ADP
Consulting : Engineering

Muswellbrook Childcare Centre

Environmental Noise Impact Assessment for Childcare Centre

Prepared for: Lockbridge Pty Ltd

Project No: SYD2384
Date: 31 May 2023
Revision: 00

Creating great environments with great people

Project:	Muswellbrook Childcare Centre
Location:	200-206 Bridge Street Muswellbrook NSW 2333
Prepared by:	ADP Consulting Pty Ltd Level 3, 8 Spring Street Sydney NSW 2000
Project No:	SYD2384
Revision:	00
Date:	31 May 2023

Rev	Date	Comment	Author	Signature	Technical Review	Signature	Authorisa-tion & QA	Signature
00	22/05/23		EC					
01	31/05/2023		EC	-	WG	-	WG	-

Project Team	
Client / Principal	Lockbridge Pty Ltd
Architect	RD Raymond Design

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1. Introduction

1.1 Document purpose

ADP Consulting Pty Ltd has been retained on behalf of Lockbridge Pty Ltd to undertake acoustic engineering services for the proposed Childcare Centre located at 200-206 Bridge Street, Muswellbrook.

This report will present an assessment of environmental noise impacts associated with the proposed development. The assessment was based on the architectural drawings, standards and other relevant documents as presented in the following section.

1.2 Referenced drawings, codes, and standards

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

- Architectural drawings with job number RD21026, Issue P2, dated 09/05/2023 and provided by RD Raymond Design.
- Muswellbrook Shire Council Pre-lodgement letter dated 8 May 2022.
- Muswellbrook Shire Council Development Control Plan (DCP) 2009.
- Draft Traffic Report with project number 16th May 2023 and provided by SECA Solution.
- Association of Australasian Acoustical Consultants (AAAC) Guideline for Childcare Centre Acoustic Assessment Version 3.0.
- Australian/ New Zealand Standard AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors.
- NSW Environmental Protection Authority (EPA) Noise Policy for Industry (NPfI).
- State Environmental Planning Policy (Transport and Infrastructure) 2021 (SEPP).
- Department of planning's Development near Rail Corridors and Busy Roads – Interim Guideline, dated 2008 (DoP Interim Guideline).
- NSW Environment, Climate Change and Water's Road Noise Policy, dated 2011 (RNP).

1.3 Project summary

This report presents an analysis of the acoustic impacts associated with the proposed childcare centre development located at 200-206 Bridge Street, Muswellbrook. The proposed childcare centre will accommodate a total number of 109 children and 19 staff members and will include the following areas:

- Seven (7) indoor play areas, which will accommodate the following age groups:
  - Activity room 1 with sleep room with 12 cots: 12 children aged 1.5 to 2 years.
  - Activity room 2: 12 children aged 0 to 1.5 years.
  - Activity room 3: 15 children aged 2 to 3 years.
  - Activity room 4: 15 children aged 2 to 3 years.
  - Activity room 5: 15 children aged 2 to 3 years.
  - Activity room 6: 20 children aged 3 to 5 years.
  - Activity room 7: 20 children aged 3 to 5 years.
- A multi-purpose room.
- Offices and other amenities.
- An outdoor carpark with a total of 27 carpark spots on the eastern side of the site.
- An approximately 967m^2 of outdoor play area to the east, west and north of the childcare centre building.

In this assessment, the following will be addressed:

- Noise emissions to all nearest noise sensitive receivers from:
  - the operation of the proposed childcare centre, including outdoor and indoor play areas.
  - the use of the carpark from staff and parents dropping off and picking up their children.
  - the operation of mechanical plant equipment associated with the proposed development.
- Environmental noise intrusions, mainly from road traffic and train to the proposed childcare centre indoor areas and outdoor play area.
- Vibration levels at the subject development site.

Details of the proposed development are highlighted in Figure 1.

1.4 Site Analysis

The site is located at 200-206 Bridge Street, Muswellbrook. A site investigation has been carried out by this office to identify noise sources that will potentially impact the project development, and nearest noise sensitive receivers potentially impacted by the proposed development.

The subject site is bounded by the following noise sources:

> Directly to the east by Bridge Street, which carries medium volumes of traffic flow.

> Directly to the west by Hunter train line.

Upon a site inspection, the following nearest most affected noise sensitive receivers have been noted:

> Receivers 1 – 3 (R1 – R3) – Single-level residential dwellings directly to the north of the subject site, at 208 Bridge Street, 13 Wilkins Street, and 11 Wilkins Street.

> Receiver 4 (R4) – Single-level residential dwelling to the west of the site, opposite the train line, at 9 Wilkins Street.

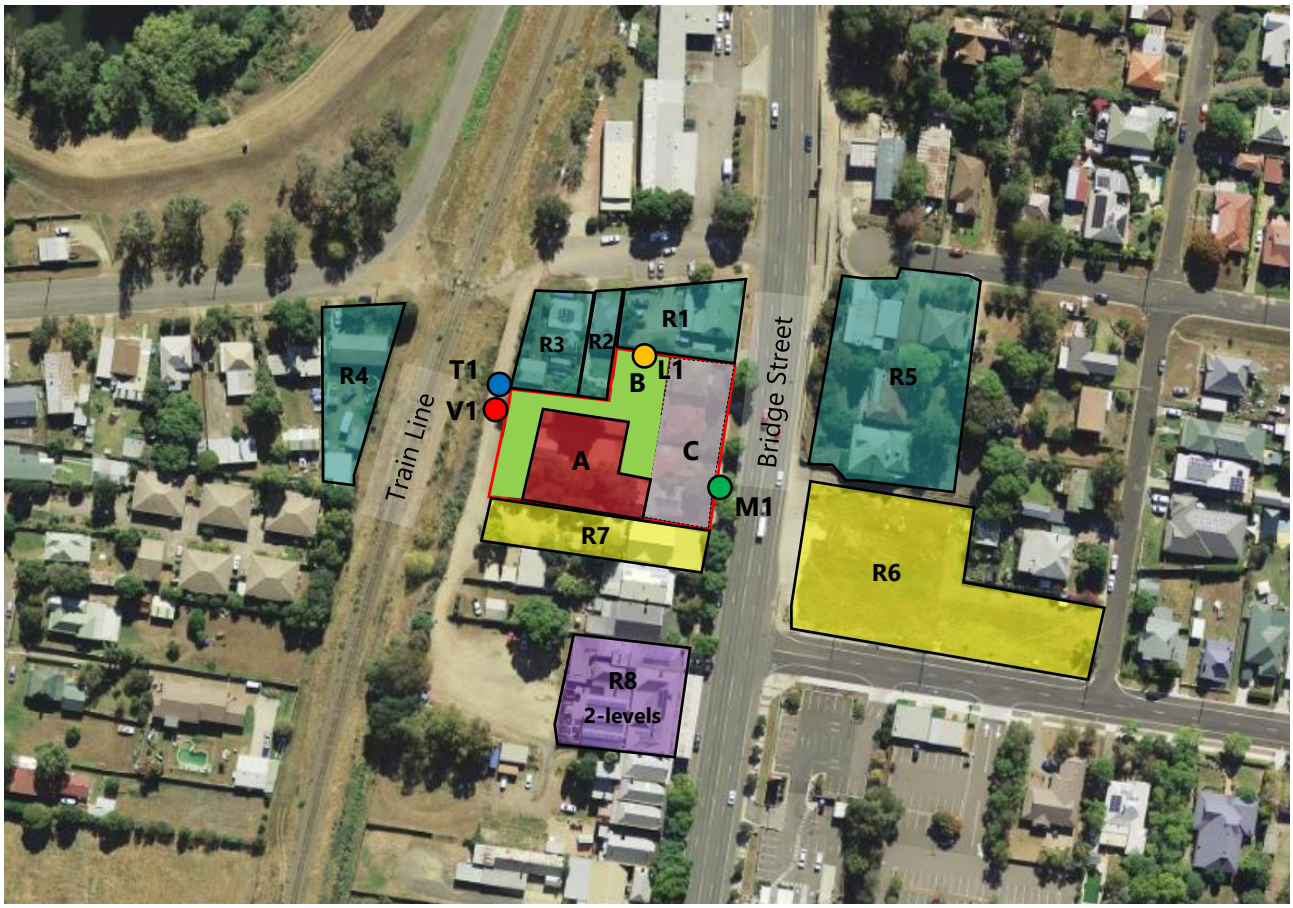
> Receiver 5 (R5) – Single residential dwellings with higher RL to the east of the site, opposite Bridge Street.

