENT

It is noted that a detailed construction plan/methodology is not available at this stage and a contractor has not been appointed. As such, the below assessments are indicative and should be further developed as part of a Construction Noise and Vibration Management Plan for CC.

7.1 PROPOSED CONSTRUCTION ACTIVITIES

At the time of writing, a contractor has not been engaged and a detailed description of work / construction methodology has not been determined. As such, the construction staging has been assumed as follows:

- Demolition works
- Bulk excavation and piling
- Structural works

Similarly, hours of work are also yet to be determined. For the purpose of this assessment, we have adopted the recommended standard hours in the ICNG which are as follows:

- Monday to Friday: 7:00am to 6:00pm
- Saturday: 8:00am to 1:00pm
- Sunday and public holidays: no work

7.2 EXPECTED CONSTRUCTION EQUIPMENT

The noise sources likely to be associated with the works listed in the previous section of this report are presented in Table 27. The equipment noise levels have been extracted from AS2436:2010 “Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites.

Table 27: Cumulative impact - construction equipment noise levels

STAGES	ESTIMATED DURATION	EQUIPMENT	QUANTITY	SOUND POWER LEVEL – dB(A)	ACOUSTICAL USAGE FACTOR (%)	USAGE IN 15-MINUTE PERIOD (MINUTES)	TIME CORRECTED SOUND POWER LEVEL– dB(A) $L_{Aeq,15min}$
Demolition	6 months	Excavator 30 tonne	1	107	40	6	103
		Excavator breaker	1	118	40	6	114
		Bobcat	1	107	40	6	103
		General Truck	1	107	30	4.5	102
Excavation and Civil Works	6 months	Excavator 30 tonne	1	107	40	6	103
		Bobcat	2	107	40	6	103
		General Truck	2	107	30	4.5	102
Structural Works	18 months	Powered hand tool	6	102	50	7.5	99
		Concrete pump truck	1	108	50	7.5	105
		General truck	2	107	30	4.5	102
		Mobile crane	1	104	20	3	97

7.3 NOISE MODELLING AND ASSUMPTIONS

In order to assess the noise impact from the site during the various construction stages, a desktop noise calculation was prepared and has been conducted generally in accordance with the ICNG calculation procedure. The calculation represents a 'reasonable' worst case noise level as this does not account for shielding attenuation such as from buildings and elevated grounds, and ground absorption.

The assumptions that were made within the assessment include the following:

- All construction equipment for each stage is operating simultaneously in an assessed 15-minute period, representing a reasonably worst-case scenario
- All construction equipment for each stage is concentrated near the project boundary closest to the respective receiver, representing a reasonably worst-case scenario
- The predicted noise levels at the receivers have been assessed at a height of 1.5m above ground level in accordance with the assessment procedures of the ICNG
- The noise levels have been assessed using neutral weather conditions

7.4 PREDICTED NOISE LEVELS

The predicted noise levels at surrounding noise-sensitive receivers have been presented in Table 28 to Table 30 and have been assessed to the ICNG construction noise management levels as per Section 4.6.1, during the ICNG recommended hours of work.

Table 28: Predicted 'worst-case' noise levels at surrounding noise-sensitive receivers (demolition works)

RECEIVER CATCHMENT	PREDICTED NOISE LEVEL RANGE (dBA $L_{Aeq,15min}$)	NOISE MANAGEMENT LEVEL (dBA $L_{Aeq,15min}$)	NOISE MANAGEMENT LEVEL EXCEEDANCE (dBA)	EXCEEDS HIGHLY NOISE AFFECTED LEVEL (YES/NO)
RC1	74-80	61	Up to 19	Yes
RC2	69-81	70	Up to 11	N/A
RC3	67-79	70	Up to 9	N/A
RC4	65-76	70	Up to 6	N/A
RC5	66-77	70	Up to 7	N/A

Table 29: Predicted 'worst-case' noise levels at surrounding noise-sensitive receivers (excavation and piling works)

RECEIVER CATCHMENT	PREDICTED NOISE LEVEL RANGE (dBA $L_{Aeq,15min}$)	NOISE MANAGEMENT LEVEL (dBA $L_{Aeq,15min}$)	NOISE MANAGEMENT LEVEL EXCEEDANCE (dBA)	EXCEEDS HIGHLY NOISE AFFECTED LEVEL (YES/NO)
RC1	68-75	61	Up to 14	No
RC2	64-75	70	Up to 5	N/A
RC3	62-74	70	Up to 4	N/A
RC4	59-72	70	Up to 2	N/A
RC5	62-72	70	Up to 2	N/A

Table 30: Predicted 'worst-case' noise levels at surrounding noise-sensitive receivers (structural works)

RECEIVER CATCHMENT	PREDICTED NOISE LEVEL RANGE (dBA $L_{Aeq,15min}$)	NOISE MANAGEMENT LEVEL (dBA $L_{Aeq,15min}$)	NOISE MANAGEMENT LEVEL EXCEEDANCE (dBA)	EXCEEDS HIGHLY NOISE AFFECTED LEVEL (YES/NO)
RC1	70-77	61	Up to 16	Yes
RC2	65-77	70	Up to 7	N/A
RC3	62-75	70	Up to 5	N/A
RC4	63-73	70	Up to 3	N/A
RC5	62-74	70	Up to 4	N/A

8 CONSTRUCTION VIBRATION ASSESSMENT

Vibration intensive activities are typically limited to demolition of structures and excavation works with hydraulic hammers, rock breaking, and percussive methods of piling installation.

The proposed construction activities include bulk excavation using tracked excavators and trucks, and piling works, which are expected to use non-impact methods such as bored piling. While these activities can generate ground vibration, the magnitude and extent of propagation are highly dependent on equipment type, ground conditions, and separation distance.

Safe working distances for vibration intensive plant and are quoted for both "cosmetic" damage (in accordance with BS 7385) and human comfort (in accordance with Assessing Vibration – a technical guideline), have been provided, based on Transport for NSW's "Construction Noise and Vibration Guideline". The recommended safe working distances for each of the plant listed above are provided in Table 24.

Table 31: Recommended safe working distances for vibration intensive plant

EQUIPMENT	APPROX. SIZE/ WEIGHT/ MODEL	MINIMUM DISTANCE – COSMETIC DAMAGE (BS 7385)	MINIMUM DISTANCE – HUMAN RESPONSE (OH&E VIBRATION GUIDELINE)
Vibratory roller	1-2 tonne	5m	15m to 20m
	2-4 tonne	6m	20m
	4-6 tonne	12m	40m
	7-13 tonne	15m	100m
	13-18 tonne	20m	100m
	> 18 tonne	25m	100m
Small hydraulic hammer	300 kg (5 to 12t excavator)	2m	7m
Medium hydraulic hammer	900 kg (12 – 18t excavator)	7m	23m
Large hydraulic hammer	1600 kg (18 to 34t excavator)	22m	73m
Pile driver – vibratory	Sheet piles	2m to 20m	20m
Piling rig – bored	≤ 800mm	2m (nominal)	N/A
Piling rig – hammer	12t down force	15m	50m
Jackhammer	Handheld	1m (nominal)	Avoid contact with structure

The closest vibration sensitive receivers are considered to be the adjacent properties (RC1 and RC2). Once a construction method is determined at time of head contractor appointment, it is recommended that the contractor engage a specialist to undertake attended vibration measurements at the commencement of work in order to verify the safe working distances.

