ACOUSTICS AND AIR

SYDNEY METRO CITY & SOUTHWEST - INTEGRATED STATION DEVELOPMENT

VICTORIA CROSS OVER STATION DEVELOPMENT
OSD SSD DA - ACOUSTIC REPORT

REPORT NO. SMCSWSVO-LLC-SVC-NA-REP-000001
VERSION E

AUGUST 2019

PREPARED FOR

ARCMAC
383 KENT STREET
SYDNEY NSW 2000

WILKINSON MURRAY

DOCUMENT CONTROL

Version	Status	Date	Prepared By	Role	Reviewed By	Role
A	Draft	9 May 2019	Luke Curtis	Engineer	Barry Murray	Director
B	Final	30 May 2019	Luke Curtis	Engineer	Barry Murray	Director
C	Final	4 June 2019	Luke Curtis	Engineer	Barry Murray	Director
D	Lend Lease comments incorporated	1 July 2019	Luke Curtis	Engineer	Ben Lawrence	Director
E	Sydney Metro comments incorporated	22 August 2019	Luke Curtis	Engineer	Ben Lawrence	Director

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GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

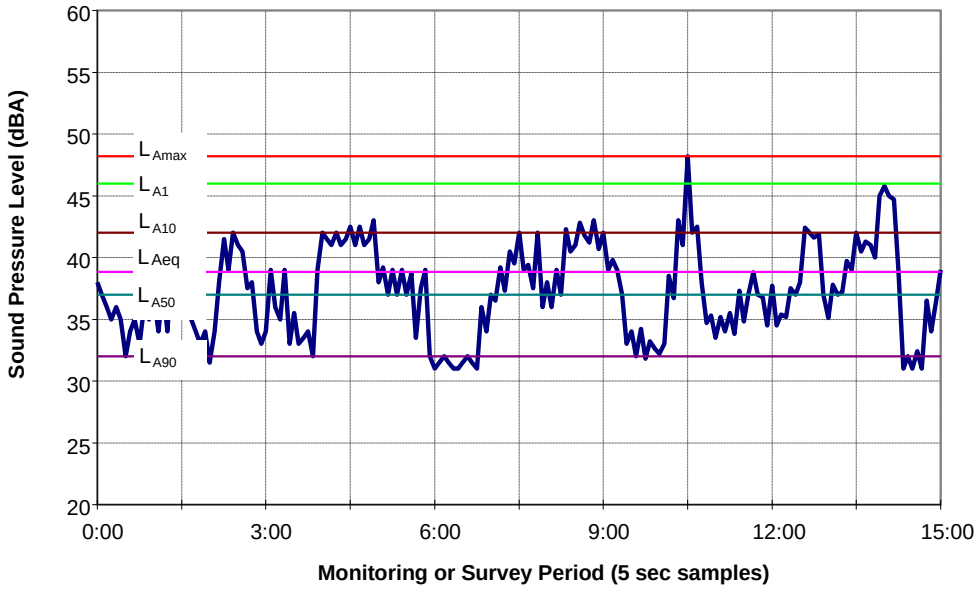
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

Typical Graph of Sound Pressure Level vs Time



1 INTRODUCTION

This report has been prepared to accompany a detailed State Significant Development (SSD) development application (DA) for a commercial mixed-use Over Station Development (OSD) above the new Sydney Metro Victoria Cross Station. The detailed SSD DA is consistent with the Concept Approval (SSD 17_8874) granted for the maximum building envelope on the site, as proposed to be modified.

The Minister for Planning, or their delegate, is the consent authority for the SSD DA and this application is lodged with the NSW Department of Planning, Industry and Environment (NSW DPIE) for assessment.

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) dated 6 May 2019. Specifically, this report has been prepared to respond to the following SEARs:

11. Noise and Vibration

The EIS shall:

- *identify any sensitive receivers to noise in the vicinity of the site, particularly child care centres and schools*
- *identify the main noise and vibration generating sources and activities at all stages of construction, and any noise and vibration sources during operation*
- *consider cumulative noise and vibration impacts with the approved CSSI works*
- *outline measures to minimise and mitigate the potential noise and vibration impacts on surrounding occupiers of land.*

This report has also been prepared in response to the following condition of consent for the State Significant Development Concept (SSD 8874) for the OSD:

Construction Impact Assessment

B9. Future detailed development application(s) shall provide analysis and assessment of the impacts of construction and include:

(c) Noise and Vibration Impact Assessment

The plans referred to above may be prepared as part of a Construction Environmental Management Plan prepared and implemented under the conditions of any consent granted by future development applications; having regard to the Construction Environment Management Framework and Construction Noise and Vibration Strategy prepared for the City Metro City and Southwest (CSSI 7400).

Noise and Vibration

> *B14. Future detailed development application(s) shall be accompanied by a Noise and Vibration Impact Assessment that identifies and provides a quantitative assessment of the main noise and activities during operation including consideration of noise and vibration impacts associated with commercial development above a train station. Details are to be included outlining any mitigation measures necessary to ensure the amenity of future sensitive land uses on the neighbouring sites is protected during the operation of the development.*

The acoustic report specifically addresses the effect of construction noise, mechanical noise and vibration and the intrusion of ambient noise (mechanical and traffic noise) into the development.

