

Alfred Quarter Project

Acoustic Town Planning and Concept Report

Prepared for: Alfred and Boundary Pty Ltd

Project No: MEL4828
Date: 27 April 2026
Revision: 07

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Project:	Alfred Quarter Project
Location:	59-101 Alfred St and 103-117 Boundary Road North Melbourne
Prepared by:	ADP Consulting Pty Ltd Level 13, 55 Collins Street Melbourne VIC 3000
Project No:	MEL4828
Revision:	07
Date:	27 April 2026

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1. Introduction

1.1 Document purpose

ADP Consulting Pty Ltd has been engaged by Alfred and Boundary Pty Ltd to undertake acoustic engineering services for the proposed residential precinct at 59-101 Alfred St and 103-117 Boundary Road, North Melbourne.

This document is to be used as a briefing document, and to provide information to the client and the design team prior to the detailed design. It may also be issued to the Melbourne City Council as part of the Town Planning Application.

This report addresses design criteria and provides preliminary advice for the following:

- > Operational noise emissions from the development to the nearest noise-sensitive receivers
- > Traffic noise intrusion
- > Industrial noise intrusion
- > Internal noise levels and reverberation times
- > Sound insulation between noisy areas and sensitive spaces
- > Vibration requirements

The design criteria and acoustic treatment concepts in this report demonstrate the pathways by which these will be addressed by ADP Consulting and the project team through further analysis, recommendations, and coordination as the design progresses.

Acoustic terminology is included in Appendix A.

1.2 Reference design documentation, codes and standards

The following guidelines, standards, regulatory requirements, drawings, conditions and other project-specific information have been referenced in preparing this report:

- > Fender Katsalidis, "Alfred Quarter", drawings dated February 2026 (Architectural Drawings)
- > Melbourne Planning Scheme, Schedule 26 to Clause 43.02 Design and Development Overlay
- > VIC EPA, Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues, Publication 1826.4, dated 1 July 2021 (EPA Noise Protocol)
- > VIC EPA, Summary of noise framework, Publication 1757.2, dated May 2021 (EPA Summary of Noise Framework)
- > VIC EPA, Guide to the Environment Protection Regulations, Publication 1753.2, dated May 2021 (EPA Guide to the EP Regulations)
- > Vicroads published traffic volumes <https://vicroadsopendata-vicroadsmaps.opendata.arcgis.com/datasets/traffic-volume> (Vicroads traffic volumes)
- > Department of Transport Welsh Office, Calculation of Road Traffic Noise, ISBN 0 11 550847 3, 1988 (CoRTN)
- > National Construction Code 2019 – Volume One, Building Code of Australia, Class 2 to 9 Buildings (NCC)

- > Apartment Design Guidelines for Victoria, Victoria State Government Environment, Land, Water and Planning, dated August 2017 (ADGV)
- > AS/NZS 2107:2016 Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors (AS/NZS 2107)
- > AS 1055.2:1997 Acoustics – Description and Measurement of Environmental Noise Part 2: Application to Specific Situations (AS 1055.2)
- > AS 2670.2:1990 Evaluation of Human Exposure to Whole-Body Vibration Part 2: Continuous and Shock-Induced Vibration in Buildings (1 to 80 Hz) (AS 2670.2)
- > AS/NZS 1668.1:2015 The Use of Ventilation and Air Conditioning in Buildings Part 1: Fire and Smoke Control in Buildings (AS/NZS 1668.1)
- > Assessing Vibration: A Technical Guideline – NSW Department of Environment and Conservation, dated February 2006 (AVTG)
- > BS 6472–1992 – Evaluation of Human Exposure to Whole-Body Vibration in Buildings (1 to 80 Hz) (BS 6472)

1.3 Site description

The subject site is located within a Mixed Use Zone (MUZ), with nearby land zones and potential noise intrusion sources as follows

- > CityLink Freeway to the West (TRZ1) with rail line directly below the Freeway
- > Mixed use zones to the north, south and east (MUZ), including some commercial/industrial sites
- > Public Park and Recreation Zone to the southeast (PPRZ)
- > General Residential Zone to the northeast (GRZ1)
- > Commercial Zone to the north (C1Z)
- > Boundary Road to the East (TRZ2)

The nearest noise sensitive receivers are as follows:

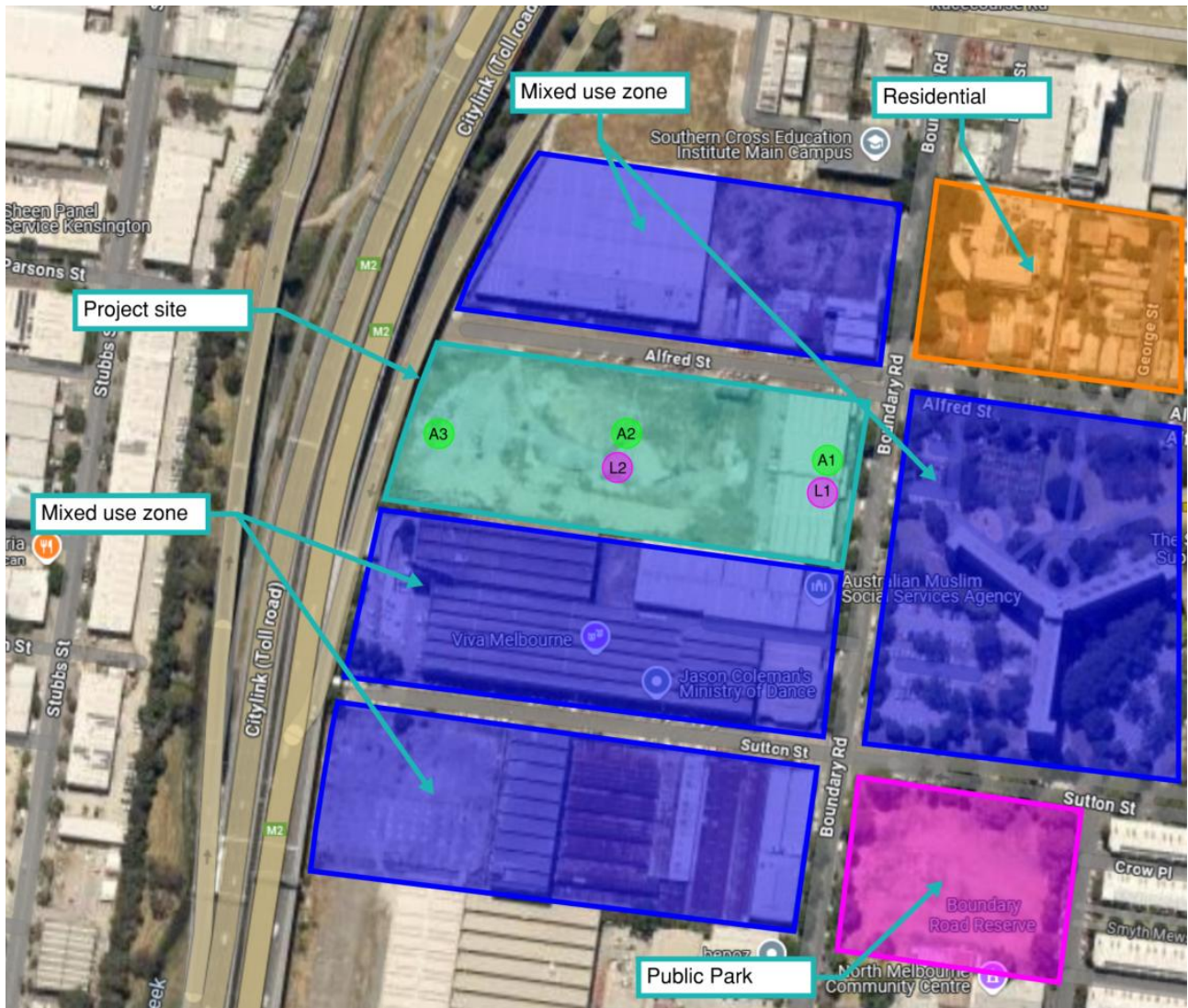
- > Residents on Alfred St to the northeast
- > Commercial and industrial receivers surrounding the site
- > Boundary Road Reserve to the southeast

Figure 1 provides a site map of the proposed development and its surrounds.

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Figure 1: Site and surrounds of 59-101 Alfred Street and 103-117 Boundary Rd



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1.4 Project summary

This site is in North Melbourne, between Boundary Road and Alfred Street. ADP understand Alfred Quarter project will consist of 3 staged developments.

Precinct 1

GFA: 46,627 sqm

- > Approx number of apartments: 307
- > Approx number of cars: 285

Precinct 2

GFA: 35,820 sqm

- > Approx number of apartments: 336
- > Approx number of cars: 137

Precinct 3

Precinct 3 GFA: 32,488 sqm

- > Approx number of apartments: 300

There are also several communal and public spaces across the precincts including:

- > Supermarket
- > Retail
- > Gym
- > Outdoor public space
- > Community space

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2. Site Investigations

2.1 Existing acoustic environment

The subject site is currently exposed to noise from the following sources:

- > Steady road traffic noise on Citylink freeway
- > Noise from train passbys on the adjacent rail line
- > Intermittent traffic noise from other surrounding roads including Alfred St and Boundary Road
- > Noise from nearby commercial or industrial use (however these are indistinguishable under the noise from traffic).

2.2 Noise measurements

Noise measurements have been conducted at the locations L1-2 and A1-3 as shown in Figure 1 to qualify and quantify the noise levels in the area and establish criteria for the assessment of noise emissions from the development.

2.2.1 Unattended noise measurement results

Long-term unattended noise measurements were carried out to quantify background noise levels in the project site and long-term exposure to existing noise sources. The measurements were conducted during the following periods:

- > Location L1: Tuesday 11th February, 1:00pm to Wednesday 19 February 2025, 9:00am
- > Location L2: Tuesday 11th February, 1:00pm to Wednesday 19 February 2025, 9:00am

Background noise measurement results collected by the noise loggers are presented in Table 1. Measurement samples affected by adverse weather were excluded from the recorded data.

Table 1: Unattended noise measurement results

Location	Background noise levels – LA90			Ambient noise levels - LAeq		
	Day (07:00-18:00)	Evening (18:00-22:00)	Night (22:00-07:00)	Day (07:00-18:00)	Evening (18:00-22:00)	Night (22:00-07:00)
L1	54	50	47	60	57	56
L2	54	51	48	67	66	60

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3. Acoustic design criteria

3.1 Noise emissions

Within the Melbourne metropolitan area, noise emissions from commercial, industrial and trade premises is governed by EPA document titled *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues (EPA Publication 1826)* (the Noise Protocol).

3.1.1 Commercial, industrial and trade premises noise – EPA Noise Protocol Part I

Noise emission restrictions apply to future base building and tenant activities and systems. These must be planned, designed, and installed to include suitable sound attenuation, vibration isolation and other necessary acoustic treatments. This report provides an approach that needs to be incorporated in the proposed development to meet the noise emission requirements of the EPA Noise Protocol Part I.

