PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV2020/1103

Date: 12 August 2021

Queensland Government

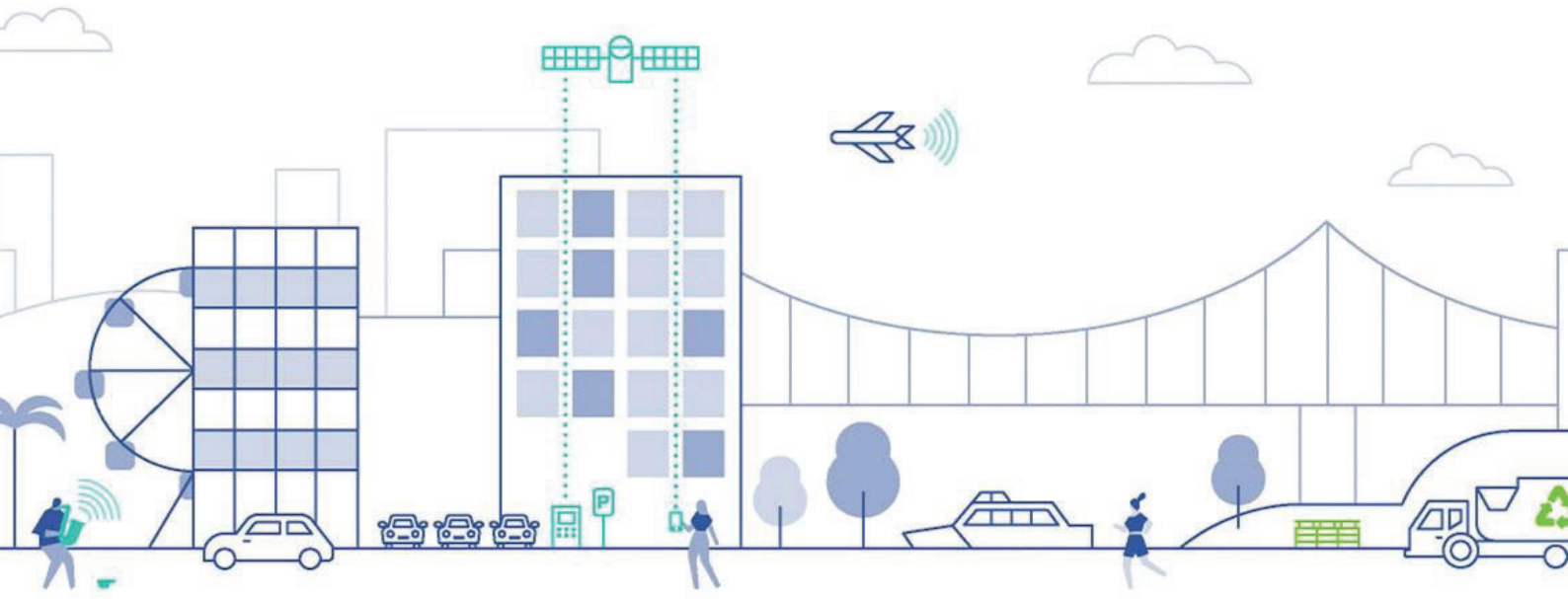
Noise Assessment Report

Proposed Mixed Use Development

490 Beams Road, Fitzgibbon

Bob Kelly & Co Pty Ltd atf RJ & KO Kelly Family Trust

17BRA0214 R01_4



About TTM

For 30 years, we've been at the centre of the Australian development and infrastructure industry. Our unique combination of acoustics, data, traffic and waste services is fundamental to the success of any architectural or development project.

We have over 50 staff, with an unrivalled depth of experience. Our industry knowledge, technical expertise and commercial insight allow us to deliver an exceptional and reliable service.

T: (07) 3327 9500
F: (07) 3327 9501
E: ttmbris@ttmgroup.com.au

Revision Record

No.	Author	Reviewed/Approved	Description	Date
A	S Yorke	J Fox	Report draft	18/02/2020
0	S Yorke		Client issue	18/02/2020
1	S Yorke		Client issue	18/02/2020
2	S Yorke		RFI response	01/10/2020
3	S Yorke		Final plans	27/11/2020
4	S Yorke	J Fox	EDQ Draft Approval Conditions response	21/05/2021

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1 Executive Summary

TTM was engaged by Bob Kelly & Co Pty Ltd atf RJ & KO Kelly Family Trust to undertake an environmental noise assessment of the proposed mixed-use development located at 490 Beams Road, Fitzgibbon. The assessment was based upon relevant planning scheme and State transport noise development codes.

Unattended noise monitoring was conducted to determine the current road traffic, rail and ambient noise levels at the development location.

Onsite noise was assessed onto the nearest noise sensitive receivers. An acoustic barrier is recommended along the eastern boundary.

Noise modelling of road traffic noise (Beams Road) and rail noise was conducted. An acoustic barrier along the site rail frontage is recommended. Some buildings are noise affected and will require acoustic treatment ranging between QDC MP4.4 noise category 0 – 4.

Compliance with the relevant planning scheme and State transport noise requirements is predicted based on the implementation of the recommendations outlined in Section 10 of this report.

2 Introduction

2.1 Background

TTM was engaged by Bob Kelly & Co Pty Ltd atf RJ & KO Kelly Family Trust to undertake a noise assessment of the proposed mixed-use development located at 490 Beams Road, Fitzgibbon. This report will form part of the development application for consideration by Economic Development Queensland (EDQ) and relevant State authorities.

The EDQ Draft Conditions of Approval for the proposed development state:

DTMR ADVICE - Railway Noise

The Noise Assessment Report, prepared by TTM Consulting Pty Ltd, reference 17BRA0214R01_3, Revision 3 has not adequately demonstrated that the development will not be adversely impacted by railway noise for the following reasons:

- *For the noise model verification, the report over-predicts the noise levels by more than 2 dB when comparing with the noise monitoring levels for both LAmax and Leq(24h).*
- *The report subsequently scales down the noise predictions to meet the 2 dB requirements. The scaling down of predictions is not acceptable as the acoustic treatments could consequently be under-designed.*
- *The ground floor RL of the proposed buildings have not been provided to ensure appropriate noise barrier design.*

It is recommended the applicant consider the following when submitting a revised Noise Assessment Report:

- *Either–*
    - *Undertake further investigations to verify the noise model. This could include contacting Queensland Rail to acquire information to affirm the noise model inputs and rail/train information at the time of noise monitoring; OR*
    - *Retain the existing noise predictions without scaling down and re-evaluate the proposed noise barrier design and QDC requirements.*
- *Provide ground floor RL's of the proposed buildings*

This report has taken the first option requested, by obtaining the actual train movements from Queensland Rail during the noise monitoring period to affirm the noise model inputs. This is detailed in Section 9.2.2.

Proposed building RL levels are provided in Table 21.

2.2 References

This report is based on the following:

- EDQ Daft Conditions of Approval
- EDQ Further Issues, email 11 June 2020

- Fitzgibbon Urban Development Area Development Scheme, 2011
- Brisbane City Council (BCC) *City Plan 2014*
- *Noise impact assessment planning scheme policy* - Schedule 6, City Plan 2014
- State Development Assessment Provisions (SDAP) Version 2.6
- Queensland Development Code (QDC) MP4.4 – *Buildings in a Transport Noise Corridor* (August 2015)
- Development plans shown in Appendix A
- Site inspection, noise measurements, analysis and calculations conducted by TTM

2.3 Scope

The assessment includes the following:

- Description of the site.
- Measurement of existing road traffic, rail and ambient noise levels.
- Statement of assessment criteria relating to onsite noise emissions, road traffic and rail noise impacts.
- Prediction of noise generated by the development onto noise sensitive receivers.
- Prediction of future road traffic and rail noise onto the development.
- Analysis of measured and predicted noise levels.
- Details of noise control recommendations to be incorporated to achieve predicted compliance.

3 Site Description

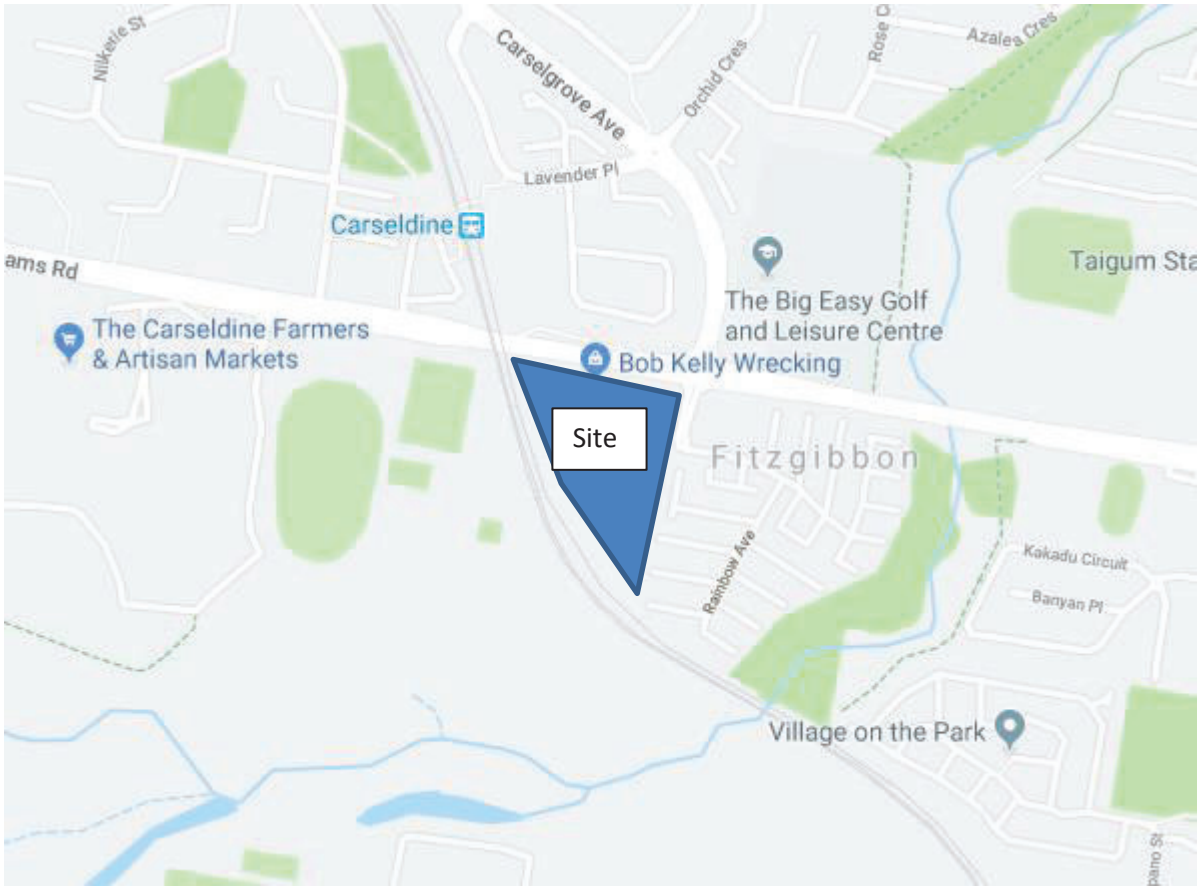
3.1 Site Location

The site is described by the following:

- 490 Beams Road, Fitzgibbon

The site locality is shown in Figure 1.

Figure 1: Site Locality



3.2 Current Site Conditions

The site is bound by Beams Road to the north, residential dwellings to the east, and a rail line to the west. The current acoustic environment at the site is primarily comprised of noise from road traffic on Beams Road, rail noise from the rail line and noise from an automobile wrecking yard on the site.

4 The Proposed Development

4.1 Development Description

The proposal is to develop the site into six, 8-storey buildings of residential use and one, 5-storey building of residential and retail/commercial use (Building E). All buildings include basement level car parking.

Retail/commercial operating hours are proposed to be between 7am – 10pm.

A site plan is presented in Figure 2. Further samples of the development plans are shown in Appendix A.

Figure 2: Site Plan

5 Measurements

5.1 Equipment

The following equipment was used to measure existing noise levels:

- ARL EL 316 Environmental noise logger (SN# 16-306-005) – Ambient noise
- ARL EL 315 Environmental noise logger (SN# 15-302-489) – Road traffic noise
- Norsonic Nor140 noise logger (SN# 1406504) – Rail noise
- Norsonic Nor140 noise logger (SN# 1406505) – Rail noise
- Norsonic Nor131 Sound Level Meter (SN# 1313158)
- RION Sound Calibrator type NC73 (SN# TTMNC73-01)

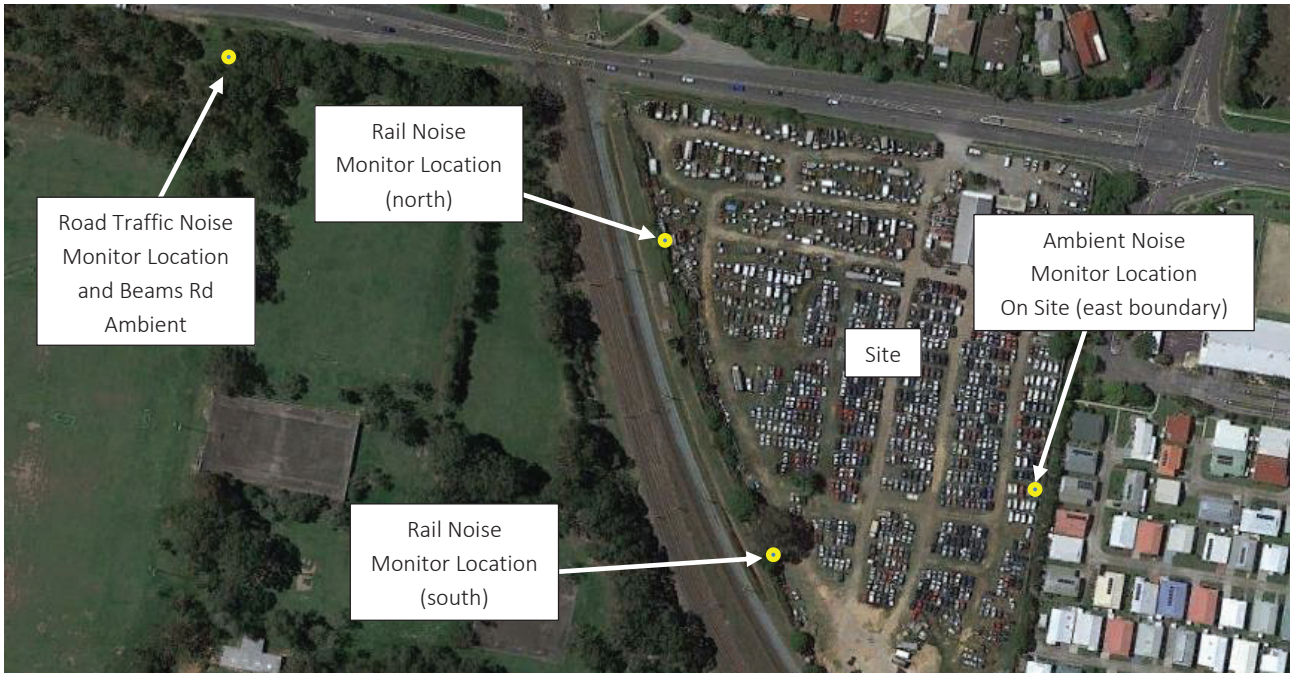
All equipment was calibrated by a National Association of Testing Authorities (NATA) accredited laboratory. The equipment was field calibrated before and after the measurement session. No significant drift from the reference signal was recorded.

5.2 Unattended Noise Monitoring

Unattended noise monitoring was conducted to establish the existing road traffic noise levels between 11th July to 18th July, 2017, and rail noise levels between 14th September to 18th September 2020, and to establish the existing ambient noise levels on site on 11th June to 19th June 2019. The noise monitoring locations are shown in Figure 3.

The ambient monitor was in a position considered representative of the ambient noise levels experienced at the site and surrounding locations. The road traffic noise monitor was placed approximately 17 metres from the edge of Beams Road. The rail noise monitors were located a distance of approximately 19 meters (both loggers) from the centre of the nearest rail line. The monitoring locations were chosen to represent the noise environment with consideration given to both access and security requirements.

Figure 3: Unattended Noise Monitoring Locations



The microphones were in a free-field location and 1.5m above ground level. The road traffic and ambient noise monitors were set to measure statistical noise levels in 'A'-weighting, 'Fast' response, over 15 minute intervals. The rail noise monitor was set to a 1 minute interval.

The rail noise logger was also set up to record audio when a trigger noise level of 65dB(A) (north) and 68dB(A) (south) or greater was measured. Audio was recorded for 20 seconds for each trigger event. The audio recordings were used to confirm that the L_{Amax} levels were from a train pass-by event.

Attended noise measurements were undertaken at all noise logger locations and were used to verify the unattended noise logging data.

Ambient noise levels were measured in accordance with Australian Standard *AS1055:2018 Acoustics – Description and Measurement of Environmental Noise* (AS1055). Road traffic noise levels were measured in accordance with Australian Standard *AS2702:1984 Acoustics – Methods for the measurement of road traffic noise* (AS2702). Rail noise measurements were conducted in accordance with Australian Standard *AS2377:2002 Acoustics – Methods for the Measurement of Railbound Vehicle Noise.*

Weather during the monitoring period was generally fine with rainfall on 16th July 2017 and 16th June 2019 (source: Bureau of Meteorology). Data affected by rainfall was excluded from the results.

5.3 Results of Measurements

5.3.1 Ambient Noise Levels

Table 1 presents the measured ambient noise levels. The Rating Background Level (RBL) was determined in accordance with the BCC *Noise Impact Assessment Planning Scheme Policy* (NIAPSP). Graphical presentation of the measured levels is shown in Appendix B.

