

Paradigm 42

Brisbane

Canberra

Acoustic Report for DA Central Village Phase 2

AMENDED IN RED

18 / 2 / 2016

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MEDQ

On Behalf of

Metro (Brunswick Street) Pty Ltd

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1 Background

Paradigm 42 has been engaged by Metro (Brunswick Street) Pty Ltd to prepare an environmental noise impact assessment for a proposed mixed-use development located known as Central Village Phase 2 which incorporates Stages 4 and 5, at Water Street, Fortitude Valley on the corner with Brunswick Street.

In this report we have:

1. Conducted unattended ambient noise monitoring; and
2. Made observations of offsite activity;
3. Assessed and established the appropriate criteria;
4. Calculated external to internal noise levels;
5. Provided recommendations to achieve the criteria.

An attempt was made at noise logging, however due to construction noise from Central Village development at the time, this was abandoned and a series of attended measurements were performed at various times throughout the day instead. Observations on site identified that individual noise sources could not be identified or measured due to the noise levels from road traffic noise which was the predominant road traffic noise, mainly from Brunswick Street. This is in variation to earlier stages which were less affected by road traffic noise due to the increased distances from Brunswick Street, but were also subject to mechanical plant noise from commercial and other occupants on Water Street. We have subsequently recommended acoustic treatments in order to attenuate all noise impacting the site.

Noise logging was carried out as recently as two years ago on Water Street however this data set was not used for this report.

1.1 References

1. Brisbane City Council's (BCC) *City Plan 2000* Noise Impact Assessment Planning Scheme Policy (*NIAPSP*);
2. Brisbane City Council's (BCC) *City Plan 2014*,
 - a. SC6.26 Refuse planning scheme policy;
 - b. SC6.21 Noise impact assessment planning scheme policy;
 - c. 9.3.14 Multiple dwelling code;
3. Australian/New Zealand Standard AS 2107-2000 Acoustics – Recommended design sound levels and reverberation times for building interiors (AS 2107);
4. TTM report 13BRA0085 R01 5 dated 28/5/2014. We note copyright and have limited our usage to within one chapter or 10%;

2 Site Description

This development is in the Central Village development and is the fourth and fifth stage of the overall site.

The site is known as:

