

Sydney Opera House  
**Lower Concourse**  
Operational Noise and Vibration  
Management Plan

AC04

Issue | 6 August 2020

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 261809-00

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# Document verification

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# 1 Introduction

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This Operational Noise and Vibration Management Plan (ONVMP) has been prepared by Arup Pty Ltd (Arup) on behalf of the Sydney Opera House (SOH).

This plan is a requirement of SSD 9794 (Condition D3) approved by the Minister for Planning and Public Spaces on 8 May 2020 for minor works and uses at the Lower Concourse of the SOH. The Plan must be approved by the Secretary of the Department of Planning and Environment (DPE) and implemented following its approval. A copy of the approved ONVMP must be submitted to City of Sydney Council and the Environment Protection Agency (EPA).

The ONVMP presents a set of noise and vibration management strategies to minimise any possible adverse noise and vibration impacts from operational uses of the Lower Concourse spaces at the SOH and is applicable to the consolidated Lower Concourse uses, including the current operations of restaurant and bar areas and the Visitor Information and Interpretation Centre.

The design objectives and strategies in this ONVMP are largely based on the “Operational and Construction Noise Impact Assessment (Rev 5)” prepared by Arup dated 21 January 2020.

There are no vibration sources which may cause perceivable vibration impacts at the nearest affected sensitive receivers. On that basis, vibration impacts will not be discussed in this ONVMP.

## 1.1 Site description

The site is located on the Bennelong Point peninsula in Sydney Harbour and is near to a major passenger ferry terminal, Circular Quay - a lively area with pedestrian noise, outdoor restaurants and buskers. Ferry noise is distinctly audible from 5am to 1am. Aircraft noise from low lying helicopters, commercial seaplanes and passenger aircraft can be heard from time to time.

The area around the SOH is effectively pedestrianised although there are some occasional deliveries and drop-offs that visit the southern end of the site. Deliveries are generally via the underground loading dock at the southern end of the site. Most of the traffic visiting the site accesses the adjacent car parking via an underground route.

The site is characterised by general pedestrian activity and noise from the harbour activity, with occasional aircraft movements. The background noise environment also contains traffic noise from the Cahill Expressway (located to the south and west on the Harbour Bridge) and rail noise from the Harbour Bridge (located to the west).

The SOH is a world heritage building and an iconic Sydney landmark located within a vibrant urban environment. The Opera House site has a long history of operating community and ticketed outdoor events. Such events are held on the nearby Forecourt, Monumental Steps and Western Broadwalk.

## 1.2 Development description

The development consent has approved the consolidation of all Lower Concourse uses, including the current operations of restaurant and bar areas and the Visitor Information and Interpretation Centre.

Opera Bar is a licenced premise with capacity for up to 1,800 patrons. The premises are expected to hold catering of food and beverage and host events with live music.

Opera Kitchen is a licenced premise with capacity of 570 patrons. Background music is played throughout the venue via a public address (PA) system.

The Visitor Information and Interpretation Centre is located on the north end of the Lower Concourse with capacity of 330 patrons. There is no live music or fixed PA system in this space.

### 1.2.1 Hours of operation

The hours of operation are restricted as follows:

- Bar and restaurant areas
  - (a) 7:30 am to 12 midnight Sunday to Thursday (inclusive);
  - (b) 7:30 am to 1:30 am Friday to Saturday (inclusive);
  - (c) 7:30 am New Year's Eve to 2:30 am New Year's Day (for the area currently trading as Opera Bar); and
  - (d) 7:30 am New Year's Eve to 2:00 am New Year's Day (for the area currently trading as Opera Kitchen).
- Visitor Information and Interpretation Centre
  - (e) 7 am to 11 pm Monday to Sunday (inclusive).

## 2 Noise management objectives

The ONVMP has been prepared in accordance with the NSW Noise Policy for Industry (NPI) in the sense that it provides best management practices and best available technology economically available to reduce noise at the source. However, note the development consent does not include any modification of addition of industrial noise sources for the uses in the Lower Concourse.

The NSW NPI explicitly does not apply to amplified music/patron noise from premises including those licensed by Liquor and Gaming NSW however, applicable criteria requirements are considered as part of the requirements in Condition E6 and further discussed in Section 2.2.

### 2.1 Noise sensitive receivers

The nearest residential noise sensitive receivers (Bennelong apartments) are located at 1 Macquarie Street, Sydney, shown in Figure 1.

