REVERB ACOUSTICS

Noise and Vibration Consultants

Noise Impact Assessment
Proposed Child Care Centre
Lots 307, 308, 309 & 310
Leyland Circuit
Lochinvar NSW

December 2022

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Building Acoustics-Council/EPA Submissions-Modelling-Compliance-Certification

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1 INTRODUCTION

Reverb Acoustics has been commissioned to conduct a noise impact assessment for a proposed child care centre at Lots 307, 308, 309 and 310 Leyland Circuit, Lochinvar. The purpose of this assessment is to theoretically determine the noise impact activities and equipment associated with nearby future commercial development may have on operation of the centre. Further assessment has been undertaken to determine the noise impact the Centre may have on nearby sensitive receivers.

The assessment was requested by GWH Build Pty Ltd to form part of and in support of a Development Application to Maitland City Council (MCC) and to ensure any noise control measures are incorporated into the design of the centre.

2 TECHNICAL REFERENCE / DOCUMENTS

Bies, D.A. and Hansen, C.H. (1996). *Engineering Noise Control: Theory and Practice*. London, E & F.N. Spon.

Gréhant B. (1996). *Acoustics in Buildings.* Thomas Telford Publishing.

Templeton, D. (1997). *Acoustics in the Built Environment.*
Reed Education and Professional Publishing Ltd.

AS 2107-2016 *"Acoustics-Recommended Design Sound Levels and Reverberation Times for Building Interiors"*.

AS 1276.1-1999 *"Acoustics – Rating of sound insulation in buildings and of building elements. Part 1: Airborne sound insulation"*.

NSW Environment Protection Authority (2017). *NSW Road Noise Policy*

NSW Environment Protection Authority (2017). *Noise Policy for Industry*

Association of Australian Acoustic Consultant's (2020) *Guideline for Child Care Centre Acoustic Assessment. Version 3.*

Plans supplied by GWH Build Pty Ltd, dated 2 November 2022. Note that variations from the design supplied to us may affect the acoustic recommendations.

A Glossary of commonly used acoustical terms is presented in Appendix A to aid the reader in understanding the Report.

3 DESCRIPTION OF PROPOSAL

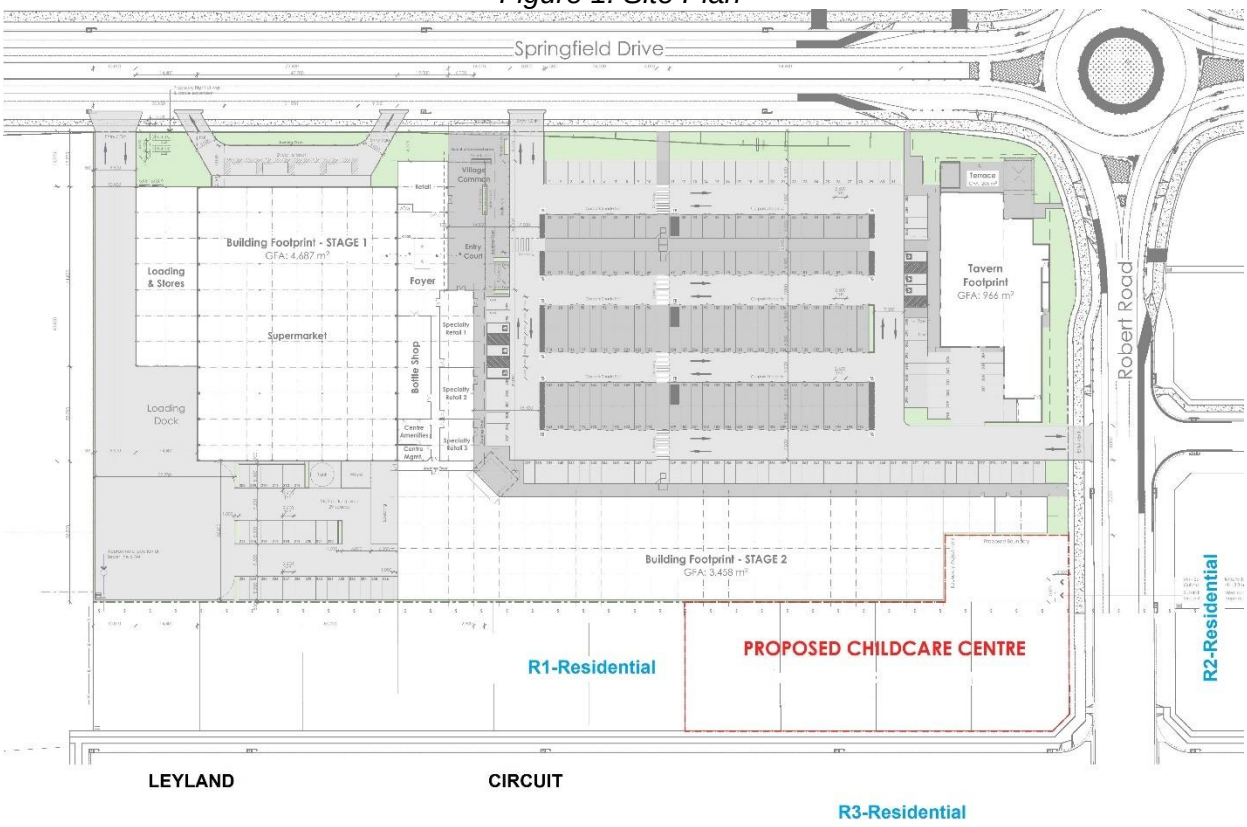
GWH Build Pty Ltd seeks Development Consent for proposed child care centre at Lots 307, 308, 309 and 310 Leyland Circuit, Lochinvar. The development will consist of playrooms, cot rooms, kitchen, offices, amenities, and an outdoor play area.

