

NOISE & VIBRATION IMPACT ASSESSMENT FOR S4.55

TOWER B, ONE ALFRED STREET, CIRCULAR QUAY

JHA

CONSULTING ENGINEERS

DOCUMENT CONTROL SHEET

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Key Contact	Mathew McGrory

Prepared By

Company	JHA Consulting Engineers
Address	Level 23, 101 Miller Street, North Sydney NSW 2060
Phone	+61-2-9437 1000
Email	mathew.mcgrory@jhaengineers.com.au
Website	www.jhaservices.com
Author	Cameron Nurse
Checked	Mathew McGrory
Authorised	Mathew McGrory

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1 INTRODUCTION

JHA Engineers has been engaged by Yuhu – AWH Investment Group to provide a noise impact assessment for the modifications proposed to the approved development located in One Alfred St, Circular Quay.

The extent of the modifications to the approved Development consists of the following:

- Increased number of hotel rooms
- Modifications to floor to floor levels
- Modifications to restaurant and bar
- Changes to the extent of roof area
- Re-location and modifications to plant rooms

The objectives of this acoustic assessment are to:

- Identify the external noise and vibration sources that will potentially affect the proposed development.
- Re-establish the appropriate noise level and vibration criteria in accordance with the relevant standards, guidelines and legislation
- Carry out a revised external noise assessment for the Bar & Restaurant located on Level 25 & 24 respectively
- Carry out an internal noise assessment based on the minor changes to the apartment mix and façade.
- Carry out a preliminary external noise assessment for the proposed changes to mechanical plant

This report provides:

- A statement of compliance with the relevant statutory criteria for the proposed use development within the vicinity of the nearest potentially affected receivers.
- Recommendations for noise mitigation measures for the proposed development in order to meet the relevant criteria when compliance is not achieved.

The following documentation has been used for the preparation of this report:

- Architectural drawings provided by Crone Architects
- Wanda Sydney Tower A Acoustic Report prepared by Arup dated 30th September 2016
- Wanda Sydney Acoustic Assessment for Entertainment Noise from Tower B dated 27/10/2016
- Wanda Sydney Tower B Acoustic Report dated prepared by Arup dated 27/10/2016
- DA Acoustic Assessment prepared by Acoustic Logic dated 15/06/2018
- Plan of Management & Security Management Plan prepared by Turner Townsend Thinc dated 24/01/2019

This document complies with JHA Consulting Engineers accreditations ISO 9001 Quality Management System and ISO 14001 Environmental Management System.

2 DESCRIPTION OF PROPOSAL

The proposed development is located at 1 Alfred St, Sydney with frontages to both Pitt St and Alfred St. The proposed development is bordered with the proposed residential development to the west (Tower A) and a proposed new commercial & licenced development located to the south. The primary noise sources on the site include the following:

- Road traffic noise from the Cahill Expressway, George St and Alfred St
- Train noise from Circular Quay Station
- Mechanical services noise from nearby buildings
- Light rail noise along Alfred Street (future)

A site map with the approximate site location is shown below in Figure 1.



Figure 1: Site Map and surrounding receivers

3 SITE MEASUREMENTS

The reported Rating Background Levels (RBLs) as summarised below in Table 1 are based on the measurements conducted by Acoustic Logic as reported in the approved acoustic report dated 15/06/2015.

These noise levels are still considered as representative of the site noise levels and are therefore considered valid for the purpose of this report.

Floor	Time	RBL
		$L_{A90,Period}$ dB(A)
Level 1	Day (7am-6pm)	64
	Evening (6pm-10pm)	64
	Night (10pm-7am)	61
Level 26	Day (7am-6pm)	65
	Evening (6pm-10pm)	65
	Night (10pm-7am)	64

Table 1: Rating Background Noise Levels

Further to the noise levels reported in Table 1, JHA has considered the various attended and un-attended noise surveys conducted by both Arup and Acoustic Logic as shown their documentation referenced in Section 1.

