

# ADVERTISED PLAN



MARSHALL DAY  
Acoustics 

2-12 WILKINSON STREET  
ACOUSTIC PLANNING REPORT

Rp 001 20240722 | 27 August 2024

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# ADVERTISED PLAN

Project: **2-12 WILKINSON STREET, BRUNSWICK**

Prepared for: **Haven Home Safe  
52-56 Mary Street  
Preston VIC 3072**

Attention: 

Report No.: **Rp 001 20240722**

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## Document Control

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## 1.0 INTRODUCTION

A mixed use commercial/residential apartment development is proposed at 2-12 Wilkinson Street, Brunswick.

Given the site's proximity to road and rail, council has requested the following information be provided for the development:

- 2. An Acoustic Report prepared by a suitably qualified acoustic engineer which includes noise measurements of the nearby train station/line and nearby existing uses (including the site to the north) and what acoustic attenuation must occur to the development as a result.*

Marshall Day Acoustics Pty Ltd (MDA) has been commissioned to provide acoustic services on the project from the town planning stage of the project.

The scope of this assessment is to determine building envelope acoustic performance requirements and mitigation treatments to control noise impacts on the site and from the proposed development.

Acoustic terminology used throughout this report is included as Appendix A.

## 2.0 SITE AND PROJECT DESCRIPTION

### 2.1 Location

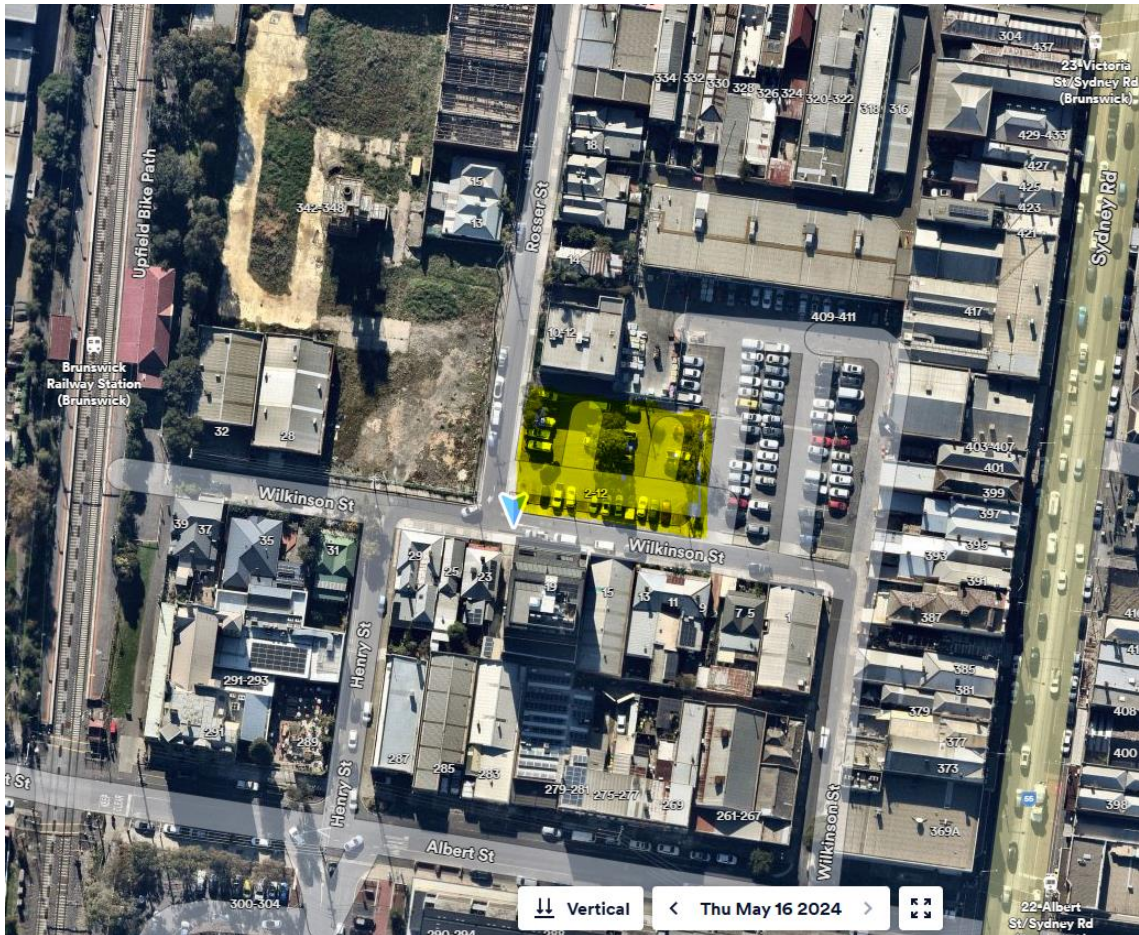
The subject site is located on land at 2-12 Wilkinson Street, Brunswick, and is bounded by the following:

- North: 10-12 Rosser Street (2 storey commercial building) and Bunnings stock yard.
- South: Wilkinson Street with residential houses on the south side
- East: Car park
- West: Rosser St with a vacant block on the west side.

An aerial photograph of the subject site and surrounding area is shown in Figure 1.

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Figure 1: Aerial view of subject site – in yellow (Source: Nearmap)



The nearest railway line, located 95 m to the west of the site, comprises two train tracks carrying metropolitan passenger trains. Trains travel to the north along the western throughway track and south along the east throughway track.

The subject site and immediate surrounds is zoned Commercial 1 Zone (C1Z), and the adjacent rail corridor is Public Use Zone (PUZ4-Transport).

The relevant zoning map is provided in Appendix B.

## 2.2 Documentation

The proposed development is for a 6 storey high mixed use development, comprising retail/commercial on ground and residential apartments above.

The assessment has been based on drawings provided by MGS Architects as detailed in Table 1. A copy of the floor plans are provided in Appendix C.

Table 1: Drawings reviewed

Drawing TP set	Revision	Title
SK,000,101,201,202,203,204,205,206,207,401,402,403,404,411,501,502,503,601,602,603,604,605,611,701,702,703,704,705,706,711	Feb 2024	Town Planning

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**2.3 Noise considerations and design criteria**

**2.3.1 Noise affecting the Site**

The following sources of noise have been identified as potentially impacting the site:

- Passenger train noise from passing trains; and
- Traffic noise from surrounding streets and the carpark.
- Noise from the Bunnings stock yard forklift

No live music venues have been identified in the area.

**2.3.2 Potential noise from the Site**

Noise from mechanical services equipment that serve commercial tenancies within the subject site (e.g., exhaust fans, refrigeration systems) or common equipment that serves the apartments (e.g., centralised air conditioning) are required to comply with legislated noise limits.

The noise limits apply to both apartments within the proposed building as well as to the existing residences on Florence Street immediately adjacent to the site to the east.

The policy is based around several documents as detailed in Section 3.0.

Noise transfer internally between apartments is addressed via legislative requirements in the National Construction Code (NCC), which are not discussed in this planning report.

Individual retail and commercial tenancies will require further considerations with respect to control of noise from music and patrons using their facilities if this is applicable. These assessments will be the responsibilities of the tenants.

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**3.0 RELEVANT LEGISLATION, STANDARDS AND GUIDELINES**

**3.1 Legislation**

A summary of the relevant Victorian legislation is provided in Table 2.

