REVERB ACOUSTICS

Noise and Vibration Consultants

Noise Impact Assessment
Child Care Centre
396-404 The Entrance Road
Erina Heights NSW

May 2019

Prepared for Perception Planning Pty Ltd
Report No. 19-2290-R1

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

REVERB ACOUSTICS PTY LTD
ABN 26 142 127 768 ACN 142 127 768
PO Box 252 BELMONT NSW 2280
Telephone: (02) 4947 9980
email: sbradyreverb@gmail.com

TABLE OF CONTENTS

1 INTRODUCTION

Reverb Acoustics has been commissioned to conduct a noise impact assessment for a proposed Child Care Centre at 396-404 The Entrance Road, Erina Heights. The purpose of this assessment is to theoretically determine the noise impact operation of the centre will have on nearby residential receivers. The assessment considers site activities (children playing in outdoors areas), mechanical plant (air conditioning, exhaust), and vehicles entering, leaving and manoeuvring on the site. Further assessment has been undertaken to determine the noise impact on the proposed centre from passing road traffic on The Entrance Road.

The assessment was requested by Perception Planning Pty Ltd to form part of and in support of a Development Application to Central Coast Council (CCC) 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*

Association of Australian Acoustic Consultant's (2013) *Technical Guideline. Child Care Centre Noise Assessment.*

Plans supplied by Sorenson Design & Planning Pty Ltd, dated 17 July 2018. Note that variations from the design supplied to us may affect the acoustic recommendations.

Intersect Traffic Pty Ltd (April 2019). *Traffic & Parking Assessment. Child Care Centre. Lot 32 in DP.1223128 & Lot 9 in DP.1135884 396 & 404 The Entrance Road, Erina Heights.*

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

3 DESCRIPTION OF PROPOSAL

Perception Planning Pty Ltd seeks Development Consent for a child care centre at 396-404 The Entrance Road, Erina Heights. The development will consist of a double-storey building with playrooms, cot rooms, a kitchen, offices and amenities, outdoor verandah play areas on both levels, an outdoor play area at the rear of the site, and carparking for staff and parents at the front of the site. Potential noise sources that may impact upon nearby residential neighbours include raised voices, crying, laughter, etc, from children in the playrooms and outdoor play areas, mechanical plant (air conditioning, kitchen exhaust), and vehicle movements from parents dropping off and picking up children.

Proposed operating hours for the centre are 6.30am-6.30pm Monday to Friday. Mechanical plant selections and locations have not been finalised at this stage, therefore for assessment purposes we have assumed that air conditioning plant will be located at the ground level at either side of the building, and kitchen exhaust discharge may be located at roof level above the kitchen.

The assessment includes measurement of the existing acoustic environment in the receiver area over several days to provide baseline data and enable establishment of noise assessment criteria. Plans supplied by Sorenson Design & Planning Pty Ltd show the layout of the site and the location of nearby land uses. Nearest residential receivers identified during our site visits are as follows (also see Figure 1):

R1. Residence on site (owned by Applicant)
R2. Residence S
R3. Residence S
R4. Residence E
R5. Residences N
R6. The Egg Shed N
R7. Ken Duncan Gallery E

Figure 1: Site Plan

4 EXISTING ACOUSTIC ENVIRONMENT

A background noise level survey was conducted using a Class 1, Svan 977 environmental noise logging monitor, installed in the centre of the site, approximately 20 metres from the near lane of traffic on The Entrance Road. The selected location is representative of the acoustic environment in the receiver area and is considered an acceptable location for determination of the background noise in accordance with Appendix B of the NSW Environment Protection Authority's (EPA's) – Noise Policy for Industry (NPI).

Noise levels were continuously monitored from 14 February to 21 February 2019, to determine the existing background and ambient noise levels for the area. The instrument was programmed to accumulate environmental noise data continuously and store results in internal memory. The data were then analysed to determine 15 minute Leq and statistical noise levels using dedicated software supplied with the instrument.

The instrument was calibrated with a Brüel and Kjaer 4230 sound level calibrator producing 94dB at 1kHz before and after the monitoring period, as part of the instrument's programming and downloading procedure, and showed an error less than 0.5dB.

