Canterbury South Public School

Noise Impact Assessment Report for Development Application - Block C

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Document Information

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Revision Table

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Glossary

A-weighting	A spectrum adaption that is applied to measured noise levels to represent human hearing. A-weighted levels are used as human hearing does not respond equally at all frequencies.
Daytime	Between 7 am and 6 pm as defined in the INP.
dB	Decibel—a unit of measurement used to express sound level. It is based on a logarithmic scale which means a sound that is 3 dB higher has twice as much energy. We typically perceive a 10 dB increase in sound level as a doubling of loudness.
dB(A)	'A' Weighted sound level in dB.
Evening	Between 6 pm and 10 pm as defined in the NPI.
Frequency (Hz)	The number of times a vibrating object oscillates (moves back and forth) in one second. Fast movements produce high frequency sound (high pitch/tone), but slow movements mean the frequency (pitch/tone) is low. 1 Hz is equal to 1 cycle per second. The human ear responds to sound in the frequency range of 20 to 20,000 Hz.
NPI	New South Wales Noise Policy for Industry, 2017.
Intrusive Noise	Noise emission that when assessed at a noise-sensitive receiver (principally the boundary of a residence) is greater than 5 dB(A) above the background noise level.
L ₁₀	Noise level exceeded for 10% of the measurement time. The L_{10} level is commonly referred to as the average maximum noise level.
L ₉₀	Noise level exceeded for 90% of the measurement time. The L90 level is commonly referred to as the background noise level.
L _{eq}	Equivalent Noise Level—Energy averaged noise level over the measurement time.
L _{max}	Maximum measured sound pressure level in the time period.
mm/s	Millimetres per second—units of vibration velocity.
m/s ^{1.75}	Units of VDV.
Night-time	Between 10 pm on one day and 7 am on the following day as defined in the INP.
Noise Management Level (NML)	Construction noise management level. Where the construction noise levels are above the NML, additional consideration of feasible and reasonable noise mitigation is required.
Peak Particle Velocity (PPV)	The maximum speed of a particle in a particular component direction due to vibration during a measurement.
Rating Background Level (RBL)	Overall single-figure A-weighted background level representing an assessment period (Day/Evening/Night). For the short-term method, the RBL is simply the measured $L_{90,15min}$ noise level. For the long-term method, it is the median value of all measured background levels during the relevant assessment period.

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1 Introduction

Resonate has been engaged to provide acoustic design advice for the redevelopment of Canterbury South Public School. The project consists of the removal of existing school buildings and a new design to cater for up to 690 children across 30 classrooms and new core facilities for years K-6. The redevelopment will include interactive and flexible learning spaces and outdoor areas. This report will address specifically operational noise requirements of Block C for the purpose of the Development Application (DA).

The principal activities of this commission are:

- Measure and document background noise levels at the rear of the site at a location representative of the background noise level at the nearest residential receivers.
- Process measured background and energy average noise levels.
- Establish noise emission criteria for mechanical plant items and other operational noise sources.
- Assess predicted noise levels against the established criteria and provide mitigation recommendations where required.

This report provides a framework for acoustic design principles that may be reasonably expected based on a review of currently available documentation and our experience on projects of a similar nature. Design advice provided in this report will be further developed as the project progresses.

2 **Project description**

This stage of the proposed development includes the construction of the General Learning Areas (GLA's) only. The site is located with residential receivers to the north, south and west and shared public recreation area to the east. The location and surrounds of Canterbury South Public School are provided in Figure 1 below. The approximate location of the preferred concept design and acoustic measurement locations are also provided on the site map.



Figure 1 Site map

2.1 Sensitive Receivers

The most affected sensitive receivers for the proposed development are the residents of Napier St, primarily the houses from number 7 to 19 to the south and residents located at 22-24 High Street to the north west.

3 Existing Acoustic Environment

The NSW EPA Noise Policy for Industry (NPI) sets out the requirements for the minimisation of noise emission from industrial noise sources, such as mechanical services plant. The policy provides guidance on setting project specific noise trigger levels based on the prevailing ambient environmental noise conditions in the vicinity of the project site.