> Receivers 6 (R6) – Commercial receiver (petrol station) to the south-west of the site, opposite Bridge Street.

> Receiver 7 (R7) – Commercial receiver directly to the south.

> Receiver 8 (R8) – Double-storey Hotel approximately 60m to the south.

Figure 1 Aerial photo of project site and nearest noise sensitive receivers (resourced from SIX Maps)



- Project site
- Nearest residential noise sensitive receivers (R1 – R5)
- Nearest commercial noise sensitive receivers (R6 – R7)
- Nearest hotel noise sensitive receivers (R8)
- Proposed childcare centre building location
- Proposed outdoor carpark & drop off/ pick up zone
- M1 Attended traffic noise measurement location
- V1 Attended vibration noise measurement location
- T1 Attended train noise measurement location
- L1 Long-term unattended noise monitor location

2. Site Investigations and Noise Measurements

2.1 Site investigations

Based on our site survey and investigations, we have identified the following nearest noise sensitive premises to the proposed redevelopment (also presented in Section 1.4 and Figure 1):

- Residential receivers R1 – R5,
- Commercial receivers R6 – R7, and
- Hotel receiver R8.

2.2 Noise measurement equipment

The following instrumentation was used for noise measurement and analysis:

- Bruel and Kjaer 2250 Integrating Sound Level Meter (S/N: 3011318)
- Bruel and Kjaer type 1 microphone – comprising of:
  - ZC 0032 preamplifier (S/N: 25754)
  - 4189 capsule (S/N: 3087045)
- Bruel and Kjaer Sound calibrator Type 4231 (S/N: 3018299)
- Convergence Instruments NSRT, MK3 sound level meter datalogger type 1.
- SVAN 958A SN 81173 Vibration analyser.

All instrument systems are laboratory calibrated using instrumentation traceable to Australian National Standards and certified within the last two years thus conforming to Australian Standards. The measurement system was also field calibrated prior to and after noise surveys. Calibration drift was found to be less than 0.2dB during measurements. No adjustments for instrument drift during the measurement period were warranted.

2.3 Attended noise measurements

Attended noise measurements were conducted around the project site at 200-206 Bridge Street, Muswellbrook on 5th April 2023 at the following location:

- **Location M1**: 6m from Bridge Street kerb, with the microphone positioned 1.5m above ground floor level and with a 180-degree view of the road (refer to Figure 1 for measurement location).

The noise measurement detailed above was used to qualify and quantify the noise levels of the area.

Table 1 presents the noise levels of the attended measurements at the locations shown in Figure 1.

Table 1 Attended traffic noise measurements, dB(A)

Location	Start Time	Date	Location and Comments	dB(A) $L_{eq,15min}$	L_{A90}
M1	1:15pm – 1:30pm	5/04/2023	6m from Bridge Street kerb	72	52

2.4 Unattended noise monitoring

Unattended noise measurements were conducted at the following location (shown in Figure 1):

> **Location L1**: At the northern site boundary, near residential receiver 1 (R1) in the period between Monday 5th to Sunday 8th April 2023.

The measured background noise levels have been corrected for meteorological conditions (excessive wind and/or rain), as required by section 3.4 of the EPA Noise Policy for Industry. Exceedances of the 5m/s average wind speed limit of the EPA were noted and corrected for in determining the background noise levels. Appendix B – Unattended Noise Monitoring Data provides the results of the unattended noise monitoring.

Background noise, equivalent continuous sound levels, and traffic noise levels at location L1 are summarised in Table 2 below.

Table 2 Unattended noise measurements at location L1 dB(A)

Noise Measurement	Daytime (7am-6pm) *	Evening (6pm-10pm)	Night-time (10pm -12am)
Location L1			
Repeatable – L_{Aeq}	55	54	51
Rating Background Level (RBL) – L_{A90}	44	40	32

* Proposed hours of operation of the childcare centre (7am – 6pm)

2.5 Attended train noise and vibration measurements

Attended noise and vibration measurements of trains passing by the site were conducted at the project site at 200-206 Bridge Street, Muswellbrook on 5th April 2023 at the following location:

- **Location T1**: at the western site boundary, approximately 23m away from the train line. The sound level meter's microphone was positioned 1.5m above ground level with 180-degrees view of the road (refer to Figure 1 for measurement location).
- **Location V1**: at the western site boundary, approximately 23m away from the train line, next to Location T1.

Table 3 presents attended noise measurement results at Location T1 shown in Figure 1. Table 4 presents the highest VDV levels measured at Location V1.

