Noise and Sound Services

Road Traffic Noise & Vibration Assessment

Lot 130, 31 Earls Avenue
Riverwood
NSW 2210

June 2022

Report No. nss23691 – Final

Prepared at the request of: -

Fowler Homes
405A Victoria Street
Wetherill Park NSW 2164

Prepared by: -

NOISE AND SOUND SERVICES

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C O N T E N T S

1. INTRODUCTION

Noise and Sound Services was requested by Fowler Homes of 405A Victoria Street, Wetherill Park, NSW 2164 on behalf of Mrs Jennie C Cai and Mr Chong Beng E Ho to carry out a road traffic noise and vibration assessment in regards to the proposed residential development at Lot 130, 31 Earls Avenue, Riverwood NSW 2210 (Subject Site).

The purpose of the survey is to assess site specific road traffic noise and vibration levels resulting from traffic movements using the subject site's nearest motorway (The M5 Motorway); Then to advise on the sound and vibration insulation requirements from external noise and vibration in line with the State Environmental Planning Policy (Infrastructure) 2007, Clause 102 – *'Impact of road noise or vibration on non-road development'* and the Australian Standards AS 3671 and AS 2107 – 2016, *'Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors'*.

2. SITE AND DEVELOPMENT DESCRIPTION

2.1 Site Description

The subject site at Lot 130, 31 Earls Avenue, Riverwood is located south of The M5 Motorway. The M5 Motorway is the main source of traffic noise and vibration within the vicinity of the subject site. The site currently consists of a single storey residential dwelling. There is an existing road traffic noise barrier, approximately 4 metres high along the relevant part of the highway.

2.2 Development Description

The development proposal includes the demolition of the existing structures on site followed by the construction of a double-storey residential dwelling. The new dwelling is set to contain habitable rooms pertaining to a family/dining room, a home cinema and a home office along the proposed ground floor along with a leisure area and four bedrooms along the proposed first floor.

The nearest affected façade of the proposed development (rear façade) is set to be located approximately 85 metres from the nearest kerb of The M5 Motorway.

Full details are given in the architectural drawings provided by *'Fowler Homes'*, Job Number: 22-1079, Revision SK-4 Drawings, Drawn By: Frankie, Dated 19th May 2022.

3. CRITERIA

3.1 State Environmental Planning Policy (Infrastructure) 2007 Clause 102 - Impact of road noise or vibration on non-road development

The State Environmental Planning Policy (Infrastructure) 2007, Subdivision 2 Development in or adjacent to road corridors and road reservations, Clause 102, Impact of road noise or vibration on non-road development provides the following: -

1) This clause 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 the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:

    (a) a building for residential use,
    (b) a place of public worship,
    (c) a hospital,
    (d) an educational establishment or child care centre.

2) Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Director-General for the purposes of this clause and published in the Gazette.

3) If the development is for the purposes of a building for residential use, 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 building — 35 dBA at any time between 10 pm and 7 am,
    (b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway) — 40 dBA at any time.

4) In this clause, freeway, tollway and transitway have the same meanings as they have in the Roads Act 1993.

3.2 Australian Standards AS 3671 and AS 2107

The Australian Standard AS 3671-1989, *'Acoustics - Road traffic noise intrusion - building siting and construction'* refers to guideline limits in Australian Standard AS 2107. Australian Standard AS/NZS 2107 – 2016, *'Acoustic – Recommended Design Sound Levels and Reverberation Times for Building Interiors'* which provides recommended design sound levels for different areas of occupancy in buildings. This includes recommended internal design sound levels from continuous road traffic noise for houses and apartments near major roads as shown in Table 1 below.

TABLE 1 - RECOMMENDED DESIGN SOUND LEVEL FOR RESIDENTIAL BUILDINGS. FROM AS/NZS 2107 (2016).

Type of Occupancy	**Design Sound Level Range ($L_{Aeq, t}$) dBA**
Houses and Apartments Near Major Roads	
Living Areas	35 to 45
Sleeping Areas (night time)	35 to 40
Work Areas	35 to 45

3.3 Site Specific Noise Goals

Site-specific internal road traffic noise goals ($L_{Aeq, period}$) in line with the State Environmental Planning Policy (Infrastructure) 2007 and Australian Standard AS/NZS 2107 are set at 35 dBA for sleeping areas and 40 dBA for living/work areas.