The detailed SSD DA seeks development consent for:

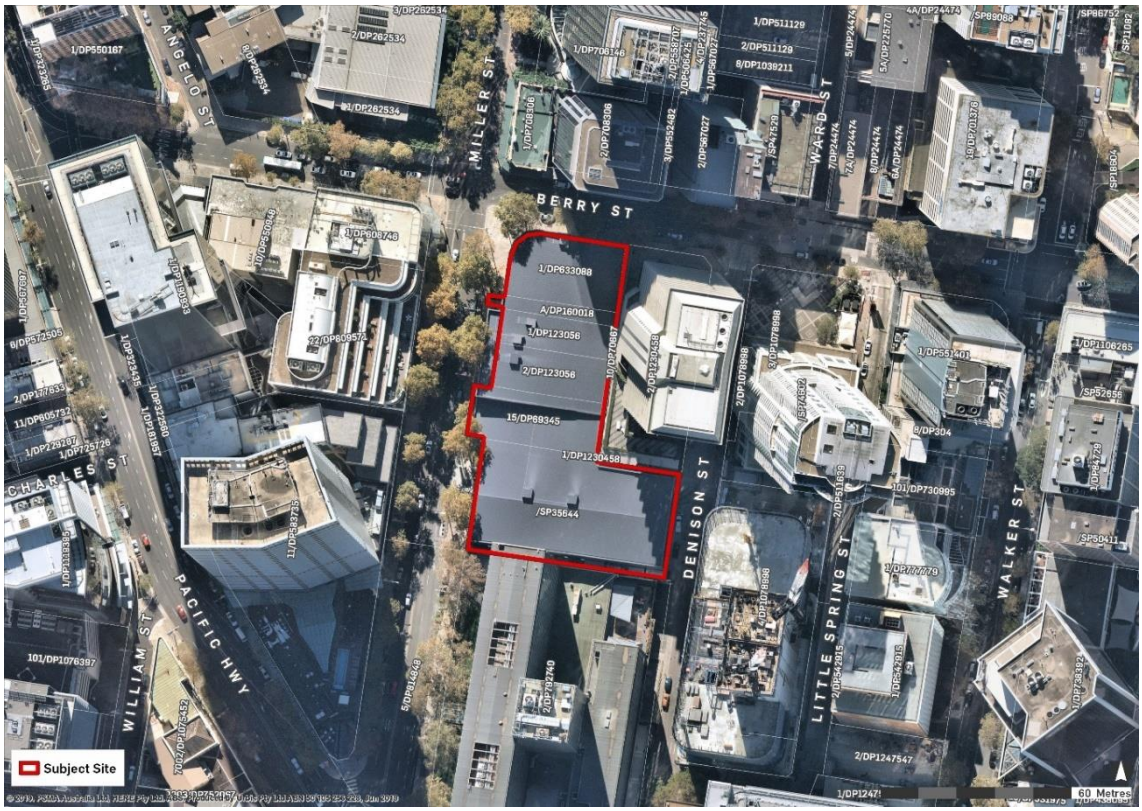
- Construction of a new commercial office tower with a maximum building height of RL 230 or 168 metres (approximately 42 storeys).
- The commercial tower includes a maximum GFA of approximately 61,500sqm, excluding floor space approved in the CSSI.
- Integration with the approved CSSI proposal including though not limited to:
    - Structures, mechanical and electronic systems, and services; and
    - Vertical transfers.
- Use of spaces within the CSSI 'metro box' building envelope for the purposes of:
    - Retail tenancies;
    - Commercial office lobbies and space;
    - 161 car parking spaces within the basement for the purposes of the commercial office and retail use;
    - End of trip facilities; and
    - Loading and services access.
- Utilities and services provision.
- Signage locations (building identification signs).
- Stratum subdivision (staged).

2 PROPOSED SITE

The site is generally described as 155-167 Miller Street, 181 Miller Street, 187-189 Miller Street, and part of 65 Berry Street, North Sydney (the site). The site occupies various addresses/allotments and is legally described as follows:

- 155-167 Miller Street (SP 35644) (which incorporates lots 40 and 41 of Strata Plan 81092 and lots 37, 38 and 39 of Strata Plan 79612)
- 181 Miller Street (Lot 15/DP 69345, Lot 1 & 2/DP 123056, Lot 10/DP 70667)
- 187 Miller Street (Lot A/DP 160018)
- 189 Miller Street (Lot 1/DP 633088)
- Formerly part 65 Berry Street (Lot 1/DP 1230458)

