Traffic Noise Impact Assessment

LAHC - Camden Boarding House – Traffic Noise Impact Assessment

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1. Introduction

This Traffic Noise Impact Assessment has been prepared for a Part 5 Activity Assessment for a Land of Housing Corporation Boarding House located at 3-5 Kelloway House, Camden NSW 2570.

The proposed development consists of Lot 1216 DP1183302, which will consist of 12 single occupant dwellings located on Ground and First Floor with provision for communal space. The proposed plan is shown in Figure 1.

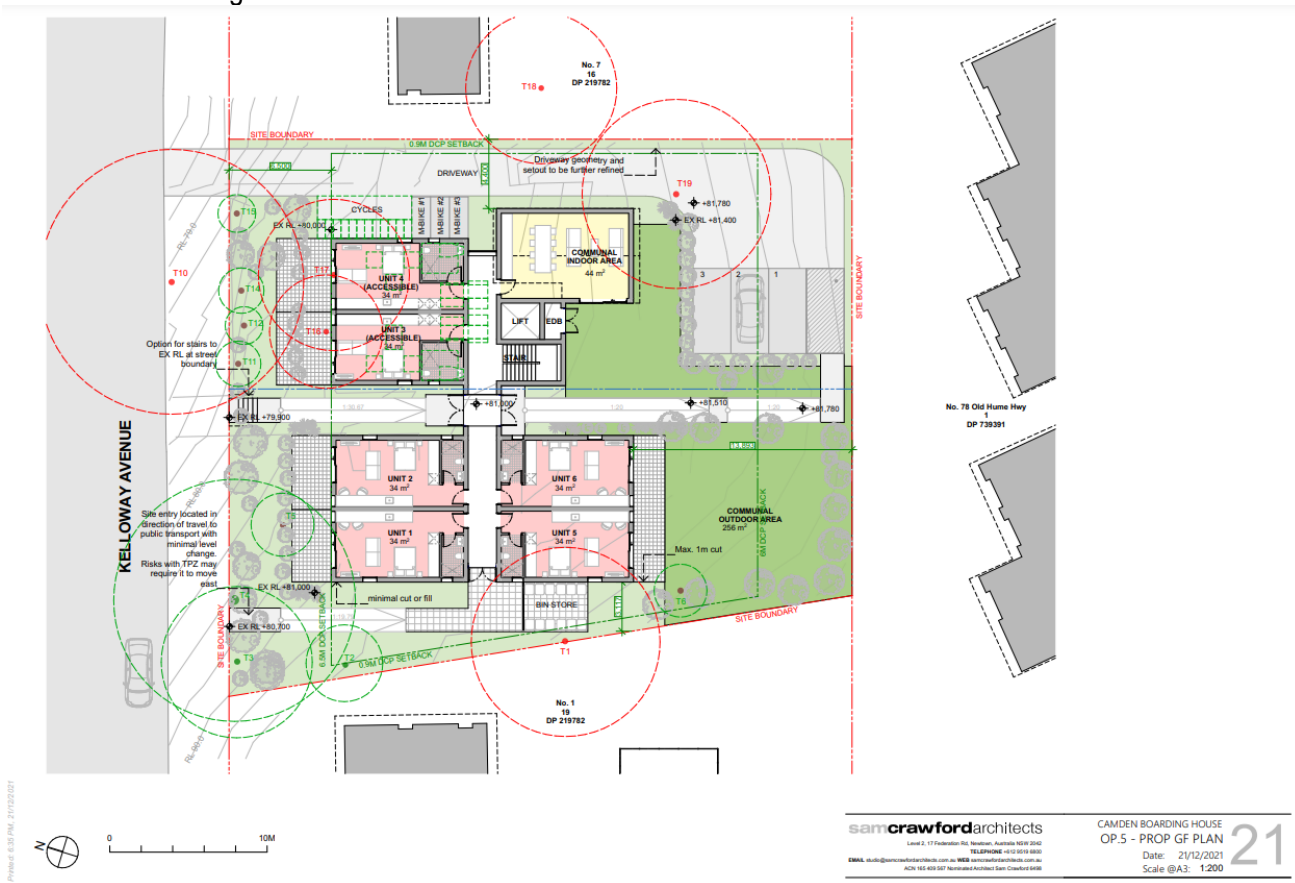

Figure 1 Proposed plan for Boarding House

1.1. Purpose and scope

The purpose for this report is to assess the traffic noise impact from Old Hume Highway on the site. This assessment has been prepared in accordance with Camden DCP 2019, clause 2.12 Acoustic Amenity - Road & Rail noise -which requires an acoustic assessment for residential uses adjacent to a collector road that is within 100m radius.

1.2. Referenced documents

- Camden Development Control Plan (2019)
- The Noise Policy for Industry, October (2017)
- The NSW Road Noise Policy, March (2011)
- The NSW Development Near Rail Corridors and Busy Roads-Interim Guideline, December (2018)
- AS/NZS 2107 Acoustics—Recommended design sound levels and reverberation times for building interiors (2016)
- AS 3671, Acoustics—Road traffic noise intrusion—Building siting and construction (1989)
- National Construction Code (formerly Building Code of Australia), (2019)
- NSW Protection of the Environment Operations Act (1997)
- State Environmental Planning Policy (Transport & infrastructure) (2021)
- State Environmental Planning Policy (Housing) (2021)
- NSW RMS Guide to Traffic Generating Developments (2013)
- NSW LAHC dwelling requirements, September (2020)

1.3. Definitions and acronyms

BSE	Building Services Engineers
Camden DCP	Camden Development Control Plan
NPfI	Noise Policy for Industry
RNP	The NSW Road Noise Policy
DoP	The NSW Development Near Rail Corridors and Busy Roads-Interim Guideline