The EPA Noise Protocol Part I requirements include determination of noise limits at the nearest external noise sensitive receivers as well as within the development itself.

The EP Regulations define the following as noise sensitive areas:

- > Residential premises
- > Retirement villages
- > Hospitals
- > Child-care centres
- > Kindergartens
- > Primary and secondary schools
- > Tourist establishments
- > Camping grounds
- > Caravan parks in rural areas.

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The methodology to determine the noise limits is described in the EPA Noise Protocol. It requires the establishment of background noise levels, and a zoning level determined by the surrounding land use. For testing of emergency equipment such as standby generators, standby boilers and fire pumps, increased (less stringent) noise limits apply.

Table 2 presents the site-specific noise emission criteria applicable for the proposed development.

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Table 2: Noise emission criteria – noise sensitive area

Time of operation	Background noise levels, dBL_{A90}	EPA Noise Protocol Part I noise limits, $dBL_{Aeq,30min}$	
		Operational	Emergency
Day (Monday to Saturday, except public holiday from 7am to 6pm)	54	60	70
Evening (Monday to Saturday, from 6pm to 10pm and Sunday and public holidays from 7am to 10pm)	50	53	58
Night (10pm to 7am)	47	50	55

The specific noise criteria defined in Table 2 apply to the cumulative noise emissions from operations at the proposed development are to meet, and planning should be undertaken with proposed tenants so that these criteria are complied with.

3.1.2 Noise characteristic adjustments

Adjustments to the noise emissions from the proposed development may be applicable as per Sections 3.3, 3.4 and 3.5 of the EPA Noise Protocol based on undesirable characteristics of the noise and/or the measurement locations. These include adjustments for duration, tonality, impulsiveness, intermittency, façade reflection and indoor measurement adjustment.

The adjustment for undesirable noise characteristics include up to a 5dB penalty for each undesirable characteristic.

It should be noted that during the detailed design / construction phase of the project, if the design team / contractor makes selections of equipment which include one or more of these undesirable noise characteristics, a modifying factor will be applied.

3.1.3 Sleep disturbance criteria

Night-time noises, which occur infrequently and for short durations of time, have a potential to cause sleep disturbance. Such noise sources may include loading area deliveries and vehicle movements.

In the absence of a sleep disturbance criteria in Victoria, we recommend the use of the NSW Noise Policy for Industry (NPfI) to derive suitable criteria for the project. Noise emission from such short duration noise events should be controlled to meet these criteria to reduce the risk of sleep disturbance to residences at night.

The NPfI recommends the following screening criteria for the assessment of potential sleep disturbance, for the period between 10 pm and 7 am:

- > $L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- > L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater

Note the RBL is the background noise level for the night-time period. Based on these, Table 3 presents recommended sleep disturbance criteria for the project.

Table 3: Sleep disturbance criteria

Activity	Receiver	Noise descriptor	Noise criterion, dB(A)
> Loading dock usage	Surrounding residences	L _{Aeq, 15min}	52
> Refuse collection			
> Deliveries and vehicle movements		L _{AFmax}	62
> Garage door operation			

3.2 Green Star

A total of 2 Acoustic Comfort credits are available as described in the Green Star Buildings Submission Guidelines.

Per the ADP Consulting Green Star Matrix, it is understood that this development is targeting a 5-Star rating and the following acoustic comfort criteria:

- > Minimum Expectation – Acoustic Comfort Strategy
- > For Residential (Class 2, 3 & 9a) compliance must be achieved for 2 of the 3 criteria
 - Maximum internal noise levels
 - Acoustic separation
 - Impact noise transfer

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A methodology is presented in this section to achieve the relevant credits.

3.2.1 Acoustic Comfort Strategy

An Acoustic Comfort Strategy must be prepared describing how the building design will deliver acoustic comfort to the building occupants.

The following requirements are to be addressed:

- > Quiet enjoyment of space
- > Functional use of space
- > Control of intrusive or high levels of noise
- > Privacy
- > Noise transfer
- > Speech intelligibility

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The Acoustic Comfort Strategy is to include:

- > A summary of the Standards, legislation, guidelines, and other requirements that apply to the project
- > The proposed performance metrics for each of the Acoustic Comfort criteria relevant to the different uses within the building and whether this exceeds minimum legislative or best practice guidelines
- > Description of how the design solution is intended to achieve the proposed performance metrics

The strategy must be prepared by a qualified acoustic consultant during the design stage and the design solutions described in the strategy must be incorporated into the Contract Documents.

It is considered that the acoustic documentation prepared by ADP including this Acoustic Report, would suffice as the project's Acoustic Comfort Strategy.

3.2.2 Maximum Internal Noise Levels

Internal ambient noise levels in the regularly occupied areas must be no greater than the upper range value relevant to the activity type in each space as recommended in the current AS/NZS 2107:2016 (refer Section 3.3.1 of this report).

For Class 2 and Class 3 buildings

In Class 2 and Class 3 dwellings the internal ambient noise levels can exclude those services under the direct control of the occupant such as split system air-conditioning units and switchable exhaust fans (e.g., toilet, kitchen hoods and laundries).

For buildings with sleeping areas

In buildings with sleeping areas (e.g., Class 2, Class 3, Class 9a) noise levels must not exceed recommended Sleep Disturbance criteria as defined in the NSW EPA Road Noise Policy 2011:

- > Up to two noise events per night: maximum internal noise levels below 70dB L_{Amax}
- > All other events: maximum internal noise levels below 55dB L_{Amax}

Measuring noise levels

Noise measurements and documentation must be provided by a qualified acoustic consultant and in accordance with the current AS/NZS 2107:2016.