Table 1: Measured Ambient Noise Levels

Location	Time Period	Measured Noise Levels, dB(A)	
		RBL L_{90}	L_{eq}
Beams Road	Daytime (7am – 6pm)	51	62
	Evening (6pm – 10pm)	49	60
	Night time (10pm – 7am)	36	55
Site (east boundary)	Daytime (7am – 6pm)	39	51
	Evening (6pm – 10pm)	38	50
	Night time (10pm – 7am)	33	49

5.3.2 Road Traffic Noise Levels

Table 2 presents the measured road traffic noise levels at the unattended noise monitoring location on Beams Road. Graphical presentation of the measured noise levels is presented in Appendix B.

Table 2: Measured Road Traffic Noise Levels

Location	Road Traffic Noise Descriptor	Time Period	Measured Level dB(A)
Beams Road	$L_{A10,18hr}$	6am to midnight	64
	Noisiest day-time $L_{Aeq,1\ hour}$	6pm to 7pm	64
	Noisiest night-time $L_{Aeq,1\ hour}$	11pm to 12am	60
	$L_{Aeq,24\ hour}$	Midnight to midnight	60
	$L_{90,\ 8\ hour}$	10pm to 6am	41
	$L_{90,\ 18\ hour}$	6am to midnight	52

5.3.3 Rail Noise Measurements

Rail timetables provided by Queensland Rail (QR) indicate approximately 250 trains per day passed the site during the measurement period including approximately 15 freight trains. The Queensland Rail *Code of Practice – Railway Noise Management* defines the single event maximum (SEM) sound pressure level as the arithmetic average of the highest 15 single maximum noise level events over a 24-hour period.

Table 3 and Table 4 presents the highest 15 free-field L_{Amax} and associated L_{Aeq} rail noise levels during each measured 24-hour period. The calculated $L_{Aeq,24hr}$ is based on these measured L_{Aeq} results (logarithmic average) and number of trains over a 24 hour period, and is therefore a conservative approach. This approach is required as the proximity of road traffic and other extraneous noises, results in a significant

portion of measured non-rail noise and it is not practical to identify and remove all non-rail event measurement data over each 24 hour period.

Table 3: Measured Rail Noise Levels (Highest 15) – North Monitor

Date	Train Type	Maximum Noise Level L_{MAX} dB(A)	Noise Level L_{eq} dB(A)	Warning Device (Train Horn)
16th September 2020	Passenger	97.2	77.0	yes
	Passenger	90.5	67.0	yes
	Passenger	90.5	71.0	yes
	Passenger	88.6	67.5	yes
	Passenger	85.4	66.6	yes
	Passenger	84.8	65.3	yes
	Passenger	84.8	65.8	no
	Passenger	84.6	61.4	yes
	Freight	84.3	72.6	no
	Passenger	84.2	66.5	yes
	Freight	83.7	62.1	no
	Passenger	83.4	67.7	no
	Passenger	83.4	65.6	yes
	Passenger	83.3	66.3	yes
	Freight	82.8	65.0	yes
	Single event maximum noise level (SEM) dB(A)	**86.1**		
	Leq,24hour dB(A)		**61.7**	
17th September 2020	Freight	103.5	85.5	yes
	Passenger	86.8	68.1	yes
	Passenger	85.9	67.7	yes
	Freight	85.5	73.6	yes
	Freight	85.4	72.0	yes
	Passenger	84.4	64.2	yes
	Freight	84.2	69.8	yes
	Freight	84.1	69.3	yes
	Passenger	84.0	64.3	yes
	Passenger	83.8	65.6	yes
	Passenger	83.5	65.5	yes
	Passenger	82.6	64.7	yes
	Passenger	82.4	65.6	yes
	Passenger	82.2	64.5	yes
	Passenger	82.1	68.3	yes

	Single event maximum noise level (SEM) dB(A)	**85.4**		
	Leq,24hour dB(A)		**67.2**	
Maximum for both 24 hour periods	**Single event maximum noise level (SEM) dB(A)**	**86.1**		
	Leq,24hour dB(A)		**67.2**	

Table 4: Measured Rail Noise Levels (Highest 15) – South Monitor

Date	Train Type	Maximum Noise Level L_{MAX} dB(A)	Noise Level L_{eq} dB(A)	Warning Device (Train Horn)
16th September 2020	Freight	96.4	73.6	yes
	Passenger	92.7	79.4	no
	Freight	89.6	77.2	no
	Freight	89.3	71.3	no
	Passenger	89.3	72.3	no
	Freight	88.8	72.6	no
	Passenger	87.0	74.2	no
	Passenger	86.9	72.2	no
	Passenger	86.8	74.8	no
	Passenger	86.7	69.8	yes
	Passenger	86.2	73.4	no
	Passenger	85.3	69.3	no
	Passenger	85.2	71	no
	Freight	85.1	70.6	yes
	Passenger	85.0	67.1	no
	Single event maximum noise level (SEM) dB(A)	**88.0**		
	Leq,24hour dB(A)		**66.1**	no
17th September 2020	Freight	100.0	83.9	no
	Freight	93.1	79.0	no
	Freight	92.0	74.5	yes
	Freight	90.9	72.0	yes
	Passenger	89.0	74.3	no
	Passenger	87.7	75.9	no
	Passenger	87.3	71.6	yes
	Passenger	87.3	74.4	no
	Freight	86.9	74.5	yes
	Passenger	86.8	70.7	no

	Passenger	86.7	71.8	no
	Passenger	85.9	70.2	no
	Passenger	85.8	70.5	yes
	Passenger	85.4	70.1	no
	Passenger	85.1	67.5	yes
	Single event maximum noise level (SEM) dB(A)	**88.7**		
	Leq,24hour dB(A)		**68.2**	
Maximum for both 24 hour periods	**Single event maximum noise level (SEM) dB(A)**	**88.7**		
	Leq,24hour dB(A)		**68.2**	

6 Noise Criteria

The Fitzgibbon Urban Development Area Development Scheme generally states noise impacts are to be addressed although does not provide specific noise criteria. Brisbane City Council *City Plan 2014* was considered to be the most relevant and appropriate reference for determining relevant noise criteria.

The Brisbane City Council *City Plan 2014* details site specific planning scheme zones, overlays and codes relevant to a site in the BCC local government area. Table 5 summarises the planning scheme requirements for the site which are relevant to the acoustic assessment.

Table 5: City Plan 2014 - Site Specific Acoustic Requirements

Zone	Development Code	Overlay Code
Emerging Community	Multiple Dwelling Code Centre or Mixed Use Code	Transport Noise Corridor Overlay

6.1 Multiple Dwelling Code

The primarily performance outcomes relating to acoustics within the *Multiple Dwelling Code* are detailed in the following Tables.

Table 6: Multiple Dwelling Code Performance Outcome P023

Performance Outcomes	Acceptable Outcomes
PO23 Development where not in a zone in the centre zones category or the Mixed use zone, provides vehicle access and parking that must not impact on the amenity and privacy of residents within or adjoining the site. Note—Where in a zone in the centre zones category or the Mixed use zone, the car parking provisions of the Centre or mixed use code apply.	**AO23.1** Development where not in a zone in the centre zones category or the Mixed use zone, ensures that a hardstand or manoeuvring area situated at ground level is: (a) located to minimise noise disturbance; (b) screened to: (i) minimise the reflection of car headlights onto dwelling windows; (ii) attenuate noise; (c) separated from habitable windows to minimise noise and fumes disturbance; (d) landscaped to soften the visual appearance of hardstand areas.

	AO23.2 Development where not in a zone in the centre zones category or the Mixed use zone: (a) ensures any vehicle movement or vehicle parking areas along the side or rear boundary are acoustically screened from adjoining dwellings; or (b) provides a vegetated buffer next to any movement or parking areas of 1m wide along the side boundary and 2m wide along the rear boundary.

To comply with *AO23.1 and AO23.2* it will be recommended that the development include an acoustic fence along the eastern boundary in proximity to the neighbouring residential dwellings.

Table 7: Multiple Dwelling Code Performance Outcome P042

Performance Outcomes	Acceptable Outcomes
PO42 Development that includes mechanical plant (including air-conditioning plant, heat pumps and swimming pool pumps) ensures it is located, designed and attenuated to achieve the following criteria: $L_{Aeq,adj,T}$ emitted from mechanical plant is not greater than the rating background level plus 3 at a sensitive use not associated with the development. Note— Where T is • Day (7am to 6pm): 11hr, • Evening (6pm to 10pm): 4hr, • Night (10pm to 7am): 9hr. Where- $L_{Aeq,adj,T}$ is the A-weighted equivalent continuous sound pressure level during measurement time T, adjusted for tonal and impulsive noise characteristics, determined in accordance with the methodology described in the Noise impact assessment planning scheme policy. The rating background level is determined in accordance with the methodology described in the Noise impact assessment planning scheme policy. Note—A noise impact assessment report prepared in accordance with the Noise impact assessment planning scheme policy can assist in demonstrating achievement of this performance outcome.	AO42 Development ensures mechanical plant is acoustically screened from nearby sensitive uses.

To comply with *Performance Outcome PO42* it is recommended the development comply with *Acceptable Outcome AO42* by applying acoustic screening to exposed mechanical plant with the potential to impact adjacent sensitive receivers.

PO42 criteria based on the measured background noise levels (Table 1 - Site east boundary) are summarised in Table 8.

Table 8: Mechanical Plant Criteria

Time Period	Measured RBL L_{90} dB(A)	Criteria $L_{Aeq,adj,T}$
Day (7am – 6pm)	39	42
Evening (6pm – 10pm)	38	41
Night (10pm – 7am)	33	36

6.2 Centre or Mixed Use Code

The retail/commercial component of the development is relevant for assessment within the *Centre or Mixed Use Code*.

6.2.1 Noise Planning Criteria

The noise emission criteria of Performance Outcome PO1 of the *Centre or Mixed Use Code (Table 9.3.3.F)* is presented in Table 9. The $L_{Aeq,adj,T}$ noise levels should not exceed the project specific criteria.

Table 9: Noise (Planning) Criteria

Location	Criteria	Intrusive noise criteria, dB(A) Day, evening and night $L_{Aeq,adj,T}$ are not greater than the RBL plus the value in 'Column 1' for the relevant criteria location				Acoustic amenity criteria, dB(A) Day, evening and night $L_{Aeq,adj,T}$ are not greater than the values in this column for the relevant criteria location		
		Column 1	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am	Day	Evening	Night
Beams Road	Low medium density residential zone boundary	3	54	52	39	55	45	40
	Project Specific Criteria*		54	45	39			
Site (east boundary)	Low medium density residential zone boundary	3	42	41	36	55	45	40
	Project Specific Criteria*		42	41	36			

*The project specific noise criterion is determined by applying the most stringent value from the Intrusive and Amenity noise criteria for each time period.

6.2.2 Night-time noise criteria

The night-time noise criteria for 'impact / short duration' type noise sources are outlined in *Table 9.3.3.3.H* of the code. This criteria is reproduced in Table 10. The project specific criteria is identified in 'bold'.

Table 10: Night-time Criteria (Table 9.3.3.3.H)

Criteria Location	Where the existing $L_{Aeq,9hr}$ night at the criteria location is:	Average of the highest 15 single L_{Amax} events over a given night period is not greater than the following values at the relevant criteria location	The Absolute highest single L_{Amax} event over a given night period is not greater than the following values at the relevant criteria location
At the zone boundary of: Low density residential zone	<45dB(A)	50dB(A)	55dB(A)
	45 to 60dB(A) **49 dB(A)**	$L_{Aeq,9hr\ night}$ + 5dB(A) **54 dB(A)**	$L_{Aeq,9hr\ night}$ + 10dB(A) **59 dB(A)**
	>60dB(A)	65dB(A)	70dB(A)

6.3 Transport Noise Corridor Overlay Code

The Transport Noise Corridor Overlay of City Plan 2014 identifies the site as being situated within a transport noise corridor as specified by the Queensland Development Code MP4.4. Table 11 outlines the performance outcomes of the Transport Noise Corridor Overlay Code.

Table 11: Transport Noise Corridor Overlay Code outcomes, City Plan 2014

Performance Outcomes	Acceptable Outcomes
PO1 Development provides outdoor space for passive recreation in a manner where transport noise has been minimised.	**AO1** Development ensures that each dwelling: (a) has a balcony or outdoor recreation area shielded by the building from direct road traffic noise; or (b) with a balcony exposed to road traffic noise has a solid gap free balustrade

It will be recommended the development adopt Acceptable Outcome AO1 where balconies exposed to road traffic noise have a solid gap free balustrade.

6.4 Road Traffic Noise

The site is located in the local government transport noise corridor of Beams Road. To ensure a satisfactory level of acoustic amenity is provided for the development, an assessment has been conducted to achieve compliance with the requirements of QDC MP4.4.

6.4.1 Queensland Development Code MP4.4 – Road Traffic Noise

The *Queensland Development Code Part MP 4.4 - 'Buildings in a Transport Noise Corridor'* August 2015 (QDC) specifies Noise Categories to ensure that habitable rooms of residential buildings are adequately protected from transport noise over a 10-year planning horizon.

The 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[1]. 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 12.

Table 12: Road Traffic Noise Category Levels – QDC MP4.4 (Schedule 3)

Noise Category	Level of Transport Noise* $L_{A10,18Hour}$ for State-Controlled Roads and Designated Local Government Roads
Category 4	≥ 73 dB(A)
Category 3	68 – 72 dB(A)
Category 2	63 – 67 dB(A)
Category 1	58 – 62 dB(A)
Category 0	≤ 57 dB(A)

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

6.5 Rail Noise

The assessment of rail noise is considered under the following criteria.

6.5.1 State Development Assessment Provisions (SDAP)

The noise criteria for land affected by emissions from rail activities are contained in State Code 2 of the State Development Assessment Provisions (SDAP). The criteria are reproduced in Table 13.

Table 13: SDAP Noise Criteria - Rail Noise

Performance Outcomes	Acceptable Outcomes
PO25 Development involving: 1. an accommodation activity; or 2. land for a future accommodation activity minimises noise intrusion from a railway or type 2 multi-modal corridor in habitable rooms.	AO25.1 A noise barrier or earth mound is provided which is designed, sited and constructed: 1. to meet the following external noise criteria at all facades of the building envelope: a. ≤65 dB(A) Leq (24 hour) façade corrected b. ≤87 dB(A) (single event maximum sound pressure level) façade corrected 2. in accordance with the Civil Engineering Technical Requirement – CIVIL-SR-014 Design of noise barriers adjacent to railways, Queensland Rail, 2011.

[1] AS NZS 2107:2016. Acoustics - Recommended design sound levels and reverberation times for building interiors

Performance Outcomes	Acceptable Outcomes
	Habitable rooms of relevant residential buildings located within a transport noise corridor must comply with the Queensland Development Code MP4.4 Buildings in a transport noise corridor, Queensland Government, 2015. Transport noise corridors are mapped on the State Planning Policy Interactive Mapping System.
PO26 Development involving an accommodation activity minimises noise intrusion from a railway or type 2 multimodal corridor in outdoor spaces for passive recreation	**AO26.1** A noise barrier or earth mound is provided which is designed, sited and constructed: 1. to meet the following external noise criteria in outdoor spaces for passive recreation: a. ≤62 dB(A) Leq (24 hour) free field b. ≤84 dB(A) (single event maximum sound pressure level) free field 2. in accordance with the Civil Engineering Technical Requirement – CIVIL-SR-014 Design of noise barriers adjacent to railways, Queensland Rail, 2011. OR **AO26.2** Each dwelling has access to an outdoor space for passive recreation which is shielded from a railway or type 2 multi-modal corridor by a building, a solid gap-free fence, or other solid gap-free structure. AND **AO26.3** Each dwelling with a balcony directly exposed to noise from a railway or type 2 multi-modal corridor has a continuous solid gap-free balustrade (other than gaps required for drainage purposes to comply with the Building Code of Australia).

6.5.2 Queensland Development Code MP4.4 - Rail

The *Queensland Development Code Part MP 4.4 - 'Buildings in a Transport Noise Corridor* August 2015 (QDC) specifies Noise Categories to ensure that habitable rooms of residential buildings are adequately protected from transport noise over a 10-year planning horizon.

The Noise Categories list the minimum acoustic R_W ratings for each building component to comply with the indoor sound criteria. 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 14.

Table 14: Rail Noise Category Levels – QDC MP4.4 (Schedule 3)

Noise Category	Single event maximum noise* (L_{Amax}) for Railway Land
Category 4	≥ 85
Category 3	80 – 84
Category 2	75 – 79

Noise Category	Single event maximum noise* (L_{Amax}) for Railway Land
Category 1	70 – 74
Category 0	≤ 69

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

7 Analysis – Onsite Noise

An assessment of on-site activities associated with the proposed development was conducted to determine potential impacts at the nearest noise sensitive receivers.

7.1 Noise Sensitive Receivers

This assessment will focus on the nearest noise sensitive receivers as outlined below and shown in Figure 4. If compliance can be achieved at these receivers, then all remaining noise sensitive locations are expected to comply.

- Receiver 1 - Residential dwellings north of the site (Low medium density residential zone)
- Receiver 2 - Residential dwellings east of the site (Low medium density residential zone)

Figure 4: Noise Sensitive Receivers

7.2 Noise Source Levels

Table 15 presents the typical variable noise sources associated with the development with the potential to impact the nearest sensitive receivers. The noise source levels were calculated to one metre and include corrections for tonality and impulsiveness as per AS1055. The number of events was estimated for a 'peak' one-hour time period providing a 'worst case scenario' applied to all time periods.

