

# | TAYLOR GROUP PTY LTD |

## CONSTRUCTION NOISE AND VIBRATION MANAGEMENT SUB PLAN

### REFERENCE NO. S11163-R01-CNVMSP-A1

SYDNEY OPERA HOUSE WESTERN RENEWAL PROJECT | 11 FEBRUARY 2020



#### **Construction Noise and Vibration Management Sub Plan**

Sydney Opera House, Bennelong Point, NSW 2000 Prepared for

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Date: 11 February 2020



### **Executive Summary**

Condition B34 of the development consent for Sydney Opera House Trust's application for '*Upgrade to the Concert Hall and new Creative Learning Centre at the Sydney Opera House*' (SSD 8663) requires a Construction Noise and Vibration Management Sub-Plan (CNVMSP). The CNVMSP addresses all requirements of, and complies with, Consent Condition B34.

The predicted noise immissions are at least 30 dB and 12 dB below the warning NMLs for Kirribilli and Bennelong Apartments, respectively. Based on this, no additional mitigation is necessary beyond the good practice recommendations to minimise noise contained within the ICNG, Taylor's management plans and the relevant recommendations in SOH's Draft CMP and Arup's NIA.



### **TABLE OF CONTENTS**

Exe	cutive Su	Immary	3
1.	Introduction		5
2.	. Background		
	2.1 I	nterim Construction Noise Guideline	7
	2.2 F	Potentially Affected Sensitive Receivers	8
	2.3	Noise Management Levels	8
3.	3. Sources		10
4.	4. Mitigation		12
	4.1 \	Work practices to minimise noise	12
	4.2 F	Reversing signals	12
	4.3 F	Recommended mitigation	12
5.	Letterbox drop		14
6.	Monitor	ing programme	15
Арр	oendix A	Source data	16
Арр	oendix B	Noise Impacts	50

### **LIST OF FIGURES**

Figure 2.1: Potentially Affected Sensitive Receivers	9
Figure 6.1: Noise logger location	
Figure B.1: Noise Contours - Demolition	51
Figure B.2: Noise Contours – Concreting	51
Figure B.3: Noise Contours – Internal Works	52

### **LIST OF TABLES**

Table 1.1: Index to condition requirements	5
Table 2.1: Project Noise Management Levels	8
Table 3.1: Noise Sources	10
Table 3.2: Predicted noise impacts	11



### 1. Introduction

Condition B34 of the development consent for Sydney Opera House Trust's application for '*Upgrade to the Concert Hall and new Creative Learning Centre at the Sydney Opera House*' (SSD 8663)<sup>1</sup> requires a Construction Noise and Vibration Management Sub-Plan (CNVMSP). Condition B34 states:

CONSTRUCTION NOISE AND VIBRATION MANAGEMENT PLAN

B34. Prior to the commencement of work, a Construction Noise and Vibration Management Plan (CNVMP) prepared by a suitably qualified person shall be submitted to the Certifying Authority. The CNVMP shall address (but not be limited to):

(a) the EPA's Interim Construction Noise Guideline;

(b) identify nearby sensitive receivers and land uses;

(c) identify the noise management levels for the project;

(d) identify the construction methodology and equipment to be used and the key sources of noise and vibration;

(e) details of all reasonable and feasible management and mitigation measures to be implemented to minimise construction noise and vibration, including consideration of the practicability of the use of audible movement alarms of a type that would minimise noise impacts on surrounding sensitive receivers, without compromising safety;

(f) be consistent with and incorporate all relevant recommendations and noise and vibration mitigation measures outlined in the 'Noise Impact Assessment' Rev B, prepared by Arup, dated 20 December 2018 and 'Draft Construction Management Plan – Sydney Opera House Concert Hall and Creative Learning Centre DA3 – SSD8663' Version 3.1 prepared by the Sydney Opera House Trust, dated August 2018;

(g) ensure all potentially impacted sensitive receivers are informed by letterbox drops prior to the commencement of construction of the nature of works to be carried out, the expected noise levels and duration, as well as contact details for a construction community liaison officer; and

(h) include a suitable proactive construction noise and vibration monitoring program which aims to ensure the construction noise and vibration criteria in this consent are not exceeded.

The CNVMSP addresses all requirements of, and complies with, Consent Condition B34.

Condition	Section in CNVMSP
B34(a)	2.1
B34(b)	2.2
B34(c)	2.3
B34(d)	3

<sup>1</sup> NSW Government Department of Planning, Industry and Environment, 2019, *Opera House Concert Hall & Creative Learning Centre (SSD 8663), Draft Development Consent* 



Condition	Section in CNVMSP
B34(e)	4
B34(f)	4
B34(g)	5
B34(h)	6



### 2. Background

#### 2.1 Interim Construction Noise Guideline

The stated aim of the NSW Interim Construction Noise Guideline<sup>2</sup> (ICNG) is

to provide guidance on managing construction works to minimise noise with an emphasis on communication and cooperation with all involved in, or affected by, construction noise.

The ICNG states its' objectives are to:

- Promote a clear understanding of ways to identify and minimise noise from construction works.
- Focus on applying all 'feasible' and 'reasonable' work practices to minimise construction noise impacts.
- Encourage construction to be undertaken only during the recommended standard hours unless approval is given for works that cannot be undertaken during these hours.
- Streamline the assessment and approval stages and reduce time spent dealing with complaints at the project implementation stage.
- Provide flexibility in selecting site-specific feasible and reasonable work practices in order to minimise noise impacts.

The ICNG states what actions the construction site should take at various levels of impact. In general, the ICNG opposes construction work outside normal daytime working hours. The noise impact is likely to be different at different times of the day, days of the week and during different phases of construction work. In addition, noise emissions from a construction site may vary significantly from one moment to the next. Psychological factors heavily influence human reaction to environmental noise. Consequently, NIAs have a high level of uncertainty. The ICNG emphasises community communication and feasible and reasonable work practices to minimise noise impacts over numerical noise limits.

The ICNG provides qualitative and quantitative assessment methods. The quantitative method determines Noise Management Levels (NMLs) relative to the Rating Background Levels (RBLs) at residences. The ICNG states:

Where noise from construction works is above the 'noise affected' levels presented below, the proponent should apply all feasible and reasonable work practices to minimise noise. The proponent should also inform potentially affected parties of the activities to be carried out, the expected noise impacts and duration.

The ICNG provide the following explanations of *Feasible* and *Reasonable* in the context of the work practices required to minimise noise levels above the NMLs.

#### <u>Feasible</u>

A work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements.

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<sup>&</sup>lt;sup>2</sup> New South Wales & Department of Environment and Climate Change (2009) *Interim construction noise guideline*, Dept. of Environment and Climate Change, Sydney N.S.W.



#### <u>Reasonable</u>

Selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure. To make such a judgement, consideration may be given to:

Noise level impacts

Noise mitigation benefits

Cost effectiveness of noise mitigation

Community views

### 2.2 Potentially Affected Sensitive Receivers

The nearest Potentially Affected Sensitive Receivers (PASR) are residences to the south (Bennelong Apartments at East Circular Quay) and to the north in the suburb of Kirribilli. Bennelong Apartments is about 260 m from the concert hall and partly screened by the southern sections of the Sydney Opera House. The residents of Bennelong Apartments are the only PASR that need to be included in the letterbox drop (refer section 5). The nearest residences in Kirribilli to the site are on the southern waterfront and about 550 m distant, across the harbour. Figure 2.1 shows these locations on an aerial photograph.

#### 2.3 Noise Management Levels

SOH's Noise Impact Assessment (NIA)<sup>3</sup> conducted noise surveys at the nearest NSRs and calculated NMLs from these in accordance with the ICNG. The Construction Management Plan sets out work patterns as:

- 1030 hours to 1800 hours General construction/no major noise generating activities
- 1800 hours to 2330 hours Planning and quiet activities which are compatible with the live performances occurring in other venues within the site
- 2330 hours to 1030 hours Works which will otherwise be disruptive to Opera House operations but not audible outside of the building

Based on this, only the NMLs for standard daytime working hours apply.

#### **Table 2.1: Project Noise Management Levels**

PASR	Kirribilli	Bennelong Apartments	Potts Point	
Warning level, <i>L</i> <sub>Aeq,15m</sub> (dB)	61	65	58	
Maximum Level, <i>L</i> <sub>Aeq,15m</sub> (dB)	64	68	61	

<sup>&</sup>lt;sup>3</sup> Arup (2018) Sydney Opera House, Building Renewal Noise Impact Assessment for DA3 - SSD 8663 R07 Issue (Rev A) | 15 May 2018





Figure 2.1: Potentially Affected Sensitive Receivers



### 3. Sources

Appendix A contains a description of the construction methodology and schedule. Table 3.1 lists the key noise sources. The source noise levels are expressed as sound power levels for external sources and overall average diffuse internal sound pressure levels for internal activities. The source terms are cumulative and assume concurrent activities throughout the building. They assume tool use throughout the 15-minute assessment period. Therefore, they represent a commonly occurring upper emission level.

There are no sources of vibration likely to give rise to adverse vibration impacts offsite. While the concrete breakers generate high vibration at the point of impact, these levels will attenuate rapidly with distance due to the high mass foundations and substructures between the source and receptors.

Activity	Construction Equipment	Source Noise Level	Index (Unit)
External works	Hand tools to remove façade elements Occasional mobile crane and forklifts	98	L <sub>AW</sub> (dB)
Internal demolition	Demolition saw Core drill Concrete breakers (handheld) Small excavators/bobcats/forklifts (electric). Bobcat with nibbler to remove staging Work platforms	96	L <sub>Ap,in</sub> (dB)
Internal works	Hand tools Small excavators/bobcats Work platforms	86	L <sub>Ap,in</sub> (dB)
Concreting (internal plant)	Vibrators	89	L <sub>Ap,in</sub> (dB)
Concreting (external plant)	Concrete trucks Concrete pumps	107	L <sub>AW</sub> (dB)
Waste handling/ removal	Funicular hoists and waste chutes	96	L <sub>AW</sub> (dB)
Vehicles	Materials and waste trucks	109	L <sub>AW</sub> (dB)

#### Table 3.1: Noise Sources

Key to Table 3.1:

L<sub>AW</sub> Sound Power Level (point source)

*L*<sub>Ap,in</sub> Internal average diffuse sound pressure level

We have predicted the noise impacts at the nearest NSRs using the iNoise software package. This implements ISO 9613-2 supplemented by the meteorological correction terms contained within CONCAWE report 4/81. The model assumes 'hard' ground for all surfaces except for the Royal Botanical Gardens, which is modelled as 'soft' ground. The model assumes Pasquil Stability Class B, which is common for a sunny daytime with a mild breeze, and the prevailing wind direction (NW) for Sydney<sup>4</sup>.

