5.2.4.9 Electro Acoustic Upgrade

Electro Acoustic Upgrade Project involves overall improvements to the acoustic performance for both the performers and patrons of the Joan Sutherland Theatre. The project is an overarching umbrella for a various areas of work which include:

- Orchestra Pit works
- Stage Edge
- JST Auditorium Acoustic Upgrades e.g. sound insulation, speakers, associated cabling and amplifiers.

Orchestra Pit

The existing Orchestra Pit will be stripped out for the refurbishment of a new Orchestra Pit. A complete overhaul of the Orchestra Pit is included in the WP1B scope of works. The Orchestra Pit design also considers the modifications made to adjacent structures such as the cutting back of existing concrete stage edge as well as changes in finished levels. To facilitate this work, there will be the following demolition works:

- Service Terminations and Removals post wall lining removal
- Mechanical Existing Return Air to be removed
- Demolition of existing Orchestra Pit Internal Step Platforms
- Soft Strip of Wall linings, ceilings and soffit walls
- Demolition of Orchestra Pit Riser and Orchestra Pit Lower

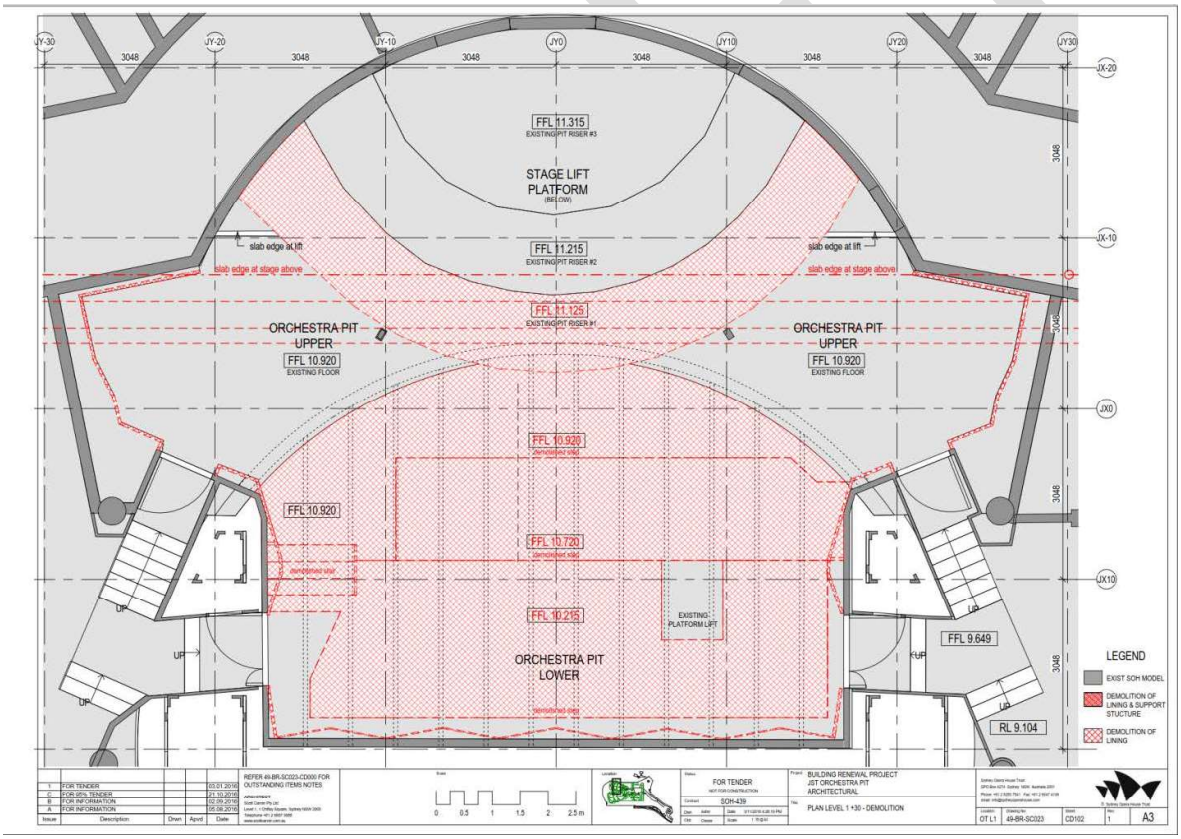


Figure 85- Orchestra Pit Scope of Lining and Support Structure Demolition

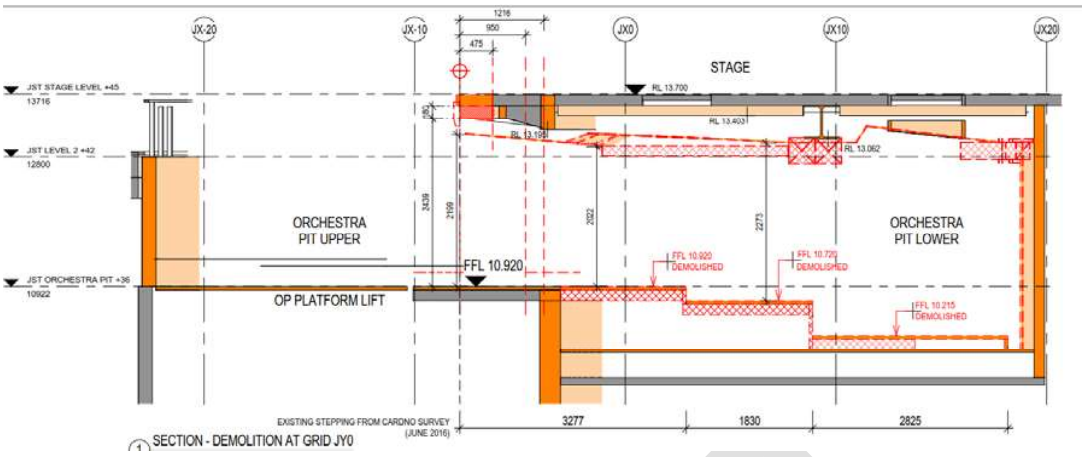


Figure 86- Section view of Orchestra Pit Ceiling and Platform demolition

Stage Edge

The existing concrete stage edge will be cut back approximately 450mm and a new structural steel stage edge to be installed to extend the current overhang of the stage. This structural steel beam will serve to house speakers and lighting for the new Orchestra Pit

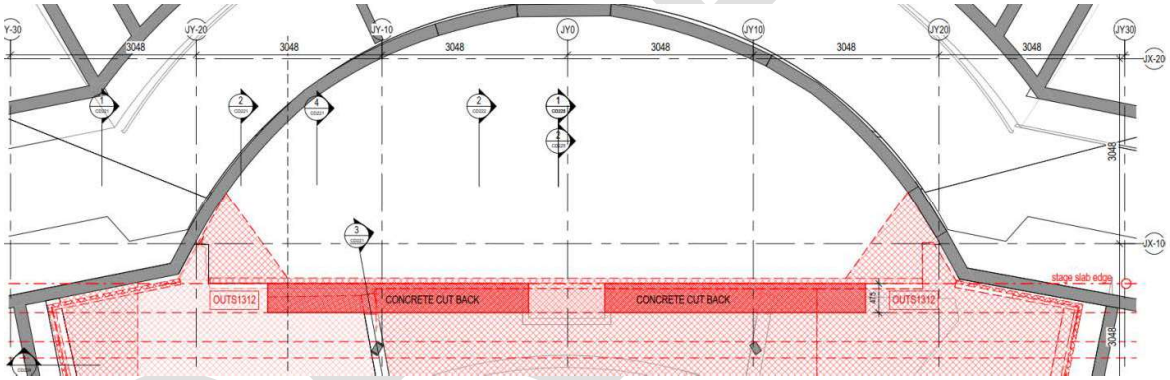


Figure 87- Concrete Cutback of Existing Stage Edge

JST Auditorium Acoustic Upgrade

Electro acoustic infrastructure within the JST Auditorium will be upgraded as part of the JST renewal works. This includes existing speakers, associated cabling, amplifiers and supporting bars. Significant amounts of speaker removal works are located in the above stage proscenium area and will be facilitated by the installation of the 'birdcage' scaffold within the JST auditorium. These works fall under the Theatre Systems Integrator Package.

5.2.4.10 Auditorium Lighting Replacement

The scope for this project includes the replacement of all house lights and controls in the auditorium. The lights to be used in the replacements are based on the specification on an earlier completed Concert Hall Lighting Replacement Project. As with the electro acoustic upgrade works, the JST 'birdcage' scaffold will be utilised to safely remove all auditorium lighting.

5.2.4.11 Surtitle Infrastructure

Surtitles are large screens which display projected multimedia during performances. As part of this project, IT infrastructure as well as winch and hoist mechanisms to be supplied by Opera Australia. Whilst there is no specific demolition works scoped for this project, the removal of existing bars, ropes and equipment hanging from JST Auditorium is required.

5.2.4.12 Assistive Listening Systems

Removal of existing Assistive Listening Systems currently installed within the JST Auditorium is required for the installation of new systems, including the zoning of new systems, with an induction driver per zone and loops serviceable.

5.2.4.13 New Follow Spot Rooms

The current follow spot room will be decommissioned and relocated further back to allow full coverage of the stage. In addition, mechanical plant upgrades will allow improvements to the working conditions within the follow spot room. Demolition works include:

- Demolition of walls and cut in of penetrations
- Demolition of stairs for replacement and to suit new level
- Demolition and removal of existing handrail
- Demolition of existing catwalk
- Existing SOH 'sawtooth profile' plywood panels on existing framing lowered and hung on Rondo 'Key Lock' suspended grid system below Follow Spot Room floor framing.

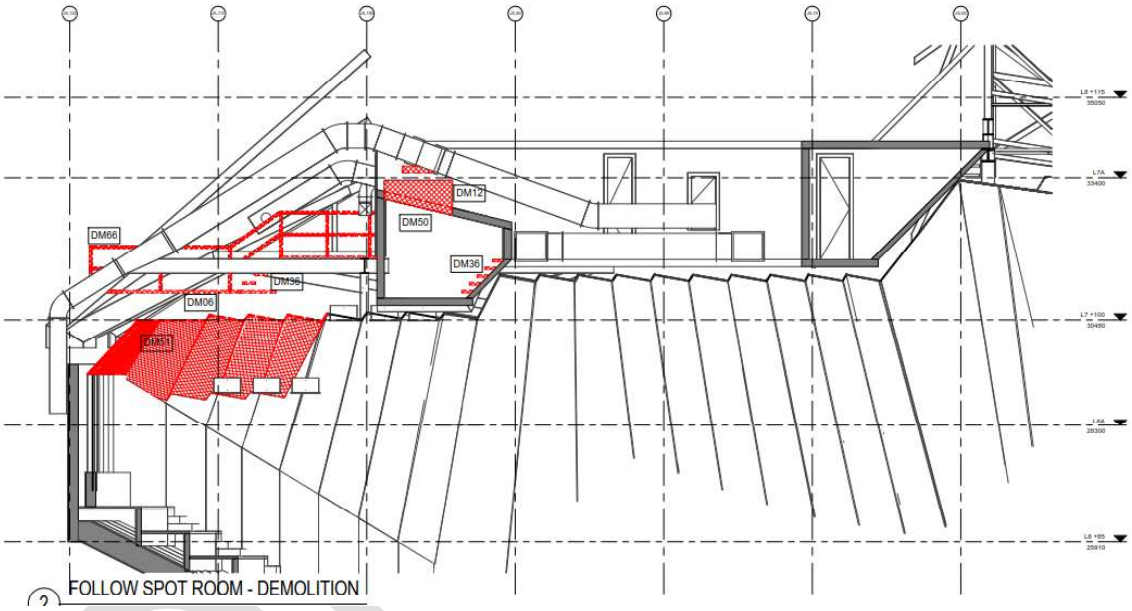


Figure 88- Demolition Plan Section of Existing Follow Spot Room

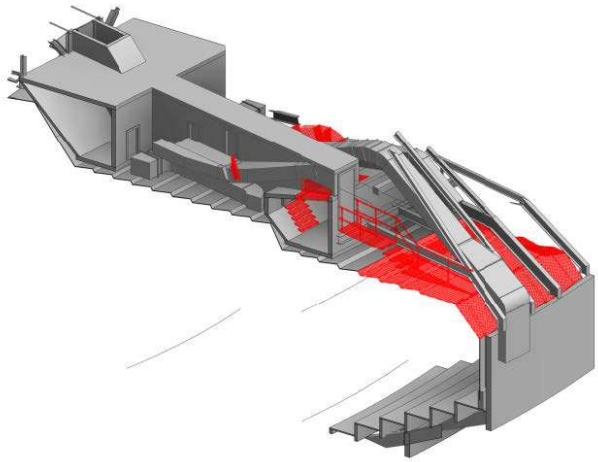


Figure 89- 3D view of Demolition of existing Follow Spot Room

5.2.5 Excavation

Minor excavation works are required to the following areas:

- Lift 36 new pit within the scenery dock into Level B1

5.2.6 Construction & Refurbishment

5.2.6.1 HVAC Plantrooms 22 & 23 Upgrade

Following the complex decommissioning, demolition and removal of largely mechanical infrastructure and existing services within Plantrooms 22 and 23, installation of new mechanical infrastructure will occur. The replacement units will be modern units to service the JST foyer, stage and auditorium. Construction and refurbishment works will include:

- Installation of new electrical distribution equipment
- Replacement of 23 AHU1, 23 AHU2 and 23 AHU3, including AHU wall floor top panels, cooling and heating coils, water actuators, supply fan, return/relief fan and dampers.
- Installation of new FCUs to service the side foyers of Opera theatre
    - New FCU's to replace 23 AHU4 and 23 AHUS and some capacity of 23 AHU2 (AHU2 currently serves side foyers as well as theatre).
    - Reusing supply air ductwork and return air duct and altering to provide outside air and relief.
    - Installation of new supply air ductwork after fancoil to serve foyer.
- Installation of new FCUs to service the south foyer of Opera Theatre
    - New FCU's to replace 22 AHU1.
    - Reusing supply air and return air ductwork between plant and foyer altering to provide outside air and relief.
    - Provide new supply air ductwork after fancoil to serve foyer.
- Replacement of Dampers
    - Replacement of supply, return, relief, outside air and other associated dampers serving plantroom 23.
- Reworking of Smoke Exhaust System OPB19
    - Replacing belts, bearings and vibration isolation and providing a general service. Blower, motor and shafts to remain.
- Reworking of the controls and control system
    - Upgrade of all controls and controls strategy to current standard.
- Improved plant access for maintenance
    - Improve circulation/access space by reducing overall footprint of plant, by deleting three off AHU's and by relocating plant to more accessible locations.
- Replacement of flexible ductwork between rigid and grilles throughout Opera Theatre and South/east and west foyers.
- Replacement of all external lagging to rigid ductwork throughout opera theatre (access to ductwork is reasonable through walkways above the theatre auditorium).
- Provision of additional cooling to follow spot booths, taken from existing AHU ductwork local to these spaces

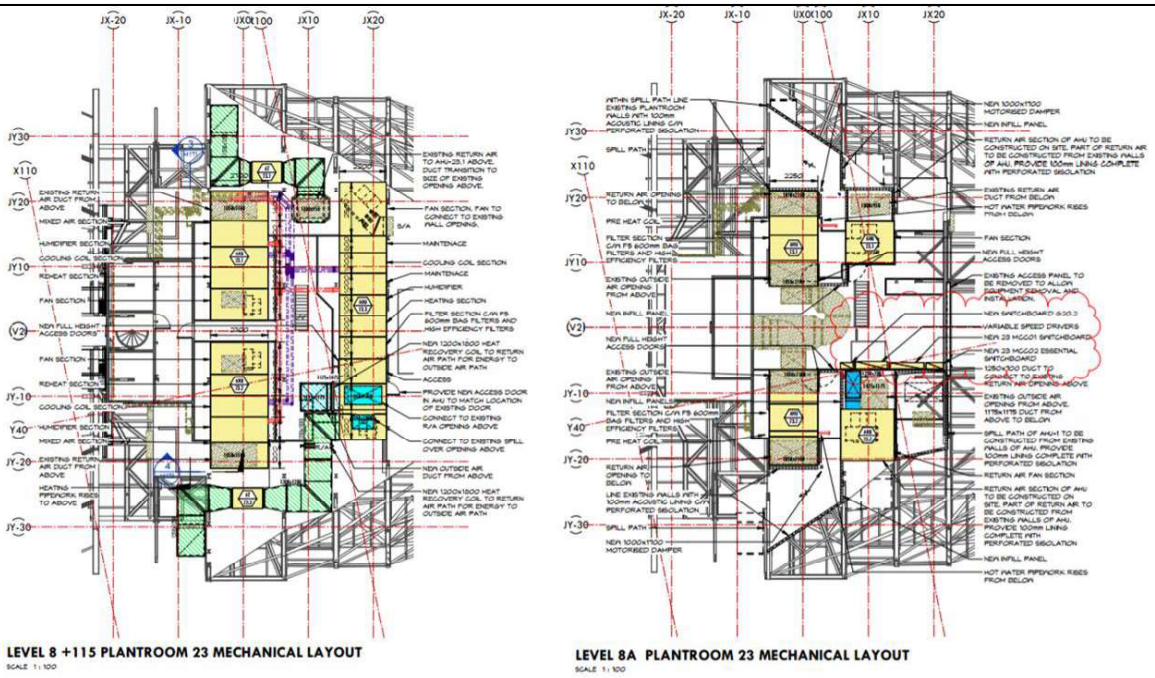


Figure 90- New Plantroom 23 Layout

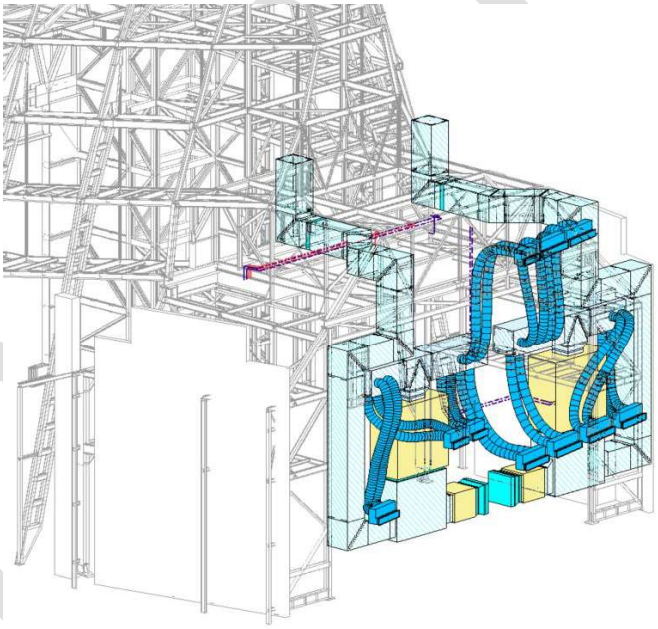


Figure 91- New Plantroom 22 Mechanical Units and Ductwork

5.2.6.2 Seat Refurbishment

Following the completion of JST auditorium works, the reinstatement of all JST Seating will be required. This has been indicated to take a 6 man crew 2 days to complete. Seating aesthetics will not be changed from the existing conditions. In addition to these works, new larger steps to facilitate disabled wheelchair seating will be constructed. Finishes of new construction will match existing within JST. Construction works associated with this project include:

- Improvements to selected JST seating, fire rating etc.
- Construction of new finish floor levels to facilitate disability access and seating

