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Proposed Mixed Use Development
37 Mayne Road, Bowen Hills

Environmental Noise Assessment Report

Arden Group Holdings Pty Ltd

Reference: 14BRA0058 R01_A
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ABN 65 010 868 621

Level 1/129 Logan Road, Woolloongabba
PO Box 1310 Coorparoo BC QLD 4151
T: (07) 3327 9500 **F**: (07) 3327 9501 **E**: ttmbris@ttmgroup.com.au

Rev No.	Author	Reviewed/Approved		Description	Date
		Name	Signature		
B	E O'Callaghan	J Fox		Draft Report	14/03/2014
0	E O'Callaghan			Client Issue	14/03/2014

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1. Introduction

1.1. Background

soundmatters have been engaged by Arden Group Holdings Pty Ltd to undertake a revised environmental noise assessment of a proposed mixed use development located at 37 Mayne Road, Bowen Hills. This report will form part of the development application for consideration by Economic Development Queensland (EDQ).

The assessment is based on and considers the following:

a. Noise criteria outlined in the Brisbane City Council's (BCC) City Plan 2000 *Noise Impact Assessment Planning Scheme Policy* (NIAPSP);

b. *Queensland Development Code Mandatory Part 4.4* (August, 2010) (QDC);

c. Development plans by *Arqus Design* 20th February, 2014 (samples shown in Appendix A);

d. Site inspection, noise measurements, analysis and calculations conducted by TTM.

1.2. Scope

The assessment includes the following:

i. Description of the site;

ii. Statement of assessment criteria relating to road traffic noise, environmental on-site and off-site noise emissions;

iii. Utilising existing road traffic and ambient noise levels from previous assessment (27242 R03);

iv. Prediction of future road traffic noise levels at the development;

v. Prediction of noise produced by the development onto nearby sensitive receivers;

vi. Prediction of noise associated with surrounding commercial premises onto noise sensitive areas of the development;

vii. Analysis of predicted noise levels;

viii. Details of recommendations to be incorporated to achieve predicted compliance.

2. Site Description

2.1. Site Location

The site is described by the following:

- *Lot 1 RP110079*
- *37 Mayne Road, Bowen Hills*

The site locality is shown in Figure 1.

Figure 1: Site Locality

2.2. Current Conditions Surrounding the Site

A comprehensive site survey was conducted on the 16th of July, 2010. The survey identified the following:

- Located west across Mayne Road is "The Courier Mail, Sunday Mail and The Australian" newspaper printing building separating the development from the Exhibition railway line (and depot), the "Clem7" tunnel and Inner City Bypass.
- A proposed 30 storey commercial/residential building is located adjacent the southern boundary separating the site from Campbell Street and a mixture of single and two storey commercial premises.
- A car park is located adjacent the eastern boundary separating the site from commercial premises and the Bowen Hills railway station (a passenger train line only).
- Located adjacent the northern boundary is light industry (warehousing) premises including a bathroom supply shop, "Cyclone Shower Screens" and furniture wholesalers.

2.3. Current Acoustic Environment

The site is primarily affected by road traffic noise associated with the surrounding road network and the railway lines to the east and west. Commercial office and retail/light industry (warehousing) premises in all directions may also affect the acoustic amenity. Activities associated with these premises are addressed in this assessment with results presented in Section 10.

A night time survey was conducted on the 18th of May, 2010 between 11pm and 11:30pm to determine the potential noise impacts from offsite mechanical plant. During the survey, mechanical plant associated with the commercial buildings in all directions was inaudible at the site and were not considered in this assessment.

The site may also experience aircraft noise associated with the Brisbane Airport (BAC). The BAC has advised that a 70 decibel noise event is considered to be the level at which aircraft noise has the potential to become intrusive and disruptive. The report has considered aircraft noise impacts at this level given the likelihood of an increased number of N70 events when the additional runway is opened.

3. The Proposed Development

3.1. Development Profile

The proposal is to develop a 28 storey residential building with commercial tenancies on the ground floor. The proposal includes the following:

Floor Levels	Uses
Basement	• Bicycle storage (305 spaces); • 29 parking spaces
Ground	• 5 retail tenancies totalling 443m^2; • Vehicle parking entry and lobby
Levels 1 – 4	• 142 vehicle parking spaces; • 12 residential apartments
Level 5	• Communal recreation area including a pool; • A gymnasium; • 10 residential apartments
Levels 6 – 27	• 212 residential apartments

A sample of the development plans is shown in Appendix A.

3.2. Hours of Operation

This assessment has assumed operating times of 24hours, 7days. Recommendations shall provide time restrictions on activities that may require it.

3.3. Access

The development plan proposes access to car parking and commercial vehicles from Edgar Street.

4. Noise Sensitive Receivers and Off-Site Premises

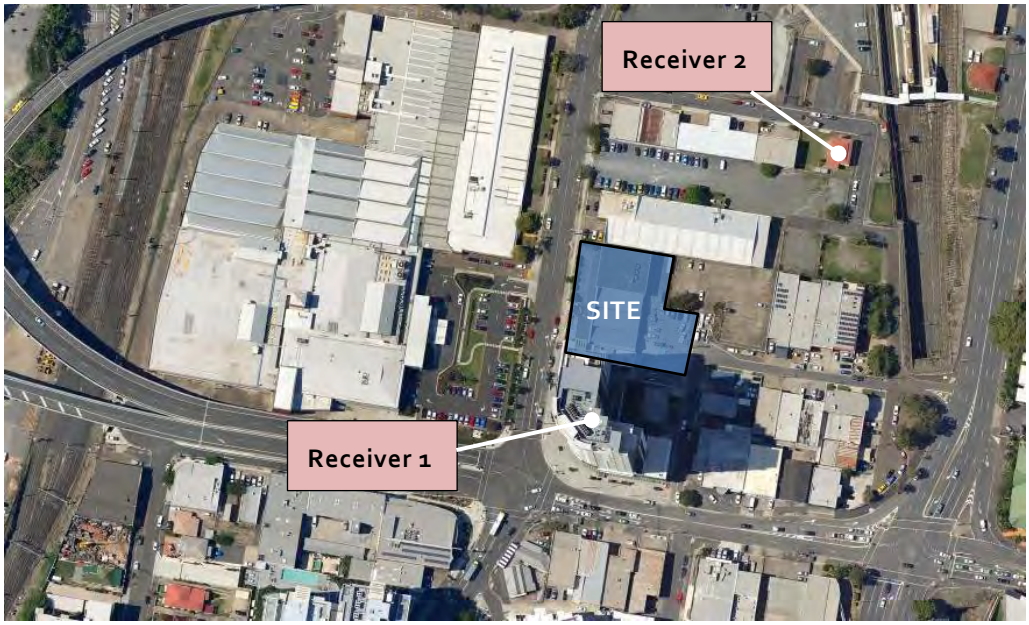
4.1. Residential Receivers

The area surrounding the site comprises a mixture of uses including light industrial, commercial, office/retail premises and residential land uses. This assessment will focus on the nearest residential receivers described as follows:

- **Receiver 1:** Madison Heights (levels 3 – 30 are residential);
- **Receiver 2:** Single storey highset dwelling located in Hudd Street.

The receiver locations are shown in Figure 2.

Figure 2: Noise Sensitive Receivers (source: Nearmap)



If compliance can be achieved at residential receivers 1 to 2, then all remaining noise sensitive locations are predicted to comply.

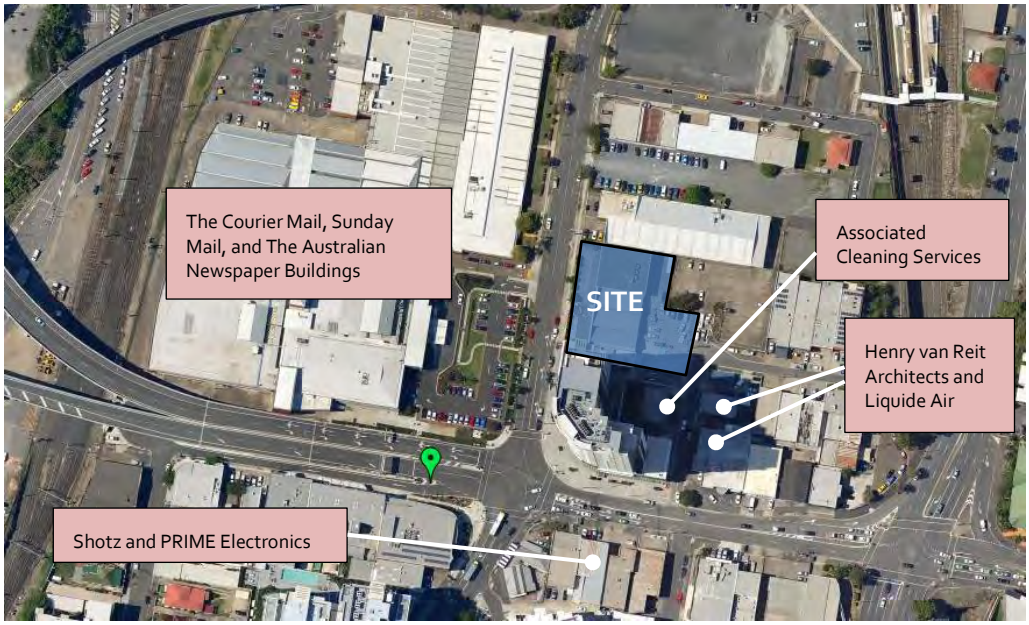
4.2. Off-Site Activities

Consideration has been given to the potential off-site activities associated with the nearby commercial, office/retail, and light industrial warehouse premises (refer to Figure 3). The off-site premises with the potential to impact the amenity of the site include:

- Associated Cleaning Services; operating hours range from 7am to 6pm Monday to Sunday;
- The Courier Mail, Sunday Mail and The Australian Newspaper; operating hours are 24 hours 7 days;
- Shotz and PRIME Electronics; operating hours range from 8am to 5pm Monday to Saturday.

Refer to Figure 3 for the location of the nearest commercial premises.

Figure 3: Nearest Off-Site Commercial Premises (Source: Nearmap)



An assessment of the off-site activities which have the potential to impact the site was conducted with the results of the analysis presented in Section 10.

5. Equipment

All equipment is calibrated by a NATA accredited laboratory. Certification is held and available on request. Calibration was checked before and after the monitoring sessions with no significant drift from the reference signal.

5.1. Unattended Noise Monitoring Equipment

The following equipment was used to measure traffic and ambient noise levels:

- Three ARL EL316 Environmental Noise Monitors (SN# 16-707-016, 16-707-040, and 16-207-011); and
- BSWA Technology Co. Ltd CA106 Acoustical Calibrator (SN# 44095).

5.2. Attended Noise Measurement Equipment

The following equipment was used to conduct train passby measurements noise levels:

- RION NA-28 Sound Level Meter (SLM) (SN#01060055); and
- RION NA-74 Sound Level Calibrator (SN# 35073393).

6. Measurements

6.1. Unattended Road Traffic and Ambient Noise Monitoring

ARL EL316 environmental noise monitors were placed at the following locations to measure road traffic and ambient noise levels:

- In the front yard of 16 Hamilton Place in a free field position 4.5 metres from the road;
- On the corner of 1 Abbotsford Road within 2 metres of a façade 7.5 metres from the road;
- Adjacent the Inner City Bypass (northern end of Mayne Road) in a free field position 7 metres from the nearest lane of the ICB.

Noise measurement locations are shown in Figure 4 over the page.

The monitors were set to measure road traffic and ambient noise from the 8th to the 16th of June and 16th to the 27th of July, 2010 as follows:

- "A" weighting;
- "Fast" response; and
- 15 minute statistical interval.

The statistical interval was chosen to allow application of *AS/NZS 2107:2000 Acoustics – Recommended Design Sound Level and Reverberation Times for Building Interiors*. Road traffic noise monitoring was conducted generally in accordance with *AS2702:1984 Acoustics - Methods for the measurement of road traffic noise*.

Rainfall was recorded on the 20th and 26th of July, 2010. The data collected on these days was omitted from the analysis. Weather conditions for the remaining days were generally fine with light wind speeds.

6.2. Onsite/Offsite Activity Noise Measurements

Noise levels associated with typical commercial activities were taken from similar investigations by soundmatters. All measurements were conducted in accordance with AS1055.

Figure 4: Noise Monitoring Locations (Source: Nearmap)

6.3. Attended Rail Noise Measurements

Attended noise measurements of train passes were conducted on the 18th of May and the 24th of November, 2010. The SLM was positioned in the vicinity of the site to measure train noise levels with direct line of sight to the line. The SLM was positioned at the following locations:

- Approximately 7 metres from the nearest Exhibition railway line and 1.2metres above ground level;
- Approximately 3 metres from the nearest Bowen Hills railway line and 10 metres above the track level.

Noise measurements were conducted using A-weighting, Fast response, and 1-5 minute statistical intervals. Statistics recorded included L_{Amax}, SEL (LAE), and L_{Aeq}.

Note: the SEL or LAE is the sound exposure level. A parameter closely related to L_{Aeq} for assessment of train events that have similar characteristics but are of different duration. The LAE value contains the same amount of acoustic energy over a 'normalised' one second period as the actual noise event under consideration. Based on the measured LAE level, calculations are conducted utilising the number of trains per day to determine the $L_{Aeq,24hr}$ noise impact at proposed residential receivers.

