REVERB ACOUSTICS

Noise and Vibration Consultants

Noise Impact Assessment
St Michael's Catholic School
Early Education Centre & OOSH Facility
12 Sproule Street
Nelson Bay NSW

August 2020

Prepared for Catholic Schools Office
Report No. 19-2469-R1

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 Early Education Centre (EEC) and Out of School Hours (OOSH) facility in the ground of St Michael's Catholic Primary School, 12 Sproule Street, Nelson Bay. The purpose of this assessment is to theoretically determine the noise impact operation of the EEC and OOSH facility 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.

The assessment was requested by Catholic Schools Office to form part of and in support of a Development Application to Port Stephens Council (PSC) 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 (2011). *NSW Road Noise Policy*

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

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

Plans supplied by CKDS Architecture Pty Ltd, Issue 04 dated 14 May 2020. Note that variations from the design supplied to us may affect the acoustic recommendations.

Intersect Traffic Pty Ltd (April 2020). *St Michael's Catholic Primary School Refurbishment and New Early Learning Centre. Lot 2 in DP.216064, 12 Sproule Street, Nelson Bay.*

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

3 DESCRIPTION OF PROPOSAL

Catholic Schools Office seeks Development Consent for a proposed EEC and OOSH in the ground of St Michael's Catholic Primary School, 12 Sproule Street, Nelson Bay. The development will consist of a lower level OOSH facility, upper level 84 space EEC, outdoor play area on the east side of the building, and 32 space on grade carpark on the south side of the building.

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 EEC and OOSH facility are 6.30am-6.00pm Monday to Friday. No information is available in relation to the location of proposed mechanical plant, therefore for assessment purposes we have assumed air conditioning plant will be located on the roof or at ground level, 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 CKDS Architecture Pty Ltd show the layout of the site and the location of nearby land uses. Nearest residential receivers identified during our site visits are shown on Figure 1.

Figure 1: Site Plan

Source: Google Earth

4 EXISTING ACOUSTIC ENVIRONMENT

A background noise level survey was conducted using a Class 1, Svan 977 environmental noise logging monitor, installed along the eat boundary of the school adjacent to nearest residences. 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 (NPfI).

Noise levels were continuously monitored from 3 April to 9 April 2020, 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 NPfI 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. Measured road traffic noise levels at the site are shown in Table 2.

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
3-4 Apr	33.3	32.2	28.3	48.6	41.4	41.3
4-5 Apr	36.6	39.4	31.7	53.1	48.9	40.5
5-6 Apr	38.8	33.4	30.8	56.1	44.2	40.5
6-7 Apr	38.6	31.5	28.5	60.1	47.8	40.9
7-8 Apr	34.6	29.0	24.6	48.5	44.0	35.4
8-9 Apr	36.2	31.3	27.3	48.6	45.4	39.3
9-10 Apr	35.8	-	-	48.9	-	-
RBL	**39.1**	**36.3**	**30.3**	**--**	**--**	**--**
LAeq	**--**	**--**	**--**	**46.7**	**45.0**	**47.0**

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 Table 2, taken from our logger results.

Table 2: Existing Source Noise levels

Time Period	Leq		Lmax		L10		L90	
	Range	Average	Range	Average	Range	Average	Range	Average
Day	40-83	49	57-101	70	40-88	51	32-63	41
Evening	33-72	45	44-90	59	35-74	47	29-68	39
Night	27-52	38	40-72	51	29-54	40	21-50	31

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).

The child care centre is well removed from the nearest arterial road, therefore impacts on the centre from passing road traffic have not been considered further.

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 39dB(A),L90 the criterion is set at 49dB(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 39dB(A),L90 the criterion is set at 44dB(A) ,Leq 15 minute.

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	**44dB LAeq,15 Minute**	7am to 6pm Mon to Sat or 8am to 6pm Sun and Pub Hol.
Evening	**41dB LAeq,15 Minute**	6pm to 10pm
Night	**35dB 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:	**44dB(A),Leq**	**DAY (external)**
Site Traffic on Public Roads:	**50dB(A),Leq**	**(external)**
Indoor Play, Mech Plant & Site Traffic:	**44dB(A),Leq**	**DAY (external)**

6 METHODOLOGY

6.1 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)
T is the time for each group of vehicles (min)
D is duration of noise of each vehicle (min)
L_{MAX} is vehicle noise, dB(A)
N is number of vehicle trips

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.

6.2 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 four (4) air conditioning condensers may be located on the roof or at ground level of the 2-5 years building and two (2) for the 0-2 years building, and a typical V53 vertical exhaust fan may be located above the kitchen of the 2-5 years building. 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.