Table 1 shows a summary of our noise survey, including the Assessment Background Levels (ABL's), for the day, evening and night periods. From these ABL's the Rating Background Level (RBL) has been calculated, according to the procedures described in the EPA's NPI and by following the procedures and guidelines detailed in Australian Standard AS1055-1997, "Acoustics - Description and Measurement of Environmental Noise, Part 1 General Procedures". A complete set of logger results is not shown, but available on request.

Table 1: Summary of Noise Logger Results, dB(A)

Time Period	Background L90			Ambient Leq		
	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am
14-15 Feb	51.6	47.7	33.7	60.6	58.8	54.8
15-16 Feb	52.0	46.3	34.9	65.8	58.2	52.4
16-17 Feb	50.8	49.4	39.4	60.0	57.6	52.3
17-18 Feb	47.4	48.7	41.0	59.4	56.9	55.1
18-19 Feb	49.9	50.1	41.1	60.3	58.6	55.8
19-20 Feb	50.9	48.5	37.8	60.6	58.7	55.7
20-21 Feb	53.4	49.2	41.6	61.7	59.0	55.9
RBL	**50.9**	**48.7**	**39.4**	**--**	**--**	**--**
LAeq	**--**	**--**	**--**	**61.8**	**58.3**	**54.8**

Site, weather and measuring conditions were all satisfactory during our noise surveys. We therefore see no serious reason to modify the results because of influencing factors related to the site, weather or our measuring techniques. A summary of the measured noise environment at the site appears in Tables 2 and 3, taken from our logger results. The measured noise levels are typical for residential areas near a busy road.

Table 2: Existing Source Noise levels

Time Period	Leq		Lmax		L10		L90	
	Range	Average	Range	Average	Range	Average	Range	Average
Day	54-74	61	67-86	72	58-80	64	43-58	53
Evening	54-63	58	66-93	70	56-65	61	45-57	52
Night	41-63	52	60-81	68	41-66	55	32-57	43

Table 3: Summary Noise Level Results–The Entrance Road

Descriptor	Noise Level dB(A)	Time Interval
Leq,1hr (day)	63.5	07:00 to 22:00
Leq,1hr (night)	58.2	22:00 to 07:00
Leq,9hr	54.8	22:00 to 07:00
Leq,15hr	61.1	07:00 to 22:00
Leq,24hr	59.4	06:00 to 06:00

5 CRITERIA

5.1 Road Traffic Noise (Impact from Passing Traffic on Development)

The Association of Australian Acoustic Consultant's (AAAC's) document, *Technical Guideline. Child Care Centre Noise Assessment*, states the following:

- For proposals that are located within 60 metres of an arterial road or railway line a noise assessment should be submitted with the development application.
- The noise level 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 noise level 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 not exceed 40dB(A).

5.2 Road Traffic Noise (Impact from Development on Neighbours)

The AAAC's document, *Technical Guideline. Child Care Centre Noise Assessment*, states the following:

- Traffic noise on local roads generated by vehicles associated with the child care centre arriving and leaving the site (for example vehicles travelling on public roads) shall comply with Leq,1hr 50dB(A) at the assessment location.

5.3 Site Noise (Impact from Development on Neighbours)

5.3.1 Outdoor Play Areas

The AAAC's document, *Technical Guideline. Child Care Centre Noise Assessment*, specifies the following limits for impacts from outdoor play areas, at residential locations:

Up to 2 Hours (total) per day:
The Leq,15 minute noise level emitted from the outdoor play area shall not exceed the background noise level by more than 10dB at the assessment location. Based on a measured background noise level for day of 51dB(A),L90 the criterion is set at 61dB(A) ,Leq 15 minute.

More than 2 Hours per day:
The Leq,15 minute noise level emitted from the outdoor play area shall not exceed the background noise level by more than 5dB at the assessment location. Based on the measured background noise level for day of 51dB(A),L90 the criterion is set at 56dB(A) ,Leq 15 minute.