If the levels are compliant with the vibration limits as listed in Section 4.7, then work may proceed based on the implementation of the measures detailed in this report. If there are exceedances, reasonable and feasible mitigation measures and additional vibration monitoring should be conducted. Measures to prevent cosmetic damage to surrounding structures are provided in Section 9 and a vibration monitoring strategy has been provided in Section 9.3.

9 CONSTRUCTION NOISE AND VIBRATION MANAGEMENT

It is noted that a detailed construction plan/methodology is not available at this stage and a contractor has not been appointed. As such, the below recommendations and mitigation measures are indicative and should be further developed as part of a Construction Noise and Vibration Management Plan for CC.

9.1 PROJECT SPECIFIC RECOMMENDATIONS

9.1.1 Noise

It is predicted that noise levels are expected to be exceeding the "noise affected" management levels at surrounding receivers throughout the stages of construction, namely due to the proximity of receivers and their line of sight to the project site.

These predicted noise levels (and exceedances) are considered to be a worst-case scenario without any corrections for shielding or directivity and with all equipment operation simultaneously in a 15-minute period. Noise levels at surrounding sensitive receivers can be expected to be less than those presented in Section 7.4, when works are not occurring simultaneously, when works are further away from the project site boundary, if a solid hoarding is implemented around the boundary, and if works occur internally within the building shell.

Furthermore, it is noted that this is an indicative assessment for a worst-case scenario and shall be refined as part of a Construction Noise and Vibration Management Plan once detailed construction plan/methodologies are available.

Notwithstanding the above, the following noise mitigation strategies are recommended to protect the amenity of surrounding noise-sensitive receivers during highly concentrated and loud activities:

- As works may potentially exceed the "highly noise affected" management level at RC1, a one-hour respite period, for example between 12:00pm – 1:00pm (or other period to coincide with construction workers lunch time(s)), should be offered per day during the most intensive periods of noisy activities. Limiting these activities outside of sensitive hours (e.g. no noisy works, such as piling, between 7:00am – 8:00am on weekdays) should also be considered
- Frequent and proactive communication with surrounding residents and neighbours is also encouraged and a Community Consultation Strategy should be developed by the contractor. This will allow occupants of surrounding residents to arrange their schedules to accommodate possible noise sensitive activities (like online meetings and conferencing). More details regarding communication with the community can be found in Section 9.2.3
- For exceedances of less than 3dB(A), careful selection and maintenance of plant equipment will ensure that disruptions to adjacent receivers are minimised.

9.1.2 Vibration

It is expected that the main vibration inducing activities could be from bored piling or rock/slab breaking and other activities are generally considered to not be highly vibration intensive activities. It is recommended that the contractor engage a specialist to undertake attended vibration measurements at the commencement of work in order to verify the safe working distances.

If the levels are compliant with the vibration limits as listed in Section 4.7, then work may proceed based on the implementation of the measures detailed in this report. If there are exceedances, reasonable and feasible mitigation measures and additional vibration monitoring should be conducted. Measures to prevent cosmetic damage to surrounding structures are provided in Section 9.2.2 and a vibration monitoring strategy has been provided in Section 9.3.4.

Upon any complaints from surrounding residents, the following shall be undertaken:

- Vibration monitoring is recommended to be conducted at surrounding sensitive receivers (or at the location of complaint) in accordance with the monitoring program strategy proposed in Section 9.3

- Reasonable and feasible measures should be considered to lessen the impact, such as alternative methods or equipment for activities which are causing complaints to achieve the vibration levels required

To further diminish the vibration impact, the one-hour respite period, for example between 12:00pm – 1:00pm (or other period to coincide with construction workers lunch time(s)), recommended for noise mitigation shall also apply for vibration mitigation.

We recommend that dilapidation reports be prepared on surrounding sensitive receivers and buildings which will be in close proximity to heavy machinery. Guidance for this may be provided by the geotechnical engineer and controlled by ground composition.

9.2 GENERAL ACOUSTIC RECOMMENDATIONS

According to AS 2436 the following techniques could be applied to minimize the spread of noise and vibrations to the potential receivers.

9.2.1 Noise

If a process that generates significant noise levels cannot be avoided, the amount of noise reaching the receiver should be minimized. Two ways of achieving this are to either increase the distance between the noise source and the receiver or to introduce noise reduction measures such as screens. Practices that will reduce noise from the site include:

- Increasing the distance between noise sources and sensitive receivers.
- Reducing the line-of-sight noise transmission to residences or other sensitive land uses using temporary barriers (stockpiles, shipping containers and site office transportables can be effective barriers).
- Constructing barriers that are part of the project design early in the project to introduce the mitigation of site noise.
- Installing purpose-built noise barriers, acoustic sheds and enclosures.

Physical methods to reduce the transmission of noise between the site works and residences, or other sensitive land uses, are generally suited to works where there is longer-term exposure to the noise. A few of these methods have been introduced below.

Screening

Hoarding: Another way of implementing screening is to build hoarding that includes a site office on an elevated structure. This option offers superior noise reduction when compared with a standard, simple hoarding. The acoustic performance is further enhanced when the hoarding is a continuous barrier.

General remarks: In many cases, it is not practical to screen earthmoving operations effectively, but it may be possible to partially shield a construction plant at the early stages of the project with protective features required to screen traffic noise.

The usefulness of a noise barrier will depend upon its length, its height, its position relative to the source and the receiver, and the material of which it is made. A barrier designed to reduce noise from a moving source should extend beyond the last property to be protected by at least ten times the shortest distance from the said property to the barrier. A barrier designed to reduce noise from a stationary source should, where possible, extend beyond the direct line of sight between the noise source and the receiver by a distance equal to ten times the effective barrier height, which is the height above the direct line between source and receiver.

If the works are already predominantly located within nominally closed structures, careful consideration should be given to reducing noise breakout at any openings.

Cranes

For the early works construction phases, any cranage will be limited to mobile cranes where the engines are typically enclosed in an acoustically treated housing.

Reversing and warning alarms

Community complaints often involve the intrusive noise of alarms commonly used to provide a safe system of work for vehicles operating on a site. Beeper reversing alarm noise is generally tonal and may cause annoyance at significant distances from the work site.

There are alternative warning alarms capable of providing a safe system of work that are equal to or better than the traditional "beeper", while also reducing environmental noise impacts. The following alternatives should be considered for use on construction sites as appropriate (and combined where appropriate):

- Broadband audible alarms incorporating a wide range of sound frequencies (as opposed to the tonal-frequency 'beep') are less intrusive when heard in the neighbourhood.
- Variable-level alarms reduce the emitted noise levels by detecting the background noise level and adjusting the alarm level accordingly.
- Proximity alarms that use sensors to determine the distance from objects, such as people or structures, and generate an audible alarm in cabin for the driver.
- Spotters or observers.

Selection of Alternate Equipment

As part of the Contractor's Construction Methodology and Construction Management Plan, the noise and vibration impact of each equipment / machinery should be considered. Where feasible and practical, quieter equipment (lower Sound Power Level) shall be selected for the task. The Contractor can review the manufacturer's equipment sound data or utilise AS2436 and the TfNSW CNS as guides in understanding what the typical Sound Power Levels are for alternative types of machinery.

Attended short-term noise measurements can also be conducted to either compare the noise levels of machinery, or to understand what the noise level at surrounding noise sensitive receivers are.

The same consideration shall be taken for vibration intensive machinery, which are expected to be only rock hammering and piling. Where feasible and practical, less vibration intensive equipment shall be selected for the task such as favouring pulverising and sawing methods rather than hydraulic hammering for rock breaking.