4 RELEVANT NOISE STANDARDS & GUIDELINES

The following standards and guidelines are considered relevant to the project and have been referenced in developing the project noise level criteria.

Noise Emissions and Intrusive Noise:

- NSW Liquor and Gaming. Noise conditions for licensed premises.
- City of Sydney Standard Conditions of Development Consent
- State Environmental Planning Policy (Infrastructure) 2007 (ISEPP)
- City of Sydney Council Development Control Plan (DCP) 2012
- NSW Rail Infrastructure Noise Guideline (RING)
- NSW EPA Noise Policy for Industry (NPI) 2017.

AS/NZS 2107:2016 – Recommended design sound levels and reverberation times for building interiors

4.1 NSW LIQUOR AND GAMING

The current noise conditions for licensed premises by the NSW Liquor and Gaming Authority are shown below.

- The L_{A10}^* noise level emitted from the licensed premises shall not exceed the background noise level (L_{A90}) 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 (L_{A90}) 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.

4.2 CITY OF SYDNEY COUNCIL – ENTERTAINMENT NOISE

(a) The LA10, 15 minute noise level emitted from the use must not exceed the background noise level (LA90, 15minute) in any Octave Band Centre Frequency (31.5 Hz to 8 kHz inclusive) by more than 5dB between the hours of 7.00am and 12.00 midnight when assessed at the boundary of any affected residence.

(b) The LA10, 15 minute noise level emitted from the use must not exceed the background noise level (LA90, 15 minute) in any Octave Band Centre Frequency (31.5 Hz to 8 kHz inclusive) between the hours of 12.00 midnight and 7.00am when assessed at the boundary of any affected residence.

(c) Notwithstanding compliance with (a) and (b) above, noise from the use when assessed as an LA10, 15 minute enters any residential use through an internal to internal transmission path is not to exceed the existing internal LA90, 15 minute (from external sources excluding the use) in any Octave Band Centre Frequency (31.5 Hz to 8 kHz inclusive) when assessed within a habitable room at any affected residential use between the hours of 7am and 12midnight.

Where the LA10, 15 minute noise level is below the threshold of hearing, T_f at any Octave Band Centre Frequency as defined in Table 1 of International Standard ISO 226: 2003- Normal Equal-Loudness-Level Contours then the value of T_f corresponding to that Octave Band Centre Frequency shall be used instead.

(d) Notwithstanding compliance with (a), (b) and (c) above, the noise from the use must not be audible within any habitable room in any residential use between the hours of 12.00 midnight and 7.00am.

The octave band inaudibility limits as per Condition (d) have been summarised below in Table 2.

Period	Criteria	Sound Pressure Level, dB re 20µPa								
		Overall dB(A)	Octave Band Centre Frequency, Hz							
			63	125	250	500	1k	2k	4k	8k
Midnight to 7:00am	Inaudibility	30	49	38	32	26	24	13	10	16

Table 2: Inaudibility Noise Limits

4.3 EXTERNAL NOISE EMISSIONS CRITERIA

The project noise criteria for external noise emissions not related to entertainment noise is summarised below in Table 3. These external noise criteria have been based on the noise monitoring and criteria established in the approved acoustic report prepared by Acoustic Logic dated 15/06/2015.

These criteria are still deemed as acceptable for use.

<i>Receiver</i>	<i>Period</i>	<i>Intrusiveness Criterion</i> <i>L_{Aeq, 15min} dB(A)</i>	<i>Amenity Criterion</i> <i>L_{Aeq, Period} dB(A)</i>	<i>Project Noise Criteria</i> <i>L_{Aeq, Period} dB(A)</i>
<i>Residential</i>	Day (7am-6pm)	69	60	60
	Evening (6pm-10pm)	69	50	50
	Night (10pm-7am)	66	45	45
<i>Commercial</i>	Day (7am-6pm)	-	59	59
	Evening (6pm-10pm)	-	59	59

Table 3: Project Noise Criteria

Further to the project noise criteria shown above in Table 3, the noise into outdoor occupied areas are recommended to meet a noise level of 55dB(A) $L_{Aeq,15min}$ in order to not affect the acoustic amenity of the users.