Commercial Receivers: **65dB(A),Leq** when in use

5.3.2 Indoor Play Areas, Mechanical Plant, Pick-Up and Drop-Off

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

The Leq,15 minute noise level emitted from the cumulative noise impact of children playing indoors, mechanical plant and traffic on the site shall not exceed the background noise level by more than 5dB at the assessment location. Based on a measured background noise levels, assessment criteria are as follows:

Day	**56dB LAeq,15 Minute**	7am to 6pm Mon to Sat or 8am to 6pm Sun and Pub Hol.
Evening	**54dB LAeq,15 Minute**	6pm to 10pm
Night	**44dB LAeq,15 Minute**	10pm to 7am Mon to Sat or 10pm to 8am Sun and Pub Hol.

5.4 Criteria Summary

Various criteria are described in previous Sections of this report for external noise sources such as traffic on public roads, activities associated with commercial developments and people on city streets. The adopted criteria for this assessment are summarised below:

Impact on Neighbours:

Outdoor Play:	**56dB(A),Leq DAY (external)**
Site Traffic on Public Roads:	**50dB(A),Leq (external)**
Indoor Play, Mech Plant & Site Traffic:	**56/54dB(A),Leq DAY/EVENING (external)**

Impact on Child Care Centre:

Road Traffic:	**40dB(A),Leq (internal) Sleeping Areas**
	40dB(A),Leq (internal) Other Areas
	55dB(A),Leq (external) Outdoor Play

6 METHODOLOGY

6.1 Road Traffic (Impact from Passing Traffic on Centre)

Applicable noise level metrics are those calculated from measurements at the site. A +2.5dB(A) facade adjustment must be added to results, as measurements were conducted in the free-field. Received traffic noise for 2019 is calculated as follows:

measured noise (facade field) + facade correction = received noise

Applying the above formula gives:

PACIFIC HIGHWAY
Day 63.5dB(A) + 2.5dB(A) = **66.0dB(A) Leq1hr** 7am – 10pm

Nearby traffic stations indicate an AADT above 28,000 vehicles along The Entrance Road for the year 2019. A figure of 5% heavy vehicles has also been adopted. The AADT for the year 2019 was applied to our computer programme, based on the EPA and RMS approved CoRTN Method of Traffic Noise Prediction, and noise levels were calculated to the theoretical facades of the centre. The CoRTN values are merely arbitrary, as calculated noise levels are adjusted to correlate with the measured peak external noise levels at the site, with the intention is to provide a (theoretical) means of determining the degree of noise control required for each building component.

Equivalent continuous noise levels were calculated for each traffic lane separately on the basis that the noise source (i.e. the traffic) was located in approximately the centre of the respective lane. In particular, this gives an accurate estimation of the location of bus and truck and bus exhausts which are generally located on the right-hand side, being approximately at the same point for both traffic directions. Our calculations have been modified to compensate for the differing acoustic centres of cars and heavy vehicles, by modelling each separately and logarithmically adding received noise levels.

Once the traffic noise level at the outer face of each building element was determined, the required Rw was calculated in accordance with the mathematical procedure given in AS3671-1989 *"Acoustics - Road traffic noise intrusion - Building siting and construction"*. This procedure is based on the required internal noise level shown in Section 5.3.

6.2 Road Traffic (Impact from Development on Neighbours)

Predicted traffic noise on nearby roads for arriving and departing vehicles at the site, has been calculated using the US EPA's Intermittent Traffic Noise calculation method. This method was adopted because of the relatively infrequent traffic movements associated with the development. Equation 1 outlines the mathematical formula used in calculating the Leq,T noise level for intermittent traffic noise.

$$L_{eq},T = L_b + 10\log\left[1+\frac{ND}{T}\left(\frac{10^{(L\,\max - Lb)\,/\,10}-1}{2.3}-\frac{\left(L_{\max}-L_b\right)}{10}\right)\right] \quad \text{..... Equation 1}$$

Where L_b is background noise level, dB(A)
L_{MAX} is vehicle noise, dB(A)
T is the time for each group of vehicles (min)
N is number of vehicle trips
D is duration of noise of each vehicle (min)

Typical vehicle noise levels were sourced from our library of technical data, which has been accumulated from measurements taken in many similar situations on other sites for others, while background noise levels are those taken from our logger results, as described in Section 4. The Lmax vehicle noise levels used in Equation 1 are the maximum predicted noise levels produced at the facade of the residence by vehicles entering and departing the site.