Potential noise sources associated with the centre that may impact upon nearby neighbours include raised voices, crying, laughter, etc, from children in the playrooms and outdoor play areas, and mechanical plant (air conditioning, kitchen exhaust). Potential noise sources that may impact upon the centre include activities associated with nearby future commercial development (vehicle movements, mechanical plant, etc).

Proposed operating hours for the centre are 6am-7pm Monday to Friday.

Plans supplied by GWH Build Pty Ltd show the layout of the site and the location of nearby land uses. Nearest neighbours identified during our site visits are shown on Figure 1.

Figure 1: Site Plan



4 CRITERIA

4.1 Nearby Commercial Development (Impact on Child Care Centre)

Section 5 of the Association of Australian Acoustic Consultant's (AAAC's) document, *Guideline for Child Care Centre Acoustic Assessment. Version 3*, states the following:

For proposals that are located within 60 metres of an arterial road, railway line, industry or win close proximity to an airport, a noise intrusion assessment should be submitted with the development application.

- The LAeq,1hr from road, rail traffic or industry at any location within the outdoor play or activity area during the hours when the Centre is operating shall not exceed **55dB(A)**.
- The LAeq,1hr from road, rail traffic or industry at any location within the indoor play or sleeping areas during the hours when the Centre is operating shall be capable (i.e. with doors and/or windows closed) of achieving **40dB(A)** within indoor activity areas and **35dB(A)** in sleeping areas.

4.2 Site Noise (Impact from Centre on Neighbours)

4.2.1 Outdoor Play Areas (Impact from Child Care Centre on Residential Receivers)

Section 3 of the AAAC's document, *Guideline for Child Care Centre Acoustic Assessment. Version 3*, specifies a base criterion of **45dB(A) ,Leq 15 minute** for the assessment of outdoor play areas where the background noise level is less than 40dB(A),L90.

4.2.2 Indoor Play Areas, Mechanical Plant, Pick-Up and Drop-Off (Impact from Child Care Centre on Residential Receivers)

Section 3 of the AAAC's document, *Guideline for Child Care Centre Acoustic Assessment. Version 3*, specifies the following limits for impacts from indoor play areas, mechanical plant and pick-up drop-off of children, at residential locations:

The cumulative Leq,15 minute noise emission level resulting from the use of the child care centre, with the exception of outdoor play discussed above, shall not exceed the background noise level by more than 5dB at the assessment location as defined above. Based on a measured background noise levels, assessment criteria are as follows:

Since background noise levels are expected to significantly change in the future due to ongoing development, assessment criteria will be based on protecting noise amenity in preference to controlling intrusiveness, on accordance with the requirements of the NSW Environment Protection Authority's (EPA's) Noise Policy for Industry (NPfI). Project amenity noise levels are determined in accordance with the requirements of Section 2.4 of the NPfI. The existing L(A)eq for the receiver areas will be classified as suburban as development. The Project Amenity Level is derived by subtracting 5dB(A) from the recommended amenity level shown in Table 2.2. A further +3dB(A) adjustment is required to standardise the time periods to LAeq,15 minute. The adjustments are carried out as follows:

Recommended Amenity Noise Level (Table 2.2) – 5dB(A) +3dB(A)

Table 1: - Amenity Noise levels

Period	Amenity Criteria
Day	53 (55-5+3)
Evening	43 (45-5+3)
Night	38 (40-5+3)
Receiver Type: Suburban (See EPA's NPfI - Table 2.1)	

Project Noise Trigger Levels are as follows:

Day **53dB LAeq,15 Minute** 7am to 6pm Mon to Sat or 8am to 6pm Sun and Pub Hol.
Evening **43dB LAeq,15 Minute** 6pm to 10pm
Night **38dB LAeq,15 Minute** 10pm to 7am Mon to Sat or 10pm to 8am Sun and Pub Hol.

4.2.3 Sleep Disturbance (Impact from Child Care Centre on Residential Receivers)

Section 3.2.3 of the AAAC's document, *Guideline for Child Care Centre Acoustic Assessment. Version 3*, specifies that the noise impact from staff arrivals, setup, cleaning or other on-site activities prior to 7am or during night-time hours should be assessed at nearby residential premises. The LAmax noise level emitted by vehicles arriving and parking, depending on the requirements of the state or territory where the centre is located shall not exceed the background noise level by more than 15dB(A) outside the nearest habitable room window.

The above requirements are in line with the requirements of the EPA's NPfI therefore a Sleep Arousal Criterion of **52dB(A),Lmax** has been adopted at the façade of residences.

5 METHODOLOGY

5.1 Commercial Development (Impact on Child Care Centre)

Noise sources associated with nearby future commercial development have been sourced from our library of technical data. The calculated acoustic sound power (dB re 1pW) for all likely noise sources on the site are theoretically propagated to the receiver, taking into account attenuation due to distance, topographical features and any intervening barriers. Atmospheric absorption, directivity and ground absorption have been ignored in the calculations. Where noise impacts above the criteria are identified, suitable noise control measures are implemented and reassessed to demonstrate satisfactory received noise levels in the residential area.

Intermittent noise sources were assessed using the following in-house mathematical formula.

Equation 2:

$$L_{eq},T = Lw - \quad 10\ log\ (2\ \pi\ r^2)\ + 10\ log \frac{(D\ x\ N)}{T}$$

Where *Lw is sound power level of source (dB(A))*
R distance to receiver (m)
D is duration of noise of each noise event (sec)
N is number of events
T is total assessment period (sec)

The Sound Pressure Level's (SPL's) of potential nearby noise sources that may impact on the centre are listed below:

Item	*SPL dB(A),Lmax*	*Comments*
Roof-Top Mechanical plant (S1)	58	@ 10m
Vehicle movements (S2)	54	@ 10m

5.2 Site Activities (Impact from Centre on Neighbours)

Future noise sources on the site cannot be measured at this time, consequently typical noise levels from child care centres have been sourced from our library of technical data. This library has been accumulated from measurements taken in many similar situations on other sites, and allows theoretical predictions of future noise impacts at each receiver and recommendations concerning noise control measures to be incorporated in the design of the site.

The calculated acoustic sound power (dB re 1pW) for all likely noise sources on the site is then theoretically propagated to the receiver, taking into account attenuation due to distance, topographical features and any intervening barriers. Atmospheric absorption, directivity and ground absorption have been ignored in the calculations. Where noise impacts above the criteria are identified, suitable noise control measures are implemented and reassessed to demonstrate satisfactory received noise levels in the residential area.

