Her Majesty's Theatre Compliance, Facilities & Operational Upgrade

Feasibility Report – Stage 3 Works

17 Lydiard Street South, Ballarat VIC 3350

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Prepared for

CITY OF BALLARAT

HER MAJESTY'S BALLARAT

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1.0 Introduction

The City of Ballarat and Her Majesty's Theatre, Ballarat have commissioned this feasibility study for the facilities, operational and compliance-based upgrade of Her Majesty's Theatre needed to support the continuing use of Her Majesty's Theatre as Ballarat's premier performing arts venue.

This report summarises the recent works completed in 2019 (stage 1 and stage 2 works) which largely address immediate structural repairs, internal refurbishment and conservation works, and provides an overview and feasibility assessment of the proposed stage 3 works.

These works are to implement Disability Discrimination Act (DDA) compliance works, compliance with the National Construction Code (NCC) and capital works to upgrade dated facilities and operational areas with associated services upgrades.

1.1 Project Background – Why are the works needed?

Built in 1875, Her Majesty's is the oldest continuously operating theatre on the mainland and a venue in constant demand for community and professional use. With changes in theatrical technology, practice and methodology, combined with a population that is growing, the ageing infrastructure at Her Majesty's Theatre no longer meets current standards.

Refurbishment of Her Majesty's Theatre will ensure the survival of one of Australia's most historic theatrical assets.

In support of this feasibility study and review of the physical requirements of the theatre, the City of Ballarat has undertaken an Investment Logic Mapping (ILM) exercise to ensure alignment between identification of the problems and appropriate solutions through the proposed Stage 3 works.

The Council has identified that Her Majesty's Theatre does not currently provide a safe environment for performers, patrons and staff, and has fallen behind current standards expected of a professional performance venue for performers and patrons alike.

The key problems are:

- The safety of performers, patrons and staff is compromised by the venue's current condition
- The venue in its current condition is not meeting statutory standards of a professional market (a contemporary performance space)
- The venue in its current condition is not meeting community expectation of this type of venue
- The ongoing operational and compliance costs are not being addressed (whole of life)
- There is conflict between users and control of venue management (complexity of governance).

The ILM process has identified the following solutions (refer Figure 1):

- Undertake compliance works to building as recommended
- Refurbish front and back of house amenity for patrons, performers and staff including access
- Replace and renew services throughout building.

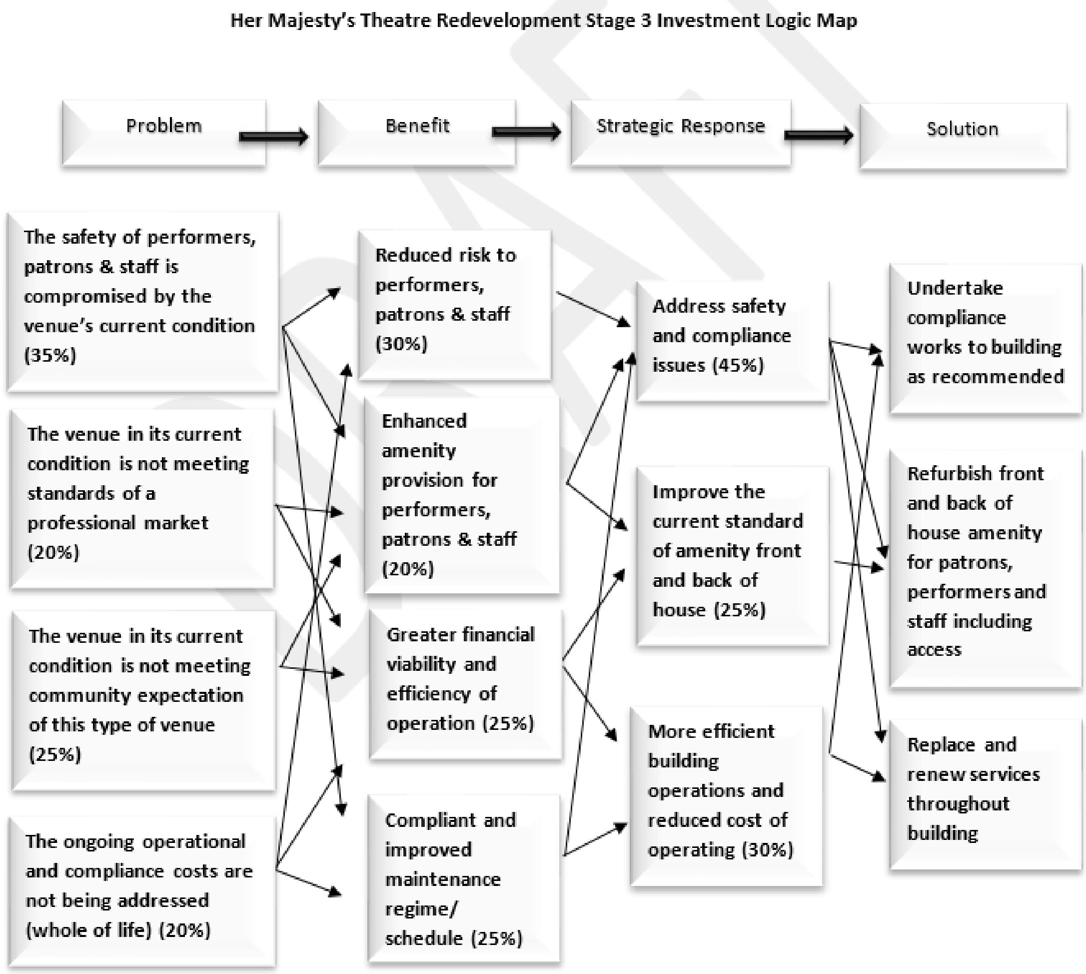

Figure 1 Her Majesty's Theatre Redevelopment Stage 3 Investment Logic Map
Source: City of Ballarat

With stage 1 and 2 works now complete, the funding provided by the Victorian State Government's Living Heritage Grant and the City of Ballarat have been expended and further support and funding is needed to undertake further stages of works to continue the necessary access and compliance upgrades and improve the operational functionality.

In November 2018, the State Government committed to investing $10 million towards the stage 3 upgrade of the theatre including the "restoration of all walls, ceilings and floors, the installation of lifts at the back and front-of-house, automation of the orchestra pit, better dressing rooms and the extension and improvement of foyer spaces."[1]

As identified through the ILM process and a comprehensive review of the existing condition of the building physically and operationally the priorities for the works are:

- Improving **accessibility**
- Improving operational **safety** and **compliance** for audience, performers and staff
- Improving **functionality**

[1] 'Restoring a Ballarat Icon for the Future' Media Release The Hon Daniel Andrews MP Premier dated Sunday 11 November 2018.

Subject to funding, it is proposed that the theatre would be blacked out in March 2021 with works to be completed by February 2023.

1.2 Report Structure

This report brings together assessments and recommendations for architectural, heritage, services and statutory compliance upgrade works to Her Majesty's Theatre, Ballarat.

Statutory compliance works to achieve compliance with the Disability Discrimination Act (DDA) are covered in Section 5.1, followed by the code compliance works to meet minimum and full compliance with the National Construction Code (NCC, formerly BCA) in Section 5.2. The architectural alterations associated with improved functionality are described in Section 5.3. The findings and recommendations in these sections form the basis for the Strategic Plan delivery and associated costings in Section 8.0.

This iteration of the feasibility report is based on the following phased delivery:

Stage 1	Living Heritage Grant Conservation Works – **Completed in 2019**.
Stage 2	Minor upgrade works – **Completed in 2019**.
Stage 3a	Accessibility, safety and compliance upgrade works to address statutory regulations (NCC and DDA) and operational and facilities upgrades to the extent possible – **Anticipated completion in 2023**.
Stage 3b	Further functional/operational upgrade works to back-of-house – **subject to future funding**

1.2.1 Consultant Input

This report contains several appendices consisting of reports prepared by other consultants. Each of these reports contains recommendations for upgrade and compliance works. These include the following:

Appendix	*Author*	*Report Title*
Appendix A	Lovell Chen	Feasibility drawings dated November 2019.
Appendix B	Mark Hodkinson	Structural Investigations report 24 February 2020.
Appendix C	Hazard Alert	Division 6 Hazardous Materials Report Rev 1 dated June 2018.
Appendix D	Hendry Group	Feasibility Consultancy Report dated June 2019 and correspondence dated 28 November 2019
Appendix E	Morris Goding	Feasibility Project Memorandum dated 28 November 2019.
Appendix F	Gincat Fire Safety	Fire Engineering Report Rev 1.4 dated 29 January 2019 and Addendum 1.0 to Fire Engineering Report, FER 1.4 dated 2 September 2019
Appendix G	Simpson Kotzman	Building Services Report Feasibility Report Stage 2, Rev A dated 30 June 2019.
Appendix H	PlanCost Australia	Her Majesty's Theatre Ballarat Cost Plan 6 rev D Future Works dated 4 February 2020.
Appendix I	L'RTMI	Her Majesty's Theatre Ballarat Specification: Orchestra Pit Modules, Stalls Removable Wall, Drapery and Track dated June 2010
Appendix J	McDougal & Vines	Conservation Management Plan (CMP) dated October 2006.

1.2.2 *Previous Reports*

The following reports have been referenced in the production of this report:

- Her Majesty's Theatre Ballarat Conservation Management Plan (CMP) prepared by McDougal & Vines Conservation & Heritage Consultants in association with Swanbury Penglase, dated October 2006.
- Her Majesty's Theatre Ballarat Feasibility Report and Executive Summary prepared by Swanbury Penglase, dated December 2006.
- Her Majesty's Theatre Ballarat Feasibility Addendum Report prepared by Swanbury Penglase, dated September 2013.
- Her Majesty's Theatre Ballarat Feasibility Addendum Report prepared by David Bagshaw, dated August 2016.
- Her Majesty's Theatre Ballarat Stage 1 Conservation Works Report prepared by David Bagshaw, dated February 2017.
- Her Majesty's Theatre Ballarat Specification: Orchestra Pit Modules Stalls Removable Walls Drapery and Track prepared by L'RTMI Theatre Design and Technologies, dated June 2010.
- Her Majesty's Theatre Ballarat Conditions Assessment and Recommendation Report for Stage Strengthening prepared by Lovell Chen, dated September 2018.
- Her Majesty's Theatre Ballarat Compliance Facilities and Operation Upgrade Feasibility Report (stage 1) prepared by Lovell Chen, dated November 2018.

1.3 Subject Site

The site is Her Majesty's Theatre located at 17 Lydiard Street South, Ballarat and containing a west facing three storey Victorian building. The building is land locked on the south and north sides by neighbouring buildings that abut the boundary wall. Part of the north elevation is accessible by Unicorn Lane and on the east the building is accessible by Lewis Street.

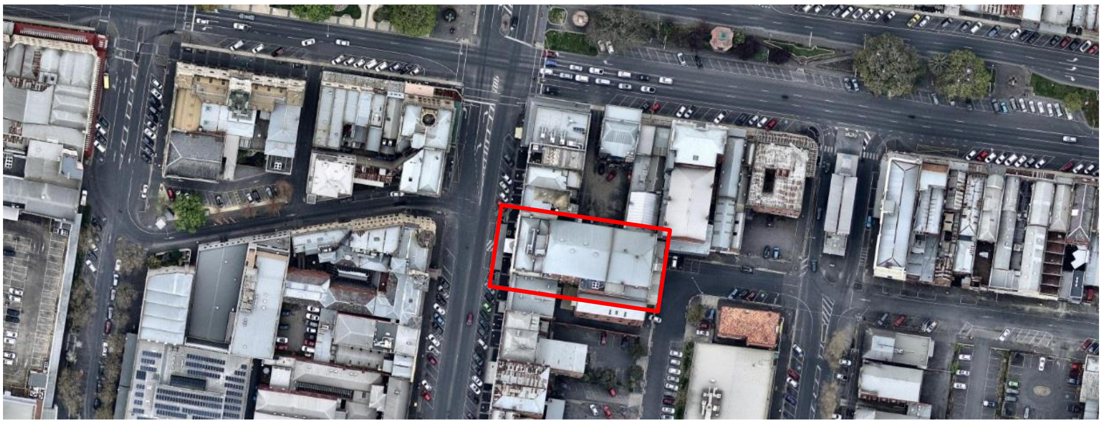

Figure 2 Aerial image of the site and site context.
Source: Nearmap

1.4 Benchmarking and Context

Her Majesty's Theatre is one of several performance venues in Ballarat including venues such as Town and Civic halls, historic cinemas and theatres and contemporary auditorium spaces.

Ballarat is undergoing population growth trending at an average annual growth rate of 3.78% over the last 8 years (157,485 recorded within the local government area at the 2016 census).[2] It is expected this positive growth trend will continue with an anticipated forecast growth of 1.9% per annum to 2031.[3]

Her Majesty's Theatre provides a venue with a higher capacity than all other live performance venues in the municipal area. The continuing growth in population demonstrates that the need for a venue like Her Majesty's Theatre is relevant, making the upgrade works necessary to continue to provide the Ballarat community with an accessible and serviceable venue comparable with those in Melbourne or other large regional centres.

Her Majesty's Theatre reopened in October 2019 following the completion of the stage 1 and 2 works. In previous years the theatre has been booked for 70% of the year, largely consisting of community-based shows including eisteddfods and the Royal South Street Competitions. The venue supports commercial performances including by the Melbourne Symphony Orchestra and other prestigious groups.

Several live performance theatres throughout Victoria have undergone upgrade works similar to those considered by this report. Examples include the following:

- Palais Theatre, Melbourne with a capacity of 2,980 in the auditorium. The Palais underwent a major refurbishment and alteration in 2016-2017 including major external conservation and structural remediation works, refurbishment, services and compliance upgrades.
- Regent Theatre, Melbourne with capacity of 2,150 in the auditorium. The Regent underwent a large redevelopment in the 1990s and will reopen in January 2020 after a 6-month closure to refurbish the auditorium, amenities and associated compliance upgrades.
- Princess Theatre, Melbourne with a capacity of 1,100 and has recently undergone a refurbishment of bathrooms, foyer and external repairs and repainting.
- Capitol Theatre, Bendigo with a capacity of 480 in the auditorium.
- Geelong Arts Centre Redevelopment. The Geelong Arts Centre is undergoing staged redevelopment with the first stage completed in 2010 and two further stages underway. The total investment is more than $160m and involves construction of new entrances, studios/rehearsal spaces, multiple new performance venues, an upgraded box office and refurbished back-of-house and administration facilities.
- Theatre Royal, Hobart is currently undergoing a $96m redevelopment that will see the historic theatre reinvigorated and conserved and the theatre substantially extended to form new performances spaces.