Table 3 Attended train noise measurements – Location T1

Train type	Number of wagons	Direction	Noise Level, dB(A)L_{eq}
Passenger train	5	Northbound	64
Freight train	53	Northbound	83

Table 4 Attended vibration measurements – Location V1

Train type	Maximum Peak Particle Velocity for Train Passovers (mm/s)
Passenger train	< 0.1
Freight train	< 0.1

3. External Noise Emission Criteria

Noise emissions from the operation of the proposed development to all nearest noise sensitive receivers should be assessed to ensure compliance with noise emission criteria presented in this section. Noise emission restrictions apply to future tenant activity and mechanical plant and equipment systems. These must be planned, designed, and installed to include suitable sound attenuation, vibration isolation, and other necessary acoustic treatments.

3.1 Muswellbrook Shire Development Control Plan (DCP) 2009 – Section 18

Section 18 of Muswellbrook Shire Council DCP includes the following noise controls for childcare centres.

Section 18 – Child Care Centres

12.4.2 Acoustic Privacy

Objectives

a. Noise levels (measured at any point on the boundary of the site between the proposed Centre and adjoining property) do not exceed 5dB(A) above the L_{90} background level during the hours of operation.

Controls

(i) Locate noisy areas such as outdoor space, vehicle access and pathways away from windows of adjoining dwellings.

(ii) Appropriate noise reduction measures are utilised.

(iii) Demonstrate compliance with operating noise levels by providing a report on noise levels prepared by a suitably qualified consultant.

3.2 NSW Noise Policy for Industry (NPfI)

NPfI requires that trigger levels be calculated from the intrusiveness and amenity criteria. The NPfI also includes the application of modifying factors for undesirable noise characteristics, up to a maximum of 10dB.

3.2.1 Noise intrusiveness

The NPfI states that the intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5dB.

schedules the noise intrusion level criteria in accordance with the NPfI. It should be noted that noise intrusiveness criteria are set in Table 6.

It should be noted that Table 2.1 of the NPfI has four categories of residential areas: rural, suburban, urban and urban/industrial. Noise emission criteria for the nearest noise sensitive receivers were assessed in accordance with the "Suburban" category.

3.2.2 Noise amenity

The NPfI describes methodology to limit the increases in noise levels from the introduction of new noise sources in an area. The NPfI specifies different amenity noise levels depend on the use of the receiver and recommends that the maximum ambient noise should not exceed the levels in Table 2.2 of the NPfI.

Table 6 summarises the project amenity noise levels (as described in Table 2.2 of the NPfI).

3.3 Sleep Disturbance

NPfI establishes sleep disturbance criteria for all residential noise sensitive receivers for peak noise events. The sleep disturbance criteria are summarised below:

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

Although the subject development is not proposed to operate during night-time period, sleep disturbance criteria for maximum noise level events during the night-time period were calculated and are summarised below for future reference, in case extension of hours of operation is proposed.

Table 5 Sleep disturbance criteria

Receivers	Night-time level dB(A) L_{90}	Emergence sleep disturbance level
Residential	32	$L_{Aeq,15min}$ dB(A) 40 L_{AFmax} dB(A) 52

3.4 Noise emission criteria summary (NPfI)

The project specific trigger levels have been derived using the methodology presented in the NPfI and are scheduled in Table 6. We note that these trigger levels have been derived from the background noise levels measured at Location L1 (refer to Table 2 for detailed measured noise levels).

Table 6 Noise emission criteria summary

Period/ Time of operation	Background noise Level dB(A)L_{90}	Intrusiveness criteria, $L_{Aeq,15min}$ (Background+5dB)	Recommended amenity, $L_{Aeq, period}$	Project amenity, $L_{Aeq, 15min}$	Project trigger levels, $L_{Aeq, 15min}$ Zone 2 Residential Receivers
Day (7am to 6pm)	44	49	55	53	49
Evening (6pm to 10pm)	40	51	45	43	43
Night (10pm to 7am)	32	45	40	38	38 (Sleep Disturbance 40 $L_{eq,15min}$ dB(A) 52 L_{Fmax} dB(A)

3.5 Association of Australasian Acoustical Consultants (AAAC) Guideline for Child Care Centre Acoustic Assessment Version 3.0 – Noise Emissions

The AAAC Guideline for Child Care Centre acoustic assessment provides criteria for noise emissions from Childcare centres. The criteria are based on background noise level recorded at location most representative of the most affected receiver locations. The criteria are detailed below.

3.5.1 AAAC Outdoor Play Area Criteria

*"**Base Criteria** – With the development of childcare centres in residential areas, the background noise level within these areas can at certain times, be low. Thus, a base criterion of a contributed $L_{eq,15min}$ 45 dB(A) for the assessment of outdoor play is recommended in locations where the background noise level is less than 40 dB(A).*

***Background Greater Than 40 dB(A)** – The contributed $L_{eq,15min}$ noise level emitted from an outdoor play and internal activity areas shall not exceed the background noise level by more than 5 or 10 dB at the assessment location, depending on the usage of the outdoor play area. AAAC members regard that a total time limit of approximately 2 hours outdoor play per morning and afternoon period should allow an emergence above the background of 10 dB (ie background +10 dB if outdoor play is limited to 2 hours in the morning and 2 hours in the afternoon).*

***Up to 4 hours (total) per day** – If outdoor play is limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed $L_{eq,15\text{-}minute}$ noise level emitted from the outdoor play shall not exceed the background noise level by more than 10 dB at the assessment location.*

More than 4 hours (total) per day *– If outdoor play is not limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed* $L_{eq,15\text{-}minute}$ *noise level emitted from the outdoor play area shall not exceed the background noise level by more than 5 dB at the assessment location. The assessment location is defined as the most affected point on or within any residential receiver property boundary. Examples of this location may be:*

- *1.5 m above ground level*
- *On a balcony at 1.5 m above floor level*
- *Outside a window on the ground or higher floors"*

Based on the above AAAC guidelines, the following criteria are applicable to the proposed development.

Table 7 Childcare centre noise criteria for outdoor play

Period	Noise criteria at residential receiver, $L_{Aeq,15\text{-}min}$	Outdoor play restrictions?
Day (7am – 6pm)	**54** (BG 44 +10dB)	Up to 4 hours outdoor play
	49 (BG 44 +5dB)	No restriction in use of outdoor play

3.5.2 AAAC Mechanical Plant Noise Emission Criteria

"Childcare centres may include air-conditioning plant and equipment, kitchen and wet area exhaust fans, car park and garbage room ventilation fans. Depending on the requirements of the state or territory where the centre is located, any such mechanical equipment should be assessed in accordance with this section and should not be audible outside the premises between 6pm and 7am".