4.4 INTERNAL NOISE LEVELS

The internal noise criteria will be designed in general accordance with the Australian Standard 2107:2016 "Acoustics- Recommended Design Sound Levels and Reverberation Times for Building Interiors", which also aligns with the Green Star Requirements and City of Sydney DA Conditions. The internal noise level requirements are shown below in Table 4.

Type of occupancy / activity	Maximum of Design Sound Level ($L_{Aeq,T}$, dB(A))
Guest room (Daytime)	32
Guest room (Night-time)	27 [L_{Amax} 45 dB(A)]
Grand Ballroom	40
Meeting Rooms	35 [L_{Amax} 50 dB(A)]
VIP Lounge and Room	40
Gymnasium / Spa / Swimming Pool	40
Dining / Café / Bar	40
Retails	40
Guest floor corridor / Lobby / Reception / Pre-function	40
Change rooms / toilets	45

Table 4: Design Sound Levels for areas relevant to the proposed development.

In addition to the internal noise levels shown above, the internal noise levels associated with the operation of the Tower B bar and restaurant have been noted not to exceed the following values.

Habitable Area in Apartment	Assumption of Building Noise Level	Octave Band Centre Frequency (Hz), dB							
		63	125	250	500	1k	2k	4k	8k
Bedroom/Living Room	38dB(A)	49	38	32	26	24	13	10	16

Table 5: Internal Noise Criteria for Nearest Sensitive Receiver

5 NOISE IMPACT ASSESSMENT & RECOMMENDATIONS

5.1 OVERVIEW

Based on the expected operations of the proposed development, the following items have been considered within the acoustic assessment:

- Noise emissions from patrons and background music for the proposed Bar & Restaurant
- Noise emissions from mechanical plant from the development to the surrounding receivers

5.2 LEVEL 25 BAR NOISE

Based on the proposed modifications to the Level 25 Bar, a revised noise assessment has been conducted. Noise emissions from the proposed bar have been assessed at the nearest noise sensitive receivers (Tower A). The noise assessment has considered the following assumptions:

- Maximum 420 patrons as per Plan of Management
- Bar & Restaurant operational hours as per Plan of Management
- The vocal efforts of patrons communicating are “raised” speech to provide a worst case scenario.
- Background music limited to 106dB(A) SWL
- Reverberation times within Australian standards (consideration for acoustics for internal finishes)
- No speakers located in uncovered areas
- Calculation at most affected point of receiver
- Glazing on Tower A as per recommendations provided within the Tower A Acoustic Report for S4.55 dated 29/01/2019
- Sound Insulation rating of Glazing as per Appendix 1
- Sound Insulation rating of operable roof R_{w21} as shown in Table 8

For the noise assessment, sound power levels have been derived as per Hayne et al technical paper¹. The calculations have been conducted using 3D acoustic modelling (Soundplan 8.0) under neutral weather conditions.

The Sound Power Levels used within the assessment are summarised below in Table 6.

Noise Source	Sound Power Level, dB re 1pW									
	Overall dB(A)	Octave Band Centre Frequency, Hz								
		31.5	63	125	250	500	1k	2k	4k	8k
L ₁₀ 420 patrons “raised” vocal effort	110	96	98	100	101	108	106	102	95	91
Background music	106	100	100	101	103	100	102	99	93	86

Table 6: Sound power levels for people talking with “raised” vocal effort.

¹ Prediction of noise from small to medium sized crowds. M.J. Hayne et al. Proceedings of AAS 2011.

Parameter	Overall dB(A)	Octave Band Centre Frequency, Hz							
		63	125	250	500	1k	2k	4k	8k
Noise from music & patrons (SWL)	112	102	104	105	109	108	104	97	92
Resulting level at residential boundary	68	61	60	62	66	65	60	51	43
Project Noise Criteria 7am to 12am (External)	70	70	71	65	66	67	62	52	38
Complies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No*

Table 7: Assessment of Level 25 Bar Noise - 7am to 12am

Note*: Due to the frequency of the exceedance, the noise is not expected to adversely affect the amenity of the receiver.