There are a number of venues available for use and hire within Ballarat, but none of them with the capacity of Her Majesty's. Most are halls and not purpose-built theatres.

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2 Population Australia Ballarat Population 2019: http://www.population.net.au/ballarat-population/ accessed on 2 December 2019.

3 Regional Development Victoria, Regional City of Ballarat: http://www.rdv.vic.gov.au/victorias-regions/ballarat# accessed on 2 December 2019.

Table 1 Comparative assessment of venues in Ballarat

Venue	*Capacity*		*Facilities*
	Auditorium	*Other*	
The Courthouse Theatre	500		Performance theatre, stage & studio spaces.
Regent Cinemas	700		Cinema nonflexible space.
Helen Macpherson Smith	90	-	Performance Theatre
Ballarat Town Hall			Hall and stage, other breakout rooms.
Ballarat Civic Hall	1,050*		Hall and stage with balcony seating. In theatre configuration with ticketed seating maximum capacity of 1,050.
Ballarat Mechanics Institute	500	200	Hall and stage, other breakout rooms.
Ballarat Mining Exchange	250	100	Hall, no stage, industrial kitchen.
Museum of Australian Democracy (MADE)	114	25	Contemporary venue with up to date facilities.
Her Majesty's Theatre	788	100	Performance theatre, stage, breakout room and studio spaces.

* Civic Hall is estimated to have a capacity to accommodate up to 1,350 patrons for cocktail (standing) function.

Some of the works recommended in this report would reduce the overall seating capacity of the theatre through the provision of accessible seating and reconfiguration of the balcony level to improve sight lines. The overall reduction in the seating numbers is approximately 47, which will mean that the theatre remains at a higher capacity than other live performance venues in Ballarat with the exception of the Ballarat Civic Hall, as identified in the table above.

2.0 Heritage Considerations

2.1 Statutory Controls

The building is subject to a number of statutory planning controls and registrations. The building is included on the Victorian Heritage Register (VHR) and as such Heritage Victoria is the key determining authority for approval of works. In addition to the Victorian Heritage Register, the site is also subject to provisions and ordinance of the Commercial Zoning (C1Z) under the Ballarat Planning Scheme.

2.1.1 Victoria Heritage Register

The subject site is included on the Victorian Heritage Register (VHR) as place number H0648. Her Majesty's Theatre is of historical and architectural significance to the State of Victoria. The extent of registration applies to the whole building and the land, described as:

> Historic Building No. 648, Royal South Street Memorial Theatre, Lydiard Street South, Ballarat (to the extent of the whole of the Memorial Theatre Building and the whole of the land in Certificate of Title, Vol. 4306 Fol. 123). Victoria Government Gazette No. G10 11 March 1987 p. 557&558.[4]

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4 Victorian Heritage Database, Her Majesty's Theatre (H0648): http://vhd.heritagecouncil.vic.gov.au/places/67, accessed on 3 May 2018

The statement of significance for the place as included in the VHR documentation is reproduced below:

> This building, which was known in 1874 as the Academy of Music, in 1898 as Her Majesty's Theatre, and, from 1966 to 1988 as the South Street Memorial Theatre, has both historical and architectural significance. It is a rare survivor of a number of Ballarat and Bendigo theatres which, in the 19th century, rivalled those in Australia's capital cities. The Ballarat theatre is arguably the oldest operating theatre in Australia. According to Ross Thorne, a major exponent of our theatrical history, the memorial theatre is "probably the most significant theatre in Australia today". Thorne claims that it is the most substantially intact of our remaining 19th century theatres, which include the Theatre Royal in Hobart, the Princess in Melbourne and Her Majesty's in Brisbane.
>
> On a Victoria-wide basis, the Ballarat theatre has special importance for its unique interior. Its double horse-shoe shaped balconies supported on columns, added from the designs of the notable architect William Pitt in 1898, are the last example of this type of theatre design in the State. The theatre has significance because of its associations with two distinguished 19th century architects, George Browne and William Pitt, both of whom specialised in the design of theatres. Browne, who was responsible for the original 1874 design of the Academy of Music, also designed Melbourne's rebuilt Theatre Royal in 1872. He was the designing architect in 1874 of Rupertswood, the Sunbury mansion of Sir William J Clarke, Patron of the Academy of Music. Pitt, who designed the 1898 alterations and additions, included among his theatrical works the new Princess Theatre in 1886, the Bijou (rebuilt after the fire of 1889), the 1891 design of the Melbourne Opera House and its rebuilding in 1901 (later known as the Tivoli), alterations to the interior of the Theatre Royal in Bourke Street in 1904 and alterations to the interior of the Hobart Theatre Royal in 1911. Also, at the turn of the century, Pitt was responsible for extensive alterations to Her Majesty's Theatre in Melbourne. Other major buildings designed by Pitt include the Rialto and the Olderfleet in Collins Street and the St Kilda Town Hall.
>
> The Theatre is a building which illustrates important aspects of the social and cultural life of Ballarat over a period of more than 100 years. It has importance for its links with Sir William J. Clarke (1831-1897), the landowner, stud breeder and philanthropist for whom it was built in 1874, and with a number of Ballarat's leading citizens, most notably William Collard Smith (1830-1894), agent, investor and politician. It is important for its associations from 1896 with the prestigious Royal South Street Society, a Ballarat organisation dedicated to the promotion of excellence in the performing arts. This society owned the building from 1965. The theatre is associated also with the Sun Aria competitions, which resulted in the discovery of many important Australian singers. Notable theatrical figures who performed at the theatre included the company of William Lyster, who is remembered for his part in establishing opera as a permanent institution in Victoria; Amy Castles, dramatic soprano; Dame Nellie Melba and Gladys Moncrieff.
>
> The building has landmark value. The original 1874 Lydiard Street facade, which survives partially intact, provides a contributory element to the Lydiard Street precinct. The rear three-storey brick section has a strong visual element and closes the vista along Lewis Street.[5]

2.1.2 Ballarat Planning Scheme

The subject site is individually identified as HO70 in the Schedule to the Heritage Overlay of the Ballarat Planning Scheme (Figure 3).

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5 Victorian Heritage Database, Her Majesty's Theatre (H0648): http://vhd.heritagecouncil.vic.gov.au/places/67, accessed on 3 May 2018

The *City of Ballarat Heritage Study* makes reference to significant buildings within the Lydiard Street Precinct, including Her Majesty's Theatre. With regard to the theatre, the Study includes the following description:

> Her Majesty's Theatre at 17 Lydiard Street South opened in 1875 and according to theatre historian Ross Thorne the former Academy of Music is the oldest operating theatre in Australia today. The first floor façade is original however the ground floor has been completely altered. Many features of the interior remain.[6]

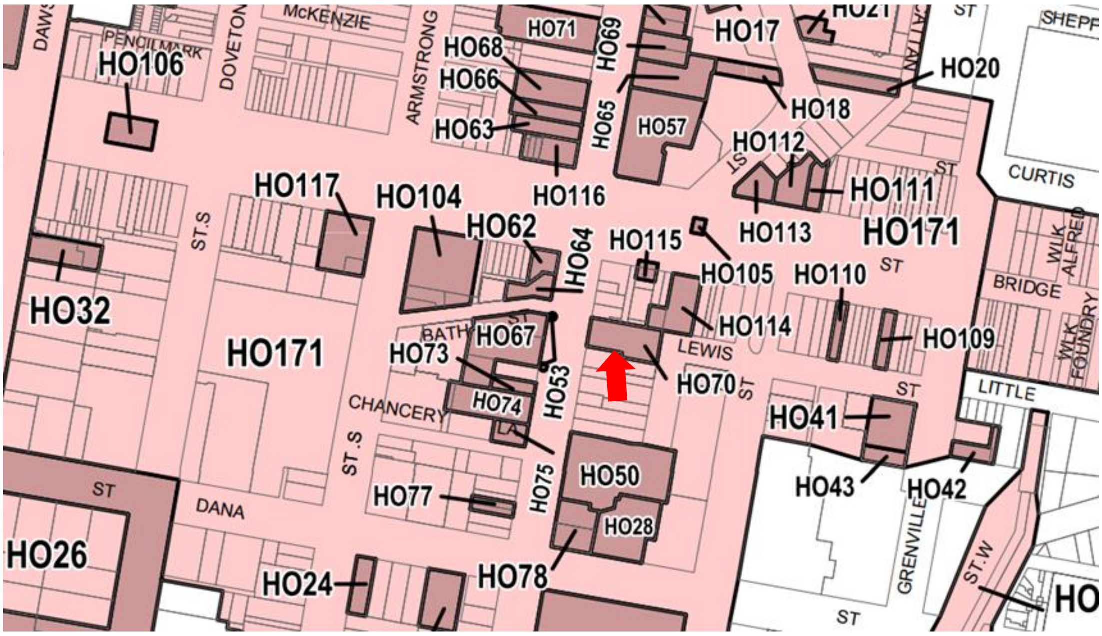


Figure 3 Detail of the Heritage Overlay map showing both the individual inclusion of Her Majesty's Theatre as HO70 (indicated) and the location of the theatre within the Lydiard Street Precinct (HO171)
Source: Ballarat Planning Scheme

The subject site is also included in the Lydiard Street Precinct which is identified as HO171 in the Schedule to the Heritage Overlay of the Ballarat Planning Scheme. The statement of significance for the Lydiard Street Precinct, as included in the *City of Ballarat Heritage Study* is reproduced as follows:

> The Lydiard Street Heritage Precinct is architecturally significant at a state level (AHC criteria D.2, E.1). It demonstrates many original and early design qualities associated with the civic and commercial development of the area from the 1850s. The intact qualities of the individually significant and contributory buildings include their predominantly Victorian and Edwardian architecture, ornate detailing, verandahs, links to notable contemporary architects, and intactness of the exteriors and interiors of the buildings.
>
> The Lydiard Street Precinct is aesthetically significant at a state level (AHC criteria D.2, E.1). It demonstrates important visual qualities that reflect the historical, cultural and architectural development of Ballarat, and contribute to the setting. The qualities include the urban foci, notably many prominent and larger civic buildings, the topographical setting on the escarpment, intact Victorian streetscapes, the grid street pattern and gracious boulevard of Sturt Street.

6 Ballarat Heritage Study Stage 2 prepared by Hansen Partnership Pty Ltd, 2003, *Lydiard Street Heritage Precinct*, Volume 2, p.160

The Lydiard Street Precinct is historically significant at a local level (AHC criterion H.1). It is associated with the early settlement of the area from squatters, demonstrated by the original use of Sturt Street, the formal layout of a township in the 1850s to the development of a municipality. Many of the individual civic buildings in the Precinct are designed by notable contemporary architects, and have associations with notable Ballarat citizens from the 1850s beyond.

The Lydiard Street Precinct is scientifically significant at a local level (AHC criterion C.2). The area is of importance for contributing to the history of infrastructure development in Ballarat West, identified by intact bluestone kerbs and gutters.

The Lydiard Street Precinct is socially significant at a LOCAL level (AHC criterion G.1). It is recognised and highly valued by the wider community for civic, commercial and religious reasons.

Overall, the Lydiard Street Precinct is of state significance.7

2.1.3 National Trust of Australia (Victoria)

Her Majesty's Theatre, known as the Former Academy of Music, is classified by the National Trust of Australia (Victoria) as a place of State significance (B3566). This registration is not subject to statutory controls. The statement of significance for the theatre prepared by the National Trust of Australia (Victoria) is as follows:

Her Majesty's Theatre at its opening in 1874, was styled the "Academy of Music". It became "Her Majesty's Theatre" in 1899. After much alteration and following after various adaptations and use as a cinema it became the home of the Royal South Street Society in 1965. In 1987, the Society gifted it to the then City of Ballarat, which undertook a major restoration of the building. The theatre re-opened as Her Majesty's in 1990. The Theatre is owned and operated by the city of Ballarat, while also remaining the home of the Royal South Street Competitions.

The theatre was erected for Sir William Clarke Bart, at the request of a group of local citizens to supersede the outdated 1858 Theatre Royal. It played an important role in the social life of Ballarat as the venue for touring professional theatre, local performances, political meetings and religious gatherings. The architect was George Browne and the builder James Sumner & Co. Alterations to the original design have been made by architects William Pitt in 1898, Clegg & Muller in 1906 and 1912, Cedric Ballantyne and Arthur Russell in 1927 and by Cowper Murphy and Appleford in 1943. The 1990 restoration was planned by Clive Lucas & partners in association with Civil & Civic.

The Royal South Street Society first used the theatre in 1896 and was the venue for that organisation until the beginning of the 20th century when the Society moved to the Coliseum in Grenville Street.

A Bio Box was built in 1916 and the theatre operated primarily as a cinema from that time until 1964.

In 1965 the Royal South Street Society purchased Her Majesty's Theatre and, after some remodelling, opened the building as the Memorial Theatre in 1966.

The facade of the building is two-storied in height with stucco ornamentation in a somewhat florid Classical style. The upper storey windows are round-headed with archivolts supported by

7 Ballarat Heritage Study Stage 2 prepared by Hansen Partnership Pty Ltd, 2003, *Lydiard Street Heritage Precinct*, Volume 2, p.166

slender columns as are the two-ground floor subsidiary entrances. The highly decorated curved entrance has now been lost.

Internally, the circle and gallery levels are horse-shoe shaped in plan and are carried on cast iron columns. The balcony balustrading is swag-bellied and decorated. The wall pilasters, panelled ceilings and proscenium are original decorations and some traces of Art Nouveau decorative motifs in the Dress circle lobby date from 1907. A 1937 Theatre Organ was installed by the Ballarat Theatre Organ Society between 1972 & 1982. The 1899 opening dome which closed in 1907 was restored in 1990. The double balcony, supported on columns, is now the earliest of this form of theatre remaining in Victoria and the theatre also contains a rare 19th century fly grid and original paint frame with wooden winches.

The shop fronts in the ground floor facade and the 1912 portico were recreated in 1990. While the first-floor facade is intact, the parapet balustrading and ornamentation have been recreated. A skillion roofed building housing back stage facilities was added in 1899 and a similar feature was built in 1990.8

2.2 Permit Exemptions

The Heritage Victoria citation for the theatre contains two specific permit exemptions, which are as follows:

> Internal minor works to the back stage, side stage and sub-basement rooms on Level 1, Level 2 and Level 3 in the areas as shown on the attached plans numbered Drawing 03/01, 03/02 and 03/03 which are endorsed by the Executive Director and form part of this permit exemption
>
> The internal minor works include but are not limited to the installation of lighting, screens, storage systems, mezzanine structures and fittings and fixtures provided the work has been agreed with by appropriately qualified heritage consultant.