6.3 Mechanical Plant (Impact from Development 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. We have further assumed that up to four (4) air conditioning condensers may be located at ground level, and a typical V53 vertical exhaust fan above the kitchen, with the outlet located 1 metre above roof level. 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 then compared to give the noise impact at the receiver.

Table 4: Lw Typical Split-System Air Conditioning Condenser

		Octave Band Centre Frequency, Hz							
Item	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Plant	**69**	45	54	61	63	64	71	53	42

Table 5: Lw of typical Kitchen Exhaust

		Octave Band Centre Frequency, Hz							
Item	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Plant	**70**	35	41	66	65	63	60	47	27

6.4 Site Activities (Impact from Development on Neighbours)

Future noise sources on the site cannot be measured at this time, consequently typical noise levels from similar developments 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.

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)

7 ANALYSIS

7.1 Road Traffic (Impact from Passing Traffic on Centre)

7.1.1 Internal Habitable Areas

Shown below is a sample calculation detailing the procedure followed in order to calculate required glazing for the Manager's office facing The Entrance Road. The traffic noise level at the outer face of the glazing is calculated as follows,

Table 6: Sample Calculation - Traffic Impact at Manager's Office Glazing

		Octave band Sound Pressure Levels, dB(A)							
Propagation calculation	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Facade traffic noise, Leq[1]	66	46	54	55	59	61	58	52	44
Arch shielding/Directivity[2]		0	0	0	0	0	0	0	0
Distance Correction[3]		-1	-1	-1	-1	-1	-1	-1	-1
Traffic noise at window	65	45	53	54	58	60	57	51	43

1. Projected to the year 2019, assumes acoustic fence on road bdry remains. 2. Intervening structures, angle of view 135°.
3. Adjustments to correct distance.

As the criterion for the office is 40dB(A), see Section 5.4, the required traffic noise reduction is *TNR* = 65-40 = 25dB(A). The traffic noise attenuation, *TNA*, required of the glazing is calculated according to the equation given in Clause 3.4.2.6 of AS 3671,

$$TNA = TNR + 10\log_{10}[(S/S_f) \times 3/h \times 2T_{60} \times C] \qquad \textit{equation 1}$$

where
S = Surface area of glazing = $1.5m^2$
S_f = Surface area of floor = $10m^2$
h = Ceiling height, assumed to be 2.4m
T_{60} = Reverberation time, s
C = No. of components = 3 (glazing, wall, roof)

Assuming that the room is acoustically average (neither too 'live' nor too 'dead') equation 9.26 in *Noise and Vibration Control*, L.L. Beranek, 1971, gives a reverberation time of 0.56s. Consequently, the value of 0.6s was used in equation 1.

Using the values listed above gives

TNA = 23dB(A) for the glazing

Substituting this value into the equation given in Clause 3.4.3.1 of AS3671 gives

$Rw = TNA + 6 \approx 29$.

Based on the above, the window in the Manager's office would need to achieve an Rw29 rating, requiring single-glazed laminated or Vlam Hush glass with acoustic seals at sliders. Similar calculations to those above have been carried out for all external windows and doors, with a glazing schedule presented in Section 8.

7.1.2 Outdoor Play Area

Shown below are calculations to predict the noise impact from passing road traffic on outdoor play areas.

Table 7: Traffic Impact at Elevated Outdoor Play Areas

		Octave band Sound Pressure Levels, dB(A)							
Propagation calculation	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Facade traffic noise, Leq[1]	66	46	54	55	60	61	58	52	44
Barrier loss[2]		-6	-7	-9	-10	-13	-16	-19	-22
Distance Correction[3]		-3	-3	-3	-3	-3	-3	-3	-3
Traffic noise impact	**51**	37	44	43	47	45	39	30	19
Criteria	**55**								
Impact	**0**								

1. Traffic noise 2018. 2. Acoustic fence on rd bdry. 3. Adjustments to correct distance.

As can be seen by the above results, noise levels in the outdoor area are predicted to be compliant with the criteria, providing acoustic fences between the centre and The Entrance Road are maintained. See Section 8 for barrier specifications.

7.2 Road Traffic (Impact from Development on Neighbours)

Traffic due to the proposal travelling on nearby public roads is assessed separate to site noise and is subject to the criteria described in Section 5.2 of this Report.