Lot 13 RP81335

Lot 12 RP10552

Lot 11 RP10552

Lot 1 RP 10553

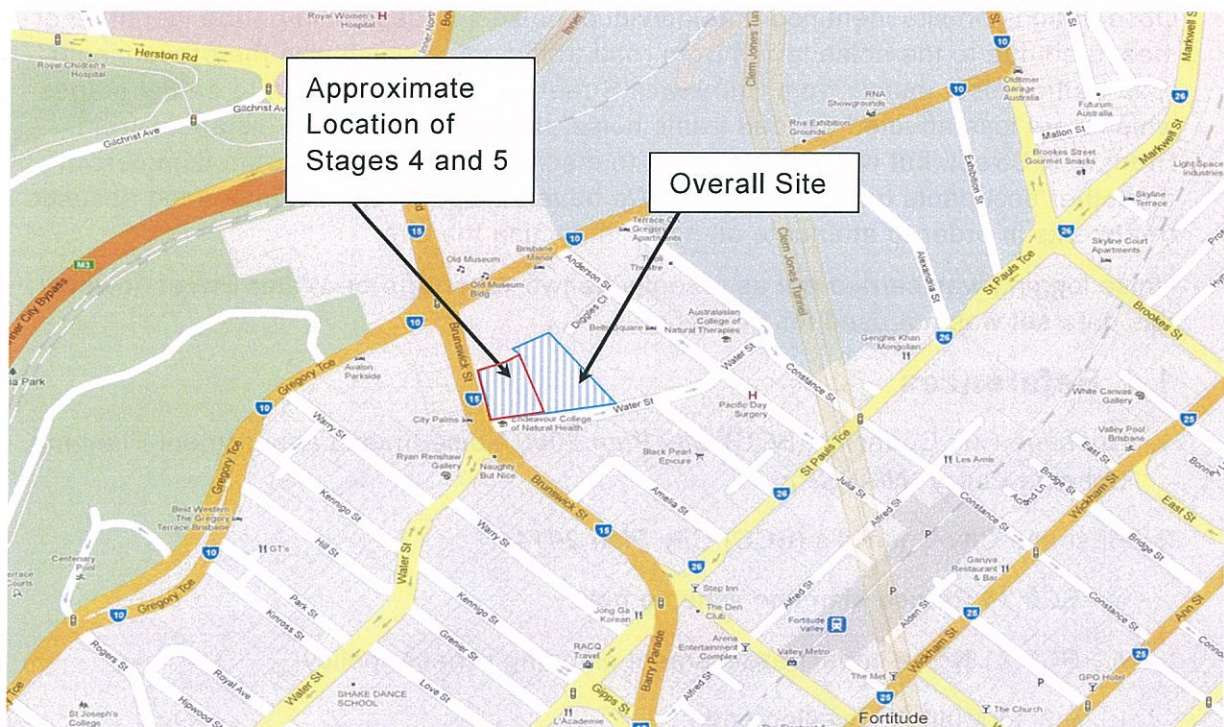
Lot 5 SP 266307

Lot 6 SP 266307

Lot 94 SP 266307

Address: 62 – 68 Brunswick Street, 332-338 Water Street.

Figure 1: Site Location



2.1 Proposed Development

The proposal is to develop the site containing the following:

1. carparking across five levels including basements and podiums;
2. Stage 4 tower with 285 apartments across 28 floors;
3. Stage 5 tower with 236 apartments across 22 levels;

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4. Roof top plant and recreational areas;
5. Retail on Podium 2 and Level 1.

A total of 521 apartments is proposed. Vehicular access is via Water Street, straight into the enclosed carpark and therefore noise associated with vehicles will need no mitigation and will not be discussed further.

Refuse collection likewise will also be collected inside the building and require no further mitigation. This complies with the BCC *City Plan 2014*, SC6.26 Refuse planning scheme policy.

Carparking is completely enclosed making it compliant with BCC *City Plan 2014*, Multiple dwelling code, section PO21.

These onsite noise sources will not be further discussed in this report. Please see Bureau Proberts drawing 2.03 for further details of access.

The following drawings by Bureau Proberts Project 14037, Revision 21 dated 20 October 2015 were utilised in the assessment (presented in Section 5).

Drawing number	Levels		
	Drawing Title	Stage 4	Stage 5
20.01	Basement 2		
20.02	Basement 1		
20.03	Podium 1		
20.04	Podium 2		
20.05	Podium 3		
20.06	Level 1		
20.07	Level 1 Recreation		
20.08	Level 2		
20.09	Level 3	3-8	3-6
20.15	Level 9	9-16	7-13
20.23	Level 17	17-22	14-17
20.24	Level 18	17-22	18-20
20.27	Level 21	17-22	21-22
20.29	Level 23	23-24	Roof
20.31	Level 25	25-26	
20.33	Level 29	27-28	

2.2 Description of Surrounding Environment

The acoustic amenity of the site is primarily affected by road traffic noise associated with the surrounding road network, in particular Brunswick Street. However, due to

the distances from Brunswick Street this is not undue. Mechanical services noise is evident from current occupants in the area. It was not possible to pinpoint sources.