Based on the above, noise emissions from mechanical plant used by the proposed childcare centre should be inaudible between the hours of 6:00pm to 7:00am. Noise emission criteria for all other hours will be drawn by NSW EPA Noise Policy for Industry (NPfI). Refer to Section 3.4 for a summary of the NPfI criteria.

3.5.3 AAAC Indoor Play Area Criteria

"Noise emission from *the indoor play and activities should be considered, including scenarios with windows and doors both open and closed. Some childcare centres may need to close their windows and doors during active indoor play or* music".

Noise emissions from cumulative noise impact of children play indoors and mechanical plant shall not exceed the background noise level by more than 5dB at the boundary of the nearest noise sensitive receivers for day and evening time periods as per NPfI criteria. Refer to Section 3.4 for a summary of the NPfI criteria.

3.5.4 AAAC Pick up and drop off noise criteria

"Depending on the requirements of the state or territory where the centre is located, noise emission from vehicles on site should be considered".

Based on the above, noise emission criteria will be drawn by NSW EPA Noise Policy for Industry (NPfI). Refer to Section 3.4 for a summary of the NPfI criteria.

3.5.5 Commercial receptors

"The cumulative $L_{Aeq,\ 15min}$ noise level emitted from the use and operation of the childcare centre shall not exceed 65 dB(A), from all activities (including outdoor play), when assessed at the most affected point on or within any commercial property boundary".

3.6 Department of Environment, Climate Change and Water NSW - Road Noise Policy (RNP), 2011

NSW Road Noise Policy provides criteria for land use developments with the potential to create additional traffic on public streets. Noise levels generated by traffic associated with the proposed development should not exceed the noise levels set out in the table below.

Table 8 Criteria for traffic noise generated by new development

Road type	Time of day	Permissible noise generation
Freeway/ arterial/ sub-arterial roads	Day (7:00am - 10:00pm)	60 dB(A) $_{Leq(15h)}$ daytime (external)
	Night (10:00pm - 7:00am)	55 dB(A) $_{Leq(9h)}$ night-time (external)

If existing noise levels exceed those in the table above, Section 3.4 of the Road Noise Policy is applicable, which requires noise impacts are reduced through feasible and reasonable measures. However, in determining what is feasible/reasonable, the Policy notes that an increase of less than 2dB(A) is a minor impact and would be barely perceptible.

3.7 Summary of Noise Emission Criteria

A summary of noise emission criteria from the use of the proposed development is presented in the following Table.

3.7.1 Childcare Centre summary of noise emission criteria

The following table presents a summary of noise emission criteria for the proposed Childcare Centre.

Table 9 Noise emission criteria – Residential receivers – (Childcare Centre)

Noise Source	**Time of operation**	**Background noise Level dB(A)L_{90}**	**Project trigger levels, $L_{Aeq, 15min}$**
Childcare Centre (cumulative noise from indoor play and carpark) & Outdoor Play area (no limitation in time spent outdoors)	Day (7am to 6pm)	44	**49** (BG + 5dB)
Childcare Centre outdoor play area (up to 4 hours play in a day)	Day (7am to 6pm)	44	**54** (BG + 10dB)
Childcare Centre (noise from mechanical plant)	Day (7am to 6pm)	44	**49** (BG + 5dB)

Table 10 Noise emission criteria – Commercial receivers (Childcare Centre)

Noise Source	**Time of operation**	**Noise emission criteria $L_{Aeq, 15min}$**
Childcare centre (cumulative noise from mechanical plant, indoor/outdoor play and carpark)	When in use	65

4. Internal Noise and Vibration Criteria

Major external noise sources that can potentially affect the proposed development include surrounding roads and airplanes flying over the site. Noise intrusions to the proposed development from these noise sources will be assessed in accordance with the criteria presented in this section.

4.1 Muswellbrook Shire Council Development Control Plan (DCP) 2009

Muswellbrook Shire Council DCP 2009 does not provide internal noise criteria for childcare centres.

4.2 State Environmental Planning Policy (Transport and Infrastructure) 2021

Clause 2.119 of the State Environmental Planning Policy (Transport and Infrastructure) 2021 (SEPP), specifies indoor noise level requirements for non-road developments that are for residential use. The following are stated:

> *(1) This section applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 20,000 vehicles (based on the traffic volume data published on the website of TfNSW) and that the consent authority considers is likely to be adversely affected by road noise or vibration—*
>
> *(a) residential accommodation,*
>
> *(b) a place of public worship,*
>
> *(c) a hospital,*
>
> *(d) an educational establishment or centre-based childcare facility.*

SEPP also states the following:

> *(3) If the development is for the purposes of residential accommodation, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded—*
>
> *(a) in any bedroom in the residential accommodation—35 dB(A) at any time between 10 pm and 7 am,*
>
> *(b) anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway)—40 dB(A) at any time.*

It should be noted that Bridge Street is not specified as a road that carries annual average daily traffic of more than 20,000 vehicles, as per the NSW Government's Road and Maritime Services website.

4.3 NSW Department of Planning Development Near Rail Corridors and Busy Roads – Interim Guideline

NSW Department of Planning Development Near Rail Corridors and Busy Roads – Interim Guideline does not provide specific requirements for childcare centres. However, the internal areas will also be used for sleeping during naptimes.

4.3.1 Airborne Noise

Table 3.1 of the NSW Department of Planning's Development Near Rail Corridors and Busy Roads Interim Guideline specifies internal noise criteria for different areas of occupancy. Noise levels are summarised below.

Table 11 Noise criteria Table 3.1 of Interim Guideline

Residential Buildings **Type of Occupancy**	**Noise Level, dBA**	**Time period**
Sleeping areas	35	Night-time (10pm – 7am)
Other Habitable areas	40	At any time

4.3.2 Ground borne noise

In addition to the above, Section 3.6.2 of the NSW Department of Planning's Development Near Rail Corridors and Busy Road – Interim Guideline' outlines the following with regards to the assessment of ground-borne noise.

> 3.6.2 Ground borne noise
>
> *"Where buildings are constructed over or adjacent to land over tunnels, ground-borne noise may be present without the normal masking effect of airborne noise. In such cases, residential buildings should be designed so that the 95th percentile of train pass-bys complies with a ground-borne L_{Amax} noise limit of 40dBA (daytime) or 35dBA (night-time) measured using the "slow" response time setting on a sound level meter".*

4.4 Association of Australasian Acoustical Consultants (AAAC) Guideline for Child Care Centre Acoustic Assessment Version 3.0 – Noise Intrusions

The AAAC Guideline for Child Care Centre acoustic assessment provides criteria for noise intrusion to Childcare centres.