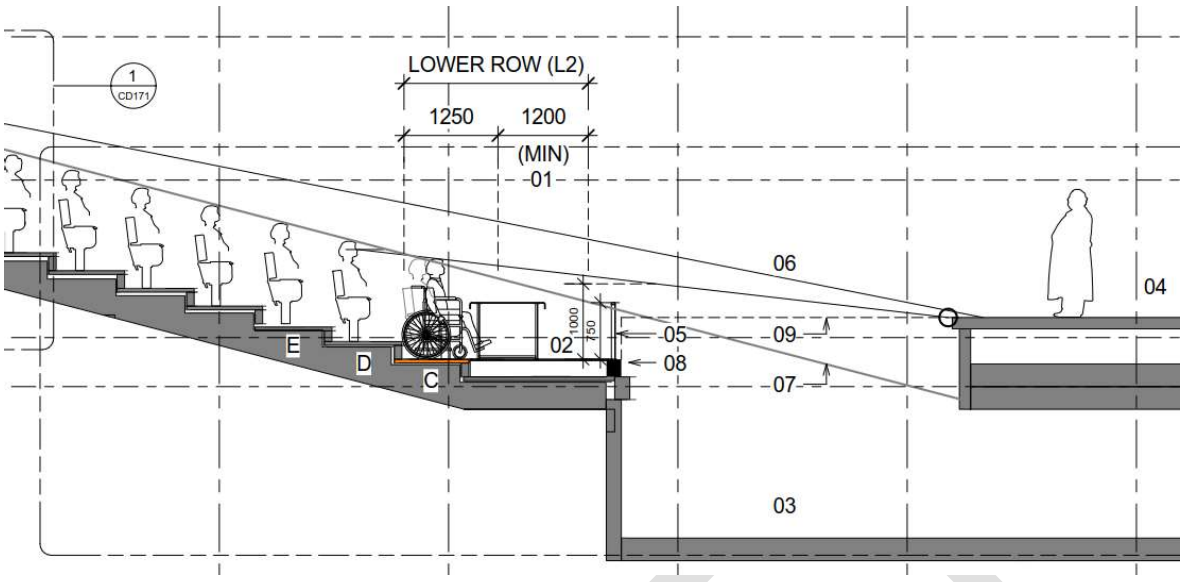


Figure 92- Construction of new disability access seating area

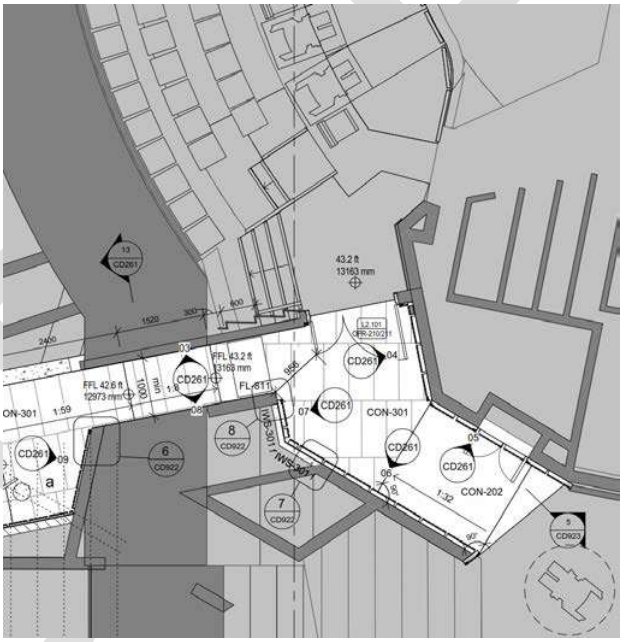


Figure 93- New finish level for the lower L2 disability area

New access from stage to the auditorium

Following the refurbishment and construction of new JST Auditorium layout and levels, there is a separate project to improve access between the stage and the main seating area. Currently, staff and performers step across a plywood box over the edges of the orchestra pit to traverse between the two areas. To improve this:

- Design and manufacture of a set of portable steps that can be held in storage near to stage edge, and deployed easily at the end of a performance to allow direct access from the auditorium to the stage.

5.2.6.3 Lower and Mid Access Tunnels

Following the demolition of concrete walls, slabs, removal and diversion of services, the construction of the lower L2 and mid L3 tunnels will occur. The construction of the new concrete tunnels will allow the throughput access from JST Southern Foyers to the Northern Foyers, which is not possible at the moment. The tunnels will also interface with new Lift 36 to provide full vertical and horizontal access within the JST.

- Construction of new L2 Lower Tunnel
- Construction of new L2 Lower Tunnel slab and concrete walls
- Construction of new Lift 8 Lobby including refurbishment of lift car and stairs
- Construction of new Kitchen Store Space
- Timber wall finish to match existing
- Construction of penetration in existing L3-L4 precast steps with Brass cladding finish and balustrade
- Construction of new tunnel to Northern Foyer Lobby area (adjacent new accessible toilet)

Figure 94- Proposed L2 Lower Tunnel Plan

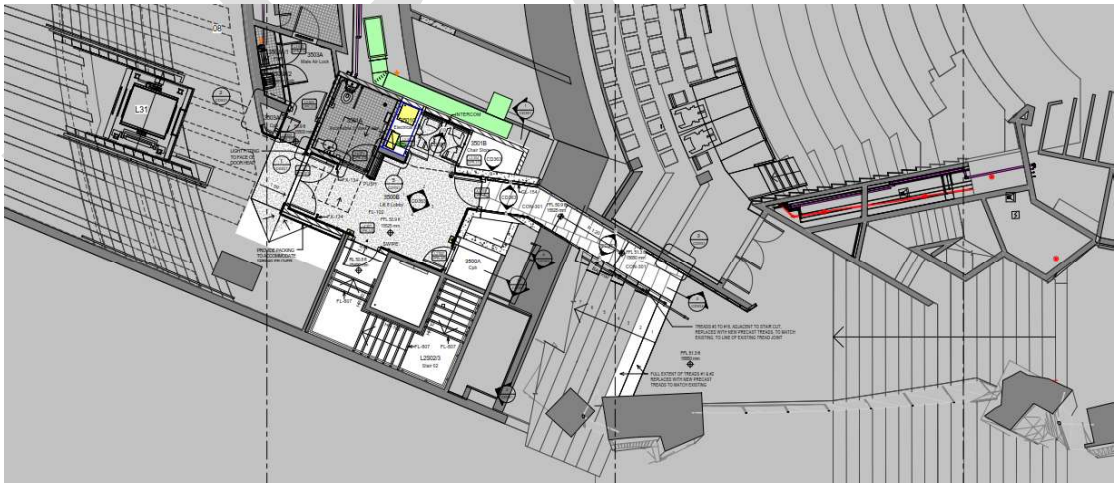


Figure 95- Proposed L3 Mid Tunnel Plan

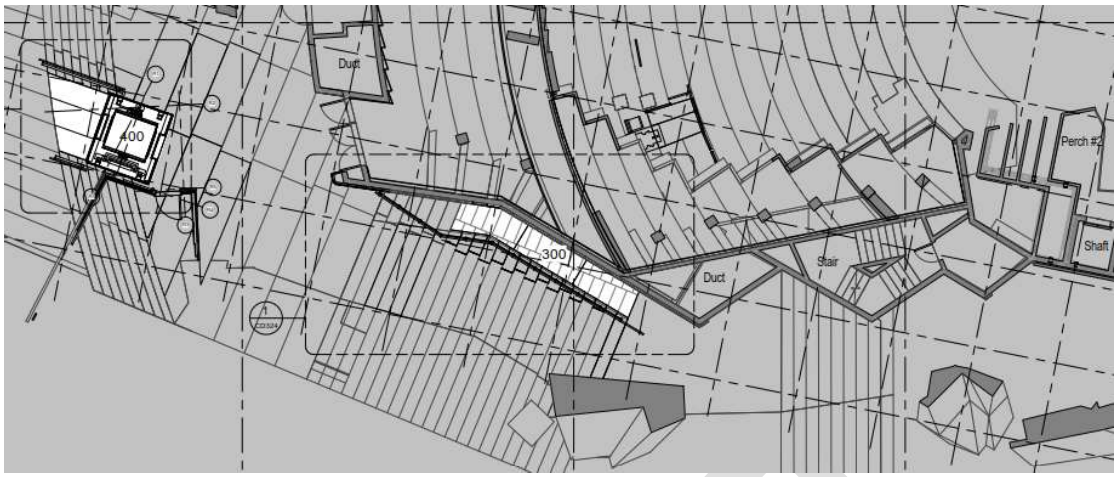


Figure 96- Proposed L4 Mid Tunnel into Precast Steps Plan

5.2.6.4 Lift 31

Enabling demolition works, including the cut in of penetrations and removal of existing glass façade, for Lift 31 works will allow the construction of the lift to occur. Works in this project include:

- Construction of concrete lift pit
- Construction of new concrete landings
- Installation of structural steel lift frame
- Installation of modified existing glass façade and roof
- Installation of new Lift 31 car

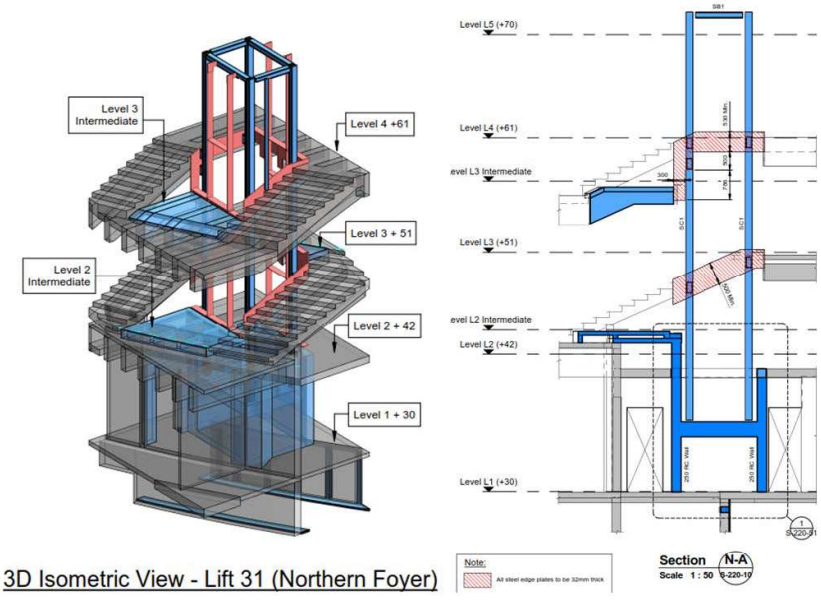


Figure 97- New Northern Foyer Lift 31 Construction

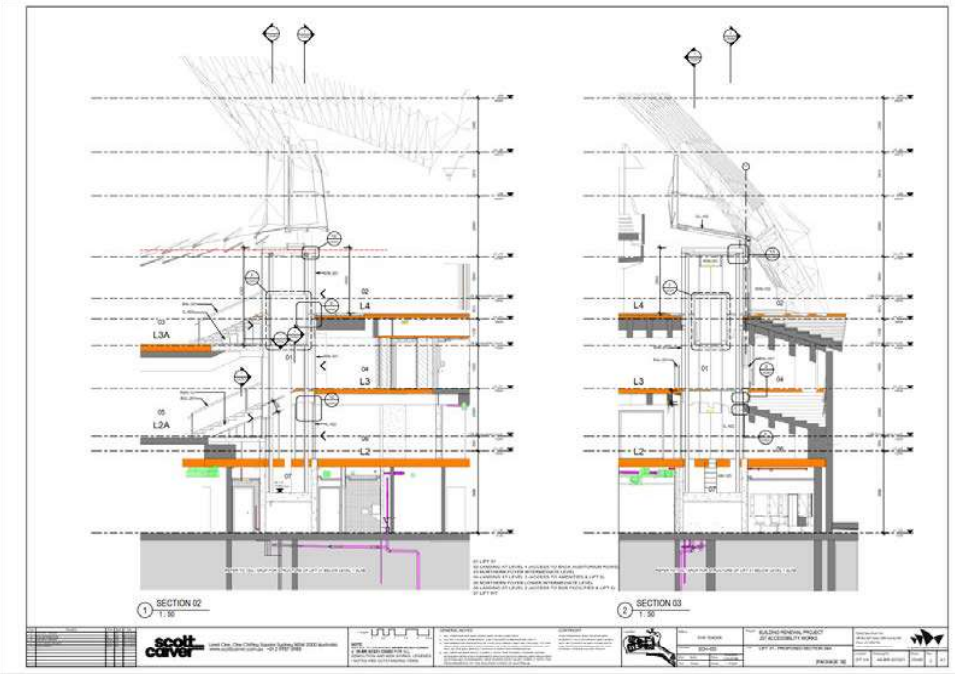


Figure 98- Lift 31 Sections

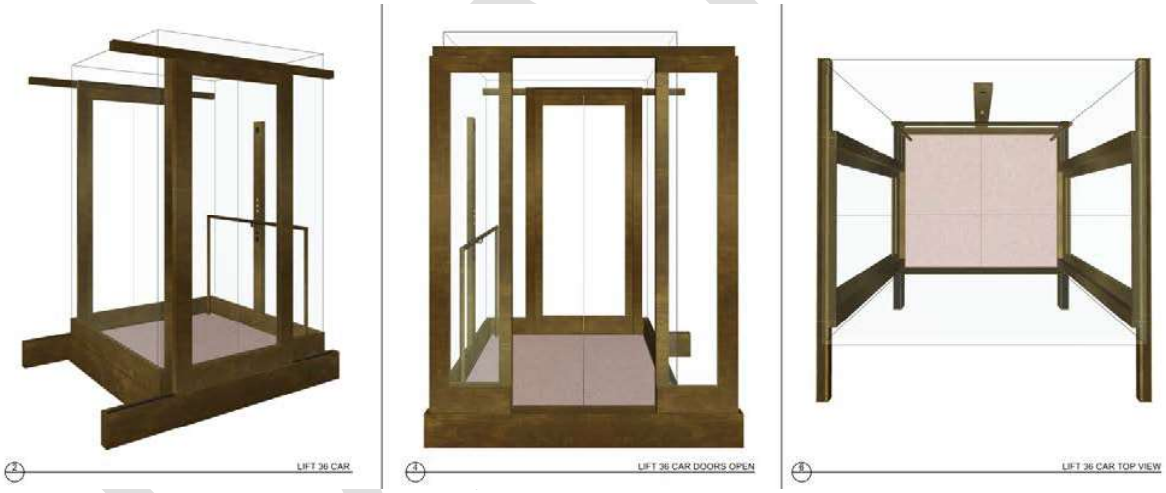


Figure 99- New Lift 36 Car, Lift 31 Similar

5.2.6.5 Dressing Room Upgrade Lift 31

Following the installation of Lift 31 Lift Pit base, Level 1 dressing room which was demolished to facilitate this will require refurbishment works. Included in this project is:

- Recommissioning of existing vanity bays
- Construction of internal walls
- Construction of new bathroom including toilet, shower and hydraulic services
- Construction of new cleaners sink in the location of previous drying room

Figure 100- New L1 Dressing Room

5.2.6.6 Dressing and Accessibility Room Upgrade East/ West)

The existing Actor's union office (west dressing room) and existing office space (eastern dressing room) as shown in the figure below are to be converted into accessible dressing rooms. The spaces which will have been stripped down to room shells during demolition stage will require:

- Installation of new services including hydraulic, fire, mechanical and electrical
- Construction of new toilets, showers
- Construction of new internal walls
- Installation of new resilient flooring and tiling finishes

Figure 101- New L1 Eastern Accessible Dressing Room

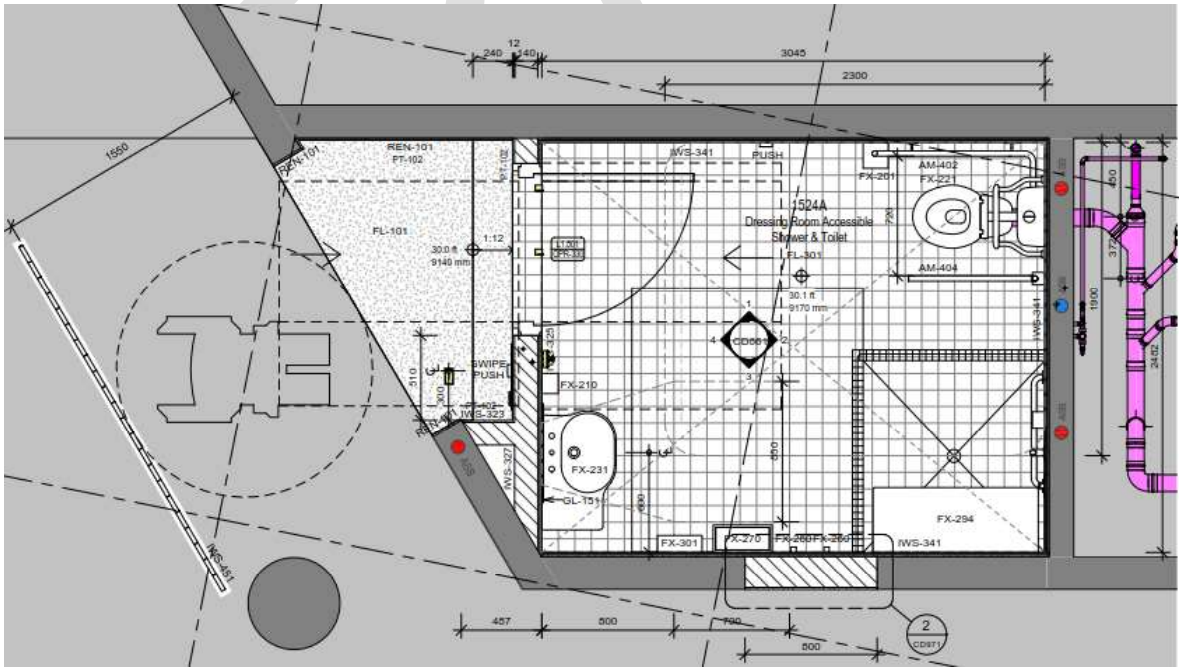


Figure 102- New L1 Western Accessibility Room

5.2.6.7 Sanitary Facilities Upgrade

A complete refurbishment of the existing Level 3 Northern Foyer female toilets will occur as part of the sanitary facilities upgrade. In addition to this, a new accessible facilities located on Western side will be constructed in line with SAVE objectives. Male toilets will not refurbished.