Noise measurements must account for all internal and external noise including noise arising from building services equipment, noise from outdoor sources such as traffic, speech masking, and (where known) noise from industrial process. Occupancy noise is excluded.

For open plan spaces compliance must be demonstrated by doing 1 measurement per 100 m². Every floor of the building is to be tested. For enclosed rooms, 10% of the enclosed rooms are to be tested. These need to be representative of the spaces within the building and reflect the range of external noise impacts on the building.

The selection of representative spaces must be justified and must consider how the spaces are considered to be the most conservative with respect to both internal and external noise sources. The acoustic compliance report must include mark-up plans of where the tests were conducted.

Naturally ventilated buildings

For naturally ventilated buildings the internal noise requirements must be achieved with all windows/openings closed. The acoustic consultant should also provide the results of measurements when the windows/openings are open to no less than 10% of the minimum natural ventilation area required for the ventilation design of the building and describe how the project has been designed to minimise external noise intrusion in this configuration. These measured noise levels do not need to meet the internal noise level criteria.

3.2.3 Impact Noise Transfer

Impact noise transfer measured in accordance with ISO 16283-2 through a floor where:

- > Floors are located above regularly occupied areas
- > Adjacent spaces belonging to different tenancies which share a floor must not exceed dB L_{nT,w}:
 - 55 for floors above Class 2 and Class 3 buildings accommodation spaces
 - 60 for all other spaces

3.2.4 Acoustic Separation

Green star for Class 2 requires that:

- All walls and floors (excluding riser walls) separating enclosed spaces must exceed minimum NCC requirements by 5 points.
- Party walls separating open plan kitchens (where joinery units are fixed) from another open plan kitchen or living room should be of discontinuous construction.
- Entry doors must have perimeter and threshold seals.

3.3 Internal acoustic environment

3.3.1 Noise levels (AS/NZS 2107)

Indoor background design noise levels considered acceptable to the majority of reasonable occupants are published in AS/NZS 2107. These apply to existing and completed buildings, excluding occupant noise. The acoustic design will have to make appropriate allowances for the individual contributions from these different noise sources.

The design sound levels from AS/NZS2107, required by Green Star, are presented in Table 4.

Table 4: Internal noise level criteria

Type of occupancy	Design sound level, dB _{Aeq,T_r}
Apartment sleeping areas– in inner city areas	35 to 40
Apartment living areas – in inner city areas	35 to 45
Residential common areas (e.g. foyer, lift lobby, corridors)	45 to 50
Washrooms and toilets	45 to 55
Kitchen and storage areas (including typical BOH areas)	< 55
Enclosed carpark	< 65

3.3.2 Fire mode noise conditions (AS/NZS 1668)

Building systems which only operate in fire mode, and during periodic testing, do not add to background noise under typical conditions. In accordance with AS/NZS 1668.1:2015, these systems are subject to noise limits, relating not to occupant comfort but rather to occupant distress and the intelligibility of emergency commands.

The fire mode noise limits are presented in Table 5.

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Table 5: Fire mode maximum sound pressure levels

Area type	Maximum SPL, L_{Aeq} , dB(A)
Occupied Area	65
Fire-isolated exit (e.g. fire stair)	80

3.3.3 Noise intrusion specific requirements (ADGV)

The Apartment Design Guidelines Victoria (ADGV) (previously Better Apartment Design Standards BADS) were implemented in all Planning Schemes and the Victoria Planning Provisions via Amendment VC136 on 13 April 2017. These standards are contained within the new Clause 58 – Apartment Developments of the Victoria Planning Provisions (and all local Planning Schemes).

Planning Clause 58.04-3 (Standard D16) provides target criteria for environmental noise impacts on new apartment developments in Victoria. These requirements cover noise sources including road traffic, railway and industrial zones.

Apartment developments within a “noise influence area” as defined by Table D5 of Standard D16 must be designed and constructed to achieve applicable internal noise level targets.

The project site is within the noise influence area of roads (Westlink Freeway) carrying more than 40,000 Annual Average Daily Traffic Volume (AADT). Therefore, the apartments should be designed and constructed to achieve the following maximum noise levels:

- > Bedrooms from 10pm to 6am $35dB_{Aeq}(8hr)$
- > Living areas from 6am to 10pm $40dB_{Aeq}(16hr)$

The above noise levels should be measured in unfurnished and finished floor with the windows closed.

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3.3.4 Melbourne Planning Scheme

The *Schedule 26 to clause 43.02 Design and Development Overlay* includes noise attenuation requirements of the West Melbourne and Arden Macaulay area where the project is located.

The following excerpts from the scheme are relevant to the project:

1.0 Design Objectives

- > To ensure that new, refurbished or converted developments for new residential and other noise sensitive uses constructed in the vicinity of the Laurens Street, North Melbourne Industrial Area and in the vicinity of industrial operations in Arden-Macaulay include appropriate acoustical measures to attenuate noise levels within the building.
- > To ensure that land use and development in the vicinity of the Laurens Street, North Melbourne Industrial Area and in the vicinity of industrial operations in Arden-Macaulay does not adversely affect the viability of industry within these areas.