BCA	Building Code of Australia

2. Existing Acoustic Environment

2.1. Existing Location

The proposed boarding house is located at 3-5 Kelloway Ave, Camden NSW 2570. The proposed development is within 100 meters from Old Hume Highway and surrounded by residential receivers. Site and unattended noise logger are shown in Figure 2.

Figure 2 Site location map showing noise monitoring locations.

Attended and unattended noise monitoring was conducted at the location of the development proposal. The unattended noise monitor was left at the back of the property in the middle of the backyard. The location was chosen to assist in the acoustic design for the boarding house and to obtain representative background levels (RBL's). Photographs of the unattended noise loggers at the time of deployment is shown in Figure 3.

Figure 3 Unattended Noise logger

2.2. Attended Noise Measurements

BSE conducted one 15-minute attended noise measurement to assist in identifying and quantifying the local noise sources within the environment. BSE determined that noise levels across the study area were dominated by local traffic and birds.

Table 1 Attended noise measurements and observations

Date/ time	Location	L_{Aeq} dBA	L_{A90} dBA	L_{A10} dBA	L_{Amax} dBA	Observations and instantaneous sound power levels
24/03/2022 11:42 Hrs.	Site	59	47	62	77	Constant birds: 51 – 62 dBA Pass by car: 60 – 77 dBA Loud bird 74 Constant traffic in the background from Old Hume Hwy

2.3. Unattended Noise Monitoring

To determine appropriate site-specific noise levels required for the project an Acoustic Research Laboratories EL316 Type 1 noise logger was left unattended on-site for 8 days, from 16 March 2022 to 24 March 2022. In addition, meteorological data from weather station Camden (IDN 60801) was used to filter wind speeds >5.0 m/s and rainfall (mm) from the data set. The noise logger was calibrated before and after use, using a 94 dB 1kHz tone, with no significant drift occurring (+/-2dB). Unattended noise logger data with weather exclusion is shown in Figure 4.

