PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV2021/1183

Date: 09/09/2021

Queensland Government

Acoustic Assessment Report

Carseldine Village – Stage 3

532 Beams Road, Carseldine

Economic Development Queensland

17BRA0109 R04_5 - Stage 3

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.

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Revision Record

No.	Author	Reviewed/Approved	Description	Date
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1	S Yorke		Client issue – final plans	29/03/2021
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4	S Yorke		Client issue – final plans	22/07/2021
5	S Yorke		Client issue – final plans	13/08/2021

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1 Executive Summary

TTM was engaged by Economic Development Queensland, Urban Development to undertake a noise assessment of Stage 3 of the proposed Carseldine Village development located at 532 Beams Road, Carseldine. The assessment was based upon relevant planning scheme and transport noise development codes.

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

A rail acoustic barrier, as detailed in previous Stage assessments, was included in the analysis (Section 9.1) and is now constructed.

Noise modelling of road traffic noise from Beams Road was conducted. No Stage 3 lots are adversely impacted by road traffic noise.

Noise modelling of rail noise was conducted. Stage 3A lots are noise affected by rail noise and future dwellings will require acoustic treatment (Section 9.2).

Compliance with the relevant planning scheme and State transport noise requirements is predicted based on the implementation of the recommendations outlined in Section 9 of this report.

2 Introduction

2.1 Background

TTM was engaged by Economic Development Queensland, Urban Development to undertake a noise assessment of Stage 3 of the proposed Carseldine Village development located at 532 Beams Road, Carseldine. This report will form part of the development application for consideration by Economic Development Queensland (EDQ), Development Assessment and relevant State authorities.

2.2 References

This report is based on the following:

- Fitzgibbon Urban Development Area Development Scheme
- 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 road traffic and rail noise impacts.
- 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:

- Part of Lot 7000 on SP311875
- 532 Beams Road, Carseldine

The site locality is shown in Figure 1.

Figure 1: Site Locality

3.2 Current Site Conditions

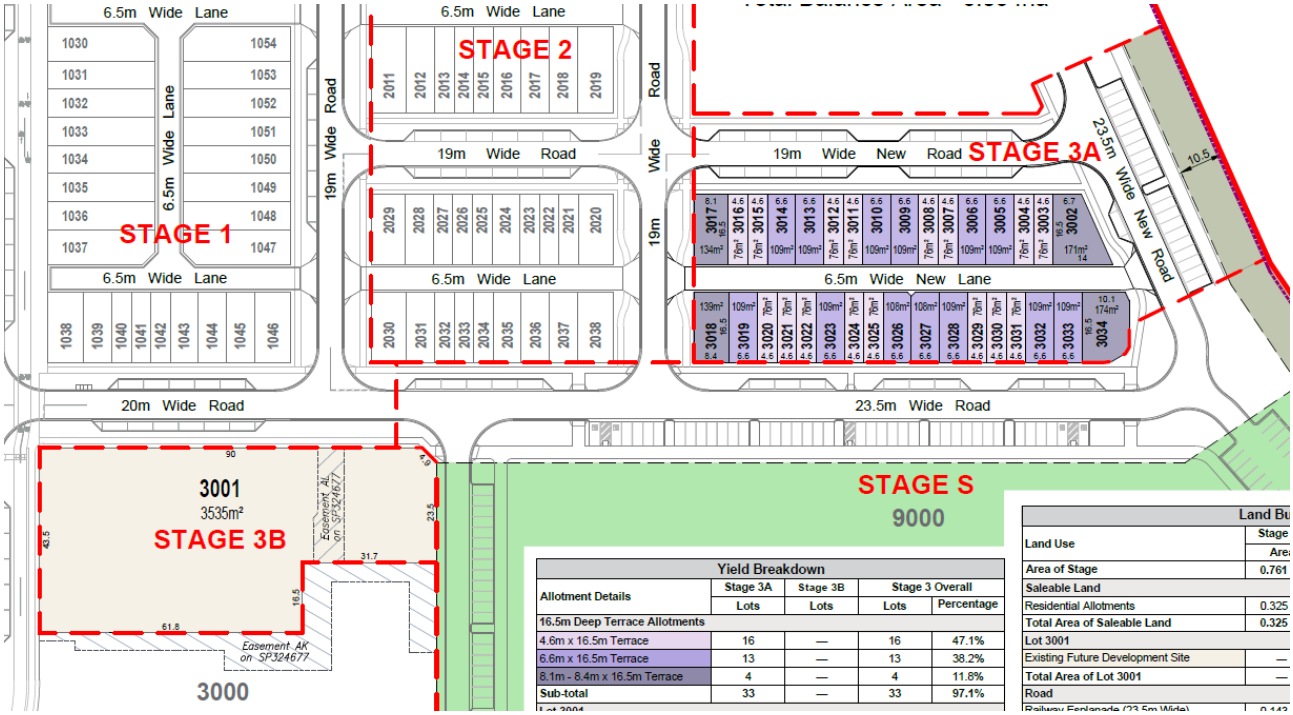
The site is bound by Beams Road to the north, Dorville Road to the west, bushland to the south and a rail line to the east. The current acoustic environment at the site is primarily comprised of noise from road traffic on Beams Road and rail noise from the rail line.

4 The Proposed Development

4.1 Development Description

The Stage 3 proposal is to develop the site into residential terrace allotments (Stage 3A) and a future development site (Lot 3001, Stage 3B). The future development site (Lot 3001) will be subject to future development approvals and therefore this report focuses on the acoustic assessment for Stage 3A only. A site plan of the lot subdivision is presented in Figure 2. Further samples of the development plans are shown in Appendix A.

Figure 2: Site Plan – Stage 3



5 Measurements

5.1 Equipment

The following equipment was used to measure existing noise levels:

- ARL EL 315 Environmental noise logger (SN# 15-302-489) – Road traffic noise
- Norsonic Nor140 noise logger (SN# 1406504) – 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 and rail noise levels between Tuesday 11th July, 2017 to Tuesday 18th July, 2017. Appropriate growth rates have been applied where relevant for planning horizon modelling. The noise monitoring locations are shown in Figure 3. The road traffic noise monitor was placed approximately 17 metres from the edge of Beams Road. The rail noise monitor was located a distance of approximately 17 meters from the centre of the nearest rail line. The monitoring locations were chosen to best represent the relevant 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 noise monitor was set to measure statistical noise levels in 'A'-weighting, 'Fast' response, over 15 minute intervals. The rail noise monitor was set to a 5 minute interval.

The rail noise logger was also set up to record audio when a trigger noise level of 75dB(A) or greater was measured. Audio was recorded for 10 - 15 seconds following 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 each noise logger location on Tuesday 11th July 2017 and were used to verify the unattended noise logging data.

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 and temperatures ranging between 9-20°C (source: Bureau of Meteorology). Data affected by rainfall was excluded from the results.

5.3 Results of Measurements

5.3.1 Road Traffic Noise Levels

Table 1 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 1: 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

5.3.2 Rail Noise Measurements

After analysing the noise logging data and audio recordings, 54 valid train pass-by measurements were captured during a 24 hour period. Measurement data was discarded from the analysis where audio recordings identified inclusion of train horns and other extraneous noise sources. 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 2 presents the highest 15 free-field L_{Amax} and associated L_{Aeq} rail noise levels during the 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, results in a significant portion of measured road traffic noise and it is not practical to identify and remove all non-train event measurement data over the 24 hour period.