The measurements were conducted generally in accordance with Australian Standard *AS2377:2002 Acoustics – Methods for the Measurement of Railbound Vehicle Noise*.

6.4. Results of Measurements

6.4.1. Measured Road Traffic Noise Levels

Table 1 presents the measured road traffic noise levels at the unattended noise monitoring locations.

Table 1: Measured Road Traffic Noise Levels

Location & Date	Road Traffic Noise Descriptor	Time Period	Measured Level dB(A)
Hamilton Place, - June 2010	$L_{A10,18hr}$	6am to midnight	73
	Noisiest day-time $L_{Aeq,1\ hour}$		73
	Noisiest night-time $L_{Aeq,1\ hour}$		69
	$L_{Aeq,24\ hour}$	Midnight to midnight	70
Inner City Bypass – July 2010	$L_{A10,18hr}$	6am to midnight	76
	Noisiest day-time $L_{Aeq,1\ hour}$		75
	Noisiest night-time $L_{Aeq,1\ hour}$		73
	$L_{Aeq,24\ hour}$	Midnight to midnight	73
Abbotsford Road – July 2010	$L_{A10,18hr}$	6am to midnight	72
	Noisiest day-time $L_{Aeq,1\ hour}$		72
	Noisiest night-time $L_{Aeq,1\ hour}$		67
	$L_{Aeq,24\ hour}$	Midnight to midnight	69

The decimal place is detailed to show the rounding corrections used throughout the analysis.

6.4.2. Measured Ambient Noise Levels

Table 2 presents a summary of the measured ambient noise levels relevant to the development. The measurements are based on the unattended noise monitoring data shown graphically in Appendix B and are the arithmetic average of all non-weather affected periods.

Table 2: Measured Ambient Noise Levels

Time Period	Measured Noise Levels, dB(A)	
	L_{A10}	L_{A90}
Daytime (7am – 6pm)	72	61
Evening (6pm – 10pm)	69	57
Night time (10pm – 7am)	66	47

The data presented above was used to determine the assessment criteria for the development.

6.4.3. Measured Rail Noise Levels

Table 3 and Table 4 present the results of trains measured on the 18th of May and the 24th of November 2010.

Table 3: Measured Rail Noise Levels from Passing Trains on the Exhibition Railway Line

Location/ Date	Train Type	Separation Distance (m)	Instantaneous Noise Level SEL dB(A)	Maximum Noise Level L_{Amax} dB(A)	Horn/ Warning Device
Exhibition Railway Line – 18th May 2010	Passenger	7	83	71	No
	Freight	7	108	97	No
	Passenger	19	81	75	No
	Passenger	7	103	95	No
	Passenger	19	83	76	No
	Passenger	19	78	70	No
	Passenger	19	90	81	No
	Passenger	7	98	92	No
	Passenger	19	84	77	No
	Passenger	19	83	73	No

Table 4: Measured Rail Noise Levels from Passing Trains on the Bowen Hills Railway Line

Location/ Date	Train Type	Separation Distance (m)	Instantaneous Noise Level SEL dB(A)	Maximum Noise Level L_{Amax} dB(A)	Horn/ Warning Device
Bowen Hills Railway Line – 24th November 2010	Passenger	17	96	94	No
	Passenger	8	97	95	No
	Passenger	8	92	86	No
	Passenger	3	90	88	No
	Passenger	8	95	92	No
	Passenger	12	84	84	No
	Passenger	17	91	85	No
	Passenger	17	84	74	No
	Passenger	12	88	85	No
	Passenger	17	93	90	No
	Passenger	3	93	88	No
	Passenger	17	84	76	No
	Passenger	12	82	74	No
	Passenger	3	81	73	No
	Passenger	8	94	90	No

7. Noise Criteria

As Economic Development Queensland (EDQ) does not have specific noise criteria assessment procedures, we are recommending the application of the Brisbane City Council criteria. The criteria applied to the site is divided into sections (5.1 – 5.4) and details the relevant assessment methods for road traffic, onsite/offsite activities, mechanical plant and rail noise.

7.1. Road Traffic Noise

7.1.1. NIAPSP

The road traffic noise criteria applied to the proposed development is pursuant to the *NIAPSP*. The assessment methodology requires that road traffic noise is investigated for the 10 year planning horizon (2024).

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 *AS2107* and are reproduced in Table 5.

Table 5: Internal Noise Limits for Residential Buildings from AS/NZS 2107:2000

Type of Occupancy / Activity	Recommended Design Sound Level, L_{Aeq} dB(A)
7. RESIDENTIAL BUILDINGS	
Houses and apartments near major roads -	
Living and working areas	35 - 45
Sleeping areas	30 - 40

Since *AS2107* does not offer limits for outdoor recreation areas, the *NIAPSP* states that the L_{eq} averaged over a 24 hour period should not exceed 55 dB(A). The maximum $L_{Aeq\,1\,hour}$ for any hour should not exceed 60 dB(A).

Table 6 outlines the road traffic noise assessment criteria.

Table 6: Road Traffic Noise Assessment Criteria

Description	Noise Level Criteria dB(A)
Communal Recreational Areas	55 dB(A) L_{Aeq} (24 hour)
Private Recreational Areas	55 dB(A) L_{Aeq} (24 hour)
External Façade	60 dB(A) L_{Aeq} (1 hour) (Façade Corrected)
Internal noise limits	As per Table 1

7.2. Queensland Development Code

We note that as of a search conducted on 13/03/2014 the site is not located in a transport noise corridor under the Queensland Development Code MP4.4 *Buildings in a Transport Noise Corridor*. However for the purposes of the DA report, we have utilised Schedule 3 of QDC MP4.4 to identify the locations requiring acoustic treatment and to show that an acceptable solution is achievable with results based upon modelled noise levels. The policy provides a simple and easy to follow explanation of acoustic treatment requirements.

The QDC Noise Categories list the minimum acoustic R_W ratings for each building component to comply with the indoor sound levels as outlined in Australian Standard AS2107. Details regarding the noise categories and acceptable forms of construction can be found within Schedule 1 and 2 of the QDC document. The triggers for each noise category are summarised in Table 7.

Table 7: Noise Category Levels – QDC MP4.4 (Schedule 3)

Noise Category	Level of Transport Noise* $L_{A10,\ 18\ hour}$ for State-Controlled Roads and Designated Local Government Roads	Single event maximum noise* (L_{AMax}) for Railway Land
Category 4	≥ 73 dB(A)	≥ 85
Category 3	68 – 72 dB(A)	80 – 84
Category 2	63 – 67 dB(A)	75 – 79
Category 1	58 – 62 dB(A)	70 – 74
Category 0	≤ 57 dB(A)	≤ 69

*** Measured at 1 metre from the façade of the proposed or existing building.**

The noise categories presented in Table 7 were obtained from QDC and are applied to dwellings located within transport noise corridors.

7.3. On-site/Off-site Activity Noise

Brisbane City Council requires the assessment be conducted in accordance with the *NIAPSP* and detail the location, extent and construction specifications for proposed attenuation measures and include all assumptions and methodologies used.

Noise criteria associated with the proposed commercial activities are pursuant to the *NIAPSP*. In essence, the policy requires the following:

- Assessment of immission[1] and emission[2].

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 *AS2107* – Comparison with a defined set of sound pressure levels, for specified indoor areas occupied by people set out in Table 1 of *AS2107*.
3. Sleep awakenings – Comparison with sleep levels.

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

- L_{10}[3] Vs L_{10} for transient noise sources (i.e. waste collection, car parking and loading dock). *NIAPSP* allows the existing L_{10} level to be exceeded by 3 dB by any proposed activities (taking into account the number of discreet noise events, character of the noise, time of occurrence);
- Application of *AS2107* for control of mechanical plant noise.

Based on these assessment requirements, the criterion detailed in Table 8 applies for residential receivers.

Table 8: Transient Activity Noise Assessment Criteria

Time Period	Criteria (L_{A10} + 3dB(A))
Daytime (7am – 6pm)	75
Evening (6pm – 10pm)	72
Night time (10pm – 7am)	69

1 Immission is the noise received by the development when it is immersed in an ambient sound environment.

2 Emission is the noise emitted by activities within the development.

3 L10 level is the level exceeded for 10% of the measurement time

Sleep Disturbance Criteria

Criteria for sleep disturbance under the *EPP (Noise)* is addressed in the *User's Guide to the EPP*:

> *"In the case of fluctuating noise, the maximum level is correlated to sleep disturbance, rather than the ambient level. For good sleep, maximum noise levels of 45dB(A) to 50dB(A) should not be heard in a bedroom more than 10 to 15 times a night".*
> *"Where noise is continuous, the ambient level during the sleeping period should not exceed 30 – 35dB(A) indoors in a bedroom".*

Assuming a 5 dB(A) reduction through an open window, the effective external noise limit for transient activities becomes 50 dB(A).

Intrusiveness Criteria

Further to the above, we recommend applying a limit of LAmax 45dB(A) inside dwellings for fluctuating noise as the World Health Organisation's Guidelines for Community Noise 1999 states that "speech in relaxed conversation" can be "understood fairly well in background levels of 45dBA". The LAmax level is therefore considered unlikely to interfere with normal speech levels, watching television and other typical household activities.

7.4. Mechanical Plant

In accordance with *NIAPSP*, application of *AS2107* for the control of mechanical plant noise is recommended for within habitable spaces.

In addition, to prevent background creep to the surrounding receivers, we recommend plant (measured as an $L_{Aeq,T}$) is designed to comply with the background noise level representative of the receivers ($L_{A90,T}$).

TTM have performed site specific noise monitoring to determine the criteria for background creep. In accordance with *NIAPSP* to prevent background creep, plant must be designed to not exceed the measured background noise levels presented in Table 9.

Table 9: Mechanical Plant Noise Assessment Criteria

Time Period	Criteria (L_{A90} + 0), dB(A)
Daytime (7am – 6pm)	61
Evening (6pm – 10pm)	57
Night time (10pm – 7am)	47

To comply with AS2107 internal at receivers, we recommend that plant is designed to not exceed 45 dB(A) at the external façade of the nearest receivers.

The above levels are quoted as a measured level, not an individual item of plant component level; hence, all plant proposed must be included in assessment. By designing plant noise to a measured level rather than a component level, the cumulative effect of multiple plant is taken into account.

7.5. Rail Noise

The criteria applied to the site for rail noise is divided into two sections and details the noise limits required for both Brisbane City Council and Transport and Main Roads (TMR).

7.5.1. Brisbane City Council

A criteria for rail noise impacting the site is detailed in Brisbane City Council's "Noise Methodology Guidelines" (June 2002) under City Plan 2000 – "Noise Impact Assessment Planning Scheme Policy". The criterion applicable to the site is detailed as follows:

"D.2.2 Trains

The noise due to trains should not exceed the following:

Design all proposed residential units affected by rail noise to achieve the following criteria:

Residential Dwelling Outdoor Noise:

- *$L_{Aeq,24hour}$ 55 dB(A)*
- *L_{Apmax} (maximum peak noise level of a passby) 80 dB(A)*

Residential Dwelling Indoor Noise:

- *Relaxing and sleeping areas L_{Apmax} 50 dB(A)*
- *Normal Domestic L_{Apmax} 50 dB(A)"*

7.5.2. Transport and Main Roads

The noise criteria for land affected by emissions from transport activities are contained in the Department of Transport and Main Roads *Policy for Development on Land Affected by Environmental Emissions from Transport and Transport Infrastructure, Version 2.* The criteria are reproduced in Table 10.

Table 10: TMR Rail Noise Criteria for New Sensitive Land Uses

Development Type	Location	Environmental Noise Criteria
Accommodation activities / residential care facilities	External (All facades)	≤ 65 dB(A) L_{eq} (24h) façade corrected
		≤ 87 dB(A) (single event maximum sound pressure level) façade corrected
	External (Recreation areas)	≤ 62 dB(A) L_{eq} (24h) free field
		≤ 84 dB(A) (single event maximum sound pressure level) free-field
	Internal (Habitable rooms all times)	≤ 45 dB(A) single event maximum sound pressure level
Offices	Internal	≤ 55 dB(A) single event maximum sound pressure level

8. Analysis - Road Traffic Noise

Section 8 relates to the assessment of road traffic noise impacting the proposed development.

8.1. Measured Road Traffic Noise Levels

The measured road traffic noise levels are presented in Section 6.4.

8.2. Traffic Volumes

The traffic volumes and percentage of heavy vehicles for the surrounding road network were obtained from TTM Data Division, Veitch Lister Consulting and *Airport Link Phase 2 – Detailed Feasibility Study (October 2006)* prepared by SKM & Connell Wagner.

Due to the high level of development expected for the surrounding area, predicted volumes presented in Table 11 and are based on worst case scenario traffic volumes, as supplied by Veitch Lister Consulting, SKM & Connell Wagner and TTM Consulting.