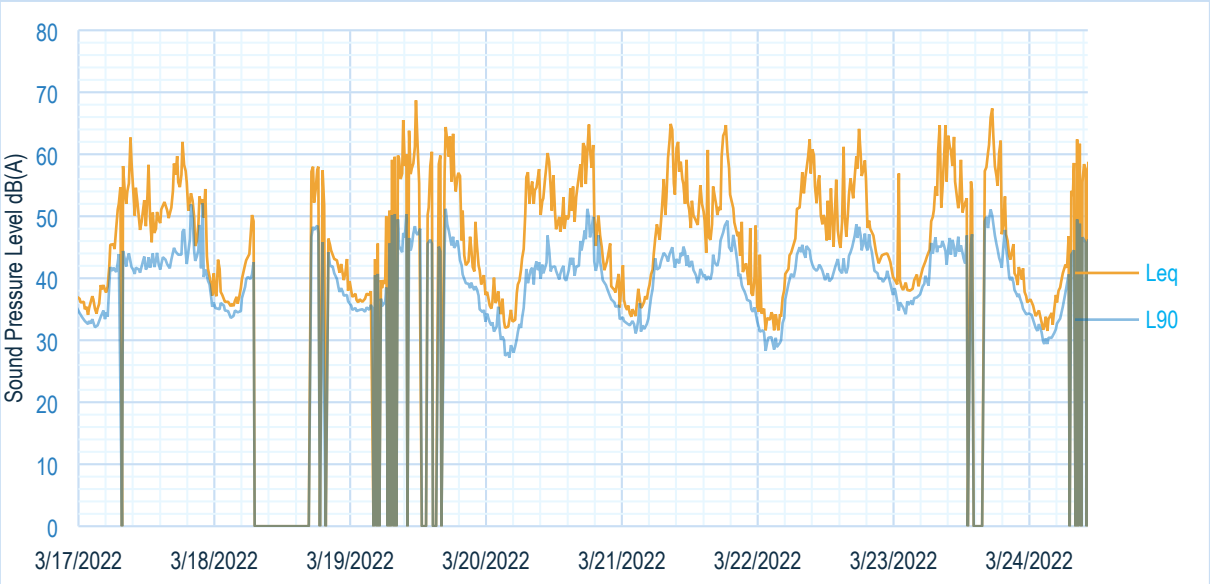

Figure 4 Camden- Unattended Noise Logger data with weather exclusions- Logger 0352

3. Acoustic Criteria

3.1. NSW Protection of the Environment Operations Act (1997)

Under the NSW Protection of the Environment Operations Act (1997) (POEO), the NSW Environment Protection Authority, has the responsibility to issue policy statements to set out criteria and methods of management for noise within the state.

3.2. State Environmental Planning Policy – Housing (2021)

With regards to the State Environmental Planning Policy (SEPP) - Housing (2021), acoustic requirements are as follows:

'Seniors housing should be designed to consider the visual and acoustic privacy of adjacent neighbours and residents by—

(a) using appropriate site planning, including considering the location and design of windows and balconies, the use of screening devices and landscaping, and
(b) ensuring acceptable noise levels in bedrooms of new dwellings by locating them away from driveways, parking areas and paths.'

3.3. State Environmental Planning Policy - Transport and Infrastructure (2021)

With regards to the SEPP Transport and Infrastructure (T&I) 2021, acoustic requirements require compliance with the following:

'…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.

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 LAeq levels are not exceeded—
in any bedroom in the residential accommodation—35 dB(A) at any time between 10 pm and 7 am,
anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway)—40 dB(A) at any time.'

3.3.1. NSW Development Near Rail Corridors and Busy Roads-Interim Guideline

The NSW Development Near Rail Corridors and Busy Roads-Interim Guideline (DoP) applies to developments adjacent to rail corridors and busy roads. It supports specific rail and road provisions of the State Environmental Planning Policy SEPP T&I (2021).

A Busy Road is defined in Clause 102 of the (T&I SEPP) as a freeway, tollway or a transitway or any other road with an average annual traffic (AADT) volume of more than 40,000 vehicles (based on the traffic volume data provided on the website of the RTA).

Airborne noise is calculated as $L_{Aeq,15h}$ for day and $L_{Aeq,9h}$ for night.