Figure 2-1 Site Aerial



3 SYDNEY METRO DESCRIPTION

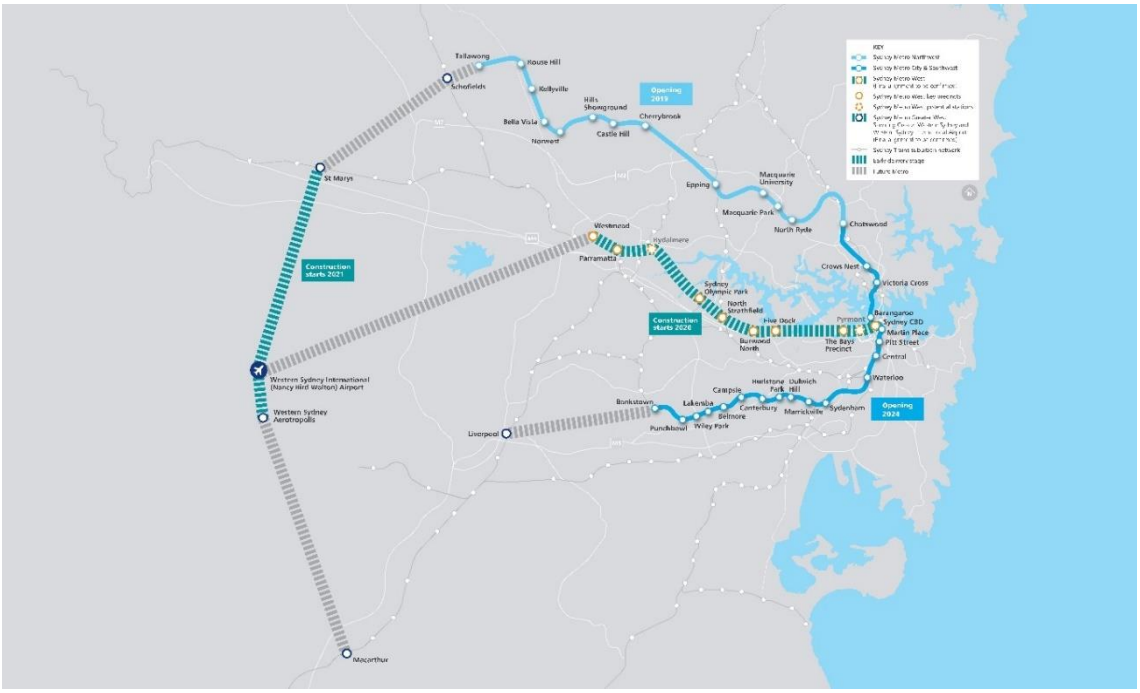
Sydney Metro is Australia's biggest public transport project. Services started in May 2019 in the city's North West with a train every four minutes in the peak. Metro rail will be extended into the CBD and beyond to Bankstown in 2024. There will be new metro railway stations underground at Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street, Waterloo and new metro platforms under Central.

In 2024, Sydney will have 31 metro railway stations and a 66 km standalone metro railway system – the biggest urban rail project in Australian history. There will be ultimate capacity for a metro train every two minutes in each direction under the Sydney city centre. The Sydney Metro project is illustrated in the Figure below.

On 9 January 2017, the Minister for Planning approved the Sydney Metro City & Southwest - Chatswood to Sydenham project as a Critical State Significant Infrastructure project (reference SSI 15_7400) (CSSI Approval). The terms of the CSSI Approval includes all works required to construct the Sydney Metro Victoria Cross Station, including the demolition of existing buildings and structures on both sites. The CSSI Approval also includes construction of below and above ground improvements with the metro station structure for appropriate integration with the OSD.

With regards to CSSI related works, any changes to the "metro box envelope" and public domain will be pursued in satisfaction of the CSSI conditions of approval and do not form part of the scope of the Concept SSD DA for the OSD.

Figure 3-1 Sydney Metro Alignment Map



Source: Sydney Metro

4 EXISTING ACOUSTIC ENVIRONMENT

Victoria Cross Station is a substation located underneath Miller Street in North Sydney. The Metro Station has two surface access sites including the Northern Entrance on the north eastern corner of McLaren and Miller Street, and the Southern Entrance on the south eastern corner of Berry and Miller Street. A mixed-use retail and commercial precinct will reside at the Southern Entrance of the Sydney Metro Victoria Cross Station.

The Southern Entrance is located within a 'B3 – Commercial Core' zone predominately made up of commercial and retail spaces. This precinct includes a three-storey retail building, a five-storey podium office building and a 42 storey Over Station Development residing above the Southern Entrance of the Sydney Metro Victoria Cross Station.