- Installation of new services in mechanical, fire and hydraulic
- Complete refurbishment of female toilets including new toilet partitions, basins and other fixtures
- Construction of wall and floor finishes
- Construction of new accessible facility

Figure 103- New Level 3 Northern Foyer Female Toilets

Figure 104- New Western Side Accessible Toilet

5.2.6.8 Control Room Upgrade

The control room will be the central headquarters for the newly installed Theatre Systems Integrator package. In line with these upgrades, refurbishment to the existing control room will occur following removal of outdated mechanical infrastructure and equipment. New works include:

- Installation of new hardwood flooring or similar to improve appearance
- Installation of new height adjustable work benches with underside equipment racking
- Installation of new lighting
- Installation of improved wall finishes and acoustics
- New airlock wall with sliding door to the LX control side
- New mechanical system
    - Stand-alone AHU/ FCU
    - BMS Control Cabinet
    - Mechanical Services Switchboard MSSB

5.2.6.9 Electro Acoustic Upgrade

Orchestra Pit

Construction of the refurbished Orchestra Pit will occur under a protected scaffold to allow simultaneous works on the proscenium and TMP. Following the complete strip out of the existing Orchestra Pit during the demolition phase of works,

e existing Orchestra Pit will be stripped out for the refurbishment of a new Orchestra Pit. A complete overhaul of the Orchestra Pit is included in the WP1B scope of works. The Orchestra Pit design also considers the modifications made to adjacent structures such as the cutting back of existing concrete stage edge as well as changes in finished levels. To facilitate this work, there will be the following demolition works:

- Service Terminations and Removals post wall lining removal
- Mechanical Existing Return Air to be removed
- Construction of new of existing Orchestra Pit Internal Step Platforms
- Soft Strip of Wall linings, ceilings and soffit walls
- New Tiers, e.g. Orchestra Pit Riser and Orchestra Pit Lower

Installation of improved wall finishes and acoustics

New access stairs

New mechanical ductwork and bulkhead

New orchestra pit floor

New tiered flooring

Stage Edge

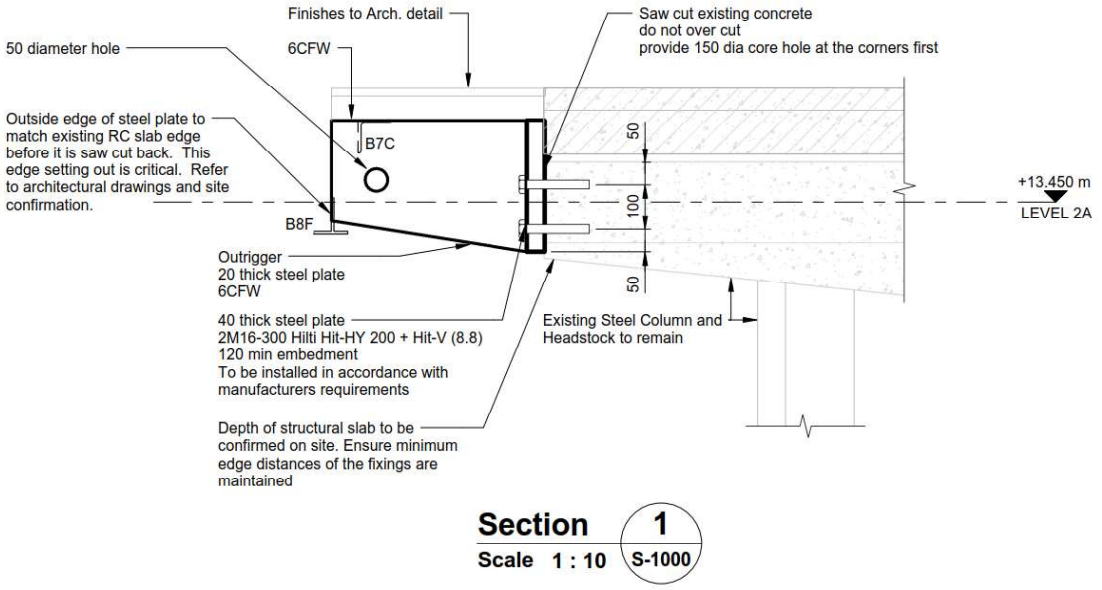


Figure 105- Section View of New Structural Steel Stage Edge

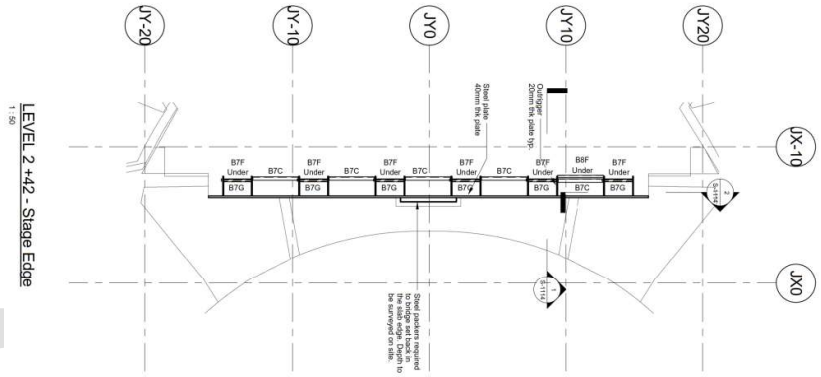
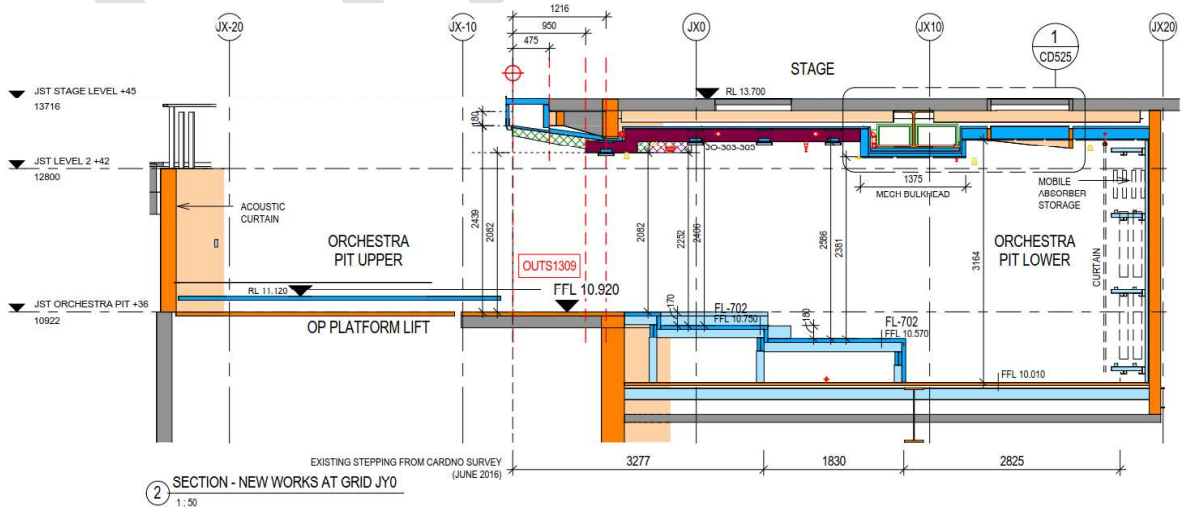
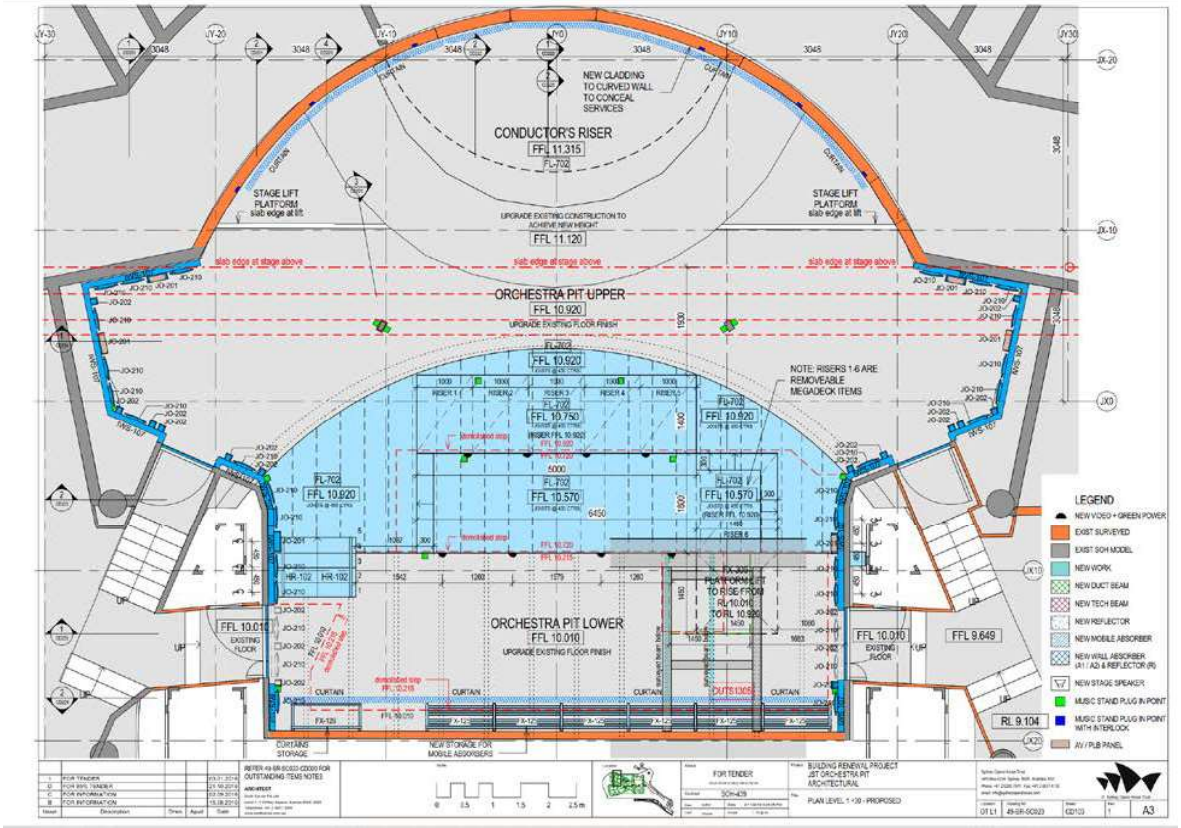


Figure 106- Plan view of new Structural Steel Stage Edge





JST Auditorium Acoustic Upgrade

Locations of the speakers to be installed inside the JST auditorium include the ashtray loges, under the upper balcony (galleries), upper level balustrades and rear wall stalls, ceiling above front/ middle circle, side wall at rear circle, ceiling above stalls and ceiling above middle circle.

The speakers are comprised of arrangements of loudspeakers and subwoofers. Some of which are housed within recesses which may extend out on telescopic fixtures as required by the acoustic needs of the performance. Some excerpts from the Muller-BBM Loudspeaker Arrangement Set Drawings (M223739_DD_LS_Position) are shown below.