As with noise, attended short-term vibration measurements can be conducted at start of vibration intensive works to ensure vibration criteria at surrounding receivers are not exceeded.

As a guide, the Contractor can also refer to AS2436 and the TfNSW CNS to use as a guide in understanding vibration intensive activities and their alternate methods, based on minimum working distances.

Machinery shall be selected based on the noise criteria and vibration criteria as presented in Section 4.6 and 4.7

9.2.2 Vibration

Vibration can be more difficult to control than noise, and there are few generalizations that can be made about its control. It should be kept in mind that vibration may cause disturbance by causing structures to vibrate and radiate noise in addition to perceptible movement.

Impulsive vibration can, in some cases, provide a trigger mechanism that could result in the failure of building components that had previously been in a stable state. Vibrations can also trigger annoyance, which might get elevated into action by occupants of exposed buildings and should therefore be included in the planning of communication with impacted communities.

It should be remembered that failures, sometimes catastrophic, can occur as a result of conditions not directly connected with the transmission of vibrations, e.g. the removal of supports from retaining structures to facilitate site access. BS 7385-2 provides more information on managing ground-borne vibration and its potential effects on buildings. Where site activities may affect existing structures, a thorough engineering appraisal should be made at the planning stage.

General principles of seeking minimal vibration at receiving structures should be followed in the first instance. Predictions of vibration levels likely to occur at sensitive receivers are recommended when they are relatively close, depending on the magnitude of the source of the vibration or the distance associated. Relatively simple prediction methods are available in textbooks, codes of practice and standards, however, it is preferable to assess site transmission and propagation characteristics between source and receiver locations through measurements.

Guidance for measures available for the mitigation of vibration transmitted can be sought in more detailed standards, such as BS 5228-2 or policy documents, such as the NSW DEC *Assessing Vibration: A technical guideline*. Identifying the strategy best suited to the control of vibration follows a similar approach to that of noise: avoidance, control at the source, control along the propagation path, control at the receiver, or a combination of these. It is noted that vibration sources can include stationary plants (pumps and compressors), portable plants (jackhammers and pavement vibrators), mobile plants, pile-drivers, tunnelling machines and activities, and blasting, amongst others. Unusual ground conditions, such as a high water-table, can also cause a difference to expected or predicted results, especially when considering the noise propagated from piling.

9.2.3 Community Consultation to be Undertaken

The builder shall directly contact adjacent noise sensitive receivers and provide them with the following information:

- The contact details for a nominated representative in order to make noise / vibration complaints
- Explain the timeframe for the construction works and the proposed activities, i.e. the proposed start / stop dates of work and a description of the noise producing equipment that will be used
- Notify the noise sensitive receivers and relevant local / state authority in a timely manner should there be any need for an extension to the proposed arrangements
- Provide them with a copy of this report as approved by the relevant local / state authority
- Where noise is demonstrated as being compliant with criteria, this should not limit the proponent in undertaking further additional reasonable and feasible steps to reduce noise emissions.

9.2.4 Complaint Handling Procedures and Community Liaison

To assist in the management of noise and vibration complaints various procedures are to be followed. These include:

- Clearly visible signage identifying any key personnel along with their contact details to be erected along the perimeter of the building site including:
    - A 24-hour contact name, phone number and email address provided for the resident to address any complaint. The signage will declare; “For any enquiry, complaint or emergency relating to this site at any time please contact…”
- Give complaints a fair hearing
- Relevant local / state authority should be notified of the nature and details of complaints received (time, complainant etc.) and what remedial action has taken place, if any
- Have a documented complaints process, including an escalation procedure so that if a complaint is not satisfied there is a clear path to follow
- Call back as soon as possible to keep people informed of action to be taken to address noise problems. Call back at night time only if requested by the complainant to avoid further disturbance
- Implement all feasible and reasonable measures to address the source of the complaint
- A register is to be kept by the contractor to keep a record of complaints and detail any information associated with them. The contents of the register will include:
    - The name and the address of the complainant
    - Time and date of the complaint

- The nature of the complaint (Noise/Vibration)
- Subsequent details
- Remedial action undertaken

The contents of the register will be maintained and updated on a monthly basis with any new complaint without delay. The complaints will be reported to both the relevant local / state authority and the Contractor. The investigation of the complaint and any remedial actions will be performed by the builder and/or client representative on a monthly basis. In the event of noisy works scheduled, the builder will notify residents 5 business days in advance.

9.3 NOISE & VIBRATION MONITORING STRATEGY

9.3.1 General Methodology

Monitoring may be in the form of regular checks by the builder or indirectly by an acoustic consultant engaged by the builder and in response to any noise or vibration complaints. Where noise and vibration criteria are being exceeded or in response to valid complaints, noise and / or vibration monitoring should be undertaken. This would be performed inside the premises of the affected property and on site adjacent to the affected receivers.

Monitoring is to be undertaken by an experienced noise and vibration monitoring professional or an acoustic consultant. The results of any noise or vibration monitoring are to be provided to the relevant party or person in a timely manner allowing the builder to address the issue and respond to the complaints.

Noise and vibration monitoring can take two forms:

- Short-term monitoring
- Long-term monitoring

Both of these approaches are elaborated below.

9.3.2 Short-term Monitoring

Short-term monitoring consists of attended monitoring when critical stages of the construction are occurring. This normally provides real-time assistance and guidance to the subcontractor on site, telling them when the noise and vibration criteria are exceeded. Thus, the selection of alternative method on construction or equipment selection is allowed in order to minimise noise and vibration impacts.

Short-term monitoring may also be undertaken prior to start of works to ensure noise levels emitted from machinery and equipment are within the manufacturer's tested data / tolerance. This check can be implemented periodically throughout the construction program as a maintenance routine to ensure machinery and equipment stay within the manufacturer's data / tolerance and are not faulty.

9.3.3 Long-term Monitoring

Similarly, to short-term monitoring, long-term monitoring provides real-time alerts to the builder / site manager when the noise and vibration criteria are exceeded. Instead of someone being on site measuring, noise and vibration loggers are used.

Typically, the noise and vibration loggers stay on site for a period of several months for the critical construction stages of the project, such as the demolition and excavation phases.

Both methodologies are complementary and normally used simultaneously providing a significant amount of data via the long-term monitoring but also providing information on the sources of noise and vibration generating exceedances via the short-term or attended monitoring.

Long-term noise monitoring reports shall be prepared and presented in accordance with the recommendations of the NSW ICNG (Section 8.2 of the ICNG).

9.3.4 Proposed Monitoring Programme

A monitoring programme is recommended to be carried out as part of a Construction Noise and Vibration Management Plan for CC, once construction plans/methodologies are available and a contractor is appointed.

10 CONCLUSION

This Noise and Vibration Impact Assessment has been prepared in support of a Development Application (DA) made to City of Canterbury Bankstown Council for the proposed development at 83-99 North Terrace, Bankstown (also known as Barings Compass Centre Bankstown).