Conditions:

1. Exempt classes of works or activities are to be planned and carried out in a manner which prevents damage to the registered place / object. However, if other previously hidden original or inaccessible details of the object or place are uncovered, any works that may affect such items shall immediately cease. The Executive Director shall be notified of the details immediately to enable Heritage Victoria representatives to inspect and record the items, and for discussion to take place on the possible retention of the items, or the issue of a modified approval.
2. If there is a Conservation Policy and Plan approved by the Heritage Council or Executive Director, all works and activities shall be carried out in accordance with that Policy and Plan.
3. Nothing in this Declaration prevents the Executive Director from amending or rescinding all or any of the permit exempt alterations provided work has not commenced on the alteration.

2.3 Conservation Management Plan

Her Majesty's Theatre Ballarat Conservation Management Plan (CMP) prepared by McDougal & Vines Conservation & Heritage Consultants in association with Swanbury Penglase includes a series of specific conservation policies related to the conservation and upgrade of the site. These policies have been established in order to 'ensure the ongoing use of the theatre is achieved through appropriate adaptation and change. Adaptations and changes should balance current performance and user

8 Victorian Heritage Database, Former Academy of Music (B3566): http://vhd.heritagecouncil.vic.gov.au/places/67530, accessed on 3 May 2018

requirements with the significant heritage qualities of the theatre'.[9] The relevant policies related to the works outlined in this report are as follows:

2.3.1 External Conservation Policies

Rear Facade	Policy: Maintain the stonework and brickwork of the rear façade in good condition. Necessary changes to expand the theatre at this elevation must maintain the building's silhouette such that it continues to be a strong visual element that closes the vista along Lewis Street.
Site	Policy: Her Majesty's Theatre should be maintained as a dominant landmark feature in the townscape and the manner in which the rear section closes the vista along Lewis Street should be retained. Implementation: Ensure that any future development, works and activities do not obscure or lessen the contribution of the building to the current setting. Ensure that future development directly adjacent to and/or surrounding the site does not visually dominate the theatre and is complementary in building form, materials, colours, proportions and overall bulk and form. No works or activities should be carried out that will obscure or lessen the contribution of the building to the streetscape and as a landmark in the area.
Adaption & Change	Background: Of the remaining 19th century theatres in Australia, Her Majesty's Theatre is substantially intact. However, it is currently restricted in its staging capacity. Aspects of its significant historic qualities including the size of the stage, the height of the fly tower, original roof truss configuration, backstage facilities and disability requirements do not meet current user requirements and benchmark standards. This constrains the current range of possible performances which can be staged at the theatre. Policy: Ensure the ongoing use of the theatre is achieved through appropriate adaptation and change. Adaptations and changes should balance current performance and user requirements with the significant heritage qualities of the theatre. Implementation: Assess each potential adaptation and change against the requirements for continued use of the theatre and its conservation. Allow for original elements to be evident and respect the form, detailing and significant fabric of the building.

2.3.2 Internal Conservation Policies

Foyer	Policy: Ensure that the foyer is capable of meeting the requirements of users. Changes should allow for original elements to be evident and respect the form and detailing of the foyer and significant fabric. Implementation: Investigate opportunities to expand into adjoining buildings and side passages to ease spatial pressures on the foyer and provide more adequate space for commercial outlets.
Auditorium Seating	Policy: Any upgrades to seating should respect the existing seating design and retain a section of the current seating in the upper balcony area. Seating capacity should be maintained or increased if possible and shall also meet disabled seating requirements. Implementation: Upgrade seating designs and configurations to improve sight lines and provide for more comfortable seating.

9 Her Majesty's Theatre Ballarat Conservation Management Plan prepared by McDougall & Vines Pty Ltd, 2006, p.42

Auditorium Dome	Policy: The dome should be retained, and future conservation works should continue to be undertaken to match the dome to its original 1898 form. Implementation: Reinstatement of a painted mural either accurately reconstructing or deriving from the remnant paper lining mural is recommended for the dome.
Stage Floor	Policy: Upgrades to the stage should only be undertaken to promote the theatre's use. Upgrades shall ensure that original elements are evident and respect the form, detailing and all significant fabric of the building. Maintain the rake of the stage if this is vital to the establishment of sight lines in the theatre. Implementation: Explore opportunities to expand the stage area as well as the feasibility of having a sacrificial stage and/or providing traps in the stage.
Fly Gallery & Tower	Policy: In order to meet current community expectations and theatre industry standards, changes could be undertaken to the fly gallery and tower. These necessary changes should allow for original elements to be retained or interpreted appropriately. Any change should respect the form, detailing and significant fabric of the building and should not be detrimental to the theatre's structural stability. Implementation: Investigate options to raise the height of the fly tower to meet current benchmark standards. Original Equipment: Background: The fly gallery contains a number of early equipment and fittings of heritage value including original handlines, fire curtain winch and wind and thunder machine. Most of the original equipment is obsolete and does not meet current safety standards. In 1988-90 the handlines were replaced with counterweight fly lines. Current benchmarks call for automated power flying in new and refurbished theatres. Policy: Early equipment and fittings that are now obsolete should be retained on-site for interpretation purposes. Implementation: Continue to maintain original equipment as part of an active interpretation program. Install an automated flying system to meet current safety requirements.
Bio-Box	Policy: Any adaptations and changes should respect the form, detailing and all significant fabric of the building. Implementation: Provide covered access from the fly gallery to the Bio box by investigating opportunities to connect the roof cavity area with the fly gallery.
Long Room	Policy: Continue to retain this room in its original 1875 form. Retention of the bar (installed in 1989) is not a requirement. Implementation: Consider removing or replacing the bar with a smaller bar to allow for more flexible use of the room. Investigate opportunities for disability access and extended uses for the room such as a function room, offices or rehearsal room.
Electrical Services	Policy: Continue to maintain current lighting levels. Any new heating or cooling requirements and other electrical services should be undertaken in the most unobtrusive manner for the building. Implementation: Consideration could be given to the replacement of the c1950s chandeliers with the pendant period lights elsewhere in the theatre. Future upgrading and installation of electrical services should adhere to the following: • Consolidation of conduits into a single cable and careful consideration of the location of supply conduits. • Recessing/chasing of cable into masonry walls or wainscotting. • The least obtrusive and less damaging method should be determined in all cases.

- Any computer fibre optic cable should be combined with electrical supply and recessed into wall cavity. Any signal cable should be installed to ASTA Standard.

Amenities	Policy: Ensure that appropriate amenities are provided for all staff and patrons including disabled persons. Retain the male WC (room 214) within a framework of current plumbing standards. Implementation: Continue to maintain current amenities, consider upgrading wet areas (including access for disabled persons) as required.

3.0 Description and Materiality

Her Majesty's Theatre was opened in 1874 as the Academy of Music, constructed to designs by George Browne in a Classical 'boom' style.

Exterior

The two-storey building presents to Lydiard Street with a symmetrical rendered façade divided into five bays separated by pilasters at the upper level and incorporating entrance doors and shopfronts at ground floor level, also divided by pilasters. The façade features elaborate moulded ornamentation and is topped by the reconstructed parapet incorporating urns and a central arched pediment featuring a lyre motif. The 1990s modifications of the ground floor presentation of the building included the installation of automatic full-height clear glazed doors to the central entrance of the theatre, and the erection of a portico with cast-iron posts and a corrugated sheet metal roof, over the central entrance.

The building is set on a bluestone (Basalt) plinth. The taller component of the building is set to the rear of the two-story rendered front section. This taller component forms the auditorium and is constructed of red brick with engaged piers on the north and south walls with a pitched roof clad in corrugated metal sheet. The rear building has face red brick buttresses at even intervals along the north and south facades with multi-paned sash windows at the upper level. The building has face red brick chimneys and ventilation caps on both the north and south slopes of the pitched roof.

To the rear of the building, at the eastern end, is a large corrugated sheet metal addition at first floor level, supported by columns. The addition has a tall central lift shaft which provides a goods lift connection between ground floor and the stage. The additions extend from this central tower to the north and south, at first floor level, with pairs timber-framed sash windows evenly placed along the addition. The eastern elevation is stone at ground floor level, with areas of brick infill. The upper level is comprised of red face brick with multipaned sash windows to match those elsewhere on the building. Both the north and south elevations are stone at the base, with red face brick above. Sash windows, that were evenly spread along the facades have been removed and infilled with face red brick.

Interior

The interior of the theatre comprises the main public spaces (foyers, long room, auditorium, western, north and south stairs and toilet facilities) and the back-of-house areas (basement levels, stage, Bio box and associated support areas).

The main entrance foyer is accessed by a central entrance from Lydiard Street. Additional entries to the north and the south ends of the eastern façade also provide access into the main foyer and to the stairwells.

The main foyer incorporates restrained ornamentation, a partitioned box office to the south and a candy bar to the north of the central glass automatic sliding doors. A central flight of stairs descends down to the auditorium entry to the stalls.

The doors to the north and south of the central doors provide access to the stairs leading to the upper floors. Above the main foyer is the Long Room (Figure 9), a double height space which provides a bar at the dress circle level. The dress circle foyer has decorative tiling to the floor and the entrance to the auditorium is ornamented by columns, a cornice and pediment featuring an Art Nouveau design. Toilet facilities are also accessed from the dress circle foyer.

The auditorium has a horseshoe shaped gallery, with a dress circle level and gallery level above the steeply sloped floor of the stalls; the ceiling features a dentilated moulded cornice with coving above and a large central dome, with chandeliers providing lighting. As outlined in the CMP, the existing colour scheme is an interpretation of the 1898-99 scheme.

The stalls incorporate seating in a curved formation, with an enclosed tech booth to the rear. Interspersed throughout the rear half of the stalls are two rows of cast iron columns supporting the dress circle above. The walls are ornamented with pilasters and framed moulded panels, while access to the fire escapes are located to the north and south sides.

The dress circle has an ornately decorated balustrade with an embossed swag pattern facing the stage and seating organised in a curved form following the line of the balcony. There are two main aisles on this level dividing the seats into three main sections. Centrally within the balustrade, is a small projecting bay which is separated from the main tiered seating by a low wall. A line of cast iron columns runs along the front portion of the level supporting the gallery above. An additional row of columns is situated at the rear of the seating behind a low barrier wall. The walls to this level have limited ornamentation.

The upper level, or gallery, has a similar layout to the dress circle below. The balustrade follows the same line and has the same detailing as the balustrade below, excluding the projecting bay. The seating is separated by two aisles into three areas. Nearing the top of the steeply sloped gallery is a dado height barrier, with an additional seating behind. The walls at this level are highly decorated, with pilasters featuring Corinthian capitals, and infilled windows incorporating decorative screens.

Basement 1 level is accessed via the northern staircase from the main foyer and a lift. This level is separated into public and back of house spaces. The public areas accommodate women's and men's toilets and storage rooms. Natural light to the toilets is provided by pavement lights.

The back-of-house area provides support spaces for the operation of the theatre, including administration offices, meeting rooms and archive spaces, organ rooms, dressing rooms and toilets, a laundry and substation. This area has no uniform layout and the wall fabric comprises a variety of materials including bluestone, brick and plasterboard. Basement 2 level is below the stage and extends to the east as far as the orchestra pit. This level comprises additional dressing rooms, the orchestra pit and spaces for the technical department.

The stage and associated back of house area comprise the stage and smaller adjacent rooms including props storage, a workshop, piano store and lift shaft. The stage has a highly decorative proscenium, with a heavy velvet curtain. The backstage area incorporates rigging, lighting and various other components, with a gantry level above. This area is painted black with exposed brick and trusses to the upper level. The lift is located at the rear of the stage and operates between the lower basement levels and the stage. The workshop and piano room are located adjacent to the lift shaft.

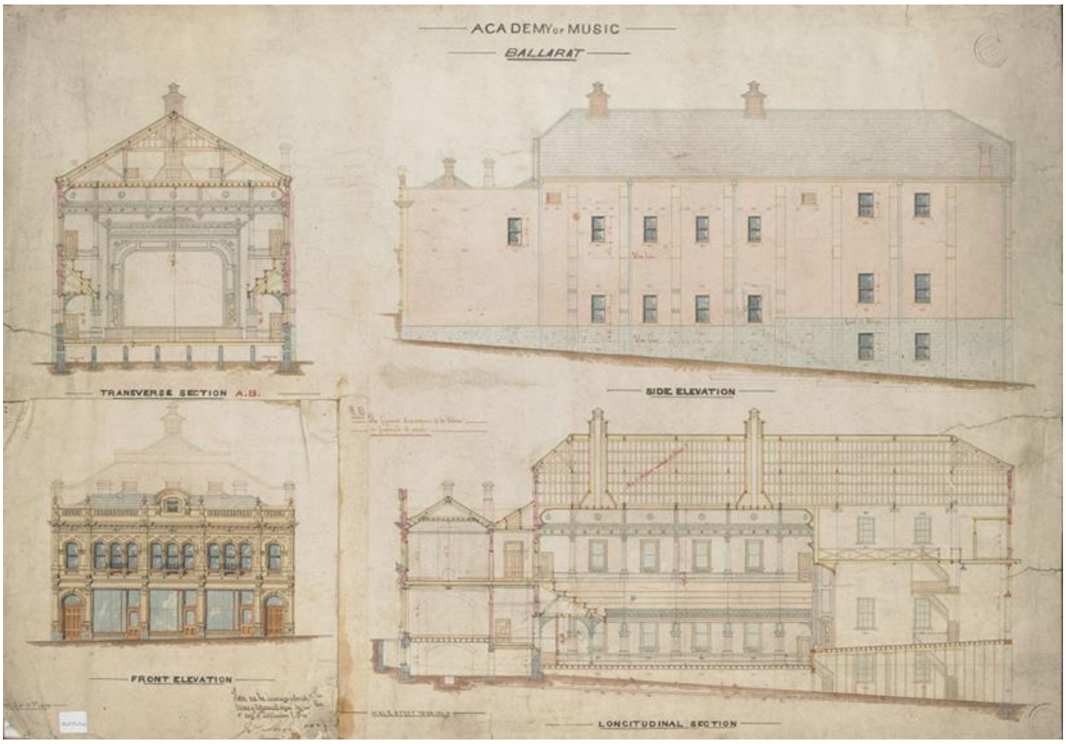


Figure 4 Historic drawing of Her Majesty's Theatre c1872 indicating the earlier treatment of the auditorium with a single balcony level.
Source: University of Melbourne.