Based on the above, we have assumed the following mechanical plant items may be required:

Location	*Plant Item*
Building J (2-5 Years)	Kitchen Exhaust Fan (x1) (ducted to 1m above roof) Air Con Condensers (x4) (Roof)
Building J (0-2 Years)	Air Con Condensers (x24) (Roof)

6.3 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 mathematical formula.

Equation 2:

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

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 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 59-68vtph may occur as a result of the centre EEC during the morning and afternoon peak periods when parents drop off and pick up their children.

Cars typically produce an average sound power of 88-90dB(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 3 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 3: Traffic Noise Calculations, dB(A)

	Peak Periods (7am-6pm)
Typical Maximum Sound Power, Lmax	90
Average Distance to Receiver, m	10
Traffic Volume/hour	68
Calculated Traffic Noise, Leq	**47.5**
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 at all residential receivers and is considered acceptable.

7.2 Outdoor Play Areas (Impact from Development on Neighbours)

We understand that a total of 84 children may be at the EEC and a further 75 at the OOSH. 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)*	*Total Lw Children dB(A)*
12	0-1 years	77-80	78-81
12	1-2 years	77-80	78-81
25	2-3 years	83-87	87-91
35	4-5 years	84-90	89-95
75	5+ years	84-90	93-99

A technical paper 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 8dB(A) when averaged over a 15 minute assessment period. To provide a measure of conservatism we have assumed only a 7dB(A) reduction, which averages at 82dB(A),Leq for the EEC and 88dB(A) for the OOSH.

To create our acoustic model, we have assumed a worst-case situation where all children are using the outdoor area 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 4: Noise Impact from Children in Outdoor Area, dB(A),Leq. Propagated to Nearest Residential Boundaries

Location/Activity	Outdoor Play Areas/Residential Receivers		
	R1	R2	R3
Average Lw dB(A)	82	82	82
Barrier loss[1]	15	10	12
Received	**31**	**40**	**42**
Criteria (day)	**44dB(A),Leq**		
Impact	**-**	**-**	**-**

1. Fences on boundary between outdoor area and residences.

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 residential receivers, providing acoustic fences 1800-2100mm high are erected along the east boundary of the outdoor play area and residential boundaries. Higher noise received levels will be experienced if greater numbers of children are in the play area. 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.

7.3 Mechanical Plant (Impact from Development on Neighbours)

Shown below are results of calculations to predict the noise impact from mechanical plant at nearest residential boundary, based on locations detailed in Section 6.2.

Table 5: Noise Impact from Proposed Mechanical Plant Propagated to Nearest Residential Boundaries

Receiver	SPL at Residence	Criteria	Compliant YES/NO
R1	31	44	YES
R2	39	44	YES
R3	37	44	YES

As can be seen by the results in the above Table, noise emissions from proposed mechanical plant is predicted to be compliant with the day criterion of 44dB(A),Leq at nearest residential boundaries.

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

	Lw, dB(A)	*SPL at 1m dB(A)*
Air conditioning Plant	69	63
Exhaust plant	70	64

Exceedances may occur if plant is left running during the night, therefore, all plant must only operate during centre operating hours. Acoustic barriers will be required at roof-top exhaust discharge outlets if the limits above limits are exceeded. Furthermore, air conditioning plant must not be located along the east façade of the 2-5 years building. Preference should be to locate plant in a shielded location. See Section 8 for barrier design and further recommendations to ensure compliance.

7.4 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 59-68vtph, which equates to say 30 vehicle movements during a worst case 15 minute assessment period. Table 6 shows calculations to predict the noise impact at nearest residences from vehicles movements.

Table 6: 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	86	78
Ave Dist to rec (m)	15	30	20
Duration	0.25 sec	5 sec	10 sec
No. of Events	60	30	30
Barrier loss	6	8	8
Rec dB(A),Leq	**33**	**33**	**31**
Combined	**37**		
Crit (day)	**44dB(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 erected along the site boundaries. Fence construction is discussed in more detail in Section 8.

7.5 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.

7.6 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 7: Cumulative Noise Impact - Propagated to Nearest Receivers (Peak Periods)

Receiver/Item	Children in Play Area	Mech Plant	Site Vehicles	Sum
R1. Residence SE	31	31	37	**39**
R2. Residence E	40	39	37	**43**
R3. Residence NE	42	37	<20	**43**

Criteria: Residential Day = 44dB(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. Cumulative impacts up to 1dB(A) above the criteria are predicted at receiver R7, however, given that maximum numbers of children in the outdoor area and other activities such as peak vehicle movements will not occur at the same time, compliance with the criteria is implied.

8 SUMMARY OF RECOMMENDED NOISE CONTROL

8.1 Proposed centre operating hours of 6.30am-6.00pm 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	69	63
Exhaust plant	70	64

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. Alternatively, plant should be located at ground level along facades shielded from residences to the east.