Figure 107- Speaker Locations at the Ashtray Loges

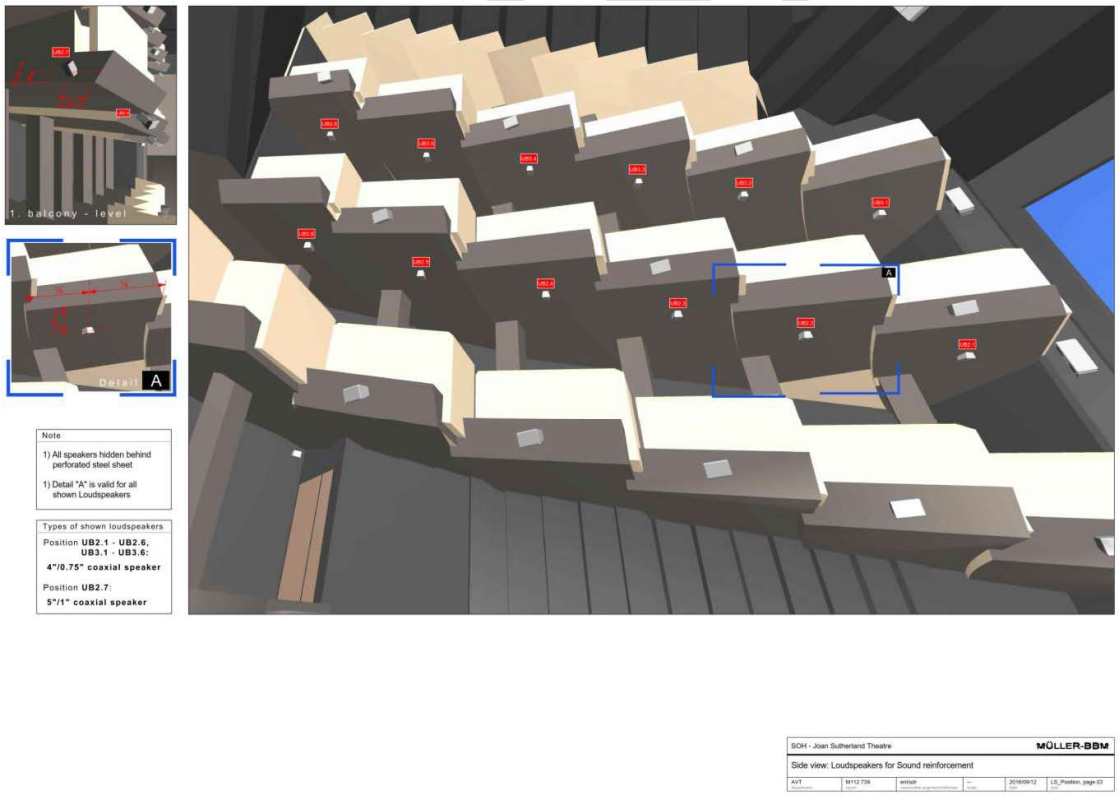


Figure 108- Speakers to the underside of the Ashtray Loges

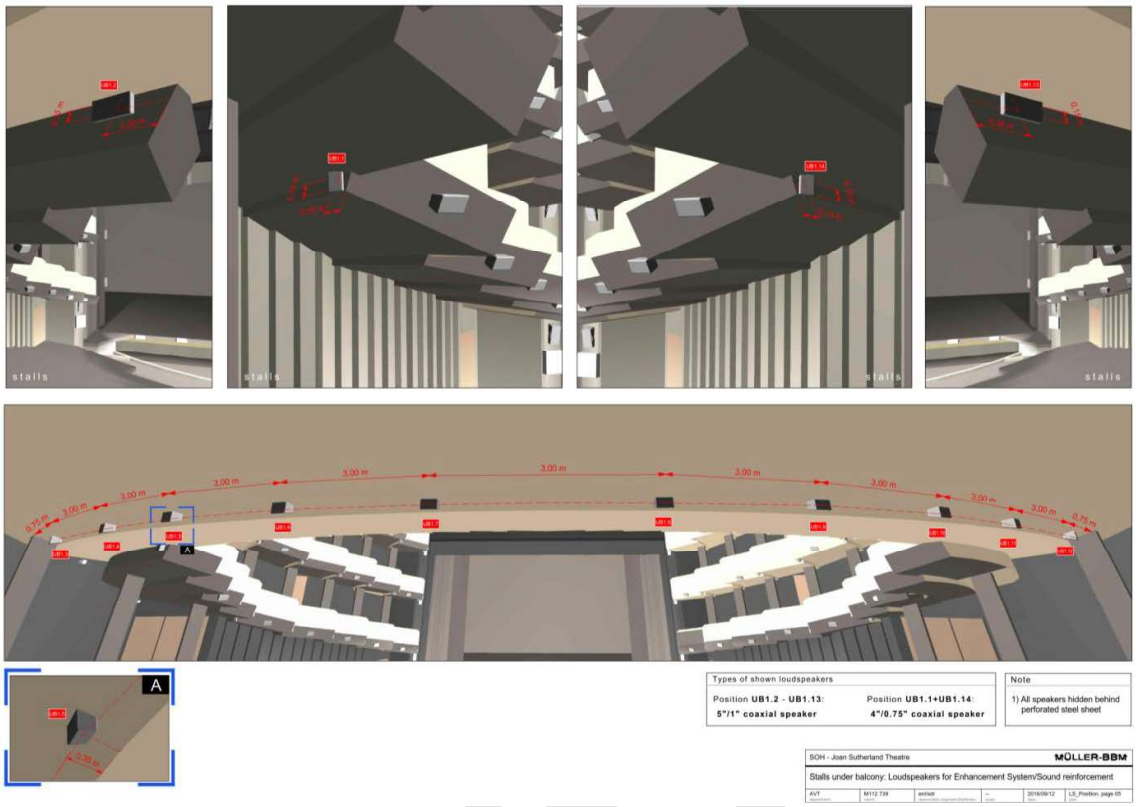


Figure 109- Speakers under upper seating balcony

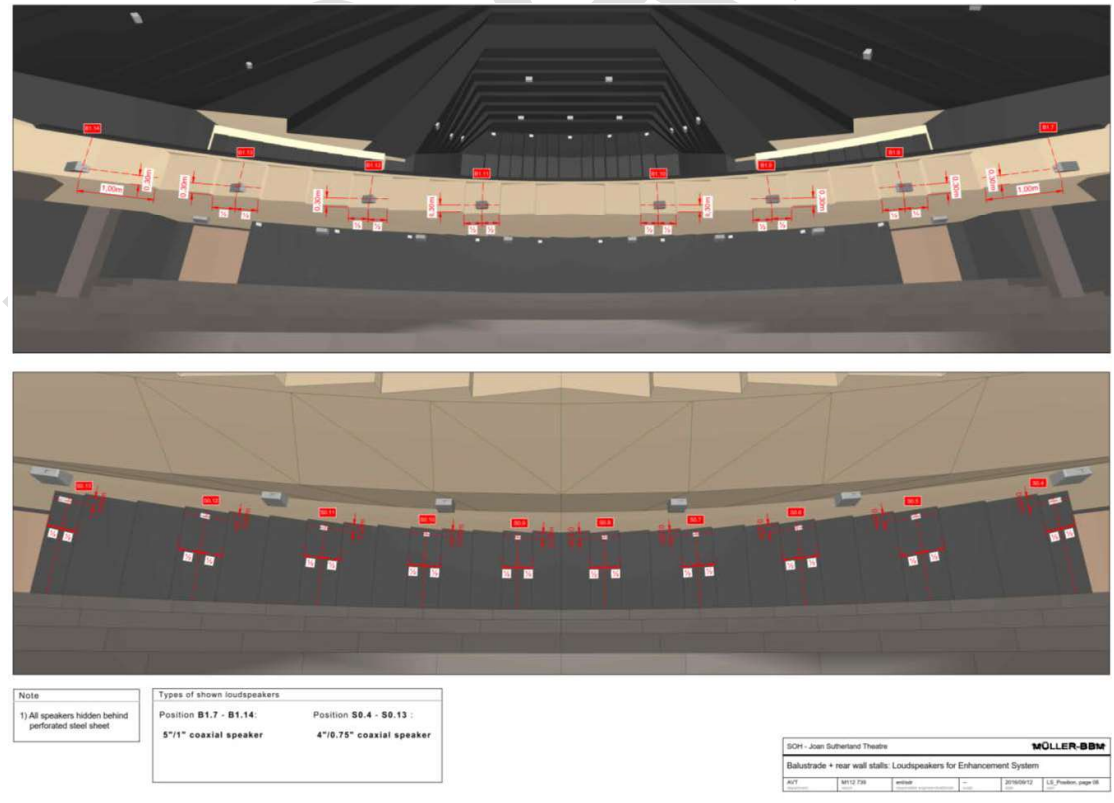


Figure 110- Speakers on upper seating balcony balustrades and JST Rear Wall

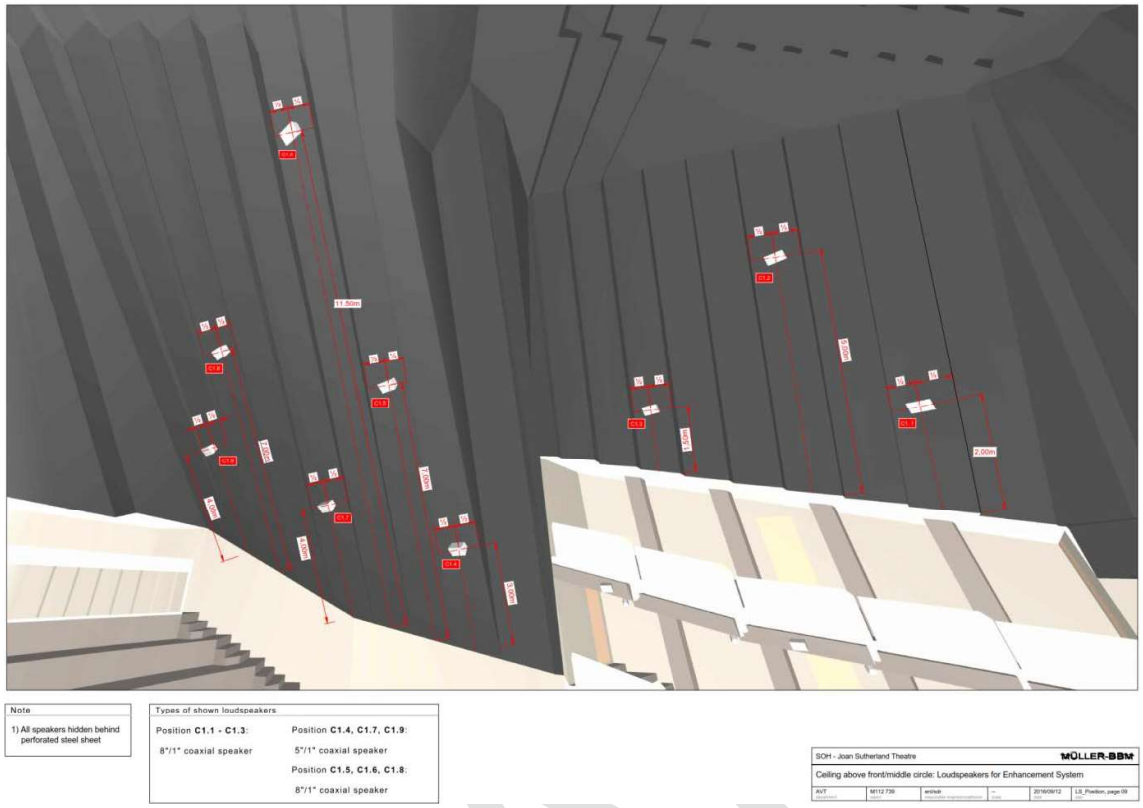


Figure 111- Ceiling above front/ middle circle

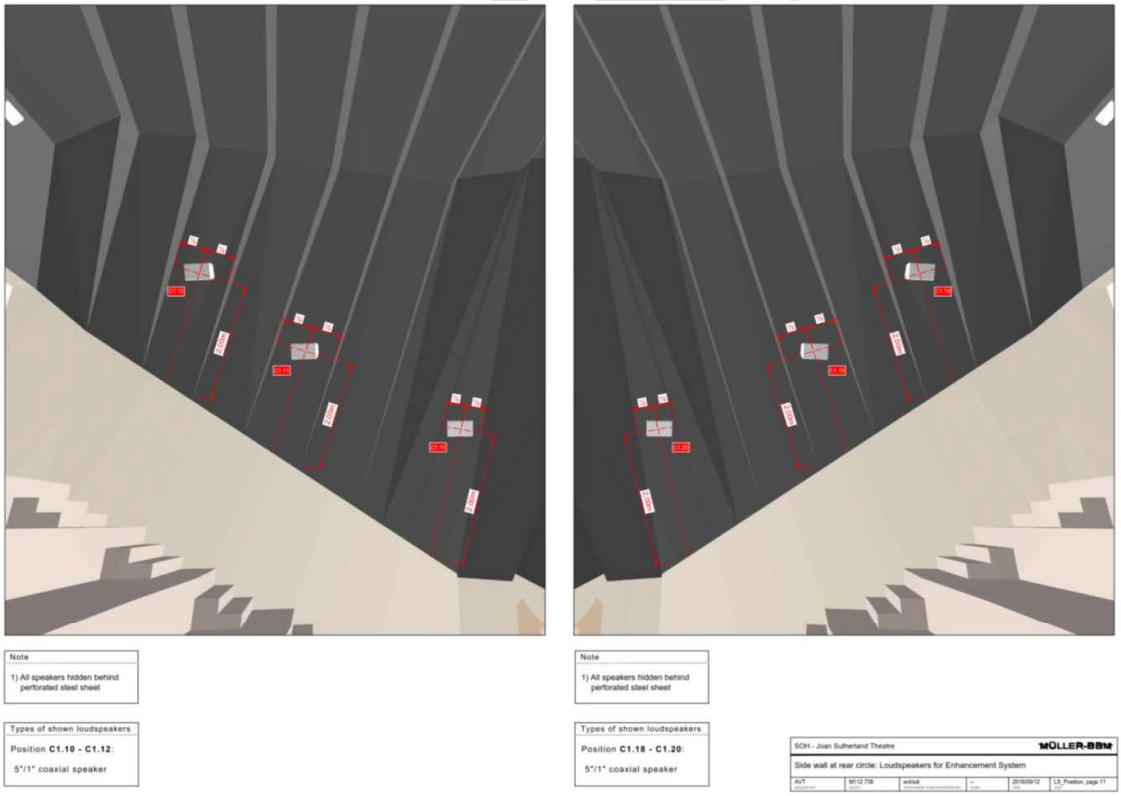


Figure 112- Speakers at Side Wall above Rear Circle

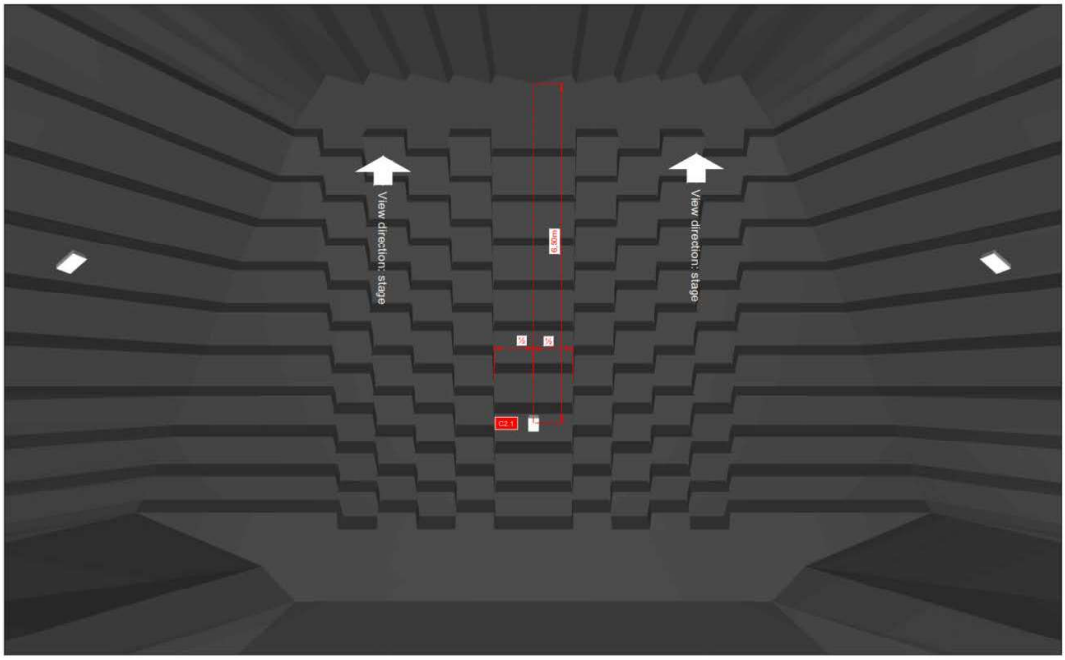


Figure 113- Speakers in Ceiling above Stalls

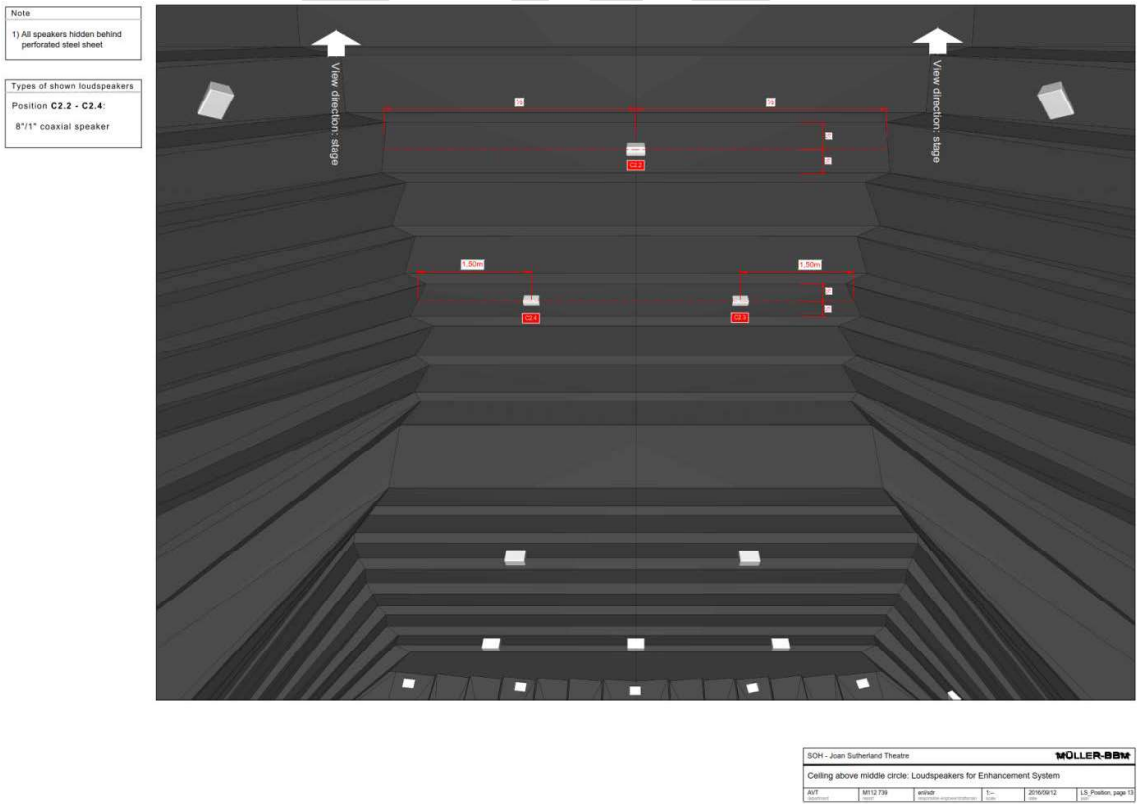


Figure 114- Ceiling above middle circle

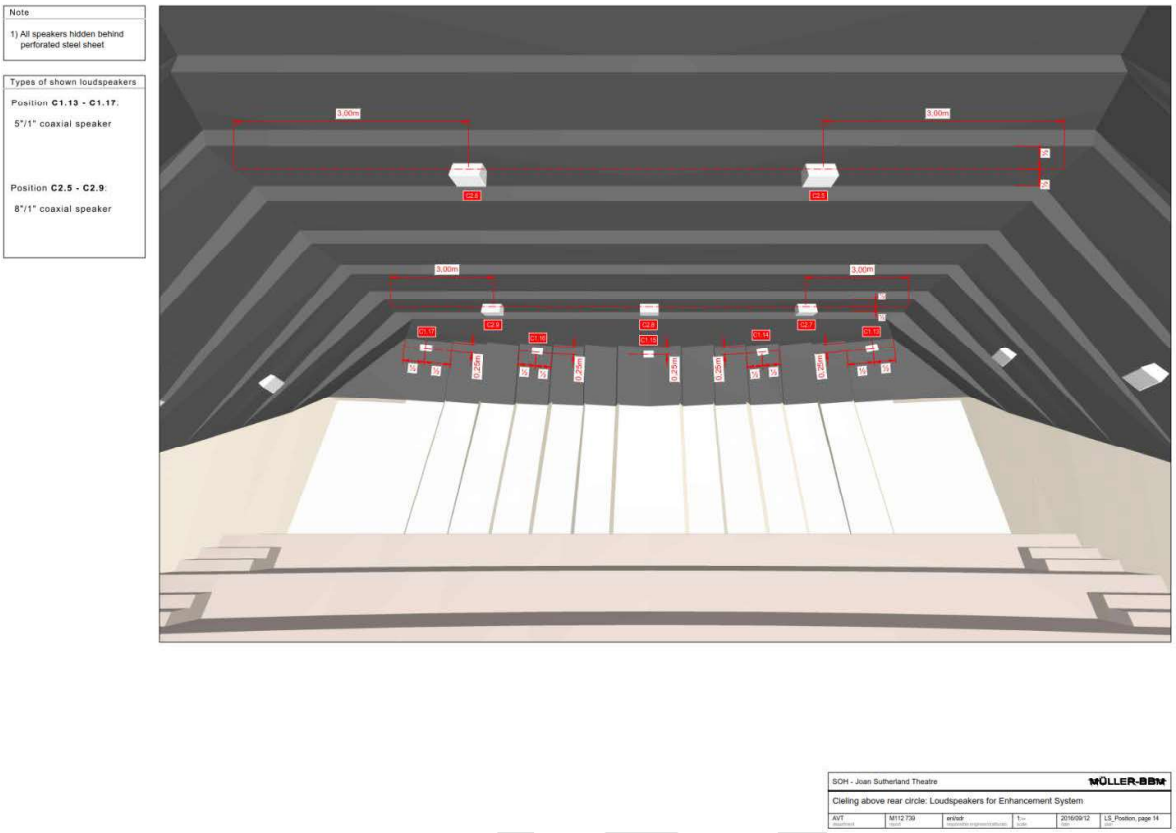


Figure 115- Ceiling above Rear Circle

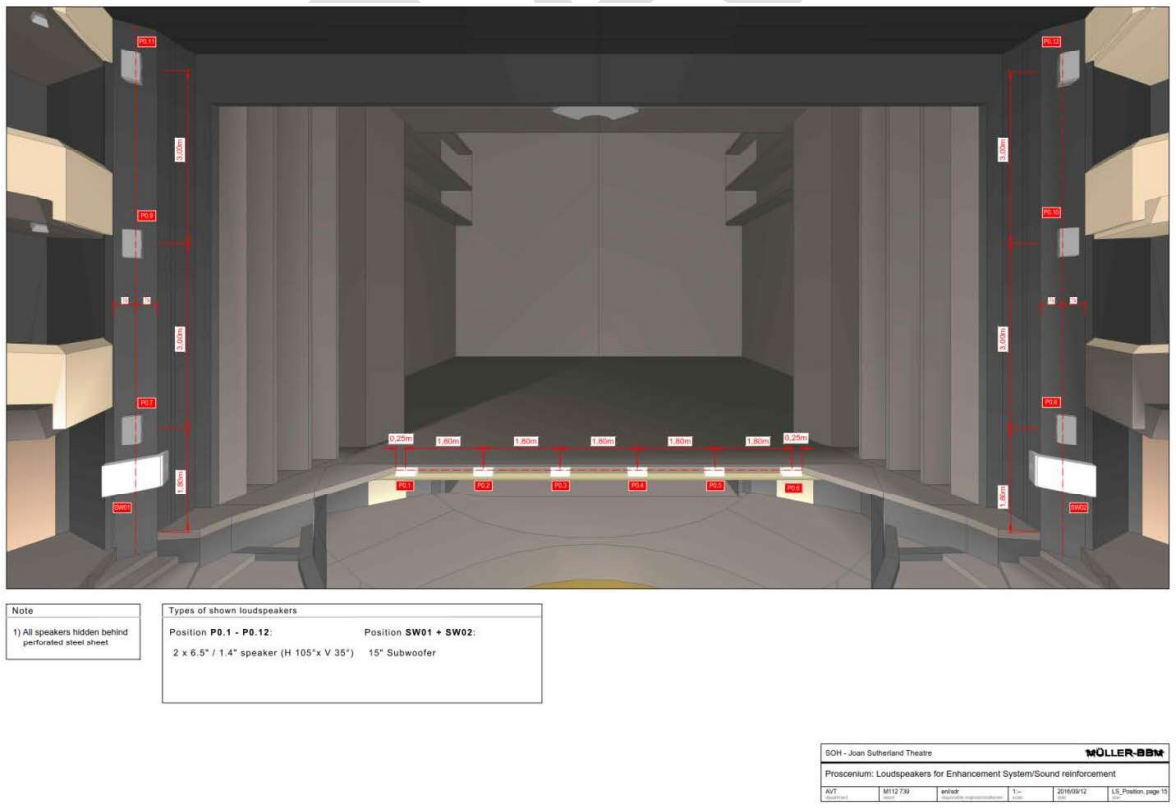


Figure 116- Speakers around the stage

5.2.6.10 Auditorium Lighting Replacement

- the replacement of all house lights and controls in the auditorium
- Auditorium Rigging, including lighting bars, winches and chain hoists.

5.2.6.11 Surtitle Infrastructure

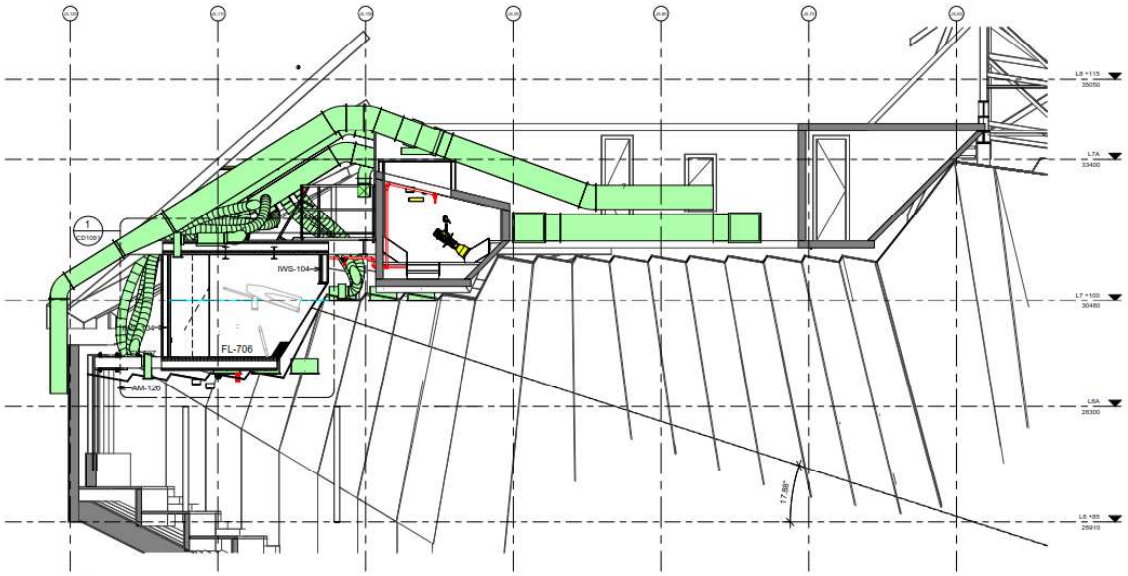
- The Principal will provide the IT infrastructure and winch & hoisting mechanisms for new surtitles, which will be supplied by Opera Australia.