The following operational noise and vibration assessments were conducted as part of this report:

- Airborne noise intrusion from traffic/rail noise sources surrounding the site
- Ground borne noise and vibration impact from the rail corridor near the site
- Noise emissions associated with the development's carpark
- Noise emissions associated with the development's loading dock and service vehicles
- Noise emissions associated with the development's communal outdoor areas
- Noise emissions associated with the development's retail tenancies
- Noise emissions associated with the development's medical suites
- Noise emissions associated with the development's gyms
- Noise emissions associated with the development's hotel function areas
- Noise emissions associated with the development's childcare centre
- Noise emission from mechanical plant and equipment serving the development

The following construction noise and vibration assessments were conducted as part of this noise and vibration impact assessment:

- Noise generated during the construction of the development and associated impacts on the surrounding noise sensitive receivers
- Vibration generated during the construction of the development and associated impacts on the surrounding vibration sensitive receivers

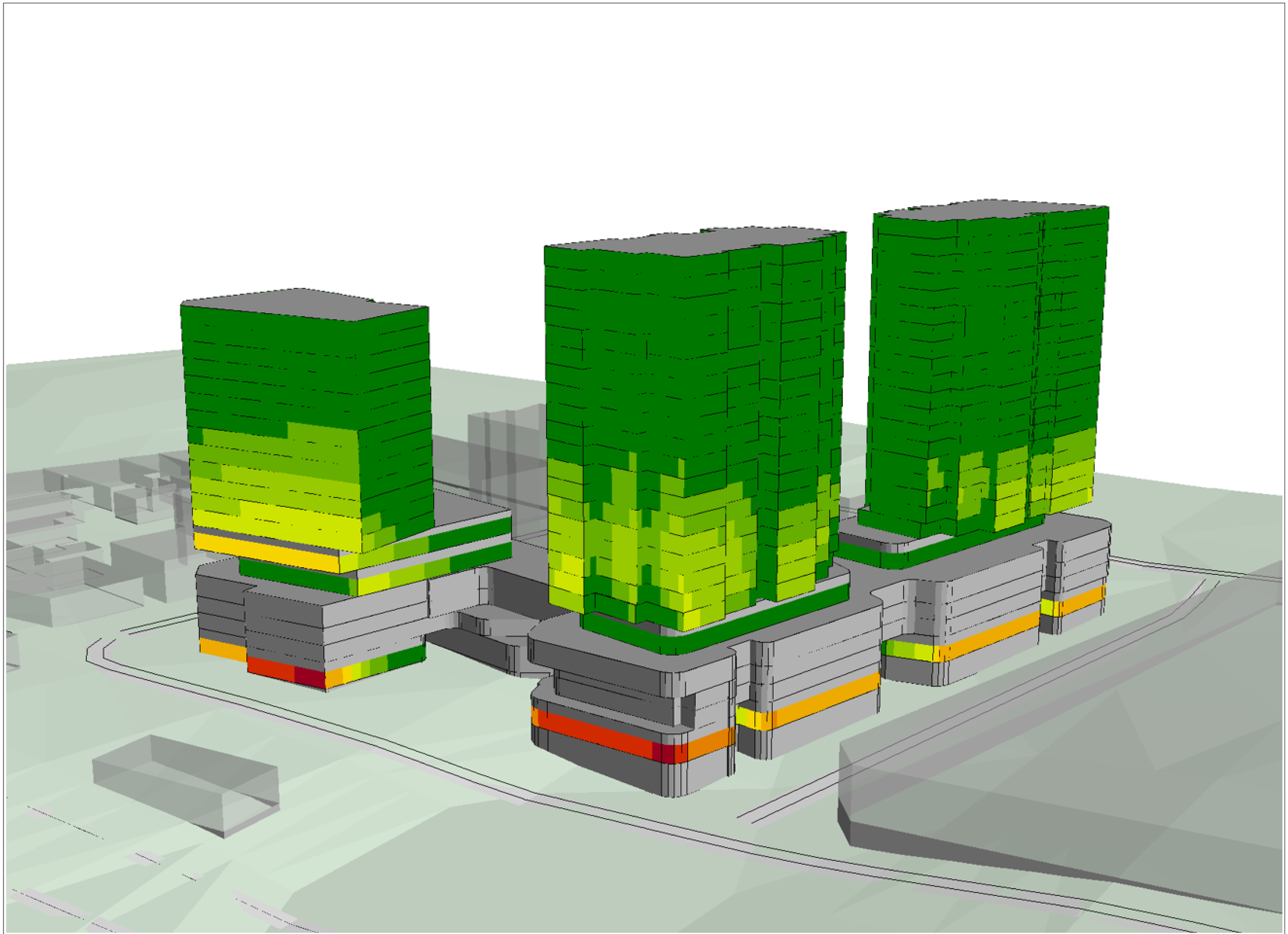
To assess each of the acoustic considerations for the proposed development, noise and vibration criteria has been established in Section 4 in accordance with the following documents:

- Canterbury-Bankstown Development Control Plan 2023 (DCP)
- Canterbury-Bankstown Local Environmental Plan 2023 (LEP)
- NSW EPA's Noise Policy for Industry 2017, dated October 2017 (NPI)
- NSW EPA's Road Noise Policy, dated March 2011 (RNP)
- NSW's State Environmental Planning Policy (Transport and Infrastructure) 2021 (SEPP 2021)
- NSW EPA's Development Near Rail Corridors and Busy Roads – Interim Guideline, dated December 2008 (Interim Guideline)
- NSW EPA's Assessing Vibration: a technical guideline, dated February 2006 (AVTG)
- AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors (AS/NZS 2107)
- AAAC's Guideline for Child Care Centre Acoustic Assessment, Version 3.0 (AAAC Guideline)
- NSW EPA's Interim Construction Noise Guideline, dated July 2009 (ICNG)
- British Standard BS5228 – Part 1:1997 "Noise and Vibration Control on Construction and Open Sites."
- British Standard BS7358:1993 "Evaluation and Measurement for Vibration in Buildings"
- German Standard DIN4150 – Part 3: "Structural vibration in buildings – Effects on structures"

Having given regard to the analysis conducted within this report, it is the finding of this noise and vibration impact assessment that the proposed development is compliant with the relevant noise and vibration criteria controls for this type of development, and it is expected to comply with the applicable regulations with regards to noise and vibration, particularly those listed above.

It is recommended the Development Application for the proposed development is approved on the basis of noise and vibration, given that the implementation of the mitigation measures provides a compliant and suitable noise and vibration outcome.

Appendix A **Façade Noise Levels**



E-LAB CONSULTING

ISSUE	DATE	STATUS
1	28/03/2024	For Information
2	01/05/2025	For DA

LEGEND

Daytime Facade Noise Level, $L_{Aeq,15hour}$ dB(A)

