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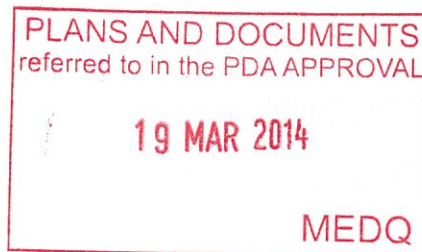
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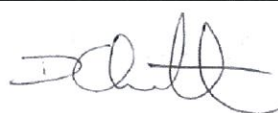
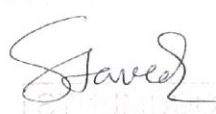
9-11 Bowen Bridge Road, Herston

Noise Impact Assessment



70Q-14-0049-TRP-516151-0

07 Mar 2014

Report Title: Noise Impact Assessment Job Title: 9-11 Bowen Bridge Road, Herston														
DOCUMENT NO: 70Q-14-0049-TRP-516151-0 PREPARED FOR: Dameline Developments Pty Ltd Unit 19, 10 Depot Street Banyo Qld 4104 PO Box 2242, Milton Qld 4064 CONTACT: Damien Todd Tel: 0447 758 339 Fax:	REPORT CODE: TRP PREPARED BY: Vipac Engineers & Scientists Ltd. Level 2, 146 Leichhardt Street, Spring Hill, QLD 4000, Australia Tel: +61 7 3377 0400 Fax: +61 7 3377 0499													
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REVISION HISTORY <table border="1"> <thead> <tr> <th>Revision No.</th> <th>Date Issued</th> <th>Reason/Comments</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>07 Mar 2014</td> <td>Initial Issue</td> </tr> <tr> <td>1</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td></td> <td></td> </tr> </tbody> </table>			Revision No.	Date Issued	Reason/Comments	0	07 Mar 2014	Initial Issue	1			2		
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EXECUTIVE SUMMARY

Vipac Engineers & Scientists Ltd (Vipac) has completed a noise impact assessment for the proposed residential apartments at 9 to 11, Bowen Bridge Road, Herston. Noise immissions and emissions have been considered as part of the assessment and assessed according to Brisbane City Council, AS/NZS 2107:2000, AS 3671:1989 and the Department of Environment and Heritage Protection noise policies.

Noise sources considered in this assessment are:

- Road traffic noise from Bowen Bridge Road and O'Connell Terrace;
- Noise from the neighbouring car park; and
- Mechanical plant associated with the proposed development

The following noise mitigation is recommended for noise levels at noise sensitive receivers within the development and neighbouring residences to comply with applicable noise limits:

- Design of mechanical plant to the noise limits in this report
- Glazing requirements as detailed in this report
- Alternative ventilation may be required in all habitable rooms as doors and windows need to be closed to comply with applicable indoor noise limits; and
- Alternative ventilation may include air-conditioning, borrowed ventilation, mechanically assisted ventilation or other suitable methods.

The proposed roof / ceiling and external walls systems which were predicted to result in compliance with indoor noise limits consisted of:

- External wall: Concrete blocks and 10mm plasterboard, expected to achieve an R_w acoustic rating of 52; and
- Ceiling / roof: concrete with 10mm plasterboard, expected to achieve an R_w acoustic rating of 45.

Should the design change, an alternative external wall achieving R_w 52 or ceiling / roof achieving R_w 45 will be acceptable.

When final details of mechanical plant are available, a further report should be issued demonstrating that the proposed mechanical plant will comply with the noise limits specified in this report.

In conclusion, noise impacts associated with the proposed development can be controlled to an acceptable level by implementing the recommendations in this report.



TABLE OF CONTENTS

1	INTRODUCTION	5
2	PROPOSED DEVELOPMENT AND SURROUNDING AREA	5
3	SITE INSPECTION	6
4	EXISTING NOISE LEVELS	6
5	NOISE POLICY	7
5.1	Road Traffic Noise	7
5.2	Mechanical Plant	8
5.2.1	EPA 1994	8
5.2.2	BCC Background Creep	8
5.3	Noise Limits	8
6	NOISE PREDICTION METHODOLOGY	9
6.1	Mechanical Plant Noise	9
6.2	Traffic Noise Modelling	9
6.2.1	Traffic Noise Model Calibration	10
6.2.2	Noise Descriptor Conversions	10
7	NOISE PREDICTION RESULTS	10
7.1	Noise Barriers	11
7.1.1	Building Construction Acoustic Requirements	11
7.1.1.1	Glazing Requirements	12
7.1.1.2	Ventilation	14
8	RECOMMENDATIONS	15
9	CONCLUSIONS	15
APPENDIX A : NOISE MEASUREMENT DETAILS		16
APPENDIX B : BUILDING PLANS		20
APPENDIX C : SITE PHOTOS		34

1 INTRODUCTION

Vipac Engineers & Scientists Ltd (Vipac) was commissioned by Dameline Developments to provide a noise impact assessment for the proposed residential apartments, to be located at 9 to 11, Bowen Bridge Road, Herston. The purpose of this assessment is to determine the impacts of any potential noise emissions from and immissions to the development.