Table 3.2 lists the predicted noise impact separately for the works at the site (internal and external) and a delivery vehicle accessing the site from Macquarie Street. With reference to Table 2.1, the predicted noise immissions are at least 30 dB and 12 dB below the warning NMLs for Kirribilli and Bennelong Apartments, respectively.

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#### Table 3.2: Predicted noise impacts

Scenario	Source	Noise Immission, L <sub>Aeq,15m</sub> (dB) Kirribilli	Noise Immission, L <sub>Aeq,15m</sub> (dB) Bennelong (4th floor)	Noise Immission, L <sub>Aeq,15m</sub> (dB) Bennelong (9th floor)
	Delivery	9	51	48
Demolition	Building	31	40	40
	Total	31	51	49
	Delivery	9	51	48
Concreting	Building	26	50	50
	Total	26	53	52
	Delivery	9	51	48
Internal works	Building	19	35	35
	Total	19	51	49



### 4. Mitigation

#### 4.1 Work practices to minimise noise

As stated in section 2.1, The ICNG states:

Where noise from construction works is above the 'noise affected' levels presented below, the proponent should apply all feasible and reasonable work practices to minimise noise. The proponent should also inform potentially affected parties of the activities to be carried out, the expected noise impacts and duration.

The predicted noise immissions are at least 30 dB and 12 dB below the warning NMLs for Kirribilli and Bennelong Apartments, respectively. Based on this, no additional mitigation is necessary beyond the good practice recommendations to minimise noise contained within the ICNG, Taylor's management plans and the relevant recommendations in SOH's Draft CMP and Arup's NIA.

#### 4.2 Reversing signals

It would be practicable for Taylor to require the onsite plant and equipment to have suitable broadband movement alarms that can minimise noise impacts on surrounding sensitive receivers without compromising safety. We expect that this would minimise the noise impact to NSRs. It is not practicable for Taylor to require all vehicles attending site temporarily, particularly delivery and waste vehicles, to have broadband reversing signals because they would have little control over these vehicles.

#### 4.3 Recommended mitigation

The following recommendations include those contained within:

- Taylor's Noise Management Procedure (NMP) <sup>5</sup>
- Taylor's Construction Management Plan (CMP) <sup>6</sup>
- Sydney Opera House Trust's Draft Construction Management Plan (DCMP) <sup>7</sup>
- Arup's Noise Impact Assessment (NIA)

#### <u>General</u>

- i. Where possible, position and orientate noisy plant and equipment away from sensitive receivers.
- ii. Ensure all construction activities are undertaken during approved working hours
- iii. Prevent vehicles and plant queuing and idling outside the site prior to the morning start time.
- iv. Prevent vehicles and plant idling when not in use.

#### <u>Complaints</u>

<sup>&</sup>lt;sup>5</sup> Taylor Construction Group Pty Ltd (2019) *Noise Management Procedure*, SE-OP-04

<sup>&</sup>lt;sup>6</sup> Taylor Construction Group Pty Ltd (2019) Construction Management Plan – Western Renewal Project at Sydney Opera House Bennelong Point

<sup>&</sup>lt;sup>7</sup> Sydney Opera House, 2018, Concert Hall and Creative Learning Centre, DA3 – SSD8663, Draft Construction Management Plan



- v. If a noise or vibration-related complaint is received, report and investigate in accordance with the incident reporting and investigation procedure.
- vi. Feedback on resolution of a complaint should be provided to the complainant where requested.

#### Temporary opening in the façade for access to the Concert Hall

- vii. Provide a solid timber or steel door to close off the temporary opening in the façade for access to the Concert Hall.
- viii. Provide door with gasket seals around the perimeter and a mechanism to hold the door closed
- ix. Ensure that the door is kept closed except when needing to be open for access for plant and materials.

### **Reversing signals**

x. Onsite plant and equipment in long-term use to have suitable broadband movement alarms.



### 5. Letterbox drop

SOH will undertake the required letterbox drop. The residents of Bennelong Apartments at East Circular Quay will receive the letterbox drop.

- Contact telephone number is 1300 382 692
- Email address is constructionfeedback@sydneyoperahouse.com



### 6. Monitoring programme

SOHT's Draft CMP states:

A noise logger will be installed and maintained which can be interrogated remotely by SOHT staff as well as SOHT's Contractor. The logger will also be required to automatically send a text message to SOHT's Contractor's representative on site once the 'warning' threshold is breached. The SOHT representative on site during the works will also be copied in with the warning texts.

This provides a suitable proactive construction noise and vibration monitoring program. Taylor should designate an appropriate manager who will interrogate the logger at the start of each change in work schedule likely to change the overall site emissions materially and weekly during the noisiest works. As a minimum, this should be at the commencement of and during demolition and concreting works.

The noise logger should be installed at the PASR expected to have the highest noise immission level. That is at the northern façade of Bennelong Apartments. The noise logger should be installed on a balcony on, or as close as possible to the fourth floor. This is the same location as 'Location 1' of Arup's background noise monitoring. Figure 6.1 shows that location and is reproduced from Arup's report (Figure 2).

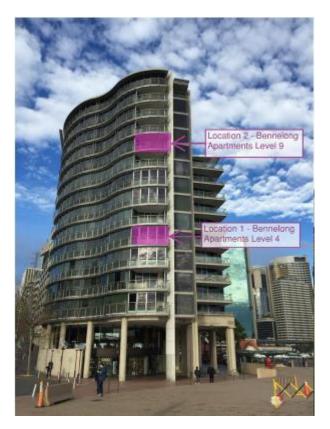
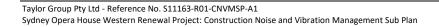


Figure 6.1: Noise logger location



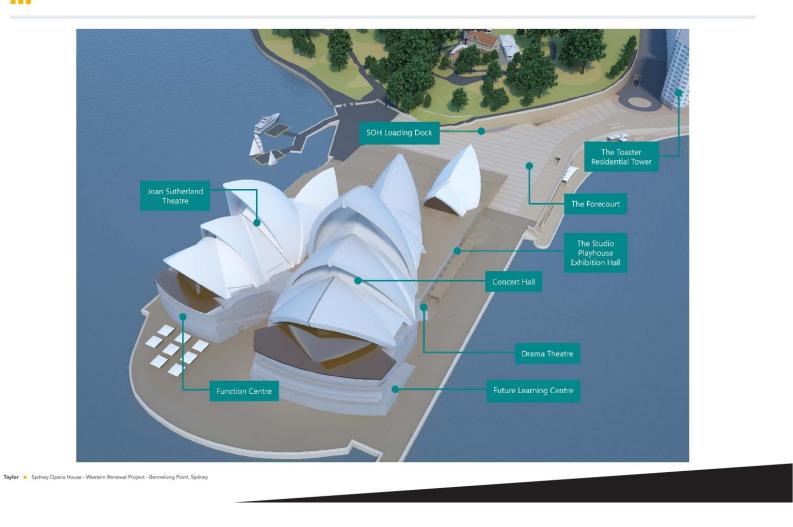






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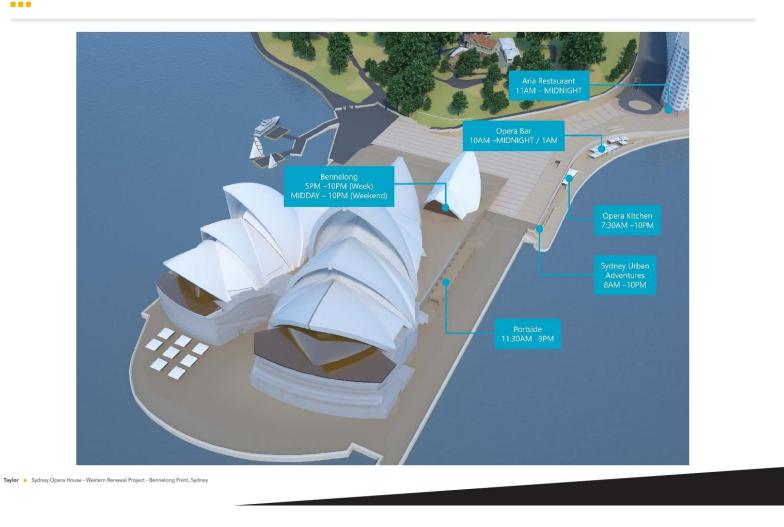
Operating Venue





## **TAYLOR**

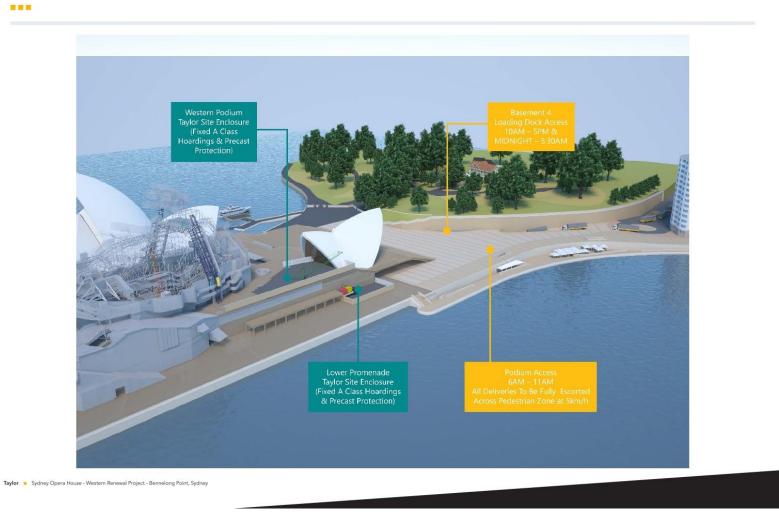
Public Venue Operating Hours





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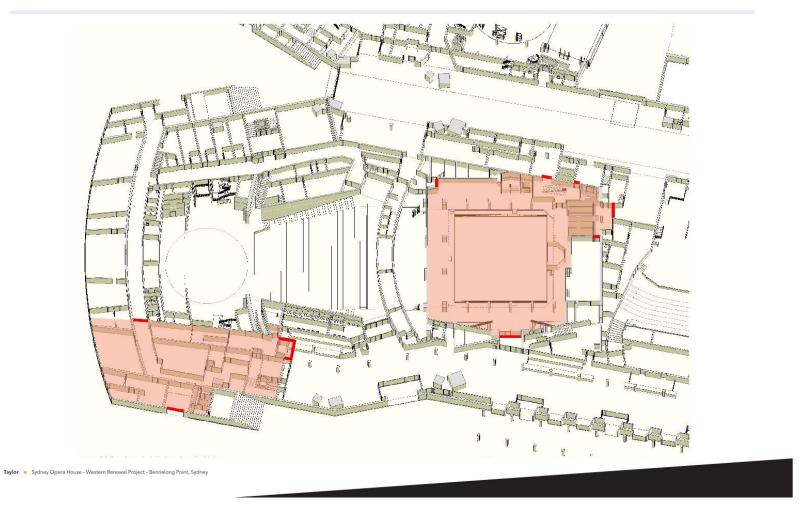
Site Establishment - External Materials Handling Strategy