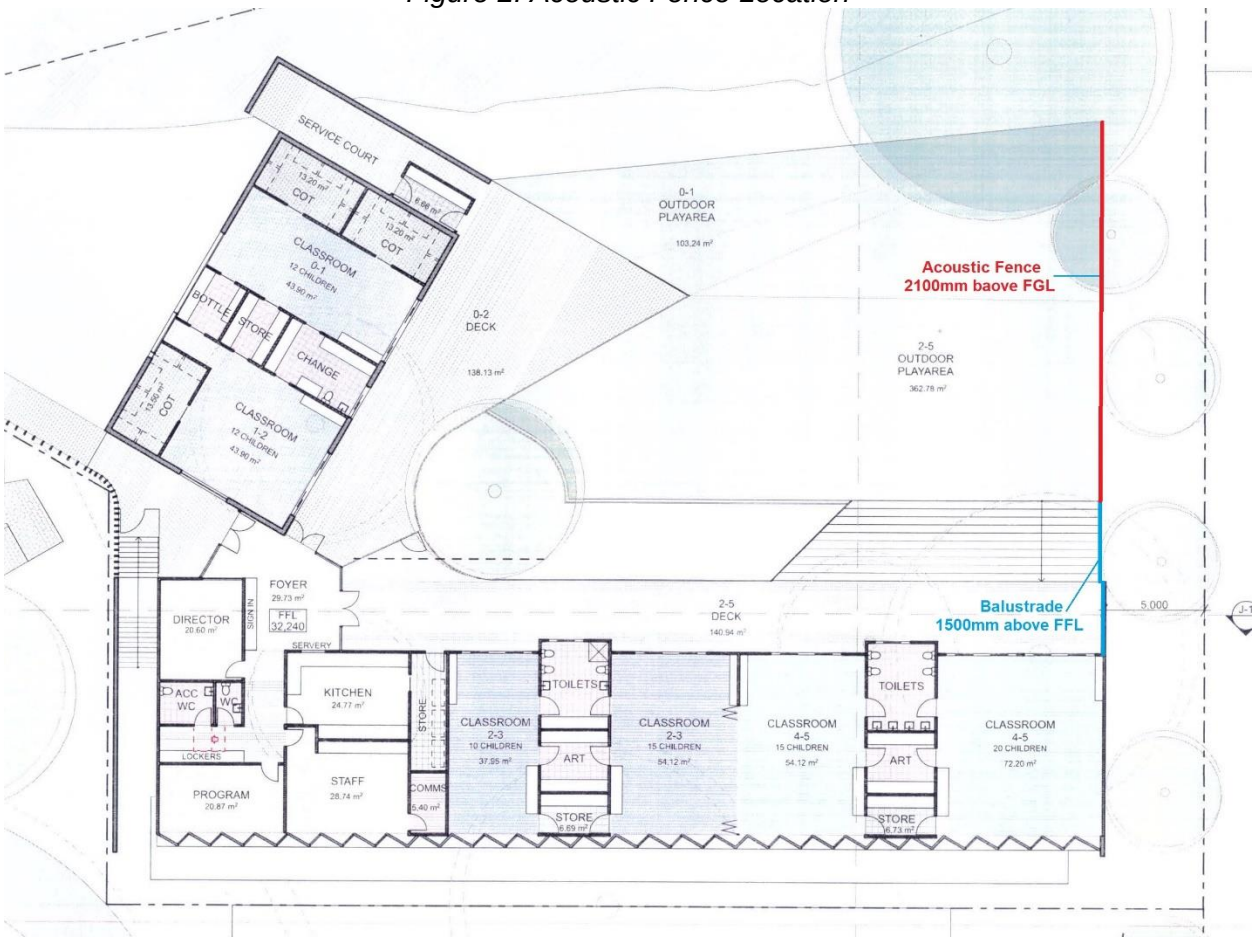
8.5 The contractor responsible for supplying and installing the plant should be asked to supply evidence that installed plant meets specified noise emission limits, or that noise control included with the plant is effective in reducing the sound level to the specified limit. Once selection and location 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 An acoustic fence 2100mm above FGL must be erected along the east side of the outdoor play area and carpark area (also see Figure 2). 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.

8.8 An acoustic fence 1800mm above FGL must be erected along the east site boundary to the south of Building J between the OOSH Overflow Parking Area and the Staff Parking Area. Acceptable forms of construction include Colorbond or paling. Existing fences may be retained, providing they achieve the minimum required height of 1800mm above FGL.

Figure 2: Acoustic Fence Location



8.9 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.

8.10 Administrative noise control must be implemented for the outdoor play area. We suggest each age group should be allocated a roster for usage of the outdoor area.

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 proposed EEC and OOSH facility in the ground of St Michael's Catholic Primary School, 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 area 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 facilities 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).