Table 15: Typical Noise Sources Associated with the Development

Noise Source	Source Location	Measured Duration (s)	$L_{eq,T}$ dB(A)	L_{max} dB(A)	'Peak' events per hour
Car door closure	Nearest car park	2	75	83	34
Car bypass	Nearest internal road/ driveway	6	62	N/A*	246
Car engine start	Nearest car park	3	72	75	34
Conversation	Nearest congregation location	60	58	N/A*	Continuous
Deliveries	Nearest loading bay	60	85	86	2

*People and vehicle pass-by noise is excluded from L_{max} assessment in accordance with NIAPSP

7.3 Calculation Assumptions

The following assumptions have been made for noise calculations:

- Onsite vehicle movement rates (based on TTM traffic engineering predictions) for a peak (1 hour) period were applied. Car movements were considered at the nearest car parking or driveway area to the receiver. Car door closures and engine starts were predicted from the nearest group of car parking spaces relative to the receiver.
- The method of predicting vehicle noise from the nearest single location is conservative as the noise sources would be spread out across the car park at varying distances from the receiver.
- The conversation noise level is based on a 'male' voice with 'normal' vocal effort as reported in published data contained in Harris, C.M., Handbook of Acoustical Measurements and Noise Control – 3rd ed. Ch 16.3, Mc Graw-Hill Inc, 1991. The noise duration was assumed to be continuous.
- Deliveries were predicted from the nearest loading bay and include all activities associated with loading and unloading the vehicle.
- Where applicable, noise attenuation from the recommended acoustic barrier (see Section 10.1) was included.

7.4 Predicted Onsite Noise Levels at Receivers

The predicted noise levels from typical onsite activities are based on the noise sources presented in Table 15 and the assumptions outlined in Section 7.3. Sample calculations are included in Appendix C.

7.4.1 Noise Criteria - L_{eq}

Table 16 presents the predicted onsite noise emission levels at the nearest sensitive receiver.

Table 16: Predicted Noise Planning Impacts

Receiver	Noise Source	Predicted External Noise Level L_{Aeq} dB(A)	Complies with Criteria?		
			Day 7am-6pm 54dB(A)	Evening 6pm-10pm 45dB(A)	Night 10pm-7am 39dB(A)
1	Car door closure	27	✓	✓	✓
	Car bypass	27	✓	✓	✓
	Car engine start	25	✓	✓	✓
	Conversation	27	✓	✓	✓
	Deliveries	31	✓	✓	✓
2	Noise Source	Predicted External Noise Level L_{Aeq} dB(A)	Day 7am-6pm 42dB(A)	Evening 6pm-10pm 41dB(A)	Night 10pm-7am 36dB(A)
	Car door closure	28	✓	✓	✓
	Car bypass	35	✓	✓	✓
	Car engine start	27	✓	✓	✓
	Conversation	29	✓	✓	✓
	Deliveries	41	✓	✓	×

All noise sources are predicted to comply with the relevant criteria at all receivers during all time periods with the exception of:

- Deliveries at Receiver 2 during the night period. It will be recommended that deliveries occur during the day/evening period 7am – 10pm.

7.4.2 Night Time Noise Criteria - L_{max}

Table 17 presents the predicted night time noise emission levels at the nearest sensitive receivers. The criteria are specified in the table heading.

Table 17: Predicted Night Time Noise Impacts

Receiver	Noise Source	Predicted Level L_{max} dB(A)	Complies with Criteria?
			Night 54 / 59 dB(A)
1	Car door closure	52	✓
	Car pass-by	N/A*	✓

Receiver	Noise Source	Predicted Level L_{max} dB(A)	Complies with Criteria? Night 54 / 59 dB(A)
	Car engine	44	✓
	Conversation	N/A*	✓
	Deliveries	46	✓
2	Car door closure	54	✓
	Car pass-by	N/A*	✓
	Car engine	46	✓
	Conversation	N/A*	✓
	Deliveries	56	✗

*People noise and vehicle pass-by noise is excluded from L_{max} assessment in accordance with NIAPSP

All noise sources are predicted to comply at all receivers during the night period with the exception of:

- Deliveries at Receiver 2. It will be recommended that deliveries occur during the day/evening period 7am – 10pm.

8 Analysis – Road Traffic Noise

An assessment of road traffic noise onto the proposed development was conducted to determine the acoustic treatment requirements for predicted compliance with the relevant criteria.

Future Beams Road and/or busway upgrades/overpass are not included in this assessment due to lack of detail of future upgrade plans, location and vehicle volume predictions.

8.1 Traffic Volumes

Existing traffic volumes and growth rates were obtained from Cardno traffic engineers. The traffic volumes used in the noise model are presented in Table 18.

Table 18: Traffic Volumes used in the Noise Model

Road	Traffic Volumes (AADT)			Heavy Vehicles (%)	Growth Rate (%)
	2016	2017	2030		
Beams Road	13,500	13,770	17,813	5.0%	2.0%

The 18 hour traffic volumes used in the noise model are taken to be 95% of the AADT (Annual average daily traffic).

8.2 Noise Model

8.2.1 Noise Modelling Parameters

Road traffic noise predictions were conducted using 'SoundPLAN v8.1', a CoRTN based modelling program. The basis of the 'SoundPLAN' model is presented in Table 19.

Table 19: Noise Modelling Parameters

Description	Value
Noise modelling standard	CoRTN (UK)
Grid spacing (noise maps)	2m
Road surface type	Impervious (+0 dB(A))
Ground contours	Natural ground level data from Land Partners
Beams Road Speed limit	60 km/h
Noise source height above grade	0.5m
Floor heights	2.8m
Receiver heights	1.5m above floor level
Façade correction	+2.5 dB(A)

8.2.2 Noise Model Verification

To verify the road traffic noise model, the $L_{A10,\ 18hour}$ noise levels were modelled and compared to the measured levels as presented in Table 20. As the noise monitor was in a free-field location, the predicted noise level is also shown as free-field.

Table 20: Comparison of Measured and Predicted Road Traffic Noise Levels

Location	Measured $L_{A10,\ 18\ hour}$	Predicted $L_{A10,\ 18\ hour}$	Required Correction
Beams Road	64	64	0

The modelled level is within the allowable tolerance of 2 dB(A) of the measured level, therefore no correction is required to the model.

8.3 Predicted Noise Levels

Modelling was conducted to determine road traffic noise levels at the development in the 10 year planning horizon from a forecast completion date of 2020. The predicted future noise levels take into account the 2030 traffic volumes.

Predicted road traffic noise contour maps illustrated as QDC noise categories for Ground floor, Level 3, and Level 7 are presented in the following figures.

Figure 5: Predicted Road Traffic Noise Levels – Ground Floor (Indicative)

Figure 6: Predicted Road Traffic Noise Levels – Level 3 (Indicative)

Figure 7: Predicted Road Traffic Noise Levels – Level 7 (Indicative)

Based on the receiver point results presented in Appendix D (the noise contour maps above are indicative only), the development is predicted to be impacted by road traffic noise at QDC noise category 0 - 3.

Solid balcony balustrades and facade acoustic treatments will be recommended in order to provide improved amenity for balconies and comply with QDC MP4.4 internal criteria for habitable rooms.

QDC noise categories and associated acoustic treatment requirements for each façade and floor level are detailed in Section 10.

9 Rail Noise Assessment

An assessment of rail noise onto the proposed development was conducted to determine the acoustic treatment requirements for predicted compliance with the relevant criteria.

9.1 Rail Volumes

Rail timetables provided by Queensland Rail (QR) indicate approximately 250 trains (including 15 freight trains) are scheduled to pass site per day. QR advised that all services are subject to alteration, addition and cancellation which may vary the number of actual trains passing daily. The actual number of train passes during the noise monitoring period are summarised in Section 9.2.2 below.

9.2 Noise Model

9.2.1 Noise Modelling Parameters

Rail noise predictions were conducted using 'SoundPLAN' v8.1. The basis of the 'SoundPLAN' model is as follows:

Table 21: Rail Noise Modelling Parameters

Description	Value
Prediction methodology	Nordic Rail Prediction (Kilde Rep. 130)
Grid spacing (noise maps)	2m
Train Frequency (daily) passenger / freight	235 / 15 (approximate)
Train speed	Passenger: 60km/h (estimated) Freight: 80km/h (standard reference speed)
Train length	Passenger: 144m Freight: 1000m Diesel engine: 36m (dual locomotive)
Rail track head height	0.6m above ground
Rail noise source height	0.5m (wheels) and 4.0m (diesel engine) above track head height (includes Kilde +0.5m addition)
L1 train type corrections	Passenger electric: -4.6dB Diesel engine: +4.4dB Freight wagons: -6.5dB
L2 correction (dLtype engine)	-100dB (removes contribution)
Bend correction	+3dB (300m<R<500m)
Rail noise measurement distance	19m from the nearest line
Ground contours	Elevation data from Land Partners
Acoustic Barrier	Existing rail acoustic barrier – height 4.0m, approx. 30m length from site south corner
Floor heights	3.0m (Building E 2.8m)
Residential receiver height	1.5m above each floor level

Receiver Buildings RL	Buildings A, B C, D, F, G: 13.8m (Ground Floor) Building E: 16.8m (First Floor)
Façade correction	+2.5 dB(A)

9.2.2 Noise Model Verification

The measured rail noise levels at the monitoring location were verified in the noise model prior to modelling noise impacts at the development. Table 22 presents the results of the rail noise model verification.

Table 22: Verification of the Rail Noise Model

Location	Descriptor	Measured dB(A)	Predicted dB(A)	Required Correction
North noise monitor	L_{Amax}	86.1	90.0	-1.9
	$L_{Aeq,24hr}$	67.2	67.9	0
South noise monitor	L_{Amax}	88.7	90.0	0
	$L_{Aeq,24hr}$	68.2	71.4	-1.2

Corrections were applied to the rail noise source to bring the model to +2dB of the measured level. The over prediction is considered to possibly be caused by freight locomotives with a lower engine noise emission on site (ie. notch setting).

Furthermore, the actual train movement data for the noise monitoring period was obtained from Queensland Rail (received 27/04/2021) and is reproduced below.

Carseldine **Daily Train Count Average -**

Year	Month Number	Month	Calendar Date	Day Of Week	Week Comm Monday	Citytrain	Freight	Maintenance	Travel Network	Total Count
2020	09	Sep	14/09/2020	Mon	14/09/20	240	7		6	253
2020	09	Sep	15/09/2020	Tue	14/09/20	243	11	1	8	263
2020	09	Sep	16/09/2020	Wed	14/09/20	243	13		3	259
2020	09	Sep	17/09/2020	Thu	14/09/20	242	14	1	7	264
2020	09	Sep	18/09/2020	Fri	14/09/20	242	14		7	263
2020	09	Sep	19/09/2020	Sat	14/09/20	167	12		6	185
2020	09	Sep	20/09/2020	Sun	14/09/20	159	11		3	173

The actual daily train movements during the monitoring period (16-17/09/2020) were 243-242 Citytrains and 13-14 Freight trains. This is representative of the typical worst-case scheduled train movements (approximately 250 Citytrains and 15 Freight trains). A small difference in train numbers is not expected to alter the measurement results. The monitoring period was during the peak movement period for the week. Therefore, the measured level is considered to be representative and hence appropriate to use for model verification. Additionally, the modelled noise level is still +2dB above the measured level (as per Table 22).

9.3 Predicted Noise Levels

Predicted rail noise contours (L_{max} and $L_{eq24,hr}$, ground floor) are presented in Figure 8 and Figure 9 and compared to the SDAP criteria. The façade corrected SDAP criteria was used as the private outdoor space and external façade locations are both within the façade corrected zone of the proposed buildings.

Figure 8: Rail Noise Levels L_{max} - SDAP Criteria

Figure 9: Rail Noise Levels $L_{eq,24hr}$ - SDAP Criteria

Based on the receiver point modelling results presented in Appendix D, some building locations are predicted to exceed SDAP criteria (L_{max} and $L_{eq,24hr}$). An acoustic barrier (detailed in Section 10.1) is recommended to achieve compliance, primarily at ground floor locations.

Predicted rail noise contours (L_{max} and $L_{eq24,hr}$, ground floor) inclusive of a recommended acoustic barrier (detailed in Section 10.1), are presented in Figure 10 and Figure 11 and compared to the SDAP criteria. The façade corrected SDAP criteria was used as the private outdoor space and external façade locations are both within the façade corrected zone of the proposed buildings.

Figure 10: Rail Noise Levels L_{max} - SDAP Criteria – With Acoustic Barrier

Figure 11: Rail Noise Levels $L_{eq,24hr}$ - SDAP Criteria – With Acoustic Barrier

Rail noise levels are predicted to comply with SDAP criteria (L_{max} and $L_{eq,24hr}$, ground floor) with the inclusion of an acoustic barrier (detailed in Section 10.1).

Predicted rail noise contour maps (indicative) illustrated as QDC noise categories for Ground floor, Level 3, and Level 7 are presented in the following figures, inclusive of a recommended acoustic barrier (detailed in Section 10.1).

Figure 12: Rail Noise Levels L_{Amax} - QDC - Ground Floor (Indicative)

Figure 13: Rail Noise Levels L_{Amax} - QDC - Level 3 (Indicative)

Figure 14: Rail Noise Levels L_{Amax} - QDC - Level 7 (Indicative)

Based on the receiver point modelling results presented in Appendix D (noise contour maps above are indictive only), the development is predicted to be impacted by rail noise ranging from QDC noise category 0 to 4.

QDC noise categories and associated acoustic treatment requirements for each façade and floor level for compliance with internal criteria, are detailed in Section 10.

10 Recommendations

The recommended acoustic treatments are presented in the sections below to achieve predicted compliance with the relevant assessment criteria.

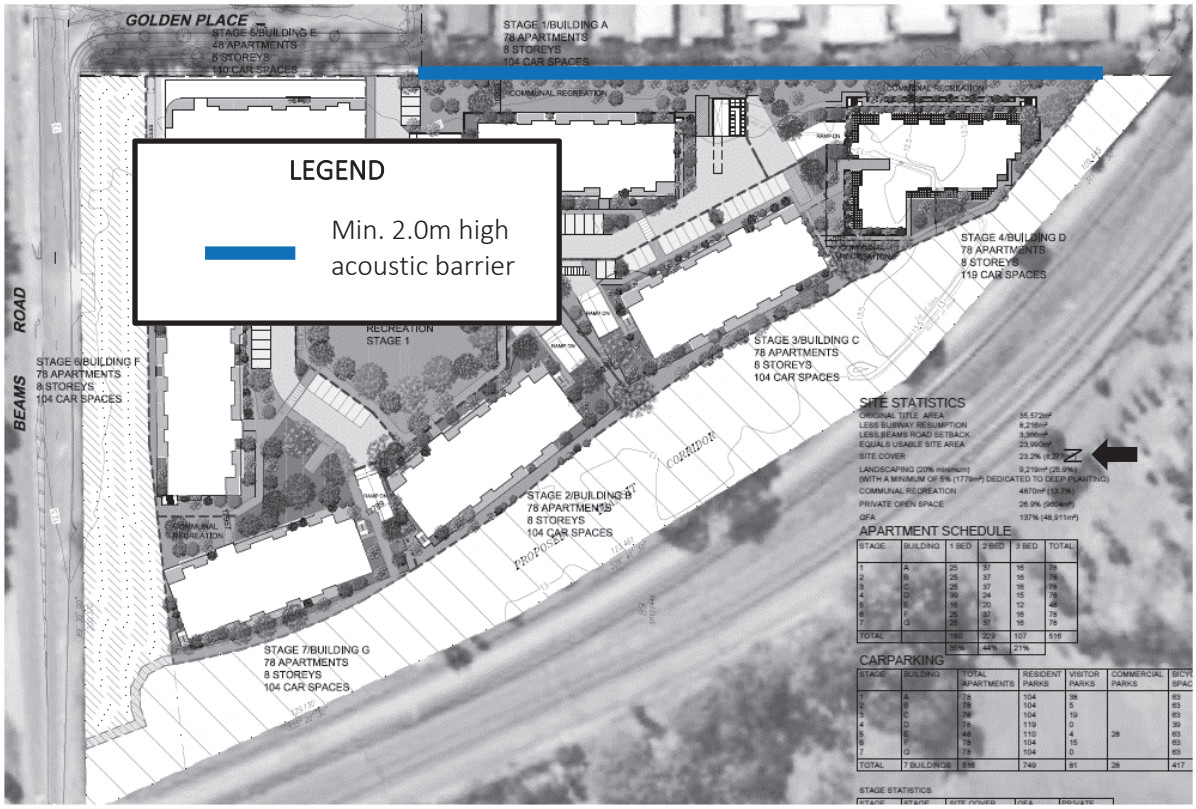
10.1 Acoustic Barrier – Onsite Noise

To comply with acoustic criteria for car park vehicle movements (and in accordance with *PO23*, *Multiple dwelling code*), screening of car parking areas is recommended with an acoustic barrier at the location, height and extent as shown in Figure 15.

The acoustic barrier should:

- Be the minimum height relative to the finished site level.
- Be of solid construction and have no gaps or holes for the extent shown.
- Be constructed of a material with a surface mass not less than 12.5kg/m^2.
- Be constructed of the following materials (but not limited to): lapped timber (minimum 40% overlap); plywood; masonry; compressed fibre cement sheet; minimum 5mm thick aluminium or minimum 2mm thick steel; glazing; earth mound or combination of the above.

Figure 15: Recommended Acoustic Barrier – Onsite Noise



10.2 Acoustic Barrier – Rail Noise

To comply with SDAP criteria for rail noise an acoustic barrier is recommended at the location, height and extent as shown in Figure 16 and Figure 17.

The acoustic barrier should:

- Be the minimum height relative to the finished site level.
- Constructed in accordance with the Queensland Rail's Civil Engineering Technical Requirement – CIVIL-SR-014 – Design of Noise Barriers Adjacent to Railways, QR, 2011.
- No gaps or holes should be evident in the barrier construction including at the base
- Be constructed of a material with a surface mass not less than 15.0kg/m2.
- Note only: The future development approval conditions for the project may require the noise barrier design to be submitted to the Department of Transport and Main Roads for review and approval, prior to the commencement of construction. Timber may not be an accepted material by Department of Transport and Main Roads.