Table 11: Road Traffic Volumes of Surrounding Road Network

Road	Traffic Volume (AADT)			Heavy Vehicles (% AADT)	Growth Rate (% p.a.)
	2006	2010	2024		
Hamilton Place	7,816	9,757	20,188	16.0	5.7
O'Connell Terrace	11,780	11,922	12,248	5.0	0.3
Campbell Street	-	9,960	32,200	6.4	-
Mayne Road	-	2,765	5,684	5.0	-
Abbotsford Road	-	26,320	38,981	3.9	2.8
Markwell Street	-	15,950	23,623	3.9	2.8
Montpelier Road	-	11,950	37,400	4.5	-
Inner City Bypass	-	52,958	58,807	5.0	-
Clem 7 Bypass	-	-	93,100	5.0	-

The 18 hour traffic volumes were used in the noise model which was approximated as 95% of the Average Annual Daily Traffic.

8.3. Noise Model

8.3.1. Noise Modelling Parameters

Road traffic noise predictions were conducted using 'SoundPLAN' v7.3, a CoRTN based modelling program. The basis of the 'SoundPLAN' model is as follows:

Table 12: Noise Modelling Parameters

Description	Value
Angle Increment	1^{O}
Road surface type	Impervious (+0 dB(A))
Ground contours	Supplied by Brisbane City Council
Speed limit (all roads except Clem 7 & ICB)	60km/h
Speed limit: Clem 7 and ICB	60-80km/h
Noise source height above grade	0.5m
Receiver heights	1.8m above assumed floor level
Finished floor levels	Based on elevation plans
Façade correction	+2.5 dB(A)

8.3.2. Noise Model Verification

To verify the road traffic noise prediction model, the $L_{10\,(18\ hour)}$ noise level at the monitoring position is calculated (using SoundPLAN) and compared to the measured level as presented in Table 13. The noise monitors were located in a free-field position and therefore the predicted level is also shown as free-field.

Table 13: Comparison of Measured and Predicted Road Traffic Noise Levels

Location	Measured $L_{A10,\ 18\ hour}$	Predicted $L_{A10,\ 18\ hour}$	Required Correction
Abbotsford Road	71.5	71.7	0
Inner City Bypass	75.9	76.4	0

The CoRTN methodology allows a maximum deviation of 2 dB(A) from measured levels. The model has predicted slightly higher traffic noise levels than the measured but is within the ±2dB(A) tolerance. Therefore no correction factor is required.

8.4. Predicted Road Traffic Noise Levels

Modelling was conducted to determine road traffic noise levels at the development in the 10 year planning horizon. The predicted noise levels take into account the 2024 traffic volumes and existing screening from currently constructed buildings surrounding the development.

The future road traffic noise contours at the development are presented in the Figures over the page. Noise contours are provided for no barriers at ground floor, and with the inclusion of barriers at ground and first floor. Detailed receiver point modelling results at each lot with the acoustic barriers are available in Appendix C.

The noise levels are based on the assumptions detailed in Section 8.3.1. Screening from surrounding buildings was incorporated into the modelling. The results are presented in Figure 5 to Figure 7.

Figure 5: Predicted Noise Impacts - Level 6

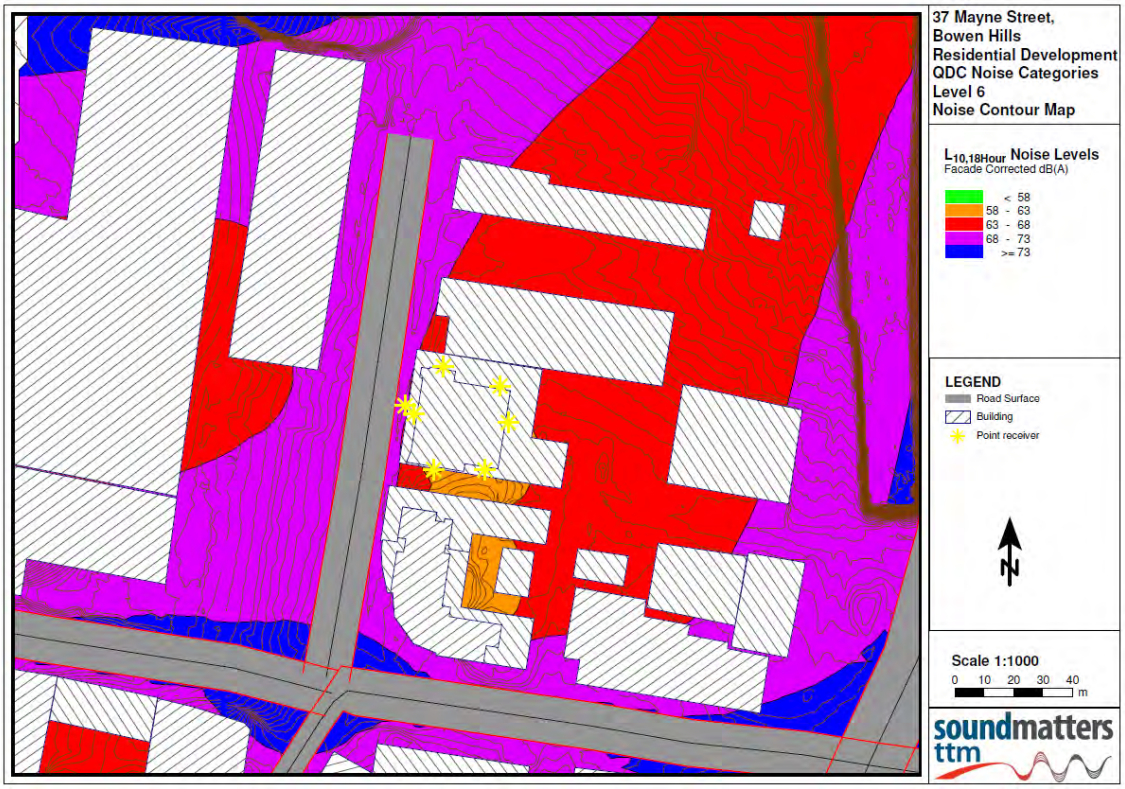


Figure 6: Predicted Noise Impacts - Level 15

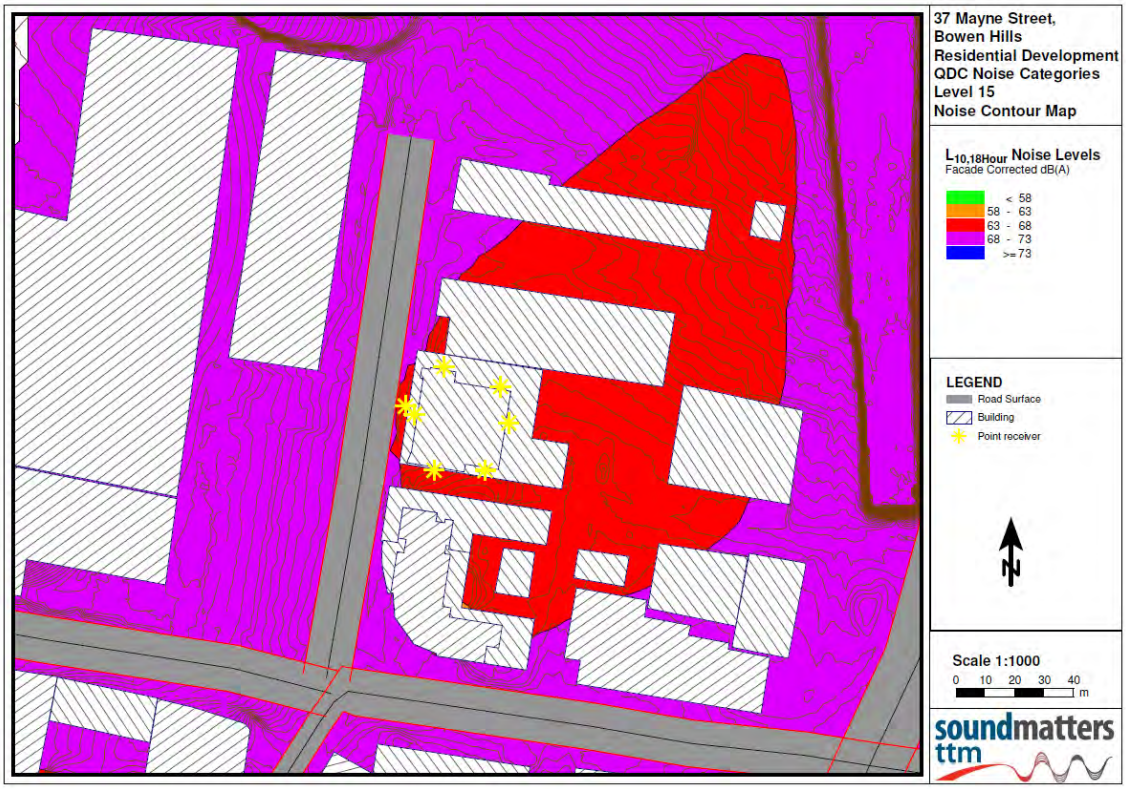


Figure 7: Predicted Noise Impacts - Level 27

The development will require acoustic treatment in order to comply with the requirements of the Queensland Development Code MP4.4 (and BCC criteria) as detailed in Section 12.

9. Analysis - On-site Activity Noise

9.1. Noise Source Levels

Table 14 presents the potential noise sources and respective noise levels in L_{A10} and L_{Amax}. The noise sources used were selected as they represent the likely activities onsite and offsite that have the potential to adversely impact noise sensitive receivers at the site or located in the vicinity of the development.

Table 14: Typical Noise Sources Associated with the Development

Noise Source Description	Measured Noise Level, dB(A) at 1m	
	L_{A10}	L_{Amax}
Car door closure	77*	83*
Single event car bypass @ 5km/h	75	77
Single event car engine ignition	74	75
Conversation	70	75
Alfresco Dining	75	80
Goods delivery	85*	91*
Waste collection	94*	105*

*** Includes 2 dB(A) adjustment to account for impulsiveness characteristics in accordance with AS1055.**

 # Includes 5 dB(A) adjustment to account for tonal noise characteristics in accordance with AS1055.

The following assumptions have been made for noise calculations:

- Car movements predicted from the visitor parking area;
- Car door closures and car starts predicted from the nearest visitor parking area.
- Conversation predicted from the nearest relevant location (i.e. front entrance/communal recreation area);
- Goods deliveries and waste collection predicted from the loading area at ground level.

9.1.1. Predicted Noise Levels at Receivers - NIAPSP

Table 15 present predicted noise levels from the development onto the nearest noise sensitive receivers as identified in Section 4.1. Predicted levels are based upon the noise source levels in Table 14 and consider screening from the building envelope where appropriate.

Table 15: Predicted Noise Levels from Site Activities to Receivers - NIAPSP

Receiver	Noise Source	Predicted Noise Level L_{A10} dB(A)		Complies with Assessment Criteria (Yes/No)		
				Day	Evening	Sleep
		Facade	Internal	75dB(A)	72dB(A)	45dB(A)
1	Car door closure – Level 1	45	40	Yes	Yes	Yes
	Car starting – Level 1	37	32	Yes	Yes	Yes
	Car bypass @ 5 km/h – Level 1	43	38	Yes	Yes	Yes
	Goods Delivery – Ground Level	55	50	Yes	Yes	Yes
	Waste collection – Ground Level	43	38	Yes	Yes	Yes
	Conversation – Level 4 Communal Area	43	38	Yes	Yes	Yes
	Alfresco Dining – Ground Level	57	52	Yes	Yes	+7
2	Car door closure – Level 1	45	40	Yes	Yes	Yes
	Car starting – Level 1	37	32	Yes	Yes	Yes
	Car bypass @ 5 km/h – Level 1	39	34	Yes	Yes	Yes
	Goods Delivery – Ground Level	44	39	Yes	Yes	Yes
	Waste collection – Ground Level	32	27	Yes	Yes	Yes
	Conversation – Level 4 Communal Area	32	27	Yes	Yes	Yes
	Alfresco Dining – Ground Level	27	22	Yes	Yes	Yes

All activities with the exception of alfresco dining at receiver 1 are predicted to comply with the criteria without additional treatments. Management controls are recommended in Section 12 to minimise annoyance.

10. Analysis - Off-site Activity Noise

10.1. Noise Source Levels

There is the potential for activities associated with the offsite commercial premises surrounding the development to impact the residential component of the site. The noise sources associated with offsite commercial activities were based on similar investigations and are presented in Table 16. The noise sources were selected as they represent the likely activities that have the potential to impact the onsite receivers.

Note offsite commercial activities were assessed based on their respective hours of operation as discussed in Section 4.2.

Table 16: Typical Noise Sources Associated with the Off-Site Activities

Noise Source Description	Measured Noise Level, dB(A) at 1m	
	L_{A10}	L_{Amax}
Car door closure	77*	83*
Single event car bypass @ 5km/h	75	77
Single event car engine ignition	74	75
Conversation	70	75
Goods delivery	85*	91*
Waste collection	94*	105*

*** Includes 2 dB(A) adjustment to account for impulsiveness characteristics in accordance with AS1055.**

 # Includes 5 dB(A) adjustment to account for tonal noise characteristics in accordance with AS1055.

The following assumptions have been made for noise calculations:

- Car movements predicted from the visitor parking area;
- Car door closures and car starts predicted from the nearest visitor parking area. Calculations consider screening from the 2.0 metre acoustic barrier detailed in Section 12;
- Conversation predicted from the nearest relevant location (i.e. front entrance/car park entrance on ground floor);
- Goods deliveries and waste collection predicted from the loading area at ground level.