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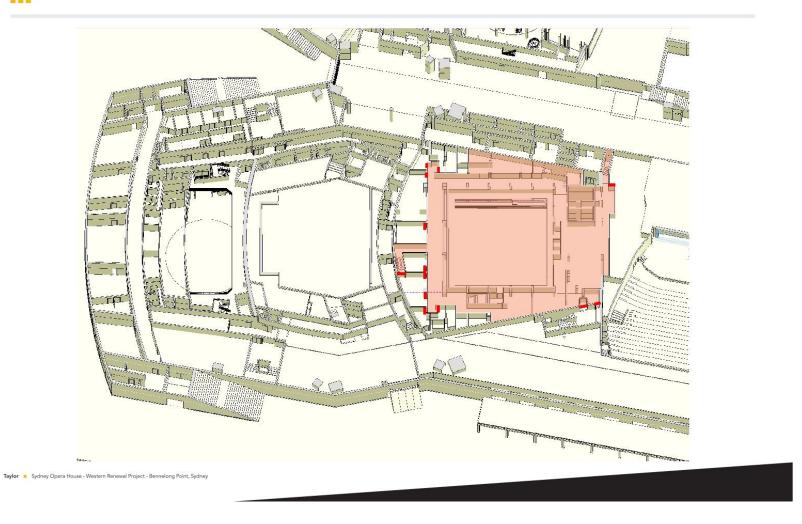
Site Hoarding Lines & Worker Movements - Ground Floor including Creative Learning Centre





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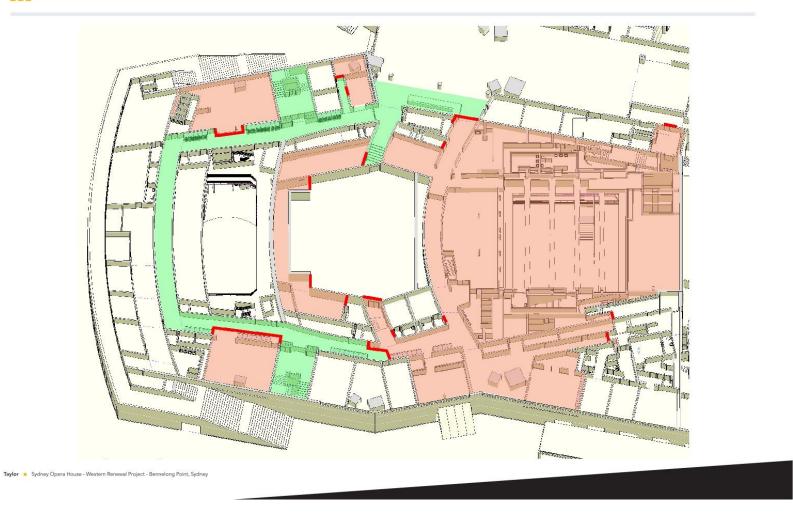
Site Hoarding Lines & Worker Movements - Ground Floor Mezz





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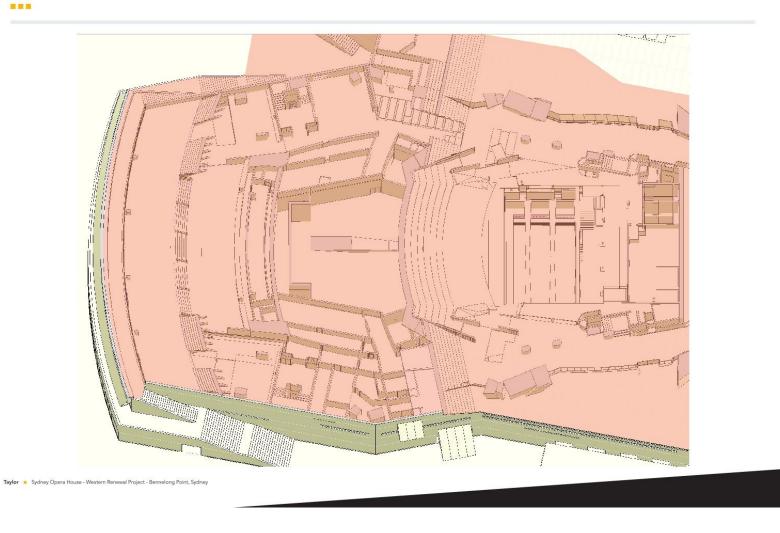
Site Hoarding Lines & Worker Movements - Level 1





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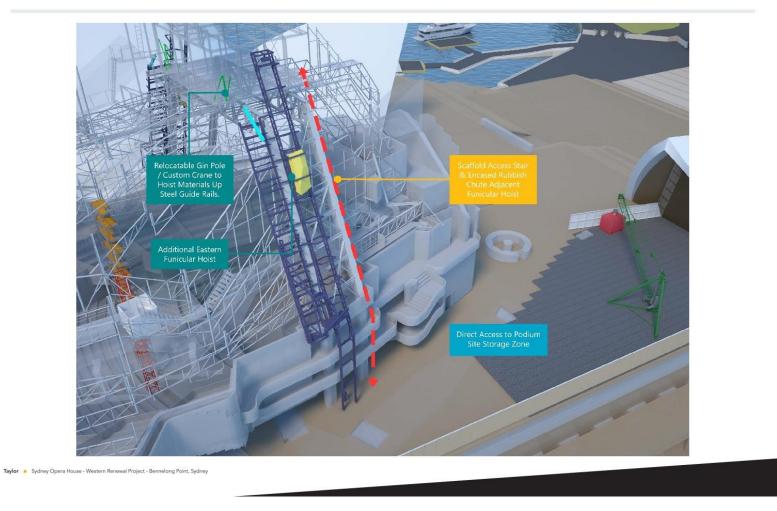
Site Hoarding Lines & Worker Movements - Level 2





# TAYLOR

OverStage Works - Funicular Hoist, Scaffold Stair & Rubbish Chute Arrangement





# **1AYLOR**

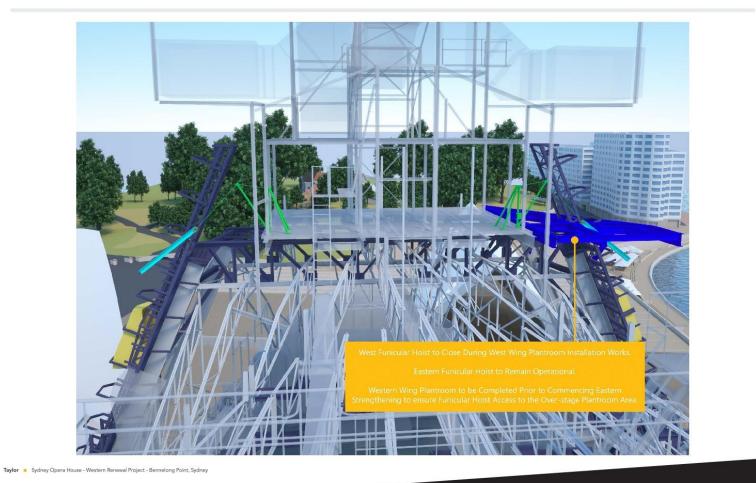
OverStage Works - Lower Truss Strengthening Sequence





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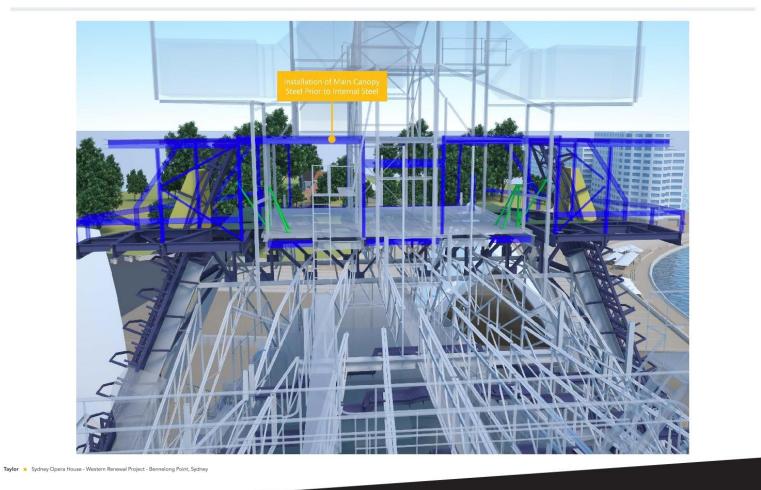
OverStage Works - Upper Plantroom structure Sequence - Phase 1





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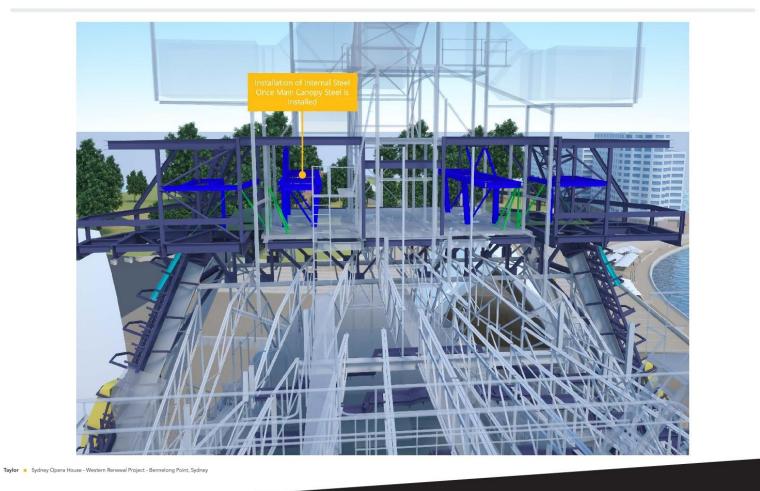
OverStage Works - Upper Plantroom structure Sequence - Phase 2