**Table 2: Relevant Victorian noise legislation applicable to proposed development**

Publication	Description
<i>Environment Protection Act 2017</i> (the EP Act)	<p>The EP Act provides the overarching legislative framework for the protection of the environment in Victoria and prohibits the emission of unreasonable or aggravated noise from non-residential premises.</p> <p>A key element of the EP Act is the establishment of a general environmental duty (GED). This duty requires anyone engaging in an activity posing a risk of harm to human health and/or the environment from pollution to minimise those risks as far as reasonably practicable. Harm includes noise related amenity impacts.</p> <p>The EP Act provides for the creation of a range of subordinate legislation and publications which are used to assess and manage noise levels (see below).</p>
<i>Environment Protection Regulations 2021</i> (EP Regulations)	<p>The EP Regulations give effect to the EP Act by establishing prescriptive requirements for a range of environmental considerations including noise.</p> <p>The noise requirements are defined according to the type of noise generating activity under consideration and include definitions such as the types of noise sensitive areas where these requirements apply and assessment time periods.</p> <p>In relation to noise from commercial, industrial and trade premises (industry), the EP Regulations specify that the prediction, measurement, assessment or analysis of noise within a noise sensitive area must be conducted in accordance with the Noise Protocol (see below). Noise from industry is prescribed by the EP Regulations to be unreasonable if it exceeds a noise limit or alternative assessment criterion determined in accordance with the Noise Protocol.</p>
EPA Victoria Publication 1826 <i>Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues</i> (Noise Protocol)	<p>The Noise Protocol defines the methods for setting noise limits for industry in Victoria, including earth resources land uses such as quarries.</p> <p>Two methods of setting limits are defined according to whether the industry is located in a major urban area or rural area. However, in both cases, the noise limits are determined by accounting for the land use zoning of the area and the background noise levels. The noise limits apply at a range of noise sensitive areas defined in the EP Regulations, including residential dwellings, education building and health facilities. Noise limits are separately defined for day, evening and night periods</p> <p>The Noise Protocol also outlines the steps that must be followed to conduct an assessment (measurement or prediction) of the effective noise level within a noise sensitive area or at an alternative assessment location. A comparison between the effective noise level and the relevant noise limit or the relevant alternative assessment criterion is used to inform whether the noise emitted from the premises is prescribed to be unreasonable under the Regulations.</p>
Clause 58 of the Victorian Planning Provisions (VPP)	<p>Clause 58-04 of the Victorian Planning Provisions (VPP) applies to apartment developments of five or more storeys and introduces new requirements for apartment developments including noise impacts.</p> <p>The objective is to contain noise from the development that could affect existing neighbouring residents, as well as protect future residents from external and internal noise sources such as traffic noise and mechanical services noise.</p>

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The subject site is located within a Noise Influence Area, as it is within 300 m from an Industrial 1 zone. Therefore, the building should be designed and constructed to achieve the following noise levels:

Not greater than 35 dB(A) for bedrooms, assessed as an  $L_{Aeq,8h}$  from 10 pm to 6 am.

Not greater than 40 dB(A) for living areas, assessed  $L_{Aeq,16h}$  from 6 am to 10 pm.

The criteria in Clause 58 is consistent with the recommended design levels contained in AS 2107 and also in Merri-Bek Planning Scheme.

National Construction Code (NCC) 2022

The full requirements of the NCC will be considered during the design development stage of the project. In this report, the NCC is referenced regarding noise transfer between commercial and residential tenancies.

### 3.2 Guidelines and standards

A summary of relevant guidelines applicable to the proposed development is provided in Table 3.

**Table 3: Relevant guidelines and acoustic standards**

Reference	Overview
Australian/New Zealand Standard AS/NZS 2107:2016 "Acoustics - Recommended design sound levels and reverberation times for building interiors" (AS 2107)	Provides recommendations for acceptable internal noise levels. Table 1 of AS 2107 presents the recommended internal noise levels for "houses and apartments near major roads", which is applicable to the development site.
Sleep disturbance criteria sourced from NSW Road Noise Policy 2011 (Sleep disturbance criteria)	The provisions of this document are often referred to in Victoria for general guidance on potential sleep disturbance. Based on a review of research into sleep disturbance, the NSW policy nominates maximum external night-time noise levels at noise sensitive locations which are unlikely to disturb sleep.
Planning Practice Note 83 Assessing external noise impacts for apartments (PPN 83)	PPN 83 is a guidance document which contains information relating to Clause 58-04 of the VPP. The guideline breaks sites into various category's and provides indications on the level of acoustic treatment that can be expected.
EPA Publication 1254.2 Noise Control Guidelines (EPA Guidelines)	Provides an overview of noise policies and legislation in Victoria for a range of different noise sources and provides supplementary guidance for situations where there is no policy or legislation.
Victorian Passenger Rail Infrastructure Noise Policy April 2013 (VPRINP)	The Victorian Passenger Rail Infrastructure Noise Policy (VPRINP) sets 'investigation thresholds' for the assessment of noise. These are noise levels, which if exceeded, indicate that noise mitigation should be considered. Note that the VPRINP does not provide design targets in the event that investigation thresholds be exceeded. Internal noise design targets are nominated by MDA based on previous planning precedents.
ISO 10137:2007 - Serviceability of buildings and walkways against vibrations Annex C Table C.1	ISO 10137 presents vibration criteria for continuous and intermittent vibration in building and specifies vibration guideline targets for human comfort based on frequency dependent criteria referred to as "Curves" which are applicable for different building usages.

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Reference	Overview
BS 6472-1:2008 <i>Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting</i>	BS 6472 takes into account human comfort based on exposure to vibration exposure over 16 hour day and 8 hour night periods.

### 3.3 Summary of acoustic criteria

Table 4 summarises the acoustic criteria, applicable for the proposed development.

**Table 4: Summary of key noise issues and corresponding noise criteria**

Potential noise impact	Source of criteria	Document status	Summary of assessment criteria
Domestic plant noise	EP Regulations	Legislation	See Section 7.0 and Appendix E
Central plant and commercial noise	EP Regulations via the Noise Protocol	Legislation	Day: 56 dB $L_{Aeq, 30min}$ Evening: 51 dB $L_{Aeq, 30min}$ Night: 48 dB $L_{Aeq, 30min}$
Waste collection and deliveries	EP Regulations via the Noise Protocol EPA 1254.2	Legislation Guideline	See Section 7.0 and Appendix E
Traffic and transport noise impacting the site	Clause 58 of VPP	State Planning Policy. Objectives must be achieved; standards should be achieved	Not greater than 35 dB(A) for bedrooms, assessed as an $L_{Aeq, 8h}$ from 10 pm to 6 am. Not greater than 40 dB(A) for living areas, assessed $L_{Aeq, 16h}$ from 6 am to 10 pm.
<div style="border: 2px solid red; padding: 5px; width: fit-content;"> <p><b>This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright</b></p> </div>	AS 2107	Australian Standard	Living areas: 35 – 45 dB $L_{Aeq}$ Sleeping areas: 35 – 40 dB $L_{Aeq}$ Work areas: 35 – 45 dB $L_{Aeq}$
	VPRINP	Guideline	Investigation thresholds (external) 85 dB $L_{Amax}$ Day: 65 dB $L_{Aeq, 16h}$ Night: 60 dB $L_{Aeq, 8h}$
	Sleep disturbance	Industry Standard	50 – 55 dB $L_{Amax}$ internal sleeping areas
Rail vibration	ISO 10137:2007 BS 6472-1:2008	ISO Standard British Standard	See Appendix E
Noise between commercial and residential	NCC	Legislation	$R_w + C_{tr}$ 50

## 4.0 NOISE LEVEL INFORMATION

Attended measurements were conducted between 1030 – 1200hrs and 1900-1930hrs on 9 August 2024 to measure ambient noise levels. Further detail is presented in Appendix D.

### 4.1 Background noise levels

The background noise levels used for determining noise limits are presented in Table 5.

**Table 5: Measured background noise levels, dB LA90**

	Day	Evening	Night
Background noise level	43	42	41

### 4.2 Source noise levels

This section presents the source data used in the acoustic design of the subject site with regards to rail, traffic and any other extraneous noise impacting the site.

In addition to rail and traffic noise measurements, there is also a Bunnings stock yard directly to the north which occasionally has a forklift operating to move stock. Noise from the forklift was measured and is similar to noise from cars using the car park.

Table 6 details measured noise levels used in our assessment.

**Table 6: Noise measurements 1030 – 1200hrs, 9 August 2024**

Source description	Octave band centre frequency (Hz)							
	A	63	125	250	500	1k	2k	4k
Traffic on local roads and carpark noise (Leq)	55	64	58	51	48	45	42	38
Bunnings Forklift (Leq)	51	60	54	45	43	43	41	34
Bunnings Forklift (Lmax)	53	63	60	52	51	51	46	45
Train horn - typical (Lmax)	66	65	58	51	58	64	62	51
Train pass by - typical (Leq)	56	64	58	52	51	55	46	48

Traffic from Sydney Rd, train pass by and train horn noise will be sufficiently attenuated over the 90 m buffer distance to subject site, resulting in the average ambient noise at the subject site being primarily influenced by local road traffic noise.

### 4.3 Rail vibration

Rail vibration at the site is almost indistinguishable from local traffic due to the large distance from the railway line. Table 7 provides the results of the peak vibration measured during three train pass bys.