10.2. Predicted Noise Levels at Receivers

Table 17 present predicted noise levels from the commercial premises impacting the nearest residential receivers on site.

Table 17: Predicted Noise Levels from Off-Site Activities to the Site

Noise Source	Predicted Noise Level L_{A10} dB(A)		Complies with Assessment Criteria (Yes/No)		
			Day	Evening	Sleep
	Facade	Internal	75dB(A)	72dB(A)	45dB(A)
Car door closure – ACS*	55	-	Yes	Yes	-
Car door closure – Newspaper	53	43*	Yes	Yes	Yes
Car starting – ACS	47	-	Yes	Yes	-
Car starting – Newspaper	45	40	Yes	Yes	Yes
Car bypass @ 5 km/h – ACS	49	-	Yes	Yes	-
Car bypass @ 5 km/h – Newspaper	47	42	Yes	Yes	Yes
Goods Delivery – ACS	57	-	Yes	Yes	-
Goods Delivery – Newspaper	48	43	Yes	Yes	Yes
Waste collection – ACS	69	-	Yes	Yes	-
Waste collection – Newspaper	60	-	Yes	Yes	-
Conversation – ACS	42	-	Yes	Yes	-

***ACS implies Associated Cleaning Services**

The predicted noise levels presented in Table 14 are based upon the noise source being at the nearest position to the receivers, and assumes direct line of sight to the development.

With the exception of car door closure, all offsite activities are predicted to comply with the criteria based on current operating hours. It is predicted road traffic/rail noise treatments will provide sufficient attenuation to achieve internal compliance, provided windows and doors are closed.

11. Analysis - Rail Noise

11.1. Rail Volumes

Train timetables provided by Queensland Rail indicate the following number of daily trains passing the site:

- Exhibition Railway Line: an average of 28 Freight and 150 passenger trains; and
- Bowen Hills Railway Line: an average of 600 passenger trains.

We were advised by QR that all services are subject to alteration, addition and cancellation which may vary the number of actual trains passing on a daily basis. During a phone conversation with QR, TTM was advised that due to confidentiality QR was unable to provide details of any future plans to duplicate the rail lines or of the ultimate rail traffic volumes.

11.2. Predicted Noise Levels

The predicted maximum noise levels presented in Figure 8 to Figure 10 are based on the following assumptions:

- Ground contours were provided by the Department of Natural Resources and Mines
- Finished floor levels based on plans provided by Arqus Design (refer to Appendix A).
- Façade correction factor was applied.
- The maximum noise level of a train passby was utilised for each respective rail line.
- Existing buildings were incorporated in the model.

Figure 8: Predicted Noise Impacts - Level 6

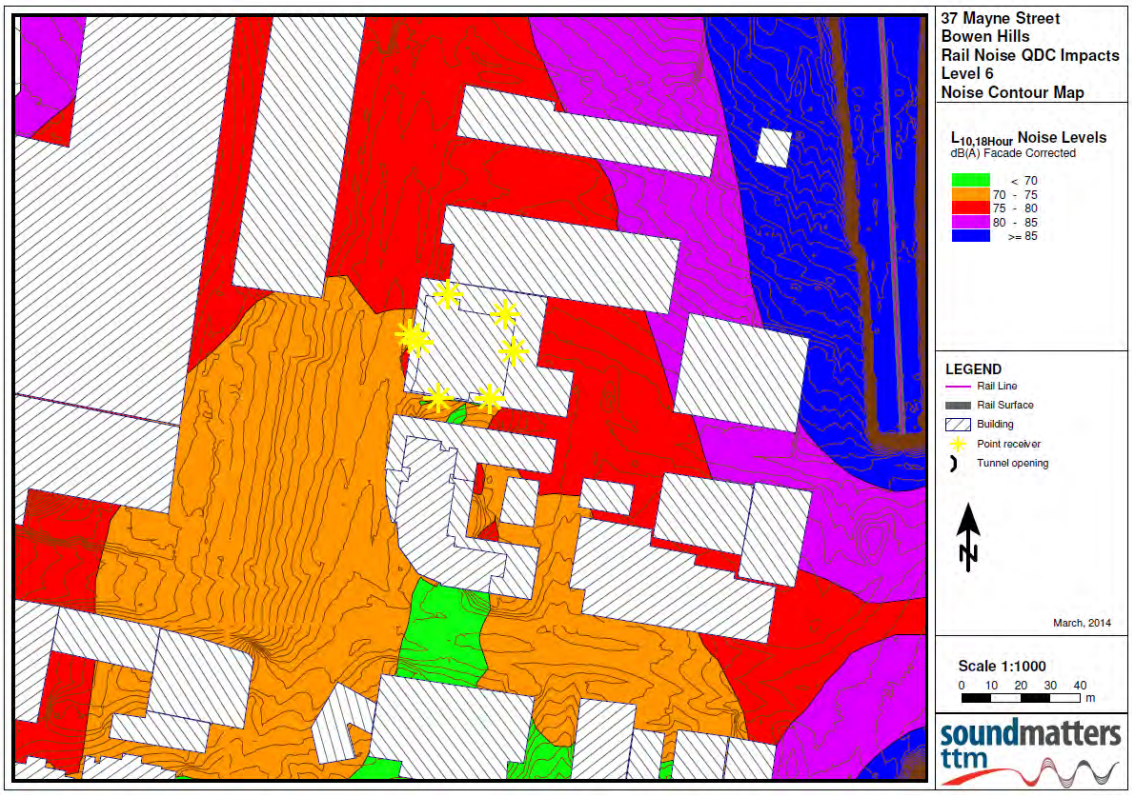


Figure 9: Predicted Noise Impacts - Level 15

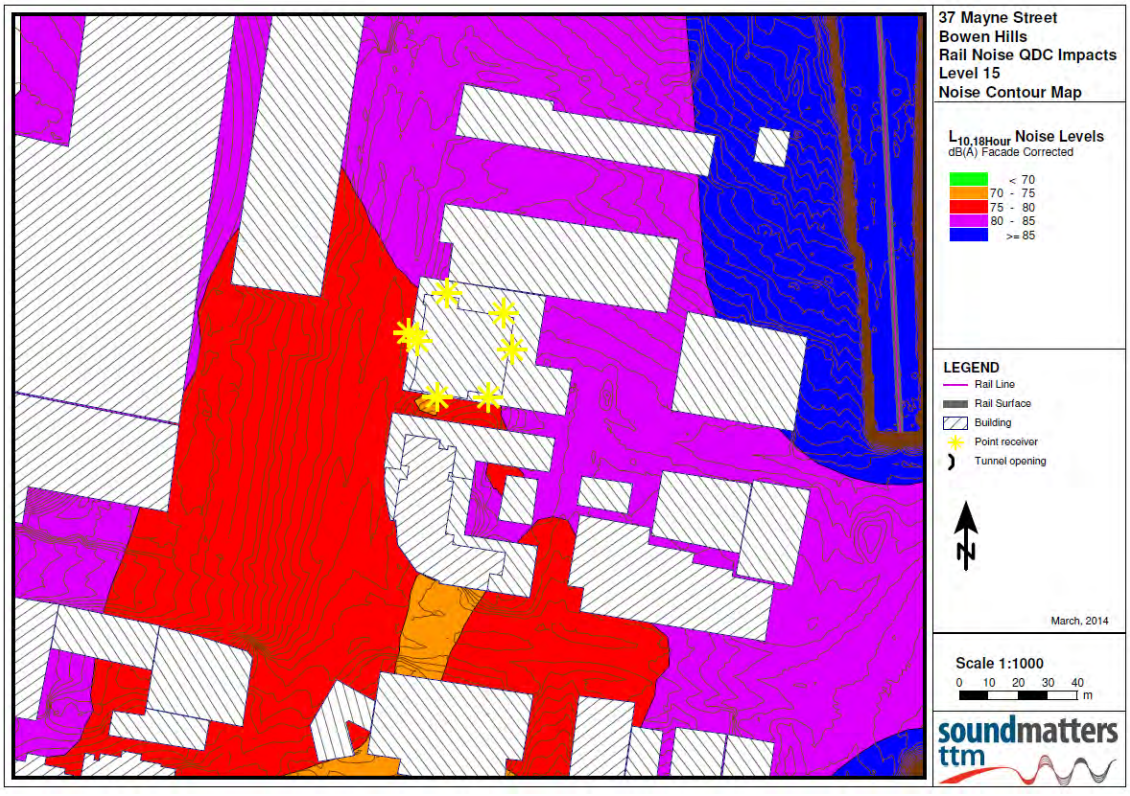


Figure 10: Predicted Noise Impacts - Level 27

The development will require acoustic treatment in order to comply with the requirements of the Queensland Development Code MP4.4 (and BCC criteria) as detailed in Section 12.

12. Recommendations

The recommended acoustic treatments are presented in Sections 12.1 to 12.9, detailing the acoustic requirements for road traffic noise, on-site activities, mechanical plant and off-site activities to ensure compliance with the relevant Brisbane City Council and TMR assessment criteria.

12.1. Road Traffic Noise

Based on a preliminary investigation, road traffic noise levels are predicted to exceed BCC criteria.

It is recommended once building designs are finalised that detailed acoustic assessment is conducted to determine optimal treatment requirements to comply with AS2107:2000. Calculations shall be conducted in accordance with AS3671:1989 by a suitably qualified acoustic consultant.

For the purpose of this application it is recommended the treatments stated in Section 12.3 are applied.

12.2. Rail Noise

The modelling predicts that the development complies with the external criteria, however will exceed the internal noise limits. We recommend that the treatments described within Section **Error! Reference source not found.** are applied.

Once the building application drawings are finalised we recommend a detailed assessment is conducted to optimise glazing treatments and should be conducted by a suitably qualified consultant.

For the purpose of this application it is recommended the treatments stated in Section 12.3 are applied.

12.3. Combined QDC Treatments

For the purposes of the development application, the Queensland Development Code provides a conservative design approach to the treatment of internal rooms within an apartment and is applied for this assessment.

The QDC MP4.4 requires that habitable rooms in residential buildings located in a transport noise corridor are adequately protected from transport noise to safeguard occupant's health and amenity.

In order to achieve the performance requirements of the QDC MP4.4, the external envelope of habitable rooms must comply with the minimum R_W for each building component specified in Schedule 1 to achieve a minimum transport noise reduction level for the relevant noise category by either one of the following:

b. Using materials specified in Schedule 2 of the QDC MP4.4;

OR

c. Using materials with manufacturer's specifications that, in combination, achieve the minimum R_W value for the relevant building component and applicable noise category.

For application of Point (b), possible alternative constructions can be determined by the glazier (for glazing) and construction manuals such as 'The Red Book' by CSR (for walls and roof/ceiling).

Table 18 presents the likely acoustic treatment requirements in accordance with the QDC MP4.4 policy.

Table 18: QDC Noise Treatments

Assessment Location	QDC Noise Category By Façade and Floor			
	North	South	East	West
3	-	-	-	3
4	-	-	-	3
5	2	2	2	2
6	2	2	2	2
7	2	2	2	2
8	2	2	2	2
9	2	2	2	2
10	2	2	2	2
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20	2	2	2	2
21	2	2	2	2
22	2	2	2	2
23	2	2	2	2
24	2	2	2	2
25	2	2	2	2
26	2	2	2	2
27	2	2	2	2

For ease of reference Schedule 1 - 3 of QDC is presented in Appendix E.

Note if building requirements are greater than acoustic requirements then the greater of these requirements should be used.

12.4. On-Site Transient Activity Noise

This assessment has investigated the 'worst case scenario', by considering potential noise impacts from onsite activities at the nearest location to the sensitive receivers and by applying the criteria described in Section 7.

Based on the results of the calculations and to minimise noise annoyance, we recommend the following management controls:

- Waste collection should occur between the hours of 7am - 6pm.
- Deliveries should occur between the hours of 7am - 10pm.
- Any grates or other protective covers in the car parks and access driveways must be rigidly fixed in position to eliminate clanging, and be maintained.
- Speed bumps should be built into the finished surface of the car park and not be made of metal.
- Any grates or other protective covers in the car parks and access driveways must be rigidly fixed in position to eliminate clanging, and be maintained.
- If a restaurant/cafe is proposed for the retail tenancy on Edgar Street it is recommended that patrons are moved inside after 10pm to ensure the criteria can be achieved.

12.5. Off-Site Transient Activity Noise

Based on the noise predictions, all off-site activities with the exception of deliveries and alfresco dining, are predicted to comply at the site without additional noise control.

Building treatments required to attenuate road traffic noise intrusion will exceed the requirements for attenuation of off-site activities.

12.6. Aircraft Noise

The Brisbane Airport Corporation raised queries into the potential for aircraft noise impacts. Analysis was conducted to determine if additional treatment was required for the attenuation of aircraft noise for compliance with *AS2021:2000 – Acoustics – Aircraft Noise Intrusion – Building siting and construction*. Based on the analysis conducted of the development, the treatment requirements for rail and road traffic noise will exceed the building treatment required for aircraft noise. Therefore based on the analysis conducted, compliance is predicted for aircraft noise level of 70dB(A).

