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Dear Jane,

Sydney Modern Project Further Acoustic Clarifications

Arup Acoustics has reviewed the request for further information from Department of Planning & Environment and the submissions related to acoustics commissioned by the Wharf Terrace Apartments.

Further clarifications in response are provided below:

1 Capacity of Outdoor Café

Request for further information:

“Confirm the capacity of the café/terrace. The PKA acoustic report (submitted by John Gerathy) states Sally advised the capacity of the café and terrace would be 200 inside and 70 outside. This is different to the figures in the RTS of 150 inside and 100 outside with up to 500 outside during events.”

Response

Capacity is as per the Response to Submissions, which is up to 500 people outside during events. The assumption of the population is 500 people for the acoustic assessment.

2 Noise Prediction and Criteria Clarification

Request for further information:

“Please provide a response to the PKA acoustic report regarding calculated noise impacts and noise criteria, in particular the potential need for additional acoustic treatments and potential impacts from the multi-purpose room/outdoor space.”

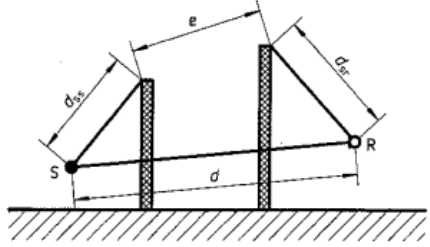
Responses

Responses for outdoor café, multi-purpose space and environmental noise criteria are provided as follows.

2.1 Outdoor Café

2.1.1 Calculation Methodology

Noise attenuation from outdoor café to 10 Lincoln Crescent is calculated based on ISO 9631-2:1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*, including distance loss and acoustic screening effects with double diffraction. The calculation and assumptions are provided in the table below:

Items	Sound Level or correction factor	Remarks
Sound Power Level of the entire outdoor café area	105 dB(A)	
Distance attenuation $A_{div} = 20\lg(d)+11$	-46.6 dB	$d=60$ m
Directivity correction, D_c	+3 dB	
Screening attenuation for double diffraction, A_{bar}	-23 dB	There are two elements can provide barrier effect between source at outdoor cafe and residential receiver: 1. According to the markup provided in Figure 1 of Acoustic SEARs report, people has been restricted from the edge of the outdoor café by garden, and it has been assumed that people are distributed in the entire outdoor café area (i.e. not all standing at the boundary); Thus, it is appropriate to assume the equivalent averaged source location is at the middle of outdoor café (~15m from the boundary). 2. The carpark building in front of the residential building provides barrier effects. In accordance with ISO 9631-2:1996, the double barrier attenuation has been calculated using the double diffraction method provided in the standard as shown in the figure below:  Figure 7 — Geometrical quantities for determining the pathlength difference for double diffraction (ISO 9631-2:1996 Figure 7)
Contingency allowed for occasional speeches	+5 dB	
SPL @ closest residential receiver of 10 Lincoln Crescent	43 dBL _{Aeq,15min}	

As such, we can confirm that additional acoustic treatments are not required for the outdoor café space under the assumptions specified in Acoustic SEARs Report Rev H.

2.1.2 Noise Assessment for Liquor license

The current noise condition for the liquor license is provided in Section 1.4.1 of Noise Guide for Local Government 2013, as shown below:

Current noise condition

The L_{A10}^* noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5Hz–8kHz inclusive) by more than 5dB between 7:00 am and 12:00 midnight at the boundary of any affected residence.

The L_{A10}^* noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5Hz–8kHz inclusive) between 12:00 midnight and 7:00 am at the boundary of any affected residence.

Notwithstanding compliance with the above, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of 12:00 midnight and 7:00 am.

* For the purpose of this condition, the L_{A10} can be taken as the average maximum deflection of the noise emission from the licensed premises.

This is a minimum standard. In some instances the Director may specify a time earlier than midnight in respect of the above condition.

Interior noise levels which still exceed safe hearing levels are in no way supported or condoned by the Director.

As mentioned in the Acoustic SEARs Report Rev H, no attendees or activities will be permitted outside after 2200h; thus, only the noise condition for 7:00am - 12:00 midnight applies. Based on the long-term noise monitoring onsite, the noise criteria for the liquor licence for day and evening are established in the table below:

	Broadband sound level	Sound Levels (dB) in Octave Band Centre Frequency, Hz								
	dB(A)	31.5	63	125	250	500	1k	2k	4k	8k
Background noise level (evening) based on the long-term noise monitoring	49 L_{90}	64	62	55	49	45	43	40	34	25
Criteria for Liquor license requirements (background noise level + 5dB)	54 L_{10}	69	67	60	54	50	48	45	39	30

Sound power level in L_{A10} for the crowds has been assumed based on the paper by Hayne, et al.¹. A typical conversational speeches spectrum from Arup databased has been adopted and corrected to establish the assumed noise spectrum, as provided in the table below. A safety factor of 5 dB has also been allowed for potential alcohol affected patrons.

Applying the calculation methodology provided in Section 2.1.1, the resultant sound pressure levels in L_{10} at 10 Lincoln Crescent are predicted to be complied with licensed premises noise condition.

