

Level 5  
151 Clarence Street  
Sydney NSW 2000  
Australia  
[www.arup.com](http://www.arup.com)

t +61 2 9320 9320  
f +61 2 9320 9321  
d +61 2 9320 9281

---

Project title    **Sydney Opera House Renewal**

Job number

257966-00

---

cc                **Peter Doyle**  
                    **Nick Boulter**

File reference

TN002

---

Prepared by    **Daniel Jimenez**

Date

26 October 2018

---

Subject                **Noise Impact Assessment for construction of “Thrust Block”**

---

## 1                **Introduction**

---

This Technical Note presents the noise impact assessment of the construction activities related to the inclusion of a “thrust block” to prevent movement of the north-south tie beams which will need to be cut to allow the installation of the Utzon Stairs escalators.

This assessment is presented to support the application of a Section 4.55 (1A) modification (NSW EP&A Act) to SSD7665 (Joan Sutherland Theatre Accessibility and Additional Works and Front of House Works) and should be read in conjunction with the Sydney Opera House Building Renewal EIS Application SSD7665.

A glossary of acoustic terminology has been included for reference.

## 2                **Summary**

---

The assessment of noise levels has shown that construction noise expected from construction activities related to the inclusion of a “thrust block” are not likely to have adverse impacts on noise sensitive receivers around the site provided the following recommendations are met:

- Following recommendations regarding noise mitigation provided in Section 7.5 of the Noise Impact Assess for DA3 – DDS 8663 (EIS Appendix 6) (i.e. Recommended universal work practices for construction noise mitigation and noise mitigation recommendations for demolition activities)
- Limiting external works at night to only those that are required because of the delivery of items that cannot be accommodated at other times.
- Preparing a Construction Noise Management Plan.

# Technical Note

257966-00

26 October 2018

## 3 Hours of work

Construction works related to the construction of thrust block “Thrust Block” are to be carried out during the following periods:

- External Works: (Intra-day respite periods will be scheduled where required during the noisy works on the Forecourt)
  - Monday to Friday 0700 – 1800;
  - Saturday 0800 – 1300
- Internal Works (which are not audible outside of the building):
  - Monday to Saturday 2330 – 1030

## 4 Criteria

### 4.1 Construction Noise

In line with the Noise Impact Assessment for the Building Renewal project, Table 1 presents a summary of the construction noise criteria established for the project based on the management levels for noise at noise sensitive receivers in the Interim Construction Noise Guideline.

Table 1: ICNG screening criteria for SOH Construction Works, dB re 20µPa

Receiver	Time Period	Noise Affected Level, $L_{Aeq}(15min)$	Highly Noise Affected Level, $L_{Aeq}(15min)$
Bennelong Apartments	Day (standard hours)	68 dB	75 dB
	Day (outside hours)	63 dB	68 dB
	Evening	62 dB	67 dB
	Night	53 dB	58 dB
Kirribilli	Day (standard hours)	64 dB	75 dB
	Day (outside hours)	59 dB	64 dB
	Evening	57 dB	62 dB
	Night	51 dB	56 dB
Potts Point	Day (standard hours)	61 dB	75 dB
	Day (outside hours)	56 dB	61 dB
	Evening	56 dB	61 dB
	Night	50 dB	55 dB

#### 4.1.1 Sleep disturbance

The sleep disturbance criteria of  $L_{A1}(1min) \leq L_{A90}(15min) + 15dB(A)$  is to be used for initial assessment. It is noted that the background  $L_{A90}(15minute)$  noise level used for establishing the sleep disturbance criteria includes all background noise including noise from the project.