12.7. Mechanical 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 should be acoustically treated to achieve the criteria detailed in Section 7.4 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.

A mechanical plant noise assessment should be conducted by a suitably qualified acoustic consultant once plant selections are finalised. Noise criteria compliance measurements should then be conducted after the equipment is installed. Such measures should also be conditioned in the Development Approval.

12.8. Design Considerations for the Gymnasium

Based on previous experience with assessment of gym noise we recommend the following:

1. Non habitable rooms (laundry, bathrooms etc.) should be located adjacent gym walls, not habitable rooms (lounge, bedrooms etc);
2. Impact isolation to the entire floor to attenuate structure borne noise to apartments. Structure borne noise can be caused by dropped weights and impact noise such as aerobics classes which are done to music and in time to the music;
3. Floors should be padded (in addition to the isolation) in areas where weights and aerobics are proposed;
4. Free weights and weight machines shall be located at the furthest distance from residential apartments. Treadmills and exercise bikes may be located nearer to the common residential walls;
5. Speakers (for music and PA) shall not be mounted directly (or by standard bracket) to walls or ceilings. Speakers mounted from a suspended ceiling are satisfactory;
6. A maximum noise level of 75dB(A) when measured at 3metres from a speaker is recommended. Further testing can be conducted to establish a higher noise level if required, such as if an aerobics style class is proposed;
7. The gym will require significant levels of attenuation to achieve criteria if weight machines and/or free weights are included as part of the equipment and requires further detailed design at building approval stage.
8. Based on the potential design requirements, the gym may be able to operate 24hours. Further detailed design is required at building approval stage.

12.9. Further Design Consideration

Further to the recommendations above, consideration is required to the acoustic amenity of residents with respect to the isolation of the pool (level 5), the communal recreation area and any plant on the roof top. This is to ensure the units are adequately treated from structure-borne noise.

The key component is to ensure these activities and components are isolated correctly.

A detailed assessment should be conducted during the detailed design stage to ensure adequate treatments are included in the design.

13. Conclusion

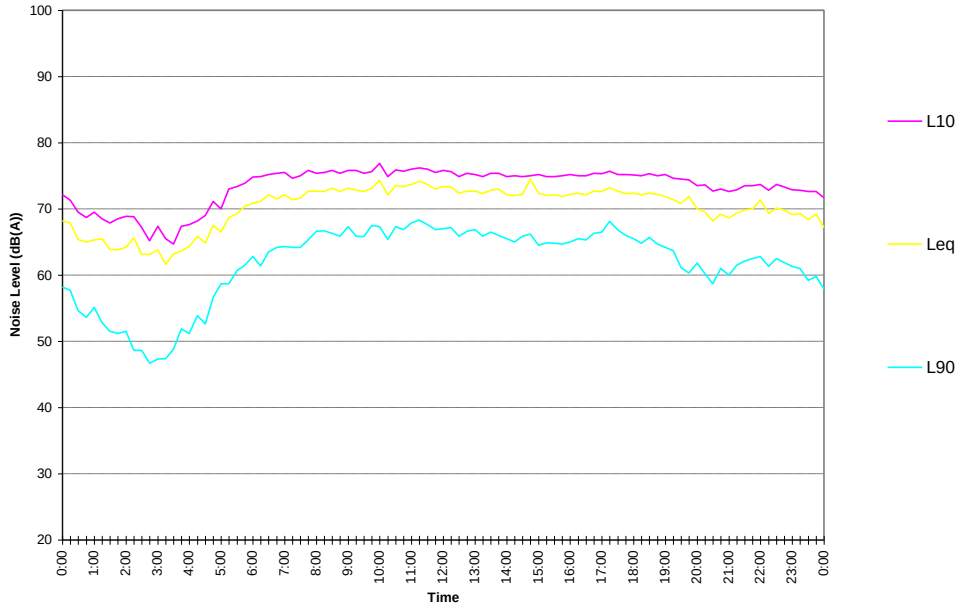
An environmental noise assessment has been conducted for the proposed mixed use development at 37 Mayne Road, Bowen Hills. On the condition the treatment recommendations presented in Section 12 are implemented, the development is predicted to comply with the assessment criteria detailed in Section 7.