Noise impacts have been assessed in accordance with Brisbane City Council (BCC), AS/NZS 2107:2000 (AS2107), AS 3671:1989 (AS3671) and the Department of Environment and Heritage Protection (EHP) noise policies.

2 PROPOSED DEVELOPMENT AND SURROUNDING AREA

The site is located at 9 to 11, Bowen Bridge Road, Herston. The proposed development is to consist of a 10 storey building of 81 apartments and one commercial tenancy. The following information about the surrounding area was observed on site and presented in Figure 2-1.

- North: Commercial buildings
- East: Walden Lane, and further east commercial buildings
- South: A car park, and further south O'Connell Terrace
- West: Bowen Bridge Road, and further west the Northern Busway



Figure 2-1: Aerial Photograph of the Site, NSRs and Noise Monitoring Locations

Noise impacts associated with the development that are assessed in this report are presented in Table 2-1.

Table 2-1: Noise Sources and NSRs affected

Noise Source	NSR affected
Proposed development: Mechanical plant noise	Nearby residences
Road traffic noise from Bowen Bridge Road and O'Connell Road	Residential apartments within the development
Neighbouring car park	

3 SITE INSPECTION

A site inspection was conducted on 26th February and on 28th February 2014. Based on the site inspection, road traffic noise from Bowen Bridge Road and O'Connell Terrace was considered the major noise source that will impact the proposed development. Therefore, it is road traffic noise that is assessed in this report. Site photos taken during the inspection are presented in Appendix C.

4 EXISTING NOISE LEVELS

Unattended noise monitoring was conducted for the following purposes:

- To obtain background noise levels for the purposes of calculating noise limits;
- To allow for the calculation of noise descriptors other than the LA10(18hr) from road traffic noise modelling results; and
- To calibrate the noise model.

An environmental noise logger was used to measure the existing noise levels on site. The location of the noise logger is shown in Figure 2-1. Noise monitoring was conducted between the 26th of February, 2014 and the 28th of February, 2014. The instrumentation, measurement details and measurement results are presented in Appendix A. Noise measurements were conducted generally in accordance with Australian Standard AS2702: 1984 "Acoustics – Methods for the Measurement of Road Traffic Noise".

Background noise levels used to determine noise limits are presented in Table 4-1.

Table 4-1: Measured Background Noise Levels Used to Determine Noise Limits

Noise Descriptor	Day (7am to 6pm)	Evening (6pm to 10 pm)	Night (10pm to 7am)
LA90	61	58	53

Measured road traffic noise levels used to calibrate the noise model are presented in Table 4-2.

Table 4-2: Measured Noise Levels for Road Traffic Noise Modelling Validation/Calibration

Noise Descriptor	Measured Noise Level
LA10(18hr)	72.4 dB(A)

5 NOISE POLICY

The major noise sources and the applicable noise policies are summarised in Table 5-1.

Table 5-1: Noise Sources and Applicable Noise Policies

Noise Source	Applicable Noise Criteria
Road traffic noise	Brisbane City Council's (BCC) Noise Impact Assessment Planning Scheme Policy (NIAPSP) AS/NZS 2107:2000 Acoustics—Recommended design sound levels and reverberation times for building interiors (AS2107) AS 3671:1989 Acoustics-Road traffic noise intrusion - Building Siting and Construction (AS3671)
Mechanical plant noise	Environmental Protection Act 1994 (Reprinted as in force on January 1st 2009), Division 3, Default Noise Standards, Section 440U Air Conditioning and Section 440V Refrigeration Equipment (EPA 1994) Brisbane City Council's Background Creep Noise Limits

5.1 Road Traffic Noise

BCC'S Noise Impact Assessment Planning Scheme is the applicable noise policy. The NIAPSP has no specific limits for road traffic noise. The policy refers to the noise limits in AS2107.

AS2107 lists recommended internal noise levels for various building and room types, including residential bedrooms and other areas. For residences, the recommended design levels are listed in Table 5-2 below.