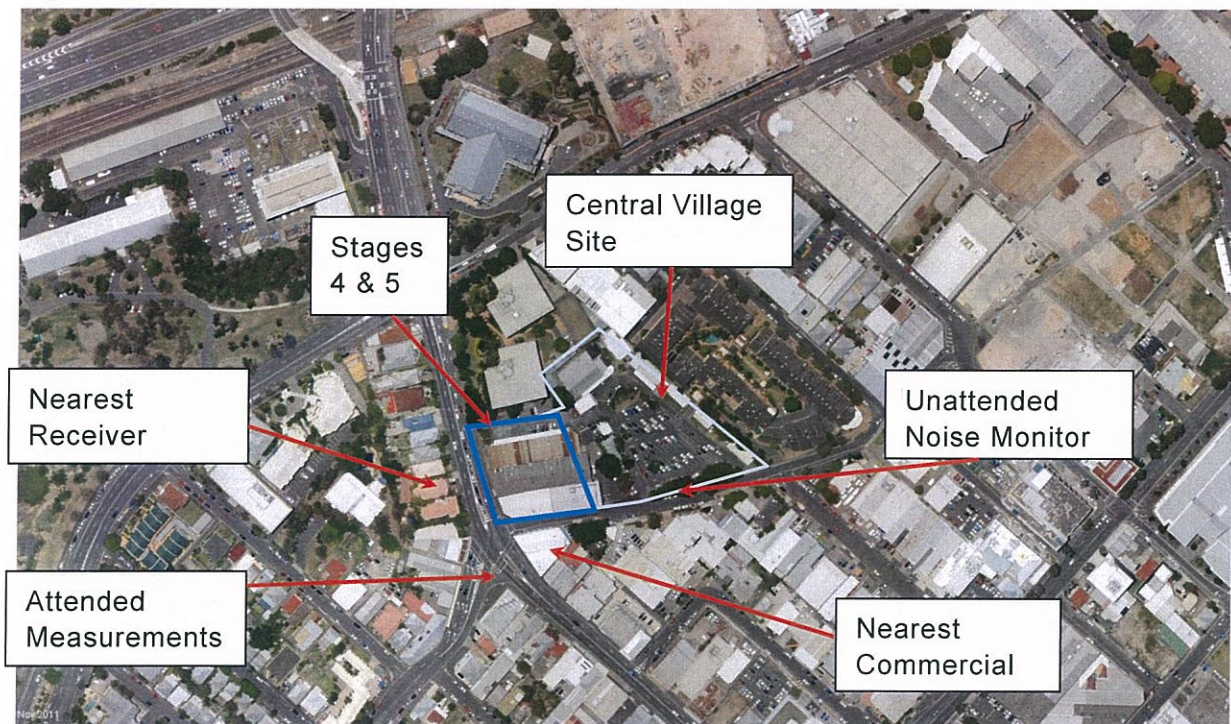
2.3 Affected Receivers

The area surrounding the site is predominantly commercial premises with residential land uses to the east. Figure 2 shows the location of the nearest receivers in relation to the site.

We have had a long association with this development and have conducted site surveys was conducted on the 28 October, 2011, and the most recent during attended measurements conducted between 24 July and 31 July 2014, and confirm the following:

- d. The proposed development is located north of Water Street, east of Brunswick Street;
- e. To the west is the are a commercial and residential occupancies;
- f. To the east is Stage 1 & 2, is complete, and Stage 3 is under construction;
- g. The southern side of Water Street is occupied by commercial terraces.

Figure 2: Nearest Affected Noise Sensitive Receivers.



If compliance can be achieved at the nearest receivers, all other receivers will comply due to the increased separation distance.

3 NOISE ASSESSMENT CRITERIA

The development is located within the Bowen Hills Priority Development Area. As the DSDIP does not have specific acoustic criteria the following sections detail the recommended acoustic requirements.

3.1 Road Traffic Noise – Brisbane City Council

Brisbane City Council's (BCC) *City Plan 2000 Noise Impact Assessment Planning Scheme Policy (NIAPSP)* is the appropriate criterion, providing consistency with the other stages in the development. The assessment methodology requires that road traffic noise is investigated for the planning horizon. This assessment has considered road traffic for the year 2026. Road traffic noise levels are assessed as an outdoor level in recreation areas, and as internal noise levels for living, work and sleeping areas.

The internal noise limits are the recommended design sound levels from Australian/New Zealand Standard *AS 2107-2000 Acoustics – Recommended design sound levels and reverberation times for building interiors (AS 2107)* and the relevant noise levels for apartments are presented in Table 1.

Table 1: Internal Noise Limits for Residential Dwellings from AS 2107, Table 1.

Type of Occupancy/Activity	Recommended design sound level, L_{Eq} , dB(A)	
	Satisfactory	Maximum
Houses and apartments near major roads—		
Living areas	35	45
Sleeping areas	30	40
Work areas	35	45
Apartment common areas (e.g. foyer, lift lobby)	45	55

The applicable criteria for outdoor recreation areas is the BCC *NIAPSP*. Table 2 outlines the assessment criteria based upon achieving the noise level objectives for Brisbane City Council.

Table 2: Road Traffic Noise Assessment Criteria.

Description	Predicted SPL dB(A)
Communal Recreational Areas	58dB(A) $L_{Eq(24hour)}$ (Free Field)
Private Recreational Areas	55dB(A) $L_{Eq(24hour)}$ (Free Field)
External façade	60dB(A) $L_{Eq(1hour)}$ (Façade Corrected)
Internal noise limits	As per AS 2107

3.2 Onsite and Offsite Activity Noise

Sources of noise generated on site include, vehicular access, associated noise such as door slams, start up, etc, refuse collection, and building services noise which includes mechanical plant.