3.4. Australian/New Zealand Standards 2107-2016

Australian / New Zealand Standard AS/NZS 2107:2016 *'Acoustics – Recommended design sound levels and reverberation times for building interiors' i*s a widely accepted guide to desirable interior background noise for various occupancies, including residential buildings and health buildings as summarised below in Table 2.

Table 2 AS2107 Recommended internal noise levels and midfrequency reverberation times (s).

Type of Occupancy/Activity		**Design Sound Level $L_{eq,T}$**
Residential Buildings	Common areas	45 to 50 dB(A)
	Living areas	35 to 45 dB(A)
	Sleeping areas (night-time)	35 to 40 dB(A)
	Work areas	35 to 45 dB(A)

3.5. Australian Standard 3671—1989 Road Traffic Noise Intrusion

AS 3671—1989, *'Acoustics—Road traffic noise intrusion—Building siting and construction'* aims to reduce the traffic noise intrusion in buildings in areas near roads carrying more than 2,000 vehicles per day. It provides guidance to determine the building construction needed to achieve interior noise levels based in the descriptor called traffic noise reduction (TNR). Internal noise levels must comply with standard AS/NZS 2107:2016.

TNR and the determination of required construction category shall be determined in accordance with *Clause 3.3 'Determination of required construction category'* and *Clause 2.2* '*Determination of traffic noise exposure*' respectively. Four construction categories are determined by the amount of TNR as shown in Table 3 below.

Table 3 AS 3671- Determination of required construction categories

Traffic Noise Reduction	Construction Category*
TNR ≤ 10 dBA	Category 1
TNR >10 ≤ 25 dBA	Category 2
TNR >25≤ 35 dBA	Category 3
TNR >35 dBA	Category 4
*Construction Categories definitions are in Appendix A in this document	

3.6. NSW Noise Policy for Industry

The NSW Noise Policy for Industry (NPfI) provides assessment methodologies, criteria and detailed information on the assessment of environmental noise emissions in NSW. The NSW NPfI criteria for noise sources consider two (2) components:

- Maintaining noise **amenity** for various categories of land use (including residential receivers and other sensitive receivers). The amenity criterion is based on the sensitivity of a particular land use affected by industrial noise. The recommended amenity noise levels detailed in Table 2.2 of NSW NPfI represent the objective for total industrial noise at a receiver location, whereas the project amenity noise level represents the objective for noise from a single industrial development at a receiver location. This is to ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area. The project amenity criteria for each new source of industrial noise are equal to the recommended amenity noise level minus 5dB(A).

  A +3dB(A) conversion is to be added to project amenity noise level for conversion from a period level to a 15-minutes level. Where the resultant project amenity noise level is 10dB or lower than the existing industrial noise level, the project amenity noise levels can be set at 10 dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time.
  With regards to sensitive land use amenity, the policy refers to Active Recreation Areas, which are relevant to this assessment, to meet L_{eq}55 dB(A), when in use.

- Controlling **intrusive** noise impacts for residential receivers. Assessing intrusiveness usually requires noise measurements to quantify background (L_{A90}) noise levels at a location considered representative of the most potentially affected residential receiver(s). The intrusiveness criterion essentially means that for a given receiver the equivalent continuous noise level (L_{ea}) of the source(s) under consideration should be controlled to 5 dB above the background noise level.

4. Site Specific Criteria

Based upon the criteria determined from the site-based noise monitoring, the following operational noise criteria were determined, as outlined in the following sections below.

4.1. Operational Noise

Nearby noise sensitive receivers are considered 'Suburban' according to the definitions in the NSW NPfI for the purposes of assessing the amenity criteria. Project external noise level criteria have been derived from the unattended measured noise levels discussed in Table 4. The project noise trigger levels are selected to be the most stringent between the amenity and the intrusiveness criteria.