5.3 Mechanical Plant (Impact from Centre on Neighbours)

Selection of mechanical plant has not been finalised at this stage. We have therefore sourced manufacturers' noise emission data for similar sized developments. Air conditioning plant will be located at ground level along the south facade at the front of the centre. We have also assumed a typical V53 vertical exhaust fan with the outlet located on the roof above the kitchen. The Sound Power Level, Lw dB(A), of anticipated mechanical plant is shown in the following Tables. The sound power of the proposed plant is propagated to residential locations taking into account sound intensity losses due to geometric spreading, with additional minor losses such as molecular absorption, directivity and ground absorption ignored in the calculations. As a result, predicted received noise levels are expected to slightly overstate actual received levels and thus provide a measure of conservatism. Comparison of the predicted noise levels produced by the plant and the allowable level are compared to give the noise impact at the receiver.

Table 2: Lw Typical Split-System Air Conditioning Condenser x2

		Octave Band Centre Frequency, Hz							
Item	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Plant	**70**	42	51	58	60	61	68	50	39

Table 3: Lw of typical Kitchen Exhaust

		Octave Band Centre Frequency, Hz							
Item	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Plant	**74**	39	45	70	69	67	64	51	31

6 ANALYSIS

6.1 External Noise Sources (Impact on Development)

The following Tables show sample calculations to predict received noise levels from activities/equipment associated with nearby future commercial development, directly north of the site propagated within habitable rooms of the child care centre. All calculations are based on distances scaled from plans supplied by GWH Build Pty Ltd.

Table 4: Received Noise – External Noise Sources, dB(A),Leq Propagated within Child Care Centre

Item/Activity	Lw dB(A)	Ave Dist Rec (m)	Duration (sec)	No. of Events	Barrier Loss/TL[1]	Received dB(A)
S1. Mechanical Plant	86	5	900	1	38	26
S2. Vehicle Movements	82	10	10	10	15	30
1. TL roof/ceiling.				**Combined**		**31**
				Criteria (internal)		**35**
				Impact		**0**

As can be seen by the above results, noise from nearby external activities/equipment is predicted to comply with the criteria within indoor areas. Note that noise levels are also compliant with the criterion of 55dB(A),Leq within outdoor areas and no special acoustic features will be required for the outdoor area fencing to attenuate noise from nearby commercial activities. See Section 6.2 for further recommendations in regard to fence requirements.

6.2 Outdoor Play Areas (Impact from Centre on Neighbours)

We understand that a total of 128 children may be at the centre. Based on Sound Power Levels (Lw's) detailed in the AAAC's document *Guideline for Child Care Centre Acoustic Assessment. Version 3*, the following noise levels apply for children in the outdoor area:

Number of Children	*Age Group*	*Lw Children x10 dB(A)*	*Lw Children Total dB(A)*
28	0-2 years	78	83
20	2-3 years	78	81
80	3-5 years	87	96

Assuming an even mix of all ages, a noise level of 90dB(A) may occur for a worst-case situation. To create our acoustic model, we have assumed a worst-case situation where all children are using the outdoor area at the same time.

Technical papers submitted to the Proceedings of Acoustics in relation to child care centres in NSW revealed that noise levels from children in outdoor play areas reduced by up to 9dB(A) when averaged over a 15 minute assessment period. Based on the above figures this equates to an average noise level of 81dB(A),Leq for the outdoor play area.

The sources were placed randomly over the available areas and the resulting sound pressure level was propagated to nearest residences using an equation[1] giving the sound field due to an incoherent plane radiator. The following Tables show calculations to predict the noise impact at nearest residential boundaries. Allowances have been made for inclusion of a 1800mm high acoustic barrier along the west boundary of the outdoor area.

[1] Equation (5.104), DA Bies and CH Hansen, *Engineering Noise Control*, E & FN Spon, 1996.

Table 5: Noise Impact from Children in Outdoor Area, dB(A),Leq.
Propagated to Nearest Residences

Location/Activity	Receivers		
	R1-Residence West	R2-Residences East	R3-Residences South
Average Lw dB(A)	81	81	81
Barrier loss/Directivity[1]	8	0	24
Received	**43**	**45**	**<20**
Criteria	**45dB(A),Leq**		
Impact	**-**	**-**	**-**

1. Intervening structures and/or acoustic fence.

As can be seen by the results in the above Table, noise from children in the outdoor play area is predicted to be compliant with the criteria at nearest receivers. Generally, noise from within the centre building is not expected to create any undue annoyance to nearby residents, with the exception of the play rooms.