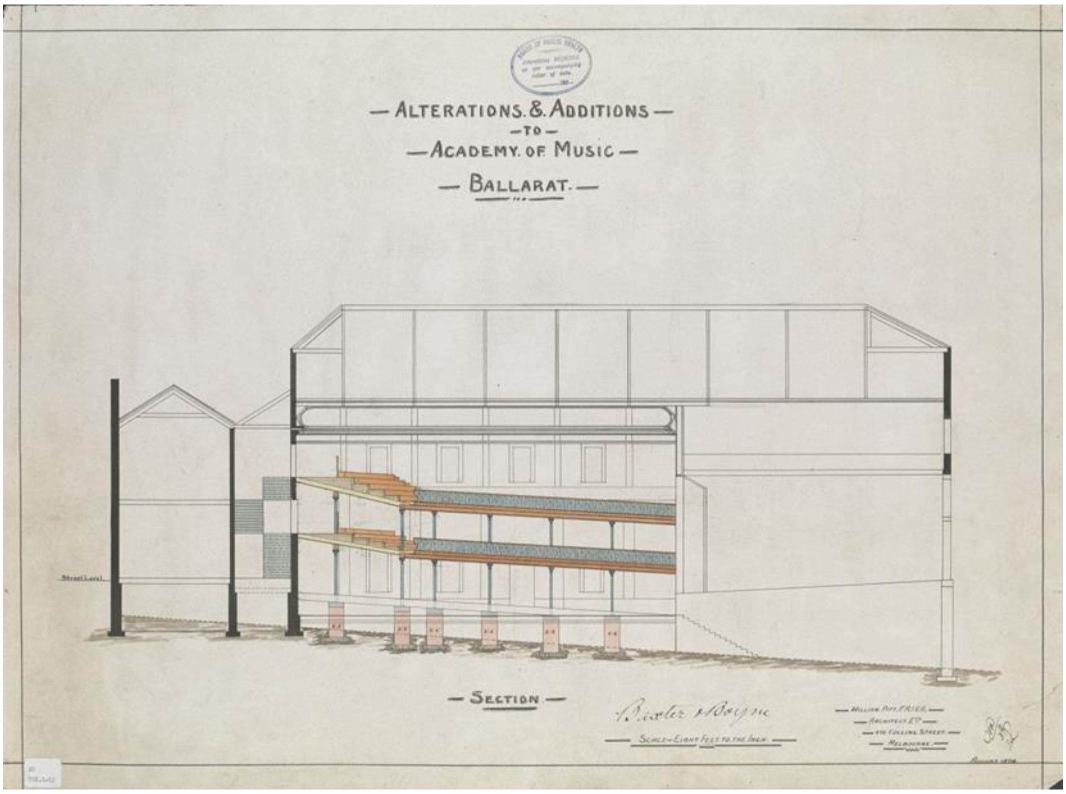


Figure 5 Section drawing of Her Majesty's Theatre c1898 indicating the changes by William Pitt auditorium with the dress circle and balcony level.
Source: University of Melbourne.

4.0 Previous Works Summary

The following is a summary of works undertaken to the site in the last 10+ years:

Completed 2016 or earlier

- New goods lift to back of stage (2002)
- Auditorium seating replacement works and minor adaptation (2016)

Stage 1 & 2: 2018 – 2019

Exterior

- Stormwater drainage maintenance/repairs and cleaning.
- Localised replacement of the roof and internal box gutter.
- External façade repairs to east, south and north elevations including wall repairs and re-pointing.

Interior

- Rising damp remediation to west, south and north walls.
- Remediation works to trusses over stage and minor structural works over auditorium.
- Stage floor structural repair.
- Fly system works in conjunction with stage structural repairs.
- Solid and decorative plaster repairs to the Auditorium.
- Upgrade and conservation of heritage urinals.
- Upgrade of fire safety systems and emergency lighting.
- Development of comprehensive fire safety strategy and implementation of the measures.
- Upgrade of Long Room air-conditioning.

5.0 Proposed Works – Stage 3

The focus of the proposed stage 3 is for an integrated package of refurbishment and upgrade works that address the following identified priorities:

- Improving **accessibility**
- Improving operational **safety** and **compliance** for audience, performers and staff
- Improving **functionality**

Accessibility upgrades are to improve the front-of-house (audience) access including access and egress paths of travel within the venue and associated amenities, while those to the back-of-house are to improve performer and administration access including paths of travel from the stage door to the operational areas below and at stage level. The intent is to implement a Universal design approach that allows everyone to the greatest extent possible and regardless of age or disability, to use the building by providing more inclusive facilities. Accessibility includes physical, social, communication and information systems within the built environment.

Safety and compliance upgrades are associated with DDA upgrades, but also include issues around safe egress (fire escape), fall protection in the auditorium, electrical, fire and mechanical services upgrades and access to the building for maintenance. An assessment has been made as to the necessity of seismic (structural) upgrades in this stage of the works against Regulation 233 (2) of the Building Regulations 2018.

Functionality upgrades are those that improve the operational efficiency and capacity of the venue and while important to the long-term viability of the venue, they are a lesser order of priority and can be, if necessary, deferred to a future date as a discrete piece of work.

The intent of the scoping of the works including services upgrades is to avoid abortive works or reworking of areas or works completed in an earlier stage and allow for packages of works that can be incrementally implemented as budget allows.

The continued operation of the building as a performance venue is a critical aspect of the building's retention of heritage significance. Necessary upgrades needed to support its continued use along with conservation and restoration works are supported from a heritage perspective.

5.1 Accessibility

Due to the age and significance of the building, not all aspects of the building are able to comply with the deemed to satisfy provisions of the National Construction Code (NCC) without having a significant impact on the heritage significance of the place. In some instances, performance solutions incorporating management systems or alternative designs will be required. Such performance solutions can be engineered and approved by the Building Surveyor by a dispensation in the Building Permit process or resolved by a modification referred to the Building Appeals Board at the Victorian Building Authority for endorsement.

As determined by the NCC Vol 1, the building is classified as Class 9b – public assembly building consisting of a single auditorium theatre along with a Class 9b – public hall, function room (Long Room). The following occupancy numbers are applicable (refer Table 2).

These occupancy rates determine the number of sanitary facilities, widths of egress and all other compliance-based upgrades.

Table 2 Applicable Occupancy Rates

Occupant Numbers - Auditorium	
Location	*Numbers*
Stalls level	439
Dress circle	199
Balcony	150
Subtotal	788

Occupant Numbers - Other	
Location	*Numbers*
Back of house	250
Staff	20
Long room	70*
Subtotal	340
Total	***1128***

*Note: If Long Room occupants increase to 120 occupants, occupation elsewhere in the building would need to be reduced to maintain a maximum occupancy of 1128

5.1.1 Access and Egress

Existing condition

At present the central Lydiard Street entrance, as the primary point of access and egress is not disability accessible and does not comply with the provisions of AS 1428.1 – 2009 Design for access and mobility Part 1: General requirements for building access – new building work. A secondary entrance exists further south on the Lydiard Street elevation, which provides direct access to the foyer and ramps down to a small lift, which provides access to the stalls level within the auditorium and the level 1 basement. There is limited ability to move throughout this basement due to a series of changes in level across the length of the building.

The stage, level 2 basement, long room and balcony levels are not disability accessible. Currently the building is three storeys (four storeys contained – basement level 2). There are several changes in levels throughout the building vertically and often more than one change across the length of the building at each nominal floor.

The implementation of a new path of travel and vertical access is critical to providing universal access enabling a high proportion of the building to become disability accessible.

Proposed complaint access and path of travel

Due to this inherent complexity and the limitations associated with the heritage fabric of the existing building, it is proposed to provide disability access to the FOH areas to basement level 1, ground floor (foyer), dress circle level and long room level. The balcony level within the auditorium will not be provided with DDA compliant access.

Access to the BOH will be addressed separately with DDA compliant access to be provided from the stage door to the stage and basement level 1 administration and dressing room level. Basement level 2 will not be disability accessible and in accordance with Section 160B of the Building Regulation a modification must be sought to address this deficiency on the basis that the current situation is improved.

It is proposed to install two new lifts providing vertical access within the building serving FOH and BOH respectively. The accessible entry point will be provided via the existing southern entry from Lydiard Street. Detailing of the solution to make these non-compliant doors accessible may require them to be hold open prior to events to allow independent access and will require NCC approval as a performance solution.

The proposed works will impact on some original fabric, including the removal of the southern stair, one of two identical stairs servicing the ground, dress circle level, balcony level, long room and bio-box.

It is noted consideration can be given to the use of a lift if approved in consultation with the Country Fire Authority (CFA). Whilst this is not a preferred method of egress in a fire evacuation event, it may be considered in order to prevent long paths of stair-based travel for persons with a disability and is supported by a separate fire compartmentation for the lift shaft. Space will be provided within the footprint of the new BOH lift for wheelchair refuge areas at the Stalls and Dress Circle levels.

A new path of travel at basement level 1 will be created along the south wall linking the stage door entry to the new DDA lift and the administration offices and Unicorn Lane foyer space.

Stair Upgrades – Unicorn Lane and South

It is proposed to demolish the existing open fire stairs to the north side of the auditorium that discharge into Unicorn Lane and construct a new fire isolated stair on the north west corner of the auditorium. This stair will service the balcony, dress circle and stalls level maintaining 3 points of egress to each level within the auditorium. It is noted the combined minimum aggregate width that is required for egress will be met for each level through this strategy. The new stair must comply with the provisions of AS 1428.1- 2009 Section 11 including handrails, tactile indicators, and nosing visibility strips.

The existing south stair that provides egress to the east will be retained, with only the final flight modified in width to accommodate the BOH lift shaft.

All existing stairs throughout the theatre are proposed to be upgraded with compliant handrails/handrail extensions, stair nosing's with 30% luminance contrast & Tactile Ground Surface Indicators (TGSIs). New handrails are to be provided to stairs and ramps within the dress circle and balcony levels.

Hardware

Several doors throughout the building retain knob-type door furniture which does not comply with the provisions of AS 1428.1 – 2009 Section 13 and AS 1428.2 – 1992 Section 22.3. In cases where doors are propped open and a management system is in place, existing hardware may be retained. Generally, hardware to existing doors along an access or egress path of travel is to be replaced with lever action furniture. Required exits from the auditorium or basement dressing room areas are to have panic bar hardware installed that operates with a downward or horizontal push.

Dress Circle and Balcony Balustrades

The existing balustrades at dress circle and balcony levels are not complaint with regards their height and it is not known, without invasive investigation, if the structure of the balustrades meets crush loading requirements in accordance with AS1170.1. The upgrade of the balustrade to a compliant height of 1m from finished floor level is challenging as depending on the angle of the plats any vertical extension of the balustrade results in significant blocking of sight lines and views of the stage.

Options including the removal of a row of seating, modifications to the balustrades, whether locally or wholesale have been considered at a high level to determine the most appropriate resolution in considering the retention of heritage significance and public safety (refer section 5.3.10 for more detail).

It is widely recognised that the need for compliant balustrade height within an auditorium is more critical at the end of a path of travel (flight of stairs) to prevent trips or falls over the balustrade. It is typically understood that for most of the time patrons are seated, and general movement is parallel to the balustrade minimising risk of fall. Subject to investigation and agreement with a building surveyor, it may be feasible to seek a dispensation for the upgrade of the balustrade in the direction of travel only (i.e. section of balustrade at the bottom of the plat stairs raised to 1m), as such improving the current condition of the balustrade without diminishing the sight lines and visibility. This approach has been taken in a number of other theatres and achieves a 750mm tall balcony railing in locations where the railings impact audience sightlines to the stage based on BCA NSW H101.14.2. This approach will require the input and advice of a reputable theatre consultant.

At the balcony level where the sight lines are not considered to be the same quality as the stalls or dress circle due to the 22-degree rake, the removal of rows of seating could also be considered.

A detailed study of the sight lines with respect to increased balustrade heights may result in the need to increase the overall height of the seating plats, particularly in the dress circle or balcony in order to maintain sight lines, but must be within the provisions of Section H1.4 of the NCC which require the angle to not be greater than 30 degrees to the horizontal joint. At this stage only a high-level review of the balcony level has been undertaken (refer section 5.3.10). Given the relatively recent replacement of seating and the associated costs it is not proposed to pursue a substantive rebuild of the plats.

Recommended actions

- Upgrade all stairs to include tactile indicators, colour contrasting nosing strips and complaint handrails.
- Upgrade all ramps to include tactile indicators, colour contrasting nosing strips and complaint handrails.
- Provide compliant access from Unicorn Lane to basement level by ramp.
- Increase the height of balustrades within the dress circle and balcony to minimise fall risk at the end of stairs, but without obstruction of sight lines.
- Provide handrails to stairs within the dress circle and balcony.
- Provide new passenger lift that meets minimum DDA access dimensions to front of house with access to basement level 1, ground floor, auditorium stalls, dress circle and long room. Lift car specification to meet City of Ballarat facilities standards as a minimum.

- Provide new passenger lift that meets minimum DDA access dimensions to back of house with access to basement level 1, auditorium stalls, stage, green rooms and dress circle. Lift car specification to meet City of Ballarat facilities standards as a minimum.
- Upgrade door hardware throughout to comply with AS 1428.1. Priority given to emergency egress path openings.

5.1.2 Seating

The current provision in the auditorium of enhanced access seating for patrons is 14 seats achieved by removing non fixed seating within the ground floor stalls including an accompanying seat for companions and 4 transfer arm seats. These seats are generally located to the outer aisles and does not address the quality of choice for patrons by providing options for more premium seats or access to the dress circle.

The overall required number of wheelchair accessible seating is 13. While there is no NCC requirement for enhanced amenity seating it is strongly recommended. This type of seating requires 500mm clearance in front of the seat in an open position, with a raised seat height of 450-460mm. The additional height can be by way of a removable cushion provided to patrons on request or more permanently raising the selected seats or seat legs. Where possible accessible spaces should allow additional seating to be put back in, when demand is low. This would allow the infill seating to become enhanced amenity seating for people with mobility impairments. It is proposed alternative seating locations be spread across the stalls and dress circle levels, providing a range of patron experiences. Location of the seats and access to them may require a management solution.

Recommended actions

- Provide a minimum of 6 new disability compliant seats to the dress circle level.
- Maintain a minimum of 8 disability compliant seats to the stalls.