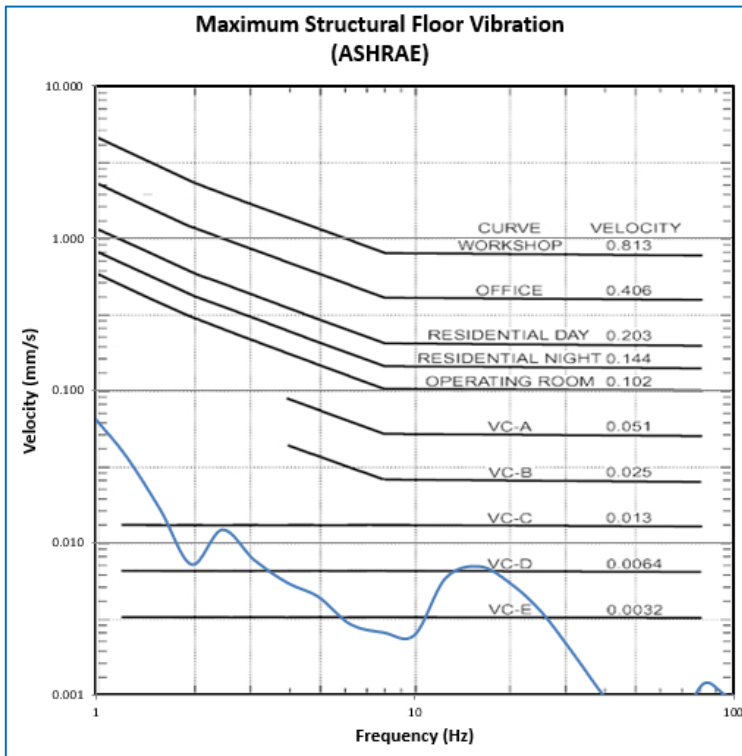
**Table 7: Peak vibration level from train pass by Lv dB**

Ground Vibration	Acceleration Level Lv dB (re 10 <sup>-6</sup> m/s RMS)										
	Third octave band centre frequency (Hz)										
	12.5	16	20	25	31.5	40	50	63	80	100	125
Trains passing	75	77	75	71	65	59	55	53	61	60	68

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Figure 2 shows the measured vibration levels plotted on the ASHRAE floor vibration criteria curves for different building types.

Figure 2: VC graph with measured vibration levels.



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The levels in Table 7 are well below the threshold where vibration should be considered. Vibration is therefore not a concern and is not needed to be assessed for this site.

## 5.0 ACOUSTIC DESIGN FOR ARCHITECTURAL ELEMENTS

### 5.1 Introduction

Based on the source reference data outlined in Section 5.0, rail noise at the site is below the VPRINP investigation threshold and thus does not trigger an assessment according to the design criteria detailed in Section 4.0.

### 5.2 Building facade

#### 5.2.1 Glazing

The internal octave band noise levels and corresponding facade requirements for these cases have been calculated, and the resulting glazing specifications for the apartments consider both the maximum ( $L_{Amax}$ ) and average ( $L_{Aeq}$ ) project noise criteria.

Indicative glazing selections are presented with the minimum acoustic performance requirements ( $R_w$ ) in Table 8.

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**Table 8: Facade glazing requirements (octave band transmission loss values for glazing is presented in Appendix F)**

Location	Room type	Facade glazing (R <sub>w</sub> )	System
Ground floor commercial	Commercial tenancy	n/a	No mandatory acoustic requirement for commercial premises. For acoustic amenity we recommend minimum 6/12/6 or 10 mm laminated glass.
Ground floor - Residential – all façades	All room types	35	6/12/8 DGU or 10 mm laminated
North – L1-L6	All room types	33	6/12/6
West – L1-L6	Bedroom	33	6/12/6
South – L1-L6	Bedroom and Living	33	6/12/6
East – L1-L6	Bedroom and Living	33	6/12/6

### 5.2.2 Non-glazed facade elements

The building envelope walls, including any light-weight wall systems, must be specified to provide a level of sound attenuation (R<sub>w</sub>) at least 10 dB higher than that of the associated glazing detailed in Table 8 in order that these elements will not degrade the performance.

Where external walls are constructed from concrete or brick, no special acoustic treatment is typically required. Where light-weight construction is proposed, the facade system must be carefully selected and designed during the design development phase such that the low frequency component of external noise is sufficiently attenuated.

Care should also be taken with the detailed design of openings to the facade such as kitchen extract ducts or ventilation pathways to ensure that noise ingress through these elements does not degrade the sound insulation performance of the glazing and walls.

### 5.2.3 External doors

All glazed external doors (including sliding doors) must incorporate the relevant glazing specifications detailed above. It is expected that a well-sealed door system incorporating the above glazing thickness will achieve a suitable acoustic performance.

There are commercially available glass sliding door systems that can achieve acoustic performance equivalent to the glazing systems specified in Table 8.

## 5.3 Ventilation strategy

As the internal noise level criteria can only be met with windows and doors closed, consideration must be given to how the ventilation requirements of applicable building codes and Australian Standards will be satisfied. If residents choose to open their windows for ventilation, noise levels in the apartment will be above the internal noise level criteria, particularly for those apartments facing the rail corridor.

### 5.4 Bunnings stock yard activity

The general environmental duty (GED) applies to all commercial, industrial and trade premises in the area as well as to the developer of the subject site.

Noise from the Bunnings stock yard activity must meet noise limits imposed by relevant Victorian regulations. In addition, the GED under the Environment Protection Act 2017 imposes obligations

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beyond just meeting the noise limits and Bunnings is required to reduce the risk of harm from any emission of noise as far as reasonably practicable. This means that reducing excessive noise from the forklift or other activity in the stock yard is Bunnings responsibility.

However, the GED also imposes some responsibility on the agent of change, in this case, the proposed development considers noise impacts from activity in the stock yard.

Based on the measured forklift noise, the equivalent A-weighted sound pressure level measured as a dB  $L_{Aeq,30min}$ , adjusted where necessary for duration, character and measurement as an external or internal noise levels is predicted to be below the acceptable noise levels provided the glazing is Table 8 is specified.

## 5.5 Discussion on VPP Clause 58.04

### 5.5.1 External rail noise impacts

The glazing requirements to achieve the applicable internal noise level criteria have been provided in Table 8. The average ( $L_{Aeq}$ ) noise data used for the building envelope glazing assessment accounts for a 'peak period' and this is expected to provide a conservative assessment with respect to the requirements of Clause 58.04 that the average noise over the respective daytime and night periods be considered.

The glazing ratings and recommendations are consistent with the indicative systems presented in Appendix 1 of PPN 83.

### 5.5.2 Internal noise sources

Noise from mechanical services plant associated within the subject site can be addressed with conventional and readily available acoustic treatments.

### 5.5.3 Noise between apartment balconies

A number of apartments within the subject site have adjacent outdoor deck areas.

There are no criteria governing noise transfer between adjacent balconies of sole occupancy apartments. The Standard (D16) of Clause 58.04-3 recommends "minimising" noise transmission.

### 5.5.4 Internal sound insulation

The apartments must be designed to meet all the requirements for internal sound insulation prescribed by the National Construction Code (NCC). The NCC is the applicable legislative document regarding acoustic performance of residential type buildings. The NCC includes airborne and impact sound insulation requirements for walls and floors as well as requirements for insulating internal services such as ducting and pipework.

An assessment of NCC acoustic requirements must be completed at the design development stage of the project.

The floor separating the retail tenancies from residential apartments should achieve minimum  $R_w + C_{tr}$  50. Furthermore, the ground floor apartments and retail tenancies should be separated using a separate stud construction and the door must be rated at  $R_w$  30.

## 6.0 NOISE FROM THE PROPOSED DEVELOPMENT

### 6.1 Commercial mechanical services

Noise from apartment building commercial tenancies, including exhaust fans and refrigeration systems or common area equipment/plant serving common areas and carpark exhaust fans, are required to achieve the EP Regulations noise limits outside of apartments proposed for the site as well as the existing residences on Albion Street immediately adjacent to the site.

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The EP Regulations noise limits are presented in Table 4.

These limits are also applicable for apartments within the proposed development, that are below the central plant areas.

The treatment of the various mechanical plant items must be considered in the detailed design stage when equipment selections and locations are refined, and incorporation of typical acoustic treatments will be investigated as required to allow compliance with the EP Regulations limits.

The types of typical mitigation strategies that may be considered include:

- Strategic location of plant items away from habitable rooms, such as within dedicated plant room enclosures or rooftop plant decks with acoustic barriers;
- Selection of quieter plant items and fans with variable speed drives as necessary; and
- Provision of attenuators to exhaust fans as necessary.

In the case of any equipment servicing commercial spaces at ground floor level compliance with the EP Regulations will be the responsibility of the respective future tenant(s).

## 6.2 Waste collection and deliveries

To minimise the risk of disturbance due to noise from waste collection from apartment buildings, adoption of the EPA recommendations for waste collection as included in Section E7 and Section E8 may be considered.

The specific managerial items to be addressed are detailed in Appendix E, and this is expected to be the role of the future body corporate to enforce or otherwise the responsibility of eventual future commercial tenancies.

## 7.0 SUMMARY

A 7 storey high mixed use commercial/residential apartment development is proposed at 2-12 Wilkinson Street, Brunswick.