Offsite noise includes all sources external to the development, including plant noise, road and rail traffic noise, street noise, and entertainment venue noise.

Brisbane City Council require onsite and offsite activities to be assessed in accordance with *NIAPSP*. The assessment should detail the location, extent and construction specifications for proposed attenuation measures including all assumptions and methodologies used.

NIAPSP requires the following:

Assessment of immission (noise ingress) and emission.

Assessment of immission and emission levels are grouped into 3 fundamental methodologies:

1. Comparison of like parameters or descriptors – Comparison, using a suitable sound descriptor, of the ambient sound character of an area without the development to that resulting with the development.
2. Application of *AS 2107* – Comparison with a defined set of sound pressure levels, for specified indoor areas occupied by people set out in Table 1 of *AS 2107*.
3. Sleep awakenings – Comparison with sleep levels. This type of assessment can be conducted using sound exposure levels (L_{AE}) to compare to the FICAN 1997 $SEL(L_{AE})$ /percentage awakening curve

We normally recommend applying the comparison of like parameters for assessment of noise from all noise sources associated with the development as follows:

- L_{A10} Vs L_{A10} for transient noise sources (i.e. waste collection, car parking and loading dock). *NIAPSP* allows the existing L_{A10} level to be exceeded by 3 dB by any proposed activities (taking into account the number of discreet noise events, character of the noise and time of occurrence);
- Application of *AS 2107* for control of mechanical plant noise to the development itself;
- Comparison of like parameters at the adjacent receivers.

However as waste collection, and car parking are effectively mitigated by enclosure within the building only mechanical plant will be assessed. This is in line with BCC's *City Plan 2014*.

Assessment criteria established for imissions have been based on the measurements (noise logging over a period of time adjusted for traffic noise 10 years after completion) conducted during that time period. Further assessments for daytime and evening were performed for living areas during the daytime (noisiest time) and the bedrooms at night time (most stringent criterion).

3.3 Mechanical Plant

Application of AS 2107 for control of mechanical plant noise is in accordance with NIAPSP, dwellings adjacent to the development are classified as being near a major road (Table 1, AS 2107), the noise design target level defined in AS 2107 for dwellings near major roads is maximum 45 dB(A) L_{Aeq} in living and work areas (studies) and 40 dB(A) sleeping areas.

Table 3: from AS 2107 Table 1

Type of occupancy/activity	Recommended design sound level, L_{Aeq} , dB(A)	
	Satisfactory	Maximum
7 RESIDENTIAL BUILDINGS (see Note 7 and Clause 5.2)		
Houses and apartments near major roads—		
Living areas	35	45
Sleeping areas	30	40
Work areas	35	45
Apartment common areas (e.g. foyer, lift lobby)	45	55

Furthermore, in order to prevent background creep, plant must be designed to not exceed the measured background noise levels. These various criteria equate to a design target for mechanical plant of the following levels:

Table 4: Mechanical Plant Assessment Criteria for Residential Receivers.

Time Period	Internal Criteria L_{eq} dB(A)	Criteria to Water Street Receivers L_{90} dB(A)	Criteria to Brunswick Street Receivers L_{90} dB(A)
Daytime (7am – 6pm)	42	44	66
Evening (6pm – 10pm)	42	46	65
Night time (10pm – 7am)	37	42	52

Unusually the evening period is noisier on Water Street than the day time period. This could be because afternoon peak hour traffic on Water Street.

Reference to the earlier TTM report should be made for graphical representation of measured noise levels

The above levels are for total emissions at a location from the proposed development and not for each component of plant. However to prevent background creep the noise emissions should be limited to 3 dB below the background so that the ambient background is not increased.

4 MEASUREMENT METHODOLOGY

Currently the site is heavily affected by construction noise which would affect any attempt at measurements during the daytime period. This has meant that noise logging has not been updated, however attended measurements have been completed at various times of the day. The previous noise logging was at a location further from Brunswick Street, and we have therefore applied a factor of 3 dB to the previous results to reflect the difference in environment.

Attended noise measurements were conducted across Brunswick Street with a similar setback to the traffic. This location was selected as being least affected by construction. As the noise on one side of Brunswick Street would have similar levels to the other, the location is deemed to be similar.