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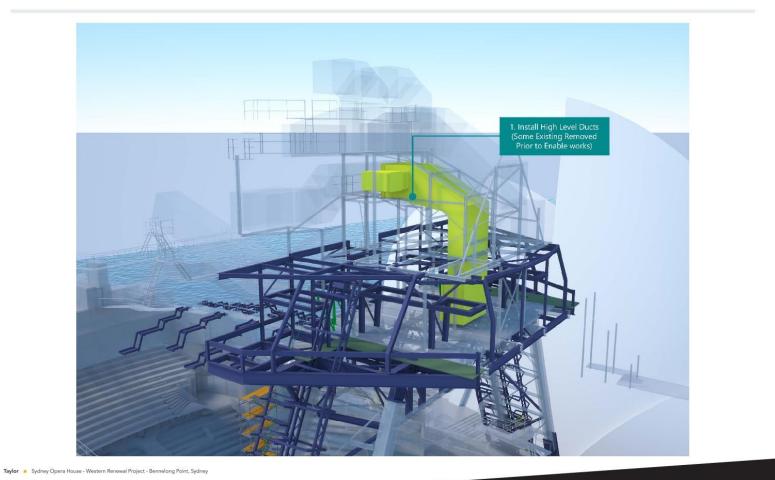
OverStage Works - Upper Plantroom structure Sequence - Phase 3





# **TAYLOR**

OverStage Works - Plantroom Construction sequence - Phase 1

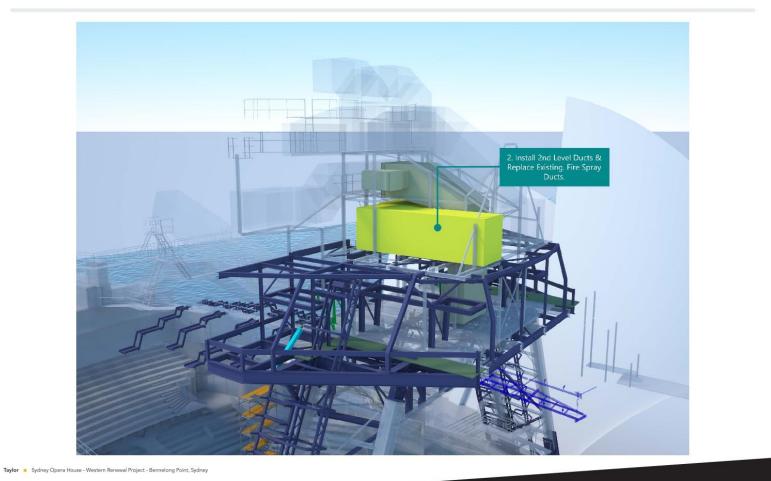


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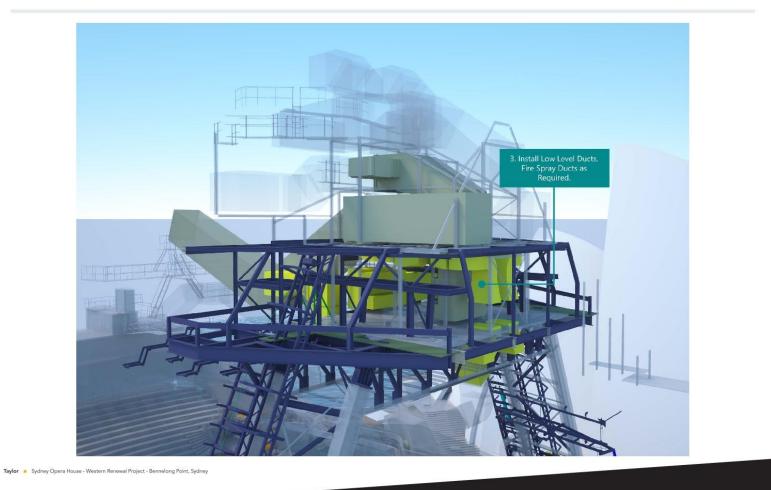
OverStage Works - Plantroom Construction sequence - Phase 2





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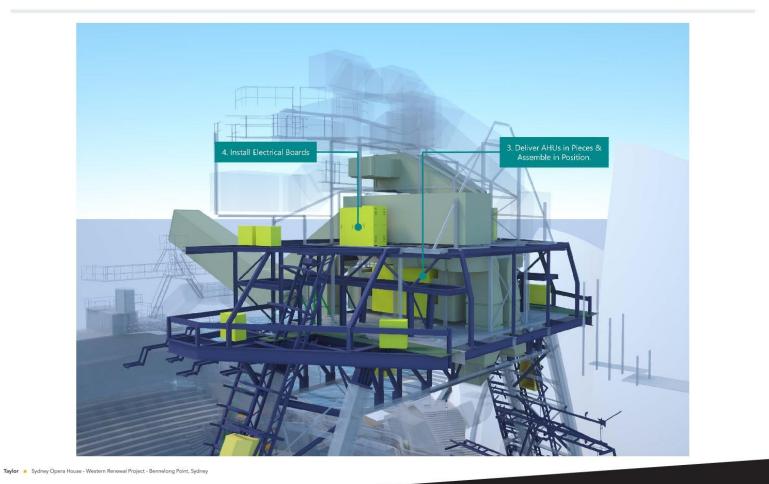
OverStage Works - Plantroom Construction sequence - Phase 3





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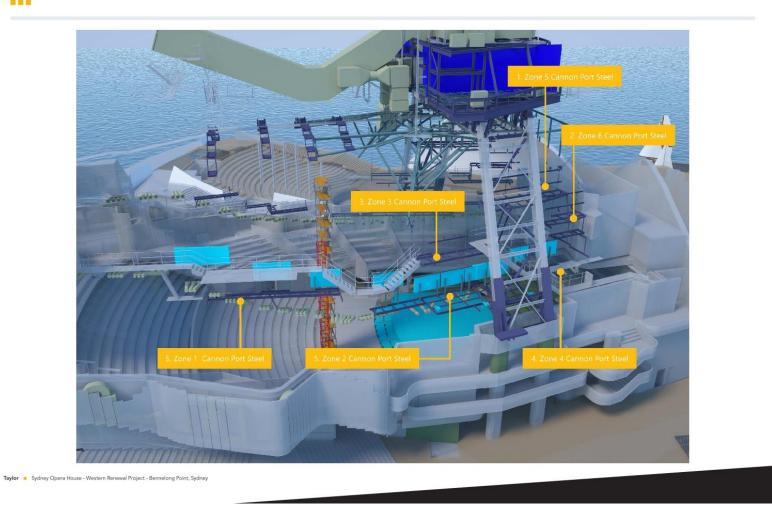
OverStage Works - Plantroom Construction sequence - Phase 4





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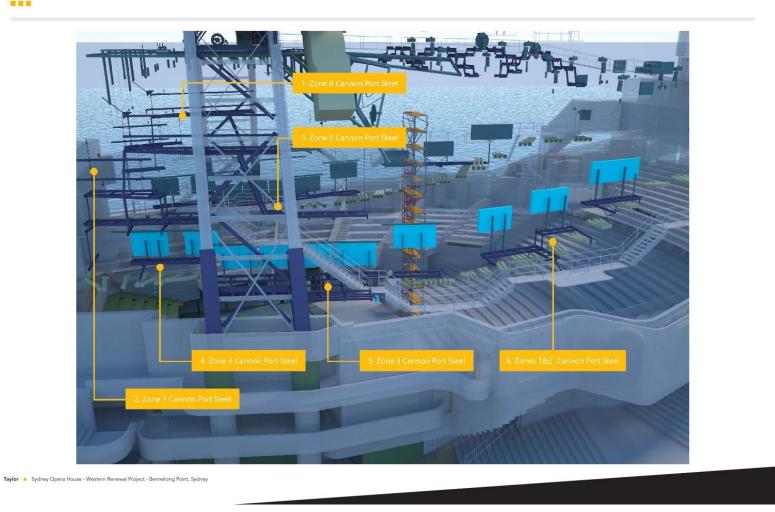
OverStage Works - Cannon port Sequence - West





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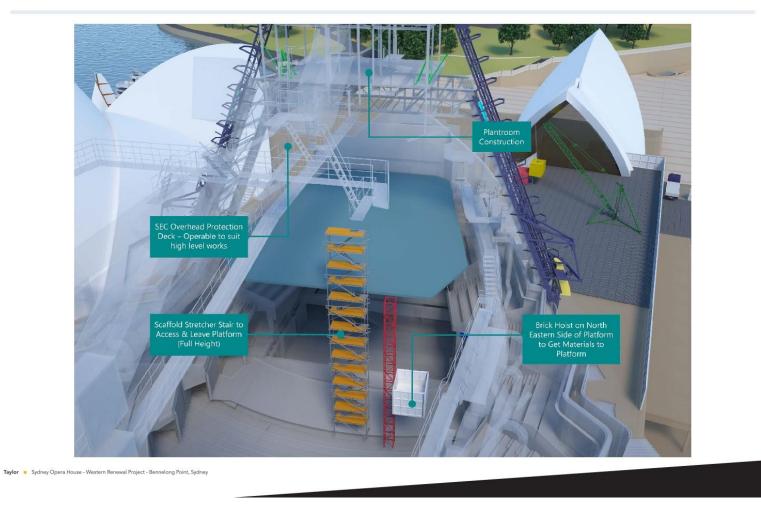
OverStage Works - Cannon port Sequence - East





# TAYLOR

Main Concert Hall - Secondary Overhead Gantry, brick hoist & scaffold

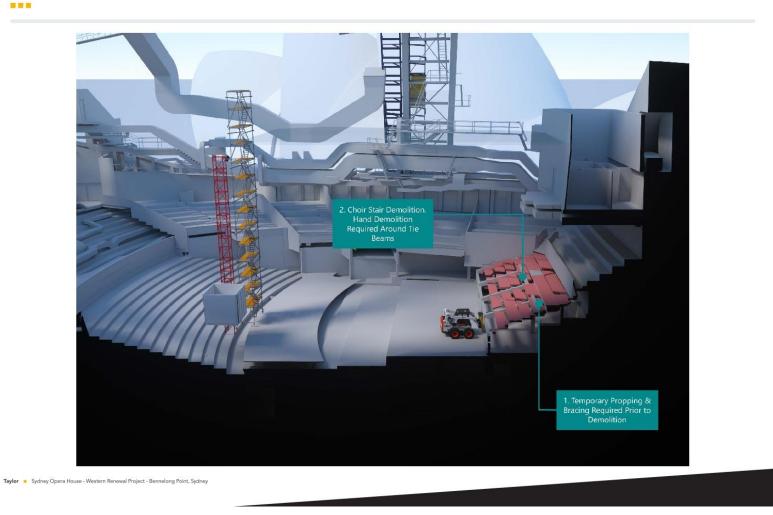




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Main Concert Hall - Choir Stall Demolition