4.4.1 Road, Rail Traffic and Industry

"The $L_{Aeq,1hr}$ noise level from road traffic, rail or industry at any location within the outdoor play or activity area during the hours when the Centre is operating should not exceed 55 dB(A).

The $L_{Aeq,1hr}$ noise level from road traffic, rail or industry at any location within the indoor activity or sleeping areas of the Centre during the hours when the centre is operating shall be capable (ie with doors and / or windows closed) of achieving 40 dB(A) within indoor activity areas and 35 dB(A) in sleeping areas".

4.5 Internal Noise Levels – AS/NZS 2107:2016

Indoor background noise levels in terms of Sound Pressure Level (SPL) and reverberation times (seconds) deemed acceptable to the majority of reasonable occupants are published in AS/NZS 2107. We have summarised the recommended indoor noise levels and design reverberation time (T) range in seconds in Table 12.

These limits apply to continuous noise sources or sources of noise internal to the proposed development and include plant equipment, lifts, traffic, etc.

The table below presents internal noise level criteria for offices, reception, kitchen and other areas.

Table 12 Internal design sound pressure levels and reverberation time recommendations

Type of occupancy	Design sound level, $L_{Aeq,t}$ range
Reception areas	40 – 45
General office areas/ multi-purpose*	40 – 45
Toilets	45 – 55
Staff rooms	40 – 45
Corridors	< 50

In absence of noise criteria for multi-purpose rooms, we used the criteria for general office areas.

4.6 Summary of Noise Intrusion Criteria

A summary of noise intrusion criteria for the proposed development is presented in Table 13 and Table 14 below.

Table 13 Noise intrusion criteria

Noise Source	Space	Traffic/ rail noise intrusion criteria
Road traffic/ Train noise	Childcare Centre Indoor Play	40 dBA $L_{eq,1hr}$
	Childcare Centre Indoor Sleeping Area	35 dBA $L_{eq,1hr}$
	Childcare Centre Outdoor Play	55 dBA $L_{eq,1hr}$

Table 14 Ground borne noise criteria

Type of Occupancy	Noise Level, dBA L_{max}	Time period
Ground-borne noise	40	Daytime (7am – 10pm)
	35	Night-time (10pm – 7am)

4.7 Internal vibration requirements

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

Human response to building vibration is a complex phenomenon. There is great variability in the vibration tolerance of humans, and as a result, human comfort criteria cannot robustly be defined and quantified. Acceptable values of human exposure to vibration depend on human activity and the character of the vibration, and they are further influenced by individual attitudes, expectations, and perceptibility.

Section 3.6.3 of the Development near Rail Corridors and Busy Roads – Interim Guideline states the following in regards to vibration criteria.

> **3.6.3 Vibration criteria**
>
> *Vibration levels such as the intermittent vibration emitted by trains should comply with the criteria in Assessing Vibration: a technical guideline (DECC 2006). The standards used for assessing the risk of vibration damage to structures are German Standard DIN 4150 Part 3 1999 and British Standard BS 7385 Part 2 1993. Human comfort is normally assessed with reference to the above British Standard or Australian Standard AS 2670.2 1990*

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. For the purpose of minimising the disturbing perceptibility of vibration within the occupied areas of this redevelopment, Table 15 specifies appropriate limits for floor vibration in a simplified form.

Table 15 Vibration limits

Type of occupancy	Time	Continuous vibration limits: r.m.s. acceleration (m/s^2) Preferred / maximum	Impulsive vibration limits: r.m.s. acceleration (m/s^2) Preferred / maximum	Intermittent vibration limits: Vibration Dose Value VDV ($m/s^{1.75}$) Preferred / maximum
Retail, circulation / other occupied ventilated space	Day or night	0.020 / 0.040	0.640 / 1.280	0.40 / 0.80
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

Given that various areas of the childcare centre will be used for napping, we will adopt the vibration limits criteria for residences at night-time for our assessment.

5. Noise Emission Assessment

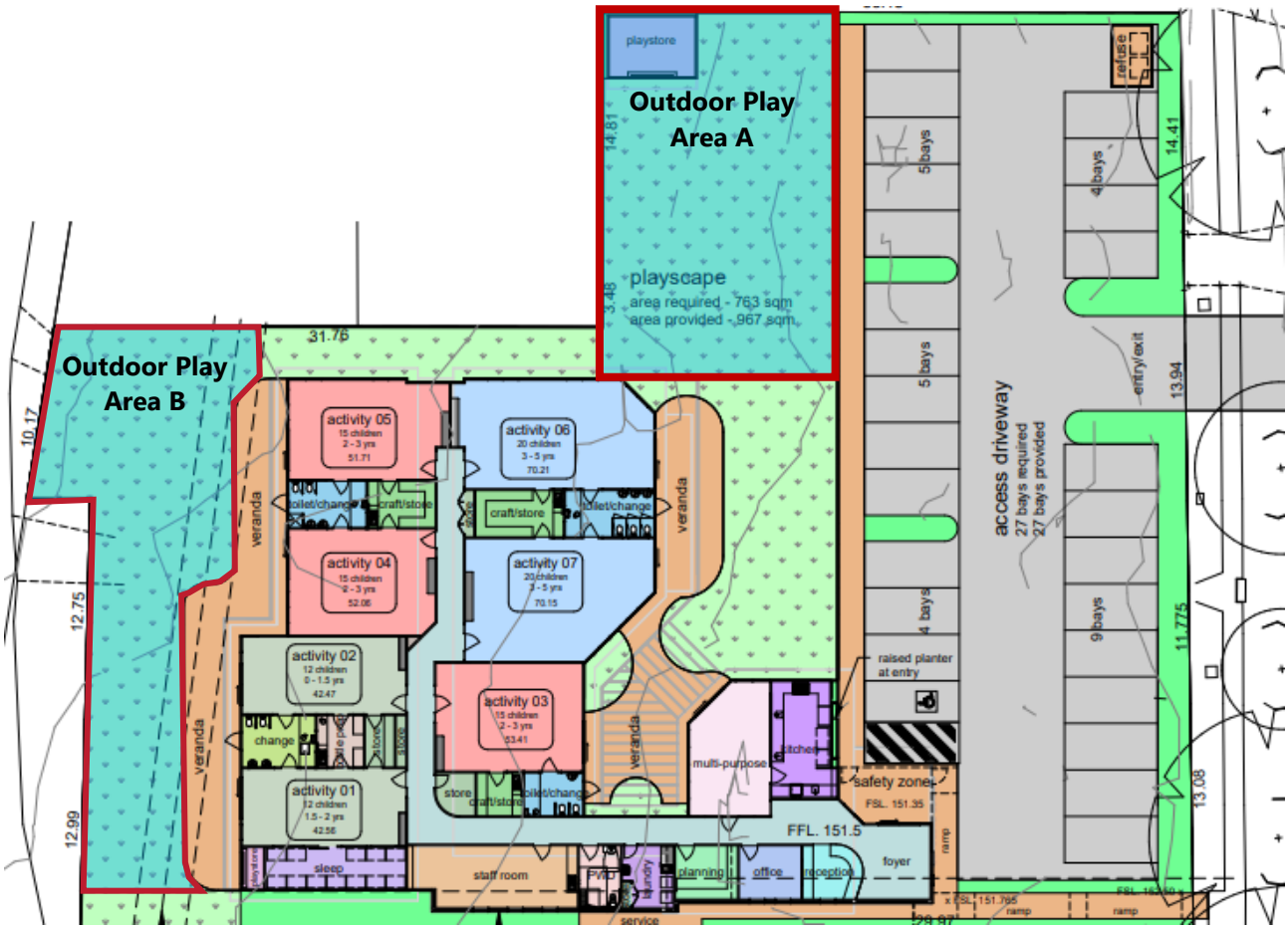
Noise emissions from the proposed childcare centre were calculated based on the following information:

- Proposed hours of operation are between 7am to 6pm Monday to Friday.
- The childcare centre will accommodate a total number of 109 children. The proposed age group of the children will be as follows.
  - 40 children aged 3-5 years.
  - 45 children aged 2-3 years.
  - 24 children aged 0-2 years.
- The outdoor play area will spread to the north, east and west, as shown in Figure 1. For the purpose of this noise assessment, we have divided the outdoor play area in two zones (refer to Figure 2).
  - Outdoor Play Area A will accommodate:
    - The children aged 0-2 years.
  - Outdoor Play Area B will accommodate:
    - The children aged 2-5 years.
- Noise emissions from the outdoor play area were calculated **based on the following maximum number of children allowed outdoors at any one time**:
  - In Outdoor Play Area A:
    - All toddlers (0-2) can play in Area A at the same time.
  - In Outdoor Play Area B:
    - Up to 12 children aged 2-3, and
    - Up to 12 children aged 3-5 can play in Area B at the same time.
- It is assumed that one in two children will be generating noise at any one time in the indoor and outdoor areas.
- Noise emissions were calculated based on the effective sound power levels for groups of 10 children playing, as presented in Table 1 of the AAAC Guideline, and presented in Table 16.

Table 16 Sound Power Levels for different children age groups – AAAC

Number/ Age of Children	Sound Power Levels [dB] at Octave Bans Centre Frequencies [Hz]								
	dB(A)	63	125	250	500	1k	2k	5k	8k
10/ 0-2 years	**78**	54	60	66	72	74	71	67	64
10/ 2-3 years	**85**	61	67	73	79	81	78	74	70
10/ 3-5 years	**87**	64	70	75	81	83	80	76	72

Figure 2 Proposed childcare indoor activity and outdoor play areas



5.1.1 Noise emissions from outdoor play areas

The predicted noise levels from the operation of the outdoor play area to all nearest noise sensitive receivers are presented below.

The predicted noise levels have accounted for any expected noise reduction provided by distance losses and the recommendations set out in Section 5.5.

Table 17 Predicted noise levels from outdoor play areas to nearest residential noise sensitive receivers

Residential Receivers	Assessment location	Predicted noise level dB(A) $L_{eq(15min)}$	Criteria (Background +5dB(A)) $L_{eq(15min)}$ (no restriction in outdoor play time)	Compliance?
Receiver 1	At the nearest façade of the residential receiver at 1.5m above ground level	39	49	Yes
Receiver 2	At the nearest façade of the residential receiver at 1.5m above ground level	45	49	Yes
Receiver 3	At the nearest façade of the residential receiver at 1.5m above ground level	47	49	Yes
Receiver 4	At 1m from nearest boundary, 1.5m above ground level	40	49	Yes
Receiver 5	At 1m from nearest boundary, 1.5m above ground level	<40	49	Yes
Receiver 8	At nearest façade on Level 1	<40	49	Yes

Table 18 Predicted cumulative noise levels from outdoor play areas to nearest commercial receivers

Commercial Receivers	Assessment location	Predicted noise level dB(A) $L_{eq(15min)}$	Criteria from AAAC for commercial receivers	Compliance?
Receiver 6	At nearest boundary	< 50	65	Yes
Receiver 7	At nearest boundary	< 50	65	Yes

5.1.2 Noise emissions from indoor play areas

Indoor play noise emissions have been calculated based on the assumptions that the windows will be left open to allow for natural ventilation. The predicted noise levels to closest sensitive receivers are detailed below.

Table 19 Predicted cumulative noise levels from indoor areas to nearest residential receivers

Noise source	Noise receiver	Predicted noise levels dB(A) L_{eq}	Time	Criteria $L_{eq(15min)}$	Compliance?
All indoor play areas	Receiver 1 (at nearest façade, 1.5m above ground level)	<40	Daytime (7am – 6pm)	49	Yes
	Receiver 2 (at nearest façade, 1.5m above ground level	<40		49	Yes
	Receiver 3 (at 1m from nearest boundary)	<40		49	Yes
	Receiver 4 (at 1m from nearest boundary)	<40		49	Yes
	Receiver 5 (at 1m from nearest boundary)	<40		49	Yes
	Receiver 8 (at nearest façade on Level 1)	<40		49	Yes

5.2 Vehicle noise emissions

Noise emissions from the vehicles of the future users of the proposed development need to comply with the noise emission criteria presented in Section 3.

5.2.1 Childcare centre carpark drop-offs

The outdoor carpark to the west of the proposed childcare centre will be used for parents to drop off or pick up their children. Noise predictions from vehicles associated with the proposed childcare development have been calculated based on the following information in the traffic report:

- In a peak 1-hour morning period there will be a total of up to 88 trips and up to 76 trips during evening peak period.
- Deliveries to the site will take place during day-time period. Although, deliveries are not proposed during peak pick up and drop off time, for a conservative calculation, we assumed that in the peak 1-hour morning period there also be 2 delivery van movements, based on one van driving in and out the site.
- Each vehicle movement (entering and manoeuvring around the carpark or exiting) will last on average 20 seconds. This assumption was made based on the length of the driveway/carpark.
- Vehicle sound power levels of 81dB(A) for passenger vehicles and 86dB(A) for delivery vans were used as per AAAC guideline.