Appendix A Development Plans

Appendix B Unattended Noise Monitoring Graphs

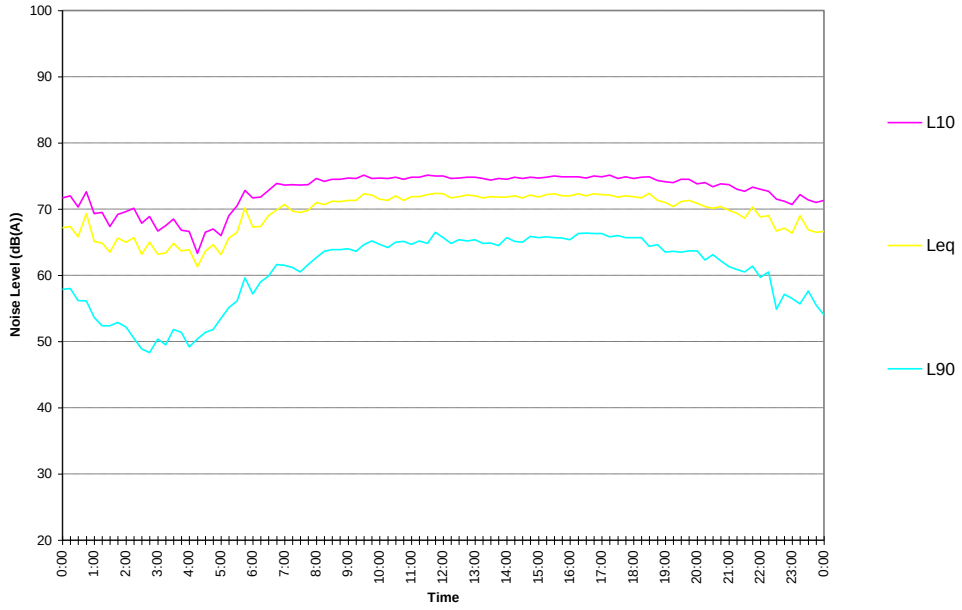
26871_Inner City Bypass

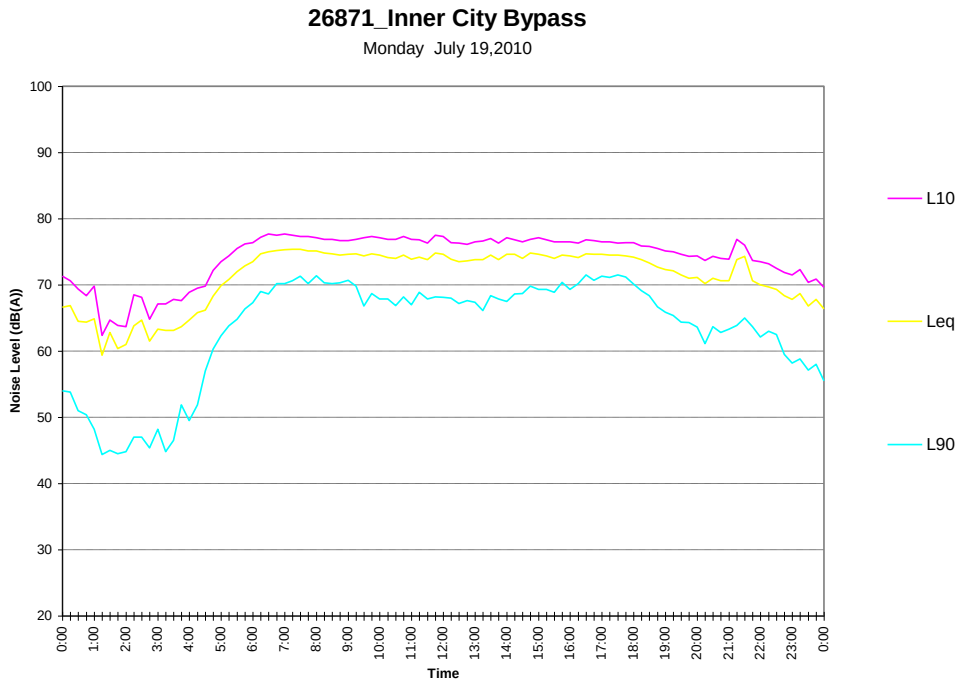
Saturday July 17,2010



26871_Inner City Bypass

Sunday July 18,2010

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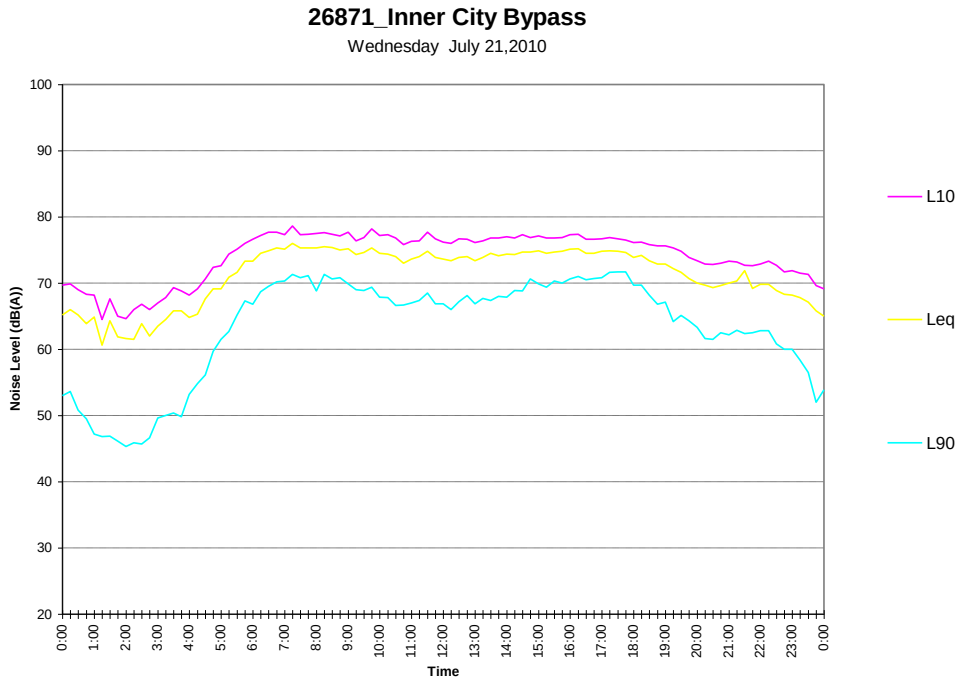
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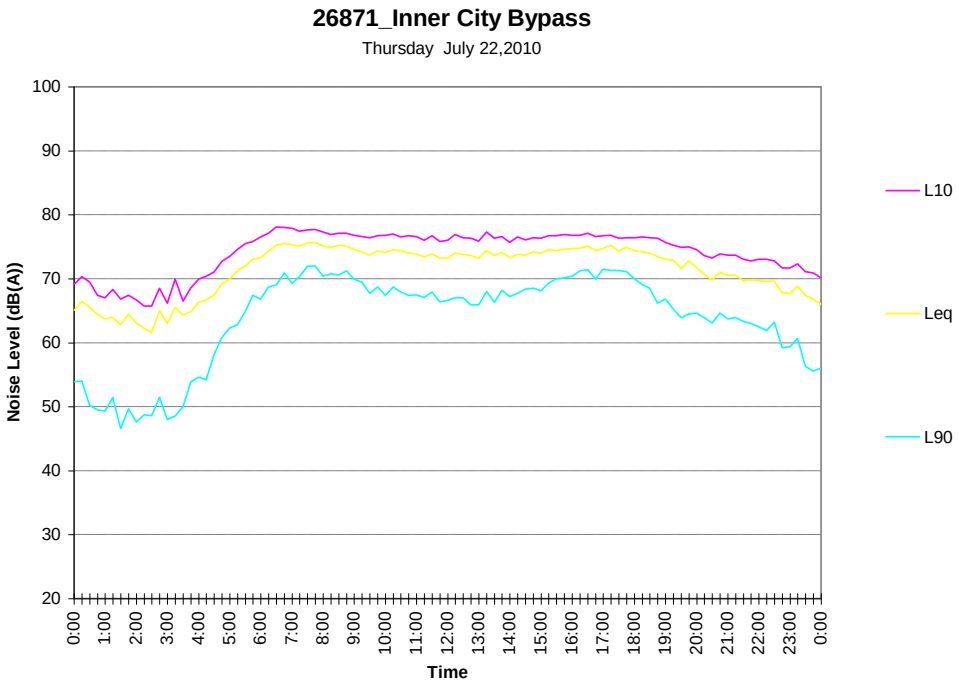
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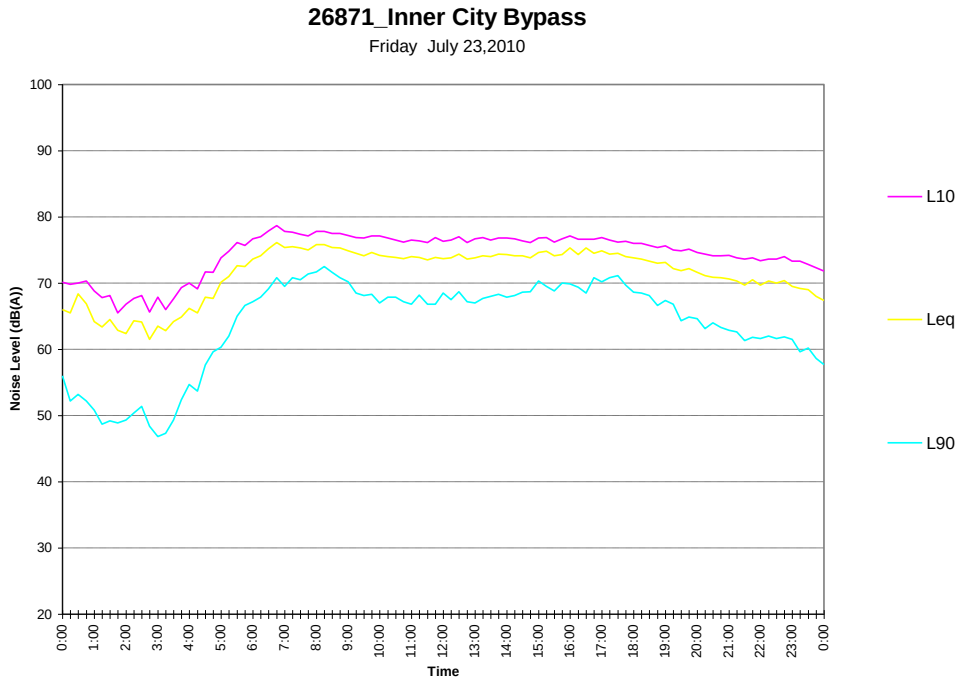
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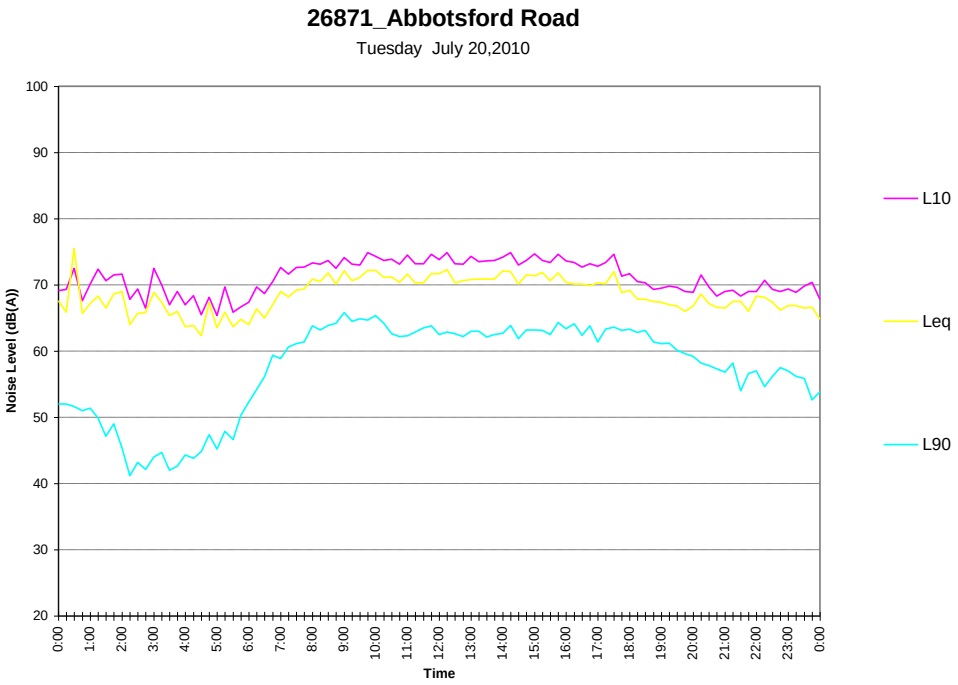
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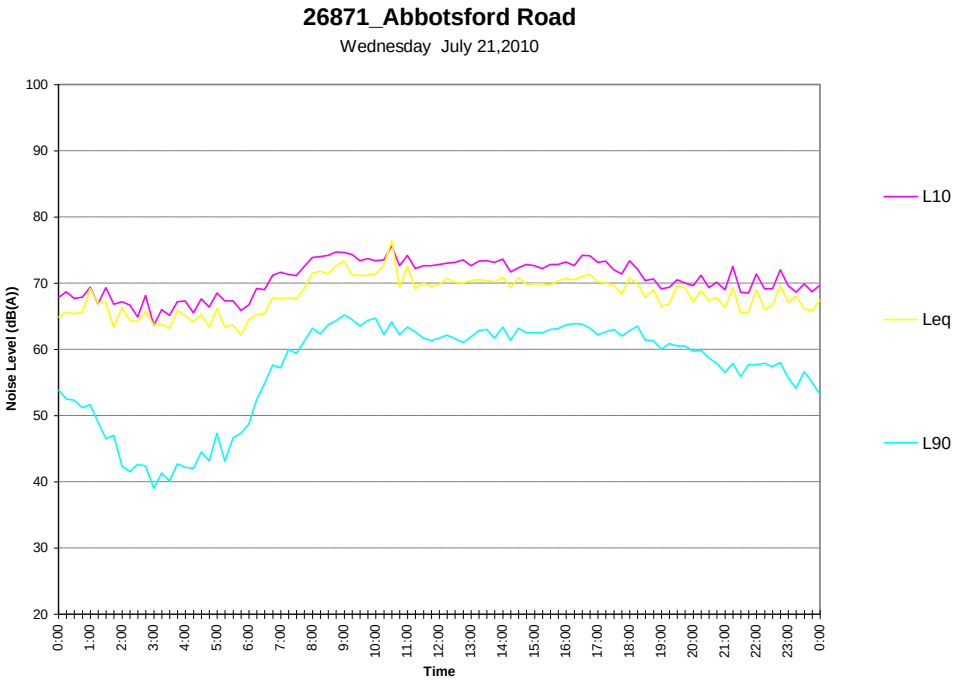
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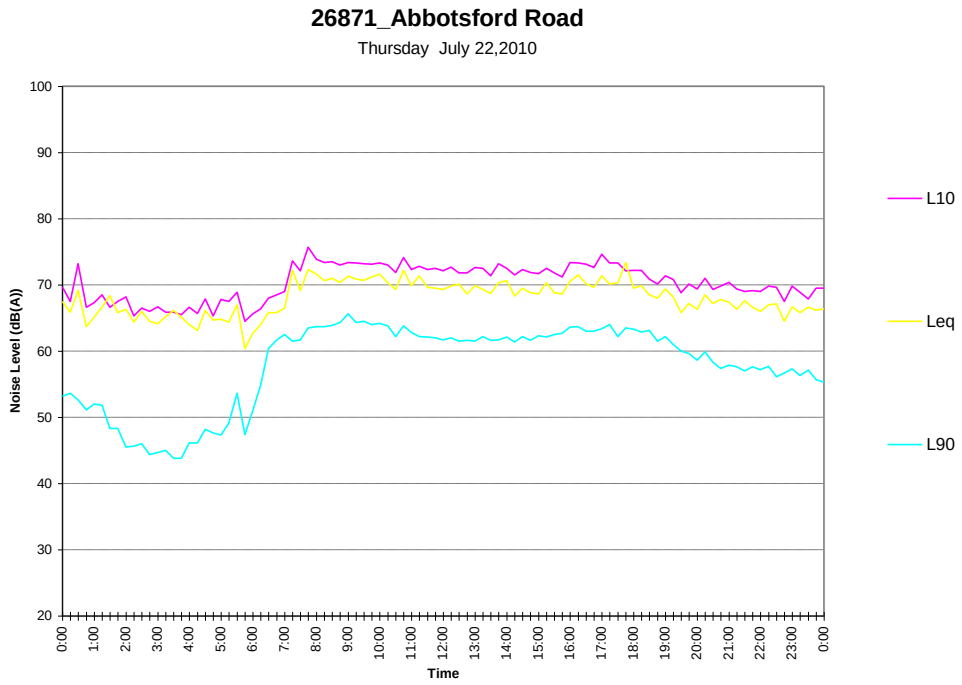
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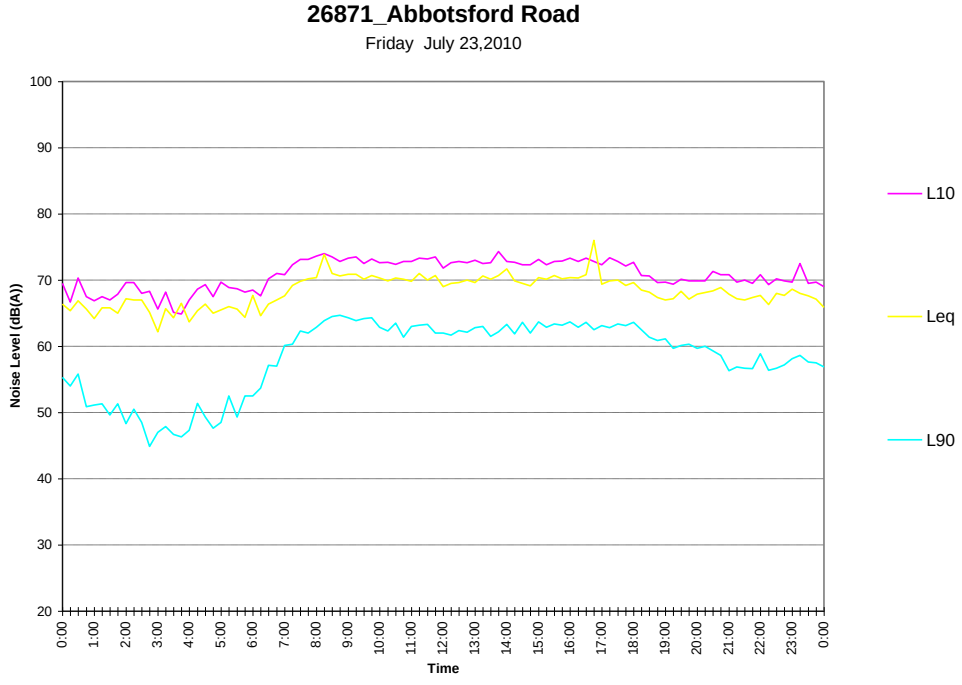
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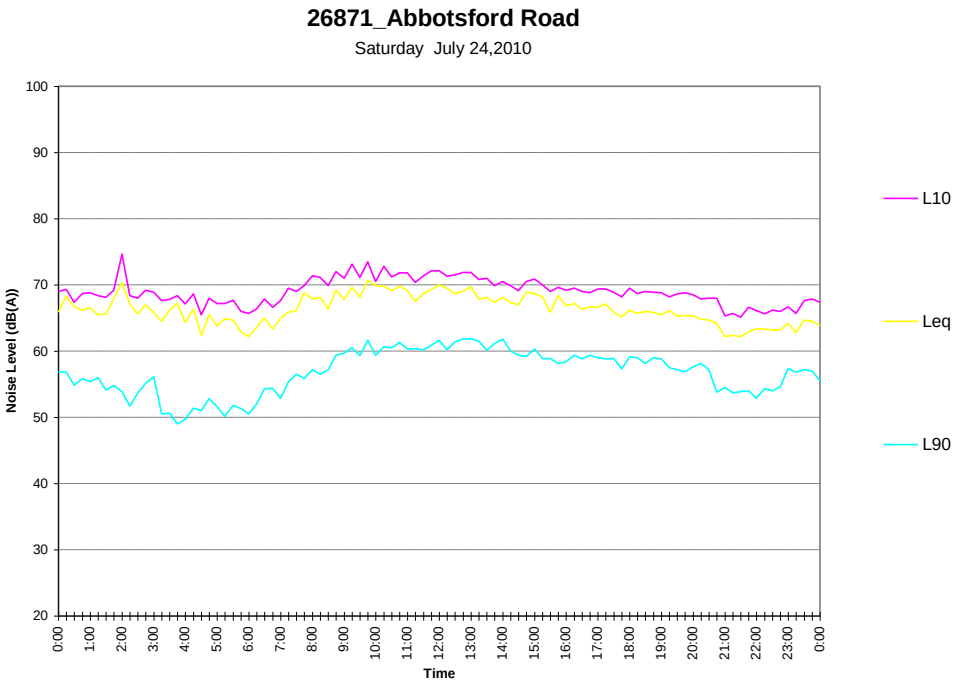
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Appendix C SoundPLAN Modelling Results