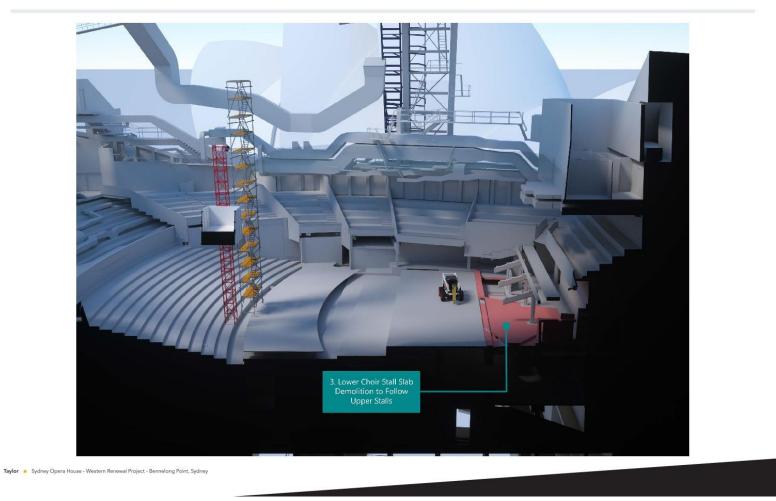






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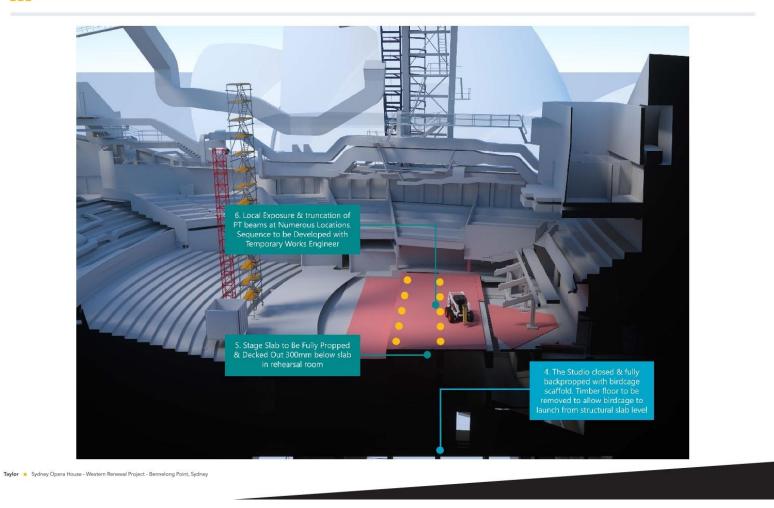
Main Concert Hall - Stage Demolition - Phase 1 - Strip Out & Propping





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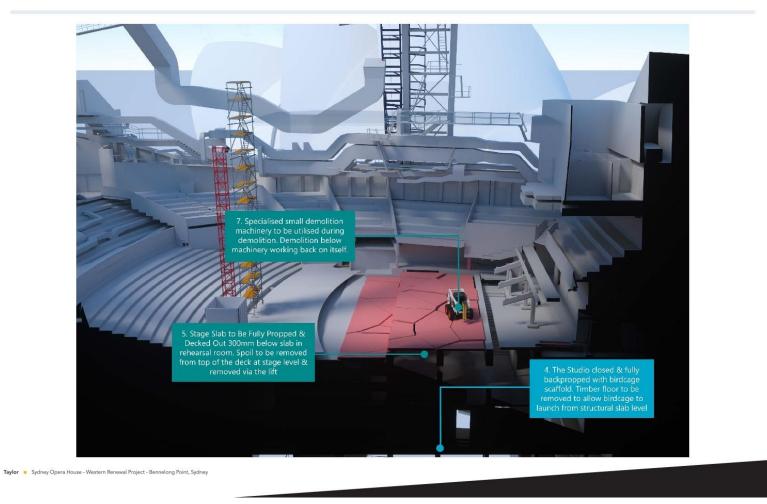
Main Concert Hall - Stage Demolition - Phase 2 - Truncations





# TAYLOR

Main Concert Hall - Stage Demolition - Phase 3 - Slab Demolition

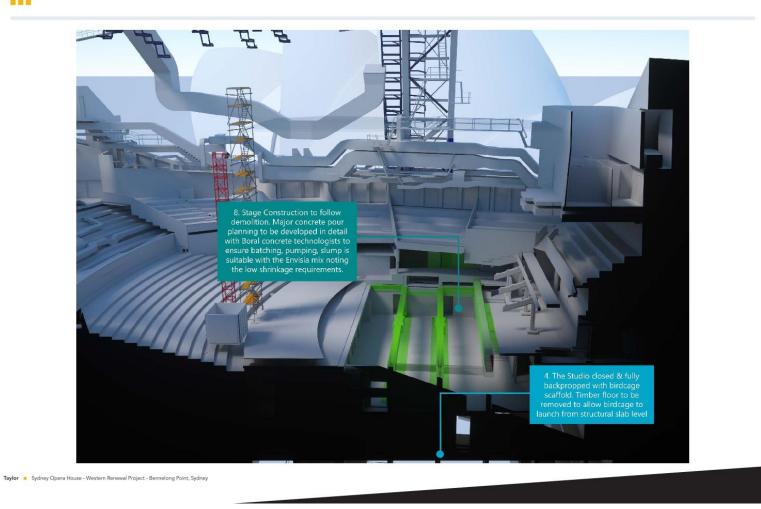




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Main Concert Hall - Stage Construction

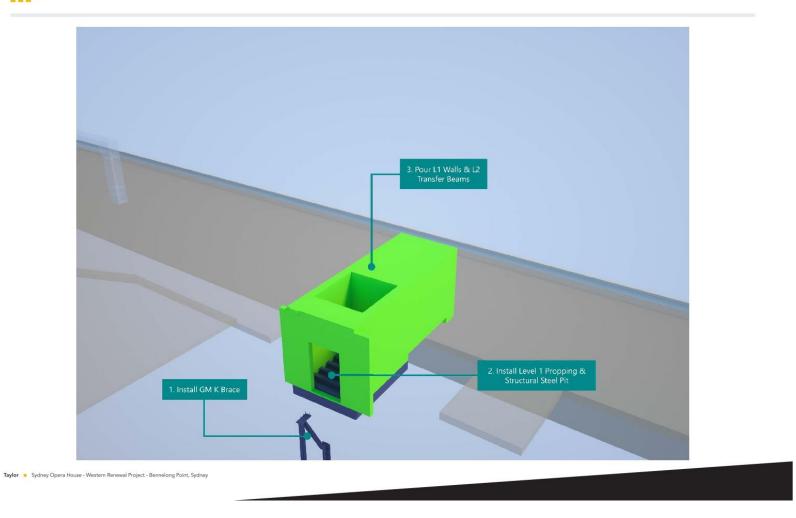
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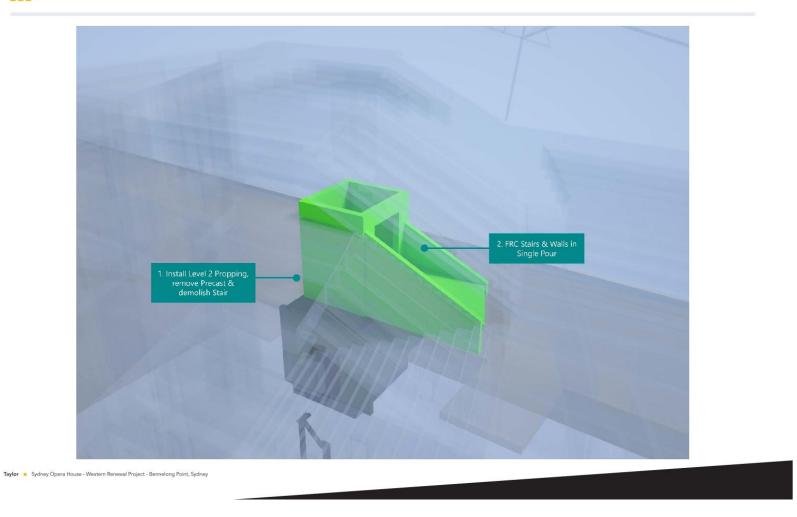
DDA Upgrades - West Lift Sequence - Level 1





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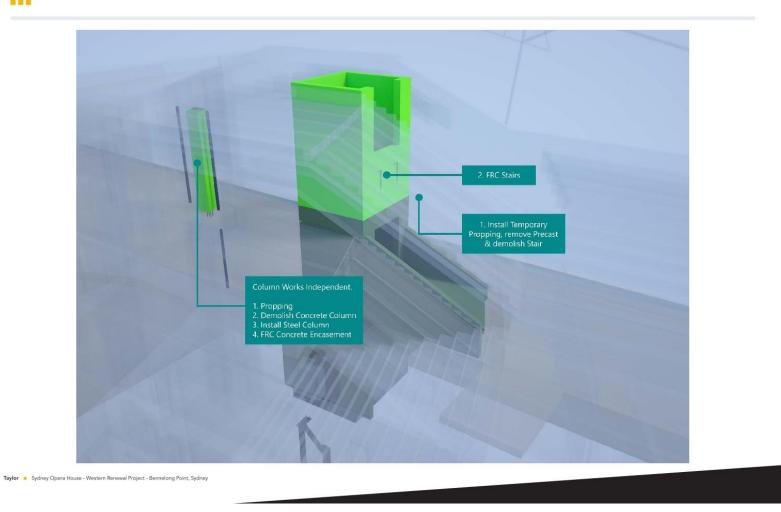
DDA Upgrades - West Lift Sequence - Level 2





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DDA Upgrades - West Lift Sequence - Level 3