5.1.3 FOH Ticketing and refreshment provisions

Currently the box office and refreshment bar do not provide zones for common reach for ambulant and disabled people. These areas should be upgraded to comply with the provisions of AS 1428.2 – 1992 Section 22. Similar provisions should be applied to the replacement bar in the Long Room. The use of digital media screens in these areas to assist with wayfinding and direction should be considered.

Recommended action

- Upgrade bar and ticket sales counters to include zones for common reach for disabled and ambulant persons.
- Upgrade long room bar to include zones for common reach for disabled and ambulant persons.

5.1.4 Sanitary Facilities

Based on the building classification and the stated occupancy rates, the building does not currently satisfy the sanitary facilities provisions of the NCC for ambulant and DDA compliant facilities and showers. While there is no regulatory requirement for a Changing Places compliant facility for a venue of this size, the client has requested consideration be given to inclusion.

Table 3 Existing Sanitary Facilities provisions

Current Allowances – Venue Wide (includes front of house and back of house)						
User	***Closet Pans***	***Urinal***	***Washbasin***	***Ambulant***	***DDA***	***Showers***
Male	8	11	9	0	2*	2**
Female	21	-	11	0		4**

* DDA facilities front of house only, include a basin in each and do not comply with requirement of current provisions.

** Showers are located back of house only.

The required provision for sanitary facilities as set-out in the NCC is as follows, assuming 50% of patrons are male and 50% of patrons are female.

Table 4 Required Provision for Sanitary Facilities

Required Provisions					
Auditorium – Capacity of 788					
User	***Closet Pans***	***Urinal***	***Washbasin***	***Ambulant***	***DDA***
Male	2	4	3	1	3
Female	8	-	3	1	
Long Room – Capacity of 70					
User	***Closet Pans***	***Urinal***	***Washbasin***	***Ambulant***	***DDA***
Male	1	1	1	1	0*
Female	2	-	1	1	
Back of House and Staff – Capacity of 270					
User	***Closet Pans***	***Urinal***	***Washbasin***	***Ambulant***	***DDA***
Male	7	3	5	1	1
Female	9	-	5	1	

* DDA facility included in Auditorium quantity.

** Building is considered to be three storeys. Basement level 2 is considered to be contained within the basement level 1.

NCC clause F2.4 - Table F2.4(a) outlines the required number of DDA accessible facilities and nominates that one accessible sanitary closet pan facility must be provided to each storey. Where more than one bank of male and female sanitary facilities exists on a storey, then not less than 50% of the banks are to contain an accessible sanitary facility. To meet current standards sanitary facilities in the building need to include ambulant facilities within each bank of sanitary facilities and the existing DDA facilities require upgrading to meet current provisions including additional facilities in the back of house.

NCC clause F2.3(i) requires that in a class 9b theatre 1 shower must be provided for every 10 participants. Notwithstanding the acceptance of a maximum occupancy for the basement BOH dressing rooms of 250 it is known based on the historical booking calendar of shows that this number is atypical and typical performances have a cast of 75. On this basis it is considered reasonable that the overall number of showers can be reduced to 7 to accommodate the typical participant numbers.

Under NCC F2.9 (iii) an accessible adult changing facility is not required in Class 9b facilities where there are less than 1500 patrons. Inclusion of such a facility would be a proactive action by the City of Ballarat and consideration should be given at the detailed design stage as to the ability to accommodate such a facility at basement Level 1.

Recommended action

- Upgrade all sanitary facilities to front of house areas and include ambulant toilet facilities.
- Retain the male facilities in the basement, identified as being of primary significance. Minor upgrade to these facilities should be accepted to include ambulant closet facilities.
- Provide new disability accessible toilet facilities including fold away baby change tables.
- Reconfigure the sanitary facilities to the basement level 1 and 2 and the green rooms, including shower facilities.
- Upgrade all associated statutory signage to comply with the provisions of AS 1428.1 – 2009 Section 8.
- Provide a total of 7 shower facilities to the back of house areas.

5.2 Safety and Compliance

This category of works captures the essential services upgrades that remain outstanding from earlier stages of refurbishment; or as a result of NCC compliance triggered by the proposal to alter or adapt areas of the theatre to achieve accessibility; or functional and operational changes.

The services components are informed by the Simpson Kotzman Building Services Report included in Appendix G and the Fire Engineering Report (FER 1.4) prepared by Gincat Fire Engineering included in Appendix F.

The approach taken is to continue upgrades that have been commenced in earlier phases with the expectation that works may not all be completed in Stage 3 due to budget constraints.

5.2.1 Electrical Services

Metering data for the theatre is yet to be confirmed by the electricity retailer Powercor. The electrical supply is fed from an existing substation located on basement level 1 with access from Lewis Street at the rear of the building. The mains cable to the MSB was installed in 1989. The building was generally re-wired during the 1990s works, and from visual inspection in accessible areas the sub mains and lighting and power sub circuit wiring appears in good condition. The main switch board (MSB) is in good condition and has some additional rating capacity, however, is likely to require extending as a result of the additional power loads from lifts and services upgrades which will trigger compliance issues for the switch room to AS3000:2018.

The distribution boards are nearing end of service life, have limited spare capacity and the majority of circuits are not RCD protected. Submains cabling has been recently upgraded and is in good condition.

Light fittings are generally dated and are not energy efficient (LED). Power outlets are generally in good visual condition throughout.

Upgrades to the electrical services can be undertaken in a progressive and logical manner to the impacted areas where works are occurring. There is a requirement to complete the investigation into the requirement for a power supply (substation) upgrade to the site.

Recommended actions

- Further investigate the requirement for a power supply (substation) upgrade to the site through consultation with Powercor and any upgrade to incoming mains cabling based on proposed new loads, including addition of lifts.

- Allow to replace main switchboard with new compliant switchboard, subject to load calculations for proposed works.
- Replace distribution switchboards with new compliant boards.
- Investigate need to upgrade sub circuit wiring to building to meet current codes.
- Include special purpose power for new lifts and mechanical plant.
- Upgrade communications and data infrastructure to refurbishment works areas.

5.2.2 Lighting and sound systems

The lighting and sound system consist of house lights and lighting associated with live performances; the audio induction loop, the front of house PA system and the audio system for the auditorium. Light fittings are generally dated and are not energy efficient (LED). An assessment of the lighting is to be undertaken to ascertain which fittings may be considered of historical significance or of value to the place and these may be retained. Generally, all other lighting throughout the building should be upgraded to meet NCC performance requirements and to comply with Section J6. This upgrade would occur to works areas as they occur, with all egress paths upgraded as a priority.

Upgrades to emergency lighting and exit lighting has been undertaken recently and is compliant to current standards.

The theatre sound system has been upgraded and is in good condition. The audio loop should be upgraded to a wireless system.

The aisle lighting in the auditorium is provided on the side of the chairs along the aisle and does no illuminate the full length of the aisle and tread of each step.

The installation of the new back-of-house lift to the south of the stage proscenium will impact on the existing patch panels and associated wiring to the stage. The constraints of locating the lift are such that removal and relocation of the wiring will be required.

Recommended actions

- Upgrade audio loop to wireless system to the auditorium, cry room and Long Room.
- Upgrade the existing front of house and back of house PA systems to be integrated with the emergency warning and intercommunication system (EWIS).
- Provide new efficient LED general and house lighting with updated lighting control systems throughout (assumed this will be delivered progressively and aligned to works areas)
- Consideration should be given to the removal of the chandeliers dating from the 1950s and reinstatement of gasolier style reproduction fittings based on historical images consistent with the theatre’s nineteenth century aesthetics or a contemporary fitting of similar size and scale.
- Upgrade aisle lighting to comply with NCC H1.7.
- Upgrade backstage and bio-box lighting controls and dimmer systems.
- Include additional emergency and exit luminaires to refurbishment works areas.
- Relocate stage electrical patch panels and wiring that conflicts with new back-of-house lift installation.

5.2.3 Mechanical Services

The existing mechanical plant consists of several different systems installed at various times over the last 20+ years including:

- **Auditorium and stage** supplied by roof mounted plant supplying 100% outside air to the front of the auditorium via wall mounted outlets on each side of the stage (3,190 litres/second) and stage (600 litres/second). No return air provision and all supply air spills to outside via ceiling openings into the roof space and roof mounted cowls. Footwarmers are installed to selected areas.

- **Dress Circle** supplied by ceiling mounted ducted fan coil unit (700 litres/second), no outside air supplied by this system.
- **Stalls** supplied by two ducted fan coil units in sub floor (1,470 litres/second) to rear, no outside air supplied to this system.
- **Balcony** not airconditioned but includes a relief air system which draws air from the auditorium and directly exhausts air through the north façade at this level.
- **Basement Level 1 Dressing Rooms** air-conditioning provided by local 100% outside air fan coil unit (790 litres/second)
- **Basement Level 2 Dressing Rooms** air-conditioning provided by local 100% outside air system comprising axial fan with duct mounted heating and cooling coils, no return air provided (995 litres/second).
- **FOH Ticket Office** local reverse cycle air-conditioning unit, no fresh air.
- **Basement Level 1 Administration Offices** local fan exposed coil units, no outside air with ventilation reliant on exhaust system drawing air from other areas. Heating by hot water radiators.
- **Green Room** local fan coil unit with a cooling coil.
- **Long Room** air cooled externally mounted packaged reverse cycle unit with external ductwork connected to roof penetrations and ceiling supply and return air grilles.

In addition to roof mounted plant over the Long Room, most of the plant is located over the southern fire stair. The gas fired boiler (installed 2015) and central air-cooled chiller set (installed 2015) deliver heating hot and chilled water to the air handling units and fan coil units located through the building.

Toilet exhaust is provided to all amenities. Roof mounted smoke exhaust fans are provided to the stage area. It is noted that exhaust rates are unlikely to comply with current codes.

There are several deficiencies in the existing air-conditioning system. A significant one being insufficient outside (fresh) air being provided when calculated in relation to current codes (AS1668.2). The auditorium is under provisioned by approximately 60%, while the basement level 1 appears to have no direct outside air. The lack of heat recovery, particularly to the auditorium, is contrary to the Part J energy efficiency requirements of the current NCC. In addition, apart from more recently installed individual units the chilled water plant, heating water plant is generally reaching end of service life and should be replaced in any upgrade.

Investigations into alternative systems for the auditorium have not found a solution that would allow reduced outside air rates and therefore it is considered that the best solution is to completely replace the auditorium air-conditioning system and allow for new mechanical plant to other areas as they are refurbished or altered.

New plant will need to be discretely located in order not to detract from the visual presentation of the heritage building. It is recommended that new plant be located on the southern fire egress stair and the proposed north egress stairs in order to minimise visibility and achieve compliant access for maintenance. Adoption of a heat recovery system in any new plant will minimise the increase in electrical load arising from the increased heating and cooling load required.

A new building automation system and mechanical switchboard and mechanical services control panel would be required.

The upgrade of the mechanical services will need to be designed to meet the natural air intake performance requirements of Section FP4.4 of the NCC and the verification methods outlined in Section

FV4.1 and Table FV4.1 Maximum Containment Limits for Acceptable Indoor Air. The design and capacity of all new mechanical plant and systems should also take into consideration the provisions of Section J0.2 Energy Efficiency Performance Requirements for heating and cooling.

Much of the system dates from 2004, and on the basis that Stage 3 works are proposed to commence after 2020, it is reasonably assumed that the existing system will reach end of life within the project time frame and replacement should be included.

Recommended actions

- Upgrade air handling plant serving the auditorium and stage to meet current standards based on maximum capacity of 1,000.
- Replace chilled water and heating water plant and equipment with new including increased capacity to meet new loads and upgrade whole plant system including building automation system, switchboard and control panel.
- Ensure redevelopment of the south and north stair provisions for new plant platforms including access for maintenance.
- Upgrade toilet exhaust in association with refurbishment of amenities areas.
- Upgrade outside air provisions to basement offices and dressing rooms.
- Review smoke exhaust system to stage area and allow to upgrade.

5.2.4 Hydraulic Services

The stormwater system on the northern elevation of the building was recently replaced and diverted from the original dilapidated system. The stormwater system on the south elevation underwent repair as part of the Stage 2 works. It is understood that remediation of the stormwater system is complete.

All other hydraulic services comprising cold water connection, domestic hot water plant and sanitary plumbing only require upgrade in association with refurbishment works. Works to upgrade the amenities areas will require the installation of local domestic hot water systems.

It is noted that the invert level of the sewer connection to the authority sewer main is above the FFL of basement level 1 and installation of facilities below this level will require a sewer pumping station.

Recommended actions

- Extend water services to new or relocated positions.
- Install local domestic hot water systems to provide for new facilities.
- Undertake sanitary plumbing works to connect new or relocated facilities.

5.2.5 Fire Protection Services

The existing fire protection services within the building are:

- Automatic fire sprinklers installed throughout with exception of auditorium.
- Fire alarm system connected to smoke detectors and other equipment.
- Occupant warning system comprising wall mounted sounders and strobe lights interlocked with fire alarm system.
- External hydrant points within town mains in Lewis and Lydiard Streets, plus internal hydrants and hose reels.
- Mechanical services fire brigade control panel in entry foyer.
- Hand fire extinguishers in selected areas.

The stage 1 and 2 works included the completion of some urgent fire safety upgrades, including the following:

- Basement level 2 ceiling construction of 13mm fire grade plasterboard with penetrations protected to NCC C3.15.
- Replacement of emergency lighting and exit signage.
- Replacement of smoke detectors throughout the building.
- Replacement of battery system.
- Replacement of the Fire Indicator Panel (FIP).
- Installation of four smoke and fire doors in the ground floor foyer and dress circle foyer.
- South fire escape construction of new 120/120/120 fire separation with storage room.

The existing sprinkler system was tested by Fire Logic in February 2018 due to the age of the heads being in excess of 24 years old. This test included a flow test of the sprinkler system and hydrants against requirements of AS2419.1 to confirm the pressure and flow simultaneously and was found to pass. The rested internal hydrants residual pressure of 320kPa against the Code minimum of 350kPa showed a non-compliance with the deemed to satisfy requirements. This requires formal sign off from the local Fire brigade and relevant Building Surveyor.

Table 5 National Construction Code Parameters

NCC Clause		Description		
A1.1	Effective height	<25m		
A3.2	Occupancy classification	Class 9b		
C1.1	Minimum type of construction	Type A		
C1.2	Rise in storeys	3 (4 – storeys contained)		
C2.2	Fire compartment	West (m2)	Mid (m2)	East (m2)
	(excludes south fire stair 160m2)	957	1765	873

The Fire Engineering Report together with the Addendum document included in Appendix F has been prepared based on the proposed changes and upgrades outlined in this report. The report prepared by Gincat Fire Safety includes the key NCC parameters (refer Table 5) as the basis for all recommendations and calculations.