3.1 Equipment

Noise logging was conducted using a Rion NL-42 sound level meter. Field calibration was conducted at the commencement and conclusion of the logging period and no significant calibration drift was observed. The noise logger was configured to record all relevant noise indices, including background noise level (L_{A90}) and equivalent continuous noise levels (L_{Aeq}). Samples were accumulated at 15-minute intervals. The time response of the logger was set to 'fast'. The noise measurements were taken in general accordance with AS1055.1.

3.2 Ambient noise monitoring

An unattended noise survey was conducted at the project site by Resonate in November 2017. A summary of the measured ambient noise levels is provided in Table 1. The location of the unattended noise logging is provided in Figure 1. These noise levels were used to determine the relevant noise criteria in accordance with the NSW Noise Policy for Industry (NPI).

Description	Measured noise level, dB(A)						
	Daytime 7:00 – 18:00	Evening 18:00 – 22:00	Night-time 22:00 – 07:00				
Rating Background Level, L _{A90}	41	39	33				
Ambient noise level, L _{eq}	65	50	48				

Table 1 Summary of unattended noise measurements

A detailed summary of the noise survey is provided in Appendix A.

4 Acoustic Criteria

4.1 Operational noise emission criteria

Noise emissions from the site when operational should comply with the requirements of the NSW *Noise Policy for Industry* (NPI).

The NPI sets two separate noise criteria to meet desirable environmental outcomes:

- Intrusiveness steady-state noise from the site should be controlled to no more than 5 dB(A) above the background noise level in the area. In this case, the steady-state L_{eq} noise level should not exceed the background noise level measured for different time periods in the environment.
- Amenity amenity criteria are set based on the land use of an area. It requires noise levels from new industrial noise sources to consider the existing industrial noise level such that the cumulative effect of multiple sources does not produce noise levels that would significant exceed the amenity criteria.

Based upon an unattended noise survey summarised in Appendix A, the project specific mechanical services noise criteria for nearby residential receivers are provided in Table 2.

	Noise Emission Criteria (dB LAeq)					
Location	Daytime 07:00 – 18:00	Evening 18:00 – 22:00	Night-time 22:00 – 07:00			
Nearby residential premises	46	44	38			

Table 2 Mechanical services noise emission criteria – residential receivers

Refer to Appendix B for further information on the derivation of the noise emission criteria.

5 Noise Impact Assessment

The main contributors for operational noise assessed in this report are from the following sources:

- Public Address (PA) system and school bells
- Mechanical services noise emission

Children playing in outdoor areas was not assessed as it is not a noise contribution from Block C, however, the building itself will act as a noise barrier for residents on Napier St for any children playing in the designated play areas and COLA in between Blocks A, B and C.

5.1 PA system and school bell

Announcements and school bells are typical activities associated with school operations. Typically, these are produced by the school PA system and can vary significantly depending on the final volume settings of the system. At this stage, the full design of the PA system has not been determined. Loudspeakers are located internally and external to the building. See Figure 2, Figure 3, and Figure 4 below for currently proposed locations. External loudspeakers/bells are indicated with blue circles and internal bells are in yellow.

The external PA speakers are located on the Northern wall aimed towards the external walkway and New Town square. This orientation means that the building will shelter the nearest residents from direct noise and be an acoustic advantage.



Figure 2 Loudspeaker locations ground floor



SCALE 1: 100

Figure 4 Loudspeaker locations level 2

The following measures should be adopted to ensure that their impact at all surrounding residences is minimised:

- Loudspeakers should be located and orientated to provide good coverage of the school areas while being directed away from residences. The coverage of the system should be subject of the detail design of the sound system.
- The volume of the system should be adjusted on site so that announcements and bells are clearly audible on the school site without being excessive. The system should initially be set so that noise at surrounding residences does not exceed the ambient noise levels by more than 5dBA.
- Once the appropriate level has been determined on site, the system should be limited to the acceptable level so that staff cannot increase noise levels. A sound level limiting circuit is an option to be incorporated in the amplifier to control the signal amplitude to a fixed level, regardless of the loudness of the operator's voice.
- Loudspeakers should be small, low-power units located in areas close to the listener position. It is recommended to have a higher number of smaller loudspeakers distributed to be close to the listeners rather than fewer more powerful loudspeakers that are required to project the sound large distances to reach the listeners.
- The system bell should be set so that it only occurs on school days.