4. NOISE MEASUREMENT RESULTS

4.1 Instrumentation – Noise

The instrumentation used during the noise source survey consisted of a Brüel and Kjær sound level meter model 2250 (serial no. 2685757). This meter conforms to Australian Standard AS IEC 61672.1-2004: '*Electroacoustics - Sound level meters – Specifications*' as a Class 1 precision sound level meter and has an accuracy suitable for both field and laboratory use. The calibration of the meter was checked before and after the measurement period with a Brüel and Kjær acoustical calibrator model 4231 (serial no. 2445349). No significant system drift occurred over the measurement period.

The sound level meter was checked, adjusted and aligned to conform to the Brüel and Kjær factory specifications and issued with conformance certificates within the last 24 months as required by the regulations. The internal test equipment used is traceable to the National Measurement Laboratory at C.S.I.R.O., Lindfield, NSW, Australia. The calibrator was checked, adjusted and aligned to conform to the Brüel and Kjær factory specifications and issued with conformance certificates within the last 12 months as required by the regulations. The internal test equipment used is traceable to the National Measurement Laboratory at C.S.I.R.O., Lindfield, NSW, Australia.

4.2 Instrumentation – Vibration

The instrumentation used for the vibration survey consisted of a Metra Meß - und Frequenztechnik in Radebeul e.K., Type VM40A vibration meter (serial no. 16115). This meter utilises a tri-axial vibration pickup transducer which has a band width of 0.8 Hz to 100 Hz and is suitable for both field and laboratory use. The vibration meter was checked, adjusted and aligned to conform to the Metra Meß factory specifications.

4.3 Measurement Procedure – Noise

The acoustical measurements were carried out in accordance with Australian Standards AS 1055:2018, '*Acoustics –Description and Measurement of Environmental Noise'*, and AS 2702 '*Acoustics –Methods for the Measurement of Road Traffic Noise'*, (1984) as required by Australian Standard AS 3671 '*Acoustics –Road Traffic Noise Intrusion – Building Siting and Construction'* (1989).

Freefield noise measurements were carried at the rear lot boundary of the subject site, at a distance of approximately 74 metres from the nearest kerb of The M5 Motorway. Due to limited site access, this was the most efficient location to conduct the survey. The measurements were carried out on Thursday 16th June 2022. The 'A' frequency weighting and 'fast' time weighting were used exclusively. The weather at the time of measurements was sunny at 19 degrees Celsius with negligible wind. The time of the measurements was selected as representing a time when the traffic flows are considered to be high whilst maintaining free flow, i.e., without congestion. As such, noise levels are considered to be a worst-case scenario. Night time levels (from 10:00 pm to 7:00 am) are lower than the day time levels and hence meeting the criteria during the day time will ensure that the night time criterion is also met.

4.4 Measurement Procedure – Vibration

Sample ground borne vibration measurements were taken at the same measurement location as the noise survey as outlined in Section 4.3 above on Thursday 16th June 2022.

4.5 Measurement Results – Noise

The daytime energy average external road traffic noise level ($L_{Aeq,\ 1\ hour}$) was measured to be **58 dBA**, at the measurement location being at a distance of approximately 74 metres from the nearest kerb of The M5 Motorway.

In addition to distance attenuation, the external road traffic noise level ($L_{Aeq,\ 1\ hour}$) at the nearest proposed façade (rear façade) of the development was calculated using the following formula:

$$\mathbf{L_{p2} = L_{p1} - 10\ log_{10}\ (r_2/r_1)}$$

Where:

L_{p1} is the measured sound pressure level at 74 metres;
L_{p2} is the calculated sound pressure level at the receiver location (85 metres);
r_1 is the distance from the noise source to the measurement location (74 metres);
r_2 is the distance from noise source to the receiver location (85 metres).

As a result of this, the external road traffic noise level ($L_{Aeq,\ 1\ hour}$) at the nearest noise affected façade of the proposed development is predicted to be **57 dBA** (from $57 = 58 - 10\ log_{10}\ (85/74)$).

A full set of results can be viewed in Appendix A.

4.6 Measurement Results - Vibration

The vibration magnitudes at the same measurement location as the noise survey were measured to be less than 0.10 mm/s. This is below the level of perception (0.5 mm/s) for whole body vibration. Therefore, no further action is required for road traffic vibration.

5. DISCUSSION AND CALCULATIONS

This section of the report discusses the measurement results at the site of the proposed development and details formula used to predict external and internal noise levels in various rooms.