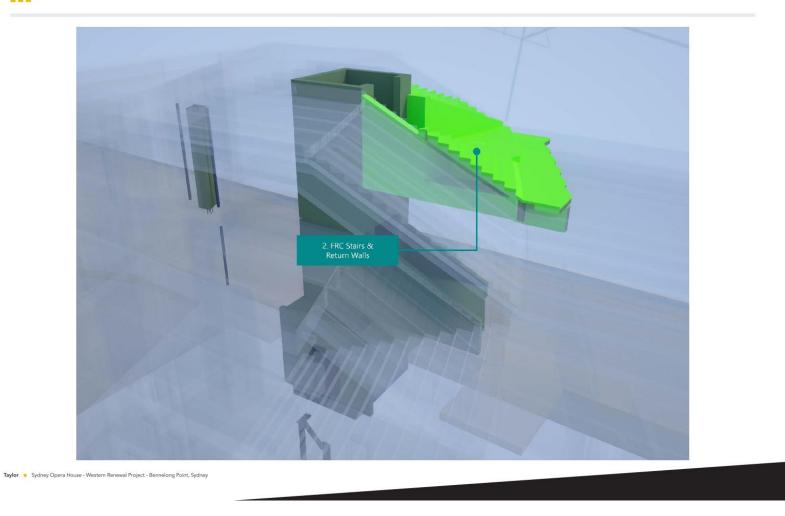




# Sydney Opera House – Western Renewal Project DDA Upgrades – West Lift Sequence – Level 4

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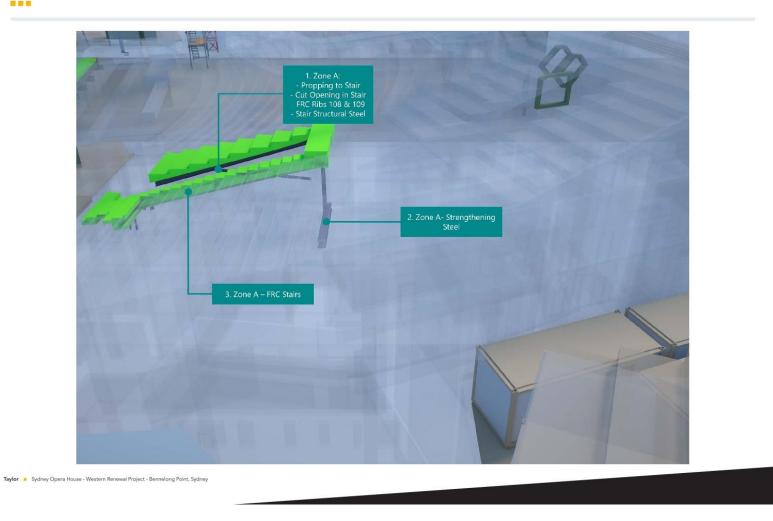




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DDA Upgrades - DDA Eastern Tunnel - Phase 1

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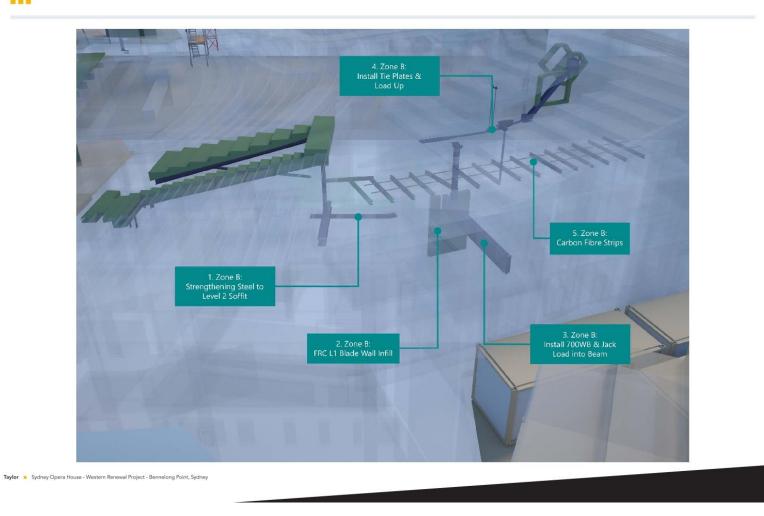




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DDA Upgrades - DDA Eastern Tunnel - Phase 2

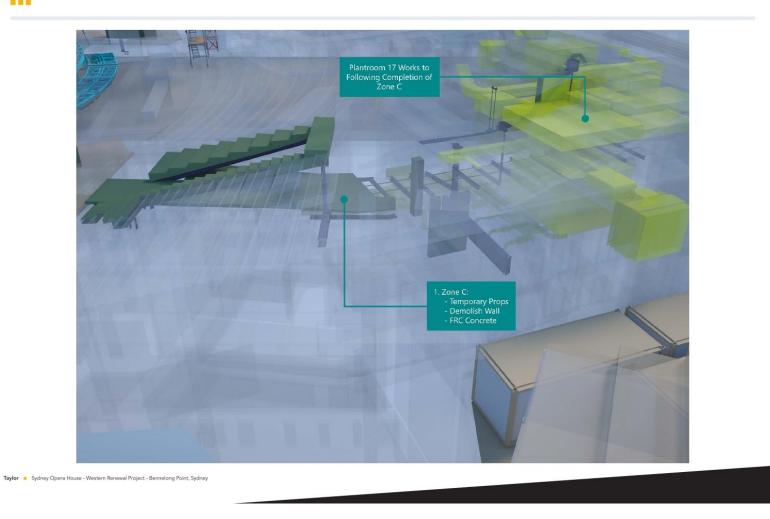
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DDA Upgrades - DDA Eastern Tunnel - Phase 3