- ≤ 60
- 60-61
- 61-62
- 62-63
- 63-64
- 64-65
- 65-66
- 66-67
- 67-68
- > 68

NOTES

PROJECT
BARINGS COMPASS CENTRE, BANKSTOWN

PROJECT NO.
P00709

ARCHITECT
PTW

CLIENT
ESSENCE

SCALE
NTS

STATUS
FOR DA

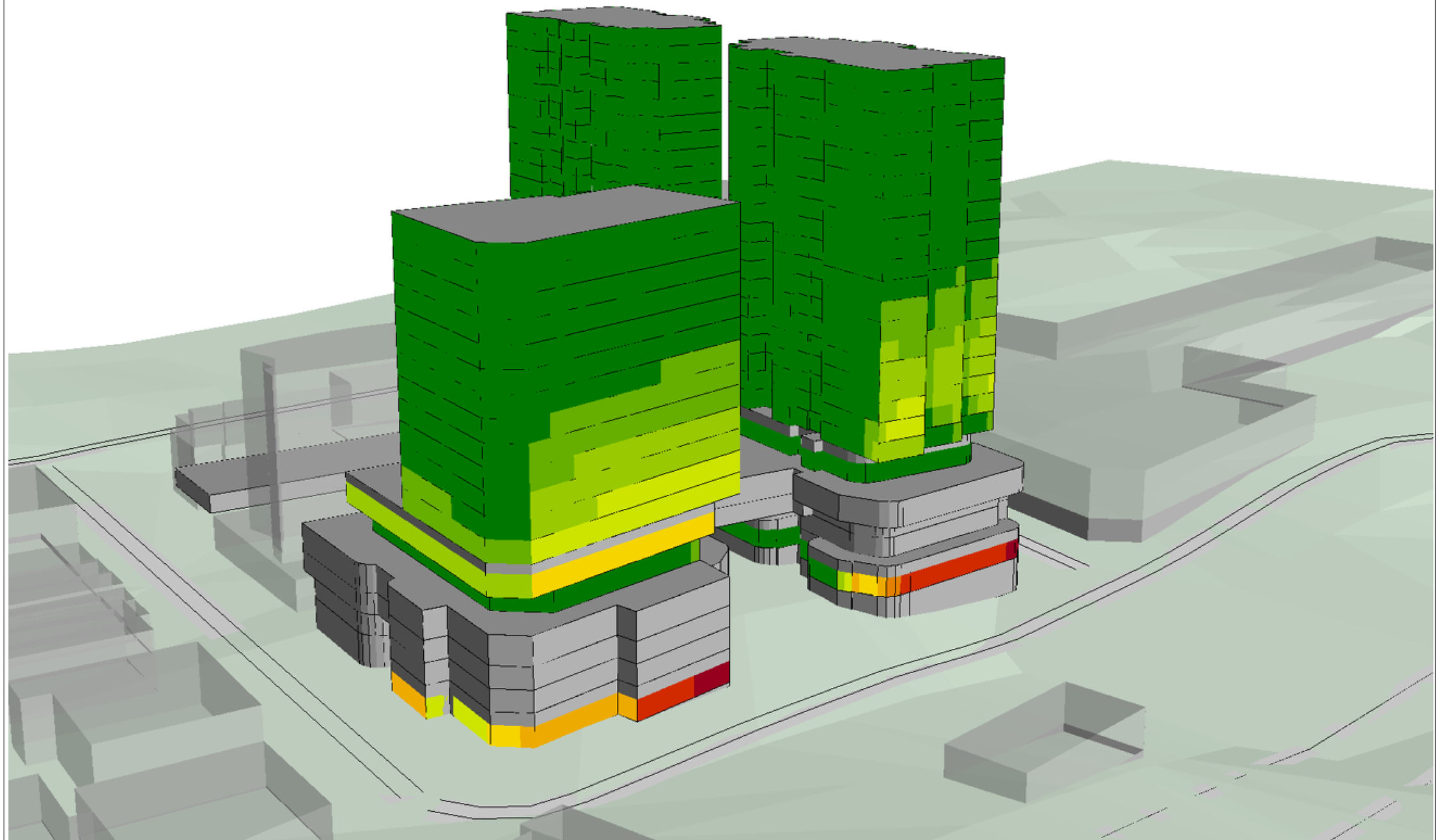
DRAWING
FACADE NOISE LEVELS

DAYTIME - VIEW 1

DISCIPLINE
ACOUSTICS AND VIBRATION

DRAWING NUMBER
AC-DWG-100-01-01

REVISION
002



E-LAB CONSULTING

ISSUE	DATE	STATUS
1	28/03/2024	For Information
2	01/05/2025	For DA

LEGEND

Daytime Facade Noise Level, $L_{Aeq,15hour}$ dB(A)

- ≤ 60
- 60-61
- 61-62
- 62-63
- 63-64
- 64-65
- 65-66
- 66-67
- 67-68
- > 68

NOTES

PROJECT
BARINGS COMPASS CENTRE, BANKSTOWN

PROJECT NO.
P00709

ARCHITECT
PTW

CLIENT
ESSENCE

SCALE
NTS

STATUS
FOR DA

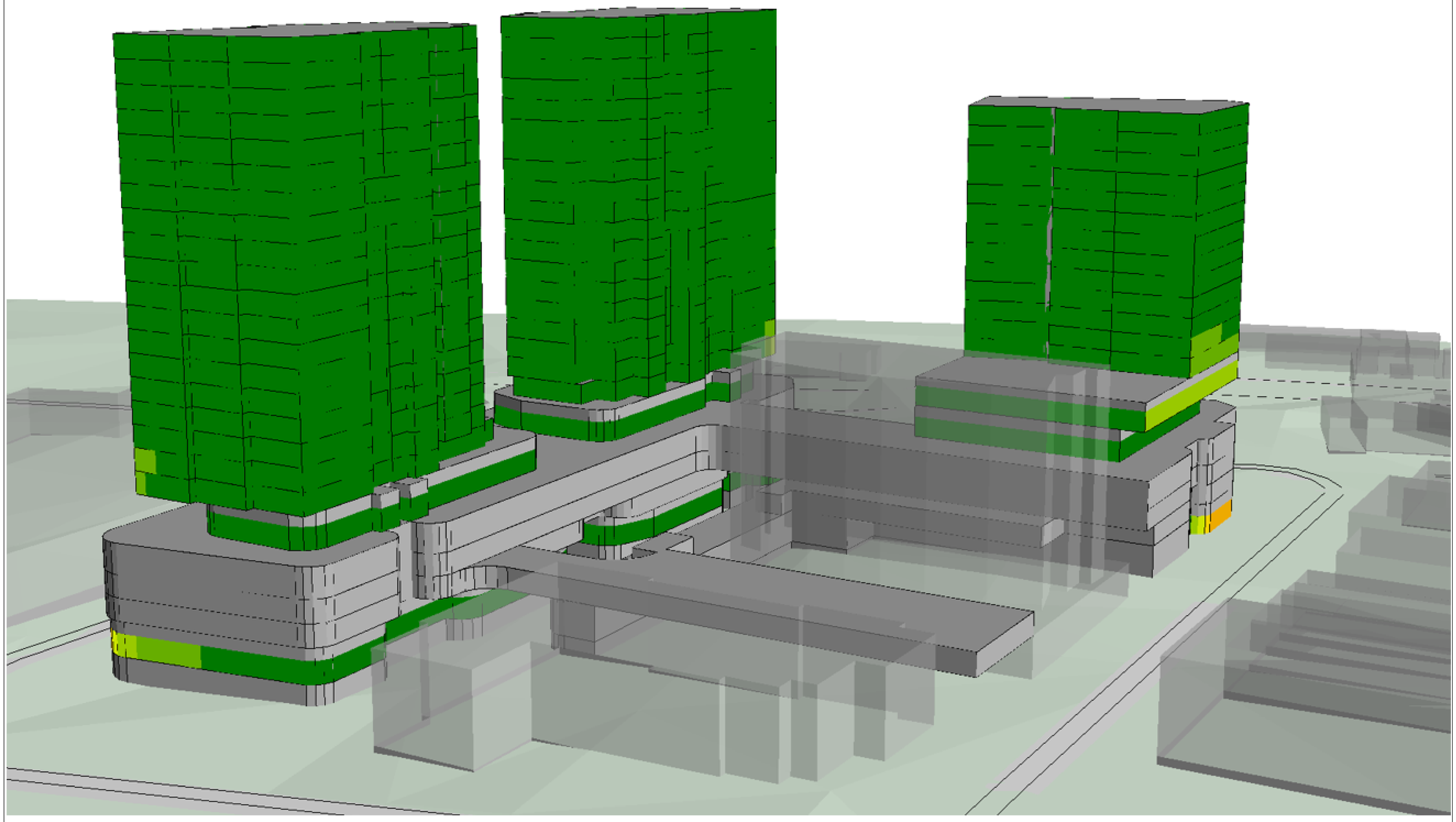
DRAWING
FACADE NOISE LEVELS

DAYTIME - VIEW 2

DISCIPLINE
ACOUSTICS AND VIBRATION

DRAWING NUMBER
AC-DWG-100-01-02

REVISION
002



E-LAB CONSULTING

ISSUE	DATE	STATUS
1	28/03/2024	For Information
2	01/05/2025	For DA

LEGEND

Daytime Facade Noise Level, $L_{Aeq,15hour}$ dB(A)