This report identifies the typical extent of building envelope construction required to address rail and road noise, considers vibration and structural borne noise as well as environmental noise from the site.

The findings are outlined as follows:

### *Building envelope*

- Rail noise from the adjacent rail corridor is well below the relevant investigation thresholds as stipulated in the Victorian Passenger Rail Infrastructure Noise Policy (VPRINP). Accordingly, building envelope acoustic performance requirements are primarily driven by local road traffic noise from nearby roads.
- The acoustic performance requirements presented for glazed building envelope elements to address traffic noise can be readily achieved using typical double glazed systems

### *Rail vibration and structure borne noise*

- Rail vibration levels at the site are very low and special mitigation measures and treatment is not required to achieve the relevant criteria.

### *Mechanical services noise*

- The acoustic performance requirements and managerial requirements should be considered at the design development stage to account for commercial and domestic mechanical services are provided in Section 7.0.

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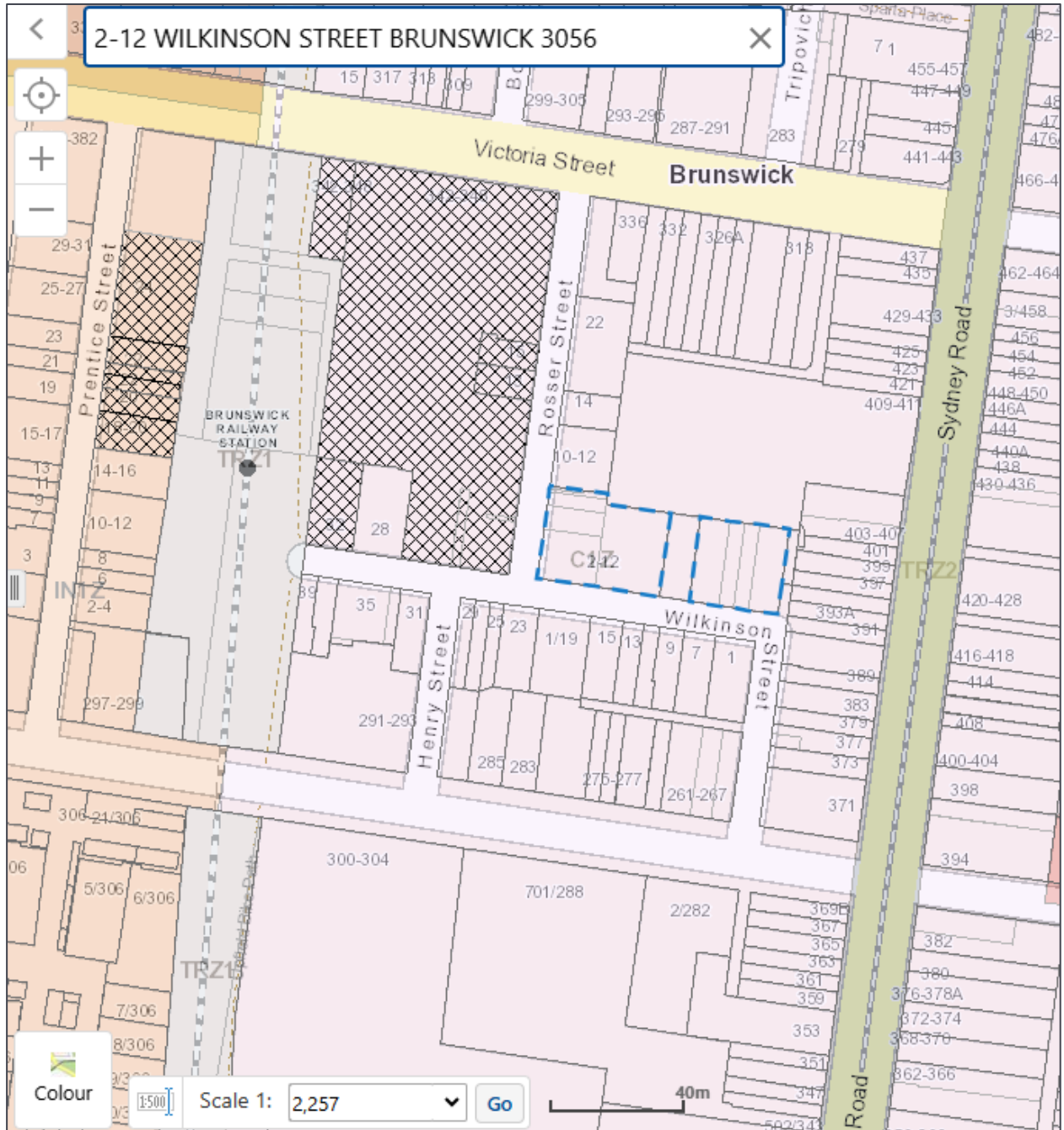
## APPENDIX A GLOSSARY OF TERMINOLOGY

<b>A-weighting</b>	<p>A set of frequency-dependent sound level adjustments that are used to better represent how humans hear sounds. Humans are less sensitive to low and very high frequency sounds.</p> <p>Sound levels using an “A” frequency weighting are expressed as dB <math>L_A</math>. Alternative ways of expressing A-weighted decibels are dBA or dB(A).</p>
<b>dB</b>	<p>Decibel. The unit of sound level. Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of <math>P_r=20 \mu\text{Pa}</math> i.e. <math>\text{dB} = 20 \times \log(P/P_r)</math></p>
<b>Frequency</b>	<p>Sound occurs over a range of frequencies, extending from the very low (e.g. thunder) to the very high (e.g. mosquito buzz). Measured in units of Hertz (Hz).</p> <p>Humans typically hear sounds between 20 Hz and 20 kHz. High frequency acuity naturally reduces with age most adults can hear up to 15 kHz.</p>
<b>Hertz (Hz)</b>	<p>The unit of frequency, named after Gustav Hertz (1887-1975). One hertz is one pressure cycle of sound per second. One thousand hertz – 1000 cycles per second – is a kilohertz (kHz).</p>
<b><math>L_a</math></b>	<p>The vibration acceleration level referenced to a standard acceleration level, usually <math>10^{-6} \text{m/s}^2</math>.</p>
<b><math>L_{A90}</math></b>	<p>The A-weighted sound level exceeded for 90 % of the measurement period, measured in dB. Commonly referred to as the background noise level.</p>
<b><math>L_{Aeq}</math></b>	<p>The equivalent continuous sound level. This is commonly referred to as the average noise level and is measured in dBA.</p>
<b><math>L_{Amax}</math></b>	<p>The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.</p>
<b><math>L_v</math></b>	<p>The vibration velocity level relative to a reference velocity, usually <math>1 \times 10^{-6} \text{mm/s}</math>.</p>
<b>Octave Band</b>	<p>A range of frequencies where the highest frequency included is twice the lowest frequency. Octave bands are referred to by their logarithmic centre frequencies, these being 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz, and 16 kHz for the audible range of sound.</p>
<b><math>R_w</math></b>	<p>Weighted Sound Reduction Index. A single number rating of the sound insulation performance of a specific building element. <math>R_w</math> is measured in a laboratory. <math>R_w</math> is commonly used by manufacturers to describe the sound insulation performance of building elements such as plasterboard and concrete.</p>
<b>Third octave band</b>	<p>One-third of an octave band. Used for more detailed analysis of sound frequency.</p>
<b>VDV</b>	<p>Vibration Dose Value. Vibration Dose Value is based on British Standard BS 6472:2008 Guide to Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz) and provides guidelines for the evaluation of whole-body exposure to intermittent vibration.</p> <p>VDV can be used to take into account the weighted measured RMS vibration from many vibration sources including rail vehicles, construction equipment such as jackhammers and industry. VDV considers the duration of each event and the number of events per day, either at present or in the foreseeable future and calculates a single value index.</p>

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## APPENDIX B PLANNING MAP (DEPT OF PLANNING – AUGUST 2024)



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## APPENDIX C ARCHITECTURAL PLANS