Vehicles arriving and departing the site may be audible at nearby residences. The number of vehicles using the site will vary from day to day and from hour to hour. The Intersect Traffic Report indicates that peak vehicle numbers of 84-96vtph may occur as a result of the centre during the morning and afternoon peak periods when parents drop off and pick up their children.

Cars typically produce an average sound power of 90-92dB(A), however wide variations are noted particularly with smaller modern cars and larger V8 or diesel powered vehicles. Our calculations present the worst case for the situation, as the noise produced by a typical car accelerating at full power is used to determine the received noise level. In reality, many people will not leave the site at full acceleration but will depart more sedately. Only a handful of people regularly drive at full throttle, and these people may be discouraged by appropriate signage and regular reminders in newsletters asking them to reduce noise and leave quietly.

Traffic Noise Calculations
Table 8 shows calculations to determine received traffic noise levels at typical worst affected receivers along Redwood Drive and Saddlers Drive for normal and peak periods.

Table 8: Traffic Noise Calculations, dB(A)

	Peak Periods
Typical Maximum Sound Power, Lmax	92
Average Distance to Receiver, m	20
Traffic Volume/hour	96
Calculated Traffic Noise, Leq	**46.5**
Criteria	**50dB(A),Leq 1hr**
Exceedance	**-**

The above Table shows the noise impact from traffic movements associated with the proposed development on public roads are predicted to be compliant with the criteria during peak periods at all residential receivers and is considered acceptable.

7.3 Outdoor Play Areas (Impact from Development on Neighbours)

We understand that a total of 144 children may be at the centre. Based on Sound Power Levels (Lw's) detailed in the AAAC's document *"Technical Guideline. Child Care Centre Noise Assessment"*, the following noise levels apply for children in the outdoor area:

Number of Children	*Age Group*	*Lw 10 Children dB(A)*	*Lw, Total dB(A)*
20	0-1 years	77-80	80-83
20	1-2 years	77-80	80-83
25	2-3 years	83-87	87-91
27	3-4 years	84-88	88-92
28	4-5 years	84-90	88-94

To create our acoustic model, we have assumed a worst-case situation where all children are using the outdoor areas at the same time. 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 Table shows calculations to predict the noise impact at nearest residential boundaries. Allowances have been made for boundary fences at residences, where applicable.

Table 9: Noise Impact from Children in Outdoor Area, dB(A),Leq. Propagated to Nearest Residences

Activity/Location	Outdoor Play Areas/Residential Receivers					
	R2	R3	R4	R5	R6	R7
Average Lw dB(A)	89	89	89	89	89	89
Ave Barrier loss[1]	5	5	6	18	18	12
Ave Dist to bdry (m)	150	110	20	190	110	170
Received	**32**	**35**	**49**	**17**	**22**	**24**
Criteria (day/even)	**56/54**	**56/54**	**56/54**	**56/54**	**56/54**	**56/54**
Impact	**-**	**-**	**-**	**-**	**-**	**-**

1. Fence on residential boundary, intervening structures.

As can be seen by the results in the above Table, noise from children in the outdoor play areas is predicted to be compliant with the criteria at nearest residential receivers, providing existing fences on boundaries are maintained. Higher noise received levels will be experienced if greater numbers of children are in the play areas. We therefore recommend considering applying administrative noise control to ensure compliance with the criterion, i.e. ensure younger and older children are in the play areas at different times. Implementation of the above strategy will result in a further 3-4dB(A) reduction in noise. See Section 8 for detailed acoustic recommendations.

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

7.4 Mechanical Plant (Impact from Development on Neighbours)

Received noise produced by anticipated mechanical plant is shown in Tables 10 and 11, propagated to the nearest residences. Table 12 shows the results of the combined noise impact from all mechanical plant at these receivers.