- ≤ 60
- 60-61
- 61-62
- 62-63
- 63-64
- 64-65
- 65-66
- 66-67
- 67-68
- > 68

NOTES

PROJECT
BARINGS COMPASS CENTRE, BANKSTOWN

PROJECT NO.
P00709

ARCHITECT
PTW

CLIENT
ESSENCE

SCALE
NTS

STATUS
FOR DA

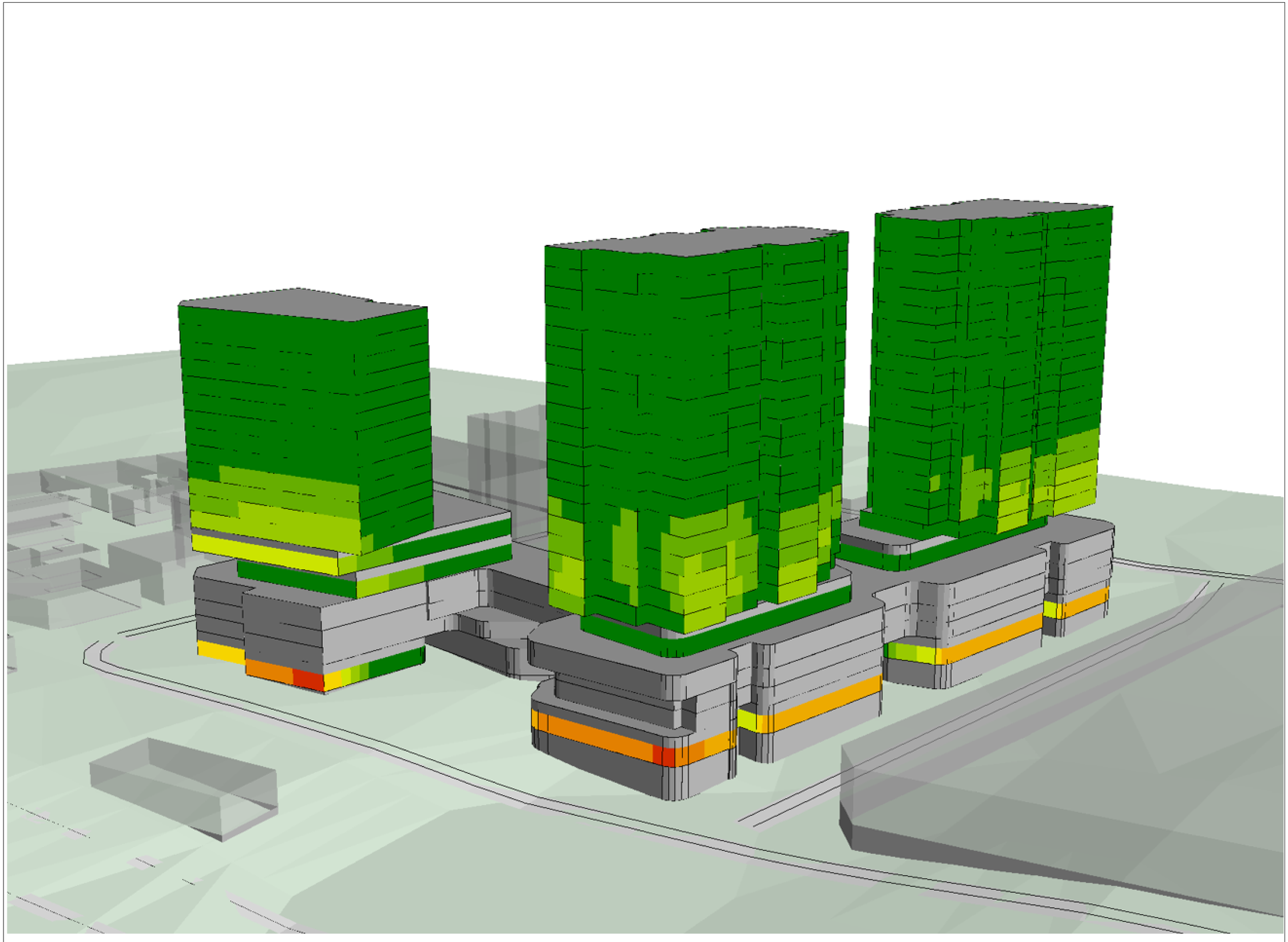
DRAWING
FACADE NOISE LEVELS

DAYTIME - VIEW 3

DISCIPLINE
ACOUSTICS AND VIBRATION

DRAWING NUMBER
AC-DWG-100-01-03

REVISION
002



E-LAB CONSULTING

ISSUE	DATE	STATUS
1	28/03/2024	For Information
2	01/05/2025	For DA

LEGEND

Night Time Facade Noise Level, $L_{Aeq,9hour}$ dB(A)