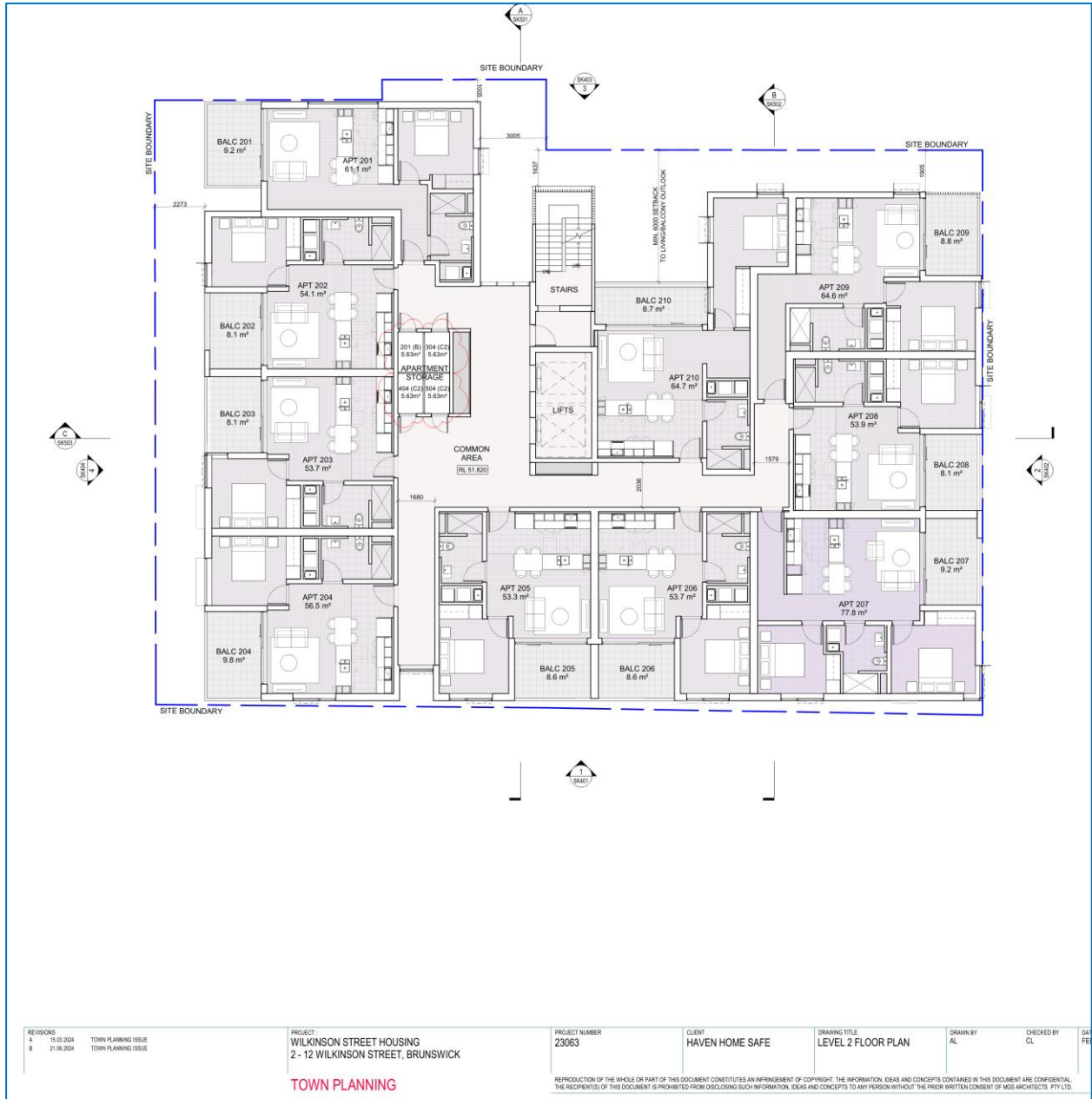
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<b>REVISIONS</b> A 15.03.2024 TOWN PLANNING ISSUE B 21.06.2024 TOWN PLANNING ISSUE	<b>PROJECT</b> WILKINSON STREET HOUSING 2 - 12 WILKINSON STREET, BRUNSWICK	<b>PROJECT NUMBER</b> 23063	<b>CLIENT</b> HAVEN HOME SAFE	<b>DRAWING TITLE</b> LEVEL 4 FLOOR PLAN	<b>DRAWN BY</b> AL	<b>CHECKED BY</b> CL	<b>DATE</b> FEB 20
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TOWN PLANNING

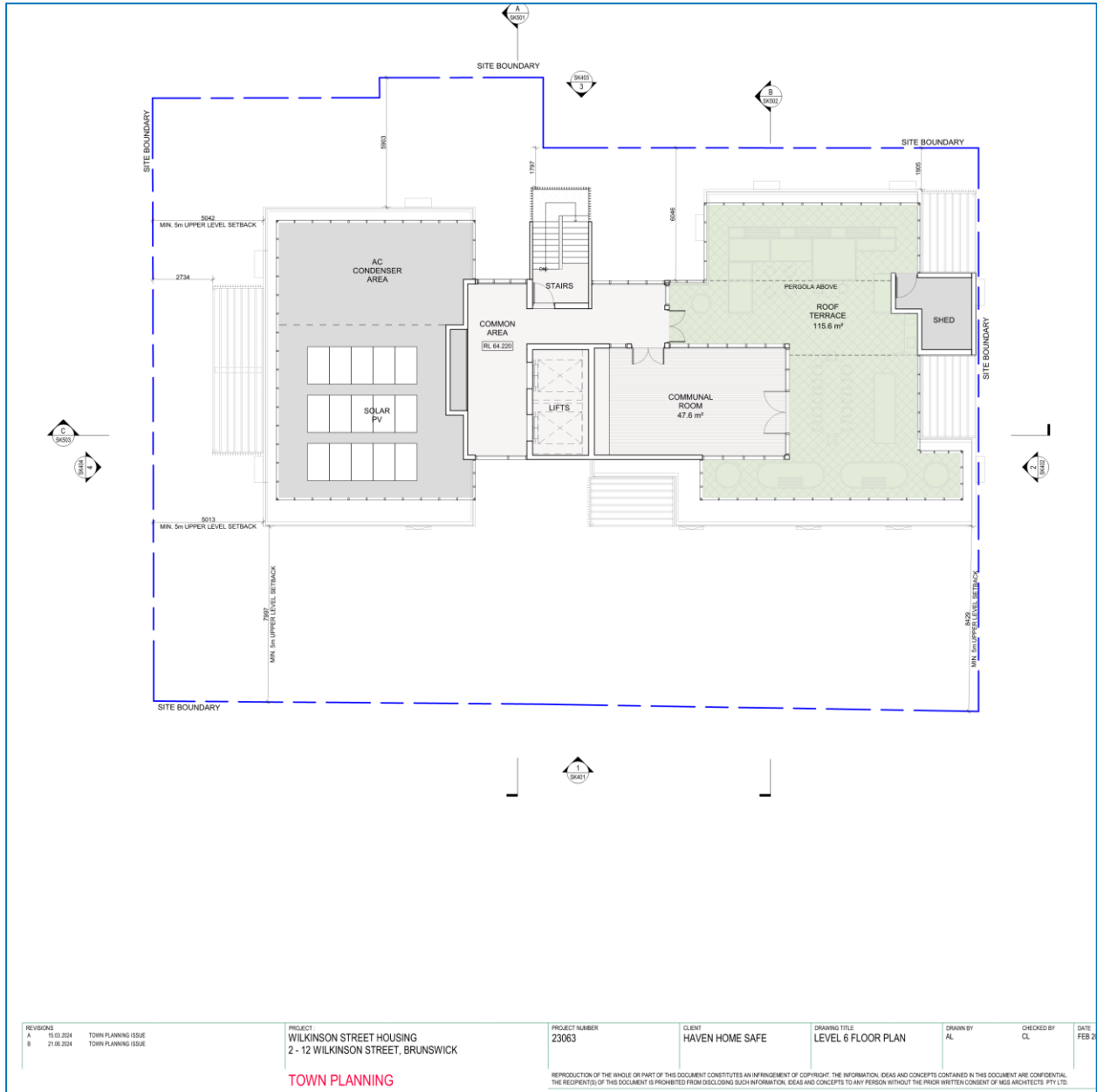
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## APPENDIX D NOISE AND VIBRATION MEASUREMENTS

Attended measurements were undertaken at the site on 9 August 2024 between 1030 – 1200hrs and 1900-1930hrs.

Noise levels were measured using a Brüel & Kjær sound level meter (Serial number: 3030015) and vibration levels using an 01dB Orion vibration logger (Serial No. 10154).

A reference tone was applied to the microphone before and after all measurements were taken, and no adverse drift in sensitivity was observed. Recorded noise levels are presented in the body of the report. The Orion vibration logger is internally calibrated.

Site photographs are shown in Figure 3. The last two photos show the location of the Orion vibration logger close to the boundary of the adjacent commercial property to the north of the site.

**Figure 3: Site photographs of attended measurement location**



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Table 9 presents the background noise levels from the two attended noise measurements conducted during the day and evening periods as well as the night-time period which is taken from a project at Hope St Brunswick which is also located between the railway line and Sydney Rd.

**Table 9: Measured background noise levels, dB LA90**

	Day	Evening	Night
Background noise level	43	42	41

Commercial noise from the Bunnings stock yard directly to the north of the site is detailed in Table 10.