The next nearest residential receivers are the Kirribilli apartments, located around 700 m across the harbour to the north of the site.



Figure 1: Closest noise sensitive receivers (image courtesy of Google Maps)

## 2.2 Noise level limits

Condition E6 in the development consent (provided below for reference) require the following noise limits apply to the development:

*E6. Noise emanating from the premises must not give rise to any one or more of the following:*

- (a) transmission of “offensive noise” as defined in the Protection of the Environment Operations Act 1997 to any place of different occupancy;*
- (b) the  $L_{A10}$  noise level must not exceed the background noise level in any Octave Band Centre Frequency (31.5Hz-8kHz inclusive) by more than 5 dB between 7 am and 12 midnight at the boundary of any affected residence;*
- (c) the  $L_{A10}$  noise level emitted must not exceed the background noise level in any Octave Band Centre Frequency (31.5Hz-8kHz inclusive) between 12 midnight and 7 am at the boundary of any affected residence; and*
- (d) notwithstanding compliance with (a), (b) and (c) above, all noise associated with the premises must not be audible within any habitable room in any residential premises between the hours of 12 midnight and 7 am, except for between midnight and 02:00AM on 1 January of each year, when the prescribed  $L_{A10}$  noise controls for the hours of 07:00 am and 12:00 midnight shall continue to apply.*

*Live music in the area currently trading as Opera Bar area must cease by 10 pm, seven-days-per-week.*

*No live music is permitted in the areas currently trading as Opera Kitchen or the Visitor Information and Interpretation Centre.*

*After 10:00 pm all amplified music must be played through a limiter, in conjunction with a system that ensures compliance with the liquor licensing conditions and the noise limits in this condition.*

*No amplified music is to be played in the area currently trading as the Visitor Information and Interpretation Centre at any time.*

The criteria relevant to the current operations of the Lower Concourse at the nearest noise sensitive receiver identified in Section 2.1 (Bennelong apartments) is summarised in Table 1.

It is noted the criteria for the Bennelong apartments is applied *within* any habitable spaces in the building complex with doors and windows closed and mechanical ventilation in operation. As per NSW Noise Policy for Industry, the internal criteria refer to the noise level at the centre of the habitable room that is most exposed to the noise and apply with windows closed where alternative means of ventilation complying with the Building Code of Australia are provided.

Table 1: Project specific operational noise criteria

Receiver – Bennelong apartments	Period	Time	Sound Pressure Level at receiver, $dBL_{A10,15min}$									
			dB(A)	Octave Band Centre Frequency, Hz								
				31.5	63	125	250	500	1k	2k	4k	8k
Building boundary	Day	7:00am to 6:00pm	63	70	68	65	61	59	58	56	52	46
	Evening	6:00pm to 10:00pm	62	68	69	63	58	57	56	56	53	48
	Night <sup>1</sup>	10:00pm to 12:00am	61	71	69	64	60	59	57	51	43	35
	Night <sup>2</sup>	12:00am to 7:00am	48	58	56	51	47	46	44	38	30	22
Inside	all times <sup>3</sup>	N/A	36	58	47	41	36	35	30	23	17	17

<sup>1</sup> Night-time period is separated into 10:00pm to 12:00am and 12:00am to 7:00am as Liquor Licence provides criteria for the night-time period before and after midnight.

<sup>2</sup> Notwithstanding compliance with the night-time criteria, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of 12:00am and 07:00am

<sup>3</sup> These are based on the measured internal background noise levels which are assumed to be dominated by building services noise and therefore not affected by time of day. The criteria for operation up to 12:00am are based on the measured level  $L_{90}+5dB$

## 2.3 Operational noise and vibration sources

The following noise sources within the development are identified as requiring consideration for operation of the proposed development:

- Patron noise
- Amplified music equipment

Operational management strategies for each of the above are discussed in the following sections.



## 3 Operational noise management

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Patron and amplified music noise associated with operations of the Lower Concourse has the potential to impact noise sensitive receivers external to the proposed development. The following sections discuss the expected noise impacts and provide operational management options for each.