Table 2: Measured Rail Noise Levels (Highest 15)

Train Type	Maximum Noise Level L_{MAX} dB(A)	Noise Level L_{eq} dB(A)	Warning Device
Passenger	89.4	67.0	No
Passenger	89.3	71.2	No
Passenger	88.3	66.9	No
Passenger	87.8	64.7	No
Passenger	87.5	66.3	No
Passenger	87.2	68.7	No
Passenger	85.8	64.5	No
Passenger	84.8	65.0	No
Passenger	83.9	63.2	No
Passenger	83.8	62.7	No
Freight	83.3	63.0	No
Passenger	83.3	63.5	No
Passenger	82.7	66.5	No
Passenger	82.2	63.3	No
Passenger	82.0	64.2	No
Single event maximum noise level (SEM) dB(A)	**85.4**		
Leq,24hour dB(A)		**58.6**	

6 Noise Criteria

Assessment criteria for road traffic noise and rail noise are outlined in the following sections.

6.1 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.

6.1.1 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 3.

Table 3: 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.

6.2 Rail Noise

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

6.2.1 Fitzgibbon PDA Development Scheme

The Fitzgibbon Urban Development Area Development Scheme specifies the following in Section 3.11 Environment - General noise requirements:

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

The design, siting and layout of development must address noise impacts and where necessary incorporate appropriate noise mitigation measures. Within 100m of the rail corridor boundary, noise sensitive uses must comply with best practice acoustic standards.

The noise assessment complies with these requirements with compliance with State noise assessment codes.

6.2.2 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 4.

Table 4: SDAP Noise Criteria - Rail Noise

Performance Outcomes	Acceptable Outcomes
PO24 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.	AO24.1 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. 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.
PO25 Development involving an accommodation activity minimises noise intrusion from a railway or type 2 multimodal corridor in outdoor spaces for passive recreation	AO25.1 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

Performance Outcomes	Acceptable Outcomes
	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).

6.2.3 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 5.

Table 5: 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
Category 1	70 – 74
Category 0	≤ 69

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

7 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.

7.1 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 6.

Table 6: Traffic Volumes used in the Noise Model

Road	Traffic Volumes (AADT)			Heavy Vehicles (%)	Growth Rate (%)
	2016	2017	2032		
Beams Road	13,500	13,770	18,533	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).

7.2 Noise Model

7.2.1 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 7.

Table 7: Road Traffic 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 levels and Design earthworks levels from Calibre Group (ref. 15-003002.01-SK-1220_1)
Beams Road Speed limit	60 km/h
Noise source height above grade	0.5m
Floor heights	2.8m
Receiver heights	1.8m above ground level
Façade correction	+2.5 dB(A)

7.2.2 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 8. As the noise monitor was in a free-field location, the predicted noise level is also shown as free-field.

Table 8: 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.

7.3 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 2022. The predicted future noise levels take into account the 2032 traffic volumes.

Predicted road traffic noise contour maps illustrated as QDC noise categories at the ground floor and first floor are presented in Figure 4 and Figure 5 respectively.

Figure 4: Predicted Road Traffic Noise Levels – Ground Level

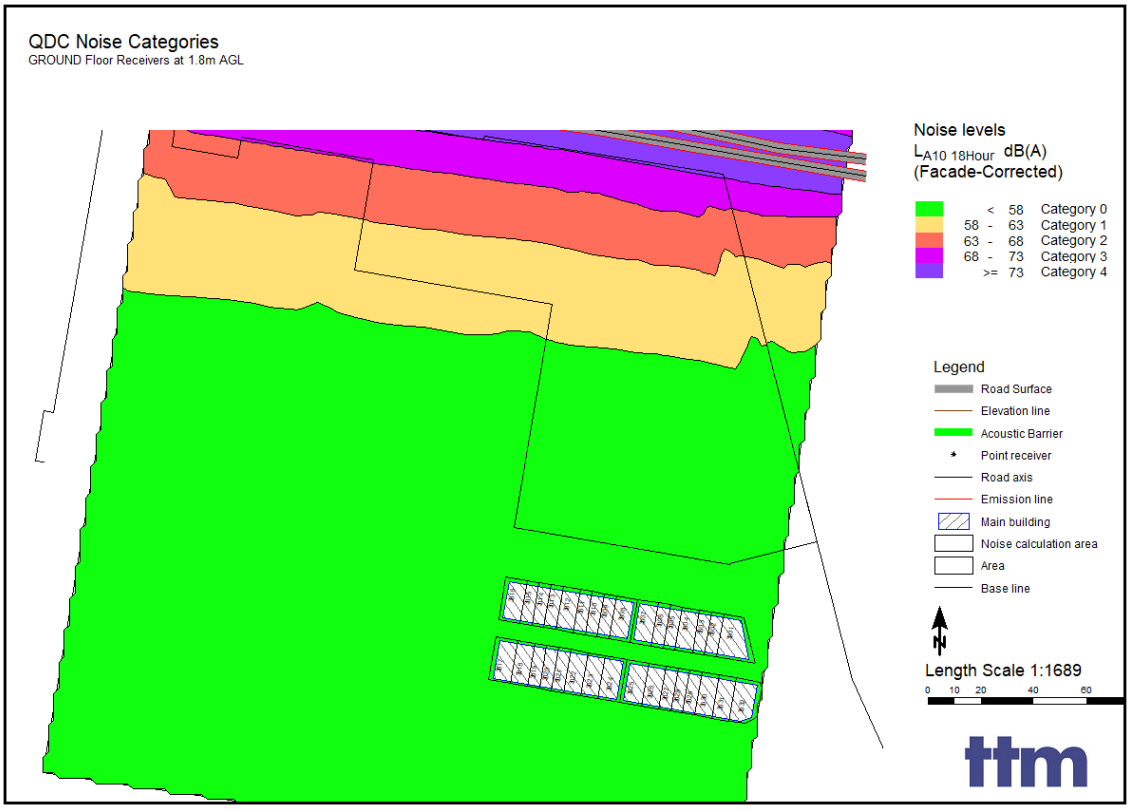
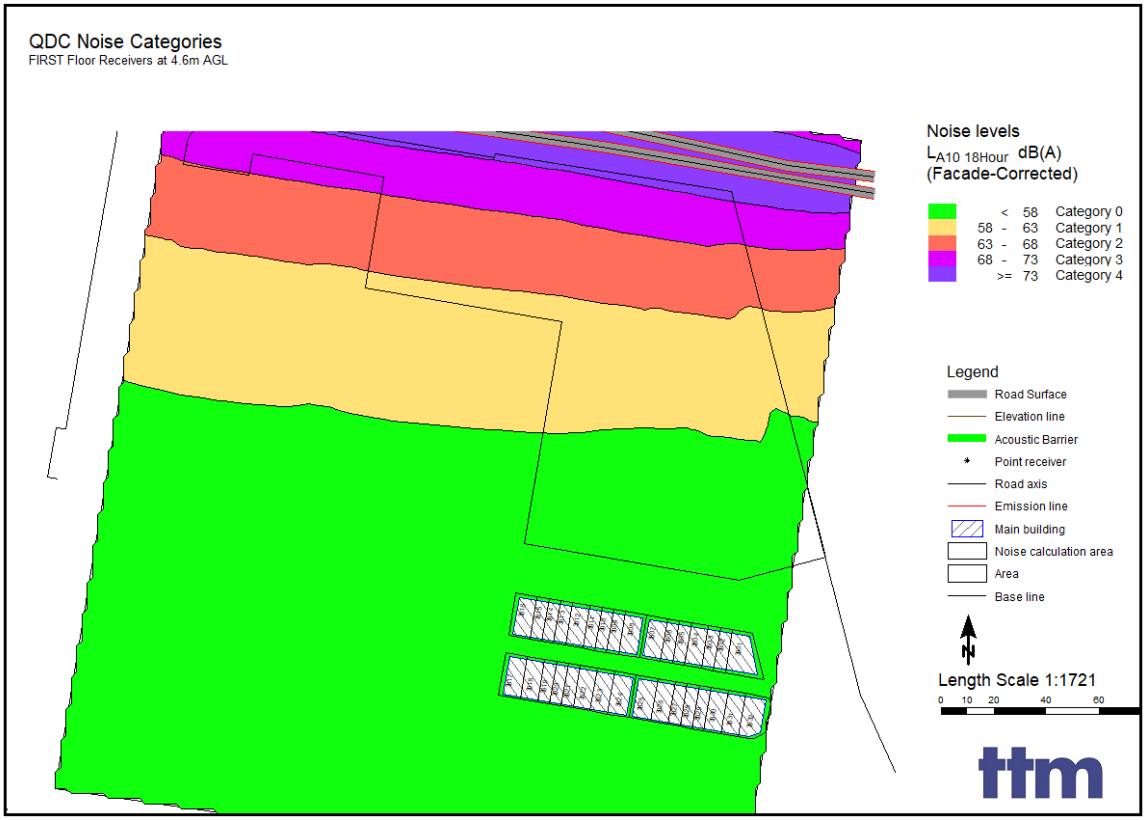