**Table 10: Commercial noise levels, dB**

Source description	Octave band centre frequency (Hz)							
	A	63	125	250	500	1k	2k	4k
Traffic on local roads and carpark noise (L <sub>eq</sub> )	55	64	58	51	48	45	42	38
Bunnings Forklift (L <sub>eq</sub> )	51	60	54	45	43	43	41	34
Bunnings Forklift (L <sub>max</sub> )	53	63	60	52	51	51	46	45

Road and rail noise measurements is detailed in Table 11.

**Table 11: Road and rail noise levels, dB**

Source description	Octave band centre frequency (Hz)							
	A	63	125	250	500	1k	2k	4k
Traffic on local roads and carpark noise (L <sub>eq</sub> )	55	64	58	51	48	45	42	38
Train horn - typical (L <sub>max</sub> )	66	65	58	51	58	64	62	51
Train pass by - typical (L <sub>eq</sub> )	56	64	58	52	51	55	46	48

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## APPENDIX E NOISE CRITERIA AND GUIDELINES

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### E1 Environment Protection Regulations 2021

The Act does not specify noise limit values or technical aspects of environmental noise but sets out legal requirements to comply with the Environmental Protection Regulations described below. Clause 166 of the Act essentially places the onus of achieving compliance with noise limits on the commercial premises.

The Environmental Protection Regulations (the Regulations) are made under section 465 of the Act and impose obligations in relation to environmental protection, including noise. The Regulations state that a person who conducts a prediction, measurement, assessment, or analysis of noise within a noise sensitive area must do so in accordance with the Noise Protocol. In particular, noise from industrial, commercial and trade premises or entertainment venues or events is prescribed as unreasonable if it exceeds a noise limit or alternative criterion determined in accordance with the Noise Protocol.

Key matters addressed in the regulations include:

- Definition of commercial, industrial and trade premises, which is essentially any premises that is not a residential premises, a road or railway. It is noted that noise from common building services equipment (such as shared condensing units and kitchen exhaust fans) is assessable
- Definition of noise sensitive areas where the noise limits are assessed, which include:
  - a) that part of the land within the boundary of a parcel of land that is
    - (i) within 10 metres of the outside of the external walls of any of the following buildings—
      - (A) a dwelling (including a residential care facility but not including a caretaker's house);
      - (B) a residential building;
      - (C) a noise sensitive residential use; or
    - (ii) within 10 metres of the outside of the external walls of any dormitory, ward, bedroom or living room of one or more of the following buildings—
      - (A) a caretaker's house;
      - (B) a hospital;
      - (C) a hotel;
      - (D) a residential hotel;
      - (E) a motel;
      - (F) a specialist disability accommodation;
      - (G) a corrective institution;
      - (H) a tourist establishment;
      - (I) a retirement village;
      - (J) a residential village; or
    - (iii) within 10 metres of the outside of the external walls of a classroom or any room in which learning occurs in the following buildings (during their operating hours)—
      - (A) a child care centre;
      - (B) a kindergarten;
      - (C) a primary school;

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- (D) a secondary school; or
- b) subject to paragraph (c), in the case of a rural area only, that part of the land within the boundary of—
  - (i) a tourist establishment; or
  - (ii) a campground; or
  - (iii) a caravan park; or
- c) despite paragraph (b), in the case of a rural area only, where an outdoor entertainment event or outdoor entertainment venue is being operated, that part of the land within the boundary of the following are not noise sensitive areas for the purposes of that event or venue—
  - (i) a tourist establishment;
  - (ii) a campground;
  - (iii) a caravan park.
- Assessment time periods
- Noise sources that must not be taken into account
- Minimum noise limit values
- Management of cumulative noise from multiple premises.

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Table 12 presents a summary of the relevant Divisions and Regulations from Part 5.3 – Noise.

**Table 12: Summary of Part 5.3 – Noise**

Section	Description
Division 1, Regulation 113	States that <i>a person who conducts a prediction, measurement, assessment, or analysis of noise within a noise sensitive area for the purposes of the Act or these Regulations, must conduct the prediction, measurement, assessment, or analysis in accordance with the Noise Protocol.</i>
Division 3	Applies to noise from commercial, industrial and trade premises
Regulation 116	Defines the day, evening and night period as follows: <ul style="list-style-type: none"> <li>• Day: 0700 to 1800 hrs, Monday – Saturday</li> <li>• Evening: 1800 to 2200 hrs, Monday – Saturday 0700 to 2200 hrs, Sunday and Public Holidays</li> <li>• Night: 2200 to 0700 hrs the next day, Monday – Sunday</li> </ul>
Regulation 117	In this Division, when the level of noise emitted from commercial, industrial and trade premises is assessed, the following sources of noise that could be expected at the proposed facility must not be taken into account: <ul style="list-style-type: none"> <li>• Voices</li> <li>• Construction or demolition activity on building sites</li> <li>• Intruder, emergency or safety alarms or sirens</li> <li>• Equipment used in relation to an emergency</li> <li>• Non-commercial vehicles (except for maintenance activities).</li> </ul>

Section	Description
Regulation 118	<p>Defines noise as being unreasonable if it exceeds the Noise Protocol limits or the alternative assessment criteria that apply at an alternative assessment location.</p> <p>Defines the lowest base noise limits as follows:</p> <ul style="list-style-type: none"> <li>Major urban area: Day: 45 dB <math>L_{eff}</math> Evening: 40 dB <math>L_{eff}</math> Night: 35 dB <math>L_{eff}</math></li> <li>Rural area: Day: 45 dB <math>L_{eff}</math> Evening: 37 dB <math>L_{eff}</math> Night: 32 dB <math>L_{eff}</math></li> </ul> <p>The noise limit for commercial, industrial and trade premises for the night period must not exceed 55 dB <math>L_{eff}</math>.</p>
Regulation 119	If multiple existing or proposed premises emit noise that contributes to the effective noise level at a noise sensitive receiver, all reasonable steps must be taken by the premises' management to ensure the combined noise level does not exceed the noise limit.
Regulation 120	This regulation essentially identifies that tonal aspects of noise must be considered when considering unreasonable noise for section 3(1)(a)(v) of the Act. The Noise Protocol provides a method of assessing tonal characteristics of noise from commercial, industrial and trade premises, with additional guidance on low frequency noise available in EPA Victoria Publication 1996 <i>Noise guideline – assessing low frequency noise</i> .
Regulation 121	<p>Noise emitted from commercial, industrial and trade premises is prescribed to be aggravated noise if it exceeds the noise limits by more than 15 dB, or the following if lower:</p> <ul style="list-style-type: none"> <li>75 dB <math>L_{eff}</math> during the day,</li> <li>70 dB <math>L_{eff}</math> during the evening, or</li> <li>65 dB <math>L_{eff}</math> during the night.</li> </ul>

## E2 EPA Victoria Publication 1826 – The Noise Protocol

As per the Division 1, Regulation 113 of the Regulations, assessment of noise within a sensitive area must be conducted in accordance with EPA Victoria Publication 1826 Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues (the Noise Protocol). The Noise Protocol outlines the EPA's required approach to the determination of noise limits and to the measurement, prediction and analysis of noise.

*Part I: Commercial, industrial and trade premises* applies to the proposed development.

### E2.1 Section A – Determining noise limits for commercial, industrial and trade premises

The Noise Protocol provides two methods for deriving the relevant noise limits, the Urban area method and the Rural area method. The Urban area method is applicable to the proposed development.

The noise limits are calculated taking into account planning scheme land 'zoning types' within a 70 m and 200 m radius of a noise sensitive receiver. The Noise Protocol categorises land zones as type 1, 2 or 3. Zone type designations consider the nature of the permitted land uses and are generally as follows:

- areas such as residential, rural and open space are type 1;
- areas such as commercial, business and light industry are type 2; and
- areas such as general industry and major roads are type 3.

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A prescribed formula is used to calculate a corresponding Zoning Level. Greater areas of type 2 and 3 land within a 200 m radius of a noise sensitive site result in higher Zoning Levels than a site with respectively larger areas of type 1 land.

The noise limit is equal to the 'zoning level' unless the background level at the noise sensitive site is categorised as low or high according to clause 4 of the Policy. If the background level is low or high, the Noise Limit is calculated from a formula taking into account both the Zoning Level and the Background Level.

The current land use zones around the subject site are shown in the planning map presented in Appendix B.

The limits are separately defined for the day, evening and night periods as defined by Regulation 116 of the Regulations. The relevant noise limits applicable to this development are shown in Table 3.