A series of deemed to satisfy works are recommended to be undertaken to bring the current building to compliance. In addition to this several performance solutions have been modelled and recommended in order to provide a managed solution where compliance cannot be achieved without adversely affecting the heritage significance or operational requirements of the theatre.

New Works

The new works consisting of new lifts, new fire isolated stairs on the north elevation and south elevation are addressed as a performance-based solution in the FER Addendum. It is assumed that the removal of the southern foyer stair in place of a fire rated lift will increase the egress demands on other exits and as such the egress on the northern side of the building will be modified with a new fire isolated egress stair extending to the balcony level and will contain a fire isolated lobby. Construction of this stair will also require the relocation of the sprinkler control valves installation on Unicorn Lane. It is anticipated this will include booster connections and suction heads to address water pressure non-compliance noted earlier. The southern auditorium fire stair will also include a new fire isolated lift, stairs and fire isolated lobby.

It is anticipated that the fit out of the administration areas in basement level 1 and alterations to the ground floor foyer will not impact the fire modelling. The proposed alterations to the green rooms and change rooms are also anticipated to have minor impacts on the fire modelling including the need to upgrade essential services in these areas.

Performance Solutions

The following performance solutions have been modelled based on the proposed scope of works.

Table 6 Variations from BCA DtS Provisions

Clause	Description of Variation from NCC Provisions	Performance
C2.7(a)(ii) Inter-alia C3.4(a)(i)(A) and C3.4(a)(iii)(A)	The provision existing openings in Bio-box bounding wall that aligns with proposed fire wall, protected by pendant sprinkler each side.	CP2, CP8
C2.11	Lift and stair in the same shaft in lieu of fire separated from each other. [Subject to dry type sprinklers to eb retained at top of lift shaft, as prescribed by BCA Specification E1.5, Clause 12, where water will discharge after 60 seconds. Louvres to be provided at lift over-run].	CP2, DP5, EP2.2
D2.20	The provision of an inward swinging door at the Long Room.	DP2(b), EP2.2
C3.5(a)(iii)	Specification C3.4 smoke doors protected by pendant sprinkler on the exposed side only on lieu of an FRL -/60/30 self-closing fire door.	CP2, CP8
D1.4(d)	Extended distance of travel of 30m in lieu of 20m in platform areas.	DP4., EP2.2
D2.8(a)	A non-fire isolated stair is provided with storage below (as per NCC Clause D2.8(b)) in lieu of no storage.	CP2, DP5, EP2.2
E1.4(f)	Omission of a hose reel installation in the Long Room [2A:20BE fire extinguishers to be provided within the Long Room adjacent to each exit].	EP1.1
E1.5 & Spec E1.5 Clause 3 Inter-alia AS2118.1 Clause 3.1.1.3	The provision of a sprinklers system that does not include fire separation between sprinkler protected and non-sprinkler protected areas. [Sprinkler protection above, though not within the auditorium].	CP2, CP8, EP1.4

Note: With regard to the performance solutions, refer to the clarifications and qualifications outlined in the Fire Engineering Report.

Recommended Actions

The following ongoing actions are required to meet the deemed to satisfy and performance solutions outlined in the Fire Engineering Report for the building.

Construction and FRL's

The following fire rating levels are to be maintained throughout the building:

- Long Room north stair to be separated by 35mm thick solid core timber doors and protected by AS 2118.12 fast response pendant sprinkler to the long room side.
- Auditorium stair to be fire separated by 35mm thick solid core timber doors and protected by AS 2118.12 fast response pendant sprinkler to the auditorium side.
- Substation and switch board construction to FRL 120/120/120 with FRL -/120/30 self-closing fire doors.
- Basement level battery room construction to FRL 120/120/120 with FRL -/120/30 self-closing fire doors.
- Basement backstage to be separated from administration and organ with fire rated door FRL -/120/30 with vision panel.
- Fire wall compartments to be maintained and where penetrated be made good with penetrations to FRL -/120/120 and penetrations protected to NCC C3.15.
- Louvers in external wall of auditorium to bio-box to be covered in metal sheet and sprinkler protection above.
- Smoke walls are to be made good to NCC specification C2.5 Clause 2.

Sprinkler Protection

- Maintain sprinkler protection throughout the building to AS 2118 – 1982 with exception of the auditorium and organ areas.
- Bio-box glazed (and operable) openings between the bio-box and auditorium to be provided with AS 2118.12 fast response pendant sprinkler to the auditorium side.
- Long room north stair to be separated by 35mm thick solid core timber doors and protected by AS 2118.12 fast response pendant sprinkler to the long room side.
- Auditorium stair to be fire separated by 35mm thick solid core timber doors and protected by AS 2118.12 fast response pendant sprinkler to the auditorium side.

Fire Detection and Alarm

- Provide a manual call point at the sub-panel and FIP and at proscenium control.
- Provide a public address (PA) system in the bio-box and at the sub-panel.
- Ensure building occupants warning speaker and strobe is provided within the orchestra pit and organ areas.
- Ensure building occupant warning speaker and strobe is provided at far end of fly platform.

Management

- Implement hot works permits for contractors.
- Induct contractors into fire evacuation procedures.
- A designated fire warden to be present on site at all times (assumed to be a member of the theatre technical staff).
- Manual call point to be available at each required exist.

- The stairs are to be adopted as a safe haven for occupants in wheelchairs. The stair is to be separated from the auditorium by inherently fire-resistant walls (masonry). Wall openings are to be protected by existing doors with sprinkler protection or self-closing minimum FRL -/120/30 door leaves with AS 1530.7 cool/medium temperature smoke seals and AS 1530.4 intumescent fire seals to the door heads, side and stiles.

To address remaining deficiencies in the system the following upgrade works are required when undertaking the proposed refurbishment works:

- Extend or alter automatic fire sprinklers system associated with alterations and additions.
- Installation of smoke detectors at basement level 1 and 2 and associated extension of existing fire alarm system coverage.
- Extend occupant warning system as required by alterations.
- Upgrade mechanical services fire brigade control panel in the event of mechanical services upgrades
- Relocate existing automatic fire sprinkler control valves in Unicorn Lane associated with new fire stair works.
- Review extent of hand fire extinguishers required and amend as necessary.

5.2.6 Lift Services

As noted earlier in the report it is proposed to replace the existing lift with two new commercial use passenger lifts to provide enhanced accessibility to the front-of-house and back-of-house areas. The lifts need to be configured to be two-sided to address the multitudinous changes in level across floor plates and this together with the need to be DDA compliant requires a minimum car and shaft size to the dimensions shown in the drawings. The lift type is to be MRL (motor room-less) to minimise the lift overrun and plant requirements within the shaft. The lift car fit out is to comply with City of Ballarat facilities standards.

It is noted the back-of-house lift needs to allow for a DDA refuge area and this coupled with maintaining clearances from the existing auditorium exit doors to the south side preclude the lift from being located to the west side of the intersection of the proscenium wall with the south wall. It is acknowledged this will result in significant relocation and rewiring of the stage electrics including patch panels.

Recommended actions

- Lift type to be commercial MRL suitable for the duty required in a public building, minimum dimensions based on two-sided lift that is DDA compliant.

5.3 Functionality

The theatre is generally equipped with an appropriate suite of front of house and back of house spaces that enable it to operate effectively as a live theatre venue with the ability to accommodate a diverse range of productions. The site footprint limits further expansion which has implications when addressing contemporary expectations of comfort and convenience of patrons and performers. It is acknowledged that some spaces in the theatre such as the Long Room could offer a greater return if some refurbishment was undertaken.

This section overviews the suite of alterations and adaptations that are proposed to enhance the functionality of the theatre and maintain existing operations. These changes are illustrated in the drawing set included in Appendix A.

5.3.1 Front of House

The front of house areas consist of the ground floor foyer containing a refreshment bar and ticket office, and a series of circulation spaces. In a full house event, the foyer struggles to provide pre-event and intermission space for the patrons which also impacts on the food and beverage and merchandise sales. To manage this crush patrons who are seated in the stalls are directed to the foyer refreshment bar and those seated at the dress circle or balcony access the Long Room, but this has implications for staffing. As the building is built to the north and south boundaries, it is not possible to extend the foyer space without purchasing adjacent property.

The proposed works include the removal of the ticket box and office, and the relocation and reconfiguration of the bar to one side of the foyer with integrated refrigeration and storage to provide both accessible serving counter and a combined ticket and refreshment sales. The opening between the south vestibule and the foyer will be widened to expand the foyer. The northern vestibule will be retained as a fire egress path. In a standing room scenario, the reconfigured foyer would be able to accommodate in the vicinity of 170 patrons based on 0.5m^2 per person.

The Long Room operates as a refreshment space for the patrons seated in the upper levels of the auditorium or as a stand-alone event space which can be used for meetings, social events or small gathering.

Recommended actions

- Demolish the existing bar, ticket box and office.
- Construct a new bar with integrated fridges, storage and point of sale for refreshments and tickets.
- Close off the existing opening between the Foyer and the north vestibule with a fire rated infill.
- Widen the existing opening between the south vestibule and foyer.
- Reconfigure the existing ramp in the south vestibule.
- Install digital signage.

5.3.2 Auditorium

The recently completed stage 2 works included major conservation works to the interior of the auditorium. Generally, the auditorium fabric is in good condition with the proposed upgrades being considered for stage 3 limited to addressing enhanced access and egress issues

In addition to the safety issues associated with the dress circle and balcony level balustrades noted in section 5.1.1 there is a requirement to remove the adjudicator's box from the front of the dress circle and reinstate the balustrade in this area to match existing profiles.

Recommended actions

- Remove the adjudicator's box from the front of the dress circle and reinstate balustrade to match existing profiles.

5.3.3 Administration Offices

The theatre administration spaces at basement level 1 accommodates up to twenty staff along with storage. This area is accessible off Unicorn Lane or via the stage door. Planned around several level changes, the auditorium structural columns and walls and organ equipment, the existing configuration is convoluted. Notwithstanding these challenges the administration areas are near the front-of-house and the back-of-house facilities and therefore it is proposed they remain on this level. A single office for ticket sales exists in the main foyer, which is shared by two staff members. It is proposed to remove this office and integrate the ticket sales into a new refreshment bar in the foyer. In assessing the spatial requirements for the administration areas, the following is proposed:

Table 7 Administration Offices

Administration Rooms Types and Areas	
Location	***Area m²***
1 x individual office	15
Open plan office (19 staff at 6m2/person)	114
Subtotal	129

Support Room Types and Areas	
Location	***Area m²***
Kitchenette	12
Storage (excluding organ storage)	30
Subtotal	42
Total	***171***

Recommended actions

- Refurbish and upgrade the administration areas based on the area allocations.
- Continue to use the sanitary facilities located in basement level 1.
- Provide all new furniture associated with the fit-out works, consisting of workstations, shelving, partitions, chairs, tables and the like.

5.3.4 Back of House

The back of house spaces consists of the green rooms, dressing rooms, stage and wings, piano store, props store and sanitary facilities associated with the dressing rooms. The back of house areas also includes the organ chamber and organ stores.

Last upgraded in the 1990s the spaces have been subject to high use and existing finishes and fixtures are tired and in need of more general refurbishment comprising general upgrade of fittings and fixtures, carpets, furniture and the like. The dressing rooms to basement level 2 were refurbished in the stage 2 works.

The proposed works include some reconfiguration at basement level 1 to accommodate the new corridor to the back-of-house lift and the complete replanning and refurbishment of sanitary facilities to include additional showers and disability compliant facilities.

It is noted the existing stage door is a high use entry point that is tightly constrained by existing steps and the stair structure. While the changes in level can be addressed by the installation of a ramp to improve the safe flow of traffic in the event of an emergency, other opportunities to improve management of this space should be investigated.

There is the opportunity to remove the north link stair between basement level 1 and 2, however this is not an essential action and should be considered as part of the works should funding allow.

The current green room extends along the rear (east) elevation of the building to the goods lift. It is proposed to undertake minor refurbishment of this area in the short term to accommodate a single artists room at stage level. A more major project to increase the green room by adding an additional level over the existing footprint is a possible future stage of works.

Recommended Actions

- Partition existing green room to create Artists dressing room at stage level.
- Refurbish the dressing rooms to basement level 1 including full upgrade of sanitary facilities, including modifications to accommodate new corridor for BOH lift.
- Upgrade sanitary facilities to basement level 2
- Provide all new fixtures, finishes and fittings including furniture to the dressing rooms.
- Install ramp at stage door to mediate the changes in level and improve path of travel.
- Investigate ability to open up the stage door lobby.
- **Future stage**: Remove the north link stair at east end of basement level 1 and 2.
- **Future stage**: Construct new two storey green room to the footprint of the rear skillion structure incorporating a new stair and unisex sanitary facilities.
- **Future stage**: Increase the wings capacity by extending the stage to the south by removing section of wall.
- **Future stage:** Construct a new props store.

5.3.5 Orchestra Pit

The orchestra pit is located at the front of the stage and provides an opportunity to extend the stage west of the proscenium in performances where the orchestra pit is not required. Appendix I of this report includes a detailed specification for the installation of a modular pit cover that can be raised from house floor level to form an extension of the stage. The infill thrust lift modules should be in four equal sections to provide the ability to raise individual parts of the platform to different heights resulting in a flexible outcome from the extension of the stage. At detailed design consideration needs to be given to the impact on the organ equipment located below the orchestra pit.

Recommended Actions

- Implement the works outlined in the specification for: Orchestra Pit Modules, Stalls Removable Wall, Drapery and Track dated June 2010.

5.3.6 Organ and Organ Chambers

The organ and associated organ chamber rooms are identified in the Conservation Management Plan as being of low heritage significance. The organ dates from 1937 and was installed in the theatre in 1982. The 2006 masterplan and CMP recommend that the organ should be relocated to remove it from the orchestra pit. The optimum location for the organ is asymmetrically located outside of the orchestra pit so that the organ can be a standalone feature when used. The organ platform requires upgrading as part of the relocation. It is proposed the organ store containing the pipes and mechanical elements remain in their current location with only minor modifications associated with the construction of the new corridor associated with the BOH lift.

Recommended Actions

- Relocate the organ to the south of the stage.
- Upgrade the organ hoisting equipment.