Table 10: Calculated SPL, Air Conditioning Plant Propagated to Nearest Residences

		Octave Band Centre Frequency, Hz							
Item	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Lw, plant (x2)	**75**	43	60	67	69	70	68	59	48
Distance loss, 20m		-34	-34	-34	-34	-34	-34	-34	-34
Barrier loss[1]		5	6	8	9	11	14	17	21
SPL at receiver	**31**	4	20	25	26	25	20	8	-
Criteria (day/evening)	**56/54**								
Impact	**0**								

1. Plant at GL, 1800mm fence on bdry.

Table 11: Calculated SPL, Kitchen Exhaust Propagated to Nearest Residences

		Octave Band Centre Frequency, Hz							
Item	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Lw, exhaust fan	**70**	35	41	66	65	63	60	47	27
Distance loss, 20m		-34	-34	-34	-34	-34	-34	-34	-34
Barrier loss[1]		0	0	0	0	0	0	0	0
SPL at receiver	**36**	1	7	32	31	29	26	13	-
Criteria (day/evening)	**56/54**								
Impact	**0**								

1. 1800mm fence on bdry.

Table 12: Combined Noise Impact – Mechanical Plant Propagated to Nearest Residences

		Octave Band Centre Frequency, Hz							
Noise Path	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Air conditioning	31	4	20	25	26	25	20	8	-
Kitchen exhaust	36	1	7	32	31	29	26	13	-
Combined	**37**	6	20	33	32	30	27	14	-
Criteria (day/evening)	**56/54**								
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 and providing plant is installed in the specified locations, i.e. exhaust above kitchen and air conditioning at ground level.

Noise control will be required for plant that exceeds the following limits:

	Lw, dB(A)	*SPL at 1m dB(A)*
Air conditioning Plant	82	76
Exhaust plant	78	72

Exceedances during the night may occur if plant is left running, therefore, all plant must only operate during centre operating hours. See Section 8 for further recommendations to ensure compliance.

7.5 Site Vehicles (Impact from Development on Neighbours)

Vehicles entering, leaving and manoeuvring on the site have the potential to impact on nearest residents. The Intersect Traffic Report indicates that peak vehicle numbers of 84-96vtph, which equates to approximately 25 vehicle movements during a 15 minute assessment period. Table 13 shows calculations to predict the noise impact at nearest residences from vehicles movements.

Table 13: Noise Impact from Activities in Carpark - dB(A),Leq Propagated to Nearest Residences

Activity	Car Door	Car Engine (enter/leave)	Car Engine (parking)
Lw dB(A),Leq	88	82	76
Ave Dist to rec (m)	30	30	30
Duration	0.25 sec	5 sec	10 sec
No. of Events	60	25	25
Barrier loss	3	3	3
Rec dB(A),Leq	**29**	**33**	**30**
Combined	**36**		
Crit (day/evening)	**56/54dB(A),Leq**		
Impact	**- / -**		

As can be seen by the above results, noise from vehicles entering, leaving and manoeuvring on the site during peak periods is predicted to be compliant with the criteria during peak periods, providing acoustic fences are maintained along the site boundaries. Fence construction is discussed in more detail in Section 8.

7.6 Indoor Areas (Impact from Development on Neighbours)

Generally, noise from within the child care 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.

7.7 Cumulative Noise Impact (Impact from Dev'p on Neighbours)

The cumulative noise impact from all activities associated with the site must be considered to confirm compliance. Peak periods during the day are considered the time periods of most concern. The acoustic sum of all noise generating items expected to operate at the site, propagated to nearest residential receivers, is shown in the following Table.

Table 14: Cumulative Noise Impact - Propagated to Nearest Receivers (Peak Periods)

Receiver/Item	Children in Play Area	Mech Plant	Site Vehicles	Sum
R2. Residence S	32	19	<20	**32**
R3. Residence S	35	22	<20	**35**
R4. Residence E	49	37	36	**50**
R5. Residence N	17	17	28	**29**
R6. The Egg Shed N	22	22	26	**28**
R7. Ken Duncan Gallery E	24	18	<20	**25**

Criteria: Residential Day/Evening = 56/54dB(A),Leq Commercial when in use = 65dB(A),Leq

As can be seen by the above results, the cumulative noise impact from activities associated with operation of the development will be compliant with the criteria at nearest residential receivers, providing acoustic modifications and strategies detailed in Section 8 are implemented.

8 SUMMARY OF RECOMMENDED NOISE CONTROL

8.1 Proposed centre operating hours of 6.30am-6.30pm Monday to Friday are acceptable.

8.2 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	82	76
Exhaust plant	78	72

8.3 If noise emissions from exhaust plant exceed the limits shown in Item 8.2 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.