Previous noise studies conducted by Reverb Acoustics at child care centres reveal that children have the potential to create high noise levels. Crying from younger children may also occur, although separate enclosed cot rooms are used to minimise disruption. In the unlikely event that complaints should arise, we recommend closing windows/doors facing towards the residence of concern. During warmer months this may create ventilation problems. We therefore suggest installing ceiling fans to supplement air conditioning. It should be acknowledged that children will be put down for sleep on an individual (on demand) basis, thus reducing the chance of several children crying at the same time.

6.3 Mechanical Plant (Impact from Centre on Neighbours)

Received noise produced by anticipated mechanical plant associated with the centre is shown in Tables 6 and 7, propagated to nearest receivers. Table 8 shows the results of the combined noise impact from all mechanical plant at nearest residential receivers.

Table 6: Calculated SPL, Air Conditioning Plant South Blg at GL
Propagated to Nearest Receivers R1

		Octave Band Centre Frequency, Hz							
Item	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Lw, plant (x2)	**70**	42	51	58	60	61	68	50	39
Distance loss, 20m		-34	-34	-34	-34	-34	-34	-34	-34
Barrier loss[1]		2	2	1	1	0	0	0	0
SPL at receiver	**36**	6	15	23	25	27	34	16	5
Criteria	**43**								
Impact	**0**								

1. Intervening structures.

Table 7: Calculated SPL, Kitchen Exhaust Centre Roof
Propagated to Nearest Residential Receivers

		Octave Band Centre Frequency, Hz							
Item	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Lw, exhaust fan	**74**	39	45	70	69	67	64	51	31
Distance loss, 30m		-38	-38	-38	-38	-38	-38	-38	-38
Barrier loss[1]		0	0	0	0	0	0	0	0
SPL at receiver	**37**	1	7	32	31	29	26	13	-
Criteria	**54**								
Impact	**0**								

1. No acoustic barriers.

Table 8: Combined Noise Impact – Mechanical Plant Propagated to Nearest Residential Receivers

		Octave Band Centre Frequency, Hz							
Noise Path	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Air conditioning	36	6	15	23	25	27	34	16	5
Kitchen exhaust	37	1	7	32	31	29	26	13	-
Combined	**39**	7	16	33	32	31	35	18	5
Criteria	**43**								
Impact	**0**								

Results in the above Tables show that noise emissions from anticipated mechanical plant will be compliant with the EPA (and therefore Council) criteria at nearest residences, based on typical source noise levels. See Section 7 for further recommendations to ensure compliance.

6.4 Site Vehicles (Impact from Development on Neighbours)

Vehicles entering, leaving and manoeuvring on the site have the potential to impact on nearest residents, particularly in the early morning period prior to 7am. Table 9 shows calculations to predict the noise impact at nearest residential boundaries.

Table 9: Site Vehicles - Propagated to Nearest Residential Facades

Activity	**Car Enter/Leave**	**Car Park**	**Car Accelerate at Exit**
Lw dB(A)	82	75	85
Ave Dist to rec (m)	20		
Barrier loss/Direct[1]	0		
Rec dB(A),Lmax	**48**	**41**	**51**
Criteria (day)	**52dB(A),max**		
Impact	**0**	**0**	**0**

As can be seen by the above results, noise from vehicles entering, leaving and manoeuvring on the site in the early morning prior to 7am is predicted to be compliant with the sleep arousal criterion.

7 SUMMARY OF RECOMMENDED NOISE CONTROL

7.1 Proposed operating hours of 6am-7pm Monday to Friday are acceptable.

7.2 An acoustic barrier minimum 1800mm above FFL along the west site boundary between the outdoor play area and Lot 306.

Acceptable forms of construction include Colorbond (minimum 0.6mm BMT), lapped and capped timber, Hebel Powerpanel, masonry. No significant gaps should remain in the fence to allow the passage of sound below the recommended height. Other construction options are available if desired, providing the fence or wall is impervious and of equivalent or greater surface mass than the above options.

