# Technical Note

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| Project title | Sydney Opera House Renewal | Job number | 257966-00 |
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| Prepared by | Daniel Jimenez | Date | 23 May 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).
- 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.

# 3 Criteria

## 3.1 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 |

### 3.1.1 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.

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 |

## 4 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 slab
   - Excavate (hammering may be required) 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:

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<br>Demolition saw<br>Hand-held pneumatic breaker<br>Small excavators/bobcats/forklifts (electric). Bobcat with nibbler | $L_{Aeq,adj,15min}$ 124 dB |
| Concreting | Concrete trucks<br>Concrete pumps<br>Vibrators<br>Excavators – loading dump truck | $L_{Aeq,adj,15min}$ 109 dB |

## 5 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.

| **Source Location** | **Activity** | **Receiver** | **Predicted Construction Noise Level, dB $L_{Aeq,adj,15min}$** | **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.

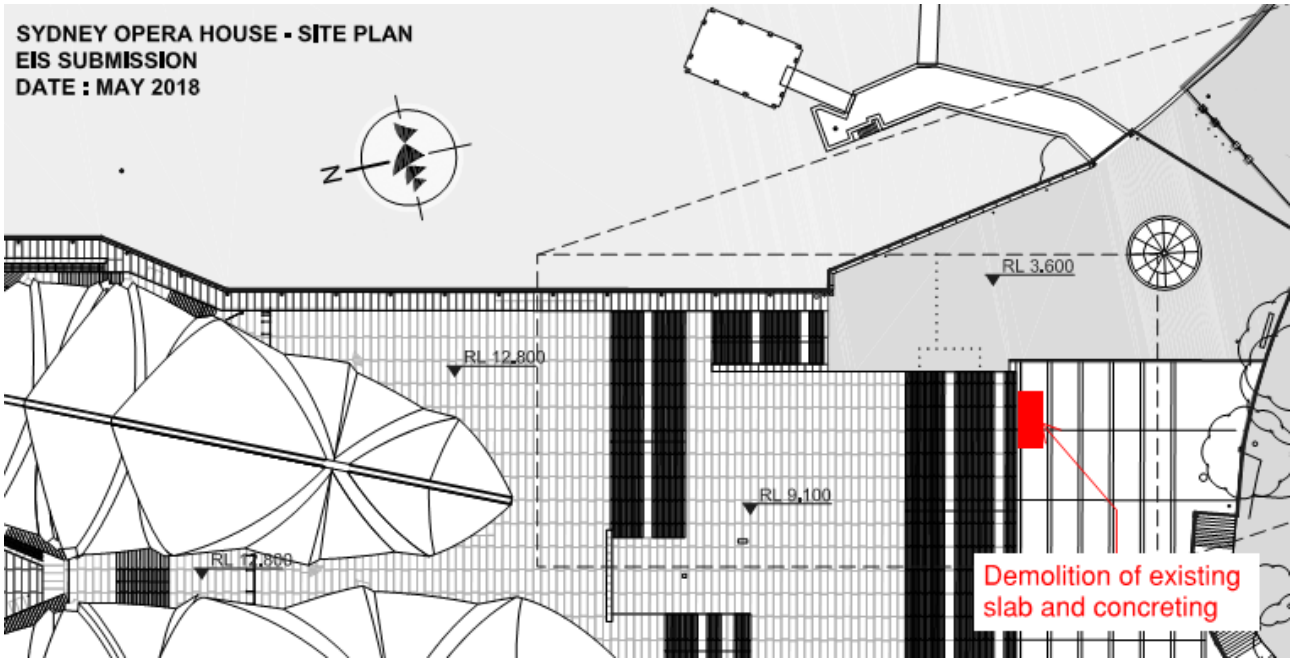


Figure 1: Indicative thrust block construction source locations

## 5.1 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 4 and assessed against the sleep disturbance criteria.

Table 4: Predicted maximum noise level from construction activities, dB re 20 µPa

| **Source Location** | **Activity** | **Receiver** | **Predicted Construction Noise Level, dB $L_{A1,1min}$** | **Sleep disturbance criteria, 10pm - 7am, , $L_{A1,1min}$, 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 |

# Technical Note

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## DOCUMENT CHECKING (not mandatory for File Note)

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