Table 5-2: Recommended Indoor Noise Levels from AS/NZS 2107:2000

Type of Occupancy/Activity	Noise Limits L _{Aeq} , dB(A)
Residential Buildings	
Living areas	35 to 45
Sleeping areas	30 to 40

The maximum noise limits from AS2107 have been adopted, based on the fact that the apartments are adjacent to Bowen Bridge Road and O'Connell Terrace, which are major roads, and in a commercial area.

The NIAPSP details expected noise attenuation factors for the differences between noise levels at the façade and indoor noise levels, depending on ventilation and glazing. The attenuation factors are given in Table 5-3.

Table 5-3: NIAPSP Attenuation Factors Between Façade and Indoor Noise Levels

Air Conditioned?	Sealed Windows or no Windows Facing the Noise Source?	Attenuation Correction, C
Yes	Yes	Add 20 dB(A)
No	Yes	Add 15 dB(A)
No	No	Add 5 dB(A)

The equivalent external façade noise criteria, including the façade corrections as per Table 5-3, are given in Table 5-4.

Table 5-4: AS2107 External Façade Noise Limits

Noise Sensitive Receiver	Indoor Noise Limit	Ventilation / Windows	Attenuation Correction Factor	Façade Noise Limit*	Noise Descriptor
Residential living areas	45	With windows partially open	5	53	L _{Aeq,day} (1hr)
		With doors and windows closed, and acoustic seals on windows	15	63	
Residential sleeping areas	40	With windows partially open	5	48	L _{Aeq,night} (1hr)
		With doors and windows closed, and acoustic seals on windows	15	58	

* Includes a factor of 2.5 dB(A) for façade reflection adjustment

5.2 Mechanical Plant

5.2.1 EPA 1994

Sections 440U and 440V of the *Environmental Protection Act 1994* apply to premises at or for which there is air conditioning equipment and refrigeration equipment, respectively.

An occupier of premises must not use, or permit the use of, the equipment on any day-

- (a) before 7a.m., if it makes a noise of more than 3 dB(A) above the background level; or
- (b) from 7a.m. to 10p.m, if it makes a noise of more than 5 dB(A) above the background level; or
- (c) after 10p.m, if it makes a noise of more than 3 dB(A) above the background level.

5.2.2 BCC Background Creep

BCC's NIAPSP contains background creep noise limits applicable to mechanical plant associated with the proposed development. According to Australian Standard AS 1055.1 "Acoustics – Description and measurement of environmental noise" (AS1055), the character of area surrounding the site is "R4", "areas with dense transportation or some commerce or industry". According to the BCC background creep noise limits, the following noise limits apply to a development in an area with type R4, where there is existing residential development:

- Background noise levels + 0 dB(A).

The development's noise contribution should also not exceed the noise levels in AS 1055 for areas with character R4, which are presented in Table 5-5.

Table 5-5: AS1055 Noise Levels for Neighbourhood Type "R4"

Noise Descriptor	Noise level for neighborhood type "R4" (dB(A))					
	Monday to Saturday			Sundays and public holidays		
	7am to 6pm	6pm to 10pm	10pm to 7am	9am to 6pm	6pm to 10pm	10pm to 9am
L _{A90}	55	50	45	55	50	45

Assuming the air conditioning plant will operate at night time, the stricter noise limits apply to the proposed development.

5.3 Noise Limits

Based on the noise criteria presented in Sections 4.1 to 5.2 and the noise monitoring results presented in Section 3, the applicable noise limits for all noise sources are presented in Table 5-6. The noise limits for mechanical plant have been derived from the strictest of the EPA 1994, BCC background creep noise limits, and AS 1055 noise area categories.

Table 5-6: All Applicable Noise Limits

Noise Source	Noise Criteria	Noise Limit	Period	Where
Air-conditioning and mechanical plant	AS1055 "R4" noise area category levels	$L_{Aeq} = 55$	Day (7am to 6pm)	At the external façade of nearby residential NSRs
		$L_{Aeq} = 50$	Evening (6m to 10pm)	At the external façade of nearby residential NSRs
		$L_{Aeq} = 45$	Night (10pm to 7am)	At the external façade of nearby residential NSRs
Road Traffic Noise	AS2107	48 dB(A) ¹³ $L_{Aeq,Night(1hr)}$	Night (10pm to 7am)	At the external façade of a sleeping area in a residential apartment within the development, windows partially open
		53 dB(A) ¹³ $L_{Aeq,Night(1hr)}$	Day / Evening (7am to 10pm)	At the external façade of a living area in a residential apartment within the development, windows partially open
		58 dB(A) ²³ $L_{Aeq,Night(1hr)}$	Night (10pm to 7am)	At the external façade of a sleeping area in a residential apartment within the development, with doors and windows closed
		63 dB(A) ²³ $L_{Aeq,Night(1hr)}$	Day / Evening (7am to 10pm)	At the external façade of a living area in a residential apartment within the development, with doors and windows closed
		40 dB(A) $L_{Aeq,Night(1hr)}$	Night (10pm to 7am)	Sleeping areas in apartments within the development, indoors
		45 dB(A) $L_{Aeq,Day(1hr)}$	Day / Evening (7am to 10pm)	Living areas in apartments within the development, indoors