Table 4 Project specific noise level- Logger 0352

Period	**RBL (L_{90})**	**L_{Aeq}**	**Intrusive Criterion RBL+5 (L_{eq}) (Residential)**	**Amenity Criteria Residential $L_{Aeq,15min}$ dBA**	**Project Noise Trigger Levels Residential $L_{Aeq,15min}$ dBA**
Day	42 dB(A)	56 dB(A)	47 dB(A)	53 dB(A)	**47** dB(A)
Evening	39 dB(A)	55 dB(A)	44 dB(A)	43 dB(A)	**43** dB(A)
Night	32 dB(A)	43 dB(A)	37 dB(A)	38 dB(A)	**37** dB(A)

4.2. Road Traffic Noise / Internal Noise Levels

The SEPP and the AS2107-2016 provides recommended internal noise levels for different areas of occupancy, while the AS3671 provides the required construction category needed to achieve those levels. Internal noise levels from road noise should not exceed dBA levels from

Table 5 below.

Table 5 Internal Road Traffic Noise Criteria

Areas of Occupancy	**SEPP & AS2107-2016dB(A)**
Common Areas	45 to 50
Living Areas	35 to 45
Bedrooms /Sleeping Areas (night-time)	35 to 40
Work areas	35 to 45

To reduce the traffic noise intrusion in buildings near roads, and to comply with the SEPP and the AS 2107-2016, the TNR should be calculated according to AS 3671 to determine the required construction category. Required construction category have been determined in Section 5.3.1 of this report.

5. Road Traffic Noise Assessment

5.1. Measured Noise Levels

BSE measure road noise across the study area during daytime (between 7AM- 10 PM) and during night-time (between 10PM- 7AM). Road noise monitoring was conducted for 8 days (with weather exclusions) at a location within the proposal as shown in Figure 2. A summary of measured $L_{Aeq,15h}$ for day and $L_{Aeq,9h}$ for night are shown in Table 6 below.

Table 6 Measured Day and Night LAeq Levels

Time period	Measured levels dB(A)
Logger 0352	
Day (7AM- 10PM)	57 dB(A) $L_{Aeq,15h}$
Night (10PM- 7AM)	43 dB(A) $L_{Aeq,9h}$

5.2. Predicted Growth Rates

Long term traffic counts have not been taken specifically for this project. Instead, following the DoP guideline advise, the latest online RMS traffic volume data was sourced for Old Hume Hwy (Station ID07023) in 2006 and in 2008. Additionally, RMS traffic volume data was sourced for Camden Valley Way (station ID85016) in 2008, 2010 and in 2021. Inspection of this AADT count data allows growth rates for Old Hume Hwy to be calculated. Further details are provided in
Table 7.

Table 7 Calculated annual growth rate on Old Hume Hwy and Camden Valley Way

Camden Valley Way						**Old Hume Hwy**		
2008 AADT	**2010 AADT**	**Annual growth rate**	**2008 AADT**	**2021 AADT**	**Annual growth rate**	**2006 AADT**	**2008 AADT**	**Annual growth rate**
15,170	16,421	1.08	15,170	17,608	1.16	9,781	10,861	1.11

The 2008 - 2021 growth rates calculated for Camden Valley Way was then applied to the 2008 RMS AADT traffic volume data for Old Hume Hwy to determine indicative 2021 AADT traffic counts. The heavy vehicle proportions reported in the 2006 and in 2008 were 5% and have been adopted, as shown in Table 8.

Table 8 Predicted AADT traffic volume (2021).

Old Hume Hwy				
2008 AADT - Day	**2008 AADT - Night**	**2021 Predicted AADT - Day**	**2021 Predicted AADT - Night**	**Heavy vehicle %**
9,938	1,058	11,528	1,227	5%

Note 1 - 2021 traffic volumes have been predicted by applying the annual growth rates shown in

5.3. Predicted Noise Levels

The most common method of prediction of road traffic noise is the CORTN (Calculation of Road Traffic Noise) procedure originally developed in the UK. Using the CORTN algorithms for freely flowing road traffic, the L_{eq} noise level generated by traffic movement may be calculated. Validation was made using the predicted AADT volumes from Section 5.2. These traffic noise level predictions were compared to the levels measured on-site These are compared in Table 9 and Table 10.