Figure 5: Predicted Road Traffic Noise Levels – First Floor



Based on the noise modelling results, Stage 3A of the development is not adversely impacted by road traffic noise at Ground and First Floor levels.

8 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.

8.1 Rail Volumes

Rail timetables provided by Queensland Rail (QR) indicate approximately 250 trains per day pass the site (including approximately 15 freight trains). We were advised that all services are subject to alteration, addition and cancellation which may vary the number of actual trains passing daily.

8.2 Noise Model

8.2.1 Noise Modelling Parameters

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

Table 9: 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)
Rail noise measurement distance	17m from the nearest line
Ground contours	Natural ground levels and Design earthworks levels from Calibre Group (ref. 15-003002.01-SK-1220_1)
Floor heights	2.8m
Receiver heights	1.8m above ground level
Façade correction	+2.5 dB(A)

8.2.2 Noise Model Verification

The measured single event maximum sound pressure level L_{Amax} noise level at the monitoring location was verified in the noise model prior to modelling noise impacts at the development. Table 10 presents the results of the rail noise model verification.

Table 10: Verification of the Rail Noise Model

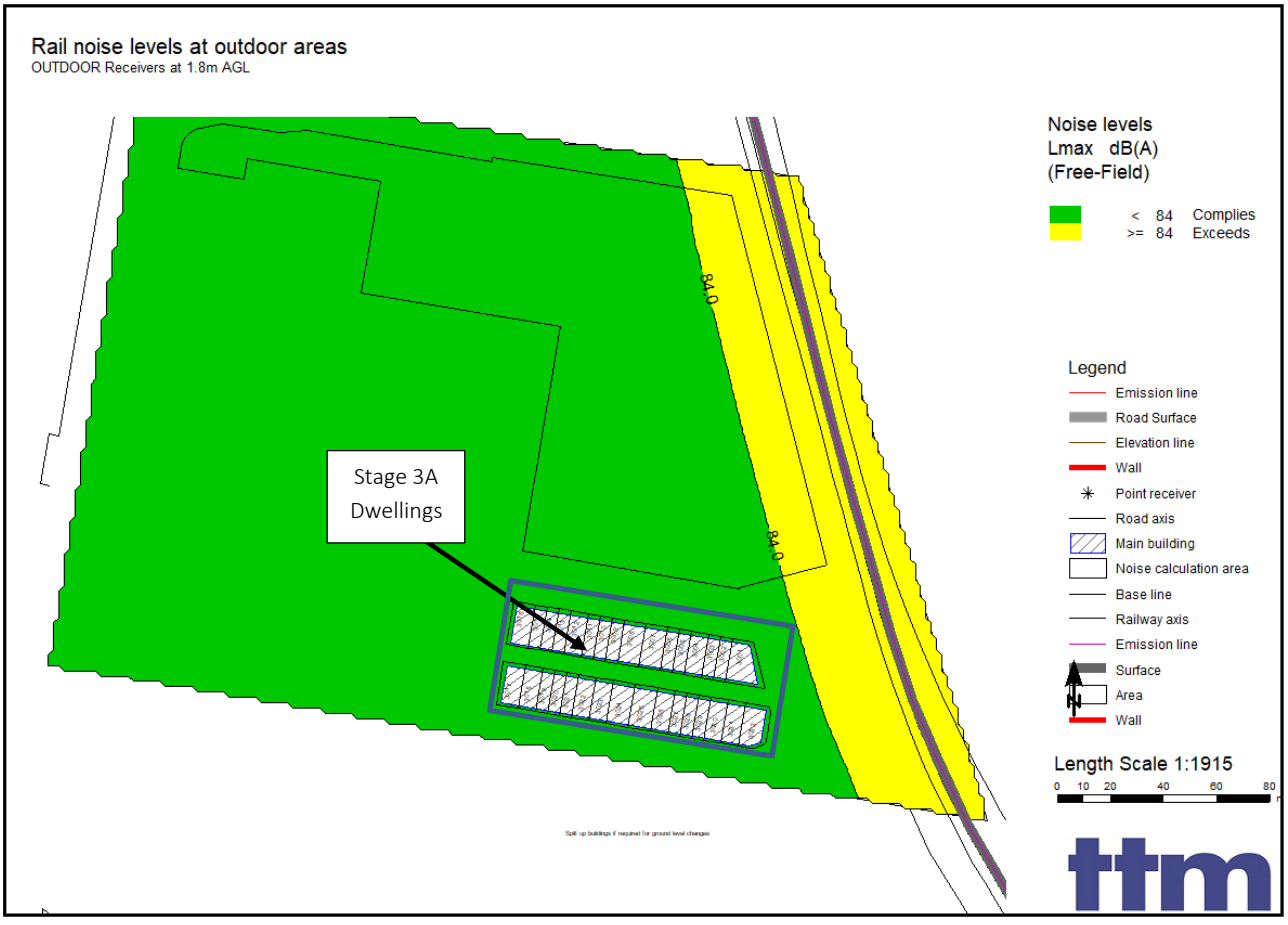
Descriptor	Measured dB(A)	Predicted dB(A)	Required Correction
L_{Amax}	85.4	89.2	-1.8
$L_{Aeq,24hr}$	58.6	60.5	0

A correction was applied to the L_{Amax} rail noise source to bring the model within +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).

8.3 Predicted Noise Levels - L_{Amax}

Predicted rail noise levels are presented in Figure 6 and compared to the SDAP outdoor passive recreation criteria.