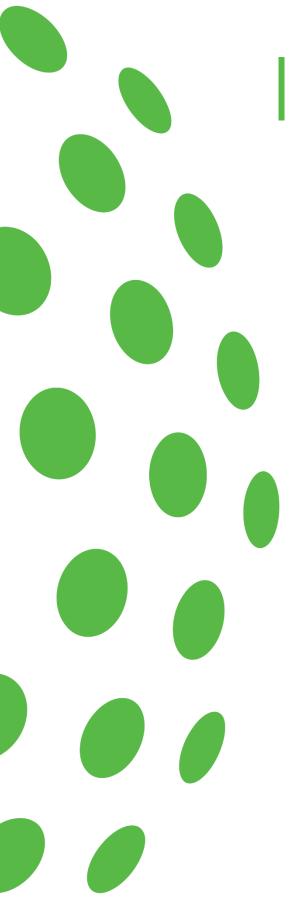


Source         Nation lines         Number         N	- REV 16 - 27DEC19
CH-LH Subject / Convert House Mealers Research Project - CONTRACT - 2005/E19         Op         Status 10         Cm	2020 2021
OH-LAI MULSIONES         OB         OF-LAI X         OPE-201	02 03 04 01 02 03 04
Solution	09-Nov-21, SOF
Open Hall, No. Construct Conversa         20         1.1.0.197.8         2.2.4.96.20           Ober Hall, S. Der Benerg Dewigsmein         10         2.4.9.4.20         11.0.197.8, 20.4.1.00.1         12.3.9.0.2.0.1.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0	
	22-Apr-20, SOB-16.MC CONSTRUCTION CONTRACT
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BORHAND SINC INC Constrained         100         11.4.114.0         0.4.0.20         0.4.0.20           BORHAND SINC INC Constrained         10         0.4.0.20         0.4.0.20         0.4.0.20           SOME AND A ATTROCHT AS TOWER APPORAL         50         0.4.0.20         0.4.0.20         0.4.0.20           SOME AND A ATTROCHT AS TOWER APPORAL         50         11.6.0.10.5.1         0.4.0.20         0.4.0.20           SOME AND A ATTROCHT AS TOWER APPORAL         50         11.6.0.10.5.1         0.4.0.0.20	16/MC2 Cost Planning Development
Contextus         Contextus <thcontextus< th="">         Contextus         <thcontextus< th="">         Contextus         <thcontextus< th=""> <thcontextus< th=""> <thcon< td=""><td>AC3 SEC/MC Coordination</td></thcon<></thcontextus<></thcontextus<></thcontextus<></thcontextus<>	AC3 SEC/MC Coordination
Contextus         Contextus <thcontextus< th="">         Contextus         <thcontextus< th="">         Contextus         <thcontextus< th=""> <thcontextus< th=""> <thcon< td=""><td>6MC4 Methodology/&amp; Programme</td></thcon<></thcontextus<></thcontextus<></thcontextus<></thcontextus<>	6MC4 Methodology/& Programme
ON-MALLS 12000 CONTRACTORNOVAL         50         21-000000         22-20-0000<	22-Apr-20, SDH-16.MC5 Main Contract
Biol         Solution         Solution <th< td=""><td></td></th<>	
SDH 450 DESIGN         110         01441.4         131/ar-20         131/ar-20           DOH 16.0 DESIGN.DEMIONT         100         01441.4         131/ar-20         110/ar-20         110	16 AU1 STATE SCHIRCANT DEVELOPMENT APPROVAL
OPENHAND LEWINANCALLONANT         012         014/174         115/001/95         014/014         014/01	
GO-HALD 2015/LED DEDIDA CLUMT ARMONAL         00	
ON-HAUS CONSTRUCTION CONSTRUCTION         197         15-Jan 20         13-Jan 20         13-Jan 20         13-Jan 20         13-Jan 20         14-Jan 20         14-Jan2	
SDH 458.15         SUBCONTRACTOR EVGAGEMENT         117         12 June 197, 22 June 20	5D3 CONSTRUCTION DOCUMENTATION
000         020 <td>16.SE SUBCONTRACTOR ENGAGEMENT</td>	16.SE SUBCONTRACTOR ENGAGEMENT
1014.102.1         1016         22.4-19.4         07.4-0.2	
1014.102.1         1016         22.4-19.4         07.4-0.2	6SE2 Hoists / Nets / Scaffold / Sheds/ Mobile Crane
000         000 <td>SE3 Demolition / Salvage</td>	SE3 Demolition / Salvage
001         002 <td></td>	
ON-MERES         Special Provides         77         OP-Sep 19A         22 Jan-20         10 Jan-20	USED SERVICE
ON-MERES         Special Provides         77         OP-Sep 19A         22 Jan-20         10 Jan-20	SE7 Giating
OP-MEXES         Specified         22-bit-20         22-bit-20 <td< td=""><td>65E8 Joinery</td></td<>	65E8 Joinery
Total Assist // Imade         T/T         Op/Sec 19/A         22 / Sec 20         Control (Control (Contro) (Control (Contro	16.5E9 Specialist Finishes
ON-HARS Ency Works         S         Site Net Start         OCH-HARS A Factorial Water Constraint (Factorial Water Constraint)         OCH-HARS A Start (Factori	
CH-HIRD         Packar Deck-Hird	25-Sep-20, SOH-16.PR PROCUREMENT
ON-HERRS Broutum         111         27-04-194         11-146-20           ON-HERRS Broutum         125         27-04-20         15-04-20           ON-HERRS Line         125         17-24-20         15-04-20           ON-HERRS Line         126         17-24-20         15-04-20           ON-HERRS Line         120         27-04-20         15-04-20           ON-HERRS Line         120         12-04-20         16-04-20.5           ON-HERRS Line         120         12-04-20         16-04-20.5           ON-HERRS Line         120         12-04-20         16-04-20.5           ON-HERRS Line         120-120         12-04-20         16-04-20.5           ON-HERRS Line         12-04-20.5         12-04-20         16-04-20.5           ON-HERRS Line         12-04-20.5         12-04-20.5         16-04-20.5           ON-HERRS Line         12-04-20.5         12-04-20.5         16-04-20.5           ON-HERRS Line         12-04-20.5         12-04-20.5         16-04-20.5	
ON-HARS Section         111         27.0-19.0         11.146-20.0           ON-HARS Section         125         17.20-19.0         15.16-20.0           ON-HARS A Section         125         17.20-19.0         15.16-20.0           ON-HARS A Section         125         17.20-19.0         15.16-20.0           ON-HARS A Section         126         17.20-10         15.16-20.0           ON-HARS A Section         126         17.20-10         15.16-20.0           ON-HARS A Section         126         25.20-19.0         25.20-19.0         15.96-20.0           ON-HARS A Section A Sectio	ar-20, \$OH-16/PR3_Podium Grane / Nets / Scaffold / Sheds / MobileCrane
QDM:SRR2 Sevices         125         12.9±70         15.9±70           QDM:SRR2 Sevices         109         0.7.9±70         25.9±70           QDM:SRR2 Sevices         119         0.7.9±70         12.9±70           QDM:SRR2 Sevices         119         0.7.9±70         11.9±70           QDM:SRR2 Sevices         119         114±70         0.7.9±70           QDM:SR2 Sevices	11/May-20, SOH-16PR5 Structure
CMD-MR32         Bondsom         120         77.49-20         15.44-20           DATA-RRA Guide         100         82.26 (Hz)         2.5 (Hz)         2.5 (Hz)           DATA-RRA Guide         100         82.26 (Hz)         2.5 (Hz)         2.5 (Hz)           DATA-RRA Guide         100         82.26 (Hz)         2.5 (Hz)         2.5 (Hz)         2.5 (Hz)           DATA-RRA Guide         120         2.5 (Hz)	27 LU20 SOR 16 00 LUC
BOH MRB Journy         199         02-591-19A         22-592-20           BOH MRB Journy         1130         22-592-20           BOH MRB JOURNY         12-592-20         12-592-20           BOH MRB JOURNY BOH MRANDARY         12-592-20         12-592-20           B	15-Jul-20, S0H-16-RR7 Services
Obj. 1990. Standard Fundaming         110         00 Sep 20         11 Jan 20           Obj. 1990. Standard Fundaming         123         12 Jan 20         12 Jan 20           Obj. 1990. Standard Fundaming         123         12 San 20         12 San 20           Obj. 1990. Standard Fundaming         123         12 San 20         12 San 20           Diff. 1990. Standard Fundaming         131         04 San 10.4         12 San 20         12 San 20           Diff. 1990. Standard Fundaming         131         04 San 11.4         12 San 20         11 San 20         11 San 20           Diff. 1990. Standard Fundaming         131         04 San 11.4         11 San 20	26-May-20, SOH-16, PK8 Glaping
SOH-16.12W         Construction         131         25 Abres 10.4         12 Abres 20           DOM-16.12W         Device 10.4         23 Abres 10.4         12 Abres 20         13 Feb 20.5           DOM-16.12W         Device 10.4         23 Abres 10.4         12 Abres 20         13 Feb 20.5           DOM-16.12W         Device 10.4         13 Ge Deve 10.4         13 Feb 20.5         13 Feb 20.5           DOM-16.12W         Device 10.4         14 Feb 20.5         14 Feb 20.5         14 Feb 20.5           DOM-16.12W         Device 10.4         14 Feb 20.5         14 Feb 20.5         14 Feb 20.5           DOM-16.12W         Device 10.4         14 Feb 20.5         14 Feb 20.5         14 Feb 20.5           DOM-16.12W         Device 10.4         14 Feb 20.5         14 Feb 20.5         14 Feb 20.5           DOM-16.12W         Device 10.4         14 Feb 20.5         14 Feb 20.5         14 Feb 20.5           DOM-16.12W         Device 10.5         14 Feb 20.5         14 Feb 20.5         14 Feb 20.5           DOM-16.12W         Device 10.5         14 Feb 20.5         14 Feb 20.5         14 Feb 20.5           DOM-16.12W         Device 10.5         14 Feb 20.5         14 Feb 20.5         14 Feb 20.5           DOM-16.12W         Device 10.5         14 Feb	25-Sep-20_SOH-16/PR9_Joiney
SDH-16. KU         SDH-16. SU         SDH-16. SU         SDH-16. SU         SDH-16. SU           SDH-16. SU	11-Jun-20 SCH-16/PR10 Specialist Einistes 01-Sep-20 SCH-16/PR12 Finistes
2014.001.20 Sinvey A Florat Chaol Bady, Diagetations Include:         44         25 496-174         16 46-20         16 496-20           2014.001.20 Sinvex A load 7 Englosme Removal         40         05 496-174         31 496-20         15 496-20         16 496-20         16 496-20         15 496-20         16 496-20 <td>12-Jun-20. SQH 156:W EARLY WORKS CONSTRUCTION</td>	12-Jun-20. SQH 156:W EARLY WORKS CONSTRUCTION
DVH SUN2 Hunde Removal         31         04 Dec 194.         31 Jan 200         31 Jan 200           DVH SUN2 Rescand Juxif Fatting Strepperty Wolk Englandsm         45         15 Jan 200         20 Met 200         13 Heb 200         1	0, SOH-16.EW1 3D Servey & Point Cloud Study - Dilapidations Included
1001-10013         Standard Judd F Haring & Temporary Work Engineering         40         04-0e-19.4         13-feb-20.5           1001-10016         Fundamental Mark Fallingham         45         13-feb-20.5         30-Mark           1001-10016         Fundamental Mark Fallingham         42         14-feb-20.5         30-Mark           1001-10017         Dealing Barge Fagureman Harrowst         47         60-Mark         15-feb-20.5         30-Mark           1001-10017         Dealing Barge Fagureman Harrowst         47         60-Mark         15-feb-20.5         30-Mark           1001-10017         Dealing Barge Fagureman Harrowst         47         60-Mark         15-feb-20.5         13-feb-20.5           1001-10017         Dealing Barge Fagureman Harrowst         47         60-Mark         15-feb-20.5           1001-10017         Dealing Barge Fagureman Harrowst         16         15-feb-20.5         15-feb-20.5           1001-10017         Dealing Barge Fagur	H-16.BV2 Hamat Removal
001         001 <td>SOH-16.EW.3 Structural Audit / Testing &amp; Temporary Works Engineering</td>	SOH-16.EW.3 Structural Audit / Testing & Temporary Works Engineering
1001-1003-1002         20         10.9-20         14.46-20         10.1424           1001-1003-1002         10.9-20         14.46-20         10.1424           1001-1003-1002         10.9-20         14.46-20         10.1424           1001-1003-1002         10.9-20         14.46-20         10.1424           1001-1003-1002         10.9-20         10.464-20         10.1424           1001-1003-1002         10.9-20         10.464-20         10.1424           1001-1003-1002         10.9-20         10.464-20         10.1424           1001-1003-1003-1003-1003-1003-1003-1003	0-Mar-20, SOH-16.EWA Services Audits & Dilapidations
100-HLIMU Ownhand Practicuto Deck Gamty         15         021-642-00         211-642-00           100-HLIMU Ownhand Practicuto Deck Gamty Whole         60         231-642-00         211-642-00           100-HLIMU Ownhand Endotid Entry Whole         60         231-642-00         60 HLIC-10         60 HLIC-10           100-HLIMU Ownhand Endotid Entry Whole         610         231-642-00         60 HLIC-10         60 HLIC-10         60 HLIC-10           100-HLIC-10 MB Presente         610         613 HLIC-00         60 HLIC-10         60 HL	SOH-16EW.S Funicular Hoist Prepetation
100-HLIMU Ownhand Practicuto Deck Gamty         15         021-642-00         211-642-00           100-HLIMU Ownhand Practicuto Deck Gamty Whole         60         231-642-00         211-642-00           100-HLIMU Ownhand Endotid Entry Whole         60         231-642-00         60 HLIC-10         60 HLIC-10           100-HLIMU Ownhand Endotid Entry Whole         610         231-642-00         60 HLIC-10         60 HLIC-10         60 HLIC-10           100-HLIC-10 MB Presente         610         613 HLIC-00         60 HLIC-10         60 HL	Mar-20, SDH-16.EW/lő Early Works Strengthening