5.3.7 Fly Tower

Works to the fly tower equipment were completed in the Stage 2 works and it is understood no further upgrade is required at this time.

5.3.8 Roof Access Systems

The roof consists of five main areas roofs, a hipped roof at the front of the building with a split gable roof to the rear forming the auditorium and fly, the roof over the southern escape stair including plant platform and the skillion roof over the green room at the rear of the building. For the purposes of maintenance of roofs and plant, the roofs are generally accessible by a ladder from the bio-box; however they do not contain fall arrest or fall restraint access systems required for traversing the roof and undertaking maintenance.

As a part of the works new access systems should be installed to meet the performance requirements set out in AS/NZS 1891.2 Section 4. Designs of fall arrest and fall restraint systems should be undertaken to AS/NZS 1891, AS/NZS 5532 and AS/NZS 4488.

Recommended Actions

- Design and install a complaint roof access system to provide access to all roof areas for maintenance or roofs, gutters and access to plant and plant platforms.
- Initiate a maintenance regime for annual testing of all access systems from date of initial certification.
- Design an access system so that access can be gained to the rear wall of the fly tower (east wall) to install banners and other forms of temporary signage.

5.3.9 Area Analysis

As the site is built to the full footprint of the title any expansion in area needs to be by rationalisation of the existing plan layout or the opportunistic addition of space by building on top of the existing building.

The introduction of enhanced access by the introduction of lifts and the convoluted levels results in the introduction of additional paths of travel in the back-of-house areas, particularly at basement level 1. This can be offset by the removal of some existing non-compliant paths of travel, but it is possible this will be staged to mitigate the impact on budget.

The building is currently 3,196m^2 over four storeys, with the replacement of the external stair with a new stair and lobby on the north elevation the building will increase by 12m^2. If in the future an additional green room is constructed over the existing to the east of the stage and storage extends over the existing stage store at the first floor the additional area gained is 68m^2. It is noted that an increase in area could trigger an approval requirement under the planning scheme.

The following table is a comparison of the existing areas compared with the proposed space rationalisation.

Table 8 Existing and proposed area schedule – stage 3

Existing Areas	
Use Type	***Area m^2***
Administration	183
Main foyer / circulation	277
Long Room	131
Auditorium	917
Stage including wings	419
Fire lobbies and stairs	453
Front of house sanitary facilities	191
Back of house sanitary facilities	98
Green rooms	105
Dressing rooms	235
Storage	126
Organ stores	44
Technical room (incl substation and plant)	17
Total	**3,196**

Proposed Areas	
Use Type	***Areas m^2***
Administration	165
Main foyer / circulation	256
Long Room	131
Auditorium	917
Stage including wings	443
Fire lobbies and stairs	415
Front of house sanitary facilities	168
Back of house sanitary facilities	85
Green rooms	104
Dressing rooms	214
Storage	151
Organ stores	49
Technical room (incl substation)	110
Total	**3,208**

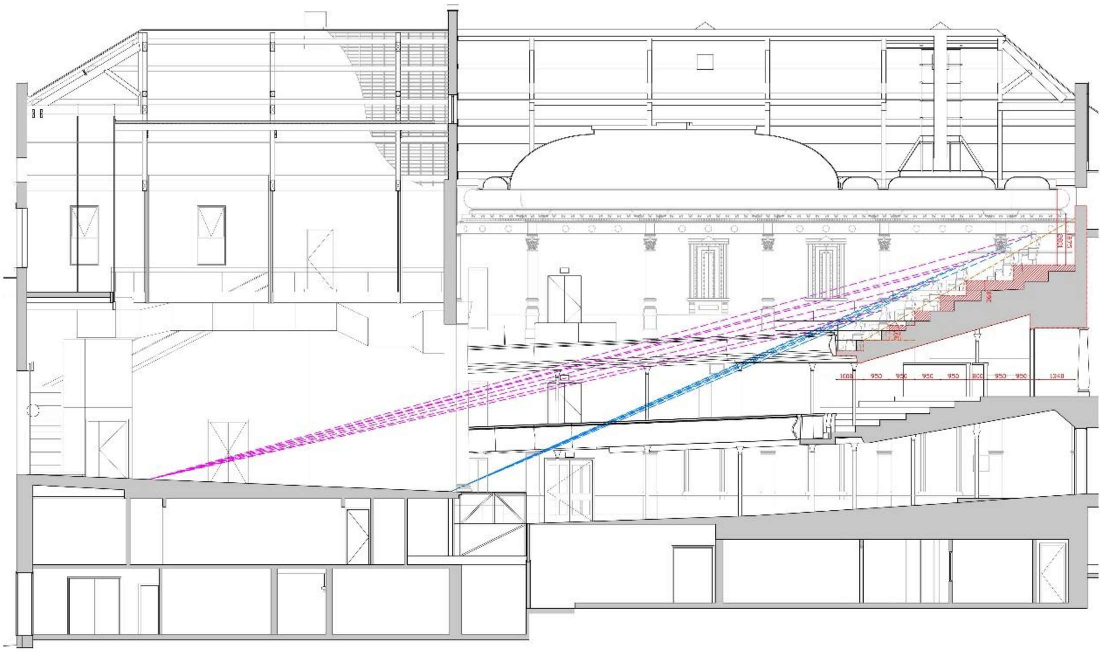


Figure 6 Sectional study of the re-raking of the balcony level to improve sight lines. Note that two rows of seats are removed to re arrange the plats for improved sight lines.

5.3.10 Balcony Level Sight Lines Study

The balcony level seating to the auditorium is underutilised due to restricted sight lines limiting the number of seats that have full views of the stage. The plats at this level are raked at 22 degrees with the first row of seats closely set to the balcony balustrade. The Theatre does not allow this first row of seats to be occupied as a management strategy to manage the risk of potential falls associated with the low height balustrade and narrow path of travel. If the plats were adjusted to have a rake at 30 degrees complying with Section H1.4 of the NCC there would be an overall reduction of seating to the balcony by 35 seats through the removal of two rows. The balcony structure would need to be replaced. These works are not included in the project cost plan or budget.

5.4 Hazardous Materials

The Part 6 Hazardous Materials Audit included in Appendix C of this report identifies a series of items within the building that contain hazardous materials including lead-based paints, synthetic mineral fibres and asbestos. The investigation was non-destructive and therefore demolition works associated with the upgrade may uncover additional hazardous material latent conditions and on this basis a provision should be allowed to address latent conditions for hazardous materials.

Key areas that contain hazardous materials that will be impacted by the works include the following:

- Drum room – loose sheeting against wall
- Switch room – switchboard
- High voltage switch room – switchboard (assumed)
- Stage door office – stage door
- Female toilets – shower base and surround
- Stage staircase – balustrade painted finish
- Candy bar store – paint finish to walls

- Auditorium fire escape – infill panel over exit door
- North and south exits – floor and ceiling
- North entry – skirting paint
- Ticket office – door frame
- Stalls – columns painted finish
- Stage wall – painted finish
- Props store – lagging
- Plant room – lagging
- Fire doors cores generally
- Store 5 – switchboard
- Lift motor room – lift motor
- Male toilets – urinal mastics
- All dressing rooms – splashbacks

Recommended Actions

- A suitably qualified contractor should be engaged for the management, removal and disposal of all hazardous materials.
- Refer to the Part 6 Audit for details on hazardous materials and their location.
- Include a contingency to address latent conditions with respect to hazardous material management and removal.

5.5 Conservation Works

Extensive conservation works have been undertaken as part of stages 1 and 2 works packages comprising roof and façade repairs, internal plaster repair and painting and conservation works associated with services upgrades, structural remediation and damp proofing works. Where possible original joinery including panelled timber doors have been retained and retrofitted with seals to achieve the fire compartmentation required. Any new doors have been detailed to match the original design.

The recently completed stage 2 works included major conservation works to the interior of the auditorium including render repairs, structural crack repair, treatment of damp affected surfaces, repair or replacement of decorative features and reinstatement of the 1898 colour scheme to the walls generally, with the exception of the proscenium and balconies. The cornice and ceiling were also excluded from the scope.

Consideration should be given to the reinstatement of the painted mural to the dome based on the remnants and the completion of the restoration works to the auditorium in the next stage. It is noted this will require a full birdcage scaffold.

Any works to the principal spaces such as the foyer, principal circulation areas, auditorium and Long Room and amenities will require ongoing conservation of original fabric including plaster repairs and reinstatement of early colour schemes. Further investigation of original colour schemes and finishes is required for the Long Room, foyer and auditorium ceiling.

The rising damp penetrating the west wall of basement level 1 needs to be addressed as part of the amenity's refurbishment works by the installation of external or internal tanking to the full face of the wall. Installing the tanking externally is preferred but may not be possible due to services within the footpath. This needs to be further investigated.

The building will require other restoration works associated with the redevelopment works, particularly where original or early fabric will be removed from the building, alterations to openings and any other changes to fabric, particularly where new structure is required to be integrated.

The replacement and upgrade of services will similarly require repair and conservation associated with the removal and replacement of fittings, conduits, fixtures. The works are likely to include painting, plaster repairs, repair of joinery and masonry where demolition is required.

Recommended Actions

- Undertake paint sample analysis to interior spaces to inform repainting as required to inform the detailed specification.
- Undertake conservation works associated with the works and repainting generally.
- Reinstate the mural inside the plaster dome of the auditorium.
- Install damp treatment to the west wall basement level 1 to address rising damp.
- At the completion of all works the CMP should be updated to reflect the alterations and to ensure that the building caretakers have guiding policies that are consistent with the buildings current form.

5.6 Building Structure

An assessment of the structural engineering aspects of the proposed works has been undertaken by Mark Hodkinson.

5.6.1 Seismic

The required seismic loadings for this building come from *AS 1170.4 – Structural Design Actions Part 4: Earthquake actions in Australia*. This building is in earthquake design category is II or III and as the building is constructed from unreinforced brickwork steel frames would need to be installed to stiffen the walls and ceilings, or the walls would need to be post-tensioned to new concrete footings, or a combination of both would be required. It is anticipated that this compliance will not be triggered unless the Regulation 233 (2) 50% volume is exceeded by the works.

5.6.2 Loading capacity of the stalls and balconies

Section 3.4 of *AS1170.1 – Structural Design Actions Part 1: Permanent, imposed and other actions* specifies areas with fixed seats such as auditoria be capable of sustaining a uniformly distributed live load of 4.0kPa. Compliance would be a requirement if major works were undertaken to the plats or seating. Exposure of the floor structures at representative locations is required to verify the existing loading capacity. It is recommended that this be done as a record of condition and to inform any future works to these areas. The proposed works in stage 3 will not in themselves trigger compliance.

The same is applicable to other areas of the theatre.

Recommended action

- Undertake investigation by exposure of structure at representative locations to verify existing loading capacity.

5.6.3 Balustrades to the dress circle and balcony and handrails

Section 3.6 of *AS1170.1 – Structural Design Actions Part 1: Permanent, imposed and other actions* specifies that balconies in areas susceptible to over-crowding such as theatres be capable of withstanding crush loadings which includes a horizontal loading of 3.0 kN/m. Exposure of the balustrades structure at representative locations is required to verify the existing loading capacity. Given the need to reconstruct a section of the dress circle balustrade and address the safety of the balustrades at both dress circle and balcony levels allowance has been made in the stage 3 works to upgrade the structural capacity of the balustrades.

Similarly, to the balustrades, handrails throughout the building need to comply with the same standard.

Recommended action

- Undertake investigation by exposure of structure at representative locations to verify existing loading capacity.
- Assume the balustrades and handrails require upgrading for costing purposes.

5.6.4 New lift installations

It is possible the new lift pits will be founded at depths greater than 1.5m below the lowest floor levels. The existing footings adjacent to the proposed lift pits need to be investigated to determine if the existing footings need to be locally underpinned and/or the existing footing outstands locally demolished.

Recommended action

- Undertake investigation by exposure of footings and undertaking geotechnical cores at representative locations to verify type and extent of underpinning required early in the design phase.

5.6.5 Stage floor structure

The stage floor structure has been significantly upgraded in the recent stage 2 works. It is noted the blockwork walls of the basement level 1 dressing rooms and women's and men's amenities are load bearing and support the c1960s reinforced concrete basement level 2 floor slab. Steel columns have been installed to support the stage floor steel beams and continue to bear on a number of these loadbearing walls in basement level 1. Allowance needs to be made for new structure which may include concrete footings and steelwork beams and columns should the loadbearing walls at either location be removed due to functional rearrangements. If possible, it is preferred the existing walls be retained and worked around. The location of the beams and walls is indicated on the drawings for clarity.

Recommended action

- Where possible retain or minimise removal of loadbearing blockwork walls at basement level 1 dressing rooms and amenity area.

5.6.6 External stair to Unicorn Lane

The existing Unicorn Lane fire egress stair does not comply with Section 3.4 of *AS1170.1 – Structural Design Actions Part 1: Permanent, imposed and other actions.* It may be necessary to construct the footings for the new stairwell structure off piles founded on rock to eliminate future differential movement between the northern wall of the auditorium and the new enclosed stair structure.

Recommended action

- Undertake geotechnical investigation early in design phase to determine the construction methodology for the new enclosed fire stair to the north of the auditorium. Primary consideration must be given to minimal impact to the original heritage fabric of the building arising from construction of this stair.

5.6.7 Green Room additions

The feasibility of constructing an additional floor above the green room located on the eastern wall of the fly tower and extent the existing stage lift to this floor level. The existing structure is supported by a series of tall columns supported off pad footings. It is not known without destructive investigation if these have the capacity for the proposed additional loadings and it is possible the structure will need to be strengthened.

Recommended action

- Undertake geotechnical investigation of the footings and expose the steel structure to the existing green room in representative locations to determine the actual capacity of the structure for an additional level.

6.0 Works scope discussion

Inevitably with a large heritage building that requires regular ongoing fabric repairs and maintenance, and cyclical upgrading of essential services and replacement of plant and equipment as they reach end of service life there are base costs associated with any phase of building works that need to be factored into any programme of works. While the Theatre has undergone phases of refurbishment in the last 20 years, none of the stages of work appears to have had the ability or budget to address a full compliance upgrade, or adequately address all the perceived functional and operational shortcomings. In some instances, the heritage constraints of the building will result in some operational compromises, but the intent of the City of Ballarat is to ensure the Theatre is a viable venue that attracts a high level of patronage and therefore where possible issues that affect the economic viability of the venue are to be addressed.