2.1 Building Design and Pre-construction Noise Measurement

Any new or refurbished development or any conversion of part or all of an existing building that will accommodate new residential or other noise-sensitive uses must:

- > *Be designed and constructed to include noise attenuation measures. These noise attenuation measures must achieve a maximum noise level of 35dB(A) L_{eq} in unfurnished and uncarpeted habitable rooms, with*

all windows and doors closed, unless there is no suitable air conditioning and/or mechanical ventilation, in which case the maximum noise level of 35dB(A)Leq in unfurnished and uncarpeted habitable rooms must be achieved with all the windows half open and the doors closed.

- > *Be fitted with suitable air conditioning and /or mechanical ventilation system to the satisfaction of the responsible authority unless the maximum noise level of 35dB(A)Leq in unfurnished and uncarpeted habitable rooms can be achieved with all the windows half open and the doors closed.*
- > *Have walls, roof, windows, doors and external glazing and the air conditioning or ventilation system designed by a qualified acoustical consultant who must certify that the incorporation of the design features recommended by the consultant will achieve a maximum noise level in unfurnished and uncarpeted habitable rooms of 35dB(A)Leq, based on the external noise levels measured by the consultant as part of a noise level assessment conducted to the satisfaction of the responsible authority.*

The pre-construction noise measurement will be conducted as follows:

- > *Be sufficient in detail and duration to be representative of the noise from the industrial operations which occur in the vicinity of the Laurens Street North Melbourne Industrial Area and the noise from industrial operations in Arden-Macaulay. This monitoring shall include sampling during the day, evening and night periods on weekdays and weekends.*

Meeting the Melbourne Planning Scheme Requirements:

This project is able to comply with the requirements detailed above.

- > Section 4.3 provides the facade treatments required to meet the internal noise level criteria
- > Noise measurements already conducted by ADP, detailed in Section 2.2 constitute the preconstruction noise measurement requirement
 - The preconstruction noise measurement contained both attended and unattended noise measurements including sampling during the day, evening and night periods on weekends and weekdays. This includes monitoring for noise impacts from nearby industrial operations in the Laurens St North Melbourne industrial area and industrial operations in Arden-Macaulay. The high traffic and rail noise levels on site exceed noise from these industrial zones.

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3.3.5 Building activity noise

For the purpose of minimising noise levels caused by the usage of resident amenity areas, including outdoor spaces, gym and community space, noise limits are proposed in Table 6 below.

Table 6: Maximum internal airborne and structure borne noise levels from communal amenity areas

Activity/operation	Adjacent space	Internal noise criterion, dBL _{Amax}	
		Day/ Evening (7am to 10pm)	Night (10pm to 7am)
> Residential amenity areas	Residences	40	35

3.3.6 Acoustic separation

Acoustic separation is important where there is a need to protect personal amenity and/or to control noise disturbance.

The amount of noise transferred between the source and receiving space depends on:

- > The level of sounds created in the source room.
- > The sound insulation provided by walls, doors, roof, floor, ductwork and other elements separating the source and receiving spaces.
- > Sound flanking paths that allow sound to go around the intervening partition/floor.

Internal sound insulation of the residential component of the development needs to comply with the NCC requirements as a minimum.

As design progresses further specific internal sound insulation targets for other uses within the project will be determined on a case-by-case basis and with reference to sustainability targets and/or other design standards as required.

In addition to codified ratings, specific higher-performing constructions may be required in some areas (e.g. plant rooms, etc.) to reduce noise to the adjacent sensitive spaces. Similarly, specific detailed constructions and treatments may be needed to maintain the specified sound insulation rating even across wall elements beyond typical wall types, such as at the junction of internal walls and the façade.

3.3.6.1 NCC requirements for residential buildings

For apartments of multi-residential buildings, the NCC specifies minimum sound insulation ratings between various occupancies. This is defined in terms of a weighted standardised level difference $D_{nT,w}$ and a weighted standardised level difference with adapted spectrum $D_{nT,w} + C_{tr}$. These ratings are determined by field testing conducted in accordance to AS/NZS 1276.1 or ISO 717.1.

The NCC also offers deemed-to-satisfy provisions based on wall Act 1987 insulation ratings determined by laboratory testing in accordance to AS/NZS 1276.1 or ISO 717.1.

Table 7 schedules NCC field-tested sound insulation ratings needed to achieve compliance, along with corresponding NCC deemed-to-satisfy provisions.

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Table 7: Building construction requirements

Element	Description	NCC performance	
		Deemed to Satisfy	Field testing rating
Walls	<u>Airborne Sound</u>		
	Separating any two sole occupancy units	$R_w + C_{tr} \geq 50$	$D_{nT,w} + C_{tr} \geq 45$
	Separating a habitable room in one dwelling and a laundry, kitchen, bathroom or toilet in another dwelling	$R_w + C_{tr} \geq 50$ + impact	$D_{nT,w} + C_{tr} \geq 45$ + impact
	Separating a sole occupancy unit and a stairway, public corridor, public lobby or the like, or parts of a different classification	$R_w \geq 50$	$D_{nT,w} \geq 45$
	Separating a sole occupancy unit and a plant room or lift shaft	$R_w \geq 50$ + impact	$D_{nT,w} \geq 45$ + impact
Doors	Door that separates a sole occupancy unit from a stairway, public corridor, public lobby or the like	$R_w \geq 30$	$D_{nT,w} \geq 25$