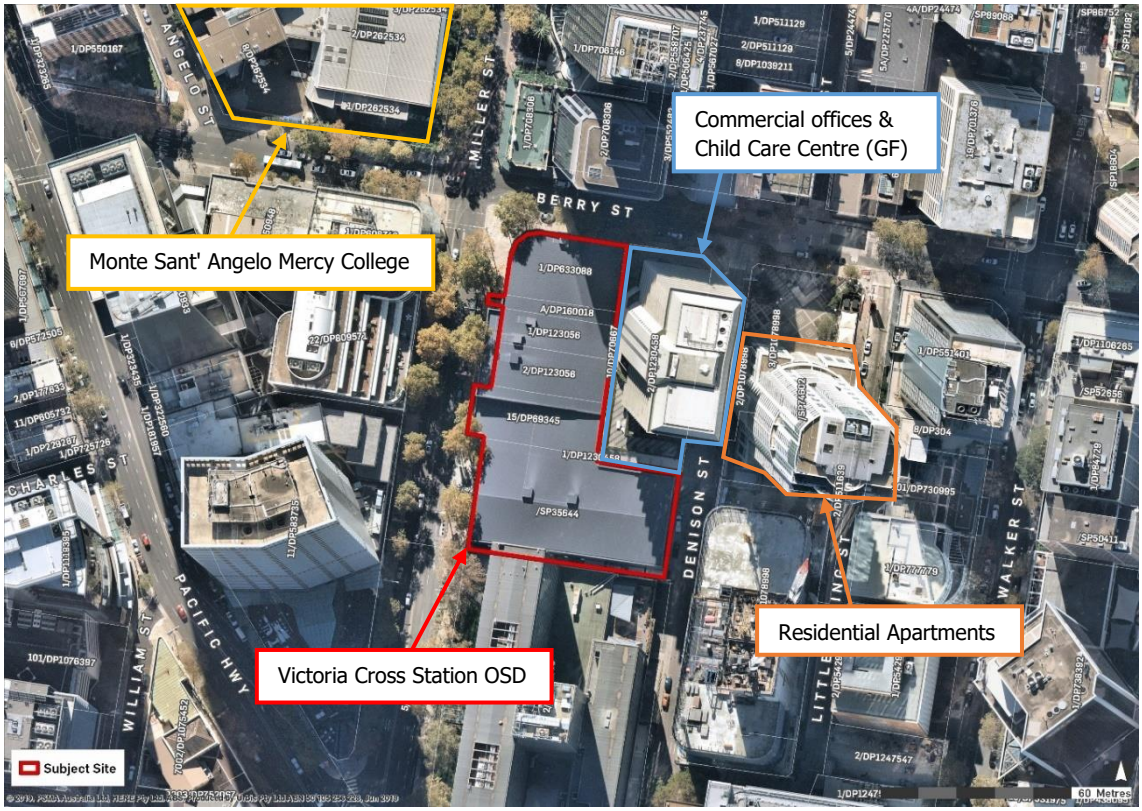
4.1 Sensitive Receivers

Nearby sensitive receivers include:

- Child Care centre – Ground Floor 65 Berry Street, North Sydney
- Commercial offices – 65 Berry Street, North Sydney
- School – Monte Sant' Angelo Mercy College, 128 Miller Street, North Sydney
- Residential – Alexander Apartments, 79-81 Berry Street, North Sydney

Figure 4-1 shows the nearby sensitive receivers.