- ≤ 55
- 55-56
- 56-57
- 57-58
- 58-59
- 59-60
- 60-61
- 61-62
- 62-63
- > 63

NOTES

PROJECT
BARINGS COMPASS CENTRE, BANKSTOWN

PROJECT NO.
P00709

ARCHITECT
PTW

CLIENT
ESSENCE

SCALE
NTS

STATUS
FOR DA

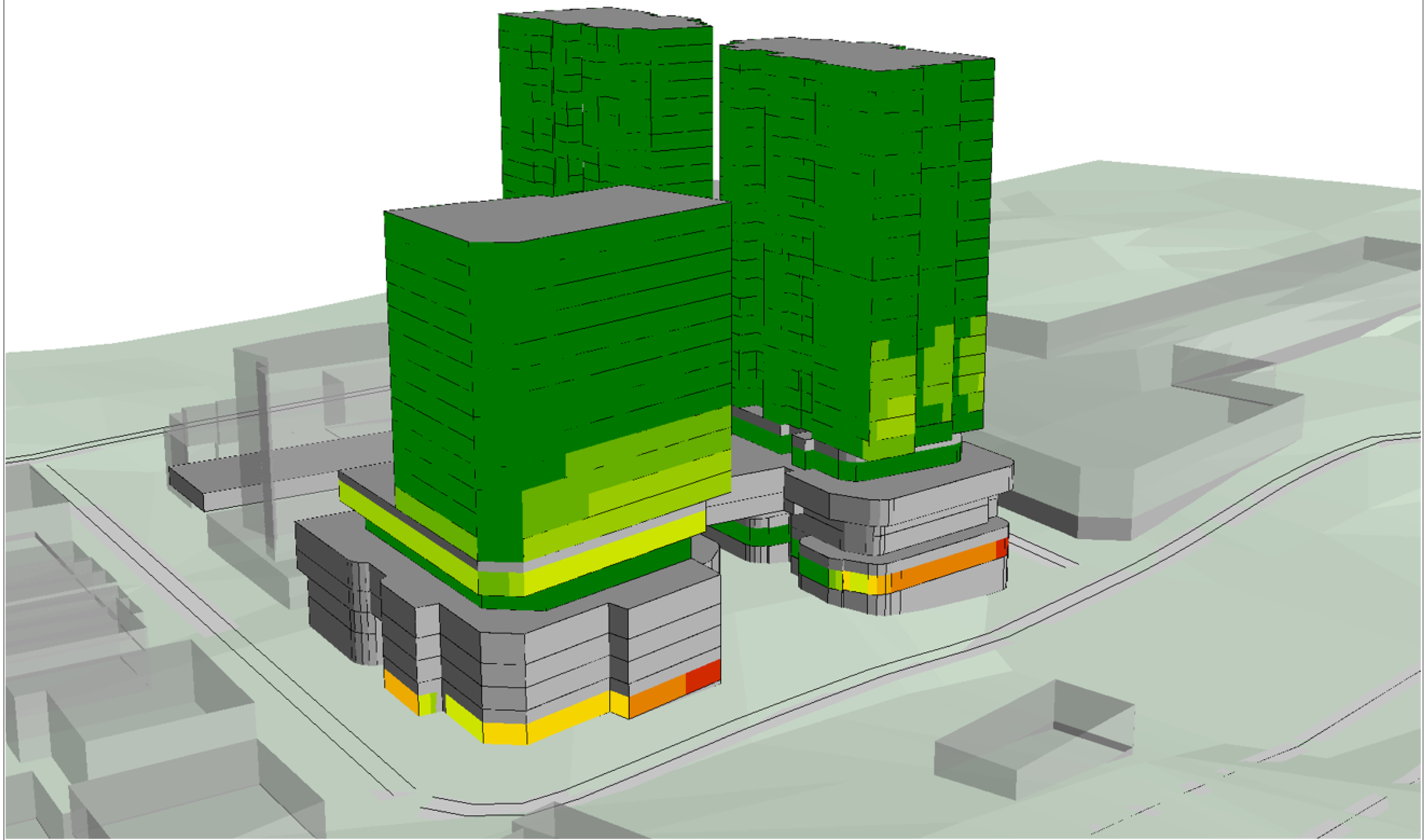
DRAWING
FACADE NOISE LEVELS

NIGHT TIME - VIEW 1

DISCIPLINE
ACOUSTICS AND VIBRATION

DRAWING NUMBER
AC-DWG-100-02-01

REVISION
002



E-LAB CONSULTING

ISSUE	DATE	STATUS
1	28/03/2024	For Information
2	01/05/2025	For DA

LEGEND

Night Time Facade Noise Level, $L_{Aeq,9hour}$ dB(A)

- ≤ 55
- 55-56
- 56-57
- 57-58
- 58-59
- 59-60
- 60-61
- 61-62
- 62-63
- > 63

NOTES

PROJECT
BARINGS COMPASS CENTRE, BANKSTOWN

PROJECT NO.
P00709

ARCHITECT
PTW

CLIENT
ESSENCE

SCALE
NTS

STATUS
FOR DA

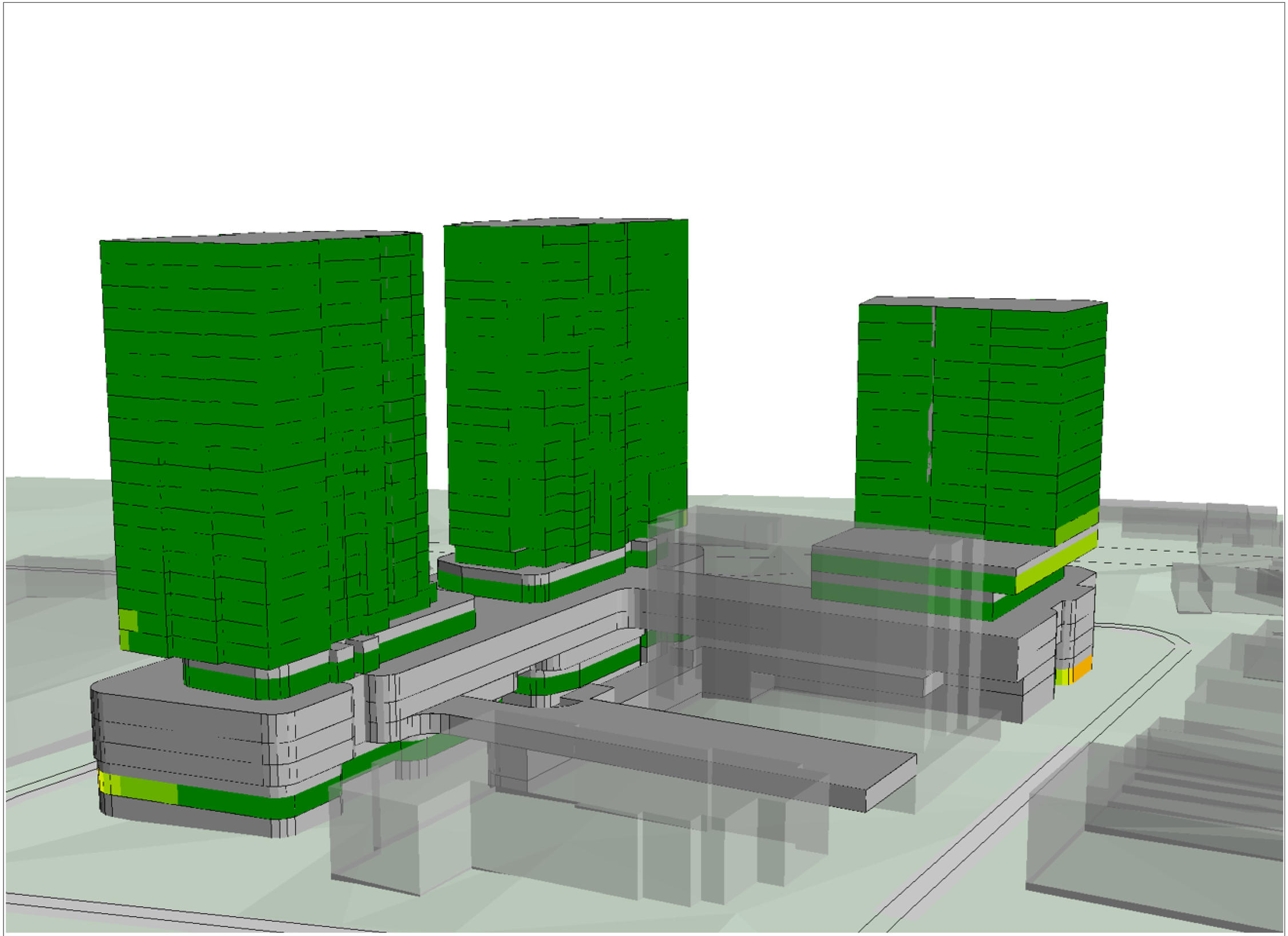
DRAWING
FACADE NOISE LEVELS

NIGHT TIME - VIEW 2

DISCIPLINE
ACOUSTICS AND VIBRATION

DRAWING NUMBER
AC-DWG-100-02-02

REVISION
002



E-LAB CONSULTING

ISSUE	DATE	STATUS
1	28/03/2024	For Information
2	01/05/2025	For DA

LEGEND

Night Time Facade Noise Level, $L_{Aeq,9hour}$ dB(A)