5.1 External Noise Levels

The free field external road traffic noise level ($L_{Aeq,\ 1\ hour}$) was measured to be 58 dBA at the measurement location of approximately 74 metres from the nearest kerb of The M5 Motorway. This measurement position represents the rear boundary of the subject site. The nearest proposed façade (rear façade) of the residential development is to be situated at a distance of approximately 85 metres from the nearest kerb of The M5 Motorway.

It is predicted that the external road traffic noise level ($L_{Aeq,\ 1\ hour}$) at this position will be **57 dBA**. The distances of other rooms and areas within the proposed development from this position have been taken into account.

5.2 Internal Noise Levels

In addition to distance attenuation, the internal noise level (L_{p3}) in various rooms of the proposed development was determined using the following formula:

$$\mathbf{L_{p3} = L_{p2} - R_w + 10\ Log_{10}\ (S/A) - K + 6\ dBA}$$

Where: L_{p2} is the external noise level;
R_w is the weighted sound reduction index of the partition;
S is the area of the partition;
A is the room acoustic absorption; and
K is an angle of view correction.

By applying this formula, the selection of the weighted sound reduction index (R_w) for building elements including the windows and glazed doors to be installed along the external façades for the proposed development can be found. The glazed areas are normally the weakest acoustic partitions in the room façades.

6. RECOMMENDATIONS

This section provides the minimum construction requirements to meet the internal noise goals as outlined in Section 3 of this report.

6.1 External Wall Construction

It was determined that the proposed external walls must achieve a minimum R_w of 42 dB, which is standard for:

- Brick veneer consisting of 110 mm thick exterior face brick, with 90 mm deep timber stud or 92 mm metal stud, at least 50 mm clearance between the masonry and stud frame and 10 mm thick plasterboard lined internally; or

- Double brick of 2 leaves of 110 mm brickwork separated by at least a 50 mm gap; or

- Timber frame or cladding construction consisting of 6 mm fibre cement sheeting or weatherboards or plank cladding or panel cladding (e.g., *'Matrix™ Cladding'* by James Hardie) externally, 90 mm deep timber stud or 92 mm metal stud, 13 mm thick standard plasterboard lined internally with R2 insulation placed within the wall cavity.

6.2 Roof / Ceiling Construction

The roof/ceiling must achieve a minimum R_w of 40 dB, which is standard for a concrete/terracotta tiled roof or a metal roof (e.g., *'Colorbond™'*) with sarking, above a single layer of 10 mm thick plasterboard ceiling fixed to the ceiling joists with acoustic absorption to be laid in the roof cavity.

The acoustic absorption material should be at least 50 mm thick with a Noise Reduction Coefficient (NRC) of at least 0.7. Thermal rating of R2.2 (e.g., *'Bradford™'* R2.2 blanket) would be suitable to meet the acoustic requirements; however, the NRC should be checked with the relevant supplier before purchase to ensure it is at least 0.7.

It is essential for sound insulation that plasterboard walls and ceilings are well sealed. For example, the joint between the wall and the ceiling can be sealed with a resilient layer such as mastic and then covered with a plasterboard cornice; or it can be sealed with tape and cornice cement.

6.3 Minimum Glazing Thicknesses and R_w Ratings

To meet the internal design goals, as given in Section 3.3 above, the glazing in the proposed dwellings will require the glazing thicknesses specified in Table 2 below in order to achieve the recommended R_w ratings.

TABLE 2 - MINIMUM GLAZING THICKNESSES AND R_W RATINGS – Lot 130, 31 Earls Avenue, Riverwood