Figure 16: Recommended Acoustic Barrier – Rail Noise - North

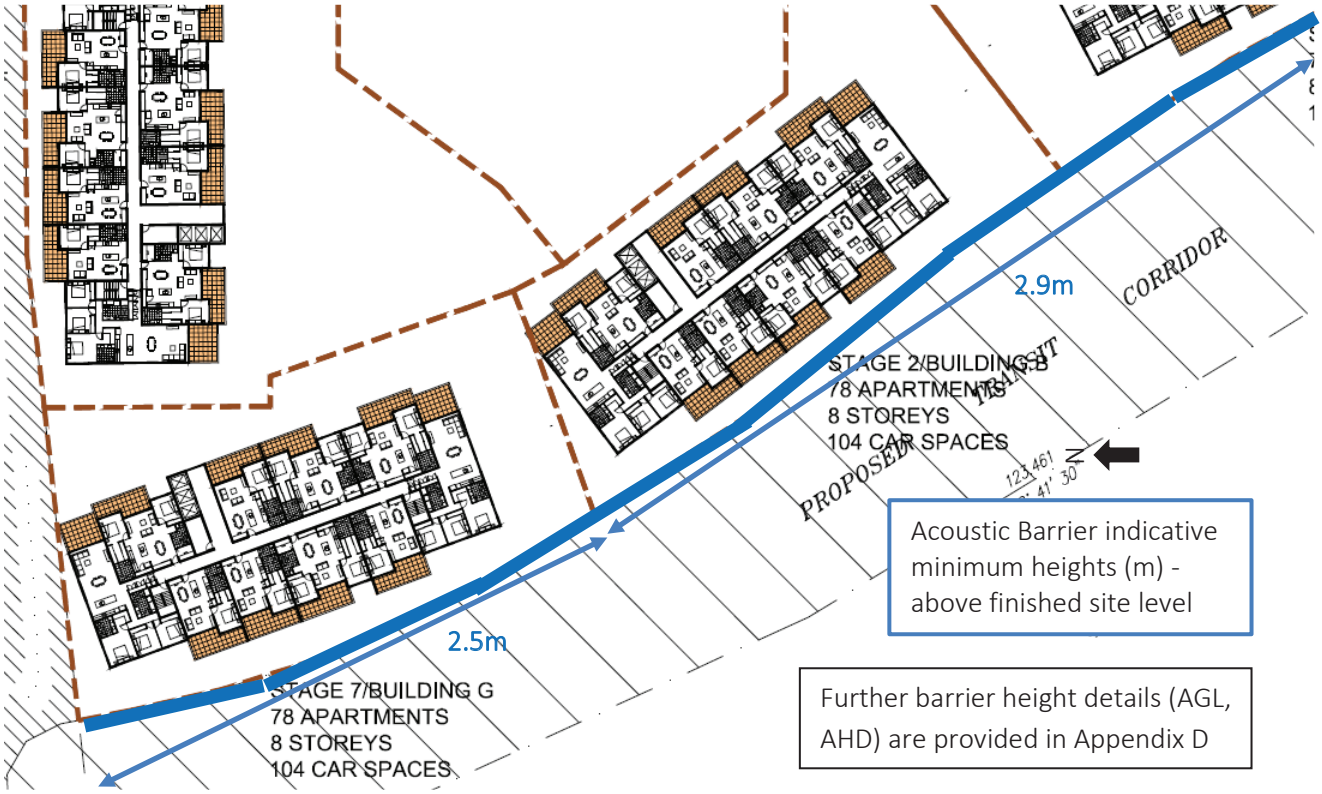
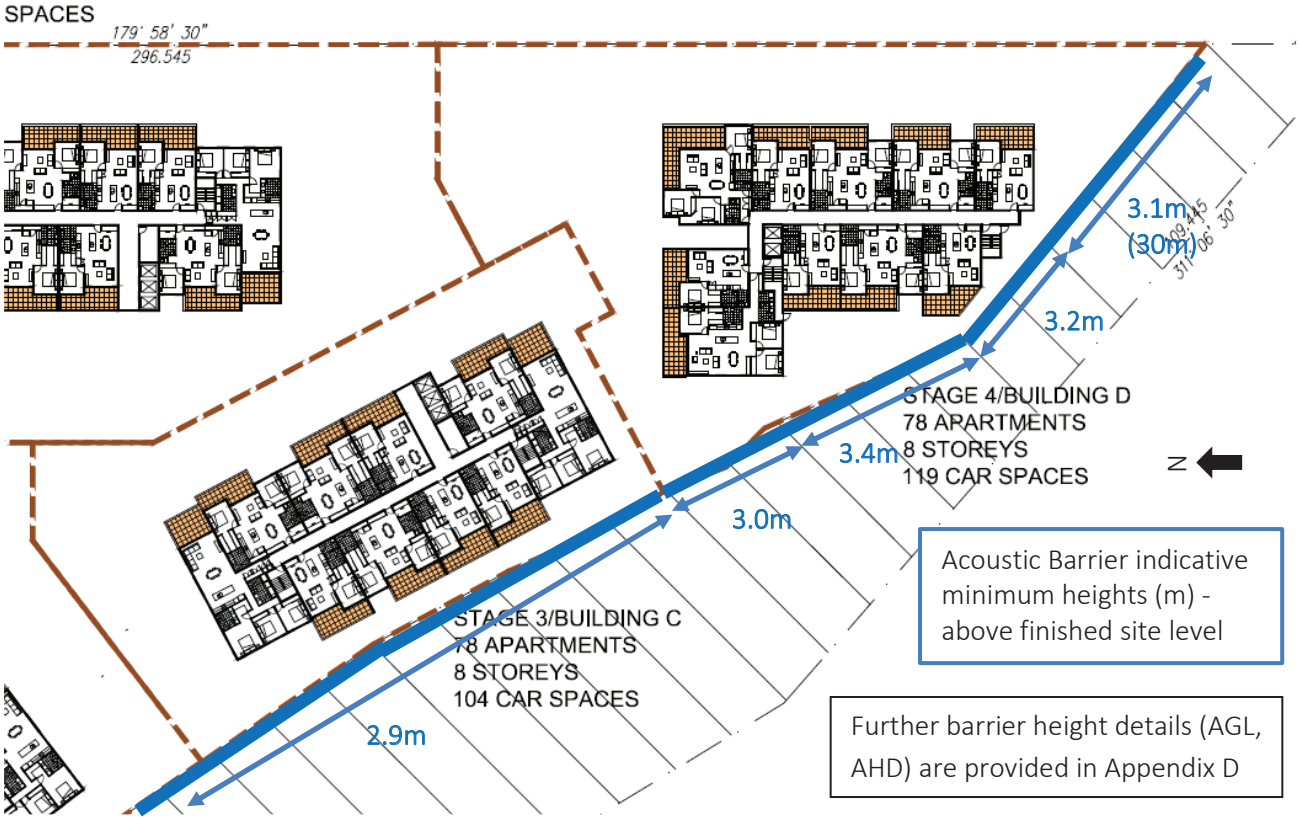


Figure 17: Recommended Acoustic Barrier – Rail Noise - South



10.3 Management Strategies

The following management strategies are recommended to minimise noise annoyance:

a. Deliveries to occur during the day/evening period (7am - 10pm).

b. Waste collection to occur during the day time period (7am – 6pm).

c. 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.

d. Speed bumps (if proposed) should be built into the finished surface of the car park / driveways and not be made of metal.

10.4 Façade Treatment

10.4.1 Road Traffic and Rail Noise

This section summarises the combined treatment required for habitable rooms for road traffic and rail noise to achieve compliance with the Queensland Development Code (QDC) MP4.4. For the purposes of the

development application, the QDC provides a conservative design approach and is applied for this assessment.

The QDC 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:

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

OR

b. Using materials with manufacturer's specifications that 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 23 presents the acoustic treatment requirements for habitable rooms in accordance with the QDC MP4.4 policy. The treatments are based on the predicted impacts from road traffic and rail noise.

Table 23: QDC Noise Category Treatments - Combined Road Traffic and Rail Noise

Building	Façade Direction	Floor Level	QDC Noise Category Habitable Rooms		
			Road Traffic	Rail	Maximum
See QDC Noise Category Results in Appendix E					

Details regarding noise categories and associated sound reduction (R_w) requirements for habitable rooms can be found within Schedule 1 of the QDC MP4.4. QDC Schedule 1 is reproduced in Table 24.

Table 24: QDC Rail Noise Categories and Associated Sound Reduction Requirements (QDC MP4.4 - Schedule 1)

QDC Noise Category	Required Sound Reduction Rating (R_w) for Habitable Rooms			
	Glazing > 1.8m²	Glazing ≤ 1.8m²	External Walls	Roof and Ceiling
Category 4	R_w 43	R_w 43	R_w 52	R_w 45
Category 3	R_w 38	R_w 35	R_w 47	R_w 41
Category 2	R_w 35	R_w 32	R_w 41	R_w 38
Category 1	R_w 27	R_w 24	R_w 35	R_w 35
Category 0	None			

Details regarding sound reduction ratings (R_w) and acceptable forms of construction can be found within QDC MP 4.4 Schedule 2. QDC Schedule 1 and 2 are provided in Appendix F of this report.

10.5 QDC Noise Category 4 - Sliding Doors or Wintergardens

For facades and floors identified to be impacted by QDC noise category 4 (as per Table 23), the QDC requirements specify a glazing sound reduction rating of R_w43. To achieve this for glazed sliding doors, this requires a double sliding door system. Note, this provides the occupant with the *option* to utilise a second sliding door for improved noise amenity. The occupant still has the option to operate one sliding door if they choose.

The alternative option to avoid double sliding doors, is to have 'wintergarden' balconies - operable windows above solid balustrades. Note, operable windows provides the occupant with the *option* of an enclosed or open balcony. This also provides the option of improved acoustic amenity for the balcony area.

If enclosed balconies are utilised, and based on indicative external noise impact levels and internal sound level criteria, with a solid, gap free balustrade, the expected indicative glazing acoustic performance for an enclosed balcony is provided in Table 25.

Table 25: Indicative Glazing Treatments for Enclosed Balconies

Glazing	Indicative Min R_W	Indicative Glazing Thickness	Acoustic seals
Balcony glazing (above solid balustrade)	27	4mm float	Yes
Sliding door to balcony	31	6.38mm laminated	Yes

10.6 Solid Balustrades

To comply with *Performance Outcome PO1* of the *Transport Noise Corridor Overlay Code*, we recommend the adoption of *Acceptable Outcome AO1*:

> *Development ensures that each dwelling:*
>
> *a) has a balcony or outdoor recreation area shielded by the building from direct road traffic noise; or*
> *b) with a balcony exposed to road traffic noise has a solid gap free balustrade.*

Solid balustrading also achieves compliance with SDAP AO26.2/AO26.3 for rail noise.

Solid balustrades are recommended for all residential balconies with a QDC noise category of 2 or higher (as per Table 23). Examples of possible construction materials for solid balustrading are masonry, glazing or other solid material with no gaps or holes. A gap at the bottom of the balustrade may be required for drainage purposes to comply with the Building Code of Australia.

10.7 Mechanical Plant

As detailed mechanical plant selections are not available at this stage, it is not possible to carry out a detailed examination of any ameliorative measures that may be required to achieve the noise criteria.

To comply with planning scheme acceptable outcomes for mechanical plant, we recommend the following for plant with the potential to adversely impact nearby sensitive receivers:

> *Development ensures mechanical plant is acoustically screened from nearby sensitive uses.*

The definition of 'acoustically screened' is provided in Table SC1.2.3.B of Brisbane City Plan 2014, Schedule 1 Definitions:

> *The source of noise is completely screened from view of habitable rooms (including balconies, patios, decks and verandas) of an adjoining sensitive use by solid, gap free material and construction e.g. acoustic fence, building, or enclosure.*
>
> *Acoustic barrier: Solid, gap free barrier with minimum surface density of 12.5kg/m^2*

Furthermore, it is also recommended that a mechanical plant noise assessment is conducted once plant selections are finalised to ensure noise emissions comply with criteria. Noise emission compliance measurements should then be conducted after the equipment is installed.

11 Conclusion

TTM conducted a noise assessment of the proposed mixed use development located at 490 Beams Road, Fitzgibbon. The assessment was based upon relevant planning scheme and State transport noise development codes.

Compliance with the relevant planning scheme and State transport noise requirements is predicted based on the implementation of the recommendations outlined in Section 10 of this report.

Appendix A Development Plans

SITE STATISTICS

ORIGINAL TITLE AREA	35,572m²
LESS SUBWAY RESUMPTION	8,216m²
LESS BEAMS ROAD SETBACK	3,366m²
EQUALS USABLE SITE AREA	23,990m²
SITE COVER	23.2% (8,273m²)
LANDSCAPING (20% minimum) (WITH A MINIMUM OF 5% (177m²) DEDICATED TO DEEP PLANTING)	9,219m² (25.9%)
COMMUNAL RECREATION	4870m² (13.7%)
PRIVATE OPEN SPACE	28.9% (9904m²)
GFA	137% (48,911m²)

APARTMENT SCHEDULE

STAGE	BUILDING	1 BED	2 BED	3 BED	TOTAL
1	A	25	37	16	78
2	B	25	37	16	78
3	C	25	37	16	78
4	D	39	24	15	78
5	E	16	20	12	48
6	F	25	37	16	78
7	G	25	37	16	78
TOTAL		180	229	107	516
		35%	44%	21%	

CARPARKING

STAGE	BUILDING	TOTAL APARTMENTS	RESIDENT PARKS	VISITOR PARKS	COMMERCIAL PARKS	BICYCLE SPACES
1	A	78	104	36		63
2	B	78	104	5		63
3	C	78	104	19		63
4	D	78	119	0		39
5	E	48	110	4	28	63
6	F	78	104	15		63
7	G	78	104	0		63
TOTAL	7 BUILDINGS	516	749	81	28	417

STAGE STATISTICS

STAGE	STAGE AREA	SITE COVER	GFA	PRIVATE OPEN SPACE
1	7,226m²	15.9% (1,156m²)	7,317m²	1,449m²
2	2,418m²	47.8% (1,156m²)	7,317m²	1,449m²
3	2,633m²	43.9% (1,156m²)	7,317m²	1,449m²
4	3,195m²	34.2% (1,094m²)	8,892m²	1,419m²
5	2,793m²	50.0% (1,396m²)	5,634m²	940m²
6	3,363m²	34.3% (1,156m²)	7,317m²	1,449m²
7	2,363m²	48.9% (1,156m²)	7,317m²	1,449m²
TOTAL		23.2% (8,273m²)	48,911m²	9,604m²

ISSUE	DATE	DESCRIPTION	INITIAL
M	24.11.2020	REVISION	GM
L	14.10.2020	REVISION	MW
K	08.09.2020	REVISION	MW
J	17.07.2020	REVISION	MW
H	21.05.2020	REVISION	MW
G	21.05.2020	REVISION	MW
F	28.01.2020	REVISION	MW
E	28.11.2019	REVISION	MW
D	22.11.2019	REVISION	MW
C	15.08.2019	REVISION	GM
B	19.06.2019	REVISION	GM
A	03.06.2019	REVISION HEIGHTS	MW
	23.10.2017	PRELIMINARY ISSUE	MW

WSA wiltshirestevens architecture

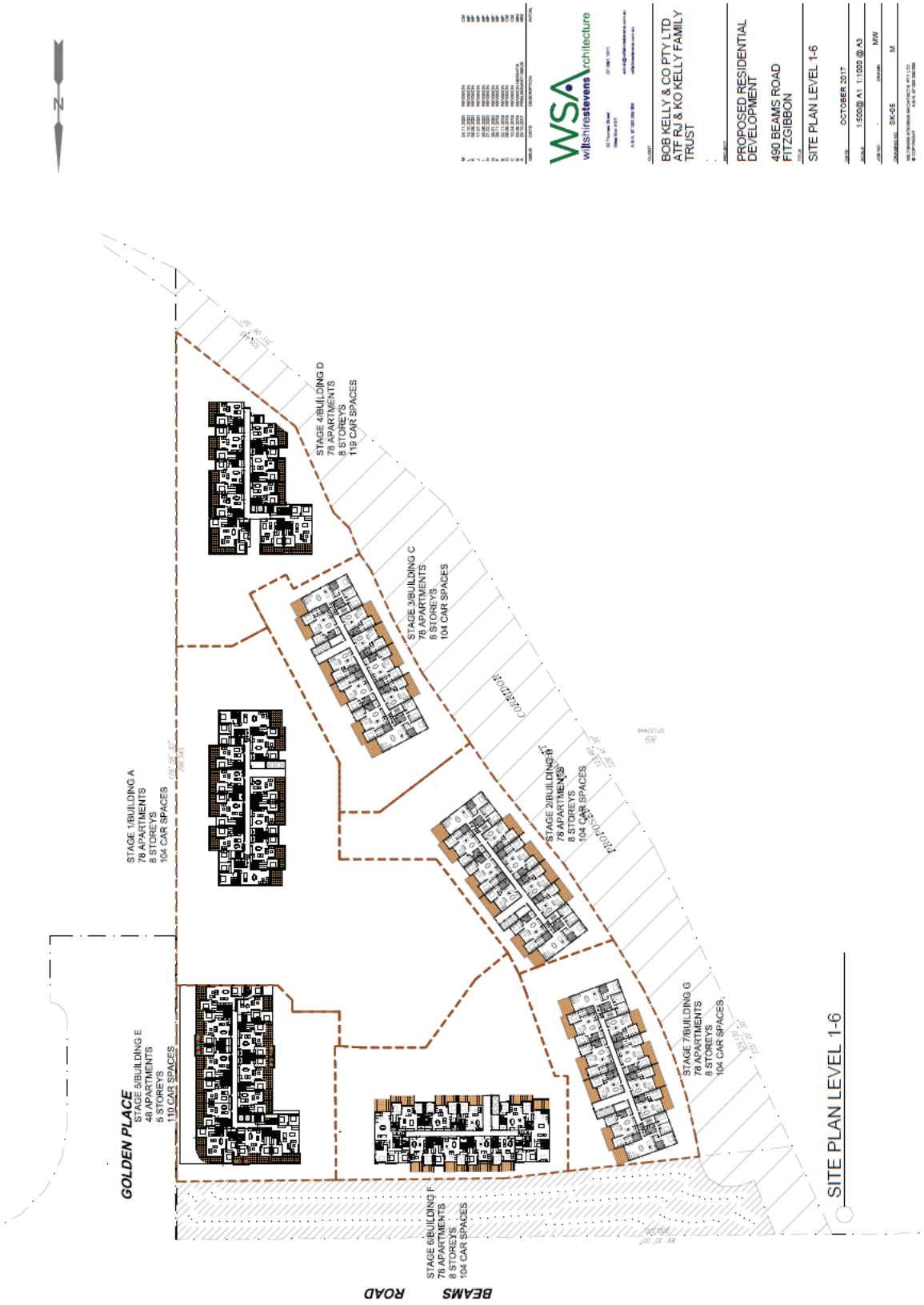
CLIENT
BOB KELLY & CO PTY LTD
ATF RJ & KO KELLY FAMILY TRUST