¹ Noise limit includes a 5 dB factor for attenuation of noise from outdoors to indoors, assuming partially open windows

² Noise limit includes a 15 dB factor for attenuation of noise from outdoors to indoors, assuming closed doors and windows

³ Includes a factor of 2.5 dB(A) for façade reflection adjustment

6 NOISE PREDICTION METHODOLOGY

6.1 Mechanical Plant Noise

No details of mechanical plant associated with the development are available at this time. Therefore, it is recommended that mechanical plant be selected and located to achieve the noise levels given in Table 5-6 at neighbouring residences.

6.2 Traffic Noise Modelling

Road traffic noise calculations were carried out using SoundPLAN noise modelling software. A 3D computational model was created based on the drawings provided. The drawings are included in Appendix B.

The data and assumptions used in road traffic noise modelling are presented in Table 6-1. The road traffic flow data obtained from BCC is presented in Table 6-2.

Table 6-1: Data and Assumptions Used in Road traffic Noise Modelling

Parameter	Data
Proposed Apartment Receiver Heights	1.5m above FFL AHDs for each storey as obtained from building plans (included in Appendix B)
Road Alignment	Google Earth Geographical Software
Calculation Method	UK's Calculation of Road Traffic Noise (CoRTN)
Road Traffic Volume Conversions - AADT to 18hr Road traffic Flows	94%
Road Surface	Dense Graded Asphalt was modelled as the road surface for all roads. No road surface correction is applied to the base noise level calculated by SoundPLAN because the base noise level prediction assumes dense graded asphalt road surface.

Table 6-2: Traffic Data Used for Noise Modelling

Scenario	Year	Road	18hr Traffic Volumes	%CV*	Speed (km/h)
Current	2014	Bowen Bridge Rd	57,000	4%	60
		O'Connell Tce	9,000	4%	60
Ultimate	2024	Bowen Bridge Rd	72,000	4%	60
		O'Connell Tce	9,000	4%	60

6.2.1 Traffic Noise Model Calibration

Noise monitoring was conducted on Bowen Bridge Road and O'Connell Terrace, between the 28th of February, 2014 and the 26th of February, 2014. The traffic noise modelling predictions differed from the noise measurement by +0.5 dB(A). A difference between predicted and measured result of less than 2 dB(A) is considered acceptable. A calibration factor of 0.5 dB(A) has been added to the traffic noise predictions.

6.2.2 Noise Descriptor Conversions

Noise descriptors other than the $L_{A10(18hr)}$ were calculated from noise predictions and noise measurements as per Table 6-3.

Table 6-3: Noise Descriptor Conversions

Noise Descriptor	Measured Noise Level	Factor to Convert from $L_{A10(18hr)}$ (dB(A))
$L_{A10(18hr)}$	72.4	+0.0
$L_{Aeq,1hr}$ Day(7am to 10pm)	71.6	-0.8
$L_{Aeq,1hr}$ Night(10pm to 7am)	73.0	+0.6

7 NOISE PREDICTION RESULTS

Predicted noise levels from road traffic noise sources at the worst affected facades of the proposed apartments are presented in Figure 7-1. No unit numbers are available at this stage. Therefore, Vipac provided unit numbers for the purpose of this assessment are also provided in Figure 7-1.