# Technical Note

257966-00

26 October 2018

The sleep disturbance criteria for the project are presented in Table 2

Table 2: Sleep disturbance criteria

Receiver	Sleep disturbance criteria, 10pm - 7am, , $L_{A1,1min}$ , dB(A)
	$L_{A90(15min)} + 15$
Bennelong Apartments	63 dB
Kirribilli	61 dB
Potts Point	60 dB

## 5 Construction Noise

Based on the current information available, the following activities are understood to take place as part of the “thrust block” construction methodology:

1. Site setup – approx. 2 weeks
  - Erect a site hoarding (Class 1 Ply with concrete / jersey kerb bases)
  - Allow to protect existing granite during excavation and drilling of rock anchors
  - Set up survey targets and continually monitor as per the requirements on Arup’s documentation
  - Allow for and complete a services search
2. Demolition of existing slab – approx. 3-3.5 weeks
  - Carefully remove the granite slabs and setts (Assuming they will be reused)
  - Saw cut and demolish existing concrete slab by means of concrete sawing
  - Excavate (high impact noise works such as rock hammering is considered in the assessment) for thrust block (sandstone) and remove all spoil from site.
  - VSL anchors
3. Concreting and reinstallation of paving (minimal noise) – approx. 2-3 weeks
  - Reinforcement
  - Concrete
  - Tension VSL anchors
  - Replace granite slabs and setts (Provide for access to install flat jacks without major disruption to forecourt or removal of excess paving)
  - Remove hoarding and clean site
  - Flat jacks between the thrust block and the tie beam may be required if there is excessive movement when the tie beam is cut for the installation of the escalators.

Table 3 summarises the construction source levels and the major items of construction equipment modelled for each major construction activity. The source noise levels include an additional 5 dB to those activities identified in the Interim Construction Noise Guideline as being particularly annoying to noise sensitive receivers:

# Technical Note

257966-00

26 October 2018

Table 3 Thrust block construction Activities, SOH Building Renewal Works

Activity	Construction Equipment	Activity Sound Power Level, dB re 1pW
Demolition of existing slab	Core drill Demolition concrete saw (for cutting into existing slabs) Hand-held pneumatic breaker (for rock hammering) Small excavators/bobcats/forklifts (electric). Bobcat with nibbler	$L_{Aeq,adj,15min}$ 124 dB
Concreting	Concrete trucks Concrete pumps Vibrators Excavators – loading dump truck	$L_{Aeq,adj,15min}$ 109 dB

## 6 Predicted Noise Levels

It is not anticipated for demolition and construction activities to occur outside of the daytime period. However, in the case of activities requiring evening or night-time works it is recommended the construction methodology includes ‘respite periods’ in accordance with the Interim Construction Noise Guideline Section 4.5.

It is noted there is potential to exceed the noise affected level at the residential apartments in Bennelong during the evening and night-time periods. It is recommended that construction activities related to the demolition of the existing slab are limited to the daytime hours only.

Construction noise levels have been predicted for the sources given in Table 3 using a spreadsheet based noise model developed for the SOH Building Renewal Works Package 2 projects. The predictions generally implemented the CONCAWE environmental noise model, which allows prediction under adverse meteorological conditions to be made, with the exception of the ground effect component. CONCAWE was developed for propagation over sound-absorbing terrain (acoustically-“soft” ground) whereas the propagation geometry for the most-affected receivers from the SOH is mainly over acoustically-reflective (“hard”) ground – i.e. pavement or water. To account for this, the ground effect component from the ISO 9613.2 noise model has been used.

Noise levels have been predicted under neutral (“still”) meteorological conditions to show the average expected noise levels and to allow ready comparison of the relative impacts between individual activities; as well as under adverse (“downwind”) conditions to indicate the potential increase in noise level under adverse conditions.

# Technical Note

257966-00

26 October 2018

Table 4 Predicted construction noise levels at the nearest noise sensitive receivers

Source Location	Activity	Receiver	Predicted Construction Noise Level, dB L <sub>Aeq,adj,15min</sub>	Noise Affected Level, dB(A)		
				Day	Evening	Night
Monumental steps	Demolition of existing slab	Bennelong	58 - 68	68	62	53
		Kirribilli	24 - 36	64	57	51
		Potts Point	28 - 44	61	56	50
	Concreting	Bennelong	46 - 55	68	62	53
		Kirribilli	< 20 - 26	64	57	51
		Potts Point	<20 - 34	61	56	50

A site plan showing the indicative construction source locations is presented in Figure 1.