Figure 4-1 Sensitive Receiver Locations

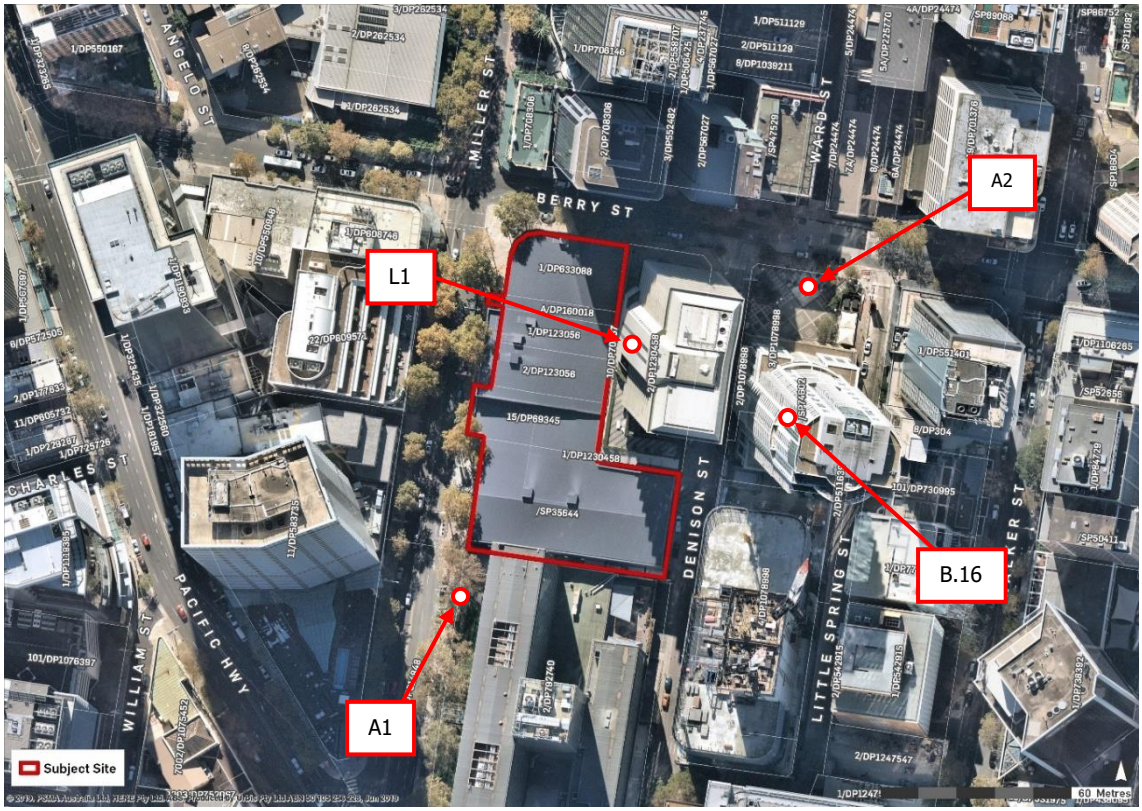


4.2 Noise Measurement Locations

Attended and unattended noise measurements were conducted at the following locations shown in Figure 4-2.

- A1 – Attended measurement at 99 Miller Street, North Sydney
- A2 – Attended measurement at 77 Berry Street, North Sydney
- L1 – Logger at 65 Berry Street, North Sydney
- B.16 – EIS Logger at 79-81 Berry Street, North Sydney

Figure 4-2 Noise Measurement Locations



Attended measurements (A1 and A2) were conducted using a Brüel & Kjær Type 2260 sound level meter (SLM). This sound level meter conforms to Australian Standard 1259 Acoustics – Sound Level Meters as a Type 1 Precision Sound Level Meter which has an accuracy suitable for field and laboratory use. The A-weighting filter of the meter was selected, and the time weighting was set to "Fast". The calibration of the meter was checked before and after the measurements with a Brüel & Kjær Type 4231 sound level calibrator and no significant drift was noted.

The Brüel & Kjær Type 2260 and Brüel & Kjær Type 4231 hold current laboratory calibrations in accordance with NATA and our in-house Quality Assurance Procedures.

Measurements were taken at 1.5m from the ground and in free field conditions.

The unattended monitoring conducted by Wilkinson Murray (L1) was based on a SmartaData web enabled system utilising a Rion type NL52.

The unattended monitoring conducted by SLR Consulting for the Environmental Impact Survey (B.16) was taken utilising a SVANTEK Type 957 noise logger.

Attended measurements A1 and A2 were taken on Thursday 2 May 2019 representing levels at the proposed development and adjacent sensitive receivers. During the measurements ambient noise was substantially affected by noise from construction of the station box. The results of measurements are shown in Table 4-1.

Table 4-1 Noise Measurements

ID	Location	Date	Time	RBL dBA	$L_{Aeq(period)}$ dBA
A1	99 Miller St	2 May 2019	10.37am – 10.52am	64	67
A2	77 Berry St	2 May 2019	10.59am – 11.14am	64	68
L1	65 Berry St	12 – 14 Jun 2018	Day (7am – 6pm)	67	72
			Evening (6pm – 10pm)	56	58
			Night (10pm – 7am)	56	58
B.16	79-81 Berry St	1 – 15 Sep 2015	Day (7am – 6pm)	65	68
			Evening (6pm – 10pm)	63	65
			Night (10pm – 7am)	52	62

5 MECHANICAL NOISE & VIBRATION ASSESSMENT

The tower will house mechanical plant on Level 3, Level 15 and the rooftop. This plant has the potential to affect nearby commercial and residential receivers.

Sydney Metro City & Southwest, Victoria Cross Integrated Station Development, Scope of Works and Technical Criteria (SWTC) state that the OSD acoustic criteria need to be developed.

5.1 External Operational Noise Criteria

5.1.1 North Sydney Development Control Plan (DCP)

North Sydney Council provides noise emission criteria for commercial developments within the North Sydney DCP 2013 (DCP) repeated below.

2.3.2 Noise

Objectives

O1 To ensure reasonable levels of acoustic amenity to nearby residents.

Provisions

P1 Noise emission associated with the operation of non-residential premises or nonresidential components of a building must not exceed the maximum 1-hour noise levels (LAeq 1 Hour) specified in Table B-2.3.

TABLE B-2.3 –Noise Emission Limits

Time Period			***Max 1-hour noise level (LAeq 1 hour)***
Day	***Week***	***Time***	
Weekday	*Day*	*7am – 6pm*	*60 dBA*
	Evening	*6pm – 10pm*	*50 dBA*
	Night	*10pm – 7am*	*45 dBA*
Weekend	*Day*	*8am – 7pm*	*60 dBA*
	Evening	*7pm – 10pm*	*50 dBA*
	Night	*10pm – 8am*	*45 dBA*

Notes: LAeq (1hour) readings are to be measured during the noisiest 1 hour period between Day – 7/8am to 6/7pm, Evening – 6/7pm – 10pm and Night – 10pm to 7/8am.