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT

490 BEAMS ROAD
FITZGIBBON

TITLE
SITE PLAN

DATE OCTOBER 2017
SCALE 1:500@ A1 1:1000 @ A3
JOB NO -
DRAWN MW
DRAWING NO SK-02
M


N
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BOB KELLY & CO PTY LTD
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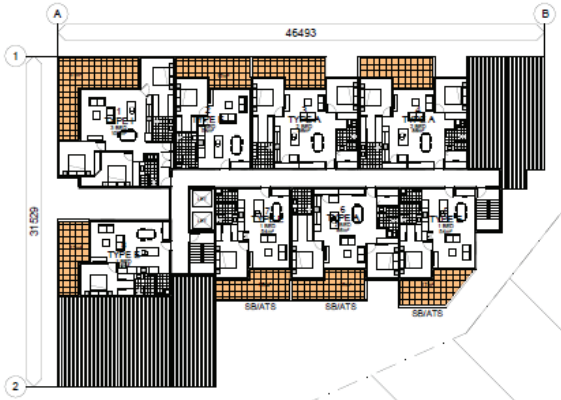
TRUST
PROPOSED RESIDENTIAL
DEVELOPMENT
490 BEAMS ROAD
FITZGIBBON
SITE PLAN LEVEL 1-6
OCTOBER 2017
1:500@ A1 1:1000 @ A3
SK-05
STAGE 1/BUILDING A
78 APARTMENTS
8 STOREYS
104 CAR SPACES
STAGE 2/BUILDING B
78 APARTMENTS
8 STOREYS
104 CAR SPACES
STAGE 3/BUILDING C
78 APARTMENTS
8 STOREYS
104 CAR SPACES
STAGE 4/BUILDING D
78 APARTMENTS
8 STOREYS
118 CAR SPACES
STAGE 5/BUILDING E
48 APARTMENTS
5 STOREYS
110 CAR SPACES
STAGE 6/BUILDING F
78 APARTMENTS
8 STOREYS
104 CAR SPACES
STAGE 7/BUILDING G
78 APARTMENTS
8 STOREYS
104 CAR SPACES
GOLDEN PLACE
BEAMS ROAD
SITE PLAN LEVEL 1-6

BUILDING D LEVEL 0 - 6 FLOOR PLAN



BUILDING D LEVEL 7 FLOOR PLAN

FLOOR LEVELS

LEVEL 0	FL 13.600
LEVEL 1	FL 16.600
LEVEL 2	FL 19.600
LEVEL 3	FL 22.600
LEVEL 4	FL 25.600
LEVEL 5	FL 28.600
LEVEL 6	FL 31.600
LEVEL 7	FL 34.600

TOTAL APARTMENTS

1 BED	39	50%
2 BED	24	31%
3 BED	15	19%
TOTAL	78	

ATS... ANTI-THROW SCREEN TO QLD RAIL REQUIREMENTS.

PS... METAL PRIVACY SCREEN

SB... SOLID, GAP FREE BALUSTRADE AS REQUIRED BY SOAP STATE CODE 2

N

ISSUE	DATE	DESCRIPTION	INITIAL
L	14.10.2020	REVISION	MF
K	09.09.2020	REVISION	MF
J	17.07.2020	REVISION	MF
I	25.06.2020	REVISION	MF
H	21.02.2020	REVISION	MF
G	28.01.2020	REVISION	MF
F	29.11.2019	REVISION	MF
E	22.10.2019	REVISION	MF
D	03.10.2019	REVISION	MF
C	19.04.2019	REVISION	CM
B	02.04.2019	REVISION HEIGHTS	MW
A	29.10.2017	PRELIMINARY ISSUE	MW

WSA
wiltshirestevens architecture
32 Thomas Street
West End 4101
07 3891 1611
A.B.N. 97 060 369 658

CLIENT
BOB KELLY & CO PTY LTD ATF RJ & KO KELLY FAMILY TRUST

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT

490 BEAMS ROAD FITZGIBBON

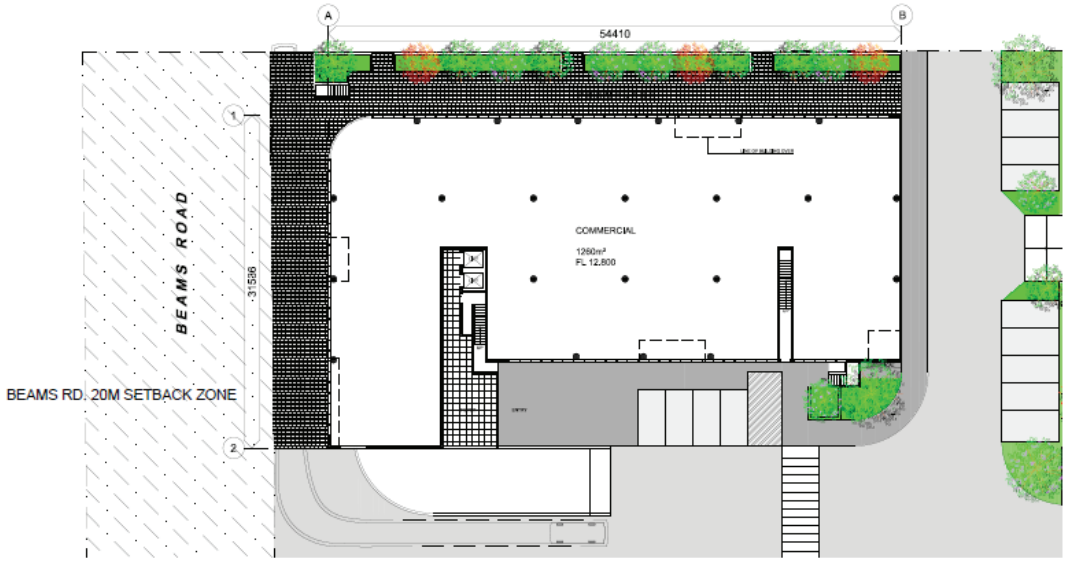
TITLE
BUILDING D FLOOR PLANS

DATE OCTOBER 2017

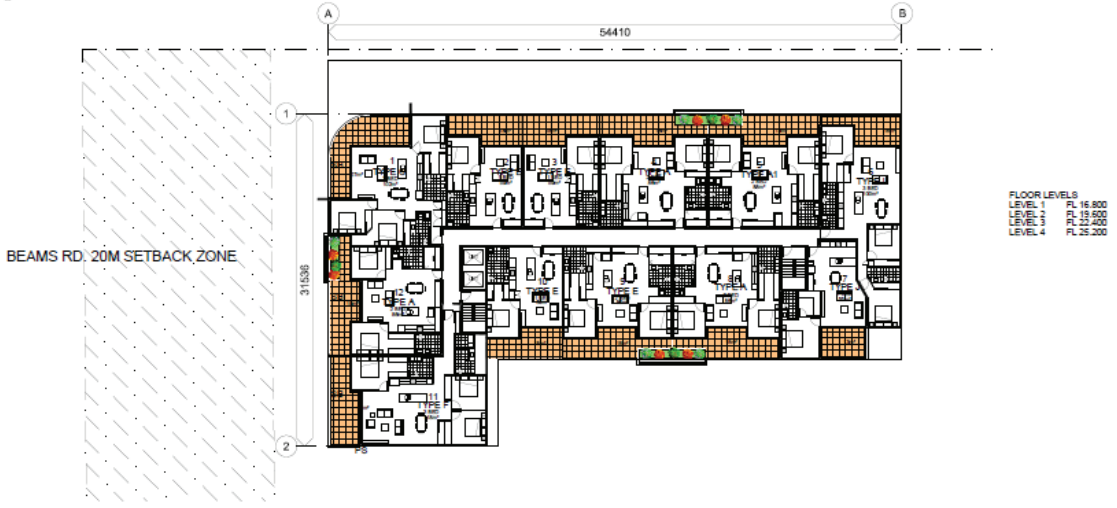
SCALE 1:200@ A1 1:400 @ A3

JOB NO - DRAWN MW

DRAWING NO SK-16 L



BUILDING E GROUND FLOOR PLAN



BUILDING E LEVEL 1- 4 FLOOR PLAN

TOTAL APARTMENTS

1 BED	16	33%
2 BED	20	41%
3 BED	12	26%
TOTAL	48	

ATS... ANTI-THROW SCREEN TO QLD RAIL REQUIREMENTS.
PS... METAL PRIVACY SCREEN
SB... SOLID, GAP FREE BALUSTRADE AS REQUIRED BY SDAP STATE CODE 2

N

M	24.11.2020	REVISION	CM
L	16.10.2020	REVISION	MP
K	09.09.2020	REVISION	MP
J	17.07.2020	REVISION	MP
I	25.06.2020	REVISION	MP
H	21.03.2020	REVISION	MP
G	29.01.2020	REVISION	MP
F	29.11.2019	REVISION	MP
E	22.11.2019	REVISION	MP
D	09.09.2019	REVISION	CM
C	10.04.2019	REVISION	CM
B	03.08.2018	REVISION HEIGHTS	MW
A	25.10.2017	PRELIMINARY ISSUE	MW
ISSUE	DATE	DESCRIPTION	INITIAL

WSA wiltshirestevens architecture
32 Thomas Street West End 4101 07 3891 1811
A.B.N. 97 083 386 856 admin@wiltshirestevens.com.au wiltshirestevens.com.au

CLIENT
BOB KELLY & CO PTY LTD ATF RJ & KO KELLY FAMILY TRUST

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
490 BEAMS ROAD FITZGIBBON

TITLE
BUILDING E FLOOR PLANS

DATE OCTOBER 2017
SCALE 1:200@ A1 1:400 @ A3
JOB NO - DRAWN MW
DRAWING NO SK-18 M

1 INTERNAL WEST ELEVATION
1 : 400

2 BUILDING A/B/C/F/G SECTION 1
1 : 200

3 BUILDING A/B/C/F/G SECTION 2
1 : 200

F	14.10.2020	REVISION	MP
E	08.09.2020	REVISION	MP
D	17.07.2020	REVISION	MP
C	21.02.2020	REVISION	MP
B	04.12.2019	PERSPECTIVES	MP
A	29.11.2019	REVISION	MP
ISSUE	DATE	DESCRIPTION	INITIAL

WSA wiltshirestevens architecture

32 Thomas Street
West End Q 4101
07 3981 1611
admin@wiltshirestevens.com.au
wiltshirestevens.com.au
A.B.N. 97 090 369 838

CLIENT
BOB KELLY & CO PTY LTD
ATF RJ & KO KELLY
FAMILY TRUST

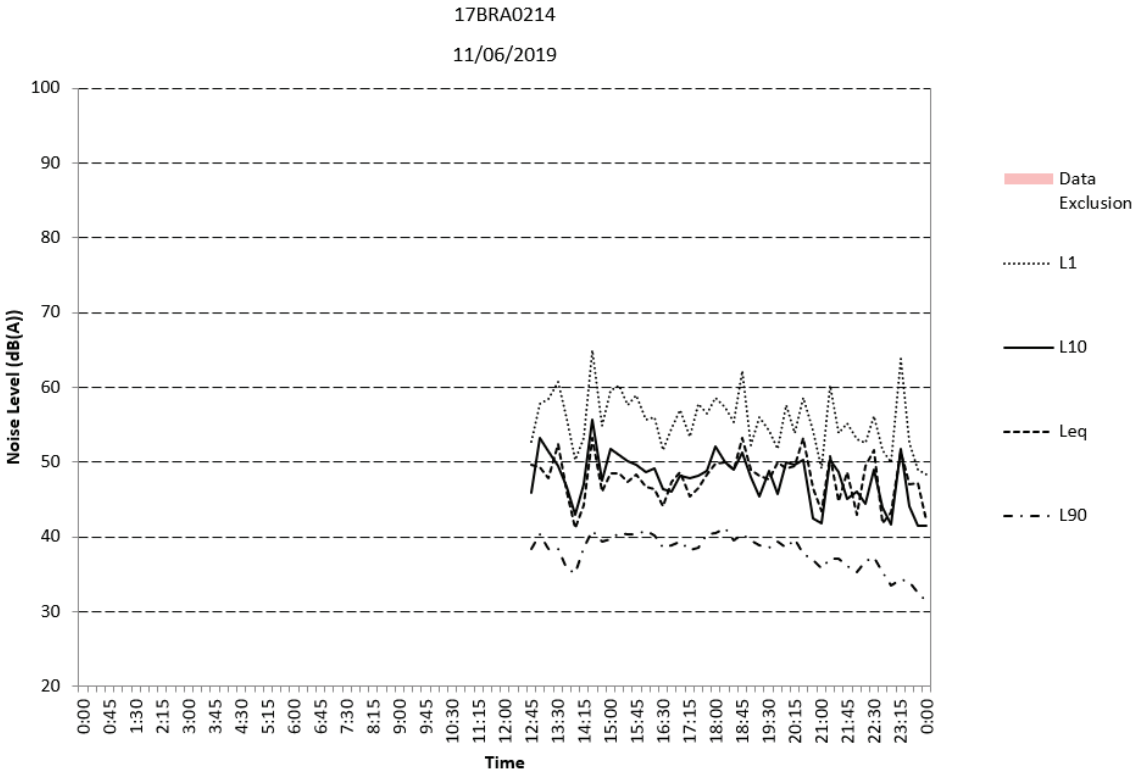
PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
490 BEAMS ROAD
FITZGIBBON