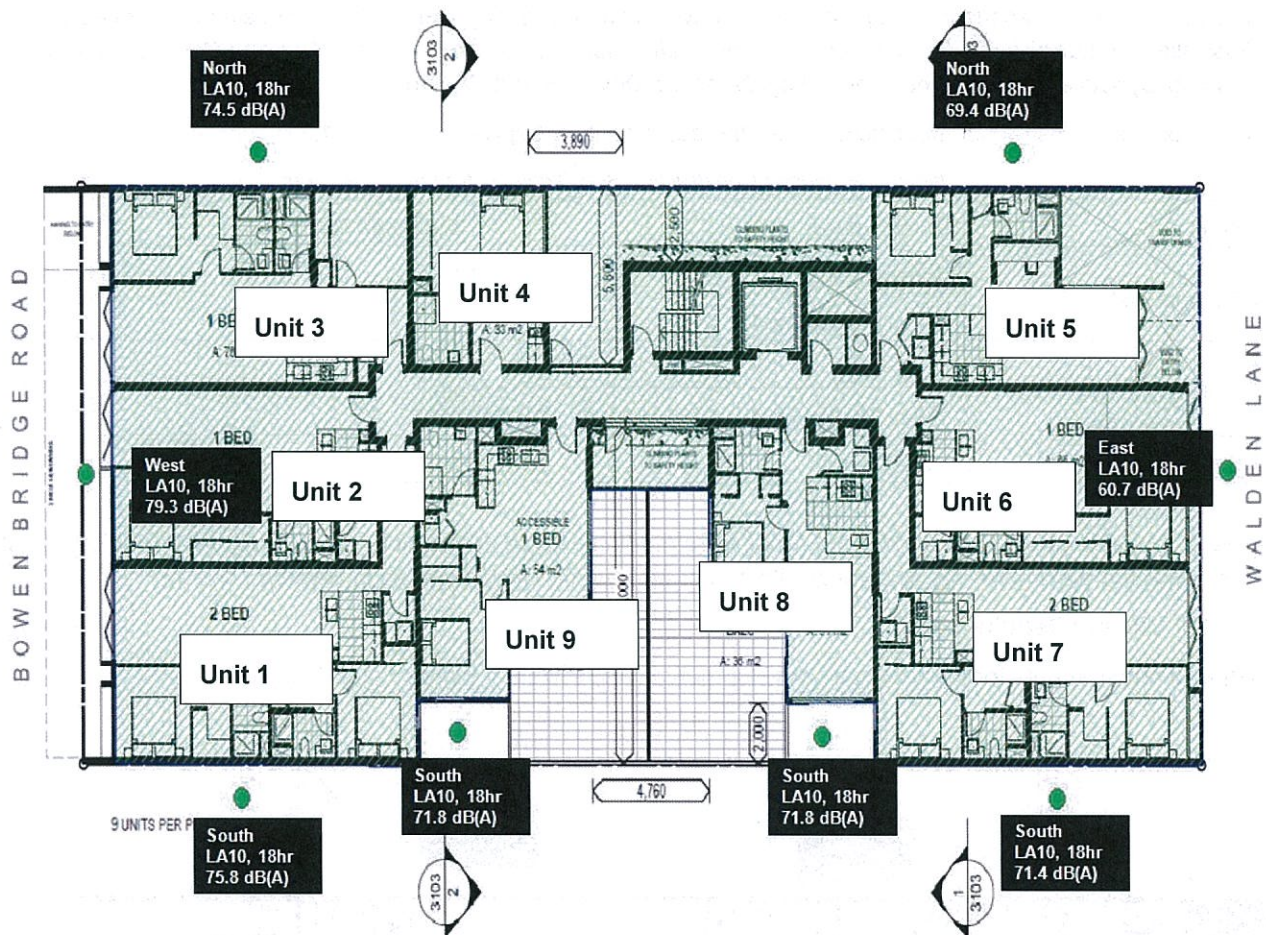


Figure 7-1: Predicted Noise Levels at unit facades

Predicted traffic noise levels will exceed the noise limits at all facades of the proposed development.

7.1 Noise Barriers

Noise barriers have been considered for this assessment. The apartments are ten storeys in height, and no residential apartments are to be located on the ground floor. It is not considered reasonable to construct noise barriers to comply with noise limits at the first floor. Even if noise barriers were constructed to comply with noise limits at the first floor, the second to ninth floor would still exceed the noise limits. Therefore, building construction acoustic requirements to achieve acceptable indoor noise levels are recommended as the most appropriate noise mitigation option.

Building construction requirements are addressed in Section 7.1.1.

7.1.1 Building Construction Acoustic Requirements

The applicable traffic noise limits will be exceeded at many of the apartment room facades. Consequently, the building construction should be designed to achieve the recommended noise limits specified in AS 2107 (See Section 5.1):

- Bedrooms: 40 dB(A) $L_{Aeq,1hr}(10pm\ to\ 7am)$
- Other habitable rooms: 45 dB(A) $L_{Aeq,1hr}(7am\ to\ 10pm)$

The recommended acoustic ratings for all walls, windows and roofing were calculated using the procedures in Australian Standard AS3671 "Acoustics – Road Traffic Noise Intrusion Building Siting and Construction" using building layouts and floor plans supplied by Dameline Development Pty Ltd.

The proposed construction specifications for the apartments are given in Table 7-1.