P2 In terms of determining the maximum noise levels as required by P1 above, the measurement is to be taken at the property boundary of the nearest residential premises. Within a mixed use development, the boundary is taken to be nearest floor ceiling or wall to a residential dwelling on the site.

P3 Despite P1 above, the noise emission associated with the operation of non-residential premises or non-residential components of a building must not exceed 5 dBA above the background maximum 1 hour noise level (LAeq 1 Hour) during the day and evening and not exceeding the background level at night when measured

at the boundary of the property.

5.1.2 Noise Policy for Industry 2017 (NPfI)

The *NSW Noise Policy for Industry 2017 (*NPfI) recommends two criteria, "Intrusiveness" and "Amenity", both of which are relevant for the assessment of noise. In most situations, one of these is more stringent than the other and dominates the noise assessment.

Intrusiveness Criterion

An intrusiveness criterion applies for residential receivers only. The intrusiveness criterion requires that the L_{Aeq} noise level from the source being assessed, when measured over 15 minutes, should not exceed the Rating Background Noise Level (RBL) by more than 5dBA. The RBL represents the 'background' noise in the area, and is determined from measurement of L_{A90} noise levels, in the absence of noise from the source.

For the given environment the intrusiveness criterion is taken as $L_{Aeq,15minute}$ = 69dBA.

Amenity Criterion

The amenity criterion sets a limit on the total noise level from *all industrial noise sources* affecting a receiver. Different criteria apply for different types of receiver (e.g. residence, school classroom); different areas (e.g. rural, suburban); and different time periods, namely daytime (7.00am-6.00pm), evening (6.00pm-10.00pm) and night time (10.00pm-7.00am).

Where a new noise source is proposed in an area with negligible existing industrial noise, the amenity criterion for that source may be taken as being equal to the overall amenity criterion. However, if there is significant existing industrial noise, the criterion for any new source must be set at a lower value. If existing industrial noise already exceeds the relevant amenity criterion, noise from any new source must be set well below the overall criterion to ensure that any increase in noise levels is negligible. Methods for determining a source-specific amenity criterion where there is existing industrial noise are set out in the *NPfI* and determined below in Table 5-1.

Table 5-1 *NPfI* Amenity Criteria

Receiver	Time Period	Noise Level, $L_{Aeq,period}$ (dBA)		
		Overall Amenity Criterion	Existing Industrial Noise	Project-Specific Amenity Criterion
Child Care Centre (65 Berry St)	Day (7am – 6pm)	35 (internal during noisiest hour)	67	30
	Evening (6pm – 10pm)	-	-	-
	Night (10pm – 7am)	-	-	-
Commercial Offices (65 Berry St)	Day (7am – 6pm)	65 (external)	67	60
	Evening (6pm – 10pm)	-	-	-
	Night (10pm – 7am)	-	-	-
Monte Sant' Angelo Mercy College	Day (7am – 6pm)	35 (internal during noisiest hour)	-	30
	Evening (6pm – 10pm)	-	-	-
	Night (10pm – 7am)	-	-	-
Alexander Apartments (77 Berry St)	Day (7am – 6pm)	60 (external)	68	55
	Evening (6pm – 10pm)	50 (external)	65	45
	Night (10pm – 7am)	45 (external)	62	40

5.1.3 OSD Mechanical Noise Criteria

External Receivers

Since mechanical noise is relatively constant in level, the different noise measures discussed above are almost identical. Accordingly, the noise criteria can be summarised in Table 5-2 using the $L_{Aeq,15min}$ levels. This table is based on closed windows to the child care centre and to the exposed parts of Monte Sant' Angelo.

Table 5-2 Mechanical Noise Criteria

Receiver	$L_{Aeq,15min}$ Noise Criteria		
	Daytime	Evening	Night Time
Child Care Centre	50[1]	-	-
Commercial	60	-	-
Monte Sant' Angelo (School)	50[1]	-	-
Alexander Apartments (Residential)	55	45	40

Note 1: Internal noise criteria have been converted to external noise criteria, assuming windows and doors are kept closed.

Vibration impacts from plant equipment installed within the OSD is unlikely to be transmitted into the surround area at perceptible levels.

Internal Noise

External mechanical noise with the potential to affect the OSD will relate to equipment on the OSD Enabling plantroom on level 3. The level 3 tower plantroom will house two diesel generators and fans, but the generator operation will dominate the noise generation.

To allow high quality offices within the tower, the internal noise level of 40dBA (L_{Aeq}) should not be exceeded. This level is based on *AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors*.

Since the generators are emergency generators, the appropriate noise criterion is 10dB above the criterion generally applying to continuous noise, that is, 50dBA during periodical testing procedures.

Assessment of noise and vibration from the future rail corridor will also be undertaken in the detailed design to ensure noise and vibration will not impact the OSD areas.

5.2 Mechanical Vibration Criteria

Vibration from the plant to be installed within the OSD is unlikely to be transmitted into the surrounding area at perceptible levels given the structural slab design.

Equally, vibration from plant on the level 3 tower plantroom is not likely to affect the OSD which extends above to the level 4 offices and below to the level 2 OSD lobby, no criterion is required.