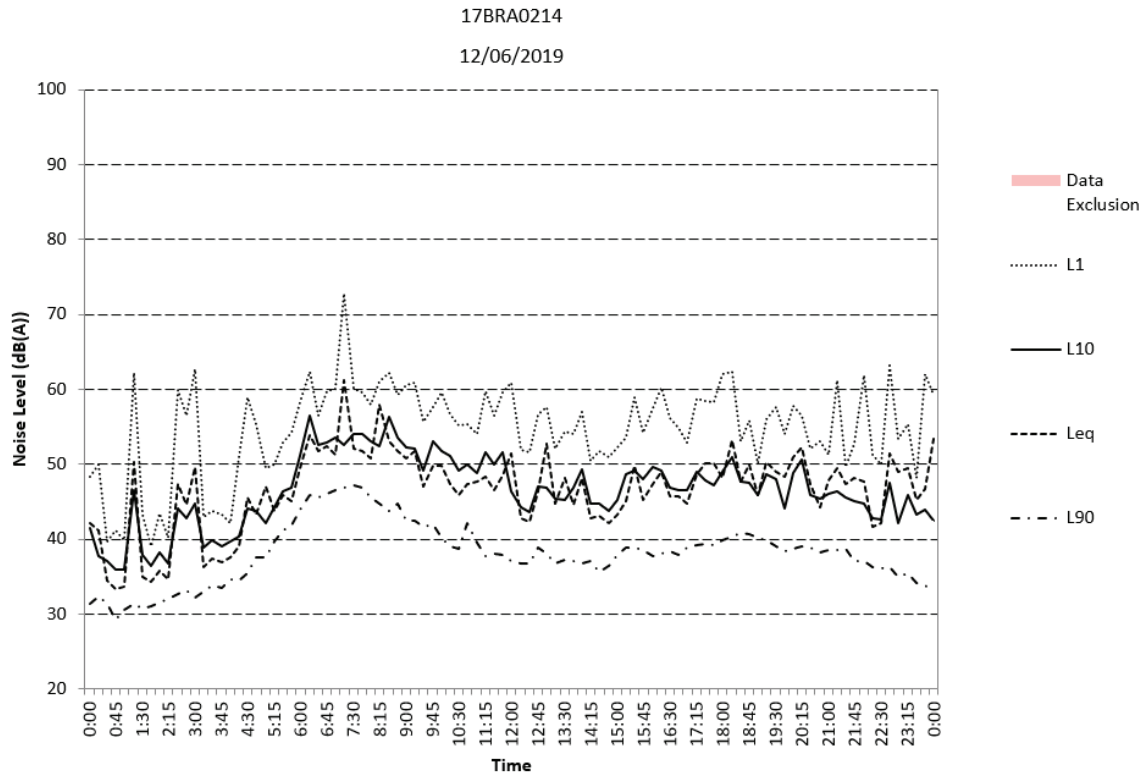
TITLE
SITE ELEVATIONS

DATE JULY 2019
SCALE As indicated @ A1
JOB NO DRAWN MP
DRAWING NO SK-26 F

Appendix B Unattended Noise Monitoring Graphs

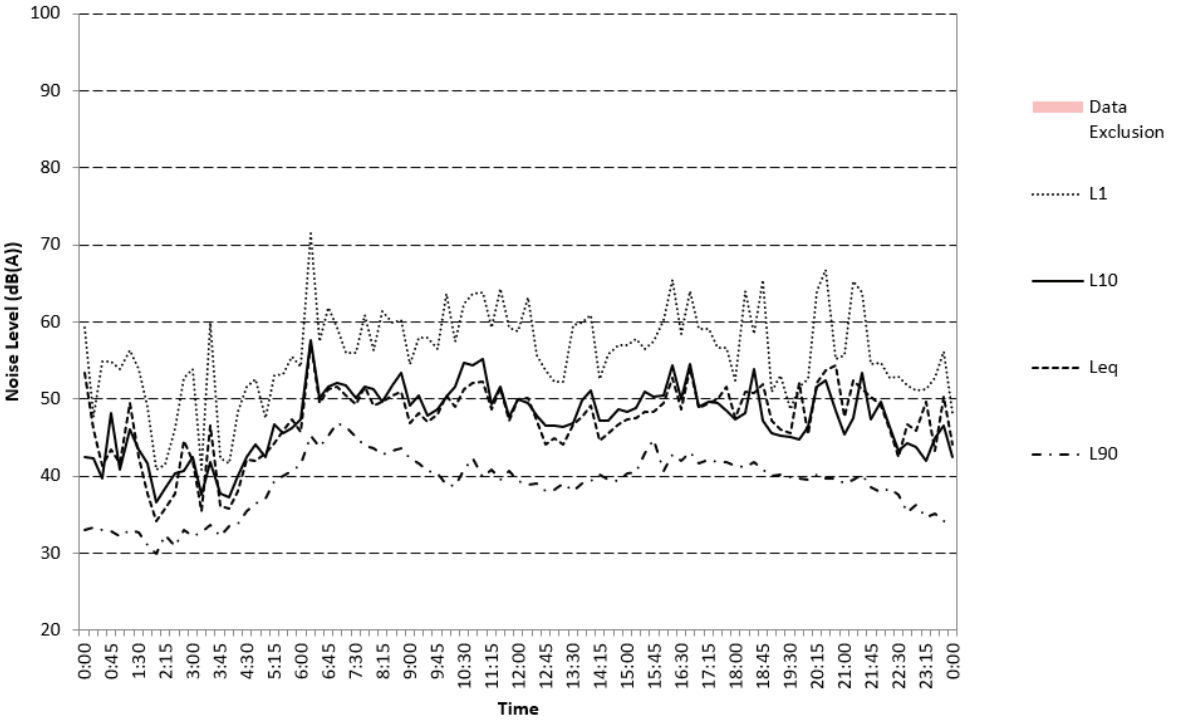
Ambient Noise Monitor





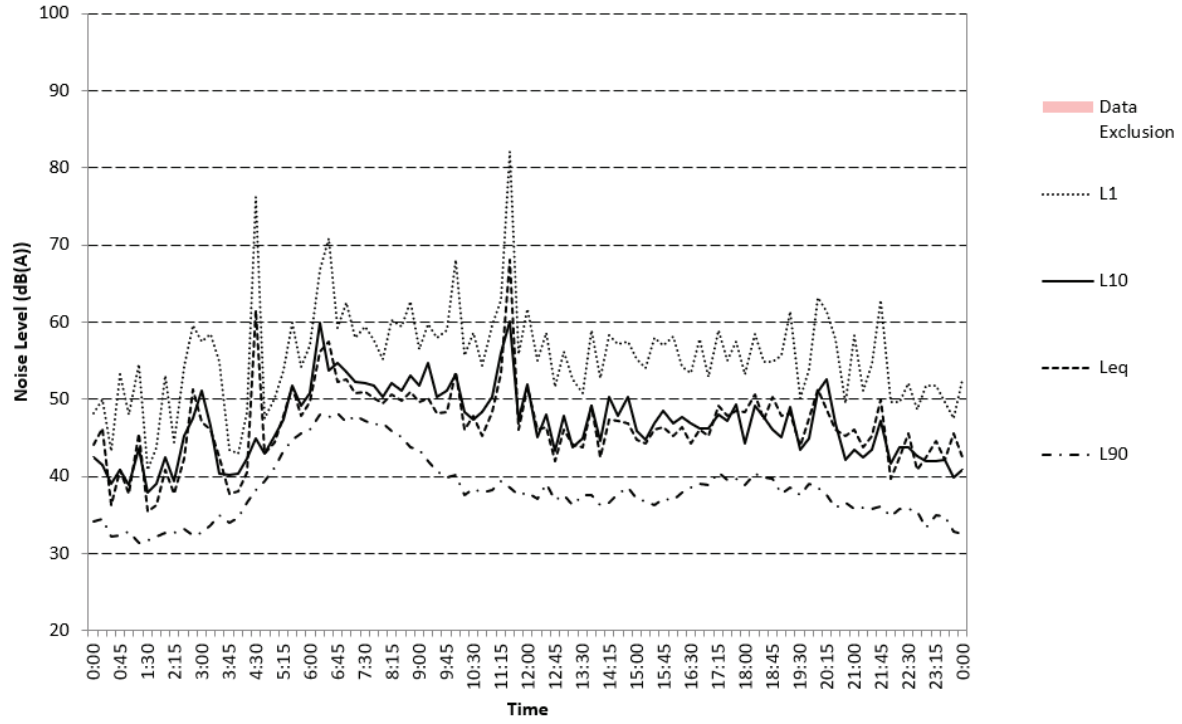
17BRA0214

13/06/2019



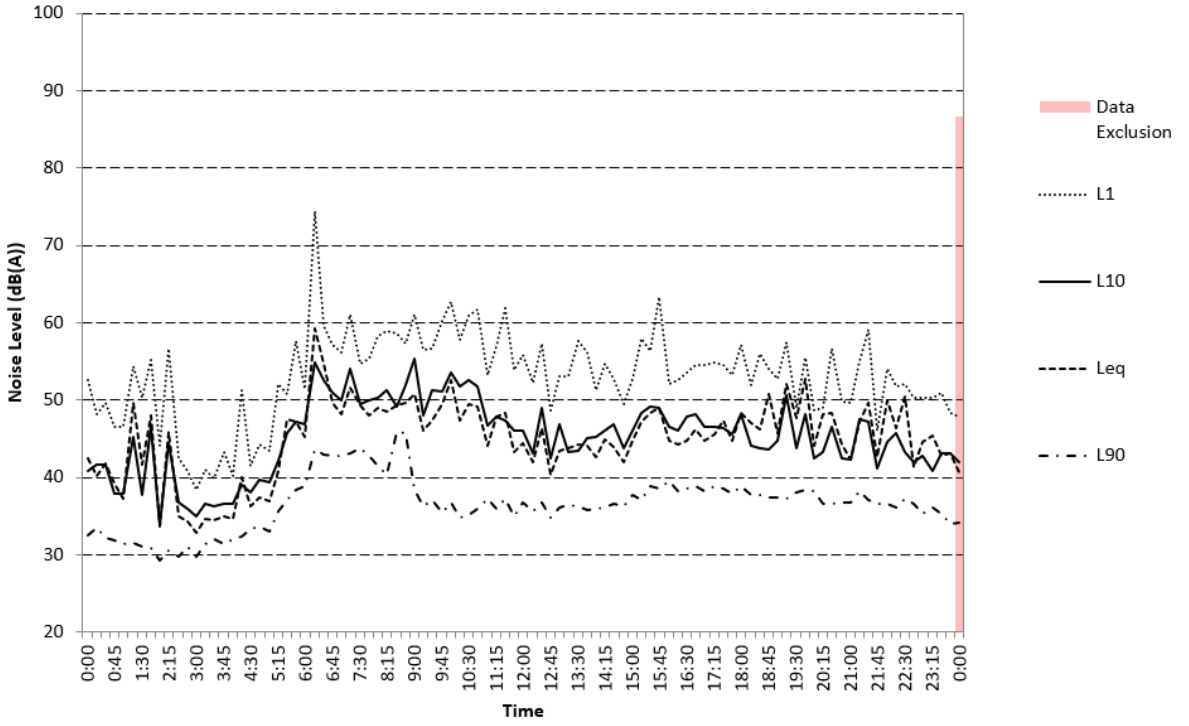
17BRA0214

14/06/2019



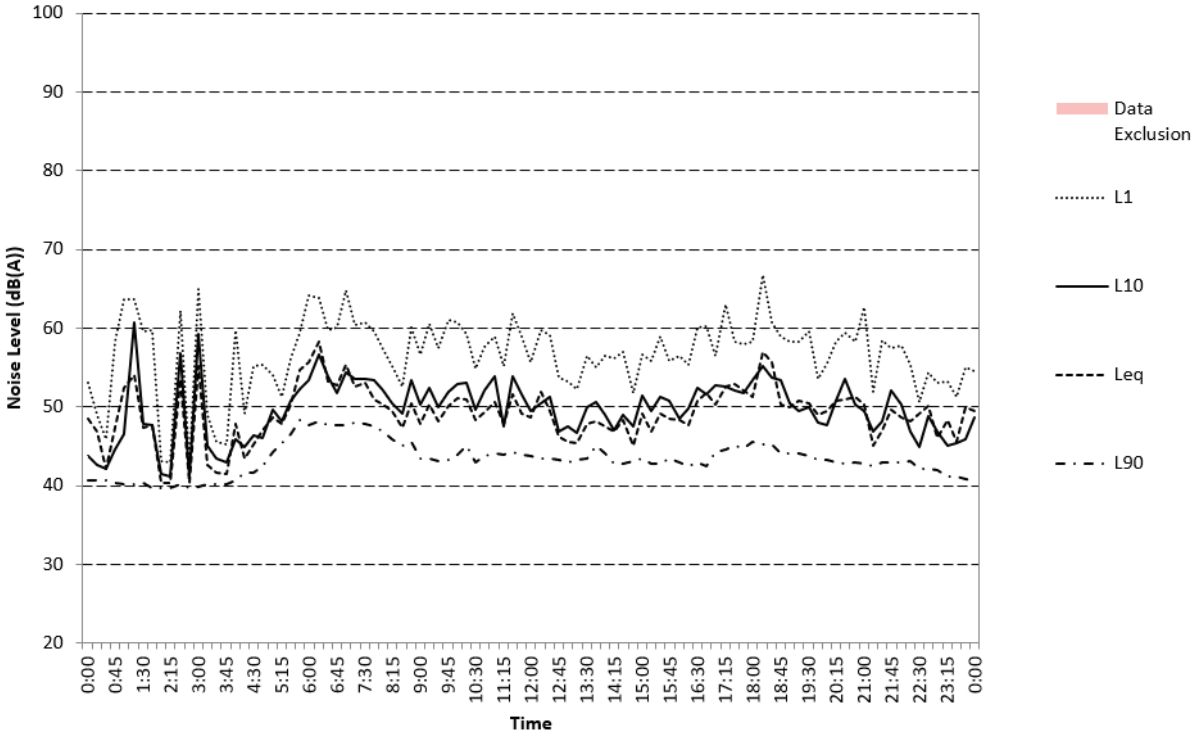
17BRA0214

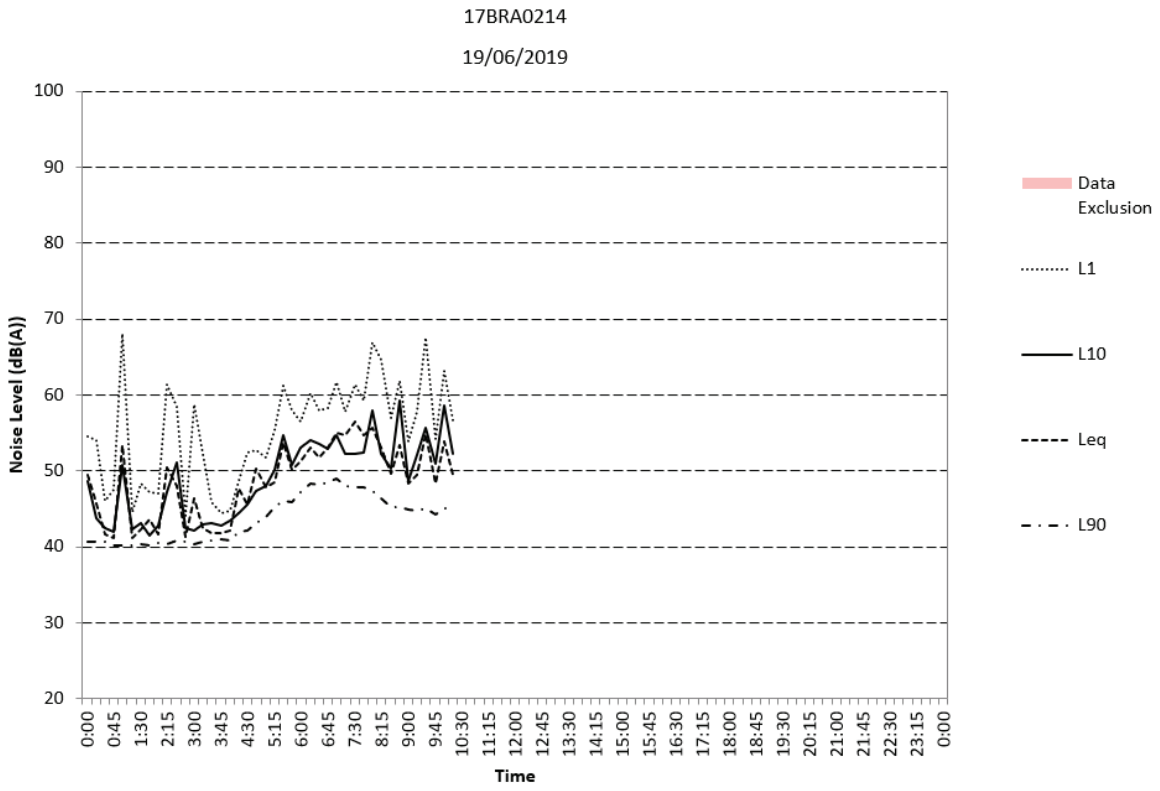
15/06/2019



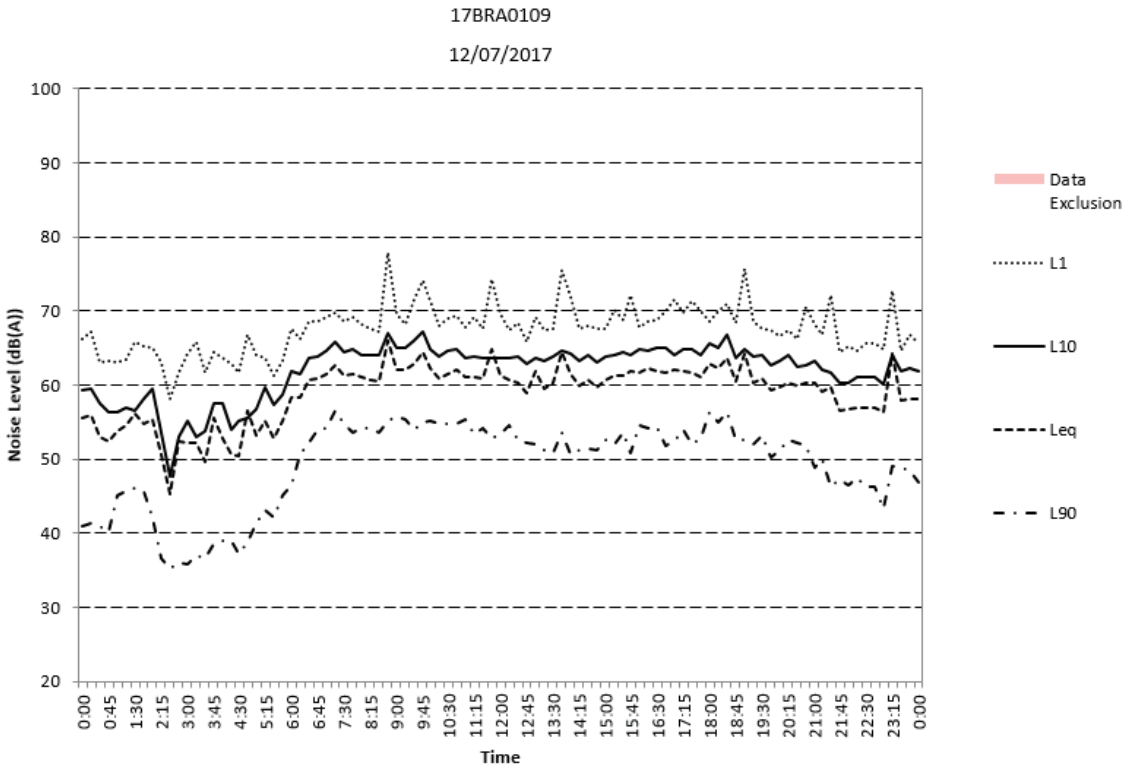
17BRA0214

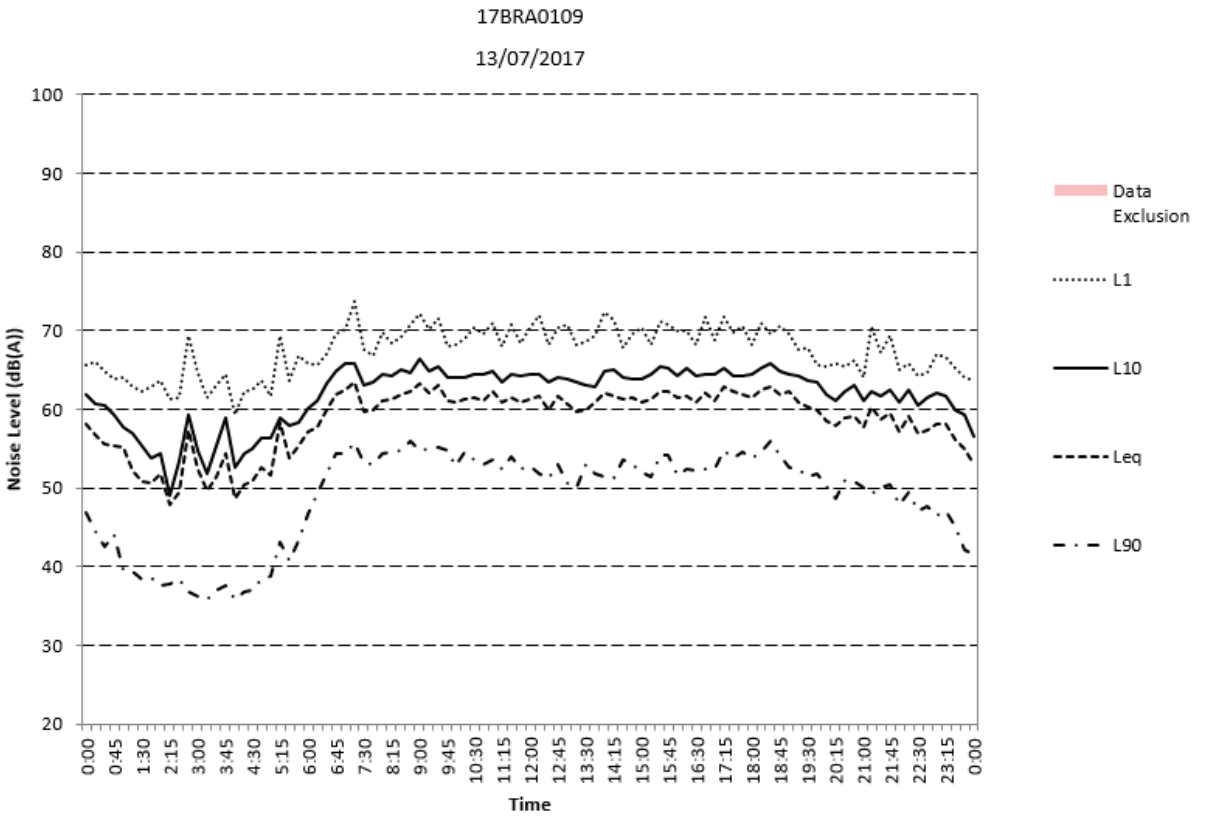
18/06/2019

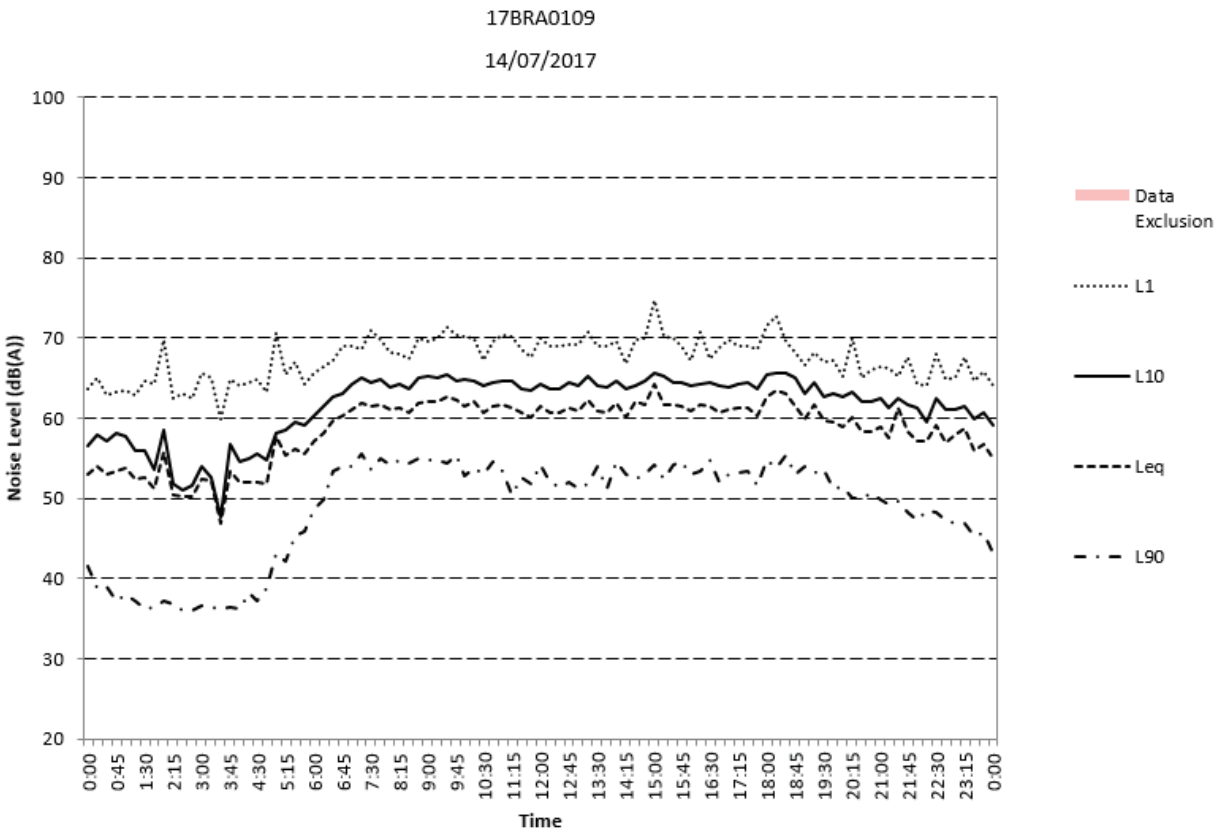




Road Traffic Noise Monitor




17BRA0109
13/07/2017
Noise Level (dB(A))
100
90
80
70
60
50
40
30
20
0:00
0:45
1:30
2:15
3:00
3:45
4:30
5:15
6:00
6:45
7:30
8:15
9:00
9:45
10:30
11:15
12:00
12:45
13:30
14:15
15:00
15:45
16:30
17:15
18:00
18:45
19:30
20:15
21:00
21:45
22:30
23:15
0:00
Time
Data Exclusion
L1
L10
Leq
L90


17BRA0109
14/07/2017
Noise Level (dB(A))
100
90
80
70
60
50
40
30
20
0:00
0:45
1:30
2:15
3:00
3:45
4:30
5:15
6:00
6:45
7:30
8:15
9:00
9:45
10:30
11:15
12:00
12:45
13:30
14:15
15:00
15:45
16:30
17:15
18:00
18:45
19:30
20:15
21:00
21:45
22:30
23:15
0:00
Time
Data Exclusion
L1
L10
Leq
L90

Appendix C Transient Noise Calculations

PROJECT #: **Activity Noise**

Noise Source	Duration (sec)	Leq	1 Hour Period (sec)	Events	Leq Level	Distance R1	Distance R2
Car door closure	2	75	3600	34	58	36	13
Car bypass	6	62	3600	246	58	36	15
Car engine start	3	72	3600	34	57	36	13
Conversation	60	58	3600	60	58	36	13
Deliveries	60	85	3600	2	70	95	30

Noise level due to Distance loss							
Car door closure						27	35
Car bypass						27	35
Car engine start						25	34
Conversation						27	36
Deliveries						31	41
0						#NUM!	#NUM!
0						#NUM!	#NUM!
0						#NUM!	#NUM!
0						#NUM!	#NUM!
0						#NUM!	#NUM!

Shielding (barrier, building etc)						**R1**	**R2**
Car door closure						0	7
Car bypass						0	0
Car engine start						0	7
Conversation						0	7
Deliveries						0	0
0						0	0
0						0	0
0						0	0
0						0	0
0						0	0

Total - Noise Level at Receiver						**R1**	**R2**
Car door closure						27	28
Car bypass						27	35
Car engine start						25	27
Conversation						27	29
Deliveries						31	41

PROJECT #:	Night Time Sleep Disturbance				
0				Distance	
Noise Source		Lmax	Lmax Level	R1	R2
Car door closure		83	83	36	13
Car bypass			N/A	36	15
Car engine start		75	75	36	13
Conversation			N/A	36	13
Deliveries		86	86	95	30
0			N/A	0	0
0				0	0
0			0	0	0
0			0	0	0
0			0	0	0

Noise level due to Distance loss					
Car door closure				52	61
Car bypass				#VALUE!	#VALUE!
Car engine start				44	53
Conversation				#VALUE!	#VALUE!
Deliveries				46	56
0				#VALUE!	#VALUE!
0				#NUM!	#NUM!
0				#NUM!	#NUM!
0				#NUM!	#NUM!
0				#NUM!	#NUM!

Shielding					
Car door closure				0	7
Car bypass				0	0
Car engine start				0	7
Conversation				0	7
Deliveries				0	0
0				0	0
0				0	0
0				0	0
0				0	0
0				0	0

Noise Level at Receiver				R1	R2
Car door closure				52	54
Car bypass				#VALUE!	#VALUE!
Car engine start				44	46
Conversation				#VALUE!	#VALUE!
Deliveries				46	56

Appendix D SoundPLAN Noise Modelling

532 Beams Rd, Carseldine Urban Village
Assessed receiver levels
RTN - Verification 2017

Receiver	Fl	L10(18h) Free Field dB(A)	
Logger Receiver - Road	GF	64.0	

	TTM Consulting (Qld) Pty Ltd Level 1 - 129 Logan Rd Woolloongabba, QLD 4102	1

SoundPLAN 7.4

490 Beams Rd, Fitzgibbon
Rail - Verification

Lot Number	LAMax Free Field dB(A)	Leq24hr Free Field dB(A)	
Logger Receiver (north) - Rail (86.1dB)	88.1	67.9	
Logger Receiver (south)- Rail (88.7dB)	90.0	70.2	

490 Beams Rd, Fitzgibbon
Road Traffic Noise Assessment
RTN - Prediction 2030

Receiver	Direction	Floor	L10(18h) Facade Corrected dB(A)
Building A	E	GF	48.5
		F 1	50.1
		F 2	51.1
		F 3	51.7
		F 4	52.2
		F 5	52.7
		F 6	53.0
		F 7	53.4
Building A	N	GF	48.6
		F 1	50.3
		F 2	51.3
		F 3	52.0
		F 4	52.5
		F 5	53.1
		F 6	53.6
		F 7	54.5
Building A	S	GF	30.0
		F 1	30.0
		F 2	30.0
		F 3	30.4
		F 4	32.0
		F 5	34.1
		F 6	37.1
		F 7	41.7
Building A	W	GF	45.0
		F 1	46.9
		F 2	48.0
		F 3	48.7
		F 4	49.2
		F 5	49.7
		F 6	50.2
		F 7	50.7
Building B	NE	GF	47.0
		F 1	48.9
		F 2	50.0
		F 3	50.6
		F 4	51.2
		F 5	51.6
		F 6	52.0
		F 7	52.5
Building B	NW	GF	49.1
		F 1	51.0
		F 2	52.0

490 Beams Rd, Fitzgibbon
Road Traffic Noise Assessment
RTN - Prediction 2030

Receiver	Direction	Floor	L10(18h) Facade Corrected dB(A)
		F 3	52.7
		F 4	53.2
		F 5	53.7
		F 6	54.1
		F 7	54.5
Building B	SE	GF	31.5
		F 1	31.5
		F 2	31.4
		F 3	32.0
		F 4	33.6
		F 5	35.8
		F 6	38.7
		F 7	43.1