5.2.6.12 Assistive Listening Systems

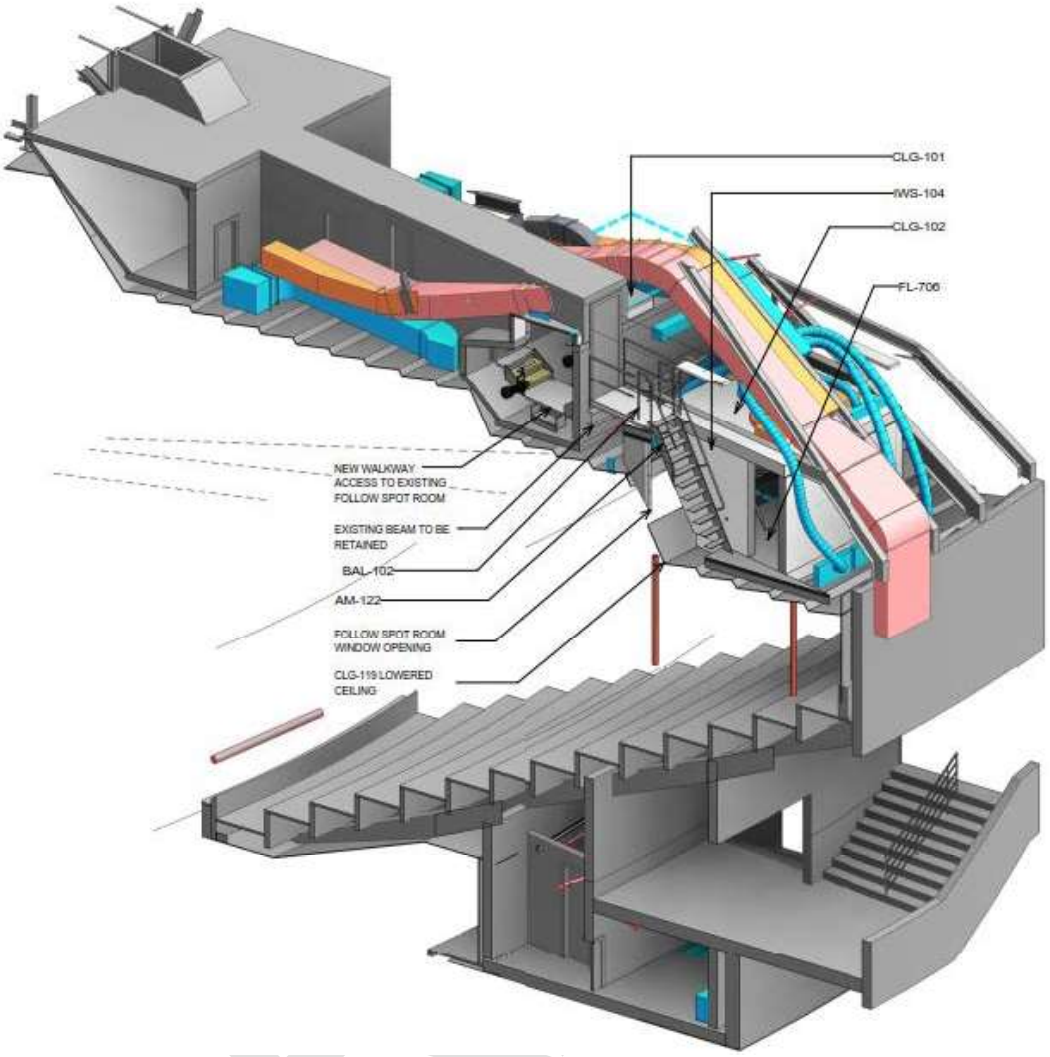
- The scope will entail the complete replacement of the existing systems, with new systems zoned, with an induction driver per zone, and the loops serviceable.

5.2.6.13 New Follow Spot Rooms

- Construction of new follow spot room at the top rear of the auditorium



1 FOLLOW SPOT ROOM - PROPOSED



5.2.7 Facade

Alterations to the existing façade include:

- Lift 31 northern foyer
- Lift 36 southern foyer
- Southern foyer double entry doors

5.2.8 Services

- Various AC units are being upgraded or replaced at low and high level
- Fire protection systems will be modified to provide compliance for the new systems
- Electrical power, lighting and communication systems are being replaced or upgraded to accommodate requirements for the new works
- Upgrade of services to the current BCA

5.2.9 Vertical Transport

- Lift 31 – new glass lift in new shaft
- Lift 36 – new glass lift in new shaft. Lift 36 will be located in the Southern Foyer with Lift Pit on Level B1 to service Ground Level, Level 1 Entry Foyer and Level 2 Southern Foyer. This will involve
- Lift 8 – refurbishment of existing lift

5.2.10 Commissioning & Handover

Laing O'Rourke recognises the importance of commissioning and system integration for the safe and energy-efficient operation of buildings. As a result, we have developed proven, clear and systematic steps to commission engineering systems and equipment in a proper and timely manner.

Successfully implemented on previous projects, this process will make a significant contribution to achieving properly commissioned engineering services systems for the Sydney Opera House Building Renewal Stage 1.

Commissioning is the verification process that is implemented to test the functionality and performance of each system against specified operating criteria. The process starts during the design completion phase, continues through the installation stage and culminates at the final witness acceptance tests.

The strategy and methodology is based on the following:

- A robust and collaborative commissioning process
- Structured lockdown, training and handover plans

A database of deliverables for commissioning will be developed that itemises all services within the renewal works to be commissioned. This database will be used to monitor the installation, testing and commissioning activities as the project progresses.

Commissioning deliverables will include:

- Inspection test sheets for items that are to be closed in risers and walls and floors
- Pre commissioning test sheets
- Method statements for commissioning various systems
- Commissioning sheets for various systems
- Marked-up schematics tracking commissioning progress
- Intersystem testing completion
- Structure for collating commissioning information.

Items forming processes and systems that will form part of the witness tests generally include the following:

- Air pressurisation and airflow tests in relevant areas
- Heated and chilled water balance tests
- Domestic hot and warm water tests
- Major mechanical plant
- Fire mode tests, including damper operation
- BMS control of system, including room temperatures
- Control of general lighting
- Emergency and exit lighting
- Security systems,
- Hydraulic systems
- Fire protection systems
- Vertical transportation.
- ICT networks and devices, including audio visual, sound and specialist lighting systems

5.3 Works Package 1C

Detailed methodologies are currently being developed and will be updated after detailed workshops with the preferred and specialist trade subcontractors and consultants. These will be incorporated in the next revision of the CMP and will be finalised prior to start on site.

Work Package 1C deals with the creation of a *new Ballet Rehearsal Room, Function Centre*, reconfiguring and upgrade of the *Entry Foyer* and *Southern Foyer* with new *escalators 7 & 8* serving from Ground floor under the steps to Level 1 Entry Foyer for the Joan Sutherland Theatre.

Central Accomodation

Ballet Rehersal Room

Entry Foyer

Souther Foyer (JST)

Function Centre

5.3.1 Access & Establishment – refer site establishment and logistics plan

Access into the work area for Works package 1C will be primarily via the B4 loading dock to the JST Ground Floor Scenery Dock. Alternate access will be required via the broadwalks, Central Passage into the Scenery dock and under the steps for the larger deliveries from time to time. This is to be approved by SOH.

Materials Handling Access

Currently it is planned to have the following types of materials handling access:

1. Crane Lift Zone – East, North and West within agreed locations lifting to the upper podium (L2), cleavage area (L2) and northern loading platforms (L3 & 4).
2. Internal Lift 2 (southern foyer), Lift 5 (central passage to Entry Foyer) – see lift weights and sizes details.
3. Forklifts and electric pallet trolleys to all areas.
4. Under the steps deliveries to the escalator hoarding area
5. Manual Handling up the steps to level 1 Entry Foyer

Pedestrian Access

Pedestrian access to the Works package 1C works includes the following:

1. Lift 2 & lift 5 central passage to Level 1 & 2
2. Existing internal fire stairs and passageways

5.3.2 Decanting & Enabling

A number of spaces within 1C work package area will be decanted by SOH's production, staging & retail tenants.

An itemised list has been developed by SOH in conjunction with LORAC. Special attention has been given to the areas which will be occupied by the future function centre

Contamination wipe downs and clearances will occur prior to starting construction works

Pumping out and decommissioning of the grease trap

Temporary protection, way finding, lighting etc. will be installed at this stage

Air, noise and vibration monitoring will be installed.

Prior to this work commencing within the entry foyer SOH will install and commission temporary ticketing and cloaking area under the steps

5.3.2.1 BRR

- LORAC to decant site office to northern foyer JST site office
- SOH to decant the duckpond emergency response room
- SOH to decant loose furniture in the BRR, piano

- SOH to decant the cleaners office and comms racks

5.3.2.2 Entry Foyer

SOH to decant the following:

- Retail spaces
- Box office ticketing and offices
- Cloaking east
- Treasury room

5.3.2.3 Southern Foyer

SOH to decant the following:

- Loose furniture
- Circular bar

5.3.2.4 Function Centre

SOH to decant the following:

- Office spaces
- Marquee
- Function rooms
- Kitchen equipment

5.3.3 Maksafe & Diversion of Existing Services

Existing services will be investigated and impact on construction works assessed

Terminations and diversions inclusive of refurbishment provisions will be carried out

Notification of disruption for service outages

5.3.3.1 BRR

- Capping off of existing services

5.3.3.2 Entry Foyer

- Capping off of existing services

5.3.3.3 Southern Foyer

- Capping off of existing services

5.3.3.4 Function Centre

- Capping off of existing services

5.3.4 Deconstruction & Demolition

5.3.4.1 BRR

- Soft strip wall, ceilings and services
- Hard demolition of the mezzanine concrete slab, new concrete wall window and door openings

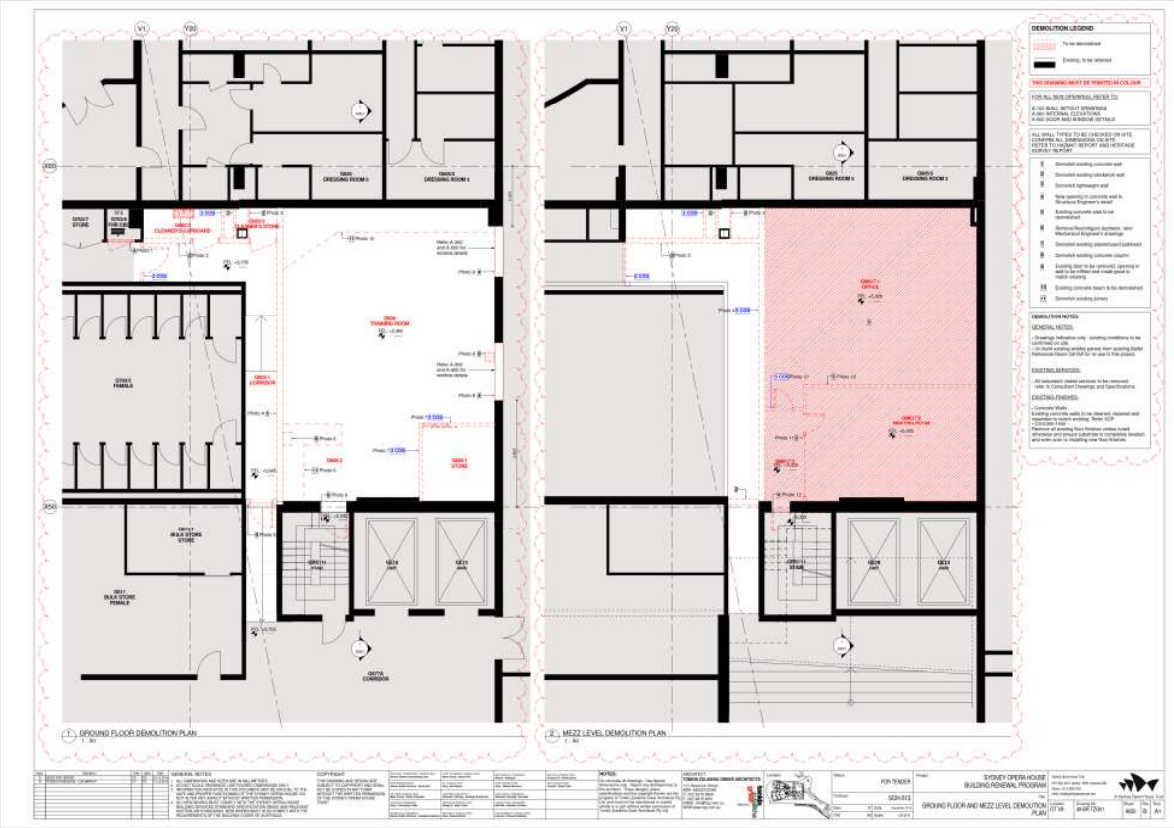


Figure 117- BRR Demolition Plan

5.3.4.2 Entry Foyer

- Staged soft strip demolition and removal of existing retail spaces, cloaking and box office
- Demolition and removal of services and equipment
- Demolition and removal of concrete and precast walls & floor planks
- Demolition of the Utzon stairs to allow installation of the escalators

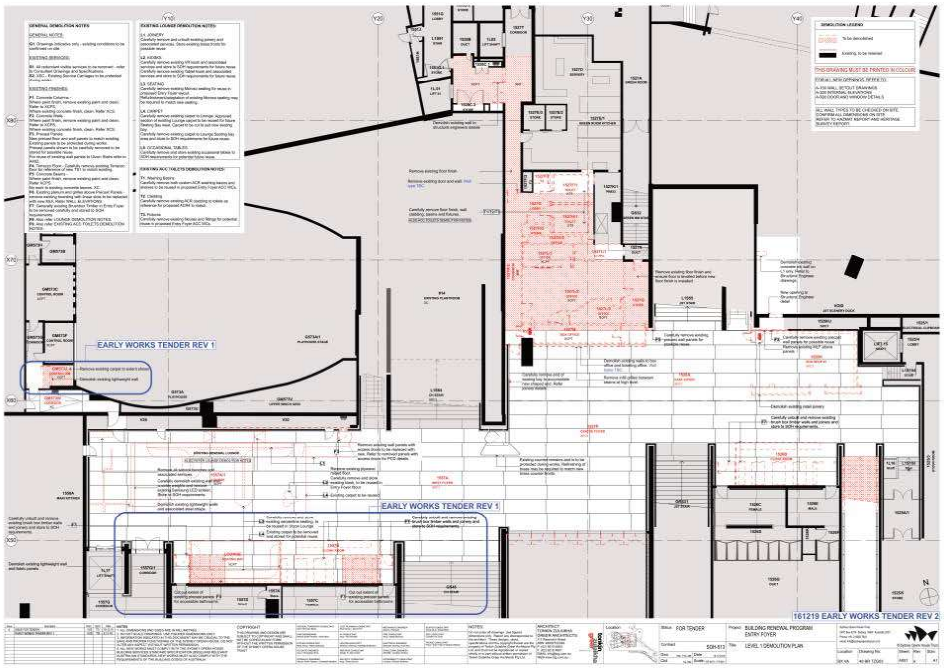


Figure 118- Entry Foyer Demolition Plan

5.3.4.3 *Southern Foyer*

- Soft demolition of the circular bar & façade for lift 36
    - Demolition of the precast circular bar and planks supporting

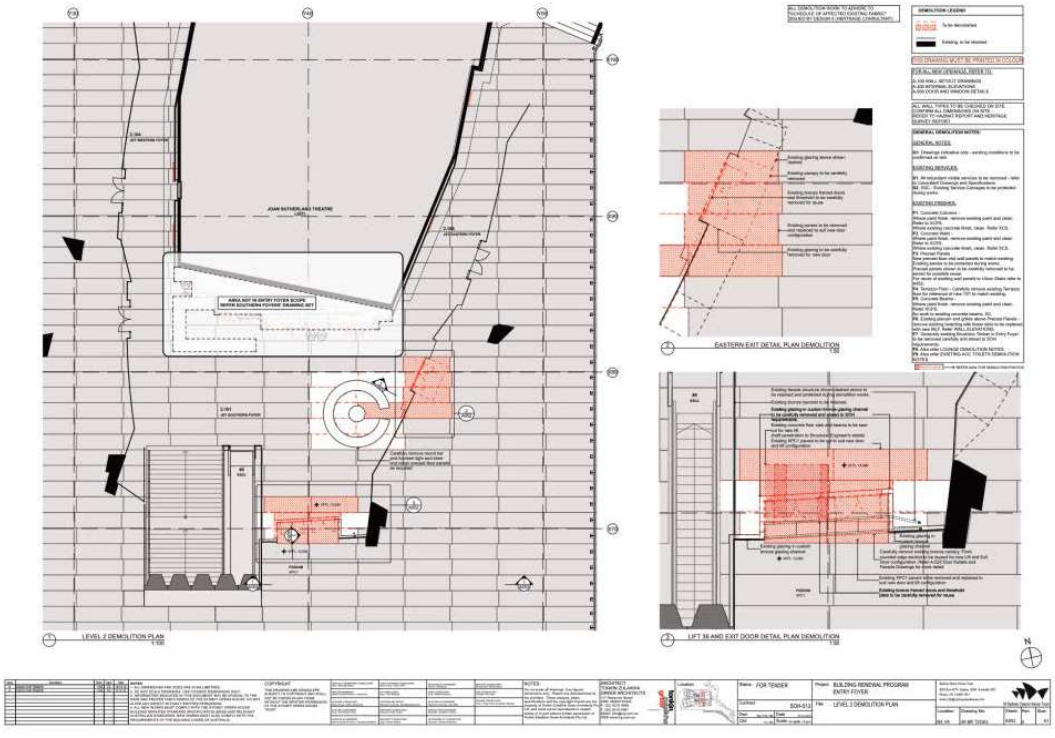


Figure 119- JST Southern Foyer Demolition Plan

5.3.4.4 *Function Centre*

- Decant of existing kitchen and office spaces

- Demolition of external marquee
- Soft strip of walls and ceilings
- Demolition of structural walls and facade

5.3.5 Excavation

5.3.5.1 Entry Foyer

- Excavation of the escalator pits to the Utzon Stairs and the respective thrust block that is required at the base of the monumental stairs.

5.3.5.2 Southern Foyer

- Excavation of lift 36 pit within the JST scenery dock.

5.3.6 Construction & Refurbishment

5.3.6.1 BRR

- New sprung ballet floor on structural steel framework
- Alterations to fire wall lines – extension of blockwork
- New services
- Reuse of existing wall and ceiling wobbly panels
- New wall mirrors, doors, frames and fire curtain

Figure 120- New Ballet Rehersal Room

5.3.6.2 Entry Foyer

- Construction of the following: Utzon lounge, Ticketing & cloaking to west, accessible toilets and seating bay, Magic moments reception desk, New Retail and cloaking to the east, Refurbish doors- maintain access through half of the doors, New western Accessible toilets, automation of exit doors to lower podium, Cash Handling west
- Installation of escalators 7 & 8
    - Entry Foyer Staging Plans