Table 9 Validated Noise Predictions- Day 2021

	Logger 0352
Measured LAeq,15hrs Day	57
Predicted LAeq,15hrs Day	58
Difference	1 dB
Average Difference	1 dB

Table 10 Validated Noise Predictions- Night 2021

	Logger 0352
Measured LAeq,9hrs Night	43
Predicted LAeq,9hrs Night	44
Difference	1 dB
Average Difference	1 dB

If the average difference between the measured and predicted is less than 2 dB, noise predictions are considered valid. This indicates predicted values are validated. Day time and night-time predicted road noise levels in 2021 are shown in Figure 5 and Figure 6, respectively.

Figure 5 Day time- Predicted 2021 Road noise levels

Figure 6 Night-time- Predicted 2021 Road noise levels

If the same predicted growth rates in
Table 7 continue for the next 10 years, the road noise will have increased by less than 2 dB by the year 2031. The noise treatment categories specified for the current conditions will still be applicable by the year 2031.

Day time worse-case external levels at the communal indoor area is approximately 57 dBA and the night-time worse-case external levels at the bedrooms are approximately 45 dBA. Note that the predictive noise levels do not currently include shielding effects from the proposed building. In reality the sides and back of the buildings will provide a shielding effect giving lower road noise levels. Noise levels at the sides of the building reduces by 6 dB and noise levels at the back of the building reduces by 10 dB (*Detailing for acoustics, Peter Lord and Duncan Templeton, 2001*). Road noise levels including shielding effects by the building are shown in Table 11 below.

Table 11 Road Noise reduction including building shielding

Room	Worst-case External level	Reduction due to Shielding effects of the building	Worst-case External levels with shielding
Bedrooms*	45 dB(A)	0 dB	45 dB(A)
Communal Areas	57 dB(A)	10 dB	47 dB(A)
*At any time between 10PM and 7AM			

The National Construction Code (NCC) requires that adequate fresh air ventilation be provided to rooms. It is accepted that a window opened sufficiently to allow for fresh air ventilation will provide approximately 10 dB noise reduction from the outside to the inside. This means that if external traffic noise level is more than 10 dB greater than the internal noise objective, a person cannot rely on leaving a window open for ventilation. Table 12 shows the internal levels resulting from an open window.

Table 12 External / internal noise levels with opened windows

Room	Internal criterion		Worst-case External level	Assumed reduction offered by partially opened window	Predicted internal level	Complies? Yes/No	
	AS 2107	SEPP				AS2107	SEPP
Bedrooms*	35 to 40 dB(A)	35 dB(A)	45 dB(A)	10 dB	35 dB(A)	Yes	Yes
Communal Areas	45 to 50 dB(A)	40 dB(A)	47 dB(A)	10 dB	37 dB(A)	Yes	Yes
*At any time between 10PM and 7AM							

5.3.1. AS3671 Assessment

Traffic Noise Exposure levels were derived from the 2031 predicted noise levels in Section 5.3. Traffic Noise Descriptor has been chosen to be $L_{Aeq,15hr}$ for day and LAeq,9hrs for night at the worse-affected façade. Traffic Noise Exposure levels are shown in Table 13.

Table 13 Traffic Noise Exposure levels

Time period	**Traffic Noise Exposure LAeq dB(A)**
Day	59 dB(A) $L_{Aeq,15h}$
Night	45 dB(A), $L_{Aeq\ 9h}$

Traffic Noise Reduction (TNR) is calculated by subtracting the recommended Indoor Sound Levels to the Traffic Noise Exposure. The TNR value gives the Required Construction Category. Required Construction Category is shown in Table 14.

Table 14 Traffic Noise Reduction (TNR) and Required Construction Noise Category- Location 1

Areas of Occupancy	**Indoor Sound Level AS-2107**	**Traffic Noise Exposure L_{Aeq}**	**Calculated TNR**	**Required Construction Category**
Common Areas	45 to 50 dB(A)	59 dB(A)	9–14	Category 2
Living Areas	35 to 45 dB(A)	59 dB(A)	14–24	Category 2
Bedrooms/Sleeping Areas	35 to 40 (night-time) dB(A)	45 dB(A)	5–10	Category 2
Work areas	35 to 45 dB(A)	59 dB(A)	14–24	Category 2
• **Category 2.** Standard construction, except for lightweight elements such as fibrous cement or metal cladding or all-glass facades. Windows, doors, and other openings must be closed. TNR of approximately 25 dB(A) is expected.				