Building B	SW	GF	50.8
		F 1	52.5
		F 2	53.5
		F 3	54.2
		F 4	54.7
		F 5	55.2
		F 6	55.5
		F 7	55.9
Building C	E	GF	42.8
		F 1	44.9
		F 2	46.0
		F 3	46.7
		F 4	47.3
		F 5	47.8
		F 6	48.3
		F 7	48.9
Building C	N	GF	44.6
		F 1	46.5
		F 2	47.6
		F 3	48.3
		F 4	48.9
		F 5	49.4
		F 6	49.9
		F 7	50.5
Building C	S	GF	28.8
		F 1	28.8
		F 2	28.8
		F 3	29.4
		F 4	31.1
		F 5	33.2

490 Beams Rd, Fitzgibbon
Road Traffic Noise Assessment
RTN - Prediction 2030

Receiver	Direction	Floor	L10(18h) Facade Corrected dB(A)
		F 6	36.2
		F 7	41.1
Building C	W	GF	47.7
		F 1	49.5
		F 2	50.5
		F 3	51.2
		F 4	51.7
		F 5	52.2
		F 6	52.6
		F 7	53.0
Building D	E	GF	43.2
		F 1	45.0
		F 2	45.9
		F 3	46.6
		F 4	47.2
		F 5	47.6
		F 6	48.0
		F 7	48.6
Building D	N	GF	42.6
		F 1	44.6
		F 2	45.6
		F 3	46.3
		F 4	46.9
		F 5	47.5
		F 6	48.0
		F 7	48.7
Building D (east)	S	GF	27.0
		F 1	27.0
		F 2	27.0
		F 3	27.7
		F 4	29.4
		F 5	31.5
		F 6	34.6
		F 7	40.0
Building D (north)	W	GF	46.2
		F 1	48.0
		F 2	49.0
		F 3	49.7
		F 4	50.2
		F 5	50.7
		F 6	51.1
		F 7	51.5
Building D (south)	W	GF	45.6

490 Beams Rd, Fitzgibbon
Road Traffic Noise Assessment
RTN - Prediction 2030

Receiver	Direction	Floor	L10(18h) Facade Corrected dB(A)
		F 1	47.3
		F 2	48.3
		F 3	49.0
		F 4	49.6
		F 5	50.0
		F 6	50.4
		F 7	50.8
Building D (west)	S	GF	28.1
		F 1	28.1
		F 2	28.0
		F 3	28.6
		F 4	30.3
		F 5	32.4
		F 6	35.4
		F 7	40.7
Building E	E	F 1	59.9
		F 2	60.6
		F 3	61.1
		F 4	61.5
Building E	N	F 1	68.5
		F 2	69.1
		F 3	69.2
		F 4	69.0
Building E	S	F 1	34.9
		F 2	36.7
		F 3	38.8
		F 4	41.8
Building E	W	F 1	63.7
		F 2	64.4
		F 3	64.9
		F 4	65.0
Building F	E	GF	60.7
		F 1	62.3
		F 2	63.1
		F 3	63.7
		F 4	63.8
		F 5	63.7
		F 6	63.6
		F 7	63.8
Building F	N	GF	67.1
		F 1	68.6
		F 2	69.3
		F 3	69.4

490 Beams Rd, Fitzgibbon
Road Traffic Noise Assessment
RTN - Prediction 2030

Receiver	Direction	Floor	L10(18h) Facade Corrected dB(A)
		F 4	69.2
		F 5	69.0
		F 6	68.8
		F 7	68.6
Building F	S	GF	36.3
		F 1	36.3
		F 2	36.3
		F 3	36.4
		F 4	37.3
		F 5	39.4
		F 6	42.4
		F 7	45.8
Building F	W	GF	61.4
		F 1	63.0
		F 2	63.8
		F 3	64.3
		F 4	64.5
		F 5	64.4
		F 6	64.2
		F 7	64.1
Building G	E	GF	57.2
		F 1	58.8
		F 2	59.6
		F 3	60.2
		F 4	60.6
		F 5	60.8
		F 6	60.9
		F 7	60.8
Building G	N	GF	66.0
		F 1	67.5
		F 2	68.4
		F 3	68.7
		F 4	68.6
		F 5	68.5
		F 6	68.3
		F 7	68.2
Building G	S	GF	34.3
		F 1	34.4
		F 2	34.4
		F 3	34.4
		F 4	36.0
		F 5	38.1
		F 6	40.8

490 Beams Rd, Fitzgibbon
Road Traffic Noise Assessment
RTN - Prediction 2030

Receiver	Direction	Floor	L10(18h) Facade Corrected dB(A)
Building G	W	F 7	44.9
		GF	57.7
		F 1	59.5
		F 2	60.4
		F 3	61.1
		F 4	61.6
		F 5	62.0
		F 6	62.2
		F 7	62.3
Communal area - Ground (free field)		GF	43.6

TTM Consulting Pty Ltd

6

SoundPLAN 8.1

490 Beams Rd, Fitzgibbon
Rail Noise Assessment

Receiver Location	Facade Orientation	Floor Level	LAmax Facade Corrected dB(A)	Leq24hr Facade Corrected dB(A)	
Building A	E	GF	73.8	51.4	
		F 1	74.3	52.2	
		F 2	74.6	52.6	
		F 3	74.9	53.0	
		F 4	75.1	53.3	
		F 5	75.3	53.5	
		F 6	74.6	53.7	
		F 7	74.7	53.9	
Building A	N	GF	70.6	49.6	
		F 1	71.1	50.8	
		F 2	71.4	52.0	
		F 3	71.7	52.5	
		F 4	71.9	52.8	
		F 5	72.1	53.1	
		F 6	72.3	51.4	
		F 7	72.4	51.7	
Building A	S	GF	73.3	52.2	
		F 1	73.8	53.2	
		F 2	74.2	53.8	
		F 3	74.4	54.1	
		F 4	74.6	54.4	
		F 5	74.8	54.7	
		F 6	75.0	54.9	
		F 7	75.1	55.2	
Building A	W	GF	77.3	53.9	
		F 1	77.9	57.4	
		F 2	78.2	59.1	
		F 3	78.5	59.5	
		F 4	78.7	59.8	
		F 5	78.9	60.0	
		F 6	79.0	60.2	
		F 7	79.1	60.4	
Building B	NE	GF	71.2	49.1	
		F 1	71.6	50.7	
		F 2	72.0	53.0	
		F 3	72.2	53.7	
		F 4	72.5	54.0	
		F 5	72.7	54.3	
		F 6	72.8	54.6	
		F 7	73.2	55.0	
Building B	NW	GF	80.7	60.2	
		F 1	81.6	64.3	

490 Beams Rd, Fitzgibbon
Rail Noise Assessment

Receiver Location	Facade Orientation	Floor Level	LAmax Facade Corrected dB(A)	Leq24hr Facade Corrected dB(A)	
		F 2	81.9	64.8	
		F 3	82.1	65.1	
		F 4	82.3	65.4	
		F 5	82.4	65.5	
		F 6	82.5	65.7	
		F 7	82.5	65.8	
Building B	SE	GF	80.6	59.1	
		F 1	82.3	64.0	
		F 2	82.6	64.6	
		F 3	82.9	65.0	
		F 4	83.0	65.2	
		F 5	83.2	65.4	
		F 6	83.3	65.6	
		F 7	83.3	65.7	
Building B	SW	GF	83.4	64.2	
		F 1	84.7	68.1	
		F 2	85.0	68.5	
		F 3	85.3	68.8	
		F 4	85.4	69.1	
		F 5	85.5	69.3	
		F 6	85.5	69.4	
		F 7	85.5	69.5	
Building C	E	GF	64.3	46.0	
		F 1	64.7	46.7	
		F 2	65.0	47.5	
		F 3	65.3	48.5	
		F 4	65.5	48.9	
		F 5	65.7	49.1	
		F 6	65.9	49.6	
		F 7	66.6	50.4	
Building C	N	GF	79.4	58.2	
		F 1	81.3	62.9	
		F 2	81.6	63.4	
		F 3	81.9	63.8	
		F 4	82.1	64.0	
		F 5	82.2	64.2	
		F 6	82.3	64.4	
		F 7	82.4	64.6	
Building C	S	GF	83.6	61.1	
		F 1	84.1	65.3	
		F 2	84.4	65.8	
		F 3	84.6	66.1	