- ≤ 55
- 55-56
- 56-57
- 57-58
- 58-59
- 59-60
- 60-61
- 61-62
- 62-63
- > 63

NOTES

PROJECT
BARINGS COMPASS CENTRE, BANKSTOWN

PROJECT NO.
P00709

ARCHITECT
PTW

CLIENT
ESSENCE

SCALE
NTS

STATUS
FOR DA

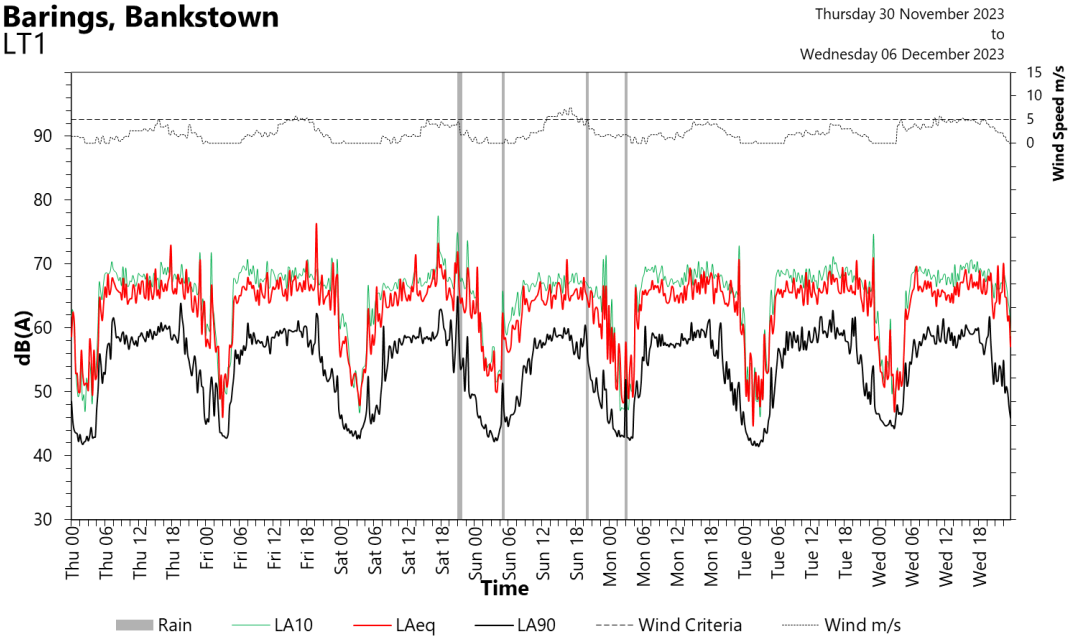
DRAWING
FACADE NOISE LEVELS

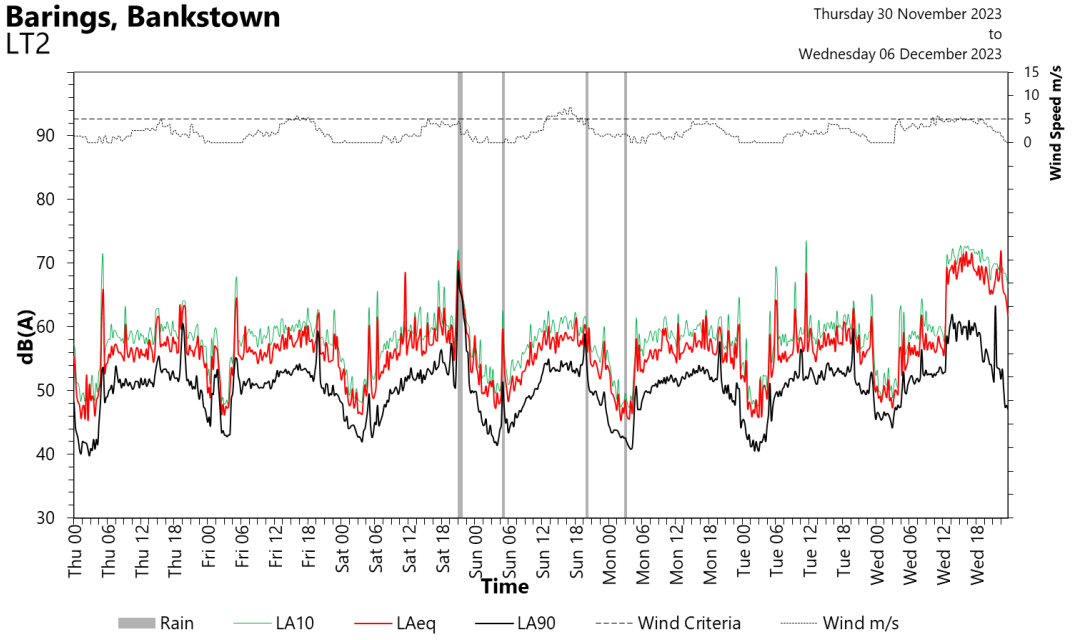
NIGHT TIME - VIEW 3

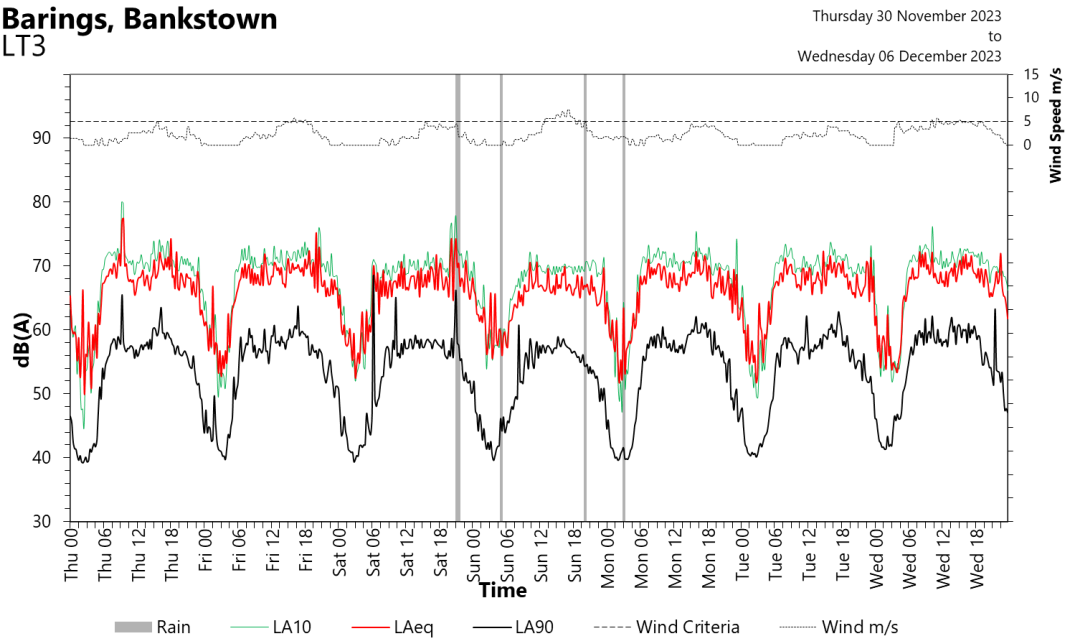
DISCIPLINE
ACOUSTICS AND VIBRATION

DRAWING NUMBER	REVISION
AC-DWG-100-02-03	002

Appendix B **Noise Monitoring Data**






Barings, Bankstown
LT3
Thursday 30 November 2023
to
Wednesday 06 December 2023
dB(A)
Wind Speed m/s
Time
Rain
LA10
LAeq
LA90
Wind Criteria
Wind m/s

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