Following analysis of traffic noise, the following reference noise levels for the project were determined. These are shown below in Table 15.

Table 15 Site specific measured traffic noise spectra, dB.

Location / Time period	63 Hz	125 Hz	250 Hz	500Hz	1kHz	2kHz	4kHz	dB(A)
Day	41	45	48	52	55	52	48	**59**
Night	28	32	35	39	42	39	35	**46**

Following an assessment of traffic noise levels into following minimum transmission loss values (typically 4mm glass + framing) to the façade of the proposed development, the following maximum glazing transmission losses (TL) will be required to achieve the AS2107-2016 recommended internal noise levels, as shown in Table 16.

Table 16 Recommend facade maximum glazing transmission loss, dB.

Location	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	Rw
Living rooms	15	17	21	26	30	33	30	**29**
Bedrooms	15	17	21	26	30	33	30	**29**

6. Sound Isolation Requirements

6.1. National Construction Code

National Construction Code (NCC) (formerly BCA) deemed to satisfy sound insulation requirements for inter-tenancy walls for a Class 1a, 2, 3 and 9c building is summarized in Table 17.

Table 17 Part F5 of NCC Acoustic Requirements

SEPARATING PARTITIONS	Minimum NCC Requirement
WALLS AND FLOORS Walls between habitable spaces of sole occupancy	Rw + Ctr 50
Walls between habitable spaces and stairway, public corridors, public lobby or the like	Rw 50
Walls between wet areas (bathrooms, sanitary compartment, laundry or kitchen) and a habitable room (other than kitchen) in adjoining apartments	Rw + Ctr 50 & of discontinuous construction
Walls between a plant room or lift shaft and a sole occupancy unit	Rw 50 & of discontinuous construction
Doors assemblies located in a wall between an apartment and a stairway, public corridor, public lobby or the like	Rw 30
Floors between sole occupancy units or between a sole occupancy unit and plant room, lift shaft, stairway, public corridor, public lobby or the like.	Rw + Ctr 50 & Ln,w + CI < 62
DOORS Door assemblies located in a wall between an apartment and a stairway, public corridor, public lobby, or the like.	Rw 30
SERVICES (a) a duct, soil, waste, or water supply pipe including a duct or pipe that is located in a wall or floor cavity serves or passes through more than one sole occupancy unit	
(i) if the adjacent room is a habitable room (other than a kitchen); or	Rw + Ctr 40
(ii) if the room is a non-habitable room	Rw + Ctr 25
(b) a storm water pipe passes through a sole occupancy unit	
(i) if the adjacent room is a habitable room (other than a kitchen); or	Rw + Ctr 40
(ii) if the room is a non-habitable room	Rw + Ctr 25
NB: Note NCSDCP (2013) has more stringent requirements and these requirements will superseded the NCC, where stated.	

These constructions are still subject to design development will be finalised during the detailed design of the phase of the project.

7. Recommendations

Standard AS3671 recommends building Construction Category 2, with recommended materials outlined in Appendix A of this report. Based upon these findings it is recommended that fibrous cement or metal cladding façade construction can meet the requirement for the project.

Furthermore, the DoP guideline provides noise treatment categories to mitigate various external road noise levels as well as providing examples of standard constructions in *Appendix C* of the guideline for each treatment category. The DoP guideline would recommend noise treatment category 1 for the proposed development.

Mechanical air ventilation has not been proposed for the development. The proposal is in climate zone 5 "warm temperate", as defined in "*NSW LAHC dwelling requirements, September 2020"*, and it has only been allowed for ceiling fans.

BSE predicts that windows in the proposed development can be left open and still meet daytime and night-time internal noise objectives.