Room Type	Glazing Reference & Approximate Dimensions (H x W) (mm)	Recommended Minimum Type and Thickness of Glazing	Required Minimum R_w or STC (dB)
Ground Floor			
Home Cinema	W38 800 x 2400	4 mm float sliding window with standard seals	20
Laundry	D63 (If Glazed) 2040 x 820	5 mm toughened glazed door with standard seals	25
Butler's Pantry	W39 600 x 1200	4 mm float sliding window with standard seals	20
Kitchen/ Family/ Dining Room	W40 400 x 3600	4 mm float fixed window with standard seals	24
	SD41 2400 x 3600	5 mm toughened sliding door with standard seals	
	W42 2000 x 2700	4 mm float sliding window with standard seals	
	W43 1400 x 2700	4 mm float sliding window with standard seals	
Bathroom	W44 1000 x 800	4 mm float sliding window with standard seals	22
Home Office	W53 1800 x 1200	4 mm float awning window with standard seals	24
First Floor			
Bedroom 3	W55 600 x 2400	6.38 mm laminated awning window with acoustic seals	31
	W56 600 x 2400	6.38 mm laminated sliding window with acoustic seals	
Bedroom 2	W45 600 x 2400	5 mm float sliding window with standard seals	25
Master Suite	W47 600 x 2700	6.38 mm laminated sliding window with acoustic seals	31
	W57 600 x 2400	6.38 mm laminated sliding window with acoustic seals	
Master Suite Ensuite	W46 1000 x 800	4 mm float awning window with standard seals	23
Void/ Leisure Area	W48 1500 x 2700	4 mm float fixed window with standard seals	22
	W49 1500 x 3500	4 mm float fixed window with standard seals	
	W50 600 x 2400	4 mm float sliding window with standard seals	
Stairwell	W51 2000 x 3500	4 mm float fixed window with standard seals	24
Bathroom	W52 1000 x 1000	4 mm float awning window with standard seals	20
Bedroom 4	W54 1800 x 1200	6.38 mm laminated sliding window with acoustic seals	33

Table 2 Notes:

- *All glazing, given in Table 2 above must be constructed in solid timber (or aluminium) frames and well-sealed when closed;*
- *All other glazing within the proposed development for non-habitable areas are to be a minimum of 4 mm thick float glass for windows and 5 mm toughened glass for doors achieving a minimum R_w or STC rating of 20 dB, assuming they are of the standard window/door types;*
- *R_w = Weighted Sound Reduction Index, covers a frequency range from 100 Hz to 3.15 kHz;*
- *STC = Sound Transmission Class, is similar to R_w but covers a frequency range from 120 Hz to 4 kHz;*
- *Alternative types of glazing are acceptable provided the R_w values as given in Table 2 above are met;*
- *Glazing systems recommended are minimum requirements for acoustic purposes. In some cases, thicker glass may be preferred or required for safety or other reasons.*

6.3.1 Glazing Manufacturers

Glazing manufacturers, as listed in Appendix B below, have provided attenuation data for their glazed windows and doors and will be able to meet the requirements as outlined in this report. Should other suppliers be used, laboratory test data to support the glazed system ratings must be provided.

6.4 Entry Doors

The main entry door and the entry door leading from the garage to the hallway area should be at least 35 mm thick and of solid-core construction or with minimum 6.38 mm laminated glass or similar. The doors should also be fitted with acoustic seals (e.g., *'Lorient™'* IS7025 and IS8011si or *'Raven™'* RP47 frame and RP38 bottom seals) to give a certified R_w rating of at least 28 dB.

6.5 Ventilation

An acoustically insulated building must be kept virtually airtight to exclude external noise. Therefore, in order for the glazed windows and doors to achieve the required R_w ratings, they must be closed. With windows, or external glazed doors opened sufficiently to provide adequate ventilation, i.e., at least 5% of the floor area of the room, a 10 dB reduction from the outside to the inside is usually assumed (see for example the NSW Environmental Criteria for Road Traffic Noise (May 1999) page 14). This predicts an internal noise level ($L_{Aeq,\ 1\ hour}$) with open glazing during the daytime hours of 47 dBA (i.e., 57 dBA – 10 dB) at the nearest affected façade of the proposed development.

This predicted noise level is less than the minimum required internal noise level ($L_{Aeq,\ 1\ hour}$) of 50 dBA for air conditioning or mechanical ventilation to be required, however, all habitable room windows and glazed doors with line of sight to the motorway should be able to be closed during the night hours and therefore air conditioning or mechanical ventilation is recommended for these rooms to provide fresh air to control odours.

Specific ventilation requirements are outside of our scope of expertise, however requirements for indoor-air quality are given in Australian Standard AS 1668.2 - 2012, *"The use of ventilation and air-conditioning in buildings - Ventilation design for indoor air contaminant control"*. Internal noise levels from air-conditioning or mechanical ventilation should not exceed 35 dBA for bedroom areas and 40 dBA for all other habitable areas. External noise levels from air-conditioning or mechanical ventilation should not exceed 5 dB over the lowest existing background noise level (L_{AF90}) when in daytime use and when measured at the neighbouring boundary. Nighttime noise levels must meet the requirements of the Protection of the Environment Operations (Noise Control) Regulation 2017.