### 3.1 Noise to the environment

Noise emission from groups of people is variable and difficult to predict, particularly for informal settings such as outdoor events. Calculation of noise impacts from the following noise sources within the Lower Concourse have been undertaken based on typical occupancy under the current operations in the Lower Concourse throughout the summer, when higher occupancy numbers are expected:

#### Daytime opening hours

- Number of patrons: 1300, during summer afternoon (12:00pm – 6:00pm)
- Outdoor area in use at restaurant and bar areas and Welcome Centre
- PA system for announcements and live music

#### Evening opening hours

- Number of patrons: 2350, during summer evening (6:00pm – 10:00pm)
- Outdoor area in use at restaurant and bar areas
- PA system for announcements and live music

#### Night-time opening hours

- Number of patrons: 2350, during summer night (10:00pm – 12:00am)
- Outdoor area in use at restaurant and bar areas
- PA system for announcements and background music

The predicted noise levels are not expected to exceed the noise level limits outlined in Section 2.2 at the nearest affected noise sensitive receiver, considering outdoors use of the sound system for live music must cease by 10pm. This is an expected conclusion given that there is no material change to the external activity and that the architectural changes would only serve to reduce noise (albeit by a small amount).

### 3.2 Noise management measures

Notwithstanding predicted compliance with the noise limits established in this ONVMP, the potential for disturbance from music and patron noise within the Lower Concourse spaces can be minimised by the following management measures:

### 3.2.1 Patron noise

- Posting notices reminding guests to keep their noise down, particularly late in the evening and when they are leaving.
- Keeping to the hours of operations.
- Signs to remind guests to be mindful of noise generation.

### 3.2.2 Amplified music equipment

- All amplified music equipment (including the proposed diffuse speaker array system to be erected with the new shade sails) to be designed, constructed and operated to satisfy the normal requirements of Liquor and Gaming NSW, in consultation with Liquor and Gaming NSW during the design phase. Including but not limited to:
  - Limiting live music performance to the area currently operating as bar areas.
  - Limiting live music performance to no later than 10:00pm seven-days-per-week.
  - Limiting amplified music to the area currently operating as restaurant and bar areas.
  - Including noise limiting devices to music amplification equipment to regulate background music noise levels after 10:00pm.
  - Regulation of music levels via careful monitoring by a responsible person at all times.
  - The sound level from music amplification equipment is recommended to be set to a maximum sound pressure level of 80 dB  $L_{Aeq}$  at normal hearing height per table when playing live music and 70 dB  $L_{Aeq}$  when playing back recorded background music. This level can be pre-set during the commissioning of the sound system. Procurement of a sound level meter is recommended to allow management to measure the existing or new PA system and ensure compliance with the recommended maximum sound pressure level.
  - Appropriate specification of any associated sound system to limit low frequency content.
  - Careful positioning and directing of loudspeakers away from noise sensitive areas.

## 3.3 Staff training

Staff at the Lower Concourse are to be trained in appropriate procedures to:

- Coordinate the use of PA systems with SOH sound staff to be aware of periods of time when live music is allowed to occur.
- Inform door staff / security staff of requirements to manage rowdy behaviour.
- Inform performers, hirers, door staff / security staff of requirements for live music and operating hours and to enforce the requirement for live performance to stop at 10:00pm.

- Maintain records of any complaints received and documenting activities that were taking place at the time of the complaint.

### 3.4 Rowdy behaviour

People congregating across the Lower Concourse uses and exiting or entering the venues particularly towards the end of an evening when they have consumed alcohol, can lead to raised voices and shouting.

This can be minimised by posting notices close to exit paths, requesting guests to leave and disperse quietly.

It is noted that the Management of the premises is required to actively manage entrances and exits. If directed by the Planning Secretary or Council or the NSW Police, the Management is to employ private security staff, such staff would be in a position to assist in the management of rowdy patrons.

### 3.5 Deliveries and waste collection

There is unlikely potential for noise disturbance from loading/unloading and vehicles manoeuvring, on site for deliveries and waste collection. These activities are anticipated to be carried out via the loading dock consistent with current operations and will not significantly differ from the current delivery and waste collection strategies implemented at the SOH. We are not aware of any issues with noise from deliveries associated with the development.

### 3.6 Operational plan of management

The Sydney Opera House is required by the conditions of development consent (SSD 9794) to have an Operational Plan of Management (OPM). This ONVMP will be an attachment to the approved OPM. The OPM details the hours of operation for the Lower Concourse, including those hours when liquor will be available for supply, along with a detailed complaints procedure.

## 4 Noise and vibration monitoring

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In line with Condition E7, attended noise monitoring at the nearest affected noise sensitive receiver shown in Section 2.1 must be carried out:

- At least twice before 8 May 2021;
- On a Friday or Saturday night;
- Between December and February;
- At both 8:00pm and 11:00pm.