**Table 13: Noise Protocol noise limits**

Period	Day	Time	Zoning level, dB	Background noise level, dB L <sub>A90</sub>	Background relative to zoning level	Noise limit, dB L <sub>Aeq</sub>
Day	Monday – Saturday	0700 to 1800 hrs	60	43	Low	56
Evening	Monday – Saturday	1800 to 2200 hrs	53	42	Low	51
	Sunday and Public Holidays	0700 to 2200 hrs				
Night	Monday – Sunday	2200 to 0700 hrs the next day	48	41	Neutral	48

## E2.2 Section B – Assessing noise from commercial, industrial and trade premises

Noise from the facility that exceeds the noise limits is prescribed to be unreasonable by the Regulations. Part 7.6 of the Act in conjunction with Regulation 166 places the onus of compliance on industry by prohibiting the emission of unreasonable or aggravated noise.

For the purposes of this report and assessments of predicted noise levels, the noise limits apply up to 10 m from a dwelling, but within the property boundary.

Once a noise limit is established, an equivalent noise level (L<sub>Aeq</sub>) due to the operation of the commercial premises is measured or predicted for a 30 minute operating period during the day, evening and night period as appropriate. If necessary, the L<sub>Aeq</sub> noise level is adjusted for duration and noise character (tonality, impulsiveness and intermittency) to give the effective noise level (Leff). If the Leff level exceeds the noise limit, then remedial action will be required.

Consideration must be given to existing and future noise sensitive areas, factors that influence the propagation of sound (including atmospheric effects) and the cumulative contribution of noise from multiple existing and proposed sites.

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## E3 Noise from residential premises, including fixed domestic plant

Noise from fixed domestic plant associated with residential properties must comply with the requirements of the Environment Protection Regulations 2021.

Part 5.3, Division 2 of the Regulations does not prescribe noise limits, but it does prescribe allowable hours of operation for the purposes of determining whether noise is 'unreasonable' at residential premises under Section 167(2) of the Environment Protection Act 2017.

The table of prescribed items and prohibited times is duplicated in Table 19 below.

**Table 14: Prescribed items and prohibited times**

Item group	Prescribed items	Prohibited times
1	A motor vehicle (other than a vehicle moving in or out of premises), vessel or personal watercraft, lawn mower or other grass cutting device or any item with an internal combustion engine that does not fall within item group 2.	Monday to Friday: before 7 am and after 8 pm  Weekends and public holidays: before 9 am and after 8 pm
2	An electric power tool, chain or circular saw, gas or air compressor, pneumatic power tool, hammer, impacting tool or grinding equipment.	Monday to Friday: before 7 am and after 8 pm  Weekends and public holidays: before 9 am and after 8 pm
3	Heating equipment (including central heating, a hot water system or a heat pump, air conditioner or split system used for heating), a vacuum cleaner, swimming pool pump, spa pump, or a water pump (other than a pump being used to fill a header tank).	Monday to Friday: before 7 am and after 10 pm  Weekends and public holidays: before 9 am and after 10 pm
4	An air conditioner, evaporative cooler or split system used for cooling.  See note below.	Monday to Friday: before 7 am and after 11 pm  Weekends and public holidays: before 9 am and after 11 pm
5	A musical instrument or any electrical amplified sound reproducing equipment including a stereo, radio, television or public address system.	Monday to Thursday: before 7 am and after 10 pm  Friday: before 7 am and after 11 pm  Saturday and public holidays: before 9 am and after 11 pm  Sunday: before 9 am and after 10 pm
6	An item of electrical equipment that does not fall within item group 2, 3, 4 or 5, other than an item for personal care or grooming, or for food heating, food refrigeration or food preparation.	Monday to Friday: before 7 am and after 8 pm  Weekends and public holidays: before 9 am and after 8 pm

Note: As per Regulation 114(2), for the purposes of section 167(2) of the Act, the prohibited times do not apply for item group 4 at any time a heat health alert issued by the Chief Health Officer is in effect in the weather forecast district in which the item is located.

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## E4 Clause 58 of the Victorian Planning Provisions (VPP)

Clause 58 of the VPP applies to apartment developments of five or more storeys and introduces new requirements for apartment developments including noise impacts.

The new apartment provisions contain Objectives, Standards and Decision Guidelines. Planning advisory note 66 (April 2017) defines these terms as follows:

*Objectives describe the desired outcome to be achieved in the completed development*

*A Standard contains the requirements to meet the objective. A standard should normally be met. However, if the responsible authority is satisfied that an alternative design solution meets the objective, the alternative design solution may be considered.*

*Decisions guidelines set out the matters that the responsible authority must consider before deciding if an application meets the objectives. When an alternative design solution is proposed, the effect of the design solution on the achievement of other objectives should be considered.*

Clause 58.04-3 relates specifically to noise and contains the following:

### Noise impacts objectives

*To contain noise sources in the development that may affect existing dwellings*

*To protect residents from external and internal noise sources*

### Standard (D16)

*Noise sources, such as mechanical plant should not be located near bedrooms of immediately adjacent existing dwellings*

*The layout of new dwellings and buildings should minimise noise transmission within the site*

*Noise sensitive rooms (such as living areas and bedrooms) should be located to avoid noise impacts from mechanical plants, lifts, building services, non-residential uses, car parking, communal areas and other dwellings.*

*New dwellings should be designed and constructed to include acoustic attenuation measures to reduce noise levels from off-site noise sources.*

*Buildings within a noise influence area specified in Table D3 should be designed and constructed to achieve the following noise levels:*

- *Not greater than 35dB(A) for bedrooms, assessed as an  $L_{Aeq,8h}$  from 10pm to 6am.*
- *Not greater than 40dB(A) for living areas, assessed  $L_{Aeq,16h}$  from 6am to 10pm.*

*Buildings, or part of a building screened from a noise source by an existing solid structure, or the natural topography of the land, do not need to meet the specified noise level requirements.*

*Noise levels should be assessed in unfurnished rooms with a finished floor and the windows closed.*

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Noise source	Noise influence area
Zone interface Industry	300 metres from the Industrial 1, 2 and 3 zone boundary
Noise influence area Roads Freeways, tollways and other roads carrying 40,000 Annual Average Daily Traffic Volume	300 metres from the nearest trafficable lane
Railways Railway servicing passengers in Victoria	80 metres from the centre of the nearest track
Railway servicing freight outside Metropolitan Victoria	80 metres from the centre of the nearest track
Railway servicing freight in Metropolitan Melbourne	135 metres from the centre of the nearest track

*Note: The noise influence area should be measured from the closest part of the building to the noise source.*

### *Decision guidelines*

*Before deciding on an application, the responsible authority must consider:*

- *The design response.*
- *Whether it can be demonstrated that the design treatment incorporated into the development meets the specified noise levels or an acoustic report by a suitably qualified consultant submitted with the application.*
- *Whether the impact of potential noise sources within a development have been mitigated through design, location and siting.*
- *Whether the layout of rooms within a dwelling mitigates noise transfer within and between dwellings.*
- *Whether an alternative design meets the relevant objectives having regard to the amenity of the dwelling and the site context.*

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## E5 AS2107 - Internal noise levels

Recommended internal noise levels for spaces of varying usage, applicable to semi-continuous sources such as road traffic, are provided in Australian Standard AS 2107:2016 “Acoustics - Recommended design sound levels and reverberation times for building interiors” (AS 2107).

Table 15 shows the recommended internal design sound levels stated in AS 2107 for “houses and apartments in inner city areas or entertainment districts or near major roads”, which is considered to be applicable to subject site.

**Table 15: AS 2107 recommended internal noise levels, dB L<sub>Aeq</sub>**

Area	Recommended design sound level range
Living areas	35 - 45
Sleeping areas	35 - 40
Work areas	35 - 45
Apartment common areas (eg, lobbies)	45 - 50
Small shops and retail areas	

The requirements of Clause 58 of the VPP are mostly consistent with the requirements of AS 2107 and further they nominate the time period during which compliance measurements should be made.

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## E6 Sleep Disturbance

The NSW *Road Noise Policy 2011* produced by the NSW EPA, provides guidance on potential for sleep disturbance. While the Policy applies strictly only in NSW, the provisions of the document are often referred to in Victoria for general guidance on potential sleep disturbance.

The NSW policy notes that from the research on sleep disturbance to date it can be concluded that:

- *Maximum internal noise levels below 50–55 dB  $L_{Amax}$  are unlikely to awaken people from sleep*
- *One or two noise events per night, with maximum internal noise levels of 65–70 dB  $L_{Amax}$ , are not likely to affect health and wellbeing significantly.*

It is noted that the maximum internal noise levels are prescribed for instances where windows to an internal area would be open. It is accepted that internal noise levels in conventional dwellings with the windows open are generally 10 dBA lower than external noise levels.