EDM:RADY Lower House BetterNal Loop Synthesis         00         23 Marc20         12 Marc20         12 Marc20           EDM:RADY Lower House BetterNal LOOP Synthesis         455         01 Fdb 20         00 Fdb 20         0	18-May-20, SOH-16.EW/7 Existing Stage Equipment Removal 10, SOH-16.EW/8 Overhead Protection Deck Gantry
SQN14.G. CONCERT HALL CONSTRUCTION         442         07.46.20         09.16.20	12 June 200 Central Protocol Deck damay
OH MC 20         Description         10	09-Nov-25.5
2014 ILC2.2 Social Sequences         10         10.444.20         0.64.44.20         2.2.4           2014 ILC2.3 The Sequence Fig.Level Environment         47         27.44.44.20         27.44.44.20         27.44.44.20           2014 ILC2.3 The Sequence Fig.Level Environment         47         27.44.44.20	18-Oct-21, SOH-11
B 0014 021 M0 Provision         5         18 Mun-20         25 Mun-20         25 Mun-20           B 0014 021 Mun-Breckson         71         67 Mun-20         71 Aug         71 Aug <td< td=""><td>08-jun-21, SOH-16,C2 Overstage/Plantropms &amp; Ga</td></td<>	08-jun-21, SOH-16,C2 Overstage/Plantropms & Ga
Status         10         62 <td< td=""><td>25-Mai-20, SOH-16.C.2.1 WHS Provisions</td></td<>	25-Mai-20, SOH-16.C.2.1 WHS Provisions
2004162.23 Induce High Lend Markes         40         25-bin-20         0.5-bin-20           3004162.24 December Set Web Adjusted         26-bin-20         0.5-bin-20           3004162.24 December Set Web Adjusted         131         13-bin-20         60-bin-23           3004162.24 December Set Web Adjusted         141         13-bin-20         13-bin-20           3004162.24 December Set Web Adjusted         144         13-bin-20         13-bin-21           3004162.24 December Set Web Adjusted         144         13-bin-20         13-bin-21           3004162.23 December Set Web Adjusted         143         13-bin-20         13-bin-21           3004162.23 December Set Web Adjusted         144         13-bin-20         13-bin-21           3004162.23 December Set Web Adjusted         149         13-bin-20         13-bin-21           3004162.23 December Set Web Adjusted         129         10-bin-20         13-bin-21           3004162.23 December Set Web Adjusted         129         13-bin-20         10-bin-20           3004162.23 December Set Web Adjusted         129         12-bin-20         10-bin-20           3004162.23 December Set Web Adjusted         120         12-bin-20         10-bin-20           3004162.23 December Set Web Adjusted         120         12-bin-20         10-bin-20	29-May-20, SDH-16,C22. Demolition 29-May-20, SDH-16,C22. Demolition 29-May-20, SDH-16,C23. Truis Strengtening
Statistics 24. Upper Prediments         100         252-bit-200         100-bit-200           Statistics 24. Upper Prediments         111         11-bit-200         100-bit-200           Statistics 24. Upper Prediments         121         11-bit-200         06-bit-201           Statistics 24. Upper Statistics         124         13-bit-200         06-bit-201           Statistics 24. Upper Statistics         124         13-bit-201         06-bit-201           Statistics 24. Upper Statistics         124         13-bit-201         06-bit-201           Statistics 24. Upper Statistics         124         13-bit-201         06-bit-201           Statistics 24. Upper Statistics         125         12-bit-201         06-bit-201           Statistics 24. Upper Statistics         126         10-fiel-20         12-bit-201           Statistics 24. Upper Statistics         12         12-bit-201         12-bit-201	01-Sep-20, SQH-16C,2:5 Techzone High Level Services
BioHeL22 ConcerveD1         111         111.un20         16 Dec-30           BioHeL22 InterveD1         134.un20         16 Dec-30           BioHeL22 InterveD1         134.un20         11.4un20           BioHeL22 InterveD1         124.un20         11.4un20           BioHeL22 InterveD1         124.un20         11.4un20           BioHeL22 InterveD1         125.un20         11.4un20           BioHeL22 InterveD1         125.un20         11.4un20           BioHeL22 InterveD1         125.un20         11.4un20           BioHeL23 InterveD1         125.un20         11.4un20           BioHeL23 InterveD1         125.un20         11.4un20           BioHeL23 InterveD1         125.un20         11.4un20           BioHeL23 InterveD1         126.un20         11.4un20           BioHeL23 InterveD1         126.un20         11.4un20           BioHeL23 InterveD1         11.4un20         11.4un20 <td>10-Dec-20, SOH-16.C.2.6 Upper Plantrooms</td>	10-Dec-20, SOH-16.C.2.6 Upper Plantrooms
504162.23 BC Oversid Twiss         104         11.0x-20         31.0x-20           504162.23 BC Oversid Twiss         105         12.0x-20         31.0x-20           504162.23 BC Oversid Twiss         105         12.0x-20         31.0x-20           504162.23 BC Oversid Twiss         105         10.0x-20         31.0x-20           504162.23 BC Oversid Twiss         103         10.0x-20         31.0x-20           504162.23 BC Oversid Twiss         41         25.0x-20         50.0x-20           504162.23 BC Overside         41         25.0x-20         50.0x-20           504162.23 BC Overside         50         7.0x-20         50.0x-20           504162.23 BC Overside         50         7.0x-20         50.0x-20           504162.24 BC Overside         50         7.0x-20         50.0x-20           504162.24 BC Overside         50         7.0x-20         50.0x-20           504162.24 BC Overside         50         52.0x-20         52.0x-21           504162.24 BC Overside         50<	16-Dec-20, SOH 16-C.2.7 Campo Port Structure Bill Campo Port Structure Bill Campo Port Structure
900446.224 BIC Clearesh PartWas         115         29.543-20         13.467-21           900446.234 BIC Clearesh Fall         115         29.543-20         13.467-21           900446.234 BIC Clearesh Fall         105         10.767-20         10.766-20           900446.234 BIC Clearesh Fall         105         10.767-20         10.766-20           900446.234 BIC Clearesh Fall         125         10.766-20         10.766-20           900446.234 DBC Clearesh Fall         25         27.767         16.167-20           900446.234 DBC Clearesh Fall         127         27.767-20         10.766-20           900446.234 DBC Clearesh Fall         127         27.767-20         10.766-20           900446.234 DBC Clearesh Fall         23         27.767-20         10.766-20           900446.234 DBC Clearesh Fall         23         23.567-20         10.766-20           900446.234 DBC Clearesh Fall         23         23.567-20         10.766-20           900446.234 DBC Clearesh Fall         23         23.567-20         10.766-20           900446.234 DBC Clearesh Fall         13         23.567-20         10.766-20           900446.234 DBC Clearesh Fall         13         23.567-20         10.766-20           900446.234 DBC Clearesh Fall         13         23.5	31-May-21, SOH-16.2.28 Technone SK: Winch Equip 31-May-21, SOH-16.2.29 SEC Overfeed Theatre Work
BitH 502 Min Circurof Min         416         19 / ref-20         3 / spc-21           Strett 62.1 Second Vehiced Centry & Bitricege         119         10 / ref-20         3 / spc-21           Strett 62.1 Second Vehiced Centry & Bitricege         12         12 / shc-20         2 / shc-20           Strett 62.1 Second Vehiced Centry & Bitricege         12         12 / shc-20         2 / shc-20           Strett 62.1 Second Vehiced Centry & Bitricege         13         12 / shc-20         2 / shc-20           Strett 62.1 Second Vehiced Centry & Bitricege         12         12 / shc-20         2 / shc-20           Strett 62.1 Second Vehiced Centry & Bitricege         12         12 / shc-20         2 / shc-20           Strett 62.1 Second Vehice Centry & Bitricege         12         2 / shc-20         2 / shc-20           Strett 62.1 Second Vehice Centry & Bitricege         12         2 / shc-20         2 / shc-20           Strett 62.1 Second Vehice Centry & Bitricege         12         2 / shc-21         2 / shc-21           Strett 62.1 Second Vehice Centry Bitricege         12         2 / shc-21         2 / shc-21           Strett 62.1 Second Vehice Centry Bitricege         12         2 / shc-21         2 / shc-21           Strett 62.1 Second Vehice Centry Bitricege         12         2 / shc-21         2 / shc-21	
BioHetC312 Out/StatiDendition         41         25 Mex-20         26/Mex-20           BioHetC312 Out/StatiDendition         52 Mex-20         26/Mex-20           BioHetC312 Out/StatiDendition         52 Mex-20         26/Mex-20           BioHetC312 Out/StatiDendition         50 Mex-20         26/Mex-20           BioHetC312 Out/StatiDendition         30         72 Mex-20         76/Mex-20           BioHetC312 Out/StatiDendition         30         72 Mex-20         76/Mex-20           BioHetC312 Out/StatiDendition         30         72 Mex-20         76/Mex-20           BioHetC312 Out/StatiDendition         102         25/Mex-20         76/Mex-20           BioHetC31 Out/StatiDendition         102         25/Mex-20         76/Mex-20           BioHetC31 Out/StatiOnencount         102         25/Mex-20         76/Mex-20 <td>13 Sep-21, SOH-16.C.3 Ma</td>	13 Sep-21, SOH-16.C.3 Ma
Structure         Structure <thstructure< th="">         Structure         <th< td=""><td>10-Nov-20, SOH-16 Ci3.2 Cheir Stall Demolifion</td></th<></thstructure<>	10-Nov-20, SOH-16 Ci3.2 Cheir Stall Demolifion
1         0.044.0.24 Bigs Construction         60         17.4m.20         21.5m.20           1         0.044.0.25 Bits Chaps Construction         80         0.045.0.25 Bits Chaps Construction           2         0.044.0.25 Bits Chaps Construction         20         29.5m.20         16.4m.21           2         0.044.0.25 Bits Chaps Construction         10         24.4m.21         12.4m.21           2         0.044.0.25 Bits Chaps Construction         11         24.4m.21         12.4m.21           3         0.044.0.25 Bits Chaps Construction         12         24.4m.21         12.4m.21	16-Jun-20. SOH-36.C.3.3 Stage Demolition
Stretule Class Bit Shape Construction         205         29.5 Sec.27         15.4 Join 21           Stretule Class Bit Development Constraint Finishes         102         29.5 sec.27         12.4 Join 21           Stretule Class Bit Development Constraint Finishes         102         35.4 sec.27         12.4 Join 21           Stretule Class Bit Development Constraint Finishes         11         24.4 sec.27         12.4 Join 21           Stretule Class Bit Development Constraint Finishes         10         24.4 sec.27         12.4 Join 21           Stretule Class Bit Development Constraint Finishes         10         24.4 sec.27         12.4 Join 21	21-Sep-20. SOH-16.C.3/4 State Construction
Both(cl.2) High level Concent Hill Relatives         102         20-Jan-21         24-Jan-21           BOHH(cl.2) Keylor (Relative) Ke	28-Sep-20, SOH-16.C.3.5 Cheir Stall/Construction 16-Aug-21, SOH-16.C.3.6 SEC Stag
SOMAG.2.38 Coals-Deed Starting Namonal         11         2.24-lum-21         12-lul-21           SOMAG.2.38 Natrigite Equipment         45         0.7-lul-21         07-solv-21	24-Juni 21, SOH-16.C.3.7 High Level Concert Ha
SOH16.C.3.9 Hanging Equipment 45 07-bil-21 07-Sep-21	12-Jul-21.SOH-16.C3.8 Crash-Dick Garity
	07-Sep-21,50H-16C339 Ha
00H-814.2.19 Concert Hell Finances         250         29:569:20         13:569:21           00H-814.2.19 Concert Hell Simunds         33:5         19:469:20         02:Jun;21	13-Sep-21, SOH-16.C.3.10 0 02-Jún-21, SDH-16.C.4 Conjcett Half Surrounds
T SOH-16.C.4.1 Western Wing Wall 335 19-Eeb-20 02-km-21	02-Jún-21, SDH-16,Č.4.1 Western Wing Wall
S0616.C42 Eastern Wing Well 180 26-Feb-20 16-Nos-20	16-Nov-20, SCH-116.C.42 Eastern Wing Wall
Actual Level of Effort Remaining Work   Milestone Page 1 of 2	Programme Assumes Dual Funicula



		SYDNEY OPERA HOUSE WESTERN RENEWAL PROJECT TAYLOR PRECONSTRUCTION SUMMARY PROGRAMME - REV 16 - 27DEC19																	-	
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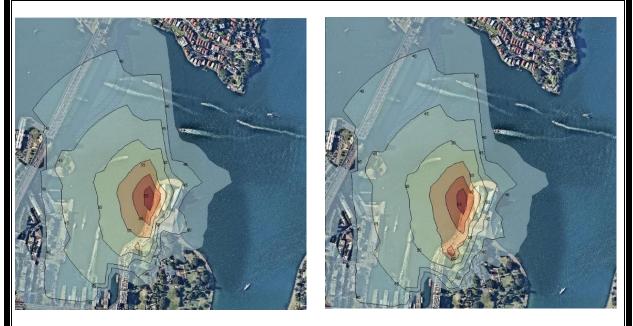


# Appendix BNoise ImpactsContour maps of predicted noise levels





Figure B.1: Noise Contours - Demolition



Site Works

Site Works and delivery vehicle

Figure B.2: Noise Contours – Concreting





Figure B.3: Noise Contours – Internal Works

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