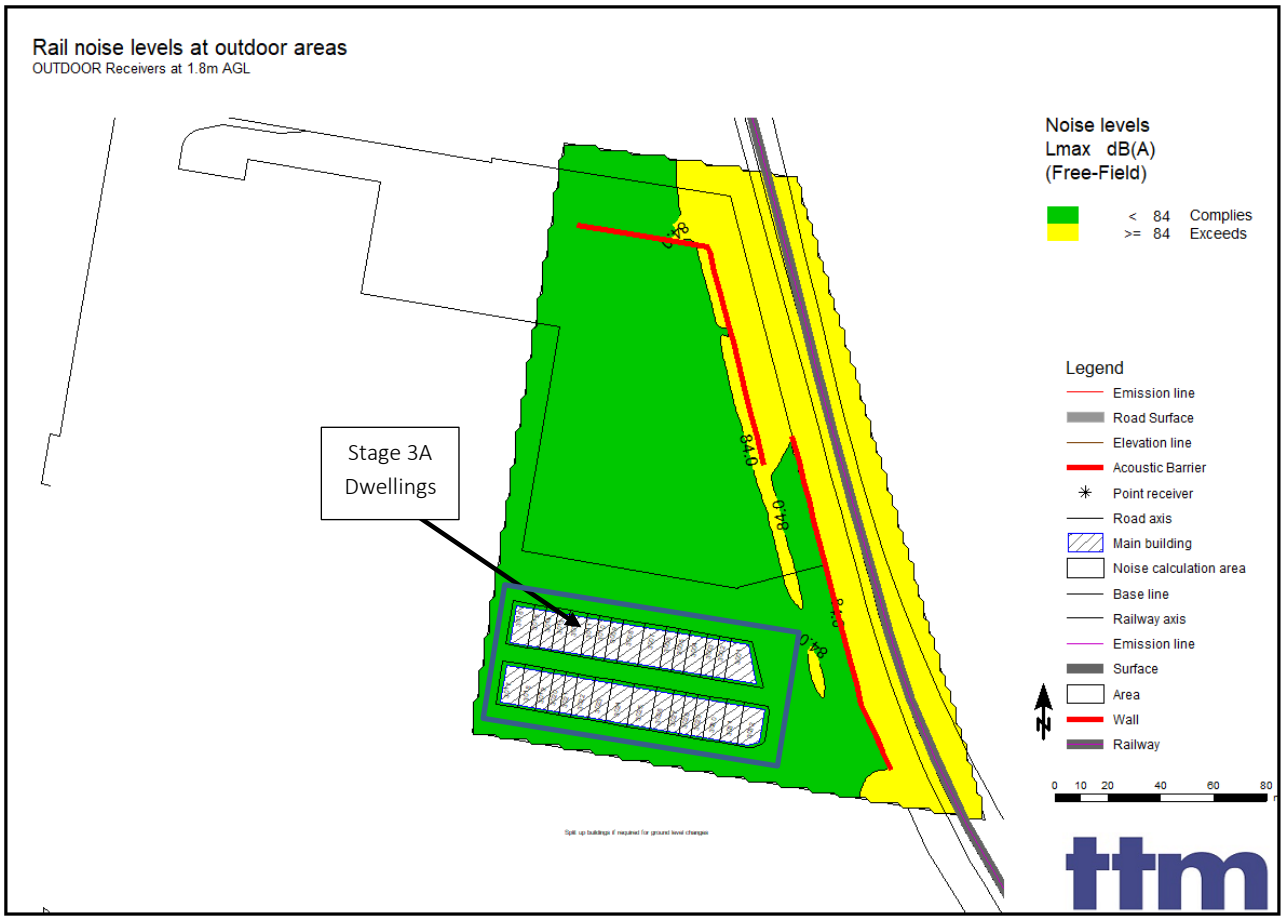
Figure 6: Predicted Rail Noise Levels Compared to SDAP Outdoor Criteria - No Acoustic Barriers



An acoustic barrier for rail noise was recommended as part of the previous noise assessments to reduce rail noise levels to dwellings. The barrier is located along the length of the eastern boundary of the site (shown in the below figures) with a height of 3.6m above natural ground level. A stepped-in portion of the barrier at the northern end of the eastern boundary is 1.8m high above site design levels. The barrier returns along Beams Road frontage at 1.8m high. Details of the barrier are provided in Appendix A. This barrier is now constructed.

Predicted rail noise levels with acoustic barriers are presented in Figure 7 and compared to the SDAP outdoor passive recreation criteria.

Figure 7: Predicted Rail Noise Levels Compared to SDAP Outdoor Criteria - With Acoustic Barriers



All Stage 3 lots are predicted to comply with the L_{Amax} and $L_{Aeq\ (24\ hour)}$ SDAP external façade (AO25.1) and outdoor passive recreation (AO26.1) criteria. Receiver point modelling results are presented in Appendix C.

Predicted rail noise contour maps illustrated as QDC noise categories for ground floor and first floor are presented in the following figures.

Figure 8: Predicted L_{Amax} Rail Noise Levels – Ground Floor (Indicative)

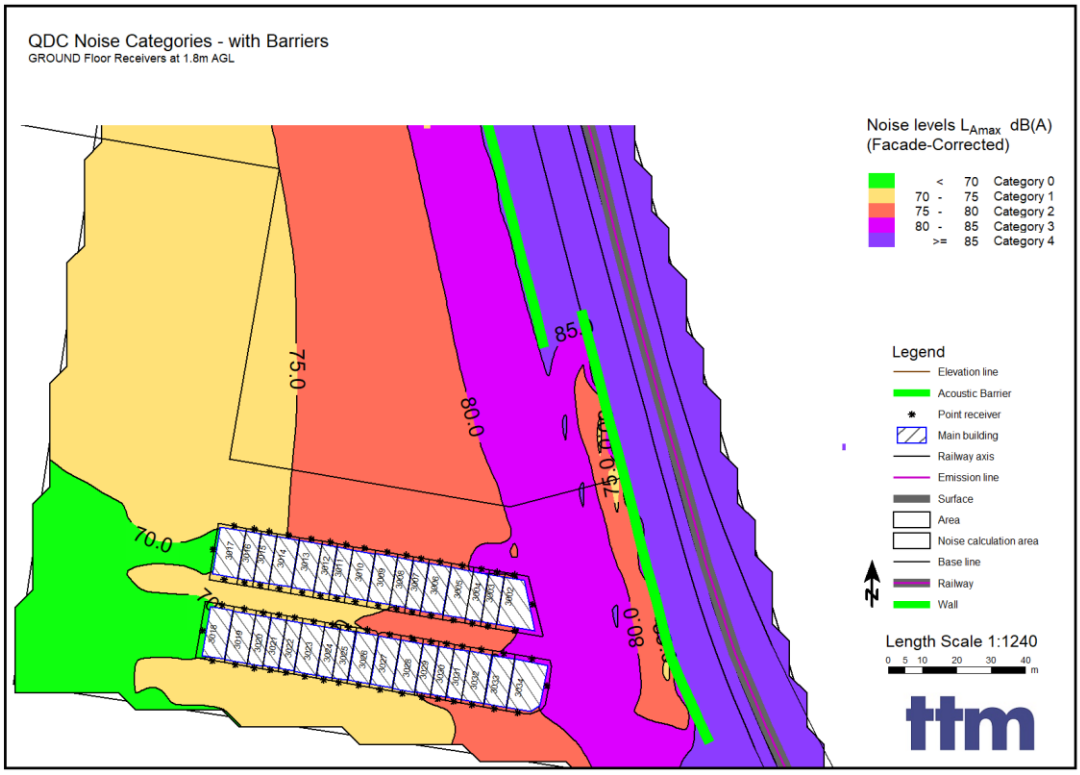
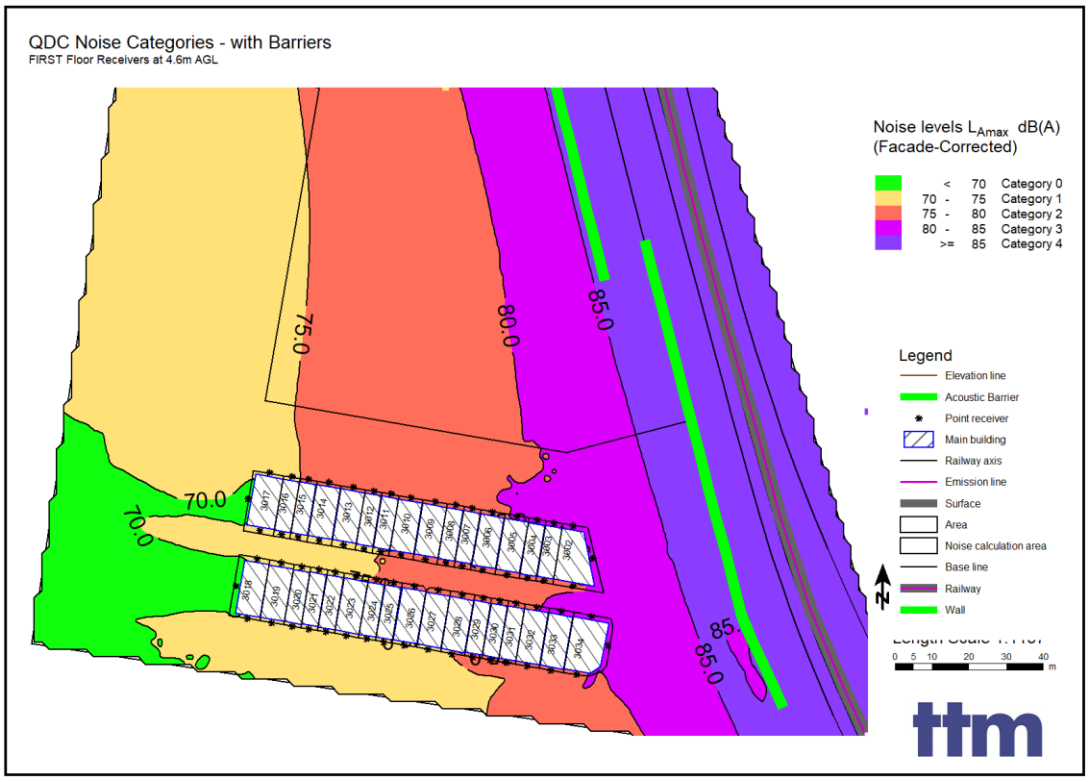