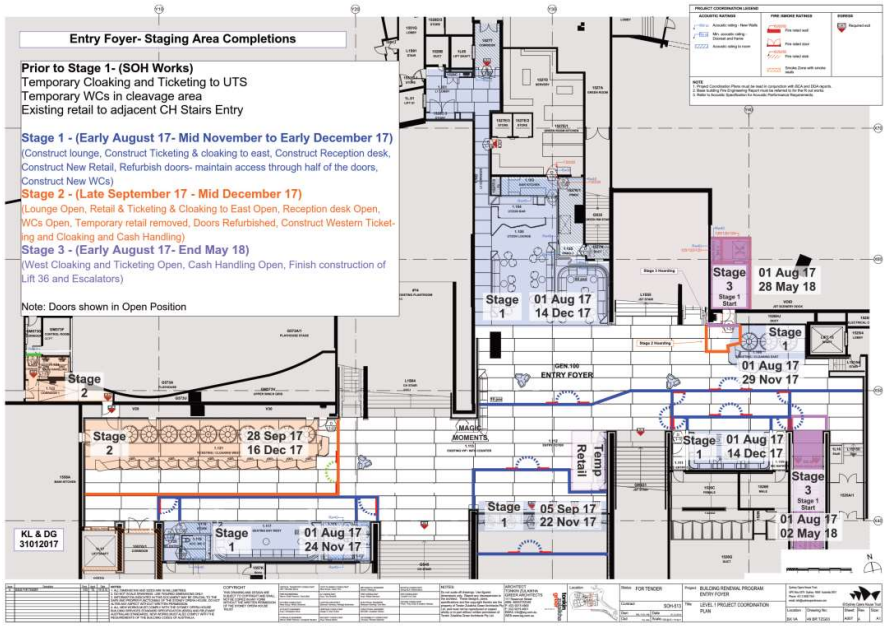


Figure 121- Entry Foyer Staging Plan

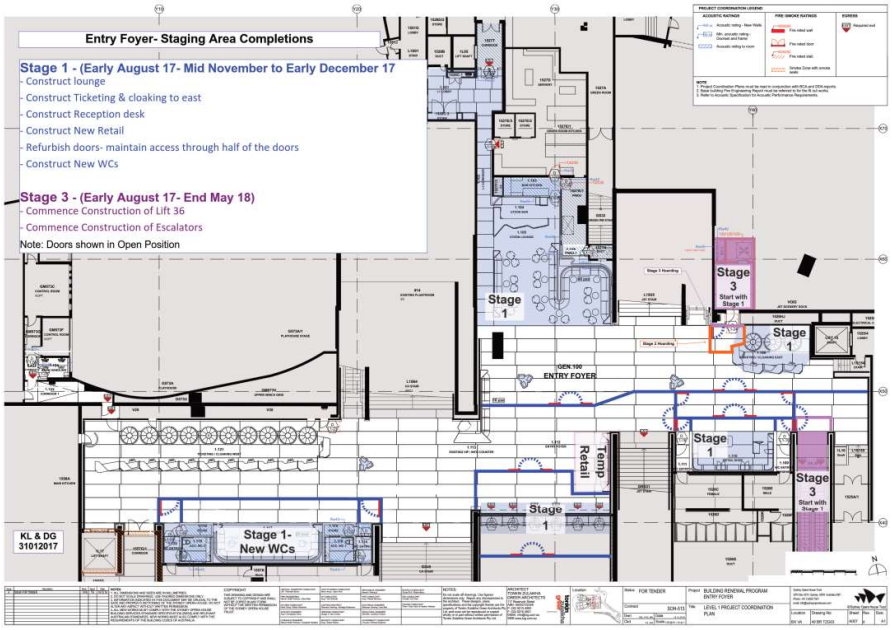


Figure 122- Entry Foyer Staging Plan – Stage 1

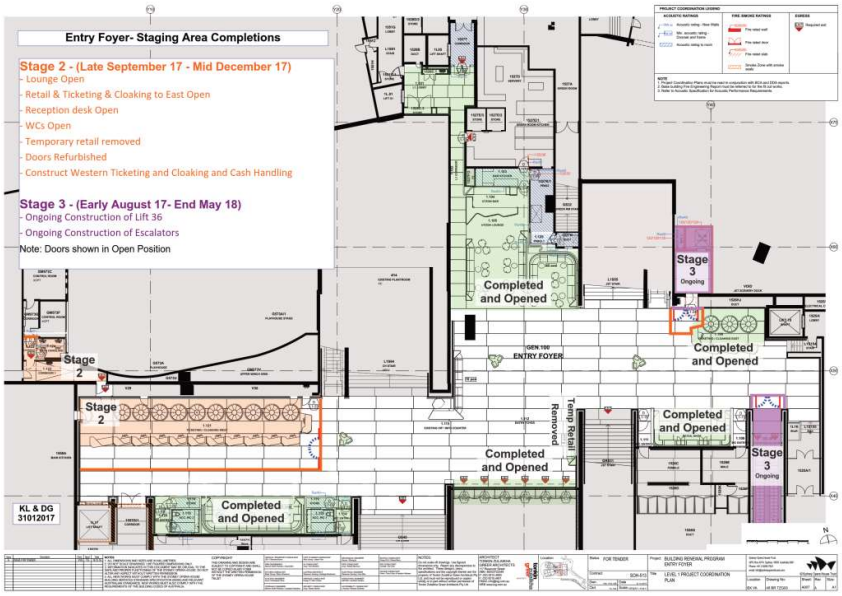


Figure 123- Entry Foyer Staging Plan- Stage 2

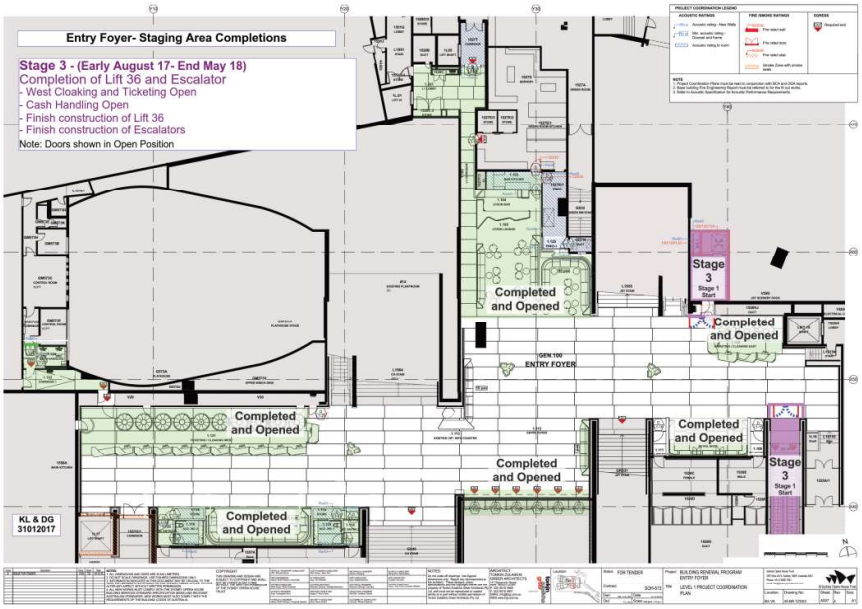


Figure 124- Entry Foyer Staging Plan- Stage 3

- Entry Foyer Images

Figure 125- Entry Foyer New Utzon Lounge

Figure 126- Entry Foyer New Escalators 7 & 8

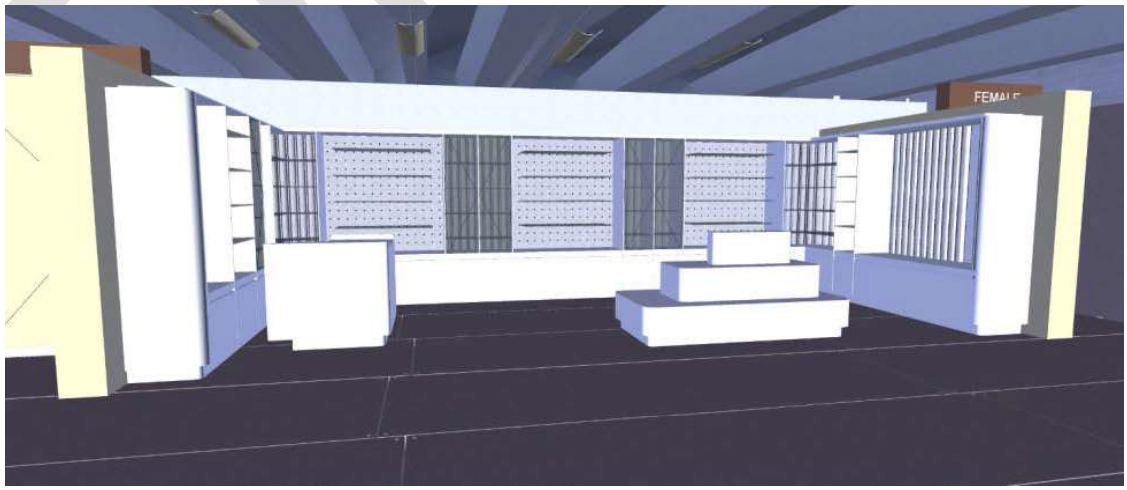


Figure 127- Entry Foyer New Retail East

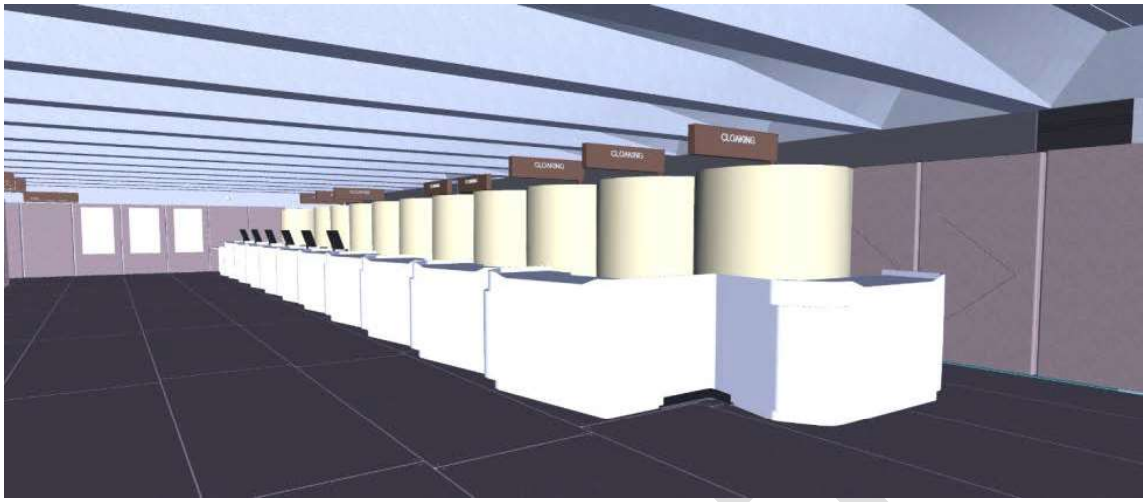


Figure 128- Entry Foyer New Western Ticketing & Cloaking

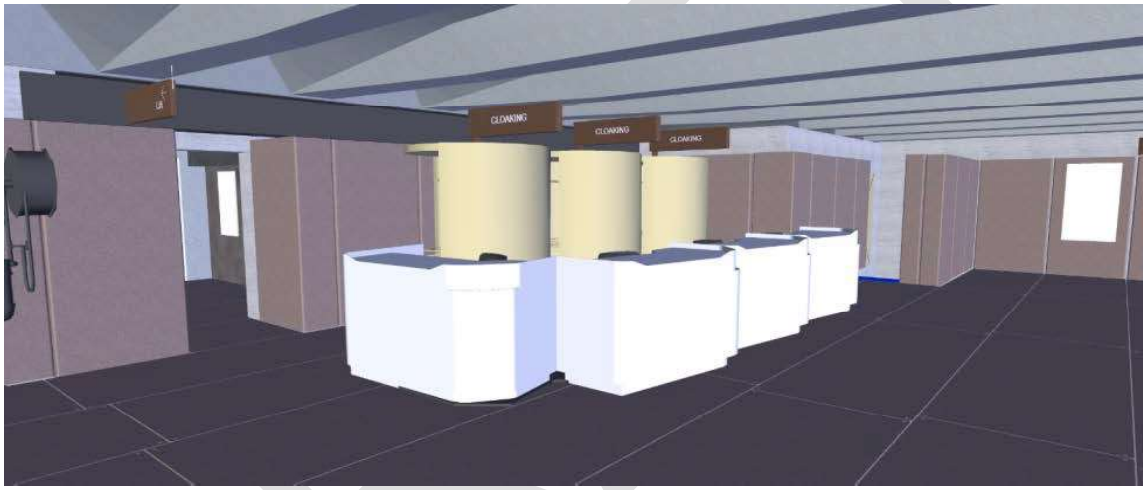


Figure 129- New Eastern Ticketing & Cloaking with new access to lift 36 behind

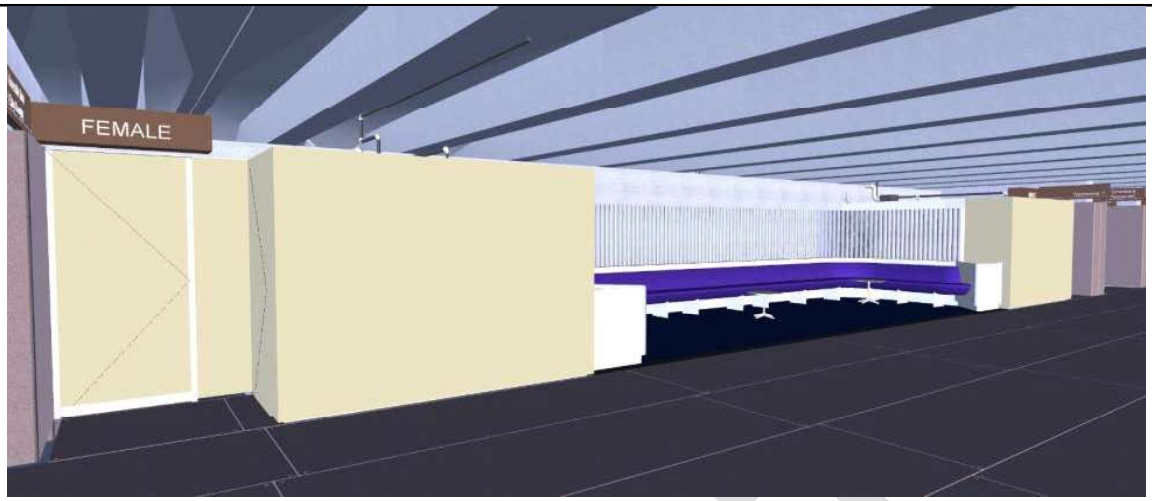


Figure 130- New Accessible toilets with lounge West

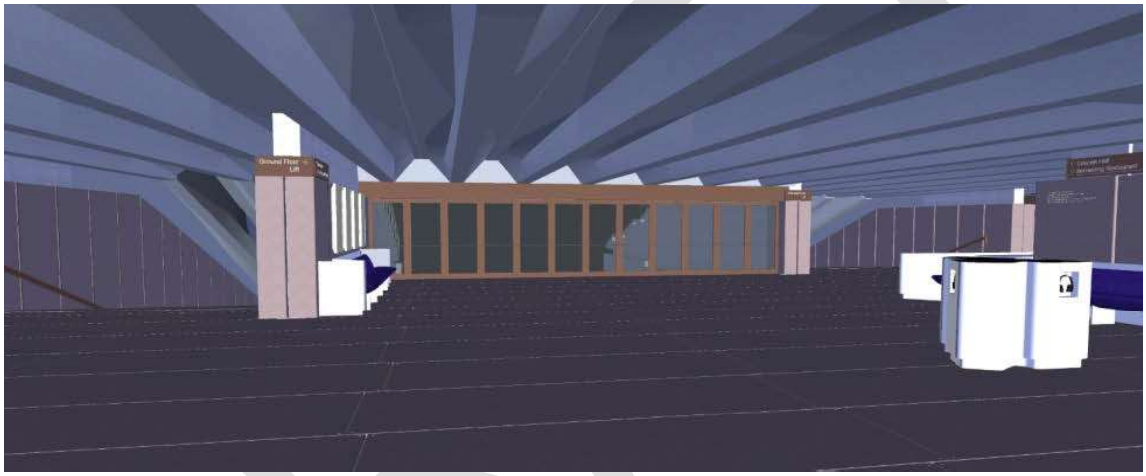


Figure 131- New automated exit doors from entry foyer to lower podium

Figure 132- New Lift 36 & level 1

5.3.6.3 *Southern Foyer*

- New bar, alterations & modifications to current glass exit doors
- New plantroom 22
- New LCD displays behind bar
- Construction of new glass lift and shaft
- New loose furniture
- New lift 36

Figure 133- Southern Foyer

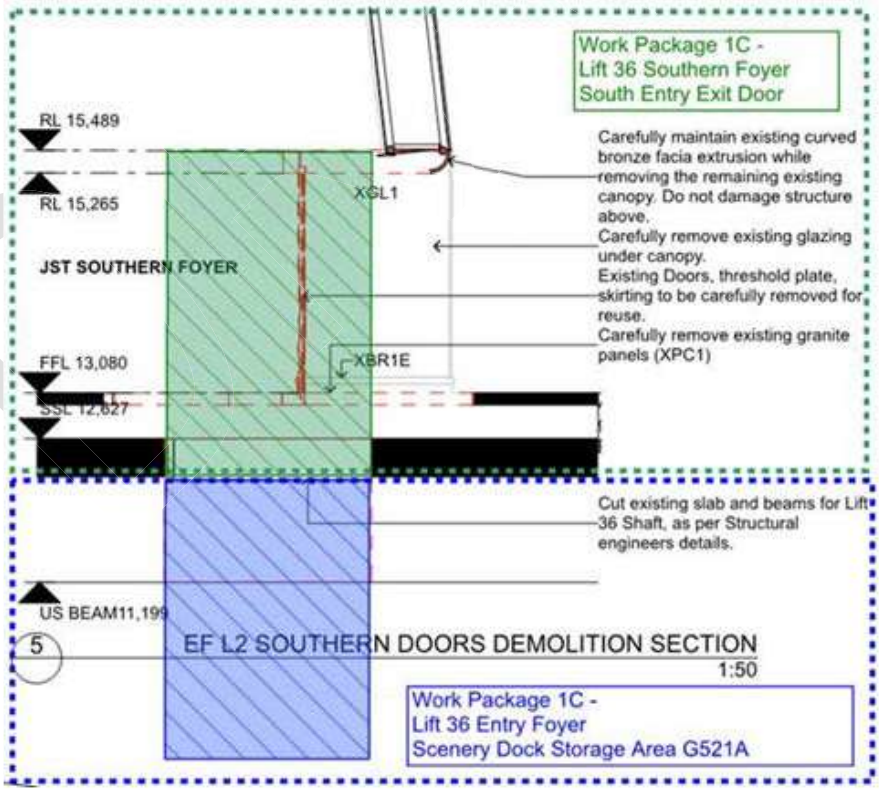


Figure 134- Southern Foyer Section Drawing

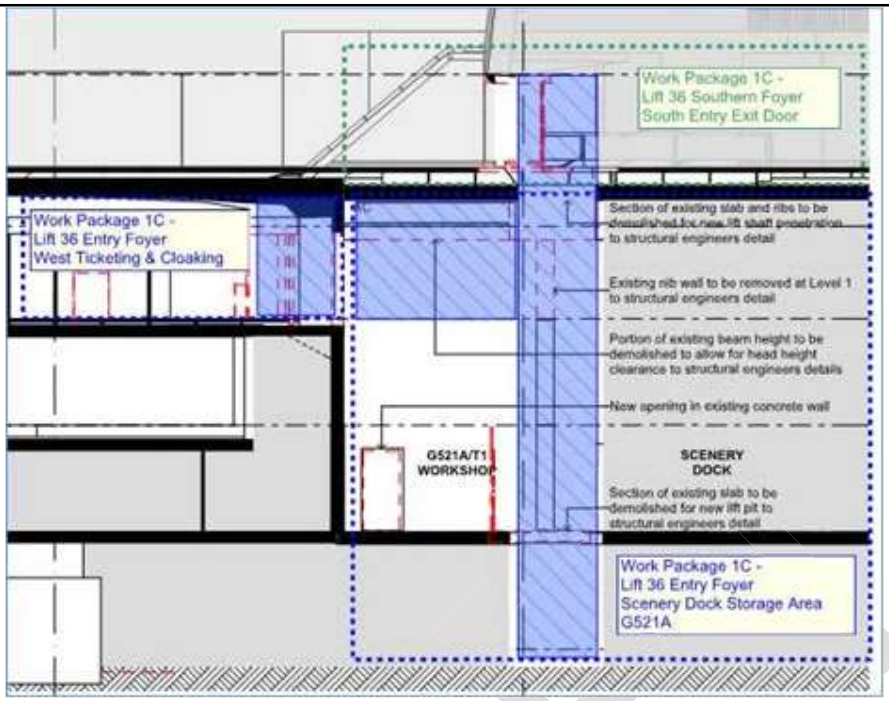


Figure 135- Southern Foyer Lift 36 Section

5.3.6.4 Function Centre

- Conversion of existing office into a multipurpose function space, including operable walls
- Refurbishment and expansion of existing kitchen and stores
- New entry foyer
- Alterations to existing perimeter entry doors
- New services including upgraded AV/ IT systems both internally and externally

Figure 136- Function Centre

5.3.7 Façade

- Façade works include:

- Function Centre entry alterations to precast panels and new entry doors
- Automated doors to lower podium entry foyer

5.3.8 Services

- Various AC units are being upgraded or replaced at low and high level
- Fire protection systems will be modified to provide compliance for the new systems
- Electrical power, lighting and communication systems are being replaced or upgraded to accommodate requirements for the new works
- Upgrade of services to the current BCA

Snapshots from the BIM model of various areas are shown below:

5.3.8.1 BRR

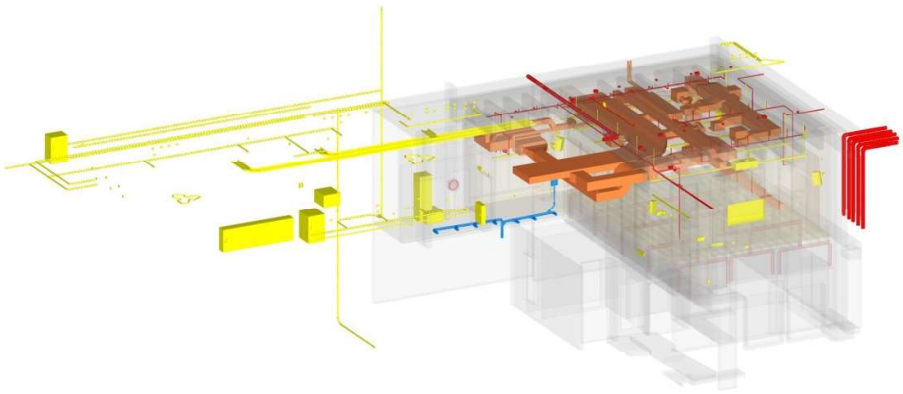


Figure 137- New Combined Services Plans BRR (yellow – electrical, red – fire, orange – mechanical, blue – hydraulic)

5.3.8.2 Entry Foyer

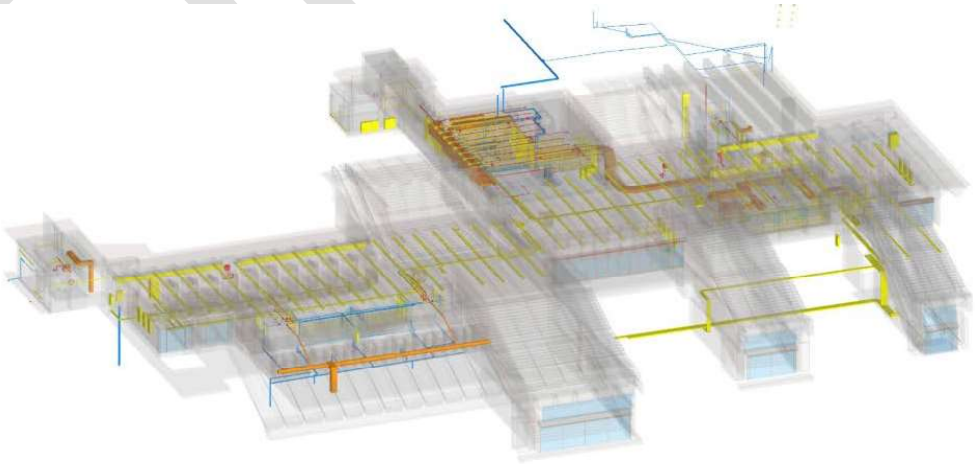


Figure 138- New Combined Services Plans Entry Foyer (yellow – electrical, red – fire, orange – mechanical, blue – hydraulic)

5.3.8.3 Southern Foyer

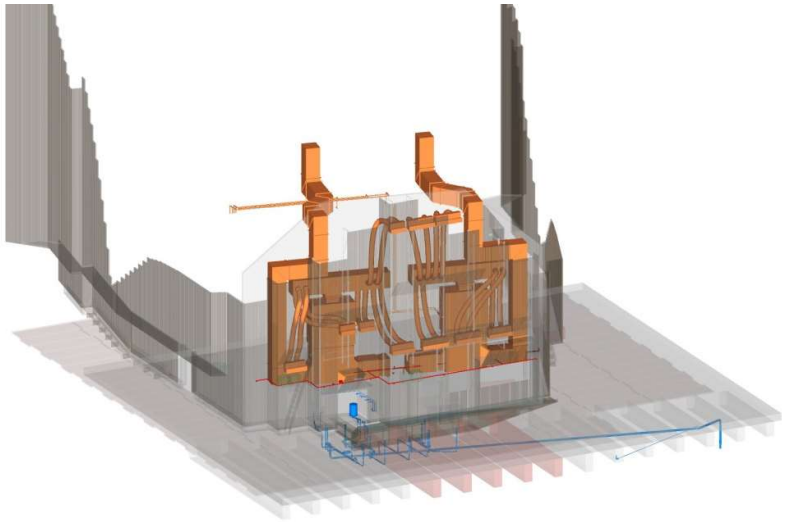


Figure 139- New Combined Services Plans Southern Foyer (yellow – electrical, red – fire, orange – mechanical, blue – hydraulic)

5.3.8.4

5.3.8.5 Function Centre

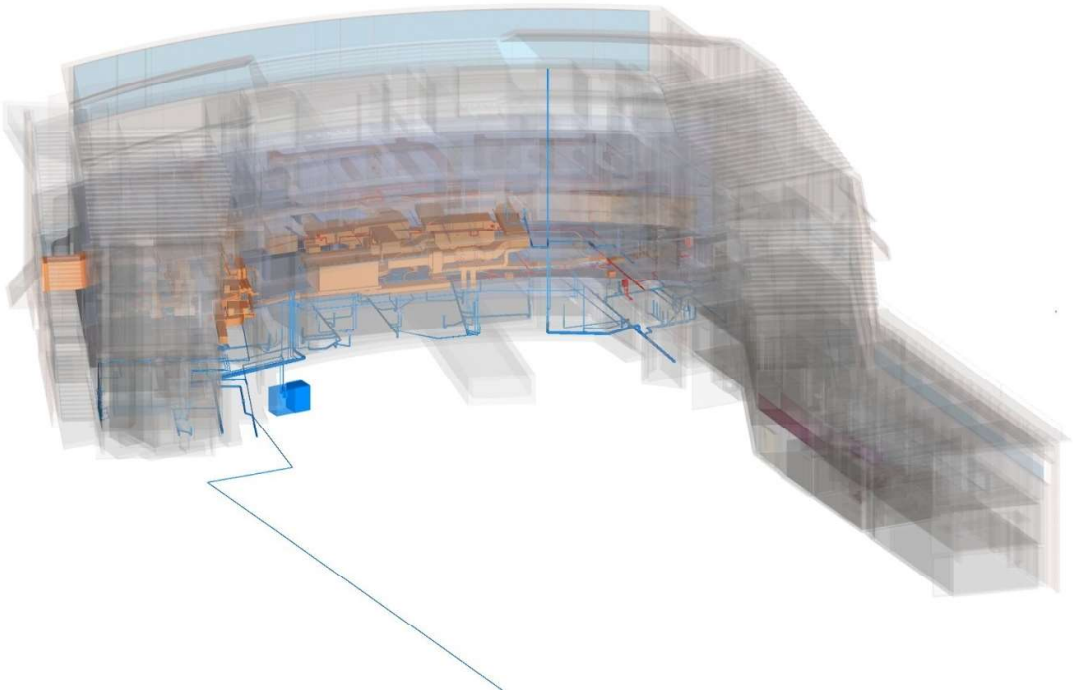


Figure 140- New Combined Services Plans Function Centre (yellow – electrical, red – fire, orange – mechanical, blue – hydraulic)

5.3.9 Vertical Transportation

- Escalators 7 & 8 – access from under the steps to main entry foyer
- Lift 36 from level 1 entry foyer to level 2 southern foyer. Shaft extends to ground floor scenery dock

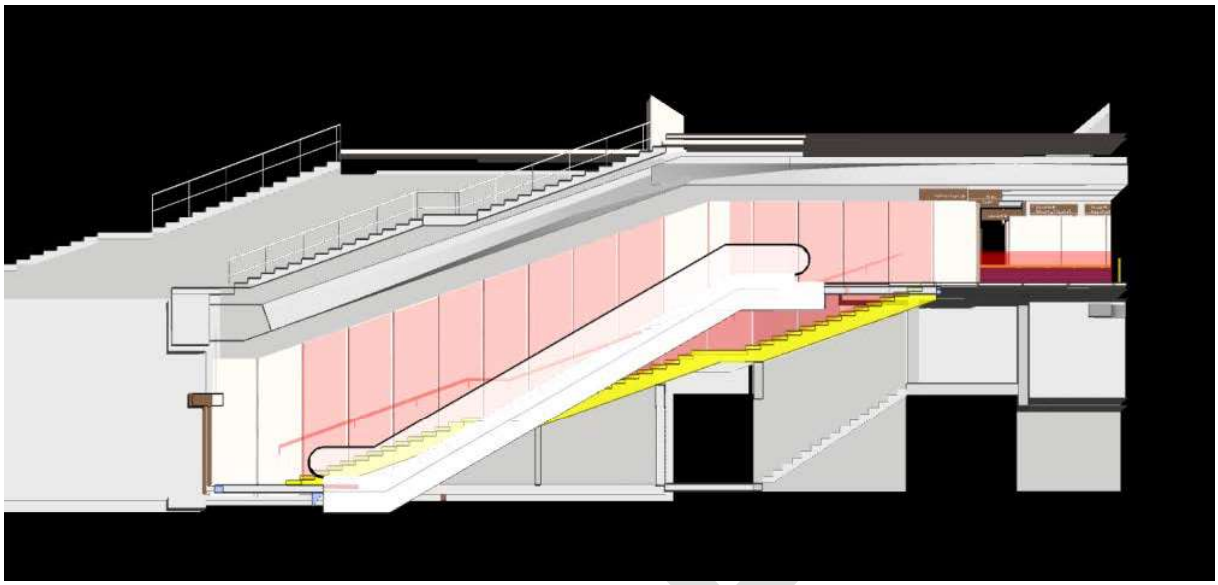


Figure 141- New Escalators location within Utzon Stairs

5.3.10 Summary Programme

5.3.10.1 Entry Foyer

Name	Duration	Start	Finish
Stage 1 | Accessible Amenities	94d	01 Aug 17	24 Nov 17
Enabling, Services Disconnections & Demolition	12d	01 Aug 17	15 Aug 17
Fit-out Accessible Amenities (1.114/115/116/118/119/120)	48d	16 Aug 17	14 Oct 17
Fit-out Seating Bay West (1.117)	24d	04 Oct 17	31 Oct 17
Commissioning, Certification & Handover	20d	01 Nov 17	24 Nov 17
Stage 2 | Western Ticketing, Cloaking & Cash Handling	62d	28 Sep 17	16 Dec 17
Enabling works & Soft Strip	6d	28 Sep 17	07 Oct 17
Demolition works [Existing Lounge & Control Room]	6d	09 Oct 17	14 Oct 17
Fitout Cash Handling / Access Corridors (1.122/123/124)	30d	16 Oct 17	20 Nov 17
Fitout Ticketing / Cloaking Facilities West (1.121)	36d	12 Oct 17	23 Nov 17
Commissioning, Certification & Handover	20d	21 Nov 17	16 Dec 17
Stage 1 | Central Motorised Doors [L1-17,18,19,20,21,22]	64d	05 Sep 17	22 Nov 17
Enabling works	8d	05 Sep 17	13 Sep 17
Remove existing, Bulkhead & doors adjustment & services rough-In	24d	14 Sep 17	14 Oct 17
Automated machinery.Reinstall swing doors & Services Fit-off	15d	16 Oct 17	01 Nov 17
Commissioning, Certification & Handover	17d	02 Nov 17	22 Nov 17
Stage 1 | East Cloaking & Ticketing Counter [FOH 1.108]	98d	01 Aug 17	29 Nov 17
Enabling, Services Disconnections & Demolition	12d	01 Aug 17	15 Aug 17
Lift 36 Lobby Entry Demolition [Lift 36 Interface]	6d	16 Aug 17	22 Aug 17
Structural modifications & services Rough-In to counter location	12d	22 Aug 17	06 Sep 17
Ticketing Counter & Cloaking Joinery	24d	04 Oct 17	31 Oct 17
Commissioning, Certification & Handover	24d	01 Nov 17	29 Nov 17
Stage 2 | East Cloaking & Ticketing Counter [BoH 1.108] "Lift 36 Hoarding Remains"	39d	23 Nov 17	30 Jan 18
Precast Concrete walls to Lift 36 Lobby Entry	3d	23 Nov 17	27 Nov 17
Inspections, Certification & Handover	36d	28 Nov 17	30 Jan 18
Stage 1 | Utzon Lounge, Bar & Entry Foyer East	108d	01 Aug 17	14 Dec 17
Enabling & Soft Strip Demolition	12d	01 Aug 17	15 Aug 17
Hard Demolition & Structural Modifications	24d	16 Aug 17	13 Sep 17
Fitout Works (Utzon Lounge, Bar & Entry Foyer East)	54d	07 Sep 17	13 Nov 17
Certification, Demobilisation & Handover	24d	14 Nov 17	14 Dec 17

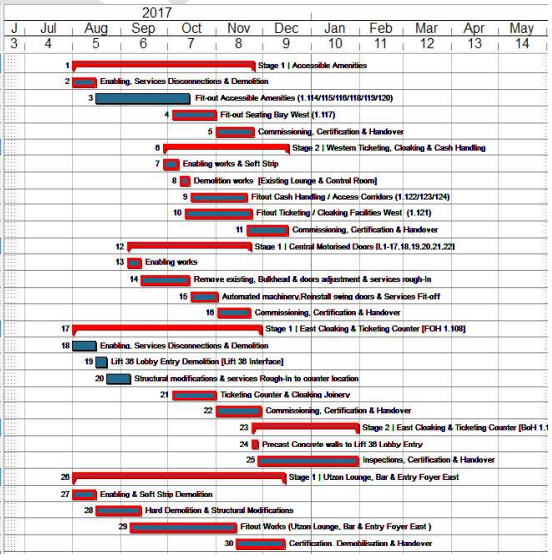


Figure 142- Entry Foyer Programme

5.3.10.2 Lift 36 and Escalators 7 & 8

Name	Duration	Start	Finish
Stage 3 | Lift 36 & Associated Areas [25.01.17]	251d	26 Jun 17	28 May 18
Scenery Dock Void - Demolition & Lift Shaft Structure [GR+12>GM+21]	56d	26 Jun 17	01 Sep 17
Enabling Works - Scenery Dock (Temporary Protection & Services Termination)	12d	26 Jun 17	11 Jul 17
Demolition & Excavation Lift Pit [GR+12 / Y40-X80]	12d	12 Jul 17	25 Jul 17
FRP Lift Pit & Kicker	12d	26 Jul 17	09 Aug 17
FRP Lift Shaft walls [GL to GM]	12d	10 Aug 17	23 Aug 17
Hard Demolition - Entry Foyer East Cloaking - Demolish Wall Opening	6d	16 Aug 17	22 Aug 17
FRP Lift Shaft walls [GM to L1]	8d	24 Aug 17	01 Sep 17
Scenery Dock Void - Demolition & Lift Shaft Structure [GM+21 to L1+2.1m]	60d	02 Sep 17	16 Nov 17
FRP Lift 36 Lobby [GM+21 to L1+2.1m]	18d	02 Sep 17	23 Sep 17
Hard Demolition - Demolish Underside L2 [L1+2.1m]	18d	25 Sep 17	18 Oct 17
Hard Demolition - Demolish Level 2 Shaft Opening [L2+2.1m]	12d	19 Oct 17	01 Nov 17
FRP Lift Shaft walls [L1 to L2]	12d	02 Nov 17	16 Nov 17
Entry Foyer East - Lift 36 Lobby & Cloaking East Entry [1.107]	102d	16 Nov 17	13 Apr 18
Precast Concrete Floor & Walls	12d	16 Nov 17	30 Nov 17
Lift 36 Lobby & Store Room Fit-out [1.106 / 1.107]	90d	30 Nov 17	13 Apr 18
Fit-out works prior to Entry Foyer Stage 1 Handover	12d	30 Nov 17	18 Dec 17
Final Finishes Ready for Lift 36 Handover	6d	06 Apr 18	13 Apr 18
Southern Foyer - Demolition & Lift Shaft Structure	70d	21 Aug 17	16 Nov 17
Enabling Works (Decanting, Temporary Protection & Services Termination)	12d	21 Aug 17	05 Sep 17
Demolition of Existing Bar [2510D]	18d	06 Sep 17	26 Sep 17
Dismantle Southern Facade Entry/Exit Doors [Retained & protected]	18d	06 Sep 17	26 Sep 17
Hard Demolition - Existing precast floor panels removal, retained & protected	12d	27 Sep 17	13 Oct 17
Scenery Dock Void Interface - Concrete Cut Existing Slab & FRP RC Lift Shaft walls L1>L2	24d	18 Oct 17	16 Nov 17
Southern Foyer - Lift 36 Enclosure Steel & Glass	48d	17 Nov 17	02 Feb 18
Install scaffold to new lift shaft void	6d	17 Nov 17	23 Nov 17
Structural Steel & Glass to Lift Shaft	42d	24 Nov 17	02 Feb 18
Southern Foyer - Facade Rectification	42d	24 Nov 17	02 Feb 18
Lift 36 Installation & Facade Rectification	48d	02 Feb 18	06 Apr 18
Lift Installation (Lift 36 GM/L1-L2)	36d	02 Feb 18	17 Mar 18
Test & Commission	12d	19 Mar 18	06 Apr 18
Inspections, Certification & Handover	39d	07 Apr 18	28 May 18
Stage 3 | Escalator & Associated Works	201d	01 Aug 17	02 May 18
Enabling Works	15d	01 Aug 17	18 Aug 17
Demolition & Structure works	77d	19 Aug 17	22 Nov 17
Escalator Installation & Complete Builders Works	75d	23 Nov 17	13 Mar 18
Inspections, Certification & Handover	34d	14 Mar 18	02 May 18

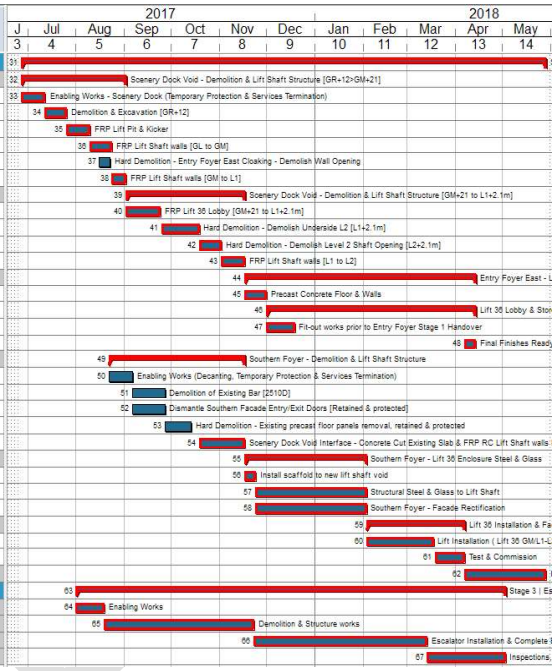


Figure 143- Lift 36 and Escalator 7 & 8 Programme

5.3.11 Commissioning & Handover

Laing O'Rourke recognises the importance of commissioning and system integration for the safe and energy-efficient operation of buildings. As a result, we have developed proven, clear and systematic steps to commission engineering systems and equipment in a proper and timely manner.

Successfully implemented on previous projects, this process will make a significant contribution to achieving properly commissioned engineering services systems for the Sydney Opera House Building Renewal Stage 1C.

Commissioning is the verification process that is implemented to test the functionality and performance of each system against specified operating criteria. The process starts during the design completion phase, continues through the installation stage and culminates at the final witness acceptance tests.

The strategy and methodology is based on the following:

- A robust and collaborative commissioning process
- Structured lockdown, training and handover plans

A database of deliverables for commissioning will be developed that itemises all services within the renewal works to be commissioned. This database will be used to monitor the installation, testing and commissioning activities as the project progresses.