5.3 External Operational Noise Assessment

Selections of mechanical equipment have not yet been finalised and therefore the predicted level of equipment-based emissions cannot be determined until such time as the mechanical equipment schedule is finalised. Preliminary equipment locations are known and therefore typical levels have been assumed for equipment emissions based on performance criteria.

5.3.1 Mechanical Equipment

The proposed development will house diesel generators and fans on OSD Enabling plantroom Level 3, various chillers, boilers, fans and other low noise emission equipment on OSD Level 15, and equipment including cooling towers, AHUs and fans on the OSD roof.

A 5-floor commercial facility is to be located adjacent to the tower as part of the Podium Office and it will serve as a mixed-use space. It will host chillers and fans on the rooftop and these need to be taken into account to assess the cumulative effect. These areas service the CSSI Metro Box development.

A 3-floor retail facility is to be located on the southern boundary across the station patron access route from the tower and co-working facility. The rooftop will host a selection of fans and again these need to be considered to assess the cumulative effect. These areas service the CSSI Metro Box development.

As sound power data becomes available from final mechanical selections the contributions from these sources can be cumulatively assessed at the nearest sensitive receivers. The ratio of source level contributions from equipment emissions on the OSD rooftop, OSD Level 15 and OSD Enabling Level 3 plantroom, Podium Office rooftop and retail rooftops will determine the compliance at residential and commercial receivers.

5.3.2 Allowable Sound Power Levels

Since equipment information is not available at this time, it is only possible to check that the noise criteria can be achieved by the use of strategic noise mitigation.

Based on the noise criteria in Table 5-2, the maximum sound power levels to ensure compliance have been determined for each plant area by reverse calculation. This combination of sound power levels represents a realistic split of noise contribution as shown in Table 5-3, but a later detailed analysis may vary this split.

Table 5-3 Maximum Plant Sound Power Levels at External Facade/Louvre

Plant Area	Maximum Sound Power Level (dBA)
OSD Enabling Plantroom Level 3	75
OSD Level 15	80
OSD Roof	87
Podium Office Roof	75
Retail Roof	78

Note 1: Maximum allowable noise levels at the external façade/louvre have been calculated with the assumption of noise barriers in place.

The relevant sound power levels for this application are those relating to the tower. These sound power levels can be achieved by standard mechanical noise mitigation, such as the following:

- Acoustic louvres surrounding rooftop equipment including cooling towers, chillers, etc;
- Residential type exhaust silencers on the OSD Enabling plantroom level 3 generators;
- Intake and exhaust attenuators within the generator room ventilation system; and
- Attenuators to some ventilation fans.

5.4 Internal Operational Noise Assessment

Two diesel generators will operate in emergency conditions on the level 3 tower plantroom and noise from these has the potential to affect the level 4 offices of the OSD tower.

Although final selections have not been made at this stage, it is anticipated that the generators will be approximately 2250kVA units. These units are expected to generate a sound power level of 124dBA each.

The level expected on level 4 without noise mitigation is 55-60dBA, over the 50dBA criterion. To ensure that the criterion is met, a more detailed analysis will be carried out as part of the detailed design, but it is likely that the following will be required:

- Lining plantroom walls with 100mm acoustic insulation faced with perforated metal; and/or
- Mounting the generators on high deflection steel springs, possibly with a floating plinth.

6 CONSTRUCTION NOISE ASSESSMENT

Construction noise from the project has been assessed in accordance with the *Interim Construction Noise Guideline* (ICNG).

6.1 Construction Noise Management Levels

It is proposed that construction be carried out during normal daytime hours. On this basis, the appropriate noise management level for residential premises is background noise level +10dB. In this case, using the lowest background noise level measured of 64dBA, the residential management level becomes 74dBA.

The *ICNG* does not recommend a management level for commercial receivers, but recommends 45dBA internal level for educational institutions and it has been assumed that child care centres fall within this category. On the basis of closed glazing, the external educational institutions' noise management level becomes 65dBA.

Table 6-1 summarises the noise management levels, being a management level for the $L_{Aeq,15min}$ measure.

Table 6-1 Construction Noise Management Levels

Building Type	Noise Management Level ($L_{Aeq,15min}$)
Residential	74
Commercial	-
School	65
Child Care Centre	65

6.2 Prediction & Assessment of Construction Noise Levels

Construction noise has been calculated for the main stages of construction.

At this stage, details of the construction activities and equipment are proposed as in the *Victoria Cross Integrated Station Development Construction and Site Management Plan.* Detailed are major plant locations alongside which general activities assumptions have been made as shown in Table 6-2. It should be noted that the bulk excavation will be carried out as part of the tunnel and stations contract, as will the construction of concrete structure up to Level 3, and the OSD construction will commence from Level 4.