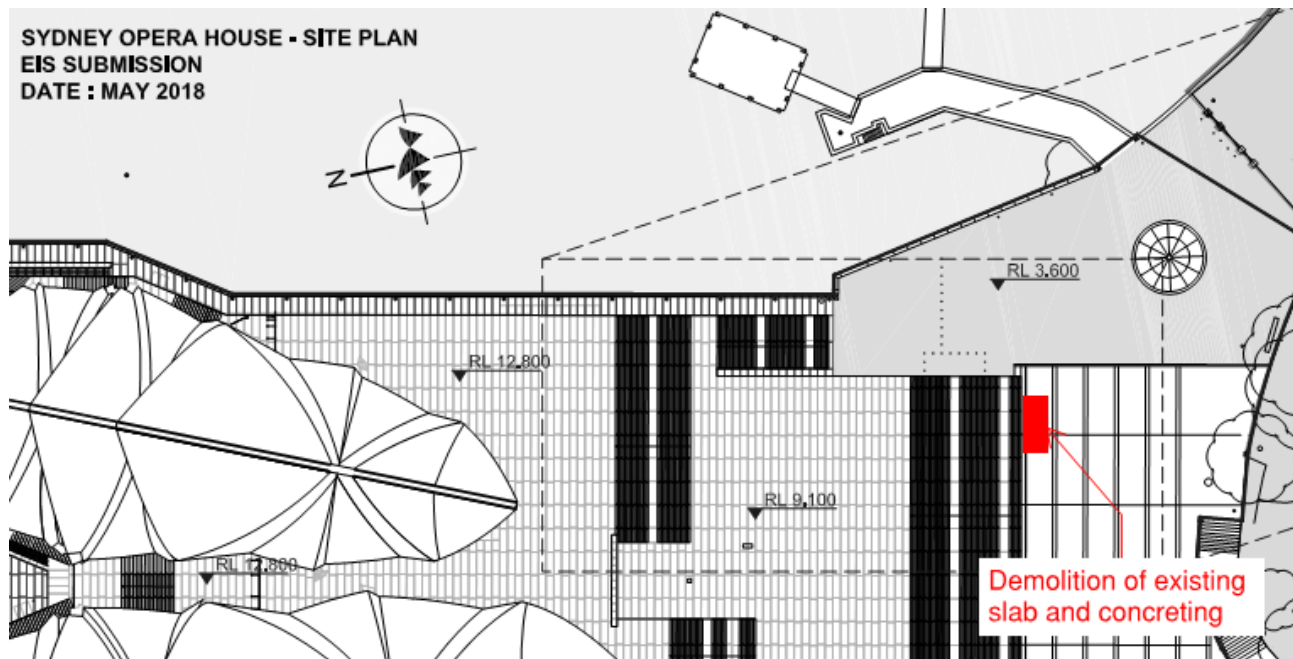


Figure 1: Indicative thrust block construction source locations

# Technical Note

257966-00

26 October 2018

## 6.1 Maximum Noise Levels

It is recommended that no external demolition takes place during the night-time period due to the potential of construction activities to exceed the sleep disturbance criteria.

The predicted maximum noise level from construction activities are presented in Table 5 and assessed against the sleep disturbance criteria.

Table 5: Predicted maximum noise level from construction activities, dB re 20 µPa

Source Location	Activity	Receiver	Predicted Construction Noise Level, dB L <sub>A1,1min</sub>	Sleep disturbance criteria, 10pm - 7am, , L <sub>A1,1min</sub> , dB(A)
Monumental steps	Demolition of existing slab	Bennelong	71	63
		Kirribilli	40	61
		Potts Point	48	60
	Concreting	Bennelong	57	63
		Kirribilli	27	61
		Potts Point	36	60

---

### DOCUMENT CHECKING (not mandatory for File Note)

	Prepared by	Checked by	Approved by
Name	Daniel Jimenez	Nick Boulter	Nick Boulter
Signature			