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5.2 Mechanical plant

Detailed specifications of new mechanical services equipment that would otherwise allow an acoustic assessment of noise emission from the site are preliminary at this stage of the project. Proposed mechanical services information has been provided by Jones Nicholson Consulting Engineers.

Resonate has been advised the main external mechanical plant being a condenser deck, will be located on the roof of Block C above the stairwell in the centre of the building, shown in Figure 5. The plant is setback from the building edge and is recessed within the roof. These two factors will likely provide a significant level of acoustic shielding to the residential receivers.



Figure 5 Proposed location of roof mounted mechanical services – Block C

Noise emissions from the condenser units were calculated to the most affected receivers, being 7 to 19 Napier Street to the south and 22-24 High Street to the north west. The predictions adopt the following assumptions:

- The condenser units have a combined sound power level of 76dB(A)
- The condenser deck has no direct line of site to the residential receiver's due to the recessed location of the deck and the barrier effect of the roof.
- The minimum distance between the condenser units and residential receivers on High Street is 15 m
- The minimum distance between the condenser units and residential receivers on Napier Street is 30 m
- It is assumed that the mechanical services will not be operational during the night time period (10pm to 7am)

Provided the above assumptions of noise emission not altered during the detailed design phase, the predicted noise levels at the most affected receivers are presented in Table 3. No exceedance of the NPI criteria are expected.

Table 3	Predicted	operational	noise	levels	with barrier	
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Receiver	Predicted noise level at	Criteria	a dB(A)	Compliance Achieved	
	receiver locations dB(A)	Daytime	Evening	✓ / ×	
High Street	39	40	4.4	✓	
Napier Street	39	40	44	✓	

Recommendations

To achieve the noise levels predicted in Table 3, the following recommendations must be implemented:

- Install a noise barrier around the condenser platform
- Barrier is to be minimum of 100mm higher than the height of the condenser units.
- Barrier is to have minimum density of 12kg/m². This is usually achieved with 6mm CFC (compressed fibre cement) or 9mm FC (fibre cement)
- Barrier is to be solid have no gaps or holes
- Barrier must go down to floor level to be effective at controlling noise from underneath the platform. If a gap is required at floor level for maintenance purposes i.e. drainage, it must be less than 100mm

6 **Conclusion**

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To support a Development Application for Canterbury South Public School's redevelopment, Resonate Consultants prepared an acoustic report addressing specifically operational noise requirements of Block C. Site-specific noise criteria that are applicable to the entire project have been established in accordance with the requirements of the NSW *Noise Policy for Industry* (NPI).

An operational noise assessment has been conducted for the activities associated with the redevelopment to determine the potential for noise impact at surrounding receivers. The assessment has considered the potential noise impact to the community from the public address system/school bell, and mechanical services.

This noise impact review of operational noise sources associated with the new Block C, has shown that with careful attention during the detailed design stages, that the project noise criteria can be met using typical and practical noise control methods.

Appendix A – Noise Survey

Unattended noise logging

Unattended background noise logging was conducted between Wednesday, 1st November 2017 and Friday, 10th November 2017. Noise surveys were conducted in accordance with the NSW Noise Policy for Industry NPI.

Equipment and set-up

A Rion NL-42 sound level meter was used. Field calibration was conducted at the commencement and conclusion of the logging period and no significant calibration drift was observed.

The noise logger was configured to record all relevant noise indices, including background noise level (L_{A90}) and equivalent continuous noise levels (L_{Aeq}). Samples were accumulated at 15-minute intervals. The time response of the logger was set to 'fast'.

The noise measurements were taken in general accordance with AS1055.1¹

Weather conditions

It is a requirement that noise data is captured during periods of favourable weather conditions avoiding adverse impacts of wind and rain on background noise levels. In order to assess weather conditions for the measurement period, half-hourly weather data was obtained from the Bureau of Meteorology (BOM) Automatic Weather Station (AWS) 066194 at Canterbury Racecourse.