Brisbane Model
Road traffic noise assessment -
14BRA0058 Planning Horizon 2024

Location	Floor level	Facade	L10(18h) dB(A)
14BRA0058 Levels G - 4	GF	W	70.0
14BRA0058 Levels G - 4	1.FL	W	71.0
14BRA0058 Levels G - 4	2.FL	W	70.2
14BRA0058 Levels G - 4	3.FL	W	69.5
14BRA0058 Residential Tower	GF	E	58.1
14BRA0058 Residential Tower	1.FL	E	60.6
14BRA0058 Residential Tower	2.FL	E	61.3
14BRA0058 Residential Tower	3.FL	E	61.8
14BRA0058 Residential Tower	4.FL	E	62.3
14BRA0058 Residential Tower	5.FL	E	62.6
14BRA0058 Residential Tower	6.FL	E	62.9
14BRA0058 Residential Tower	7.FL	E	63.1
14BRA0058 Residential Tower	8.FL	E	63.2
14BRA0058 Residential Tower	9.FL	E	63.3
14BRA0058 Residential Tower	10.FL	E	63.4
14BRA0058 Residential Tower	11.FL	E	63.4
14BRA0058 Residential Tower	12.FL	E	63.5
14BRA0058 Residential Tower	13.FL	E	63.5
14BRA0058 Residential Tower	14.FL	E	63.5
14BRA0058 Residential Tower	15.FL	E	63.5
14BRA0058 Residential Tower	16.FL	E	63.5
14BRA0058 Residential Tower	17.FL	E	63.5
14BRA0058 Residential Tower	18.FL	E	63.5
14BRA0058 Residential Tower	19.FL	E	63.5
14BRA0058 Residential Tower	20.FL	E	63.5
14BRA0058 Residential Tower	21.FL	E	63.6
14BRA0058 Residential Tower	22.FL	E	63.6
14BRA0058 Residential Tower	GF	S	55.4
14BRA0058 Residential Tower	1.FL	S	58.2
14BRA0058 Residential Tower	2.FL	S	59.9
14BRA0058 Residential Tower	3.FL	S	60.7
14BRA0058 Residential Tower	4.FL	S	61.1
14BRA0058 Residential Tower	5.FL	S	61.4
14BRA0058 Residential Tower	6.FL	S	61.7
14BRA0058 Residential Tower	7.FL	S	62.0
14BRA0058 Residential Tower	8.FL	S	62.2
14BRA0058 Residential Tower	9.FL	S	62.3
14BRA0058 Residential Tower	10.FL	S	62.4
14BRA0058 Residential Tower	11.FL	S	62.3
14BRA0058 Residential Tower	12.FL	S	62.4
14BRA0058 Residential Tower	13.FL	S	62.5
14BRA0058 Residential Tower	14.FL	S	62.5

Brisbane Model
Road traffic noise assessment -
14BRA0058 Planning Horizon 2024

Location	Floor level	Facade	L10(18h) dB(A)
14BRA0058 Residential Tower	15.FL	S	62.6
14BRA0058 Residential Tower	16.FL	S	62.6
14BRA0058 Residential Tower	17.FL	S	62.7
14BRA0058 Residential Tower	18.FL	S	62.8
14BRA0058 Residential Tower	19.FL	S	62.8
14BRA0058 Residential Tower	20.FL	S	62.9
14BRA0058 Residential Tower	21.FL	S	62.9
14BRA0058 Residential Tower	22.FL	S	62.9
14BRA0058 Residential Tower	GF	S	59.9
14BRA0058 Residential Tower	1.FL	S	61.4
14BRA0058 Residential Tower	2.FL	S	62.4
14BRA0058 Residential Tower	3.FL	S	62.8
14BRA0058 Residential Tower	4.FL	S	63.0
14BRA0058 Residential Tower	5.FL	S	63.1
14BRA0058 Residential Tower	6.FL	S	63.2
14BRA0058 Residential Tower	7.FL	S	63.3
14BRA0058 Residential Tower	8.FL	S	63.4
14BRA0058 Residential Tower	9.FL	S	63.5
14BRA0058 Residential Tower	10.FL	S	63.6
14BRA0058 Residential Tower	11.FL	S	63.7
14BRA0058 Residential Tower	12.FL	S	63.8
14BRA0058 Residential Tower	13.FL	S	63.8
14BRA0058 Residential Tower	14.FL	S	63.9
14BRA0058 Residential Tower	15.FL	S	63.9
14BRA0058 Residential Tower	16.FL	S	64.0
14BRA0058 Residential Tower	17.FL	S	64.0
14BRA0058 Residential Tower	18.FL	S	64.1
14BRA0058 Residential Tower	19.FL	S	64.1
14BRA0058 Residential Tower	20.FL	S	64.1
14BRA0058 Residential Tower	21.FL	S	64.1
14BRA0058 Residential Tower	22.FL	S	64.1
14BRA0058 Residential Tower	GF	W	63.1
14BRA0058 Residential Tower	1.FL	W	65.4
14BRA0058 Residential Tower	2.FL	W	66.7
14BRA0058 Residential Tower	3.FL	W	67.2
14BRA0058 Residential Tower	4.FL	W	67.3
14BRA0058 Residential Tower	5.FL	W	67.4
14BRA0058 Residential Tower	6.FL	W	67.4
14BRA0058 Residential Tower	7.FL	W	67.4
14BRA0058 Residential Tower	8.FL	W	67.3
14BRA0058 Residential Tower	9.FL	W	67.3
14BRA0058 Residential Tower	10.FL	W	67.3

Brisbane Model
Road traffic noise assessment -
14BRA0058 Planning Horizon 2024

Location	Floor level	Facade	L10(18h) dB(A)
14BRA0058 Residential Tower	11.FL	W	67.2
14BRA0058 Residential Tower	12.FL	W	67.2
14BRA0058 Residential Tower	13.FL	W	67.1
14BRA0058 Residential Tower	14.FL	W	67.0
14BRA0058 Residential Tower	15.FL	W	67.0
14BRA0058 Residential Tower	16.FL	W	66.9
14BRA0058 Residential Tower	17.FL	W	66.8
14BRA0058 Residential Tower	18.FL	W	66.8
14BRA0058 Residential Tower	19.FL	W	66.7
14BRA0058 Residential Tower	20.FL	W	66.7
14BRA0058 Residential Tower	21.FL	W	66.6
14BRA0058 Residential Tower	22.FL	W	66.5
14BRA0058 Residential Tower	GF	N	63.3
14BRA0058 Residential Tower	1.FL	N	64.6
14BRA0058 Residential Tower	2.FL	N	65.1
14BRA0058 Residential Tower	3.FL	N	65.5
14BRA0058 Residential Tower	4.FL	N	65.7
14BRA0058 Residential Tower	5.FL	N	65.8
14BRA0058 Residential Tower	6.FL	N	65.9
14BRA0058 Residential Tower	7.FL	N	66.0
14BRA0058 Residential Tower	8.FL	N	66.1
14BRA0058 Residential Tower	9.FL	N	66.1
14BRA0058 Residential Tower	10.FL	N	66.1
14BRA0058 Residential Tower	11.FL	N	66.1
14BRA0058 Residential Tower	12.FL	N	66.1
14BRA0058 Residential Tower	13.FL	N	66.1
14BRA0058 Residential Tower	14.FL	N	66.0
14BRA0058 Residential Tower	15.FL	N	66.0
14BRA0058 Residential Tower	16.FL	N	66.0
14BRA0058 Residential Tower	17.FL	N	65.9
14BRA0058 Residential Tower	18.FL	N	65.9
14BRA0058 Residential Tower	19.FL	N	65.9
14BRA0058 Residential Tower	20.FL	N	65.9
14BRA0058 Residential Tower	21.FL	N	65.8
14BRA0058 Residential Tower	22.FL	N	65.8
14BRA0058 Residential Tower	GF	N	61.5
14BRA0058 Residential Tower	1.FL	N	63.2
14BRA0058 Residential Tower	2.FL	N	63.8
14BRA0058 Residential Tower	3.FL	N	64.2
14BRA0058 Residential Tower	4.FL	N	64.6
14BRA0058 Residential Tower	5.FL	N	64.8
14BRA0058 Residential Tower	6.FL	N	65.0

Brisbane Model
Road traffic noise assessment -
14BRA0058 Planning Horizon 2024

Location	Floor level	Facade	L10(18h) dB(A)
14BRA0058 Residential Tower	7.FL	N	65.1
14BRA0058 Residential Tower	8.FL	N	65.2
14BRA0058 Residential Tower	9.FL	N	65.3
14BRA0058 Residential Tower	10.FL	N	65.3
14BRA0058 Residential Tower	11.FL	N	65.3
14BRA0058 Residential Tower	12.FL	N	65.4
14BRA0058 Residential Tower	13.FL	N	65.3
14BRA0058 Residential Tower	14.FL	N	65.3
14BRA0058 Residential Tower	15.FL	N	65.3
14BRA0058 Residential Tower	16.FL	N	65.3
14BRA0058 Residential Tower	17.FL	N	65.3
14BRA0058 Residential Tower	18.FL	N	65.2
14BRA0058 Residential Tower	19.FL	N	65.2
14BRA0058 Residential Tower	20.FL	N	65.2
14BRA0058 Residential Tower	21.FL	N	65.2
14BRA0058 Residential Tower	22.FL	N	65.2

Brisbane Model
Road traffic noise assessment -
14BRA0058 Planning Horizon RAIL

Location	Floor level	Facade	Lmax Railw dB(A)
14BRA0058 Levels G - 4	GF	W	64.3
14BRA0058 Levels G - 4	1.FL	W	66.1
14BRA0058 Levels G - 4	2.FL	W	67.4
14BRA0058 Levels G - 4	3.FL	W	68.5
14BRA0058 Residential Tower	GF	E	73.5
14BRA0058 Residential Tower	1.FL	E	76.0
14BRA0058 Residential Tower	2.FL	E	76.3
14BRA0058 Residential Tower	3.FL	E	76.4
14BRA0058 Residential Tower	4.FL	E	76.5
14BRA0058 Residential Tower	5.FL	E	76.9
14BRA0058 Residential Tower	6.FL	E	77.2
14BRA0058 Residential Tower	7.FL	E	77.4
14BRA0058 Residential Tower	8.FL	E	77.4
14BRA0058 Residential Tower	9.FL	E	77.5
14BRA0058 Residential Tower	10.FL	E	77.5
14BRA0058 Residential Tower	11.FL	E	77.6
14BRA0058 Residential Tower	12.FL	E	77.7
14BRA0058 Residential Tower	13.FL	E	77.7
14BRA0058 Residential Tower	14.FL	E	77.7
14BRA0058 Residential Tower	15.FL	E	77.7
14BRA0058 Residential Tower	16.FL	E	77.6
14BRA0058 Residential Tower	17.FL	E	77.5
14BRA0058 Residential Tower	18.FL	E	77.4
14BRA0058 Residential Tower	19.FL	E	77.4
14BRA0058 Residential Tower	20.FL	E	77.3
14BRA0058 Residential Tower	21.FL	E	77.2
14BRA0058 Residential Tower	22.FL	E	77.1
14BRA0058 Residential Tower	GF	S	65.2
14BRA0058 Residential Tower	1.FL	S	66.9
14BRA0058 Residential Tower	2.FL	S	67.0
14BRA0058 Residential Tower	3.FL	S	68.5
14BRA0058 Residential Tower	4.FL	S	70.1
14BRA0058 Residential Tower	5.FL	S	70.2
14BRA0058 Residential Tower	6.FL	S	70.3
14BRA0058 Residential Tower	7.FL	S	70.4
14BRA0058 Residential Tower	8.FL	S	70.5
14BRA0058 Residential Tower	9.FL	S	70.6
14BRA0058 Residential Tower	10.FL	S	70.7
14BRA0058 Residential Tower	11.FL	S	70.7
14BRA0058 Residential Tower	12.FL	S	70.7
14BRA0058 Residential Tower	13.FL	S	70.7
14BRA0058 Residential Tower	14.FL	S	70.7

Brisbane Model
Road traffic noise assessment -
14BRA0058 Planning Horizon RAIL

Location	Floor level	Facade	Lmax Railw dB(A)
14BRA0058 Residential Tower	15.FL	S	70.7
14BRA0058 Residential Tower	16.FL	S	70.7
14BRA0058 Residential Tower	17.FL	S	70.7
14BRA0058 Residential Tower	18.FL	S	70.7
14BRA0058 Residential Tower	19.FL	S	70.7
14BRA0058 Residential Tower	20.FL	S	71.6
14BRA0058 Residential Tower	21.FL	S	72.3
14BRA0058 Residential Tower	22.FL	S	72.4
14BRA0058 Residential Tower	GF	S	67.5
14BRA0058 Residential Tower	1.FL	S	67.7
14BRA0058 Residential Tower	2.FL	S	68.0
14BRA0058 Residential Tower	3.FL	S	68.1
14BRA0058 Residential Tower	4.FL	S	68.4
14BRA0058 Residential Tower	5.FL	S	68.6
14BRA0058 Residential Tower	6.FL	S	68.7
14BRA0058 Residential Tower	7.FL	S	68.9
14BRA0058 Residential Tower	8.FL	S	69.1
14BRA0058 Residential Tower	9.FL	S	69.3
14BRA0058 Residential Tower	10.FL	S	69.5
14BRA0058 Residential Tower	11.FL	S	69.4
14BRA0058 Residential Tower	12.FL	S	69.6
14BRA0058 Residential Tower	13.FL	S	69.8
14BRA0058 Residential Tower	14.FL	S	70.0
14BRA0058 Residential Tower	15.FL	S	70.3
14BRA0058 Residential Tower	16.FL	S	70.6
14BRA0058 Residential Tower	17.FL	S	70.9
14BRA0058 Residential Tower	18.FL	S	71.1
14BRA0058 Residential Tower	19.FL	S	71.2
14BRA0058 Residential Tower	20.FL	S	71.3
14BRA0058 Residential Tower	21.FL	S	71.5
14BRA0058 Residential Tower	22.FL	S	71.7
14BRA0058 Residential Tower	GF	W	71.9
14BRA0058 Residential Tower	1.FL	W	72.8
14BRA0058 Residential Tower	2.FL	W	73.2
14BRA0058 Residential Tower	3.FL	W	73.6
14BRA0058 Residential Tower	4.FL	W	73.9
14BRA0058 Residential Tower	5.FL	W	74.0
14BRA0058 Residential Tower	6.FL	W	74.1
14BRA0058 Residential Tower	7.FL	W	74.2
14BRA0058 Residential Tower	8.FL	W	74.3
14BRA0058 Residential Tower	9.FL	W	74.4
14BRA0058 Residential Tower	10.FL	W	74.4