Element	Description	NCC performance	
		Deemed to Satisfy	Field testing rating
Floors	<u>Airborne Sound</u>		
	Separating any two sole occupancy units, or separating a sole occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification	$R_w + C_{tr} \geq 50$	$D_{nT,w} + C_{tr} \geq 45$
	<u>Impact Sound</u>		
	Separating any two sole occupancy units, or separating a sole occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification	Refer to Section 3.2.3	Refer to Section 3.2.3
Services	If the adjacent room is a habitable room	$R_w + C_{tr} \geq 40$	N/A
	If the adjacent room is a non-habitable (wet) room	$R_w + C_{tr} \geq 25$	N/A
	Access panel in acoustical walls and acoustical barrier ceilings	$R_w + C_{tr} \geq 25$ equivalent	N/A
	If a storm water pipe passes through a sole occupancy unit, it must be separated as stated above		

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Note: Open kitchens are considered non-habitable (wet) source rooms but also habitable receiver rooms. For instance, where services are adjacent to a kitchen which is open to a living room, the kitchen would then be a habitable room and an NCC performance requirement of $R_w + C_{tr} \geq 40$ would apply to the services.

Where there is an identified risk of structure-borne sound transmission, the NCC requires a discontinuous construction, as scheduled in Table 8.

Table 8: NCC specified constructions for wall impact sound insulation

Wall or door type	Discontinuous construction
Wall separating a non-habitable (wet) area in one unit from a habitable room in adjacent unit; OR Wall separating a unit from a plant room or a lift shaft	Discontinuous construction means a wall having a minimum 20mm cavity between 2 separate leaves and: For masonry walls where ties are required between leaves, they are to be of the resilient type, and For walls other than masonry, no mechanical linkage between the leaves, except at the perimeter.

In addition to codified ratings, specific higher-performing constructions may be required in some areas (e.g. to plant rooms common spaces, etc.) to reduce noise to the adjacent sensitive spaces. Similarly, specific detailed constructions and treatments may be needed to maintain the specified sound insulation rating even across wall elements beyond typical wall types, such as at the junction of internal walls and the façade.

Notwithstanding deemed-to-satisfy provisions based on lab tests, field performance is critically dependent on good workmanship and installation quality, which is also a requirement of the acoustic design.

3.3.7 Vibration

Vibration is the oscillation of an object, structure, or surface at frequencies typically below 20 Hz, which is inaudible but instead can be “felt”.

Structure-borne noise means oscillation at frequencies higher than 20 Hz, resulting in audible noise, which is transmitted through rigid building elements and radiated by surfaces.

Limits for vibration of the building structure potentially affecting human comfort have been derived from AS 2670.2 and BS 6472, both of which are referenced and discussed practically in the AVTG. These standards propose maximum vibration levels in terms of baseline curves and multiplication factors. To minimise the disturbing perceptibility of vibration within the occupied areas of this development; Table 9 lists the appropriate limits for floor vibration in a simplified form.

Table 9: Internal vibration limits

Type of occupancy	Time	z-axis weighted rms vibration acceleration (m/s ²)		Intermittent Vibration Limits: Vibration Dose Value VDV (m/s ^{1.75})
		Continuous	Impulsive Vibration	
		Preferred / Maximum	Preferred / Maximum	Preferred / Maximum
Residences	Day	0.010 / 0.020	0.300 / 0.600	0.20 / 0.40
	Night	0.007 / 0.014	0.100 / 0.200	0.13 / 0.26
Offices, retail	Day or Night	0.020 / 0.040	0.640 / 1.280	0.40 / 0.80

3.3.8 Structure-borne noise

Vibration from gymnasiums risk transmitting structure-borne noise on other areas of the development.

The following activities shall be considered in relation to controlling structure-borne noise:

- > The dropping of weights in the gymnasium
- > Use of treadmills or other impact causing cardio equipment

For impulsive or intermittent noise sources such these, an $L_{A, max}$ internal noise criteria have been adopted as per recommendations made in the AAAC Gymnasium Guidelines. For these noise sources, the following criteria has been adopted:

Table 10 Internal structure-borne noise criteria [dB]

Noise Source	Receiver Space	Internal Noise Criterion $L_{AF, max}$ ($\Sigma_{Oct 31.5-250Hz}$)
Impulsive noise sources (E.g. Weight drops)	General Use	≤ 40
	Sensitive Use	≤ 35
	Critically Sensitive Use	≤ 30

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4. Assessment and recommendations

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4.1 Building services

Commercial noise emissions, including plant noise emissions, from any base-building systems and commercial tenancies within the subject development are required to comply with the EPA Noise Protocol Part I noise limits.

At time of writing, plant and equipment selection is yet to be finalised. Provision should be made to incorporate standard acoustic treatment, such as silencers, barriers, acoustically lined ductwork, acoustic louvres, etc. Generally, the following allowances should be made for in the design:

- > Selection of low noise fans, allowance for smooth and low velocity airflow conditions in ductwork, use of attenuators and lined duct work while minimising regenerated noise at bends, take-offs and transitions.
- > Support points for major plant items should be structurally rigid. Mid span areas of floor slab should be avoided where practical. Ideally columns, thick structural slabs or very strong beams (local stiffening) should be provided in such cases.
- > For major plant items such as chillers, cooling towers, plant and associated motor and drive assemblies should be mounted on rigid integral steel chassis or concrete inertia bases (in accordance with ASHRAE).
- > Vibration isolation for rotating plant should have an isolation efficiency greater than 90%.
- > All penetrations to plant rooms should be properly dimensioned, packed and sealed. Main services ducts and pipes to have their own individual penetrations, with suitable spacing to allow good sealing.
- > Speed controllers, if used, should be of good quality and compatible with the motor model. Poor quality controllers can result in significant increase in motor noise, as much as 10dB(A), with an offensive.
- > Where ceilings are required to provide acoustic priorities the treatment of unducted ceiling grilles should be as follows:
 - There should be no untreated return air penetrations within ceiling cavities. A steel cushion head box complete with 50mm thick internal acoustic lining should be fixed to the back of the return air registers. The cushion head box should have a spigot at 90 degrees to the back of the box.
 - Where waste/soil/stormwater pipes are present in ceiling cavity used as a return air plenum the cushion head box shall also be fitted with 1 metre of acoustic flexible ductwork or a lined sheet metal bend, directed away from the waste/soil/stormwater pipe to comply with the NCC requirements for acoustic separation between pipes and adjacent spaces.
 - Where cushion head boxes (boots) for return or supply air are connected to the back of a linear slot diffuser the unused sections of the linear slot diffuser shall be blanked off with 13mm thick standard plasterboard or any unperforated material having a surface density of not less than 8kg/m²