490 Beams Rd, Fitzgibbon
Rail Noise Assessment

Receiver Location	Facade Orientation	Floor Level	LAmax Facade Corrected dB(A)	Leq24hr Facade Corrected dB(A)	
		F 4	84.8	66.4	
		F 5	84.9	66.5	
		F 6	84.9	66.7	
		F 7	84.9	66.8	
Building C	W	GF	81.5	62.8	
		F 1	84.6	68.4	
		F 2	85.0	68.9	
		F 3	85.2	69.2	
		F 4	85.3	69.5	
		F 5	85.4	69.6	
		F 6	85.5	69.8	
		F 7	85.4	69.9	
Building D	E	GF	80.4	56.6	
		F 1	80.9	57.6	
		F 2	81.3	58.1	
		F 3	81.5	58.9	
		F 4	81.7	60.0	
		F 5	81.8	61.2	
		F 6	81.9	62.3	
		F 7	82.0	62.8	
Building D	N	GF	78.3	57.4	
		F 1	78.8	60.6	
		F 2	79.1	61.2	
		F 3	79.3	61.6	
		F 4	79.5	61.8	
		F 5	79.7	62.0	
		F 6	79.8	62.2	
		F 7	79.9	62.4	
Building D (east)	S	GF	87.3	63.4	
		F 1	89.2	68.3	
		F 2	89.5	69.7	
		F 3	89.6	70.8	
		F 4	89.6	71.1	
		F 5	89.3	71.2	
		F 6	89.0	71.2	
		F 7	88.7	71.0	
Building D (north)	W	GF	85.8	63.8	
		F 1	86.4	68.7	
		F 2	86.7	69.2	
		F 3	86.9	69.5	
		F 4	87.0	69.7	
		F 5	87.1	69.9	

490 Beams Rd, Fitzgibbon
Rail Noise Assessment

Receiver Location	Facade Orientation	Floor Level	LAmax Facade Corrected dB(A)	Leq24hr Facade Corrected dB(A)	
		F 6	87.0	70.0	
		F 7	86.8	70.0	
Building D (south)	W	GF	87.6	64.1	
		F 1	89.9	70.8	
		F 2	90.2	71.2	
		F 3	90.3	71.5	
		F 4	90.2	71.6	
		F 5	90.0	71.6	
		F 6	89.7	71.6	
		F 7	89.5	71.5	
Building D (west)	S	GF	87.2	63.4	
		F 1	88.4	69.6	
		F 2	88.7	70.1	
		F 3	88.8	70.4	
		F 4	89.0	70.5	
		F 5	89.0	70.7	
		F 6	88.9	70.7	
		F 7	88.7	70.8	
Building E	E	F 1	70.0	49.2	
		F 2	70.3	49.7	
		F 3	70.6	50.0	
		F 4	70.8	50.3	
Building E	N	F 1	70.3	50.8	
		F 2	70.6	51.2	
		F 3	70.8	51.6	
		F 4	71.0	51.9	
Building E	S	F 1	73.3	54.0	
		F 2	73.6	55.9	
		F 3	73.9	56.4	
		F 4	74.1	56.7	
Building E	W	F 1	70.9	50.6	
		F 2	71.2	52.5	
		F 3	71.5	53.3	
		F 4	71.7	53.6	
Building F	E	GF	67.2	48.2	
		F 1	67.7	49.5	
		F 2	68.0	50.9	
		F 3	68.3	51.7	
		F 4	68.5	51.9	
		F 5	68.7	52.1	
		F 6	68.5	48.8	
		F 7	61.9	44.7	

490 Beams Rd, Fitzgibbon
Rail Noise Assessment

Receiver Location	Facade Orientation	Floor Level	LAmax Facade Corrected dB(A)	Leq24hr Facade Corrected dB(A)	
Building F	N	GF	73.4	53.4	
		F 1	73.9	54.2	
		F 2	74.2	54.6	
		F 3	74.5	55.0	
		F 4	74.7	55.3	
		F 5	74.9	55.5	
		F 6	75.0	55.7	
		F 7	75.2	55.9	
Building F	S	GF	74.9	51.8	
		F 1	75.3	54.5	
		F 2	75.7	55.8	
		F 3	75.9	56.4	
		F 4	76.1	56.7	
		F 5	76.3	57.0	
		F 6	76.5	57.2	
		F 7	76.6	57.0	
Building F	W	GF	73.5	53.5	
		F 1	74.0	54.6	
		F 2	74.3	55.2	
		F 3	74.6	55.7	
		F 4	74.8	56.1	
		F 5	75.0	56.3	
		F 6	75.1	56.5	
		F 7	75.3	56.7	
Building G	E	GF	72.6	49.0	
		F 1	73.1	51.4	
		F 2	73.4	52.7	
		F 3	73.7	53.7	
		F 4	73.9	54.1	
		F 5	74.1	54.3	
		F 6	74.3	54.6	
		F 7	74.5	54.9	
Building G	N	GF	80.2	59.2	
		F 1	80.7	61.2	
		F 2	81.0	61.7	
		F 3	81.3	62.1	
		F 4	81.5	62.3	
		F 5	81.6	62.5	
		F 6	81.7	62.6	
		F 7	81.7	62.7	
Building G	S	GF	82.0	61.7	
		F 1	82.5	65.3	

490 Beams Rd, Fitzgibbon
Rail Noise Assessment

Receiver Location	Facade Orientation	Floor Level	LAmax Facade Corrected dB(A)	Leq24hr Facade Corrected dB(A)	
Building G	W	F 2	82.9	65.8	
		F 3	83.1	66.1	
		F 4	83.3	66.4	
		F 5	83.4	66.5	
		F 6	83.5	66.7	
		F 7	83.6	66.8	
		GF	84.0	64.8	
		F 1	83.8	67.1	
		F 2	84.2	67.5	
		F 3	84.4	67.9	
		F 4	84.5	68.1	
		F 5	84.5	68.2	
		F 6	84.5	68.3	
		F 7	84.4	68.4	
Communal area - Ground (free field)		GF	72.7	51.0	

Recommended Acoustic Barrier - Minimum Barrier Heights					
Barrier Location	Coordinates		Ground Level	Barrier Height	
	X [m]	Y [m]	AHD RL (m)	AGL (m)	AHD RL (m)
1	502959.5	6974900	12.97	2.5	15.47
2	502959.7	6974890	13.01	2.5	15.51
3	502960.5	6974880	13.01	2.5	15.51
4	502961.6	6974870	13.01	2.5	15.51
5	502963.4	6974862	13.01	2.5	15.51
6	502965.2	6974853	13.01	2.5	15.51
7	502967.3	6974846	13.01	2.5	15.51
8	502969.8	6974840	13.01	2.5	15.51
9	502971.9	6974835	13.01	2.5	15.51
10	502974.3	6974830	13.01	2.5	15.51
11	502976.5	6974823	13.01	2.9	15.91
12	502979.7	6974818	13.01	2.9	15.91
13	502982.2	6974812	13.01	2.9	15.91
14	502985.1	6974804	13.01	2.9	15.91
15	502988.8	6974798	13.01	2.9	15.91
16	502991.7	6974792	13.01	2.9	15.91
17	502999.3	6974778	13.01	2.9	15.91
18	503003.2	6974771	13.02	2.9	15.92
19	503006.7	6974763	13.18	2.9	16.08
20	503011.4	6974754	13.36	2.9	16.26
21	503013.7	6974748	13.45	2.9	16.35
22	503016.5	6974742	13.48	2.9	16.38
23	503019.8	6974734	13.40	2.9	16.30
24	503022.4	6974726	13.31	2.9	16.21
25	503024.8	6974719	13.24	2.9	16.14
26	503026.3	6974712	13.07	2.9	15.97
27	503027.3	6974708	13.01	2.9	15.91
28	503028.6	6974704	12.95	2.9	15.85
29	503030.7	6974700	12.91	3.0	15.91
30	503032.4	6974693	12.76	3.0	15.76
31	503034.7	6974689	12.76	3.0	15.76
32	503036.8	6974687	12.76	3.0	15.76
33	503037.6	6974682	12.76	3.4	16.16
34	503038.6	6974678	12.76	3.4	16.16
35	503040.1	6974672	12.76	3.4	16.16
36	503042.1	6974664	12.76	3.4	16.16

Acoustic barrier height to be min AHD RL(m) height.

AHD RL height is accurate relative to floor RL receiver heights.

37	503043.3	6974659	12.76	3.2	15.96
38	503047.3	6974654	12.76	3.2	15.96
39	503050.6	6974651	12.76	3.2	15.96
40	503053.5	6974647	12.80	3.1	15.90
41	503058.6	6974642	12.76	3.1	15.86
42	503063.1	6974637	12.76	3.1	15.86
43	503066.7	6974632	12.76	3.1	15.86
44	503070.2	6974628	12.76	3.1	15.86
45	503074.3	6974624	12.76	3.1	15.86

Appendix E QDC MP4.4 Noise Category Results

Receiver	Façade Direction	Floor	QDC Noise Category		
			Road Traffic	Rail	Maximum
Building A	E	GF	0	1	**1**
		F 1	0	1	**1**
		F 2	0	2	**2**
		F 3	0	2	**2**
		F 4	0	2	**2**
		F 5	0	2	**2**
		F 6	0	2	**2**
		F 7	0	2	**2**
Building A	N	GF	0	1	**1**
		F 1	0	1	**1**
		F 2	0	1	**1**
		F 3	0	1	**1**
		F 4	0	1	**1**
		F 5	0	1	**1**
		F 6	0	1	**1**
		F 7	0	1	**1**
Building A	S	GF	0	1	**1**
		F 1	0	1	**1**
		F 2	0	1	**1**
		F 3	0	1	**1**
		F 4	0	2	**2**
		F 5	0	2	**2**
		F 6	0	2	**2**
		F 7	0	2	**2**
Building A	W	GF	0	2	**2**
		F 1	0	2	**2**
		F 2	0	2	**2**
		F 3	0	2	**2**
		F 4	0	2	**2**
		F 5	0	2	**2**
		F 6	0	2	**2**
		F 7	0	2	**2**
Building B	NE	GF	0	1	**1**
		F 1	0	1	**1**
		F 2	0	1	**1**
		F 3	0	1	**1**
		F 4	0	1	**1**

		F 5	0	1	**1**
		F 6	0	1	**1**
		F 7	0	1	**1**
Building B	NW	GF	0	3	**3**
		F 1	0	3	**3**
		F 2	0	3	**3**
		F 3	0	3	**3**
		F 4	0	3	**3**
		F 5	0	3	**3**
		F 6	0	3	**3**
		F 7	0	3	**3**
Building B	SE	GF	0	3	**3**
		F 1	0	3	**3**
		F 2	0	3	**3**
		F 3	0	3	**3**
		F 4	0	3	**3**
		F 5	0	3	**3**
		F 6	0	3	**3**
		F 7	0	3	**3**
Building B	SW	GF	0	3	**3**
		F 1	0	3	**3**
		F 2	0	4	**4**
		F 3	0	4	**4**
		F 4	0	4	**4**
		F 5	0	4	**4**
		F 6	0	4	**4**
		F 7	0	4	**4**
Building C	E	GF	0	0	**0**
		F 1	0	0	**0**
		F 2	0	0	**0**
		F 3	0	0	**0**
		F 4	0	0	**0**
		F 5	0	0	**0**
		F 6	0	0	**0**
		F 7	0	0	**0**
Building C	N	GF	0	2	**2**
		F 1	0	3	**3**
		F 2	0	3	**3**
		F 3	0	3	**3**

		F 4	0	3	**3**
		F 5	0	3	**3**
		F 6	0	3	**3**
		F 7	0	3	**3**
Building C	S	GF	0	3	**3**
		F 1	0	3	**3**
		F 2	0	3	**3**
		F 3	0	3	**3**
		F 4	0	3	**3**
		F 5	0	3	**3**
		F 6	0	3	**3**
		F 7	0	3	**3**
Building C	W	GF	0	3	**3**
		F 1	0	3	**3**
		F 2	0	4	**4**
		F 3	0	4	**4**
		F 4	0	4	**4**
		F 5	0	4	**4**
		F 6	0	4	**4**
		F 7	0	4	**4**
Building D	E	GF	0	3	**3**
		F 1	0	3	**3**
		F 2	0	3	**3**
		F 3	0	3	**3**
		F 4	0	3	**3**
		F 5	0	3	**3**
		F 6	0	3	**3**
		F 7	0	3	**3**
Building D	N	GF	0	2	**2**
		F 1	0	2	**2**
		F 2	0	2	**2**
		F 3	0	2	**2**
		F 4	0	3	**3**
		F 5	0	3	**3**
		F 6	0	3	**3**
		F 7	0	3	**3**
Building D	S	GF	0	4	**4**
		F 1	0	4	**4**
		F 2	0	4	**4**

		F 3	0	4	**4**
		F 4	0	4	**4**
		F 5	0	4	**4**
		F 6	0	4	**4**
		F 7	0	4	**4**
Building D	W	GF	0	4	**4**
		F 1	0	4	**4**
		F 2	0	4	**4**
		F 3	0	4	**4**
		F 4	0	4	**4**
		F 5	0	4	**4**
		F 6	0	4	**4**
		F 7	0	4	**4**
Building D	W	GF	0	4	**4**
		F 1	0	4	**4**
		F 2	0	4	**4**
		F 3	0	4	**4**
		F 4	0	4	**4**
		F 5	0	4	**4**
		F 6	0	4	**4**
		F 7	0	4	**4**
Building D	S	GF	0	4	**4**
		F 1	0	4	**4**
		F 2	0	4	**4**
		F 3	0	4	**4**
		F 4	0	4	**4**
		F 5	0	4	**4**
		F 6	0	4	**4**
		F 7	0	4	**4**
Building E	E	F 1	1	1	**1**
		F 2	1	1	**1**
		F 3	1	1	**1**
		F 4	1	1	**1**
Building E	N	F 1	3	1	**3**
		F 2	3	1	**3**
		F 3	3	1	**3**
		F 4	3	1	**3**
Building E	S	F 1	0	1	**1**
		F 2	0	1	**1**

		F 3	0	1	**1**
		F 4	0	1	**1**
Building E	W	F 1	2	1	**2**
		F 2	2	1	**2**
		F 3	2	1	**2**
		F 4	2	1	**2**
Building F	E	GF	1	0	**1**
		F 1	1	0	**1**
		F 2	2	0	**2**
		F 3	2	0	**2**
		F 4	2	0	**2**
		F 5	2	0	**2**
		F 6	2	0	**2**
		F 7	2	0	**2**
Building F	N	GF	2	1	**2**
		F 1	3	1	**3**
		F 2	3	1	**3**
		F 3	3	2	**3**
		F 4	3	2	**3**
		F 5	3	2	**3**
		F 6	3	2	**3**
		F 7	3	2	**3**
Building F	S	GF	0	2	**2**
		F 1	0	2	**2**
		F 2	0	2	**2**
		F 3	0	2	**2**
		F 4	0	2	**2**
		F 5	0	2	**2**
		F 6	0	2	**2**
		F 7	0	2	**2**
Building F	W	GF	1	1	**1**
		F 1	2	1	**2**
		F 2	2	1	**2**
		F 3	2	2	**2**
		F 4	2	2	**2**
		F 5	2	2	**2**
		F 6	2	2	**2**
		F 7	2	2	**2**
Building G	E	GF	0	1	**1**

		F 1	1	1	**1**
		F 2	1	1	**1**
		F 3	1	1	**1**
		F 4	1	1	**1**
		F 5	1	1	**1**
		F 6	1	1	**1**
		F 7	1	2	**2**
Building G	N	GF	2	3	**3**
		F 1	2	3	**3**
		F 2	3	3	**3**
		F 3	3	3	**3**
		F 4	3	3	**3**
		F 5	3	3	**3**
		F 6	3	3	**3**
		F 7	3	3	**3**
Building G	S	GF	0	3	**3**
		F 1	0	3	**3**
		F 2	0	3	**3**
		F 3	0	3	**3**
		F 4	0	3	**3**
		F 5	0	3	**3**
		F 6	0	3	**3**
		F 7	0	3	**3**
Building G	W	GF	0	3	**3**
		F 1	1	3	**3**
		F 2	1	3	**3**
		F 3	1	3	**3**
		F 4	1	3	**3**
		F 5	1	3	**3**
		F 6	1	3	**3**
		F 7	1	3	**3**

Appendix F QDC MP4.4 Schedules 1 and 2

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 1.8m²)
			35 (where total area of glazing for a *habitable room* is less than or equal to 1.8m²)
		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 1.8m²)
			32 (where total area of glazing for a *habitable room* is less than or equal to 1.8m²)
		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 1.8m²)
			24 (where total area of glazing for a *habitable room* is less than or equal to 1.8m²)
		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/m³ or 50mm thick polyester insulation with a density of 20kg/m³ 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/m³ 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/m³ 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/m³ 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/m³ or polyester insulation at least 50mm thick with a density of at least 20kg/m³ 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/m³ or polyester insulation at least 50mm thick with a density of at least 20kg/m³ 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/m³.

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/m³ 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/m³ 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/m²; or (iv) Solid core timber door not less than 35mm thick fitted with full perimeter *acoustically rated seals*.