4.1 Equipment

The following equipment was used to record road traffic and ambient noise levels surrounding the site:

- Hand held sound level meter Bruel and Kjaer Type 2250, SN 3006332; and
- Field Calibrator Bruel and Kjaer Type 4231, SN 3009148.

4.2 Unattended Road Traffic and Ambient Noise Monitoring

Unattended noise monitoring on Water Street was previously conducted by TTM reference 13BRA0085 R01 5. Ambient noise levels have been taken from that report.

4.3 Onsite Activity Noise Measurements

The only on site activity that requires mitigation will be mechanical plant noise. As plant has not been selected a performance specification at the receivers has been provided and plant noise should comply with this specification. At this stage we cannot make recommendation until specific plant is selected, and the actual noise levels provided.

4.4 Offsite Activity Noise Measurements

As the site is so dominated by road traffic noise, addressing road traffic noise will also address all other noise sources.

4.4.1 Measured Levels

Table 5 presents the measured noise levels measured at the unattended monitoring location. As this location was further away from Brunswick Street than the current proposal we have added 3 dB to provide more accurate noise levels of the location of these developments.

Table 5: Measured Noise Levels.

Date	Noise Descriptor	Time Period	Measured Level dB(A)	Including modifying (3 dB)
27 October, 2011	LA10,18Hour	6am to midnight	57	60
	Noisiest day-time LEq,1Hour	8pm to 9pm	58	61
	Noisiest night-time LEq,1Hour	11pm to Midnight	59	62
	LEq,24Hour	Midnight to midnight	55	58

Graphical presentation of the measured road traffic noise levels are presented in Figure 3.

4.5 Attended Measurements

Attended measurements were conducted over a series of days at the location shown in

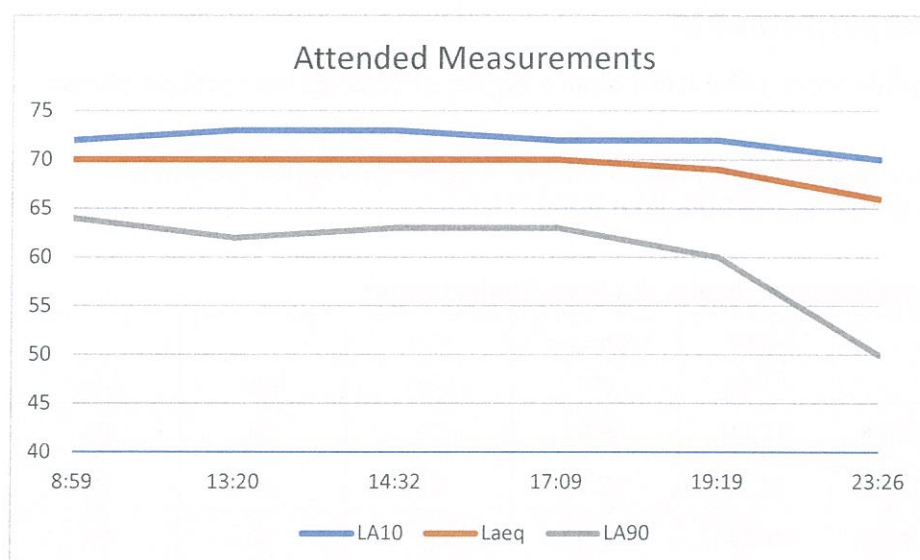
Figure 2. Results are as per Table 6 and Table 7. As per convention we have rounded the results to the nearest decimal point.

Table 6: Attended measurement results in chronological order

File reference	Date	Start Time	Duration (m)	LA10	Laeq	LA90
003	24/07/2014	17:09	15:01	72	70	63
006	28/07/2014	14:32	15:18	73	70	63
009	29/07/2014	8:59	15:02	72	70	64
012	29/07/2014	13:20	15:02	73	70	62
015	30/07/2014	19:19	15:02	72	69	60
018	31/07/2014	23:26	15:02	70	66	50

Table 7: Attended measurement results by time of day

File reference	Date	Start Time	Duration (m)	L _{A10}	L _{aeq}	L _{A90}
009	29/07/2014	8:59	15:02	72	70	64
012	29/07/2014	13:20	15:02	73	70	62
006	28/07/2014	14:32	15:18	73	70	63
003	24/07/2014	17:09	15:01	72	70	63
015	30/07/2014	19:19	15:02	72	69	60
018	31/07/2014	23:26	15:02	70	66	50

Figure 3: Graphed results of attended measurements


The difference of the L₁₀ to L_{eq} being equal to two - three decibels shows that the noise environment is dominated by road traffic noise. This is quite typical of a busy road.