Noise data has been excluded from the processed results if:

- Rain was observed during a measurement period, and/or
- Wind speed exceeded 5 m/s (18 km/h) at the measurement height of 1.5 m above ground. Wind data obtained from the BOM is presented as the value at 10 m above ground.

The BOM wind speed data obtained for this report was measured at a height of 10 m above ground level. It is therefore necessary to apply a correction factor in order to estimate the wind speed at the height of the logger (1.5 m).

The methodology to formulate a correction factor has been derived². The correction multiplier for the measured wind speed at 10 m is derived by the following formula:

$$W_{1.5} = W_{10} \times \left(\frac{M_{1.5,cat}}{M_{10,cat}}\right)$$

where:

 $W_{1.5}$ = Wind speed at height of 1.5 m W_{10} = Wind speed at height of 10 m $M_{1.5,cat}$ = AS 1170 multiplier for receiver height of 1.5 m and terrain category W_{10} = AS 1170 multiplier for receiver height of 1.0 m and terrain category

 $W_{10,cat}$ = AS 1170 multiplier for receiver height of 10 m and terrain category

² Gowen, T., Karantonis, P. & Rofail, T. (2004), *Converting Bureau of Meteorology wind speed data to local wind speeds at 1.5m above ground level*, Proceedings of ACOUSTICS 2004

¹ Australian Standard AS1055.1 1997: Description and measurement of environmental noise – Part 1: General Procedures

Noise Policy for Industry

In order to determine mechanical services noise emission criteria, data from the unattended noise monitoring outlined in above was processed according to the procedures and time periods in the NSW Noise Policy for Industry (NPI) time periods as follows:

- Daytime: 7 am to 6 pm
- Evening: 6 pm to 10 pm
- Night-time: 10 pm to 7 am

It is necessary to establish a representative noise level for each of these time periods. The procedure set out in the NSW NPI has been used to derive a representative background noise level (Rating Background Level or RBL) for the daytime, evening and night-time periods. An RBL is the median of the lowest 10th percentile of the background LA90 samples for each daytime, evening and night-time measurement period.

Measured Rating Background Noise Levels and ambient noise levels for Canterbury South Public School are provided in Table 4.

Table 4 Noise survey results (Canterbury South)

Description	Measured noise level, dB(A)						
	Day (7 am—6 pm)	Evening (6 pm—10 pm)	Night (10 pm—7 am)				
Rating Background Level, L _{A90}	41	39	33				
Ambient noise level, L _{eq}	65	50	48				

Supplementary short-term attended measurements were conducted during operating hours of the school to capture existing noise levels of children at play for each school site. Short-term measurements results are provided in Table 5.

Location	Measured L _{Aeq(15minute)} , in dB for each Octave Band (Hz)								
	63	125	250	500	1k	2k	4k	8k	Overall
At logger location (no children at play)	32	35	35	37	40	40	36	30	46
Near basketball court with children at play approx. 30- 40 m away	43	49	53	58	63	63	55	45	67

Table 5 Short-term attended noise measurements (Canterbury South)

Appendix B – Derivation of Noise Criteria

In consideration of the above, project specific criteria have been established in accordance with the NSW NPI.

Criteria for continuously operational mechanical services and other operational noise sources at the proposed development site are shown in bold in Table 6. For the purpose of determining amenity criteria at this site, the nearby residentially zoned land is considered to be located in a 'suburban' noise environment as defined in the NSW NPI.

Location	Noise Level (dB re 20 μPa) during Period					
Residential receivers	NPI Daytime 07:00 – 18:00	NPI Evening 18:00 – 22:00	NPI Night-time 22:00 – 07:00			
Rating Background Level (RBL)	41	39	33			
Intrusive criterion (RBL + 5 dB)	46	44	38			
Acceptable Noise Level (ANL) Suburban	55	45	40			
Amenity Criterion (ANL – 5dB(A) + 3dB(A))	53	43	38			
NPI Project specific criteria	46	44	38			

Table 6 – NPI Noise emission criteria – residential receivers

The amenity criteria presented in Table 6 take into account the Modification Factors presented in Table 2.2 of the NPI, existing measured energy average noise levels presented in Table 4 above and our impressions of the site during multiple site visits.

Appendix C – Noise Logging Graphs



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