8. Conclusion

A Traffic Noise Impact Assessment has been undertaken for a Part 5 Activity Assessment, for a Land of Housing Corporation Boarding House located at 3-5 Kelloway House, Camden NSW 2570. The proposed development is within 100 meters from Old Hume Highway and surrounded by residential receivers.

Based on the Traffic Noise Impact assessment, Section 5 in this report, standard AS3671 recommends building Construction Category 2, with recommended materials outlined in Appendix A of this report. Similarly, the DoP guideline recommends Construction Category 1 (shown in *DoP- Appendix C)* for each building element.

Windows at the proposed boarding house can be left open and meet internal noise criteria. Following recommendations, Section 7 of this report, the proposal will meet daytime and night-time internal noise criteria in all spaces.

Based upon the findings of this assessment, BSE are satisfied that the requirements for the project can meet clause *2.12 Acoustic Amenity - Road & Rail noise*, *Council* and *EPA* requirements for the project.

A. Appendix A – AS3671 Construction Categories

A.1. DEFINITION OF CONSTRUCTION CATEGORY

- **Category 1.**
  Standard construction: openings, including open windows and doors may comprise up to 10% of the exposed facade. TNR of approximately 10 dB(A) is expected.
- **Category 2.**
  Standard construction, except for lightweight elements such as fibrous cement or metal cladding or all-glass facades. Windows, doors, and other openings must be closed. TNR of approximately 25 dB(A) is expected.
- **Category 3.**
  Special construction, chosen in accordance with Clause 3.4. Windows, doors, and other openings must be closed. TNR between 25 and 35 dB(A) is expected.
- **Category 4.**
  TNR greater than 35 dB(A) is required; special acoustic advice should be sought.

Appendix B – Acoustic Terminology

'A' Weighted	Frequency filter applied to a noise spectrum that adjusts ('weights') each frequency differently. The 'A' weighting very roughly corresponds with subjective assessments of noise levels.
Ambient Sound	The overall noise level associated with an environment or space. It is usually a composite of sounds from many sources, both near and far. Usually taken to mean the L_{Aeq} value.
Background Noise Level	The average of the lowest measured noise levels in an affected area, in the absence of noise from occupants and/or unwanted external noise sources. Usually taken to mean the L_{A90} value.
dB(A)	The overall 'A' Weighted sound pressure level.
Decibel, dB	Unit of acoustic measurement. Measurements of power, pressure and intensity may be expressed in dB relative to standard reference levels.
L_{90}, L_{10}, etc	A statistical measurement giving the sound pressure level which is exceeded for the given percentile over a measurement period, i.e., L_{90} is the level which is exceeded for 90% of the measurement period. Likewise, the L_{10} level is the noise level exceeded for 10% of the measurement time. The L_{A90}, L_{A10} (etc) levels are the A-weighted noise levels exceeded for the respective percentile.
$L_{Aeq, T}$	Equivalent continuous A-weighted sound pressure level. The equivalent continuous A-weighted sound that, within a measurement time interval T, has the same A-weighted sound energy as a time-varying sound.
R_W	Weighted Sound Reduction Index. A single number value of the acoustic performance of a partition or building element. Calculation procedures for R_W are defined in ISO 140-2:1991 "*Measurement of Sound Insulation in Buildings and of Building Elements Part 2*". The R_W is function of the level difference between two spaces separated by the building partition or element, surface area of the building partition or element, room volume and area of absorption in the receiver room (generally measured by the reverberation time).
Sound Isolation	A reference to the degree of acoustical separation between any two areas. 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 and measurement conditions to be specified.
Sound Pressure Level L_p, dB	A measurement obtained directly using a microphone and sound level meter. Sound pressure level depends on the distance from a source and on the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the rms. sound pressure to the reference sound pressure of 20 microPascals - $20\log_{10}$(measured rms pressure/2 x 10^{-6})
Sound Power Level L_w, dB	Sound power level is a measure of the sound energy emitted by a source. It does not change with distance and is not directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with apropriate corrections for distance and/or environmental conditions. Sound power level is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt. - $10\log_{10}$(Sound Power/1 x 10^{-12})