7.3 Mechanical plant must be installed at the following locations. Acoustic treatment may be required for plant located in alternate positions to those detailed below.

Location	Plant Item
Roof	Kitchen Exhaust
South East corner building at GL	Air conditioning

7.4 No acoustic treatment is required for air conditioning or exhaust plant that satisfies the following noise emission limits:

	Lw, dB(A)	*SPL at 1m dB(A)*
Air conditioning Plant	70	64
Exhaust plant	72	66

7.5 If noise emissions from individual items of air conditioning plant exceed the limits shown in Item 7.4 above acoustic barriers must be constructed between the plant and residences. Barrier construction should consist of *either* Acoustisorb panels (available through Modular Walls) *or* an outer layer of one sheet of 12mm fibre cement sheeting (Villaboard, Hardiflex), or 19mm marine plywood. The inside (plant side) is to be lined with an absorbent foam to reduce reverberant sound (fibrous infills are not recommended as they will deteriorate if wet), and must be minimum 300mm above the top of the plant item.

7.6 If noise emissions from exhaust plant exceed the limits shown in Item 7.4 above acoustic barriers must be constructed to enclose the fan discharge. Barriers must fully enclose at least three sides towards any residence. In our experience, a more efficient and structurally secure barrier is one that encloses all four sides. The barrier must extend at least 600mm above and below the fan centre and/or the discharge outlet and must be no further than 1200mm from the edges of the exhaust. Barrier construction should consist of *either* Acoustisorb panels (available through Modular Walls) *or* an outer layer of one sheet of 12mm fibre cement sheeting (Villaboard, Hardiflex), or 19mm marine plywood. The inside (plant side) is to be lined with an absorbent foam to reduce reverberant sound (fibrous infills are not recommended as they will deteriorate if wet), Note that variations to barrier construction or alternate materials are not permitted without approval from the acoustical consultant. Barrier construction is based solely on acoustic issues. Visual, wind load issues must be considered and designed by appropriately qualified engineers.

7.6 The contractor responsible for supplying and installing the plant should be asked to supply evidence that installed plant meets specified noise emission limits, or that noise control included with the plant is effective in reducing the sound level to the specified limit. Once selection and location of plant has been finalised, details should be forwarded to the acoustic consultant for approval.

8 CONCLUSION

A noise impact assessment proposed child care centre at Lots 307, 308, 309 and 310 Leyland Circuit, Lochinvar, has been completed. The assessment has shown that the site is suitable for the intended purpose, subject to our recommendations. With these or equivalent measures in place, noise impacting on the centre is predicted to be compliant with the criteria.

An assessment of external noise impacting on the development and nearest neighbours has resulted in the compilation of required acoustic modifications and strategies detailed in Section 7 to meet the requirements of the AAAC and EPA.

In conclusion, providing the recommendations given in this report are implemented, noise impacts will comply with the requirements of the EPA, AAAC and MCC. We therefore see no acoustic reason why the proposal should be denied.

Steve Brady M.A.S.A. A.A.A.S.
Principal Consultant

APPENDIX A
Definition of Acoustic Terms

Definition of Acoustic Terms

Term	Definition
dB(A)	A unit of measurement in decibels (A), of sound pressure level which has its frequency characteristics modified by a filter ("A-weighted") so as to more closely approximate the frequency response of the human ear.
ABL	*Assessment Background Level* – A single figure representing each individual assessment period (day, evening, night). Determined as the L90 of the L90's for each separate period.
RBL	*Rating Background Level* – The overall single figure background level for each assessment period (day, evening, night) over the entire monitoring period.
Leq	Equivalent Continuous Noise Level - which, lasting for as long as a given noise event has the same amount of acoustic energy as the given event.
L90	The noise level which is equalled or exceeded for 90% of the measurement period. An indicator of the mean minimum noise level, and is used in Australia as the descriptor for background or ambient noise (usually in dBA).
L10	The noise level which is equalled or exceeded for 10% of the measurement period. L_{10} is an indicator of the mean maximum noise level, and was previously used in Australia as the descriptor for intrusive noise (usually in dBA).