Figure 9: Predicted L_{Amax} Rail Noise Levels – First Floor (Indicative)



Based on the noise modelling, Stage 3A of the development is predicted to be impacted by rail noise at a level of QDC noise category 0 – 3 for some ground and first floor levels. Receiver point modelling results are presented in Appendix C.

Facade acoustic treatments are recommended in order to comply with QDC MP4.4 internal criteria for habitable rooms. QDC noise categories and associated acoustic treatment requirements for noise affected façades and floor levels are detailed in Section 9.

9 Recommendations

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

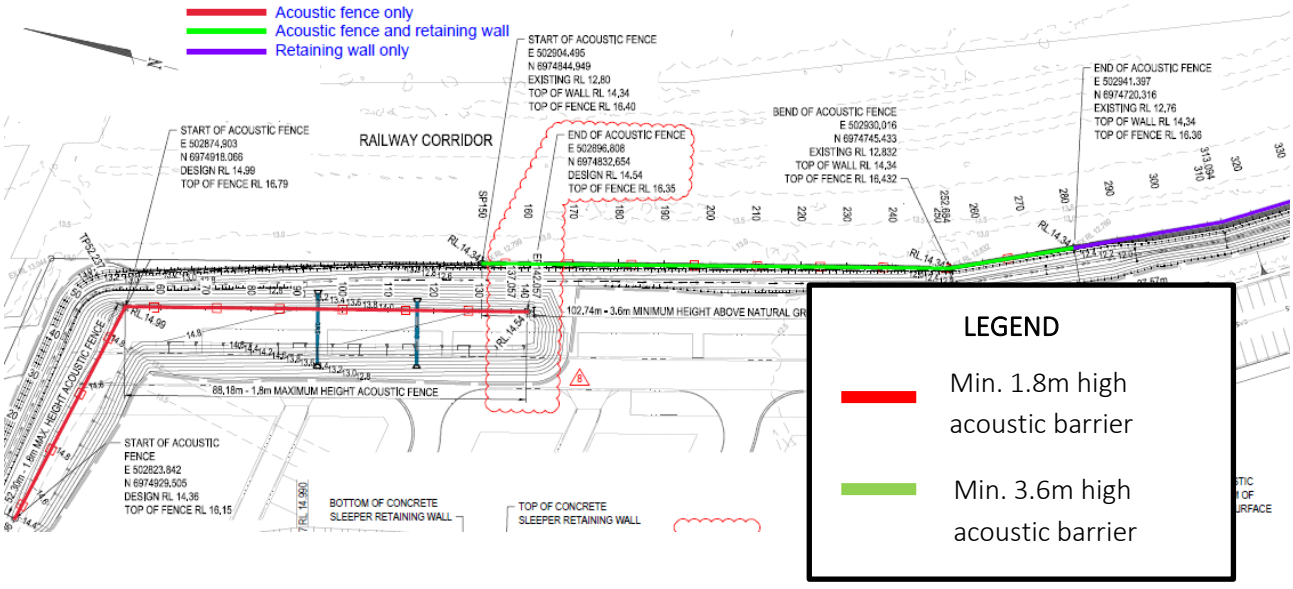
9.1 Acoustic Barrier

To reduce built form acoustic treatment requirements, an acoustic barrier is recommended at the location, height and extent as shown in Figure 10. This barrier was recommended as part of the previous Stage noise assessments. A detailed plan of the acoustic barrier is included in Appendix A. This barrier is now constructed.

The acoustic barrier was constructed to achieve the following:

- The minimum height as shown, relative to the site boundary level and finished site levels (as applicable). Further barrier height information is included in Appendix A.
- Constructed in accordance with Queensland Rail Civil Engineering Technical Requirement – CIVIL-SR – 014 Design of noise barriers adjacent to railways.
- No gaps or holes in the barrier construction including at the base.
- The barrier should be constructed of a material with a surface mass not less than 15kg/m^2.
- Suitable materials may include earth mound, steel panels, fibre cement sheeting, plywood, glass, masonry, or a combination of materials.

Figure 10: Recommended Acoustic Barrier – Rail Noise (Detailed plan in Appendix A)



9.2 Built Form Treatments

9.2.1 Rail Noise

This section summarises the combined building form treatment required for habitable rooms for 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 MP4.4 requires that habitable rooms in residential buildings located in a transport noise corridor are adequately protected from transport noise to safeguard occupant's health and amenity.

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

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).

QDC Noise Categories applicable for all lots are listed in Appendix D

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 11.

Table 11: 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	Rw 43	Rw 43	Rw 52	Rw 45
Category 3	Rw 38	Rw 35	Rw 47	Rw 41
Category 2	Rw 35	Rw 32	Rw 41	Rw 38
Category 1	Rw 27	Rw 24	Rw 35	Rw 35
Category 0	None	None	None	None