Commissioning deliverables will include:

- Inspection test sheets for items that are to be closed in risers and walls and floors
- Pre commissioning test sheets
- Method statements for commissioning various systems
- Commissioning sheets for various systems
- Marked-up schematics tracking commissioning progress
- Intersystem testing completion
- Structure for collating commissioning information.

Items forming processes and systems that will form part of the witness tests generally include the following:

- Air pressurisation and airflow tests in relevant areas
- Heated and chilled water balance tests
- Domestic hot and warm water tests
- Major mechanical plant

- Fire mode tests, including damper operation
- Control of general lighting
- Emergency and exit lighting
- Security systems,
- Hydraulic systems
- Vertical transportation systems (escalators and lifts)
- Fire protection systems
- ICT networks and devices, including audio visual, sound and specialist lighting systems
- BMS Interface (In collaboration with SOH incumbent controls contractor Honeywell Systems)
    - Control of system, including room temperatures
    - Essential services Interface testing

5.3.12 Current Decant/ Asset List

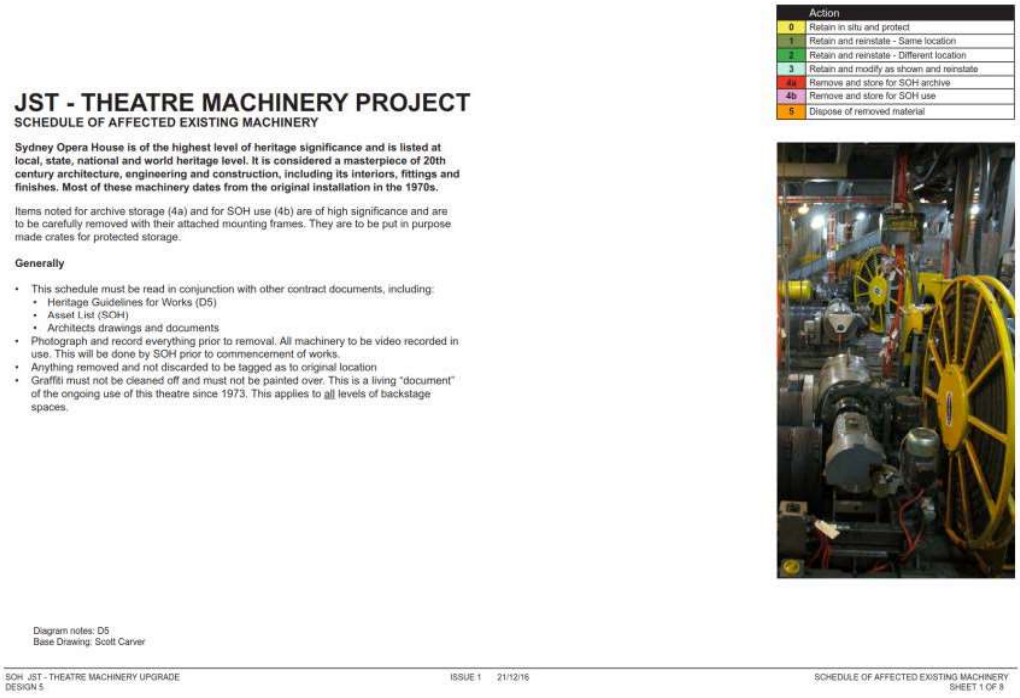
The current decant and asset list has been developed in conjunction with Design 5, SOH Stakeholders and Project Management teams.

Asset types and Owners

				Before Site Handover to LOR				After Site Handover to LOR	
				Removal / Relocation of items (to keep)		Removal of unwanted items (before closure)		Removal (after closure)	
	Equipments	Owner	Contact	Moving	Location	Moving	Location	Moving	Location
Food and Beverage	High tables and black leather sofas	Building	Managed by Staging	SOH (DTZ)	?	SOH (DTZ)	?		
	Aria Kitchen equipment	Aria	David Madden	Aria	Offsite and various location	Aria	?	LOR	Recycling / skip (unless specified)
	F&B Fixtures	Building	David Madden					LOR	Recycling / skip (if not fixed)
Production	Lighting Equipment	Lighting	Josh Neufeld	Production	St Peters (2B)	SOH Production Department	On-site skip	LOR	Recycling / skip (unless specified)
	Staging Equipment	Staging	William Gregory	Production	St Peters (2B)	SOH Production Department	On-site skip	LOR	Recycling / skip (unless specified)
	Audio Equipment	Audio	Royce Sanderson	Production	St Peters (2B)	SOH Production Department	On-site skip	LOR	Recycling / skip (unless specified)
	Tech Support equipment	Tech Support	David Dalton	Production	St Peters (2B)	SOH Production Department	On-site skip	LOR	Recycling / skip (unless specified)
	Venue Theatre Assets (fixed)	Building	Dean Jakubowski					LOR	Recycling / skip under supervision of specialist contractor
Event Planning	Dressing Room	Building	Monica Girard	SOH (DTZ)	Onsite in other dressing rooms				
	Production Orchestra chairs	Staging	Monica Girard	Production	Onsite in other dressing rooms				
Visitor Experi	SOH Retail Team	Retail	Nicola Brandon	SOH (DTZ)	Retail Team storage	SOH (DTZ)	On-site skip	LOR	Recycling / skip
	SOH Ticketing Team	Ticketing	Tracey Paul	SOH (DTZ)	Retail Team storage	SOH (DTZ)	On-site skip	LOR	Recycling / skip
Building	JST Seats	Building	Dean Jakubowski					LOR	Their own managed offsite storage
	F&B Activation Furniture	Furniture Hiring Company	TBA	Furniture Hiring Company	Return back				
	Building Operations stuff	Building Operations	TBA	Building Operations	?	Building Operations	On-site skip		
	Heritage (this will be a specified list)	Building	Sumi & Dean	SOH (DTZ)	St Peters			LOR	St Peters
	Mural			TBA					
Other	Cleaning equipment	Cleaners	TBA	Cleaners	TBA	Cleaners	On-site skip	LOR	Recycling / skip
	Staging workshop items	Opera Australia	TBA	Opera Australia	OA	Opera Australia	OA to resolve		
	Duck Pond Security Equipment	Security	David Crossly	SOH (DTZ)	TBA	?	?		

Figure 144- Asset Classifications

The following 3 schedules were issued in December 2016.



	Action
0	Retain in situ and protect
1	Retain and reinstate - Same location
2	Retain and reinstate - Different location
3	Retain and modify as shown and reinstate
4a	Remove and store for SOH archive
4b	Remove and store for SOH use
5	Dispose of removed material

JST - THEATRE MACHINERY PROJECT

SCHEDULE OF AFFECTED EXISTING MACHINERY

Sydney Opera House is of the highest level of heritage significance and is listed at local, state, national and world heritage level. It is considered a masterpiece of 20th century architecture, engineering and construction, including its interiors, fittings and finishes. Most of these machinery dates from the original installation in the 1970s.

Items noted for archive storage (4a) and for SOH use (4b) are of high significance and are to be carefully removed with their attached mounting frames. They are to be put in purpose made crates for protected storage.

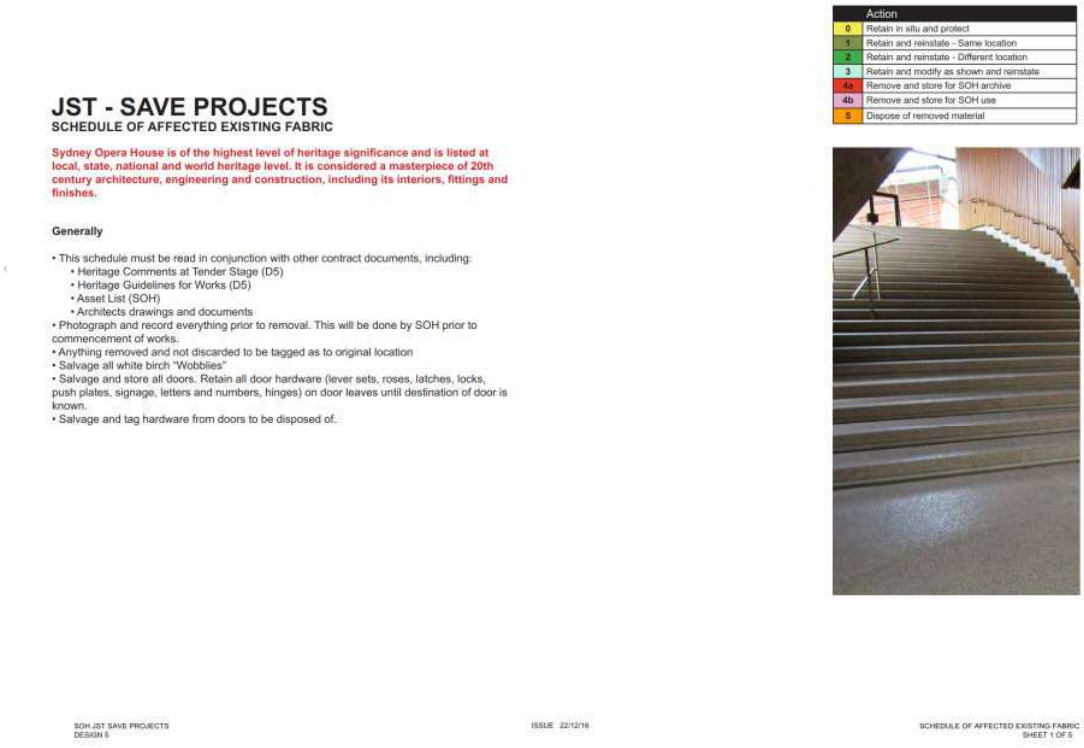
Generally

- This schedule must be read in conjunction with other contract documents, including:
  - Heritage Guidelines for Works (D5)
  - Asset List (SOH)
  - Architects drawings and documents
- Photograph and record everything prior to removal. All machinery to be video recorded in use. This will be done by SOH prior to commencement of works.
- Anything removed and not discarded to be tagged as to original location
- Graffiti must not be cleaned off and must not be painted over. This is a living "document" of the ongoing use of this theatre since 1973. This applies to all levels of backstage spaces.

Diagram notes: D5
Base Drawing: Scott Carver

SOH JST - THEATRE MACHINERY UPGRADE DESIGN 5 | ISSUE 1 21/12/16 | SCHEDULE OF AFFECTED EXISTING MACHINERY SHEET 1 OF 8

Figure 145- Asset Schedule



	Action
0	Retain in situ and protect
1	Retain and reinstate - Same location
2	Retain and reinstate - Different location
3	Retain and modify as shown and reinstate
4a	Remove and store for SOH archive
4b	Remove and store for SOH use
5	Dispose of removed material

JST - SAVE PROJECTS

SCHEDULE OF AFFECTED EXISTING FABRIC

Sydney Opera House is of the highest level of heritage significance and is listed at local, state, national and world heritage level. It is considered a masterpiece of 20th century architecture, engineering and construction, including its interiors, fittings and finishes.

Generally

- This schedule must be read in conjunction with other contract documents, including:
  - Heritage Comments at Tender Stage (D5)
  - Heritage Guidelines for Works (D5)
  - Asset List (SOH)
  - Architects drawings and documents
- Photograph and record everything prior to removal. This will be done by SOH prior to commencement of works.
- Anything removed and not discarded to be tagged as to original location
- Salvage all white birch "Wobblies"
- Salvage and store all doors. Retain all door hardware (lever sets, roses, latches, locks, push plates, signage, letters and numbers, hinges) on door leaves until destination of door is known.
- Salvage and tag hardware from doors to be disposed of.

SOH JST SAVE PROJECTS DESIGN 5 | ISSUE 22/12/16 | SCHEDULE OF AFFECTED EXISTING FABRIC SHEET 1 OF 5

Figure 146- Asset Schedule

	Action
0	Retain in situ and protect
1	Retain and reinstate - Same location
2	Retain and reinstate - Different location
3	Retain and modify as shown and reinstate
4a	Remove and store for SOH archive
4b	Remove and store for SOH use
5	Dispose of removed material

ENTRY FOYER, SOUTHERN FOYER, FUNCTION CENTRE, BALLET REHEARSAL ROOM

SCHEDULE OF AFFECTED EXISTING FABRIC

Sydney Opera House is of the highest level of heritage significance and is listed at local, state, national and world heritage level. It is considered a masterpiece of 20th century architecture, engineering and construction, including its interiors, fittings and finishes.

Generally

- This schedule must be read in conjunction with other contract documents, including:
  - Heritage Comments at Tender Stage (D5)
  - Heritage Guidelines for Works (D5)
  - Asset List (SOH)
  - Architects drawings and documents
- Photograph and record everything prior to removal. This will be done by SOH prior to commencement of works.
- Anything removed and not discarded to be tagged as to original location
- Salvage all white birch "Wobblies"
- Salvage and store all doors. Retain all door hardware (lever sets, roses, latches, locks, push plates, signage, letters and numbers, hinges) on door leaves until destination of door is known.
- Salvage and tag hardware from doors to be disposed of.

SOH ENTRY FOYER, SOUTHERN FOYER, FUNCTION CENTRE, BALLET REHEARSAL ROOM
DESIGN 5

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SCHEDULE OF AFFECTED EXISTING FABRIC
SHEET 1 OF 4

Figure 147- Asset Schedule

PROJECT NAME	SPACE	AFFECTED COMPONENT		ACTION	NOTES	IMAGE
Entry Foyer (Box Office Foyer)	Utzon Stairs GS30	Stairs	Precast granite treads	4b	Remove and store to accommodate new escalator	
		Wall	Granite pannels	3	Cut to configuration to accommodate new escalator	
			Upward Light	0	Retain	
		Ceiling	Folded concrete beams	0	To be carefully cleaned asper SOH specifications. Damage from earlier fixings repaired	
			Strip light	0	Retain	
		Doors	Glazed double door	0	Retain	
		Other	Bronze handrail and light	2		
	Foyer General 1526A, 1521P, 1527A	Floor	Precast granite floor panel	0	no works	
		Wall	Concrete	0	no works	
		Ceiling	Folded concrete beams	0	To be carefully cleaned asper SOH specifications. Damage from earlier fixings repaired	
		Doors	Granite pannel cladded door shown as demolished	3		
			Glazed double door	0		
		Others	Bronze box and bronze plate signage	2		
			Led screen advertising display screen	3		
	Cloak room 1526B & 1557B	Floor	Precast granite floor panel	0	no works	
		Wall	Concrete	0	no works	
		Ceiling	Folded concrete beams	0	To be carefully cleaned asper SOH specifications. Damage from earlier fixings repaired	
		Others	Brush box flat panel including bronze rail and tray	4b	Store 1 and discard other panels but salvage and store bronze fittings	
			Brush box umbrella holder	4b	Store 1 and discard others	
			All bronze fitting (railing, umbrella holder)	4b	Salvage and store	
			WC bronze signage	2	Retain and adjust to position shown	
	Box office counter 1527M	Floor	Brown carpet	4b	To be salvaged if in good condition	
		Wall	Plasterboard	5		
		Ceiling	Bronze ceiling	4b		
		Others	Digital text information led display screen	5		
			All fitout generally	5		
	Shop 1526H	Furniture	Retail shopand gongoles	5		
	Corridor 1527R/2 Office 1527L/1, 1527L/2, 1527L/3, 1527L/5	Floor	Brown carpet	4b	To be salvaged if in good condition	
		Wall	Wall shown as demolished	5		
		Ceiling		0		
		Doors	All doors as generally	4b	As generally	
			Door hardware as generally	4b	As generally	

SOH ENTRY FOYER, SOUTHERN FOYER, FUNCTION CENTRE, BALLET REHEARSAL ROOM
DESIGN 5

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SCHEDULE OF AFFECTED EXISTING FABRIC
SHEET 2 OF 4

Figure 148- Sample Schedule of Affected Assets

	Accessible toilet 1527F/1 and 1527H/1	Floor	Terrazo floor	2		
		Wall	Terrazo panel	2		
		Ceiling		0		
		Doors	All doors as generally	4b	As generally	
			Door hardware as generally	4b	As generally	
		Others	Fittings and plumbing	2		
			Benchtop and tapware	2		
			SS bin and fittings	2		
Southern Foyer	Of Southern Foyer	Floor	Granite floors panels	3	Remove salvage and reinstate same location for panels around the round bar	
		Brush box façade	Brush box panel	3		
			Steel truss framing supporting brush façade	3		
		Round bar	Granite benchtop	5		
			Bronze "tree" light with ice bucket in centre of the round	4b		
			Stainless steel benchtop and bar equipment	5		
			Bronze door	4b		
		Others	Switchboard shown as to be removed	5		
			Benches	5		
			Small round tables	0		
	JST Southern Foyer	Floor	Granite floors panels	3	Remove salvage and reinstate same location for panels around the round bar	
		Brush box façade	Brush box panel	3		
			Steel truss framing supporting brush façade	3		
		Glass façade	Bronze tinted glass and bronze handrail	3	cut to configuration	
			Steel structure	3	cut to configuration	
		Round bar	Granite benchtop	5		
			Bronze "tree" light with ice bucket in centre of the round	4b		
			Stainless steel benchtop and bar equipment	5		
			Bronze door	4b		
		Others	Benches	5		
			Small round tables	0		
Function Center	Cleaners room: g500, g500/a, g500/1, g500/2, gm500, gm500/1	Floor		0	No works	
		Wall	Wall shown as demolished	5		
		Doors	All doors as generally	4b	As generally	
			Door hardware as generally	4b	As generally	
		Others	Metal staircase and handrail	5		

SOH ENTRY FOYER, SOUTHERN FOYER, FUNCTION CENTRE, BALLET REHEARSAL ROOM DESIGN 5 | ISSUE 1 22/12/16 | SCHEDULE OF AFFECTED EXISTING FABRIC SHEET 3 OF 4

Figure 149- Sample Schedule of Affected Assets

	Kitchen g514j, g507a	Floor	Terrazo floor tiles underneath existing floor	0		
		Wall	Shown demolished	5		
		Ceiling	wobbles above existing ceiling (continuing into f&b area)	2		
		Doors	All doors as generally	4b	As generally	
			Door hardware as generally	4b	As generally	
		Others	kitchment equipment	5		
	F&B area g507, g508 wine bar g504, g504a office g503	Floor	Terra floor tiles	0		
		Wall	Wall shown as demolished	5		
		Ceiling	Birch 'wobbles'	3		
		Doors	All doors as generally	4b	As generally	
			Door hardware as generally	4b	As generally	
Current Ballet rehearsal room g515a	Current Ballet rehearsal room g515a	Floor	Tarkett vinyl floor	2		
			Plywood floor under tarkett vinyl floor	5		
			Oregon floor under plywood floor	2	Salvage (if possible) for repair elsewhere	
		Wall	Concrete wall shown as demolished	5	Cut to configuration	
			Slotted birchwood wobbles with acoustic panel	2	To be reused in the proposed Ballet Rehersal Room	
		Ceiling	Plasterboard	5		
		Doors	All doors as generally	4b	As generally	
			Door hardware as generally	4b	As generally	
		Others	Ballet barre and mirrors	4b	salvage or dispose of - up to builder	
		Light fitting	Salvage reflectors	4b		
		Furniture	Piano etc.		SOH Responsibility	
Proposed Ballet Rehearsal room	Proposed Ballet Rehersal Room	Floor	Floor shown as demolished	5		
		Wall	Wall shown as demolished	5		
		Ceiling	Ceiling shown as demolished	5		
		Doors	All doors as generally	4b	As generally	
			Door hardware as generally	4b	As generally	

SOH ENTRY FOYER, SOUTHERN FOYER, FUNCTION CENTRE, BALLET REHEARSAL ROOM DESIGN 5 | ISSUE 1 22/12/16 | SCHEDULE OF AFFECTED EXISTING FABRIC SHEET 4 OF 4

Figure 150- Sample Schedule of Affected Assets