Table 7-1: Proposed Construction Specifications for the Apartments

Item	Construction	Expected R_w
External Wall	Concrete block	52
	10mm plasterboard	
Ceiling and Roof	Concrete	45
	10mm Plasterboard	
Glazing and Frames	4mm Float	24

The proposed external wall and ceiling / roof were predicted to be sufficient to comply with indoor noise limits. The predicted glazing ratings to comply with indoor noise limits are presented in Section 7.1.1.1.

7.1.1.1 Glazing Requirements

Glazing requirements for the proposed development are specified in Figure 7-2 to Figure 7-4.

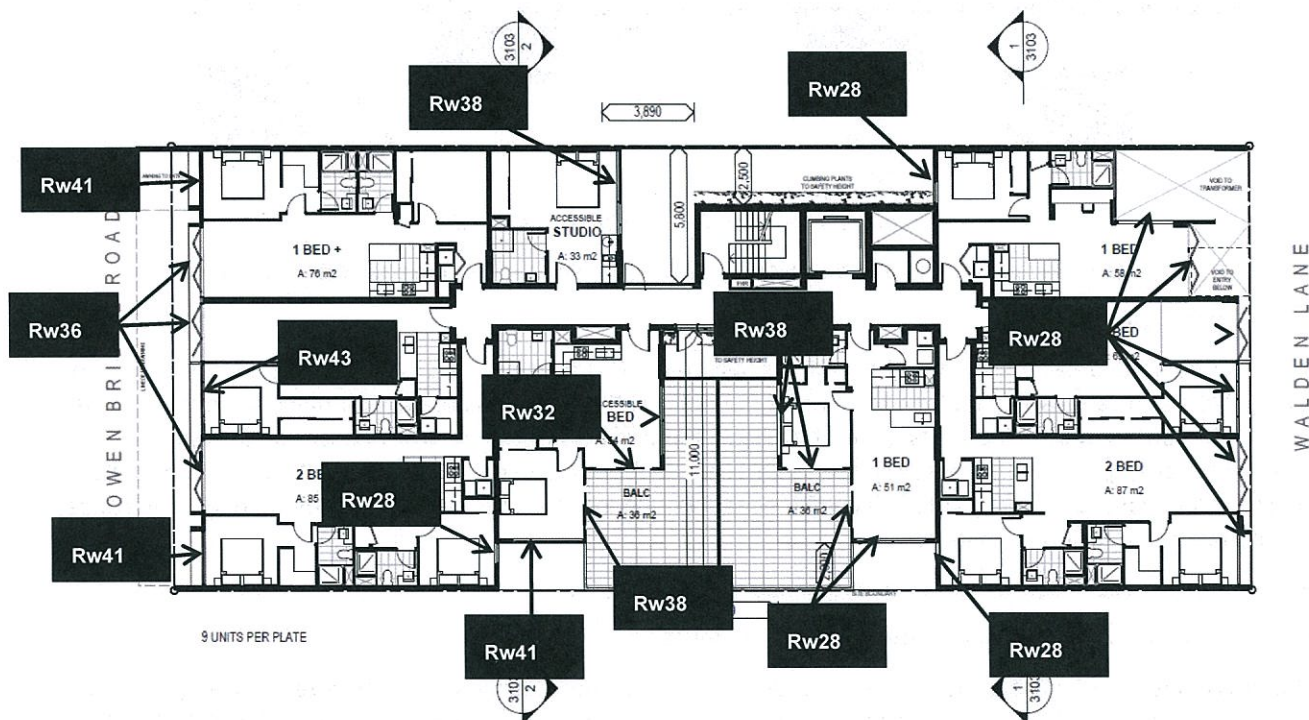


Figure 7-2: Required Glazing Construction for Level 1 of the Proposed Development to Comply with Indoor Noise Limits