7. SUMMARY AND CONCLUSIONS

Noise and vibration levels primarily resulting from road traffic movements using The M5 Motorway in Riverwood NSW, have been measured in the vicinity of the subject site at Lot 130, 31 Earls Avenue, Riverwood NSW 2210. The measurements have been used to predict internal noise and vibration levels for the proposed residential development at the subject site. No exceedances of internal noise or vibration levels are predicted in accordance with the relevant criteria as outlined in Section 3 above. This is providing that the recommendation details shown in Section 6 above are fully complied with.

Status	**Date**	**Prepared by:**	**Position**
Draft	16th June 2022	Anthony Nachar B.Eng. MAAS	Acoustician
Status	**Date**	**Checked by:**	**Position**
Draft	20th June 2022	Ken Scannell MSc MAAS	Acoustician
Status	**Date**	**Issued by:**	**Position**
Final	29th June 2022	Ken Scannell MSc MAAS	Acoustician

Important Note. *All products and materials suggested by 'Noise and Sound Services' are selected for their acoustical properties only. All other properties such as airflow, aesthetics, chemical, corrosion, combustion, construction details, decomposition, expansion, fire rating, grout or tile cracking, loading, shrinkage, ventilation, etc. are outside of 'Noise and Sound Services' field of expertise and* ***must be*** *checked with the supplier or suitably qualified specialist before purchase.*

APPENDIX A – MEASURED SOUND PRESSURE LEVELS

Environmental noise levels can vary considerably with time; therefore, it is not adequate to use a single number to fully describe the acoustic environment. The preferred, and now generally accepted, method of recording and presenting noise measurements is based upon a statistical approach. For example, the L_{AF10} noise level is the level exceeded for 10% of the time and is approximately the average maximum noise level. The L_{AF90} level is the level that is exceeded for 90% of the time and is considered to be approximately the average of the minimum noise level recorded. This level is often referred to as the 'background' noise level. The L_{Aeq} level represents the average noise energy during the measurement period.

The measurement procedure and the equipment used for the noise survey are given in section 4 of this report. The measurement results are shown in Table A. All sound pressure levels in Table A are rounded to the nearest whole decibel.

TABLE A – Noise Measurement Results – Lot 130, 31 Earls Avenue, Riverwood NSW 2210

Measured approximately 74 metres from the nearest kerb of The M5 Motorway, Riverwood

Measurements Taken on Thursday 16th June 2022.

Time		Sound Pressure Level (dBA)					
Start	**Finish**	**L_{Aeq}**	**L_{AF1}**	**L_{AF10}**	**L_{AF50}**	**L_{AF90}**	**L_{AF99}**
11:30	11:45	58	62	59	58	56	54
11:45	12:00	58	65	60	58	56	54
12:00	12:15	58	63	60	58	56	55
12:15	12:30	58	62	60	58	56	54
11:30	**11:45**	**58**	**65**	**59**	**58**	**56**	**54**

APPENDIX B - RECOMMENDED MATERIAL SUPPLIERS

Acoustic Glazing Suppliers:

'Southern Star Windows', telephone: 1300 733 599
https://www.windowsanddoors.build/contactus
'Trend Windows & Doors Pty Ltd', telephone: (02) 9840 2000.
www.trendwindows.com.au
'Wideline Pty Ltd', telephone: (02) 8304 6400.
www.wideline.com.au
'Vantage Windows', telephone: 1300 026 189
http://www.awsaustralia.com.au
'Christoffel Pty Ltd', telephone: (02) 9627 4811
www.christoffel.com.au/contact.htm
'Sound Barrier Systems Pty Ltd', telephone: (02) 9540 4333
www.soundbarrier.com.au
'Velux Australia', telephone: 1300 859 856
www.velux.com.au

Acoustic Door Seals Suppliers:

'*Kilargo*', telephone: 1300 858 010
www.kilargo.com.au
'Raven', telephone: 1800 888 123
www.raven.com.au

Internal Wall-Mounted Air Ventilators Suppliers:

Active:
'Acoustica', telephone: 1300 722 825
www.acoustica.com.au
'Sonair', telephone: 1300 858 674
www.edmonds.com.au

Passive:
'Silenceair®', telephone: (02) 9555 7215
www.silenceair.com