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

10 Conclusion

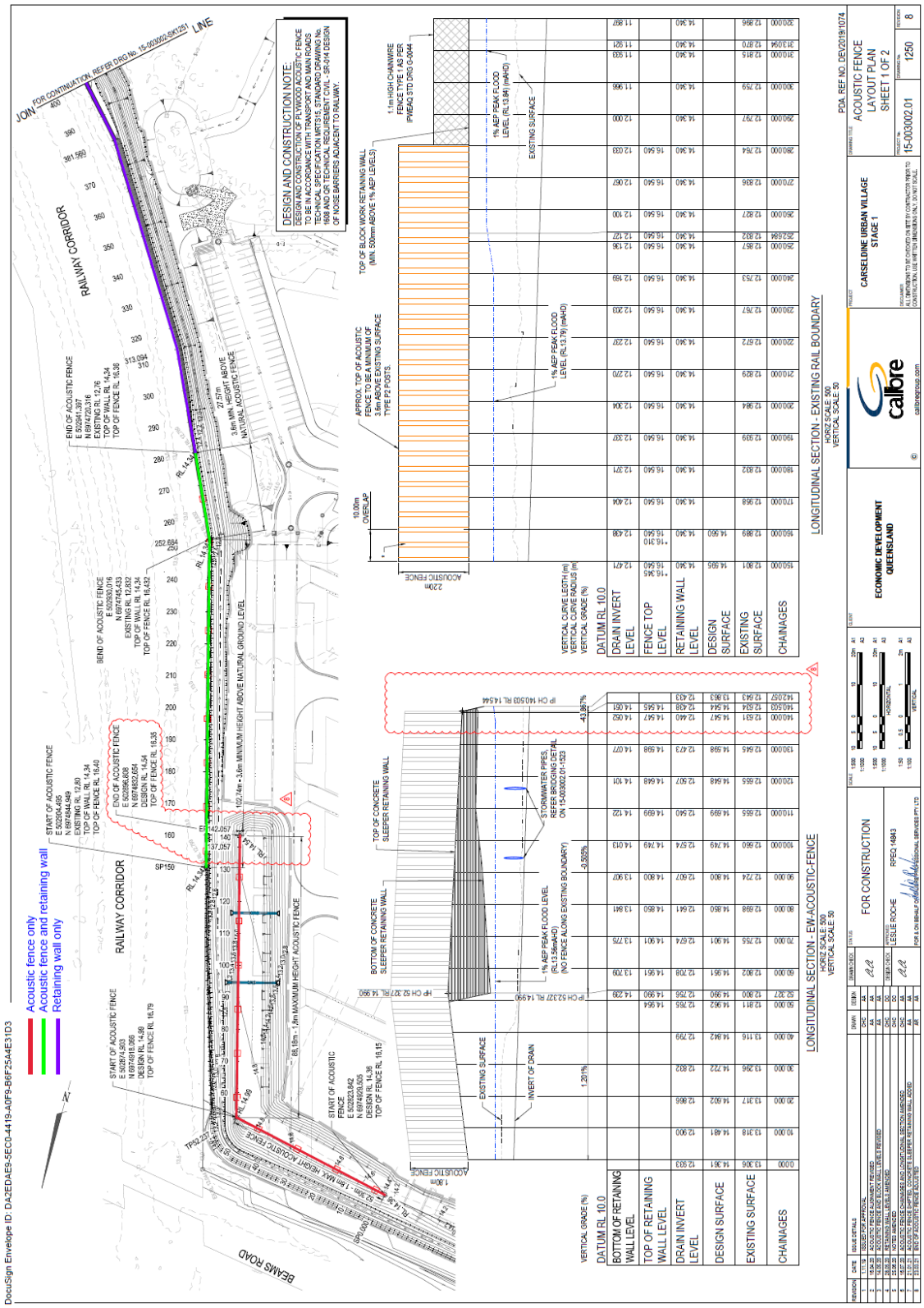
TTM was engaged by Economic Development Queensland, Urban Development to undertake a noise assessment of Stage 3 of the proposed Carseldine Village development located at 532 Beams Road, Carseldine. The assessment was based upon relevant planning scheme and transport noise development codes.

Compliance with the relevant planning scheme and State transport noise requirements is predicted based on the implementation of the recommendations outlined in Section 9 of this report.

Appendix A Development Plans

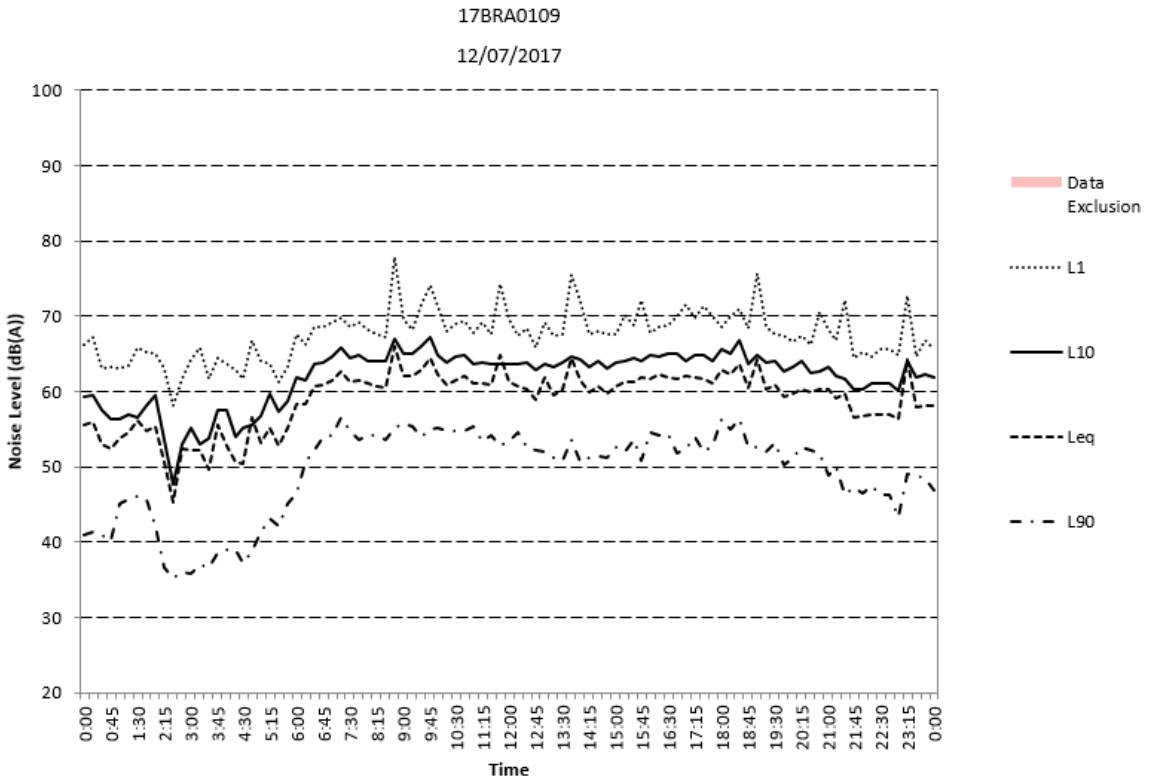

CARSELDINE URBAN VILLAGE
PLAN OF SUBDIVISION
STAGE 3A & 3B
(Pt) 7003
1.792ha (Balance)
Total Balance Area - 5.094ha
STAGE 1
STAGE 2
STAGE 3A
STAGE 3B
STAGE S
9000
3000
3001
3535m²
KEY MAP
Scale: 1 : 10,000
Legend
Site Boundary
Proposed Stage Boundary
Sports Park
Existing Access Easements
Existing Acoustic Barrier
Land Budget
Stage 3A
Stage 3B
Overall Stage 3
Yield Breakdown
Allotment Details
Stage 3A Lots
Stage 3B Lots
Stage 3 Overall Lots
Stage 3 Overall Percentage
23.5m Wide New Road
19m Wide Road
6.5m Wide Lane
20m Wide Road
23m Wide New Road
6.5m Wide New Lane
URBAN DESIGN
RPS