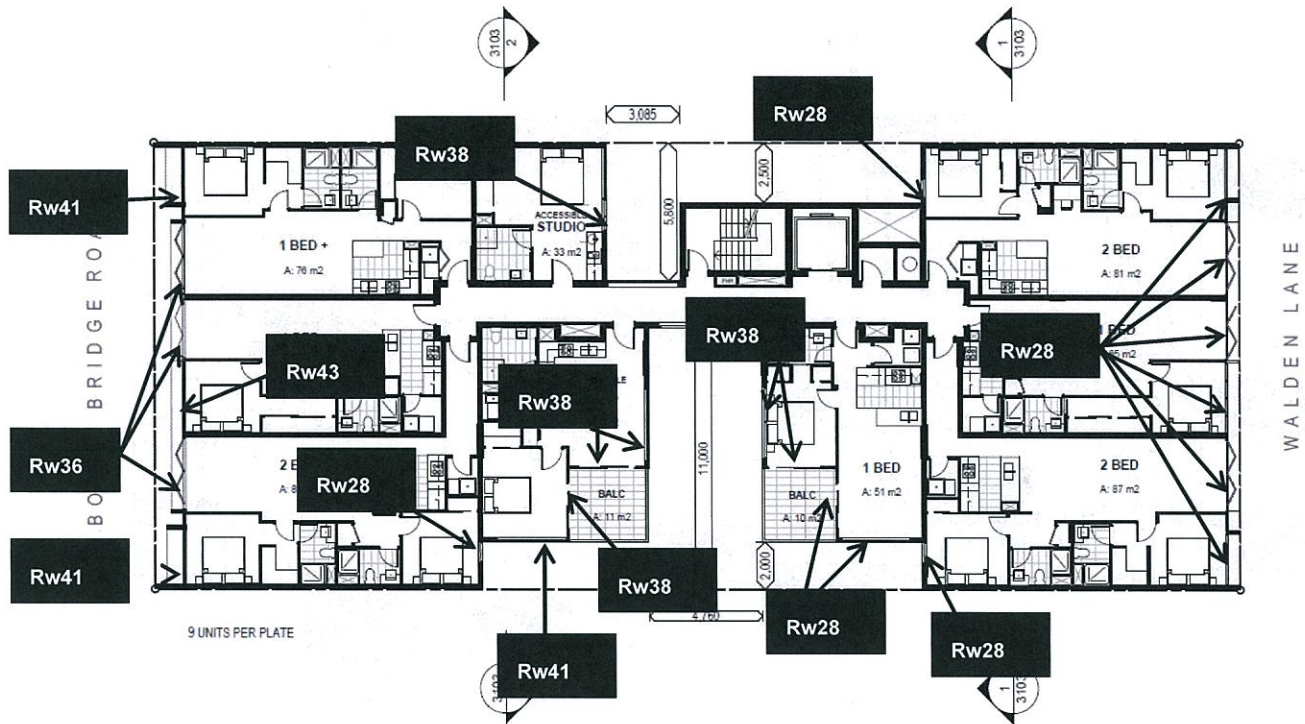
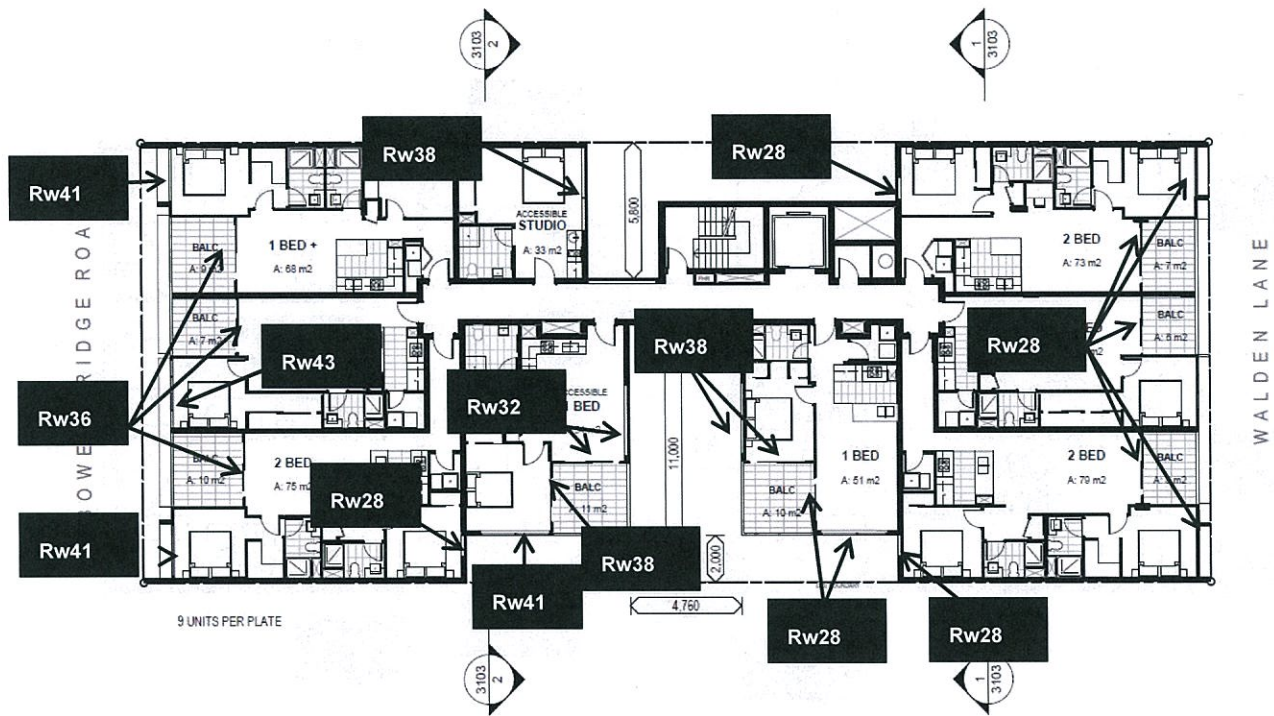