Brisbane Model
Road traffic noise assessment -
14BRA0058 Planning Horizon RAIL

Location	Floor level	Facade	Lmax Railw dB(A)
14BRA0058 Residential Tower	11.FL	W	74.4
14BRA0058 Residential Tower	12.FL	W	74.5
14BRA0058 Residential Tower	13.FL	W	74.6
14BRA0058 Residential Tower	14.FL	W	74.7
14BRA0058 Residential Tower	15.FL	W	74.8
14BRA0058 Residential Tower	16.FL	W	74.7
14BRA0058 Residential Tower	17.FL	W	74.7
14BRA0058 Residential Tower	18.FL	W	74.8
14BRA0058 Residential Tower	19.FL	W	74.8
14BRA0058 Residential Tower	20.FL	W	74.9
14BRA0058 Residential Tower	21.FL	W	75.0
14BRA0058 Residential Tower	22.FL	W	75.1
14BRA0058 Residential Tower	GF	N	75.6
14BRA0058 Residential Tower	1.FL	N	76.1
14BRA0058 Residential Tower	2.FL	N	76.3
14BRA0058 Residential Tower	3.FL	N	76.4
14BRA0058 Residential Tower	4.FL	N	76.5
14BRA0058 Residential Tower	5.FL	N	76.6
14BRA0058 Residential Tower	6.FL	N	76.7
14BRA0058 Residential Tower	7.FL	N	76.7
14BRA0058 Residential Tower	8.FL	N	76.8
14BRA0058 Residential Tower	9.FL	N	77.1
14BRA0058 Residential Tower	10.FL	N	77.2
14BRA0058 Residential Tower	11.FL	N	77.0
14BRA0058 Residential Tower	12.FL	N	76.9
14BRA0058 Residential Tower	13.FL	N	76.9
14BRA0058 Residential Tower	14.FL	N	76.9
14BRA0058 Residential Tower	15.FL	N	76.9
14BRA0058 Residential Tower	16.FL	N	76.8
14BRA0058 Residential Tower	17.FL	N	76.8
14BRA0058 Residential Tower	18.FL	N	76.8
14BRA0058 Residential Tower	19.FL	N	76.7
14BRA0058 Residential Tower	20.FL	N	76.7
14BRA0058 Residential Tower	21.FL	N	76.6
14BRA0058 Residential Tower	22.FL	N	76.5
14BRA0058 Residential Tower	GF	N	75.9
14BRA0058 Residential Tower	1.FL	N	76.4
14BRA0058 Residential Tower	2.FL	N	76.5
14BRA0058 Residential Tower	3.FL	N	76.5
14BRA0058 Residential Tower	4.FL	N	76.8
14BRA0058 Residential Tower	5.FL	N	77.1
14BRA0058 Residential Tower	6.FL	N	77.4

Brisbane Model
Road traffic noise assessment -
14BRA0058 Planning Horizon RAIL

Location	Floor level	Facade	Lmax Railw dB(A)
14BRA0058 Residential Tower	7.FL	N	77.7
14BRA0058 Residential Tower	8.FL	N	77.7
14BRA0058 Residential Tower	9.FL	N	77.7
14BRA0058 Residential Tower	10.FL	N	77.8
14BRA0058 Residential Tower	11.FL	N	77.9
14BRA0058 Residential Tower	12.FL	N	78.0
14BRA0058 Residential Tower	13.FL	N	78.1
14BRA0058 Residential Tower	14.FL	N	78.1
14BRA0058 Residential Tower	15.FL	N	78.2
14BRA0058 Residential Tower	16.FL	N	78.1
14BRA0058 Residential Tower	17.FL	N	78.1
14BRA0058 Residential Tower	18.FL	N	78.1
14BRA0058 Residential Tower	19.FL	N	78.0
14BRA0058 Residential Tower	20.FL	N	77.9
14BRA0058 Residential Tower	21.FL	N	77.8
14BRA0058 Residential Tower	22.FL	N	77.7

Appendix D QDC MP4.4 Schedule 1 - 3

Schedule 1

Noise category	Minimum *transport noise reduction* (*dB (A)*) required for *habitable rooms*	Component of building's *external envelope*	Minimum R_w required for each component
Category 4	40	Glazing	43
		External walls	52
		Roof	45
		Floors	51
		Entry doors	35
Category 3	35	Glazing	38 (where total area of glazing for a *habitable room* is greater than 1.8m^2)
			35 (where total area of glazing for a *habitable room* is less than or equal to 1.8m^2)
		External walls	47
		Roof	41
		Floors	45
		Entry doors	33

Noise category	Minimum *transport noise reduction* (*dB (A)*) required for *habitable rooms*	Component of building's *external envelope*	Minimum R_w required for each component
Category 2	30	Glazing	35 (where total area of glazing for a *habitable room* is greater than 1.8m^2)
			32 (where total area of glazing for a *habitable room* is less than or equal to 1.8m^2)
		External walls	41
		Roof	38
		Floors	45
		Entry doors	33
Category 1	25	Glazing	27 (where total area of glazing for a *habitable room* is greater than 1.8m^2)
			24 (where total area of glazing for a *habitable room* is less than or equal to 1.8m^2)
		External walls	35
		Roof	35
		Entry Doors	28
Category 0	No additional acoustic treatment required – standard building assessment provisions apply.		

Schedule 2

Component of building's *external envelope*	Minimum R_w	Acceptable forms of construction
Glazing	43	Double glazing consisting of two panes of minimum 5mm thick glass with at least 100mm air gap and full perimeter *acoustically rated seals*.
	38	Minimum 14.38mm thick laminated glass, with full perimeter *acoustically rated seals*; OR Double glazing consisting of one pane of minimum 5mm thick glass and one pane of minimum 6mm thick glass with at least 44mm air gap, and full perimeter *acoustically rated seals*
	35	Minimum 10.38mm thick laminated glass, with full perimeter *acoustically rated seals*.
	32	Minimum 6.38mm thick laminated glass with full perimeter *acoustically rated seals*.
	27	Minimum 4mm thick glass with full perimeter *acoustically rated seals*
	24	Minimum 4mm thick glass with standard weather seals

Component of building's *external envelope*	Minimum R_w	Acceptable forms of construction
External walls	52	Two leaves of clay brick masonry, at least 270mm in total, with subfloor vents fitted with noise attenuators.
	47	Two leaves of clay brick masonry at least 110mm thick with: (i) cavity not less than 50mm between leaves; and (ii) 50mm thick mineral insulation or 50mm thick glass wool insulation with a density of 11kg/m^3 or 50mm thick polyester insulation with a density of 20kg/m^3 in the cavity. OR Two leaves of clay brick masonry at last 110mm thick with: (i) cavity not less than 50mm between leaves; and (ii) at least 13mm thick cement render on each face OR Single leaf of clay brick masonry at least 110mm thick with: (i) a row of at least 70mm x 35mm timber studs or 64mm steel studs at 600mm centres, spaced at least 20mm from the masonry wall; and (ii) Mineral insulation or glass wool insulation at least 50mm thick with a density of at least 11 kg/m^3 positioned between studs; and (iii) One layer of plasterboard at least 13mm thick fixed to outside face of studs. OR Single leaf of minimum 150mm thick masonry of hollow, dense concrete blocks, with mortar joints laid to prevent moisture bridging.

Component of building's *external envelope*	Minimum R_w	Acceptable forms of construction
	41	Two leaves of clay brick masonry at least 110mm thick with cavity not less than 50mm between leaves OR Single leaf of clay brick masonry at last 110mm thick with: (i) a row of at least 70mm x 35mm timber studs or 64mm steel studs at 600mm centres, spaced at least 20mm from the masonry wall; and (ii) mineral insulation or glass wool insulation at least 50mm thick with a density of at least 11 kg/m^3 positioned between studs; and (iii) One layer of plasterboard at least 10mm thick fixed to outside face of studs OR Single leaf of brick masonry at least 110mm thick with at least 13mm thick render on each face OR Concrete brickwork at least 110mm thick OR In-situ concrete at least 100mm thick OR Precast concrete at least 100mm thick and without joints.

Component of building's *external envelope*	Minimum R_w	Acceptable forms of construction
	35	Single leaf of clay brick masonry at least 110mm thick with: (i) a row of at least 70mm x 35mm timber studs or 64mm steel studs at 600mm centres, spaced at least 20mm from the masonry wall; and (ii) One layer of plasterboard at least 10mm thick fixed to outside face of studs OR Minimum 6mm thick fibre cement sheeting or weatherboards or plank cladding externally, minimum 90mm deep timber stud or 92mm metal stud, standard plasterboard at least 13mm thick internally.
Roof	45	Concrete or terracotta tile or sheet metal roof with sarking, *acoustically rated plasterboard* ceiling at least 13mm thick fixed to ceiling joists, cellulose fibre insulation at least 100mm thick with a density of at least 45kg/m^3 in the cavity. OR Concrete or terracotta tile or sheet metal roof with sarking, 2 layers of *acoustically rated plasterboard* at least 16mm thick fixed to ceiling joists, glass wool insulation at least 50mm thick with a density of at least 11kg/m^3 or polyester insulation at least 50mm thick with a density of at least 20kg/m^3 in the cavity.
	41	Concrete or terracotta tile or metal sheet roof with sarking, plasterboard ceiling at least 10mm thick fixed to ceiling joists, glass wool insulation at least 50mm thick with a density of at least 11kg/m^3 or polyester insulation at least 50mm thick with a density of at least 20kg/m^3 in the cavity. OR Concrete suspended slab at least 100mm thick.
	38	Concrete or terracotta tile or metal sheet roof with sarking, plasterboard ceiling at least 10mm thick fixed to ceiling cavity, mineral insulation or glass wool insulation at least 50mm thick with a density of at least 11 kg/m^3.

Component of building's *external envelope*	Minimum R_w	Acceptable forms of construction
	35	Concrete or terracotta tile or metal sheet roof with sarking, plasterboard ceiling at least 10mm thick fixed to ceiling cavity.
Floors	51	Concrete slab at least 150mm thick.
	45	Concrete slab at least 100mm thick OR Tongued and grooved boards at least 19mm thick with: (i) timber joists not less than 175mm x 50mm; and (ii) mineral insulation or glass wool insulation at least 75mm thick with a density of at least 11kg/m^3 positioned between joists and laid on plasterboard at least 10mm thick fixed to underside of joists; and (iii) mineral insulation or glass wool insulation at least 25mm thick with a density of at least 11kg/m^3 laid over entire floor, including tops of joists before flooring is laid; and (iv) secured to battens at least 75mm x 50mm; and (v) the assembled flooring laid over the joists, but not fixed to them, with battens lying between the joists.
Entry Doors	35	Solid core timber not less than 45mm thick, fixed so as to overlap the frame or rebate of the frame by not less than 10mm, with full perimeter *acoustically rated seals*.
	33	Fixed so as to overlap the frame or rebate of the frame by not less than 10mm, fitted with full perimeter *acoustically rated seals* and constructed of - (i) solid core, wood, particleboard or blockboard not less than 45mm thick; and/or (ii) acoustically laminated glass not less than 10.38mm thick.

Component of building's *external envelope*	Minimum R_w	Acceptable forms of construction
	28	Fixed so as to overlap the frame or rebate of the frame, constructed of - (i) Wood, particleboard or blockboard not less than 33mm thick; or (ii) Compressed fibre reinforced sheeting not less than 9mm thick; or (iii) Other suitable material with a mass per unit area not less than 24.4kg/m^2; or (iv) Solid core timber door not less than 35mm thick fitted with full perimeter *acoustically rated seals*.

Schedule 3

The objective of the *noise assessment* is to clearly demonstrate that the *noise category* that is applicable to a particular part of or entire building, or site. The criteria for determining the relevant *noise category* are given below in Table 1:

Table 1 – *Noise category* levels

Noise Category	Level of *transport noise* * ($L_{A10,\ 18hr}$) for *State-controlled roads* and designated local government roads	Single event maximum noise* (L_{Amax}) for *railway land*
Category 4	≥ 73 dB(A)	≥ 85 dB(A)
Category 3	68 - 72 dB(A)	80 – 84 dB(A)
Category 2	63 – 67 dB(A)	75 – 79 dB(A)
Category 1	58 - 62 dB(A)	70 - 74 dB(A)
Category 0	≤ 57 dB(A)	≤ 69 dB(A)

* measured at 1 m from the façade of the proposed or existing building.