Parameter	Overall dB(A)	Octave Band Centre Frequency, Hz							
		63	125	250	500	1k	2k	4k	8k
Noise from music & patrons (SWL)	112	102	104	105	109	108	104	97	92
Sound Reduction of Operable Roof		-7	-8	-12	-16	-21	-25	-23-	-23
Resulting level at residential boundary		54	52	50	50	44	35	28	20
Project Noise Criteria 12am-7am (External)	64	64	65	59	60	61	56	46	32
Complies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 8: Assessment of Level 25 Bar Noise - 12am to 7am

Parameter	Overall dB(A)	Octave Band Centre Frequency, Hz							
		63	125	250	500	1k	2k	4k	8k
Noise from music & patrons (SWL)	112	102	104	105	109	108	104	97	92
Sound Reduction of Operable Roof		-7	-8	-12	-16	-21	-25	-23-	-23
Tower A glazing as per acoustic report		-26	-26	-27	-39	-46	-49	-53	-53
Resulting level within habitable space of nearest receiver (SPL)	19	30	28	25	13	0	0	0	0
Project Noise Criteria 12am-7am (Internal)	30	49	38	32	26	24	13	10	16
Complies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 9: Internal Noise Assessment of Level 25 Bar Noise - 12am to 7am

5.3 LEVEL 24 RESTAURANT NOISE

Based on the proposed modifications to the restaurant a revised noise assessment has been conducted. The revised noise assessment has been calculated at the nearest noise sensitive receivers (Tower A). The noise assessment has considered the following assumptions

- Maximum 364 patrons as per Plan of Management
- Operational hours as per Plan of Management
- The vocal effort of patrons communicating are “raised” speech to provide a worst case scenario.
- Background music limited to 106dB(A) SWL
- Reverberation times within Australian standards (consideration for acoustics for internal finishes)
- Calculation at most affected point of receiver
- Glazing on Tower A as per recommendations provided within the Tower A Acoustic Report for S4.55 dated 29/01/2019
- Sound Insulation rating of Glazing as per Appendix 1

For the noise assessment, sound power levels have been derived as per Hayne et al technical paper². The Sound Power Levels used within the assessment are summarised below in Table 10.

Noise Source	Sound Power Level, dB re 1pW									
	Overall dB(A)	Octave Band Centre Frequency, Hz								
		31.5	63	125	250	500	1k	2k	4k	8k
L ₁₀ 364 patrons “raised” vocal effort	109	95	97	99	100	107	105	101	94	90
Background music	106	100	100	101	103	100	102	99	93	86

Table 10: Sound power levels for people talking with “raised” vocal effort.

Parameter	Overall dB(A)	Octave Band Centre Frequency, Hz							
		63	125	250	500	1k	2k	4k	8k
Noise from music & patrons (SWL)	111	101	102	103	105	108	107	103	97
Sound Reduction of Glazing as per Appendix 1		20	23	28	32	35	37	47	47
Resulting level at residential boundary	47	55	51	44	41	43	41	27	20
Project Noise Criteria 12am-7am (External)	64	64	65	59	60	61	56	46	32
Complies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 11: Assessment of Level 24 Restaurant Noise - 12am to 7am

² Prediction of noise from small to medium sized crowds. M.J. Hayne et al. Proceedings of AAS 2011.