8.4 If noise emissions from individual items of air conditioning plant exceed the limits shown in Item 8.2 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.

8.5 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.

8.6 It should be noted that no penalties have been applied for tonality produced by mechanical plant, therefore the contractor's attention is drawn to the fact that the plant will be near sensitive receivers and it is vitally important that units are free from specifically annoying characteristics (eg. tones, squeaks, pulsations etc). Careful selection of plant and equipment is recommended to ensure quiet and vibration free operation in compliance with the specified noise criteria. Replacement and/or modification will be necessary to all systems causing undue noise or vibration exceeding the specified criteria.

8.7 Glass installed in window assemblies must comply with AS1288-2006. Materials, construction and installation of all windows are to comply with the requirements of AS2047-2014. Similar calculations to those in Section 7 were performed for all building elements of the proposed development. From these calculations, a schedule of required glazing has been compiled, shown below. The glazing systems, sighted in the following Table, are presented as a guide for the supplier:

Glazing Systems: Type A: Standard glazing. No acoustic requirement.
Type B: Single-glaze 5-8mm clear float glass.
Type C: Single glaze laminated glass or Vlam Hush
Type D: Double-glaze or IGU.

Note: The typical glazing shown in the following Table should be used as a guide only. The supplier of the window/door must be able to provide evidence from a registered laboratory that the complete system will achieve the specified Rw performance, i.e. do not simply install our recommended glass in a standard window frame.

Table 15: Glazing Schedule

Facade	Room	Description	Required Rw Must Achieve for Compliance	Typical Glazing System (Not for Specification)
LEVEL 1				
All	All	All	-	No acoustic requirement
LEVEL 2				
North	Manager's	Window	**29**	Type C
	Reception	Window	**27**	Type B or C
	Waiting	Window	**27**	Type B or C
	Waiting	Door	**24**	See Note 1
	Bathroom	Window	-	No acoustic requirement
	Laundry	Window/Door	-	No acoustic requirement
	Fire Stair	Door	-	No acoustic requirement
East	All	All		No acoustic requirement
West	All	All	-	No acoustic requirement
South	All	All	-	No acoustic requirement

NOTE 1: 30-40mm solid core, glazed section minimum 4-6mm clear float.

8.8 In the unlikely event that complaints should arise from children playing, crying, etc, in the indoor play rooms, we recommend closing external windows facing towards the residence. Consideration should be given to installing ceiling fans to provide additional ventilation.

8.9 Existing acoustic fences between the proposed centre and The Entrance Road and also between the centre and nearest residences must be maintained. If fences are replaced in the future, acceptable forms of construction include Colorbond, lapped and capped timber, Hebel Powerpanel, etc. 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 construction options.

8.10 Administrative should be considered for the outdoor play areas. We suggest each age group should be allocated a roster for usage of the outdoor areas.

8.11 For both staff and visitors, some form of education campaign is required to ensure satisfactory noise levels at nearby residences. For staff, the education can be part of in-service training, while for visitors' reminders may be included in "Centre Newsletters" and reinforced with erection of appropriate signage.

The above noise control recommendations are not necessarily the only options available, but are expected to be the most cost-effective and practical with the information currently to hand. Alternative options can be considered provided they result in the same or lower received noise levels at any nearby residence.

9 CONCLUSION

A noise impact assessment for a new child care centre at 396-404 The Entrance Road, Erina Heights, 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 from the site will be either within the criteria or generally below the existing noise level in the area for the majority of the time.

This assessment is based on a worst-case situation, i.e. maximum number of children in play areas at the same time, while in reality many activities will not always be taking place in the most exposed areas, so actual received noise levels are expected to be less than the predictions shown in this report, or at worst equal to the predicted noise levels for only part of the time.

For the majority of the time, with relatively constant traffic during the day, noise generated by the site may be audible at times but not intrusive at any nearby residence. The existing average Leq noise levels already impacting the residential areas is above that predicted by the proposal and since the character and amplitude of activities associated with the proposal will be similar to those already impacting the area, it will be less intrusive than an unfamiliar introduced source.

Subject to noise control recommendations discussed within this report, this assessment has shown operation of the child care centre should result in minimal impact on the surrounding residential area. Therefore, with the proposed noise control measures and strategies incorporated into the design, we 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).