5 ANALYSIS AND RESULTS

5.1 Road Traffic Noise

5.1.1 Traffic Volumes

2011 traffic volumes and percentage of heavy vehicles for the surrounding road network were obtained from TTM Data Division. Predicted 2026 traffic volumes are presented in Table 6 and are based on a growth rate as advised by TTM Traffic.

Table 8: Road Traffic Volumes for the Surrounding Road Network.

Description (Location):	Traffic Volume (AADT)		Heavy Vehicles (% AADT)
	2011	2026	
Water Street	900	3,070	4.40
Brunswick Street	28,390	35,300	2.70

The CoRTN methodology requires the input of 18 hour traffic volumes and is approximated as 95% of the Average Annual Daily Traffic.

5.1.2 Predicted Road Traffic Noise Levels

Road traffic noise predictions were conducted using the formula:

$$\text{Total Increase} = 10 \times \log (N2/N1)$$

where N2 is the forecast vehicles, and N1 is the current number of vehicles.

The result is added to current noise levels to forecast the increased noise levels. This method must use the same parameters to calculate N1 and N2 such as the 18 hour traffic volumes.

The calculations give a 7 dB increase in noise. This should represent the design intent as below.

Table 9: Predicted Road Traffic Noise Levels.

Date	Road Traffic Noise Descriptor	Time Period	Predicted Level dB(A)
2026	LA10,18Hour	6am to midnight	67
	Noisiest day-time L _{Eq,1Hour}	8pm to 9pm	68
	Noisiest night-time L _{Eq,1Hour}	11pm to Midnight	69
	L _{Eq,24Hour}	Midnight to midnight	64

Predicted road traffic noise impacts at 10 years after the completion of the development were calculated using established formulae and are based on the

1. Layout used for the modelling are based on the architectural plans from Bureau Proberts as stated in section 2;
2. The speed limit on Brunswick Street is 60 km/hour and 50km/hr on Water Street;

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3. The façade correction factor of +2.5dB(A) was considered in the calculations (where applicable).
4. Outputs predicted $L_{Eq,1hour}$ day and night time levels (based on measurement data) to compare with the BCC criteria (refer to Appendix C).

Table 10 presents the modelled noise level at the communal recreation area and includes screening from the development as detailed in Section 6.

Table 10: Predicted Road Traffic Impacts at Communal Recreation Area.

Location:	Predicted SPL (dB(A)) in 2026 (Free field)	
	$L_{A10,18hour}$	$L_{Aeq,24hour}$
Communal Recreation Area (Podium Level)	Less than 52	Less than 48

The communal recreation area is calculated to comply with the BCC assessment criteria due to sufficient separation distance and screening from the development.

Based on floor plans and elevations, glazing and building treatments were determined by using the calculation methods Based on floor plans and elevations, glazing and building treatments were determined using an inside to outside calculation method as published in Smith, Peters and Owen, *Acoustics and Noise Control*, Second Edition, Edinburgh, 1996, p. 155.

$$SPL_{in} = SPL_{out} - R + 10 \log_{10} S - 10 \log_{10} A + K.$$

5.2 Onsite Activity Noise

An assessment of the proposed onsite residential/commercial activities reveals that activities will either be in the enclosed underground carpark area, or off site and were assessed as part of stage one.

5.3 Offsite Activity Noise

There is the potential for offsite activities associated with the nearby commercial premises to impact the residential component of the development. These have essentially been addressed by addressing the noise levels that were measured by noise logging. As noise logging measures all noise regardless of source. So by addressing those noise levels all noise sources are addressed.

Total noise levels have been included in the calculations for façade design, and all noise ingress into the residential components of the proposed development.

6 RECOMMENDATIONS

The recommended acoustic treatments are required to ensure compliance with the relevant BCC and Queensland Transport assessment criteria.

6.1 Road Traffic Noise – Brisbane City Council

Compliance is predicted with the BCC assessment criteria on the condition the following treatments are implemented.

The communal recreation area located on the podium level is predicted to comply due to sufficient separation distance and screening by the development.