As the design progresses through the detailed design phase, acoustic measures will be refined so that the noise emission criteria presented in Section 3.1.1 will be complied with.

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4.2 Gymnasium treatment

The proposed gym should be designed to ensure compliance with the criteria as outlined in Section 3.3 of this report.

Given that vibration levels are proportional to the energy impact, vibration impacts are not easy to predict. Typically, acoustic testing is performed at the site after the construction of the development. Acoustic testing involves the simulation of gym activities within the gym tenancy and the measurement of the impulsive event levels at a position corresponding to the most-affected rooms within the development.

Activities in gyms, particularly the dropping of weights, can generate high levels of vibration and structure-borne noise in the underlying building structure. Vibration isolation from the building structure is therefore necessary to reduce the transfer to adjacent sensitive areas.

Typical treatments and recommendation for gyms are listed below:

- > Walls and ceilings to incorporate sound absorptive finishes for reverberance and noise control.
- > Provide vibration isolation systems from the building structure for areas where free-weights, barbells, machine-weights, and other intensive activities will occur.
- > The development of an effective management strategy for the club's operation, whereby sensitive areas are not used at the same time as the gymnasium.
- > The gym floor will likely need to be covered with a minimum of quality 50mm thick acoustic matting, however, the thickness/gym floor build-up will need to be reviewed after acoustic testing of proposed activities is conducted at the site.
- > For weight machines and treadmills, isolation systems are typically built into the equipment itself, however, if this is not the case or a higher level of isolation is required, additional isolation mounts such as OEM resilient mounts or Embelton MRD mounts (or similar) could be used.
- > Rowing machines, training bikes, cross trainers, and weight stacks equipment to be placed on standard rubber gymnasium tiles (E.g. 15mm impact tile).
- > If squat racks are to be installed, vibration isolation is required between the rack and structure of the building. Isolation in the form of rubber mounts or 15mm thick gym tiles placed between the bottom of the uprights and the concrete should be used.
- > Maximum allowable music levels to be determined.
- > Spring mounts (Embelton/Mason Mercer/Getzner or similar) may be required to be installed under the squat racks, deadlift platforms and free weight areas to provide the required vibration isolation.

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Noise from weight dropping activities and the like is recommended to be acoustically tested on site to ensure that noise and vibration levels generated by their use, will be compliant with the noise and vibration criteria. Structure borne noise and vibration levels should be measured inside sensitive areas of the attached development.

4.3 Apartment façade treatment

4.3.1 Glazing

Based on the measured and estimated noise levels presented in Sections 2.2, indicative glass build-ups and minimum acoustic performance required to achieve the internal noise level targets presented in Section 3.3.3 and Section 3.3.4 have been determined and are presented in the tables and figures below. **Both the ADGV**

(Planning Clause 58.04-3) and the Melbourne Planning Scheme (Schedule 26 to clause 43.02 Design and Development Overlay) are able to be achieved with the glazing provided below.

Stage 3 tower, which faces the freeway, was identified to be exposed to significant levels of traffic noise, allowance shall be made for robust façade design and potential alternative (mechanical) ventilation for any spaces with windows facing the freeway.

Table 11 Preliminary strategy for glazing based on room type

Room type	Level	Glazing performance recommended
Stage 1		
Bedroom	All	Rw 34
Living area	All	Rw 34
Stage 2		
Bedroom	All	Rw 39
Living area	All	Rw 34
Stage 3		
Bedrooms not facing the freeway	All	Rw 39
Living not facing the freeway	All	Rw 34

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These spaces will be highly noise-affected due to traffic, particularly those level with or higher than the elevated freeway. These will require coordination that may include:

- Non-operable windows or operable windows that achieve a performance of Rw 45 with frame included
- Reduced glazing area
- Winter garden style balcony
- High-performance double glazing (above Rw 45)
- Mechanical ventilation

Bedrooms and living facing the freeway

Glazed bedroom areas facing the freeway shall be minimised as far as practicable.

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Table 12: Recommended glazing performance requirements

Performance	Indicative glazing construction	Minimum Transmission Loss, dB							
		Octave Band Frequency, Hz							
		63	125	250	500	1k	2k	4k	8k
Rw 34	6mm monolithic glass/ 12mm airgap/ 6.38mm laminated glass	20	21	21	31	39	37	46	46
Rw 39	10mm monolithic glass/ 12mm airgap/ 6.38mm laminated glass	23	27	29	36	41	42	52	52
Rw 44	10mm monolithic glass/16mm airgap/ 12.5 'VLam Hush' laminated glass	25	29	32	44	45	57	60	60

The recommended glass build-up and acoustic performance are preliminary and may be refined during design development. The acoustic performance is subject to:

- > Final apartment layouts, glazing areas and balcony configuration.
- > Thermal requirements
- > Structural requirements
- > Final plans for glazing sizes
- > Wind loading requirements of the glass.
- > Selection of a glazing contractor.