Table 6-2 Construction Stages & Equipment

Construction Stage	Typical Equipment
Concrete Pouring	Concrete Agitator Concrete Pump Concrete Vibrator Truck
Concrete Pouring & Façade Fixing	Concrete Agitator Concrete Pump Concrete Vibrator Crane Truck

The sound power levels adopted for these items of plant are shown in Table 6-3.

Table 6-3 Plant Sound Power Level

Plant	Sound Power Level ($L_{Aeq,15min}$)
Crane	102
Diamond saw	106
Truck	103
Concrete Agitator	105
Concrete Pump	106
Concrete Vibrator	102

The noise levels to be expected at the nearby receivers from the two stages of construction have been calculated and the results are shown in Table 6-4.

Table 6-4 Assessment of Construction Noise Levels

Construction Stage	Receiver	Predicted $L_{Aeq,15min}$	Noise Management Level (External)
Concrete Pouring	Alexander Apartments (residential)	61	74
	Monte Sant' Angelo (school)	55	65
	Child Care Centre 65 Berry Street	66	65
Concrete Pouring & Façade Fixing	Alexander Apartments (residential)	62	74
	Monte Sant' Angelo (school)	55	65
	Child Care Centre 65 Berry Street	65	65

The Construction and Site Management Plan indicates noise management mitigations including an acoustic shed installed to encase the concrete pump. This shed is required to provide a transmission loss of 10dB from the noise source and as such it is expected that the concrete pump will comply with the noise criteria at all receivers.

The levels at Alexander Apartments will be up to 62dBA outside, but these will comply with the noise management level.

Construction noise levels at the child care centre will marginally exceed the noise management level by up to 1dB. As such, all reasonable and feasible noise mitigations will be required to be met and will be detailed within the Construction Noise Management Plan. Such noise mitigation strategies for construction activities may include the following:

- Noise barriers for temporary works;
- Notification to surrounding receivers of excessively noisy activities;
- Respite periods for construction works; and
- Noise monitoring during construction.

7 FACADE DESIGN

7.1 Required Internal Noise Criteria

Australian Standard 2107 *Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors.* To allow high quality offices within the OSD, the internal noise level of 40dBA (L_{Aeq}) should not be exceeded. This level is based on AS/NZS 2107.

7.2 Prediction Tower Internal Noise Levels

The tower will be exposed to traffic noise from Miller Street and Berry Street as well as noise from other nearby commercial buildings. The highest long term L_{Aeq} level measured in the area was 72dBA at location L1, but this level, obtained using unattended logging, may be affected by extraneous noise. The 68dBA level measured at location A2 using attended techniques has been applied to the northern facade of the development. The highest level measured on Miller Street was 67dBA and this level has been adopted for the western facade.

The predicted external levels and facade glazing specifications proposed for the tower are as follows in Table 7-1.

Table 7-1 Southern Building External Levels and Minimum Glazing Specification

Façade	Street Level (Ground – Lv3)	Low Rise (Lv4 – 14)	Mid Rise (Lv15 – 28)	High Rise (Lv29 – 40 Mezz.)
Berry St (North)	68dBA R_W33 (6.38mm lam.)	63dBA R_W32 (6/12/6 DGU)	58dBA R_W32 (6/12/6 DGU)	60dBA R_W32 (6/12/6 DGU)
Miller St (West)				56dBA R_W32 (6/12/6 DGU)
Laneway (South)	65dBA R_W33 (6.38mm lam.)	60dBA R_W32 (6/12/6 DGU)	55dBA R_W32 (6/12/6 DGU)	58dBA R_W32 (6/12/6 DGU)
Denison St (East)				63dBA R_W32 (6/12/6 DGU)

Note the increase in external levels on High-Rise facades exposed to noise impacts from the Warringah Freeway at high level. These impacts from exposure to increase noise levels are not significant to improve the acoustic specifications for facFAade glazing. The analysis reveals that internal noise levels just under 40dBA is achievable inside the critical northern and western facades with these glazing systems. The system achieves this result with assumptions including a carpet floor covering and acoustic mineral fibre ceiling tiles as a part of the base build. No additional treatment is required.

8 CONCLUSION

This report generally addresses mechanical services noise from the Victoria Cross Station OSD in respect to patrons and sensitive receivers in the surrounding area. Mechanical plant complies with the criterion specified in the DCP and *NPfI* subject to the implementation of the acoustic recommendations supplied in Section 5.3.2 of this report.

OSD Enabling plantroom level 3 diesel generators operating under emergency conditions will require adequate provision for the installation of acoustic mitigation measures. Untreated, the noise intrusion to Level 4 offices from diesel generators has been determined to exceed the 50dBA criteria. Mitigation measures identified in Section 5.4 of this report will be implemented to address this and will therefore comply with internal operational and emergency criteria as implemented per manufacturer's installation recommendations.

The proposed minimum facade construction will achieve an internal noise level just below 40dBA. This level will be suitable for normal commercial use.

Construction noise will marginally exceed the relevant noise management levels at times at the adjacent child care centre. Noise management strategies will be detailed within the Construction Noise Management Plan presenting all reasonable and feasible noise controls for construction of the OSD.