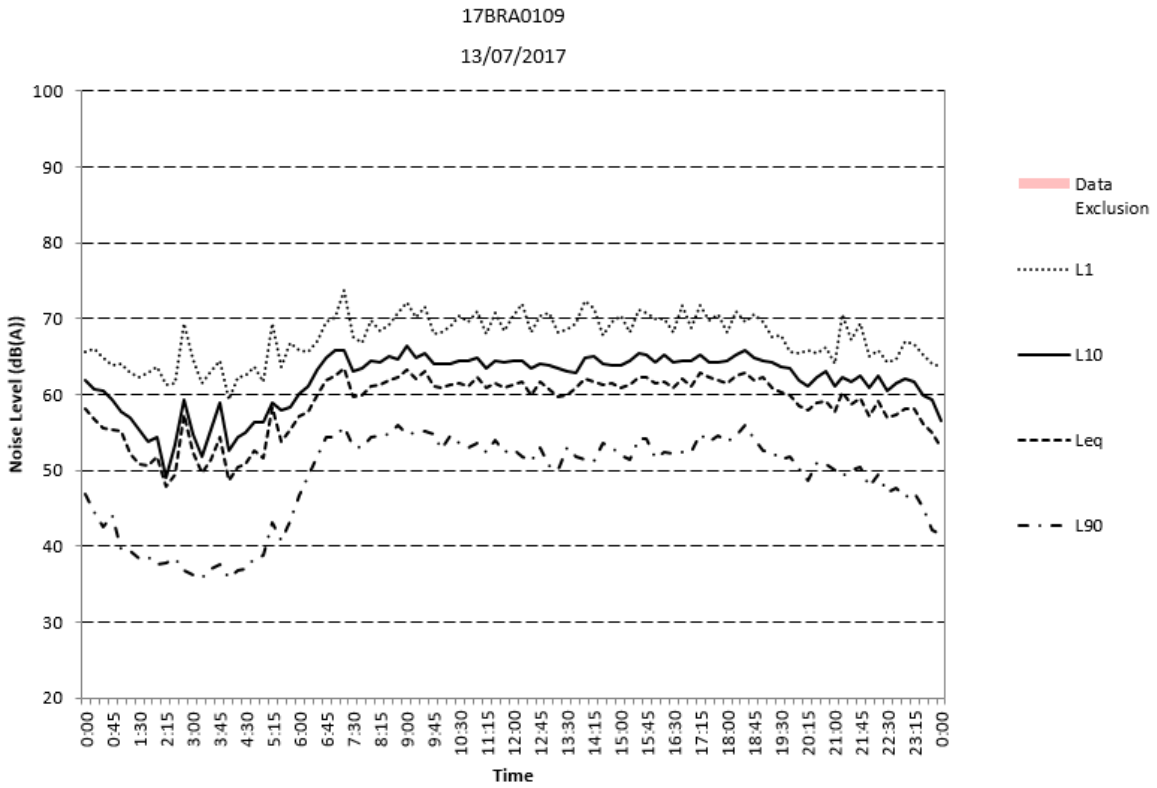
Previously Recommended Rail Noise Acoustic Barrier (Now Constructed)



Appendix B Unattended Noise Monitoring Graphs

Road Traffic Noise Monitor






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 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	

490 Beams Rd, Fitzgibbon
Rail - Verification

Lot Number	LAMax Free Field dB(A)	Leq24hr Free Field dB(A)	
Logger Receiver - Rail (85.4dB)	87.4	60.5	

532 Beams Rd, Carseldine Urban Village
Assessed receiver levels
Rail - Prediction with barrier - Stage 3

Receiver	Dir	Fl	Building Pad Level m (AHD)	Lmax Facade corrected dB(A)	Leq,24hr Facade corrected dB(A)
3002	E	GF	14.44	82.5	54.0
		F 1	14.44	82.8	56.1
3002	N	GF	14.50	81.5	51.3
		F 1	14.50	82.1	53.9
3002	S	GF	14.49	78.2	52.5
		F 1	14.49	79.4	54.4
3003	N	GF	14.57	81.2	50.9
		F 1	14.57	81.7	53.3
3003	S	GF	14.58	77.9	50.1
		F 1	14.58	79.1	52.8
3004	N	GF	14.61	80.7	50.4
		F 1	14.61	81.1	53.1
3004	S	GF	14.60	77.5	49.4
		F 1	14.60	78.9	52.1
3005	N	GF	14.65	80.0	50.1
		F 1	14.65	80.4	53.0
3005	S	GF	14.60	76.8	48.4
		F 1	14.60	78.2	51.7
3006	N	GF	14.69	79.1	49.6
		F 1	14.69	79.6	52.7
3006	S	GF	14.61	76.2	48.7
		F 1	14.61	77.6	51.9
3007	N	GF	14.72	78.4	49.0
		F 1	14.72	78.9	52.2
3007	S	GF	14.62	75.5	49.6
		F 1	14.62	76.5	52.3
3008	N	GF	14.74	77.9	48.6
		F 1	14.74	78.5	51.8
3008	S	GF	14.63	75.2	48.6
		F 1	14.63	76.4	51.8
3009	N	GF	14.77	77.3	48.1
		F 1	14.77	78.0	51.4
3009	S	GF	14.70	74.6	47.8
		F 1	14.70	75.9	51.3
3010	N	GF	14.81	76.7	47.7
		F 1	14.81	77.3	50.9
3010	S	GF	14.80	74.5	47.5
		F 1	14.80	75.4	50.5
3011	N	GF	14.84	76.3	47.2
		F 1	14.84	76.9	50.3
3011	S	GF	14.80	74.2	46.5
		F 1	14.80	75.1	49.8

532 Beams Rd, Carseldine Urban Village
Assessed receiver levels
Rail - Prediction with barrier - Stage 3

Receiver	Dir	Fl	Building Pad Level m (AHD)	Lmax Facade corrected dB(A)	Leq,24hr Facade corrected dB(A)
3012	N	GF	14.86	75.8	46.8
		F 1	14.86	76.4	49.9
3012	S	GF	14.80	73.9	45.5
		F 1	14.80	74.7	49.0
3013	N	GF	14.89	75.5	46.3
		F 1	14.89	76.1	49.2
3013	S	GF	14.82	73.6	44.7
		F 1	14.82	74.2	48.3
3014	N	GF	14.92	75.0	45.7
		F 1	14.92	75.6	48.5
3014	S	GF	14.83	72.9	44.4
		F 1	14.83	73.7	47.9
3015	N	GF	14.94	74.4	45.2
		F 1	14.94	75.0	47.7
3015	S	GF	14.90	72.6	44.5
		F 1	14.90	73.4	48.1
3016	N	GF	14.96	74.1	44.8
		F 1	14.96	74.6	47.2
3016	S	GF	15.00	72.7	44.2
		F 1	15.00	73.7	47.8
3017	N	GF	15.00	73.9	44.4
		F 1	15.00	74.4	46.7
3017	S	GF	15.00	72.5	43.7
		F 1	15.00	73.2	47.2
3017	W	GF	14.89	54.7	34.6
		F 1	14.89	59.1	39.3
3018	N	GF	15.00	72.4	43.6
		F 1	15.00	73.2	46.9
3018	S	GF	14.99	71.3	46.8
		F 1	14.99	71.9	47.9
3018	W	GF	15.00	53.2	33.1
		F 1	15.00	57.5	37.7
3019	N	GF	15.00	72.6	44.1
		F 1	15.00	73.5	47.4
3019	S	GF	14.97	71.7	47.3
		F 1	14.97	72.2	48.5
3020	N	GF	14.98	73.0	44.5
		F 1	14.98	73.8	48.1
3020	S	GF	14.89	71.9	47.7
		F 1	14.89	72.5	49.0
3021	N	GF	14.97	73.3	45.1
		F 1	14.97	74.1	48.9