¹ Hayne, M., Taylor, J., Rumble, R., & Mee, D. Prediction of Noise from Small to Medium Sized Crowds.

	Broadband sound level	Sound Levels (dB) in Octave Band Centre Frequency, Hz								
	dB(A)	31.5	63	125	250	500	1k	2k	4k	8k
Assumed Sound Power Level	108 L ₁₀	89	89	89	104	107	104	94	84	67
5 dB safety factor for potential alcohol affected patrons	+5	5	5	5	5	5	5	5	5	5
Resultant Sound Pressure Level at closest residence boundary (including 5 dB contingency for occasional speech and 5 dB for potential alcohol affected patrons)	49 L ₁₀	45	43	39	50	50	46	36	26	9
Acoustic criteria for Liquor license	54 L ₁₀	69	67	60	54	50	48	45	39	30
Compliance with criteria	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Although the compliance to the noise condition is feasible, it is recommended that a management plan should be in place to control the noise when it becomes excessive.

2.2 Multi-purpose space

The doors to the external area for the multi-purpose space are for fire escape purposes and will be kept closed during normal operation, and an acoustic rating will be specified for the doors to reduce the leakage of the sound. As an acoustically enclosed space, the building envelope of the multi-purpose room is expected to provide robust sound attenuation of minimum R_w 30. In addition, the distance between the multipurpose space to the nearest residence is more than 60m with screening by the carpark building of the 10 Lincoln Crescent.

Assuming the sound pressure level inside the multi-purpose space is 95 dB(A), the resultant noise level at the nearest residential receiver at 10 Lincoln Crescent is predicted to be 30 dB(A) or less, which is significant lower than the background noise level. It is anticipated that sound break-out from the multi-purpose space is unlikely to be an acoustic issue.

The external space outside the multi-purpose space is not configured for outside activities. It is not anticipated to generate acoustic impact to the residents.

As such, additional acoustic treatments are not necessary for the multi-purpose space.

2.3 Environmental noise criteria

For the purpose of the SEARs assessment for the Sydney Modern Project, the industrial noise criteria are established based on the methodology provided in NSW Industrial Noise Policy. Long term noise monitoring was conducted at the various locations as shown below (Figure 2 of the Acoustic SEARs Report Rev H).



The environmental noise criteria for 10 Lincoln Crescent were established based on the noise monitoring results at Location 2 and Location 2A which are the most or potentially most affected noise sensitive location.

Noise from the existing substation is approximately 50-52 dBL_{A90, 15min} based on short-term measurements at Location 2B (on top of the residence roof close to substation). Given the noise from existing substation is steady state, it is determined that the background noise level is generally greater than the one monitored at Location 2A (50 dBL_{A90,day/evening} and 44 dBL_{A90,night}). The noise criteria proposed are based on the more onerous requirements from the measurements at location 2A and have therefore not been influenced by noise from the substation and future changes to that (e.g. if the substation is decommissioned) would not change the appropriate criteria.

2.4 Seawater heat exchange

Based on the preliminary mechanical design and equipment selection, the following sound power levels are used for acoustic assessment.

	Broadband sound power level	Sound Power Levels (dB) in Octave Band Centre Frequency, Hz								Remarks
	dBL _{Aeq}	63	125	250	500	1k	2k	4k	8k	
Pump (2 pumps are in operation)	79 per pump	69	70	72	72	75	72	68	62	The broadband sound level is based on the manufacturer's data. Spectrum is based on empirical data.
Fan	78	76	76	75	74	73	71	68	68	Based on the empirical data

As provided in the Acoustic SEARs Report Rev H, the following preliminary acoustic mitigation measures are recommended:

- Minimum 600mm long acoustic louvre for the air intake
- Minimum 25mm thick acoustic internal lining to the ducts and bends of the fan discharge.
- The building envelope should be constructed to meet minimum sound insulation rating of R_w 45. The current proposals for the plantroom construction will easily achieve this.
- Acoustic seals should be provided to the plant room door and the access panel
- Provision of appropriate vibration isolation measures beneath the pumps (e.g. inertia bases and open spring mounts)

The predicted sound pressure levels are given in the table below. A contingency of 3 dB has been included.

	Broadband sound pressure level	Sound Pressure Levels (dB) in Octave Band Centre Frequency, Hz								Compliance with criteria
	$dB L_{Aeq, 15min}$	63	125	250	500	1k	2k	4k	8k	
10 Lincoln Crescent closet residence (approx. 19m from louvre)	29 (including 3 dB contingency)	33	32	29	23	24	23	18	17	✓ (most stringent criterion: 41 dB $L_{Aeq, Night}$)
1m from above ground structure (The Domain)	50 (including 3 dB contingency)	55	55	51	44	44	43	38	38	✓ (criterion: 50 dB $L_{Aeq, period}$)

3 Acoustic barrier on land bridge

The acoustic barrier was purposed to reduce the traffic noise impact to the Function Centre and its outdoor function spaces on top of the land bridge.

We can confirm that the acoustic barrier on edge of land bridge is no longer required as the Function Centre no longer exists.

Yours sincerely,



Harvey Yang
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