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4.3.2 Non-glazed external walls

It is recommended that these are proposed to be masonry or precast concrete and achieve a minimum acoustic performance of R_w 50.

4.4 Garage doors

We make the following comments for the selection, installation and operation of the garage doors:

- > We recommend that during the selection of the equipment that the contractor ensures compliance with the criteria presented in Section 3.1.3. It is recommended that the selected equipment adheres to a maximum L_{max} noise emission level of 60dB(A) at a distance of 3 metres.
- > It is recommended that all elements, including guides/tracks/channels, motors, brackets and the like, be isolated from the building structure via the installation of flexible connections such as anti-vibration mounts. Manufacturers typically offer noise/vibration reduction packages as accessories which may be considered – the treatments are to be installed in accordance with the manufacturer's specification.

4.5 Lifts

The contractor is to ensure the following items are complied with:

- > The noise generated by the lift operation is to be 5dB(A) below the noise satisfactory levels presented in Section 3.3.1
- > Noise levels inside the lift care are not to exceed 55dB(A) under the following circumstances:
 - Door opening and closing
 - Accelerating and decelerating
- > Noise levels inside the lift care are not to exceed 50dB(A) when running at constant speed.
- > The lift chime is not to exceed 25dB(A) inside the apartment with the apartment door closed.
- > Lift guide alignment should be accurate enough such as to not give rise to increased levels of noise during operation.
- > Noise from lift shaft riser is to be inaudible in habitable spaces of apartments.
- > Lift shafts are to be constructed with a minimum R_w of 50.

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5. Conclusion

A site investigation of the existing surrounds at 59-101 Alfred Street and 103-117 Boundary Road has been completed to determine existing noise levels for the environment and surrounds for a proposed mixed-use redevelopment of the site.

Current standards associated with the development have been reviewed and assessed in accordance with existing site constraints. Preliminary construction standards have been provided to ensure that relevant guidelines are satisfied.

The design criteria and acoustic treatment concepts in this report demonstrate the pathways by which these will be addressed by ADP Consulting and the project team through further analysis, recommendations and coordination as the design progresses.

Therefore, ADP Consulting believe there are no site conditions, statutory or other requirements that would preclude this development from complying with the criteria defined in this report.

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Appendix A Glossary of Acoustic Terminology

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Air-borne sound

The sound emitted directly from a source into the surrounding air, such as speech, television or music.

Ambient sound

Of an environment: the all-encompassing sound associated with that environment, being a composite of sounds from many sources, near and far. This is normally taken to be the L_{Aeq} value.

Background noise level

The average of the lowest levels of the noise levels measured in an affected area in the absence of noise from occupants and from unwanted external ambient noise sources. Usually, the L_{A90} value represents the background noise level.

dB(A)

Unit of acoustic measurement weighted to approximate the sensitivity of human hearing to sound frequency.

Decibel scale

The decibel scale is logarithmic, to better represent the response of the human ear. For example, a 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. It is generally accepted that a 10 dB increase in the sound pressure level corresponds to a perceived doubling in loudness.

Examples of decibel levels of common sounds are as follows:

- > 0 dB(A) Threshold of human hearing
- > 30 dB(A) A quiet country park
- > 40 dB(A) Whisper in a library
- > 50 dB(A) Open office space
- > 70 dB(A) Inside a car on a freeway
- > 80 dB(A) Outboard motor
- > 90 dB(A) Heavy truck pass-by
- > 100 dB(A) Jackhammer / Subway train
- > 110 dB(A) Rock Concert
- > 115 dB(A) Limit of sound permitted in industry
- > 120 dB(A) 747 take off at 250 metres

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Frequency

The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high-pitched sound and a low frequency to a low-pitched sound.

L_{90} , L_{10} , etc

A statistical measurement giving the sound pressure level which is exceeded for the given percentile of a measurement period (i.e., L_{90} is the level which is exceeded for 90 percent of a measurement period). L_{90} is commonly referred to as a basis for measuring the background sound level.

$L_{Aeq,T}$

The equivalent continuous A-weighted sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound.

L_{Amax}

The maximum sound pressure level measured over the measurement period.

L_{Amin}

The minimum sound pressure level measured over the measurement period.

Day

Referred to as the period between 7 am and 6 pm for Monday to Saturday and 8 am to 6 pm for Sundays and Public Holidays.

Evening

Referred to as the period between 6 pm and 10 pm for Monday to Sunday and Public Holidays.

Night

Referred to as the period between 10 pm and 7 am for Monday to Saturday and 10 pm to 8 am for Sundays and Public Holidays.

Assessment background level (ABL)

The overall background noise level on each day, evening, and night periods for each day of the noise monitoring.

Rating background level (RBL)

The overall background level on each day, evening, and night periods for the entire length of noise monitoring.

Reverberation

The persistence, after emission by the source has stopped, of a sound field in an enclosure.

Sound isolation

A reference to the degree of acoustical separation between two spaces. Sound isolation may refer to sound transmission loss of a partition or to noise reduction from any unwanted noise source. The term 'sound isolation' does not specify any grade or performance quality and requires the units to be specified for any contractual condition.

Sound pressure level, L_p , dB of a sound

A measurement obtained directly obtained using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the R.M.S. sound pressure to the reference sound pressure of 20 micro-Pascals.

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