Figure 7-3: Required Glazing Construction for Level 2-4 of the Proposed Development to Comply with Indoor Noise Limits



1 FLOOR PLAN - PROPOSED LEVEL 05-09 1:200

Figure 7-4: Required Glazing Construction for Level 5-9 of the Proposed Development to Comply with Indoor Noise Limits

Figure 7-2 to Figure 7-4 presents the required R_w ratings (Weighted Sound Reduction Index) for glazing and frames. It is required that the R_w performance ratings of the glazing systems (glazing and frames) be certified by the supplier prior to installation. Glazing certificates will be required for building certification.

The ratings required are considered to be achievable, and not unusual for residential apartment buildings near major roads.

7.1.1.2 Ventilation

Internal noise levels based on indoor noise criteria can be achieved, however, for all habitable rooms, doors and windows must be closed to achieve acceptable indoor noise levels. Under these conditions, alternative ventilation will be required in affected rooms.

Alternative ventilation may include air-conditioning, borrowed ventilation, mechanically assisted ventilation or other suitable methods.

8 RECOMMENDATIONS

The following noise mitigation is recommended for compliance with the applicable noise criteria:

- Selection of mechanical plant as per Table 5-6;
- Selection of glazing as presented in Figure 7-2 to Figure 7-4;
- For all habitable rooms, doors and windows must be closed to comply with indoor noise limits. Under these conditions, alternative ventilation will be required in affected rooms;
- Alternative ventilation may include air-conditioning, borrowed ventilation, mechanically assisted ventilation or other suitable methods; and

When final details of mechanical plant are available, a further report should be issued demonstrating that the proposed mechanical plant will comply with the noise limits specified in this report.

If the final building layouts differ significantly to those used in this assessment, or pad heights change by more than 200mm, building construction requirements should be recalculated.

9 CONCLUSIONS

Vipac Engineers & Scientists Ltd (Vipac) has completed a noise impact assessment for the proposed residential apartments at 9 to 11, Bowen Bridge Road, Herston. Noise immissions and emissions have been considered as part of the assessment and assessed according to Brisbane City Council, AS/NZS 2107:2000, AS 3671:1989 and the Department of Environment and Heritage Protection noise policies.

The following noise mitigation is recommended for noise levels at noise sensitive receivers within the development and neighbouring residences to comply with applicable noise limits:

- Design of mechanical plant to the noise limits in Table 5-6;
- Glazing requirements as detailed in Figure 7-2 to Figure 7-4;
- Alternative ventilation may be required in all habitable rooms as doors and windows need to be closed to comply with applicable indoor noise limits; and
- Alternative ventilation may include air-conditioning, borrowed ventilation, mechanically assisted ventilation or other suitable methods.

The proposed roof / ceiling and external walls systems which were predicted to result in compliance with indoor noise limits consisted of:

- External wall: concrete blocks and 10mm plasterboard, expected to achieve an R_w acoustic rating of 52; and
- Ceiling / roof: concrete with 10mm plasterboard, expected to achieve an R_w acoustic rating of 45.

Should the building design change, an alternative external wall achieving R_w 52 or ceiling / roof achieving R_w 45 will be acceptable.

When final details of mechanical plant are available, a further report should be issued demonstrating that the proposed mechanical plant will comply with the noise limits specified in this report.

In conclusion, noise impacts associated with the proposed development can be controlled to an acceptable level by implementing the recommendations in this report.



Appendix A: Noise Measurement Details

Table A-1: Instrumentation

Instrument	Serial Number	Lab Calibration Due	Field Calibration
Larson Davis LD-831 Noise logger	2254	13 June 2012	94.0dB(A) before 94.1dB(A) after

Table A-2: Measurement Details for Noise Monitoring

Microphone Height	1.5m
Microphone Orientation	Pointing vertically upwards
SLM Time Weighting	Fast
SLM Frequency Weighting	A
Measurement Interval Period	1 hour intervals
Logger location	On site, as presented in Figure 2-1
Measurement weather	Mostly fine. Refer to Figure A-2 for details.
Date of measurement	Between the 28th of February, 2014 and the 26th of February, 2014



Figure A-1 Noise logger located at location