Noise levels were predicted noise levels are presented below.

Table 20 Predicted vehicle noise emissions to nearest residential receivers

Receiver	**Assessment location**	**Predicted noise level dB(A) $L_{eq(15min)}$**	**Time**	**Criteria (Background +5dB(A))$L_{eq(15min)}$**	**Compliance?**
Receiver R1	At nearest façade of receiver 1.5m above ground level	44	7:00am – 6:00pm	49	Yes

Table 21 Predicted vehicle noise emissions to nearest commercial receiver

Receiver	Assessment location	Predicted noise level dB(A) $L_{eq(15min)}$	Time	Criteria (Background +5dB(A))$L_{eq(15min)}$	Compliance?
Receiver R7	At nearest boundary	<45	When in use	65	Yes

5.3 Noise from increased traffic generation on public streets

For land use developments with the potential to create additional traffic in public streets, compliance with the requirements of the EPA Road Noise Policy is mandatory. Based on Section 2.3 of the policy, noise levels generated by traffic should not exceed the noise levels set out in Table 8.

Primary vehicular access to the proposed development is via Bridge Street. Predictions of noise generation are based on the following:

> Bridge Street: In a peak 1-hour daytime period (7am – 10pm), there will be an addition to the current traffic of 164 vehicles.

> Each car has a sound power level of 94dB(A) (typical noise level in our experience for cars driving at 40-50km/h).

Noise emissions were predicted at the building facades of the most affected receivers R1, R5, R6 and R7 from vehicles driving on Bridge Street, and results were compared against the acoustic criteria set out in Table 8.

Table 22 Predicted noise levels at nearest residential receivers by additional traffic on public roads

Time of day	Receiver	Predicted noise level dB(A) $L_{eq,1\text{-}hour}$	Criteria Day (7am - 10pm)	Compliance?
Day-time period (7am – 10pm)	Receiver 1	<55	60 dB(A) $L_{eq(15h)}$ daytime (external)	Yes
Day-time period (7am – 10pm)	Receiver 5	<55		Yes
Day-time period (7am – 10pm)	Receiver 6	<55		Yes
Day-time period (7am – 10pm)	Receiver 7	<55		Yes

5.4 Mechanical noise assessment

At this stage, mechanical drawings and plant selections are not available. Based on information provided to ADP Consulting, condenser units will be installed to service the proposed childcare centre. A preliminary noise emission assessment has been conducted based on the following assumptions:

> Three (3) condenser units will be installed at the southern site boundary.

> As there is no information at this stage regarding the proposed condenser unit selections, we calculated noise emissions based on unit model DAIKIN RXYMQ6AV4A as detailed below.

Table 23 DAIKIN Condenser Unit Noise Spectrum

Model	Operation	Octave Band Level @1m							
		63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
DAIKIN RXYMQ6AV4A	(Heating)	61	58	59	51	49	46	47	33
	(Cooling)	62	50	50	52	52	45	42	31

- Noise emission predictions from the proposed condenser units were made at the closest commercial receiver (R7), 1m from the nearest boundary, 1.5m above ground floor level.
- Predictions were made assuming that acoustic treatments as recommended in 5.5 of this report are adopted.

Predicted noise emission levels are presented in the following table.

Table 24 Predicted noise emission levels – Receiver 7

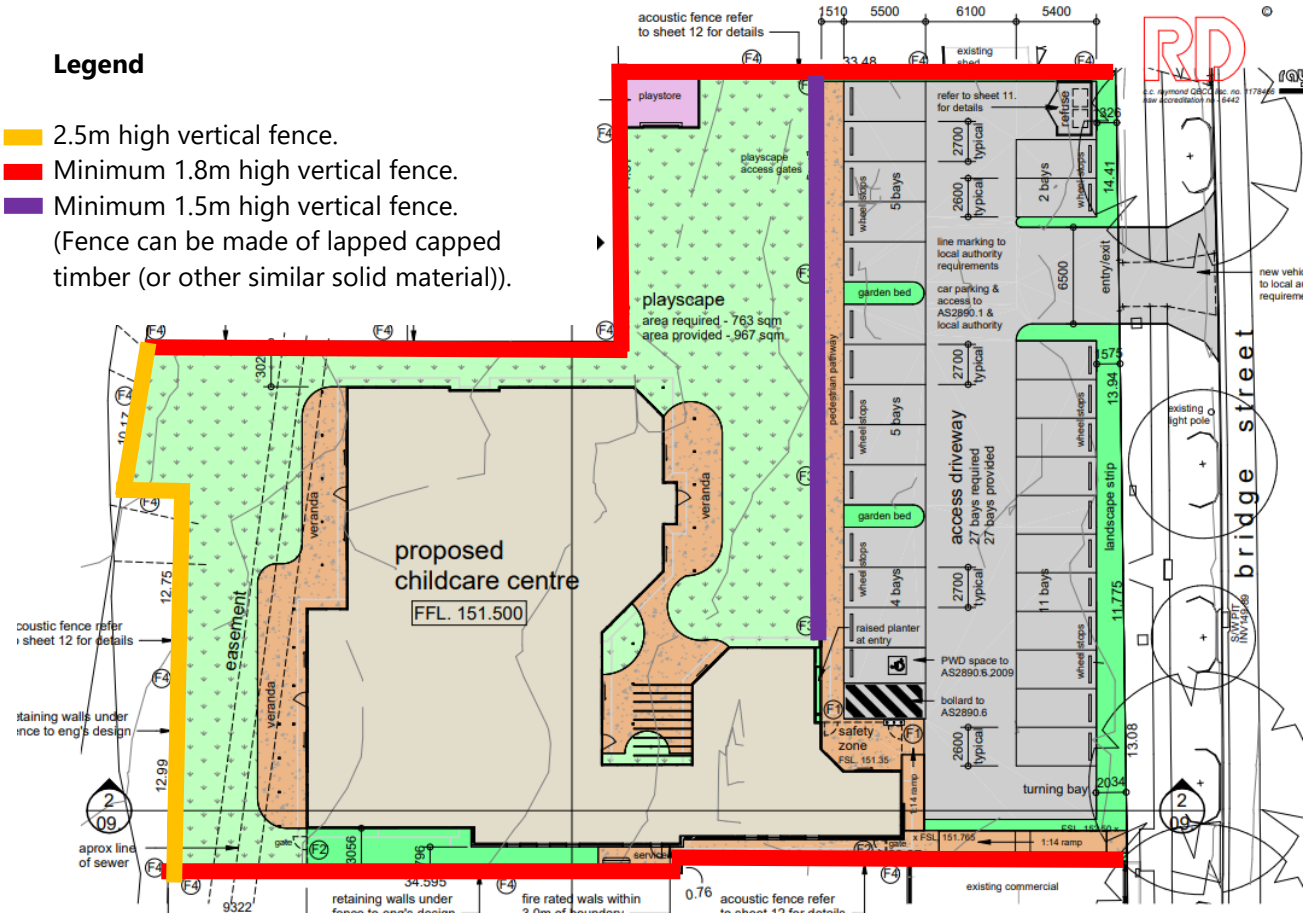
Noise source	Noise Receiver Location	Predicted Noise Level dB(A)$L_{eq(15min)}$	Criteria dB(A)$L_{eq(15min)}$	Compliance?
Three (3) condenser units at southern site boundary	1m from Receiver R7 boundary, 1.5m above ground level	<55	65	Yes
All residential receivers	Nearest facade	<49	49	Yes