If directed by the Planning Secretary at any other time, SOH must undertake noise monitoring to confirm compliance with the noise limits in Section 2.2.

### 4.1 Equipment

- Measurements of noise levels shall be undertaken with Type 1 sound level measuring equipment, compliant with AS IEC 61672.1 for sound-level meters.
- The sound level meters calibration shall be current (detailed provided in test reports) and the reference calibration checked prior to and following measurement surveys. A calibrator complying with AS IEC 60942 shall be used.

### 4.2 Measurements

- Measurements shall be undertaken at the nearest noise affected noise sensitive receiver following the methodology outlined in AS/NZS 2107:2016
- For any enclosed spaces the testing shall be carried out with all windows and doors closed and building services operating in normal condition. Where this is not practicably achieved, it shall be reported and appropriately justified.
- All measurements shall be reported, not averaged.
- A minimum 60-minute measurement period is required. All extraneous noise shall be excluded.
- $L_{eq}$  and  $L_{90}$  sound pressure levels shall be recorded and reported in broadband and octave bands between 31.5 Hz and 8 kHz inclusive.
- Measurements shall be carried out with building services equipment off to establish the background sound levels. Background measurements must be recorded and reported.

### 4.3 Reporting

A noise compliance assessment report must be submitted to the Planning Secretary and the EPA within two weeks of the completion of monitoring. The assessment must be prepared by a suitably qualified and experienced acoustical consultant and include the following information in compliance with Condition E7:

- the dates and times the monitoring occurred;
- the activities that were occurring on land administered by the Applicant during the monitoring;
- the noise-generating activities occurring in the vicinity that are **not** related to current operations of the Lower Concourse restaurant and bar areas and Visitor Information and Interpretation Centre
- an assessment of compliance with noise limits presented in Section 2.2; and
- an outline of any management actions taken within the monitoring period to address any exceedances of the limits contained in Section 2.2.

Additionally, the following information must also be included:

- Description of space(s) being measured (ambient conditions, maps, photos and diagrams etc.).
- All measurement results (including unweighted octave band results, measurement times and locations).
- Information on any relevant noise sources audible at the time of measurement.
- Name and organisation of person conducting the measurement
- Where exceedances are identified, the cause of exceedance shall be identified, and a rectification strategy/plan outlined.
- Report on any spectral imbalance or tonality characteristics as referred to in AS/NZS 2107:2016

## 4.4 Noise mitigation measures

Noise mitigation measures such as the vertical barriers around the small stage at the southern end of the Opera Bar are excluded from the recommendations of this ONVMP in line with the findings presented in the “Operational and Construction Noise Impact Assessment (Rev 5)” prepared by Arup dated 21 January 2020.

## 5 ONVMP review

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In line with the noise and vibration monitoring requirements outlined in Condition E7 and provided in Section 4 of this ONVMP, in the event that compliance with the noise limits is not demonstrated via the noise compliance assessment, suitable attenuation measures must be implemented to achieve compliance and this ONVMP will be updated to include such measures.



Mr Peter Doyle  
Project Manager  
Renewal Statutory Planning  
GPO Box 4274  
SYDNEY NSW 2001

07/08/2020

Dear Mr Doyle

**Lower Concourse Minor Works and Uses, Sydney Opera House (SSD 9794)  
Operational Noise and Vibration Management Plan**

I refer to the Operational Noise and Vibration Management Plan which was submitted in accordance with Condition D3 of Schedule 2 of the above development consent (SSD 9794).

The Department has carefully reviewed the document and is satisfied that it is adequate because it:

- has been prepared in consultation with Council and the EPA
- identifies all key sources of operational noise and vibration
- provides details of all reasonable and feasible management and mitigation measures to be implemented to minimise noise and vibration
- is consistent with and incorporates all relevant recommendations and mitigation measures outlined in the acoustic assessment provided to the Department during the assessment of the application
- includes a requirement for all amplified music equipment to be designed, constructed and operated to satisfy the normal requirements of Liquor and Gaming NSW
- includes a suitable proactive noise and vibration monitoring program.

Accordingly, as nominee of the Planning Secretary, I endorse the Operational Noise and Vibration Management Plan (Revision Issue AC04, dated 6 August 2020). Please ensure that the approved plan is placed on the project website at the earliest convenience.

If you wish to discuss the matter, please contact Karl Fetterplace on 9274 6263.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Anthony Witherdin'.

Anthony Witherdin  
Director  
Key Sites Assessments

As nominee of the Planning Secretary