Based on these NSW EPA findings, a noise level of 60-65 dBA outside an open bedroom window would be unlikely to cause awakening reactions.

## E7 Waste collection

EPA Publication 1254 *Noise Control Guidelines* provides the following recommendations for industrial waste collections:

- Refuse bins should be located at sites that provide minimal annoyance to residential premises
- Compaction should be carried out while the vehicle is moving
- Bottles should not be broken up at the collection site
- Routes which service predominantly residential areas should be altered regularly to reduce early morning disturbances
- Noisy verbal communication between operators should be avoided where possible.

The following schedule of acceptable times for waste collection is also provided in the EPA Noise Control Guidelines:

*One collection per week*

6:30 am-8 pm Monday to Saturday

9 am-8 pm Sunday and public holidays

*Two or more collections per week*

7 am-8 pm Monday to Saturday

9 am-8 pm Sunday and public holidays.

It is recommended that waste disposal activities adhere to the above guidelines and procedures.

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## E8 Deliveries

EPA Publication 1254 *Noise Control Guidelines* states the following concerning store deliveries:

*Where a residential area will be impacted by noise from deliveries, the deliveries should be inaudible in a habitable room of any residential premises (regardless of whether any door or window giving access to the room is open) outside the hours contained in the schedule*

*Schedule: Deliveries to shops, supermarkets & service stations*

- 7 am-10 pm Monday to Saturday
- 9 am-10 pm Sundays and Public Holidays.

## E9 Railway noise

The *Victorian Passenger Rail Infrastructure Noise Policy (VPRINP)* was released in April 2013. Section 5 of the policy sets out the conditions under which transport bodies must apply the policy.

The policy sets ‘investigation thresholds’ for the assessment of noise. These are noise levels, which if exceeded, indicate that noise mitigation should be considered. It states that:

*In considering changing land use near an existing passenger rail corridor, transport bodies and planning authorities should consider the receivers set out in Table B in Attachment 2. Transport bodies and planning authorities should consider whether the noise level produced at these receivers will exceed the investigation thresholds for the periods specified in Table B in Attachment 2. [Table B of Attachment 2 is reproduced below as Table 21: in this report.]*

*If an assessment shows the investigation thresholds are not exceeded, noise impacts should be considered a secondary matter. This means no further action need be considered under this policy.*

The investigation thresholds are defined in terms of:

- $L_{Aeq,16h}$  – equivalent continuous daytime (0600-2200 hrs) noise level
- $L_{Aeq,8h}$  – equivalent continuous night-time (2200-0600 hrs) noise level
- $L_{Amax}$  – maximum noise level.

Investigation thresholds for the redevelopment of land near existing rail infrastructure are presented in Table 21.

**Table 16: Investigation thresholds for changing allowable land use near an existing**

Time	Type of receiver	Investigation thresholds		
Daytime (0600-2200 hrs)	Residential dwellings including aged person homes, hospitals, motels, caravan parks, and other buildings where people sleep.  Noise sensitive community buildings including schools, kindergartens, libraries	65 dB $L_{Aeq,16h}$	or	85 dB $L_{Amax}$
Night-time (2200-0600 hrs)	Residential dwellings including aged person homes, hospitals, motels, caravan parks, and other buildings where people sleep.	60 dB $L_{Aeq,8h}$	or	85 dB $L_{Amax}$

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The investigation thresholds are not design criteria. However, should the investigation thresholds be exceeded, then the following internal design criteria are recommended by MDA:

- Bedrooms: 55 dB  $L_{Amax}$
- Other living areas: 60 dB  $L_{Amax}$
- Shops/offices: 60 dB  $L_{Amax}$

The VPRINP requires the maximum railway noise be based on the 95<sup>th</sup> percentile of the maximum for all measured events.

These limits are based on a precedent set in the Victorian Civil and Administrative Tribunal (VCAT) regarding acceptable internal noise levels for residences adjacent to Tramway lines (Reference No. P2470/2003). In this case, a decision to grant a permit was made on the basis that the noise level of trains was not to exceed 55 dB  $L_{Amax}$  in bedrooms and 60 dB  $L_{Amax}$  in living areas. These levels were based on the commonly-used criteria for sleep disturbance taken from the NSW Road Noise Policy.

Since 2003, there have been two VCAT decisions which have recommended an internal noise limit of 50 dB  $L_{Amax}$  in bedrooms. However, there is no compelling case for the lower criterion as the decisions were not based on objective evidence presented to the Tribunal and are, in MDA's opinion, unnecessarily restrictive. 55 dB  $L_{Amax}$  is very close to the threshold of onset for noise-related sleep disturbance, and there is almost no significant difference (<1 %) in reported levels of sleep disturbance between 55 dB  $L_{Amax}$  and 50 dB  $L_{Amax}$ .

The 55 dB  $L_{Amax}$  criterion has now been accepted by Public Transport Victoria (PTV) in a letter dated 18 October 2012, in relation to a residential development in Braybrook. Further details can be provided upon request.

## E10 Structural vibration

Vibration criteria for continuous (and intermittent) vibration in buildings are presented in International Standard ISO 10137:2007 *Bases for design of structures - Serviceability of buildings and walkways against vibrations* (ISO 10137). In regard to human comfort, this standard provides recommended guidelines for structural vibration for different building usages. Appendix E of the standard defines limit curves that specify vibration levels at a range of frequencies, defined as a series of spectral vibration curves (VC). VC 1.4, VC 2 and VC 4 are the appropriate targets for bedroom, living and commercial areas respectively. Table 17 presents these curves in numeric form.

**Table 17: Vertical vibration velocity criteria:  $L_v$  dB (re  $10^{-6}$  mm/s rms)**

Criteria*	Third Octave band mid frequency								Hz
	2	2.5	3.15	4	5	6.3	8	10-80	
VC 1.4 night-time residential	118	115	112	109	107	105	103	103	dB
VC 2 daytime residential	127	118	115	112	110	108	106	106	dB
VC-4 commercial/offices	127	124	121	118	116	114	112	112	dB

\* Vibration Curves (VC) 1.4, 2 & 4 from ISO 10137:2007

Structural floor vibration in the respective building spaces should not exceed these third octave targets when trains pass by Albion. Note that for structural vibration frequencies 8 Hz and above, the criteria are constant, with maximum recommended vibration velocity levels of  $L_v$  103 dB,  $L_v$  106 dB and  $L_v$  112 dB for bedroom and living areas and commercial areas respectively. As consistent with the noise assessment, the 95<sup>th</sup> percentile statistical maximum vibration of all rail passes is used for the vibration assessment.

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The perception of vibration can be affected not only by the level, but also the duration and exposure. Criteria to assess vibration exposure over an 8-hour (night) or 16-hour (daytime) is provided in British Standard BS 6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting* (BS 6472). The relevant parameter is the estimated Vibration Dose Value (eVDV) which is a measure of the total energy experienced for a range of separate events, based on the vibration amplitude of each event, the number of events per period and the duration of each event. The VDV criteria reproduced from BS6472 is presented in Table 18.

**Table 18: BS 6472 VDV impact assessment criteria  $m/s^{1.75}$**

Residential assessment period	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
Daytime (16 hrs)	0.2 – 0.4	0.4 – 0.8	0.8 – 1.6
Night-time (8 hrs)	0.1 – 0.2	0.2 – 0.4	0.4 -0.8

By assessing the VDV, the duration of and exposure to all train events over the nominated period can be established.

In general, the allowable vibration levels are well below that considered for potential structural damage and are not injurious to health. The criteria allow for an acceptable level of human comfort whilst also allowing for some train passes to still be somewhat perceptible at times. This is not unexpected for properties adjacent to a railway line.

## E11 Structure-borne noise

The cumulative effect of airborne and structure-borne train noise should be less than the nominated airborne  $L_{Amax}$  criteria, the predicted maximum structure-borne sound should therefore be 10 dB less than the internal  $L_{Amax}$  values for airborne rail noise. Therefore, the 95<sup>th</sup> percentile maximum structure-borne rail noise levels ( $L_{Amax}$ ) should not exceed 45 dB in bedroom areas and 50 dB in living room areas.

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## APPENDIX F GLAZING TRANSMISSION LOSS REQUIREMENTS

The general glazing requirements presented in the body of the report, should also achieve the octave band transmission loss performance presented below.

Table 19: Glazing performance requirements (transmission loss)

Example system	R <sub>w</sub>	Octave band centre frequency (Hz)					
		125	250	500	1k	2k	4k
6 mm glazing / 12 mm cavity / 6 mm glazing	35	25	21	32	38	36	44
6 mm glazing / 12 mm cavity / 8 mm glazing	37	25	27	36	38	37	44

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