5.5 Recommended treatments and management controls

In order to comply with the noise intrusion and emission criteria as detailed in the previous sections, the following building and management controls are required:

- The following maximum number of children are allowed to play outdoors at the same time (to be able to have no restrictions in play time):
  - Play Area A:
    - All 24 toddlers can play at the same time.
  - Play Area B:
    - Up to 16 children aged 3-5, and
    - Up to 16 children aged 2-3.
- Solid fences to be built around the outdoor play areas, as shown in Figure 3 below.
- Minimum glazing thickness as presented in Table 25.
- Noise emission from mechanical plant to be re-assessed when mechanical plans and selections are finalised.

Figure 3 Barrier requirements



6. Noise & Vibration Impact Assessment

6.1 Noise intrusion Analysis

6.1.1 Traffic noise assessment

Traffic noise impacts to the site were calculated based on the attended and unattended measurements at the site as presented in Section 2.3 and 2.4. Traffic noise predictions at the façades of the proposed development have been carried out using the CoRTN model and predicted traffic volume on the surrounding roads. Traffic noise intrusions to the proposed development were calculated based on orientation of windows, barrier effects (where applicable), total area of glazing, façade transmission loss and room sound absorption characteristics.

Treatment recommendations to ensure compliance with the relevant criteria are presented in Section 6.2.

6.1.2 Train noise assessment

Train noise impacts at worst 1 hour period was calculated based on attended train noise measurements (of both passenger and freight trains) and typical train timetable. As timetable for freight trains is not available, we assumed there will be 1 freight train movement in a worst 1-hour period. Barrier height and glazing treatment recommendations to ensure compliance with criteria presented in Section 4.6 are presented in Section 6.2.

6.1.3 Train vibration assessment

Train vibration measurements at the site have been measured and results were presented in Section 2.5. Vibration from train movements will be compliant with the vibration criteria presented in Section 4.7.

6.2 Recommended Constructions

The following constructions are recommended to ensure compliance with the project objectives for traffic and train noise intrusion.

6.2.1 Glazing

Indicative glazing requirements are presented in Table 25 below.

Table 25 Minimum glazing performance requirements

Area	Element	Glazing thickness	Minimum R_w/ STC requirement for element with frame and acoustic seals
Activity Rooms 06	Windows to the north	6.38mm laminate	31

	Window/ glazed door to the east	10.38mm laminate	33
Activity Rooms 03 and 07	Windows/ glazed doors to the east	10.38mm laminate	33
Corridor	All glazing	6mm	29
Multi-purpose room	All glazing	6.38mm	31
Foyer/ Reception	All glazed doors and windows	6.38mm	31
Office	Windows to the south	6mm	29
Staff room	Windows	6mm	29
Sleep/ Playstore	Window	10.38mm	33
Activity Rooms 01 - 05	Windows/ glazed doors	6.38mm	31

We understand that these glazing recommendations will be refined at a later stage and the following considerations will need to be accounted for. These include:

> Selection of glazing supplier (framing systems and ultimately acoustic performance of the glazing system as a whole).

> If required, reassess noise intrusion based on glazing sizes and any changes made.

> Structural and thermal requirements.

6.2.2 External walls

External walls are proposed to be constructed of a combination of masonry and light-weight materials. Masonry wall do not require acoustic upgrade. External walls proposed to be constructed from light-weight materials will need to adopt the following recommendations.

There should be no vents on the internal skin of external walls and all penetrations should be sealed.

Table 26 Recommended roof/ceiling construction

Facade	Internal lining	Truss system	External lining
All	2x10mm plasterboard	Minimum 90mm stud with 75mm thick 11kg/m^3 glasswool insulation in the cavity	9.5mm Hardies Linea weatherboard

6.2.3 Roof Construction

Sheet colorbond metal roofing is proposed for the proposed Childcare Centre. Recommended roof ceiling constructions are presented below. Penetrations in all ceilings (such as for light fittings) should be sealed gap free with a flexible sealant.

Table 27 Recommended roof/ceiling construction

Area	Roof/ceiling construction
Activity rooms, Sleep room & Foyer/ Reception	Colorbond roof + 2x10mm plasterboard with 75mm thick 11kg/m^3 glasswool insulation in the cavity
Remaining areas	Colorbond roof + 1x10mm plasterboard with 75mm thick 11kg/m^3 glasswool insulation in the cavity

7. Conclusion

ADP Consulting has completed an acoustic assessment for the proposed childcare centre located at 200-206 Bridge Street.

Provided the recommended treatments in this report are adopted, the Proposal will comply with the presented internal noise criteria.

- Muswellbrook Shire Council Development Control Plan (DCP) 2009.
- Association of Australasian Acoustical Consultants (AAAC) Guideline for Childcare Centre Acoustic Assessment Version 3.0.
- Australian/ New Zealand Standard AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors.
- NSW Environmental Protection Authority (EPA) Noise Policy for Industry (NPfI).
- State Environmental Planning Policy (Transport and Infrastructure) 2021 (SEPP).
- Department of planning's Development near Rail Corridors and Busy Roads – Interim Guideline, dated 2008 (DoP Interim Guideline).
- NSW Environment, Climate Change and Water's Road Noise Policy, dated 2011 (RNP).

A detailed noise emission assessment from proposed plant equipment will be conducted at CC Stage.

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Appendix A
Glossary of Acoustic Terms

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 in order to produce a better representation of the response of the human ear. Therefore, 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

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 7am and 6pm for Monday to Saturday and 8am to 6pm for Sundays and Public Holidays.

Evening

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

Night

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

Appendix B
Unattended Noise Monitoring Data

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