Parameter	Overall dB(A)	Octave Band Centre Frequency, Hz							
		63	125	250	500	1k	2k	4k	8k
Noise from music & patrons (SWL)	111	101	102	103	105	108	107	103	97
Sound Reduction of Glazing as per Appendix 1		20	23	28	32	35	37	47	47
Tower A glazing as per acoustic report		-26	-26	-27	-39	-46	-49	-53	-53
Resulting level within habitable space of nearest receiver (SPL)	14	30	26	18	3	0	0	0	0
Project Noise Criteria 12am-7am (Internal)	30	49	38	32	26	24	13	10	16
Complies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 12: Internal Noise Assessment of Level 24 Restaurant Noise - 12am to 7am

5.4 EXTERNAL NOISE EMISSIONS FROM MECHANICAL PLANT

A preliminary review has been undertaken for the mechanical services based on the proposed design modifications and change of plant locations/plant equipment. Based on the assessment, the noise limits from the proposed plant and their locations are able to be practically achieved, however noise controls will need to be considered and implemented throughout the detailed design stage.

Usual design noise controls that may need to be implemented will typically include, but are not limited to:

- Strategic location and selection of plant to ensure the cumulative noise levels at the receiver boundaries is met.
- Selection of appropriate quiet plant.
- Acoustic noise control measures to be put in place to minimise noise impacts such as:
 - In-duct attenuation
 - Noise enclosures as required
 - Sound absorptive panels
 - Acoustic louvres as required
 - Noise barriers as required

5.5 INTERNAL NOISE

3D acoustic modelling for external noise intrusion from the surrounding roads, rail & entertainment venues has been conducted using the software SoundPlan (Version 8.0). Noise levels from the road were calculated in accordance with the Calculation of Road Traffic Noise (CoRTN) methodology using the traffic volumes shown provided by RMS. A façade analysis was conducted using EN 12354-3:2000: "Building Acoustics – Estimation of Acoustic Performance of Buildings from the Performance of Elements – Part 3: Airborne Sound Insulation against Outdoor Sound". This façade analysis was based on the following:

- Detailed noise survey conducted by Arup & Acoustic Logic
- Receivers within the residential apartments have been located at 1.5m above ground level.
- Shielding provided by the balconies to each apartment.
- Apartment areas based on architectural drawings provided by Kerry Hill Architects
- No specific meteorological characteristics such as dominant wind direction and speed or temperature
- Noise levels in accordance with City of Sydney Entertainment Noise Conditions assumed for the Jacksons on George re-development
- Estimated noise levels from Tower B Restaurant & Bar (assumed in compliance with relevant noise requirements)
- Expected noise levels from the new Sydney Light Rail

Based on the analysis, the acoustic performance requirements are shown in Appendix 1. Further to the analysis, recommended glazing systems and their corresponding sound insulation performance are presented below in Table 13.

<i>Weighted Sound Reduction Index R_w</i>	<i>Fixed Single Glazing System</i>	<i>Fixed Double Glazing System</i>
30	6mm Float	-
32	6.38mm laminated	6mm/12mm air gap/6mm
35	10.38mm laminated	6mm/12mm air gap/10mm
37	12.38mm laminated	6mm/12mm air gap/10.38mm
41	-	6mm/12mm air gap/10.76mm
44	-	10mm/16mm air gap/10.5mm Vlam Hush

Table 13: Recommended glazing

6 CONCLUSION

A noise assessment has been carried as part of the proposed modifications to the Tower B development located at 1 Alfred St, Sydney. This forms part of the documentation package to be submitted to local authorities as part of the S4.55 process.

This report establishes relevant noise level criteria, details the acoustic assessment and provides comments and recommendations for the proposed development.

External noise emissions associated with the operation of the bar and restaurant have been assessed in accordance with the NSW Liquor and Gaming Authority & City of Sydney Council Entertainment Noise criteria. The predicted noise levels demonstrate that the operations of the Level 25 Bar & Level 24 Restaurant are expected to meet the noise criteria.

A preliminary acoustic assessment of mechanical services plant has been conducted. Based on the assessment, recommendations have been provided to minimise the impact of external noise emissions at the nearest sensitive receivers in accordance with the requirements as set out in Section 4.

Based on the information presented within this report, relevant objectives will be satisfied and therefore approval is recommended to be granted.

APPENDIX 1 – ACOUSTIC GLAZING MARK-UPS

