532 Beams Rd, Carseldine Urban Village
Assessed receiver levels
Rail - Prediction with barrier - Stage 3

Receiver	Dir	Fl	Building Pad Level m (AHD)	Lmax Facade corrected dB(A)	Leq,24hr Facade corrected dB(A)
3021	S	GF	14.82	72.2	47.8
		F 1	14.82	72.8	49.3
3022	N	GF	14.96	73.8	45.5
		F 1	14.96	74.4	49.4
3022	S	GF	14.80	72.3	48.2
		F 1	14.80	73.0	49.8
3023	N	GF	14.93	73.9	46.2
		F 1	14.93	74.7	50.2
3023	S	GF	14.80	73.0	48.6
		F 1	14.80	73.6	50.5
3024	N	GF	14.86	74.2	46.5
		F 1	14.86	75.0	50.6
3024	S	GF	14.80	73.3	48.9
		F 1	14.80	73.8	50.5
3025	N	GF	14.84	74.8	46.7
		F 1	14.84	75.6	50.8
3025	S	GF	14.80	73.2	49.2
		F 1	14.80	73.7	50.6
3026	N	GF	14.80	75.2	47.2
		F 1	14.80	76.0	51.0
3026	S	GF	14.80	73.5	49.1
		F 1	14.80	74.0	50.4
3027	N	GF	14.80	75.7	48.0
		F 1	14.80	76.4	51.6
3027	N	GF	14.77	76.3	48.4
		F 1	14.77	77.0	51.8
3027	S	GF	14.93	74.0	49.5
		F 1	14.93	74.5	50.8
3027	S	GF	14.75	74.8	49.9
		F 1	14.75	75.3	51.2
3029	N	GF	14.74	77.3	49.0
		F 1	14.74	77.9	52.2
3029	S	GF	14.60	75.1	50.3
		F 1	14.60	75.6	51.6
3030	N	GF	14.67	77.7	50.3
		F 1	14.67	78.3	52.9
3030	S	GF	14.60	75.7	50.5
		F 1	14.60	76.1	51.8
3031	N	GF	14.65	78.1	51.0
		F 1	14.65	78.7	53.2
3031	S	GF	14.60	75.8	50.8
		F 1	14.60	76.4	52.2

532 Beams Rd, Carseldine Urban Village
Assessed receiver levels
Rail - Prediction with barrier - Stage 3

Receiver	Dir	Fl	Building Pad Level m (AHD)	Lmax Facade corrected dB(A)	Leq,24hr Facade corrected dB(A)
3032	N	GF	14.62	79.3	50.0
		F 1	14.62	79.9	52.6
3032	S	GF	14.60	76.1	51.2
		F 1	14.60	76.6	52.6
3033	N	GF	14.60	80.6	49.8
		F 1	14.60	81.4	52.8
3033	S	GF	14.60	76.5	51.6
		F 1	14.60	77.0	52.9
3034	E	GF	14.63	81.7	54.3
		F 1	14.63	82.3	55.6
3034	N	GF	14.59	81.6	51.8
		F 1	14.59	82.3	54.0
3034	S	GF	14.42	76.7	51.7
		F 1	14.42	77.4	53.0

Appendix D QDC Noise Category Results

Stage 3A				QDC Noise Category
Receiver	Façade Direction	Floor	Building Pad (m)	Rail
3002	E	GF	14.44	3
3002	E	F 1	14.44	3
3002	N	GF	14.5	3
3002	N	F 1	14.5	3
3002	S	GF	14.49	2
3002	S	F 1	14.49	2
3003	N	GF	14.57	3
3003	N	F 1	14.57	3
3003	S	GF	14.58	2
3003	S	F 1	14.58	2
3004	N	GF	14.61	3
3004	N	F 1	14.61	3
3004	S	GF	14.6	2
3004	S	F 1	14.6	2
3005	N	GF	14.65	3
3005	N	F 1	14.65	3
3005	S	GF	14.6	2
3005	S	F 1	14.6	2
3006	N	GF	14.69	2
3006	N	F 1	14.69	3
3006	S	GF	14.61	2
3006	S	F 1	14.61	2
3007	N	GF	14.72	2
3007	N	F 1	14.72	2
3007	S	GF	14.62	2
3007	S	F 1	14.62	2
3008	N	GF	14.74	2
3008	N	F 1	14.74	2
3008	S	GF	14.63	2
3008	S	F 1	14.63	2
3009	N	GF	14.77	2
3009	N	F 1	14.77	2
3009	S	GF	14.7	2
3009	S	F 1	14.7	2
3010	N	GF	14.81	2
3010	N	F 1	14.81	2
3010	S	GF	14.8	2

3010	S	F 1	14.8	2
3011	N	GF	14.84	2
3011	N	F 1	14.84	2
3011	S	GF	14.8	1
3011	S	F 1	14.8	2
3012	N	GF	14.86	2
3012	N	F 1	14.86	2
3012	S	GF	14.8	1
3012	S	F 1	14.8	2
3013	N	GF	14.89	2
3013	N	F 1	14.89	2
3013	S	GF	14.82	1
3013	S	F 1	14.82	1
3014	N	GF	14.92	2
3014	N	F 1	14.92	2
3014	S	GF	14.83	1
3014	S	F 1	14.83	1
3015	N	GF	14.94	1
3015	N	F 1	14.94	2
3015	S	GF	14.9	1
3015	S	F 1	14.9	1
3016	N	GF	14.96	1
3016	N	F 1	14.96	2
3016	S	GF	15	1
3016	S	F 1	15	1
3017	N	GF	15	1
3017	N	F 1	15	1
3017	S	GF	15	1
3017	S	F 1	15	1
3017	W	GF	14.89	0
3017	W	F 1	14.89	0
3018	N	GF	15	1
3018	N	F 1	15	1
3018	S	GF	14.99	1
3018	S	F 1	14.99	1
3018	W	GF	15	0
3018	W	F 1	15	0
3019	N	GF	15	1
3019	N	F 1	15	1
3019	S	GF	14.97	1
3019	S	F 1	14.97	1

3020	N	GF	14.98	1
3020	N	F 1	14.98	1
3020	S	GF	14.89	1
3020	S	F 1	14.89	1
3021	N	GF	14.97	1
3021	N	F 1	14.97	1
3021	S	GF	14.82	1
3021	S	F 1	14.82	1
3022	N	GF	14.96	1
3022	N	F 1	14.96	1
3022	S	GF	14.8	1
3022	S	F 1	14.8	1
3023	N	GF	14.93	1
3023	N	F 1	14.93	2
3023	S	GF	14.8	1
3023	S	F 1	14.8	1
3024	N	GF	14.86	1
3024	N	F 1	14.86	2
3024	S	GF	14.8	1
3024	S	F 1	14.8	1
3025	N	GF	14.84	2
3025	N	F 1	14.84	2
3025	S	GF	14.8	1
3025	S	F 1	14.8	1
3026	N	GF	14.8	2
3026	N	F 1	14.8	2
3026	S	GF	14.8	1
3026	S	F 1	14.8	1
3027	N	GF	14.8	2
3027	N	F 1	14.8	2
3027	N	GF	14.77	2
3027	N	F 1	14.77	2
3027	S	GF	14.93	1
3027	S	F 1	14.93	2
3027	S	GF	14.75	2
3027	S	F 1	14.75	2
3029	N	GF	14.74	2
3029	N	F 1	14.74	2
3029	S	GF	14.6	2
3029	S	F 1	14.6	2
3030	N	GF	14.67	2

3030	N	F 1	14.67	2
3030	S	GF	14.6	2
3030	S	F 1	14.6	2
3031	N	GF	14.65	2
3031	N	F 1	14.65	2
3031	S	GF	14.6	2
3031	S	F 1	14.6	2
3032	N	GF	14.62	2
3032	N	F 1	14.62	3
3032	S	GF	14.6	2
3032	S	F 1	14.6	2
3033	N	GF	14.6	3
3033	N	F 1	14.6	3
3033	S	GF	14.6	2
3033	S	F 1	14.6	2
3034	E	GF	14.63	3
3034	E	F 1	14.63	3
3034	N	GF	14.59	3
3034	N	F 1	14.59	3
3034	S	GF	14.42	2
3034	S	F 1	14.42	2

Appendix E 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*.