6.1.1 Glazing Treatments

Glazing for the development will be rated at R_w 30 except for rooms as specified in **Appendix 1** ~~source not found~~. presents the minimum glazing required based on calculations conducted in accordance with AS3671:1989. Note that the minimum thickness of the glass as specified are not to be reduced regardless of the R_w /STC rating of the glazing system unless the R_w rating can be certified by the glazier. Glazing specified with acoustic seals requires a Q-Lon seal to be installed or an equivalent product. Felt seals are not acceptable.

We have conducted preliminary calculations and provide indicative glazing requirements. These should be verified prior to tender. Mark ups are to be found in Appendix 1.

Performance requirements are for the entire glazing system including the frame.

All glazing is to have acoustic seals.

These are the minimum glazing requirements. If for structural purposes thicker glazing is required, the acoustic performance will be improved.

Acoustic seals will reduce ventilation and the ventilation requirements should be reviewed.

6.1.2 External Wall Treatments

The proposed walls shall be constructed to achieve an R_w 55 and therefore will comply with the minimum rating requirements.

In all rooms, penetrations through the wall shall be acoustically treated so as not to reduce the overall rating of the installed wall system.

6.1.3 Recommended Roof Treatments

The proposed roof shall be constructed using 150mm reinforced concrete which achieves a minimum of R_w 55 and therefore will comply with the minimum rating requirements.

Any penetrations through the ceiling (such as light fittings or duct penetration) shall be acoustically treated to ensure the overall acoustic rating is maintained.

6.1.4 Provision of Alternative Ventilation

To achieve the required internal noise levels of habitable rooms, doors and windows should be closed, hence, all habitable rooms will require the provision of an

alternative ventilation system. The design and installation of the plant should not reduce the overall acoustic performance of the building shell.

6.2 Onsite Activity Noise

This assessment has investigated the 'worst case scenario', by considering potential noise impacts from onsite activities associated with the proposed development to the nearest residential receivers adjacent the site.

It is predicted that communal area activities may exceed the relevant assessment criteria during the night time period. As a result, we recommend that all terrace area activities are restricted to the day and evening periods, between 7:00 am and 10:00 pm only. Based on the modelled levels, all remaining onsite activities are predicted to comply with the day, evening and sleep disturbance criteria.

6.3 Offsite Activity Noise

Recommendations to attenuate off-site activity noise have been included in the glazing treatments.

6.4 Transient Activity Noise

Based on the measured levels, all offsite activities with the exception of waste collection and goods deliveries, are predicted to comply with the day, evening and sleep disturbance criteria.

Waste collection activities are predicted to exceed the sleep disturbance criteria at the nearest onsite residential receivers. Noise impacts associated with these activities are unlikely to be a cause of annoyance, given that they are generally an infrequent occurrence (i.e. once or twice per week) and are of short duration.

In addition goods deliveries are predicted to exceed the sleep disturbance criteria at the nearest residential component of the development. Goods deliveries are likely to occur during daytime hours and are not expected to impact the night time period.

6.5 Continuous (Plant) Noise

Because detailed plant selections are not available at this stage, it is not possible to carry out a detailed examination of the ameliorative measures that may be required to achieve the noise targets. Plant will be acoustically treated to achieve the criteria as previously detailed to prevent noise emissions from adversely impacting the surrounding properties. This may include selecting the quietest plant possible, or treating the plant equipment with enclosures, barriers, duct lining and silencers, etc if required to comply with the assessment criteria.

Experience with similar projects indicates that it would be possible to achieve the Council requirement with appropriate treatment of the plant. This treatment would be determined at the Building Approval/Construction Certificate stage.

A mechanical plant noise assessment should be conducted by a suitably qualified acoustic person once plant selections are finalised; and compliance tests conducted after the equipment is installed to ensure compliance with the criteria. Such measures should also be conditioned in the Development Approval.

7 Appendix 1 Markups of Glazing Requirements

Figure 4: Glazing requirements for Podium 3 Level and Level 1 Recreation



Figure 5: Glazing requirements Levels 2 to 5



Figure 6: Glazing requirements Stage 4 Level 5 to 8, Stage 5 Levels 5 to 6



Figure 7: Glazing requirements Stage 5 Levels 7 and 8



Figure 8: Glazing requirements Stage 4 Level 9 to 16, Stage 5 Levels 9 to 16