In approaching the current staged series of major projects there has been the ability to manage the sequence of works in a prioritised manner to the extent that funding allows. It is recognised that funding streams do not always enable the preferred range of works to be undertaken and there needs to be a degree of flexibility. This focus of this report is the third stage of the current works programme between 2018-2021 and it is essential that should the full funding for the recommended works not be secured, there is a viable and logical scope that can be achieved by the end of 2021.

The following discussion addresses the key strategic issues related to management of the priorities and risks to ensure as far as reasonably possible that the City of Ballarat can proceed to tender for the next stage of the procurement process with an identified scope of works and options for additional works should there be the funding and opportunity.

6.1 Land title

The title information for the site describes the site as comprising of Lots 1 and 2 on title plan 893826Y (formerly known as Crown Allotment 3 section 12 Township of Ballarat, part of crown allotment 4, section 13 Township of Ballarat) which includes the Theatre building to the full extent of the footprint, but excludes the northern fire escape stairs and canopy that are external to the enclosed footprint of the building on Unicorn Lane. It appears from the LANDATA® registry database that the north stair is considered part of the site as it shares the same address, but this is not able to be verified through the title information.

The access upgrades are contingent on being able to construct a new enclosed fire escape stair that services the auditorium on this area of the site and therefore it is recommended that the anomalous situation of the ownership of this portion of the site be rectified. For a building permit to be issued for works in this area Council needs to provide evidence this area is within the title boundary.

The City of Ballarat has confirmed the north fire escape title ownership is in the process of being transferred to Council.

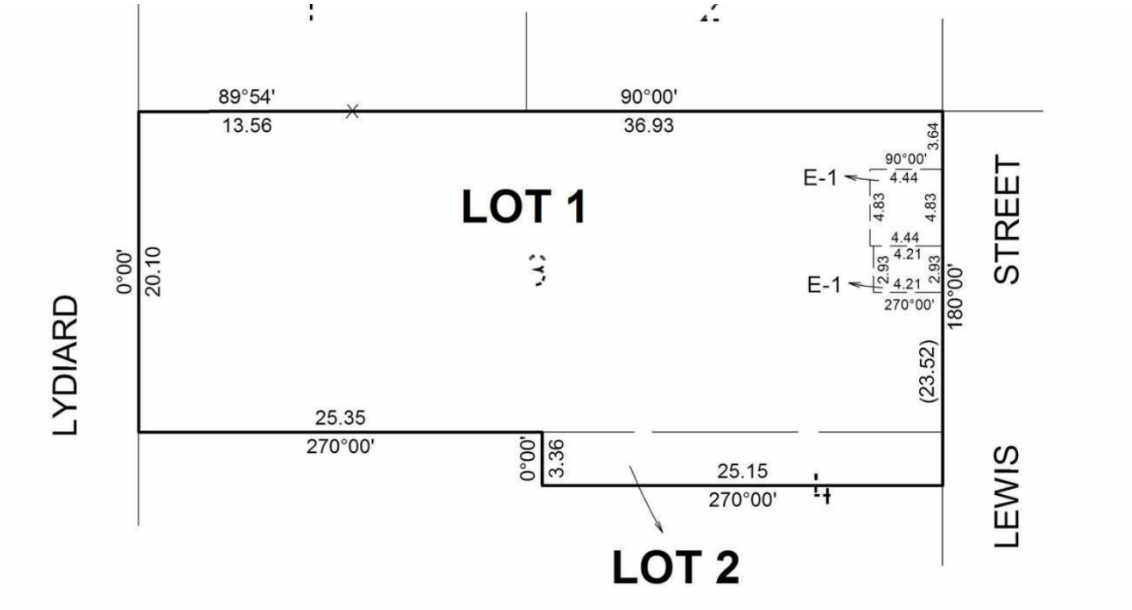


Figure 7 17 Lydiard Street, Ballarat Title Plan TP 893826Y showing that the north egress stair into Unicorn lane is not currently amalgamated into the title.
Source: LANDATA® Land Use Victoria accessed 02/12/2019

6.2 Latent conditions

There are several critical risk items associated with delivering the project that have a time and cost implication during the construction phase. In a building of this age and type the foremost of these is latent or unknown conditions that cannot be anticipated and generally come to light after demolition works. These often consist of additional hazardous materials, structural items that are concealed from view or found conditions that differ from those anticipated. To manage these risks design and construction contingencies have been included in the cost plan. Where these risks can be mitigated by additional invasive investigation this has also been factored into the detailed design stages.

6.3 National Construction Code Compliance

In undertaking a programme of works to upgrade or alter or adapt an existing building notice needs to be taken of the inherent compliance triggers.

Regulation 233 (2) of the Building Regulations 2018, stipulates if the proposed alterations to an existing building, together with any other alterations completed or permitted within the previous 3 years, relate to more than half the original volume of the building, the entire building must be brought into conformity. Given the extent of the proposed works recently undertaken to the stage, basement level 2 and anticipated to occur, managing this trigger point is critical.

Due to the age of the building, it is not expected that full compliance can be achieved, however if alterations exceed the volume trigger, a strategy will need to be implemented with the possibility of a number of further dispensations to be sought.

The Building Surveyor has assessed that building work completed in the previous 3 years combined with the proposed stage 3 building works will affect 44% of the building volume based on the current scope. On this basis Hendry have determined that the building is not required to be brought into conformity with the current regulations and BCA. Notwithstanding this all new building work undertaken in stage 3 is to comply with the BCA deemed to satisfy provisions or addressed via a performance solution.

It is important for the feasibility of stage 3 that this trigger be consistently monitored through the design and documentation phases of the project. Once the stage 3 works are complete, no further works undertaken for a period of 3 years to avoid triggering further compliance upgrades.

On the issue of retrospective triggering of compliance by a change of built volume arising during the works from latent conditions Hendry have advised there is no absolute answer to this question – it would depend on what additional works are added to the project once the building permit is issued. If they are of a relatively minor nature or associated with some services replacement (i.e. works which do not impact the volume calculation) there is likely to be no issue, but if they are structural and add significant affected volume area then it will require careful assessment by the Building Surveyor and could be a trigger.

As this potentially raises scenarios that can't be predicted the preferred course of action is to avoid significant addition to scope that is not already anticipated. In assessing the ability to add scope late in the design/documentation phase or during construction due to a potential increase in available budget, these works should be discussed with the building surveyor prior to them issuing the Building Permit for the works do there is the ability to assess the viability of adding scope without triggering 50%. If it is a potential latent condition, this would be in the category of careful assessment by the building surveyor at the time.

An alternative course of action is to ensure the building permit for stage 3 is issued outside of the 3-year window linking it to stage 2.

7.0 Risk Assessment

In the event that the recommended works could not proceed, either in part or full, the building would be at risk. The recommended works outlined in this report seek to diminish or remove some of these risks to ensure the continuing operation of the building as a key goal. Each works type has been identified with a risk category and profile to assist in understanding the necessity for the works to be undertaken. If the total project was not to proceed, options exist to continue to manage some of the risks; however long-term, a do-nothing approach will see the risk profile continue to increase.

7.1.1 Risk Assessment Matrix

There are three main risk areas arising out of the current building condition, which would be addressed by the works recommended in this report.

1. Risk to **person and property** – resulting in injury, death or damage to the building.
2. Risk to **continuing operation** – restricted access, operation, patron experience.
3. Risk to **heritage values** – diminished heritage values from development or change of use.

Table 9 Risk Assessment Matrix

Description	*Risk*	*Priority*	*Mitigation Action*
Compliance upgrades	1,2,3	**HIGH**	Upgrade the access to provide disability and ambulant access to compliance.
Services upgrades	1,2,3,	**HIGH**	Upgrade services outlined above to compliance.
Facilities and operational upgrades	2,3	**MEDIUM**	Upgrade the current facilities to assist with operational requirements.
Hazardous material management	1,2,	**MEDIUM**	Undertake removal of hazardous materials identified in this report.
Conservation works	1, 3	**MEDIUM**	Undertake the recommended and consequential conservation works outlined in this report

The impact of these risks has been assessed as either **High, Medium** or **Low** based on the following descriptions:

> **HIGH** – all three risk profiles are identified, or risk profile 1 is identified.
>
> **MEDIUM** – any two risk profiles are identified.
>
> **LOW** – only one risk profile is identified.

The 5 main works types consisting of compliance upgrades, services upgrades, facilities and operational upgrades, conservation works, and hazardous materials have been assessed against the risk profiles and their priority assessed on the basis of the above (refer Table 9).

7.2 Conservation Approach

The policies outlined in the 2006 Conservation Management Plan, identified in Section 2.3 of this report, provides guidance on the potential for alteration and adaptation of the theatre framed by the key overriding principal of ensuring the continuing operation of the theatre as a viable enterprise as critical to the significance of the place as the oldest continuing operating theatre in mainland Australia.

It is identified that some of the proposed works will result in the removal of early or original fabric, particularly where vertical access is proposed to be provided. These works are critical to the ongoing operation of the theatre and provide the required building code and legislative compliance needed to ensure that assisted and unassisted disability access is established.

7.2.1 Assessment of the Works Against Policies

The project is generally in accordance with the policies set out in the Conservation Management Plan to ensure that redevelopment does not result in a diminution of the heritage values of the place.

The following table provides a summary assessment of the recommended actions against the relevant policies and identifies where works may result in a heritage impact or are not directly in accordance with the policies.

Table 10 Assessment of the recommended actions against CMP policy

Description	*Heritage Impact Comments*
Compliance upgrades	The compliance upgrades will involve modifications to existing fabric that is of contributory significance and some localised areas of primary significance. The strategy to locate the new vertical access lifts and stairs within spaces that have been previously modified, outside the original footprint or in a manner that can be reversed mitigates the extent to which the works impact on the overall building fabric. The works are generally in accordance with the specific and general conservation policies and support the key heritage policy for ensuring the building continues to operate and is publicly accessible. These works are considered essential to the continuing use of the building and from a heritage perspective should be supported.
Services upgrades	There is a specific policy related to the upgrade of services. The proposed works are in accordance with this policy and together with the consequential conservation works these works will support the key heritage policy for ensuring the building continues to operate and is publicly accessible.

Facilities and operational upgrades	Many of the facilities and operational upgrades will alter non original fabric identified as having little significance to the building. These works propose to remove and alter non original walls and finishes minimising the heritage impact of these works. These works contribute to the ongoing operation of the building and on this basis the works are in accordance with the general policies and the specific policies for adaption and change, and for the foyer.
Conservation works	The conservation works are considered to be a good conservation outcome and are in accordance with the policies outlined in the Conservation Management Plan.
Hazardous material management	The majority of the items that are identified as containing hazardous material are not considered to be of primary or contributory significance and on this basis their removal or replacement does not diminish the heritage value of the place. It is considered that these works have minimal to no heritage impacts.

8.0 Programme

The anticipated programme for the project is as follows:

Funding approval	March 2020
Scope finalisation and tender for design consultant to include documentation, tender services, construction administration and defect period services.	March 2020 – April 2020
Design and documentation of project works 9-12 months	May 2020 – January 2021
Statutory approvals	August 2020 – November 2020
Tender construction works 6-9 weeks	January 2021 – March 2021
Award construction contract	March 2021
Theatre Black-out	March 2021
Project construction 2 years	March 2021 to December 2022
Theatre reopens	January 2023

The programme has assumed timeframes for activities as noted and does not allow for any use of the theatre from March 2021 to January 2023.

It has been assumed the statutory approval process can overlap with the documentation phase, subject to an appropriate level of comfort with the scope obtained through the pre-application meetings at schematic design stage.

9.0 Recommended Works

The following actions have been identified in this report and form the basis of the recommended scope for the stage 3 and future works to be carried out:

9.1 Accessibility Upgrades

9.1.1 Access and egress

- Upgrade all stairs to include tactile indicators, colour contrasting nosing strips and complaint handrails.
- Upgrade all ramps to include tactile indicators, colour contrasting nosing strips and complaint handrails.
- Provide compliant access from Unicorn Lane to basement level by ramp.
- Increase the height of balustrades within the dress circle and balcony to minimise fall risk, but without obstruction of sight lines.
- Provide handrails to stairs within the dress circle and balcony.
- Provide new passenger lift that meets minimum DDA access dimensions to front of house with access to basement level 1, ground floor, auditorium stalls, dress circle and long room. Lift car specification to meet City of Ballarat facilities standards as a minimum.
- Provide new passenger lift that meets minimum DDA access dimensions to back of house with access to basement level 1, auditorium stalls, stage, green rooms and dress circle. Lift car specification to meet City of Ballarat facilities standards as a minimum.
- Upgrade door hardware throughout to comply with AS 1428.1. Priority given to emergency egress path openings.

9.1.2 Seating

- Provide a minimum of 6 new disability compliant seats to the dress circle level.
- Maintain a minimum of 8 disability compliant seats to the stalls.

9.1.3 FOH Ticketing and refreshment

- Upgrade bar and ticket sales counters to include zones for common reach for disabled and ambulant persons.
- Upgrade long room bar to include zones for common reach for disabled and ambulant persons.

9.1.4 Sanitary Facilities

- Upgrade all sanitary facilities to front of house areas and include ambulant toilet facilities.
- Retain the male facilities in the basement, identified as being of primary significance. Minor upgrade to these facilities should be accepted to include ambulant closet facilities.
- Provide new disability accessible toilet facilities including fold away baby change tables.
- Reconfigure the sanitary facilities to the basement level 1 and 2 and the green rooms, including shower facilities.
- Upgrade all associated statutory signage to comply with the provisions of AS 1428.1 – 2009 Section 8.
- Provide a total of 7 shower facilities to the back of house areas.

9.2 Safety and Compliance Upgrades

9.2.1 Electrical

- Further investigate the requirement for a power supply (substation) upgrade to the site through consultation with Powercor and any upgrade to incoming mains cabling based on proposed new loads, including addition of lifts.
- Allow to replace main switchboard with new compliant switchboard, subject to load calculations for proposed works.
- Replace distribution switchboards with new compliant boards.
- Investigate need to upgrade sub circuit wiring to building to meet current codes.
- Include special purpose power for new lifts and mechanical plant.
- Upgrade communications and data infrastructure to refurbishment works areas.

9.2.2 Lighting and sound systems

- Upgrade audio loop to wireless system to the auditorium, cry room and Long Room.
- Upgrade the existing front of house and back of house PA systems to be integrated with the emergency warning and intercommunication system (EWIS).
- Provide new efficient LED general and house lighting with updated lighting control systems throughout (assumed this will be delivered progressively and aligned to works areas)
- Consideration should be given to the removal of the chandeliers dating from the 1950s and reinstatement of gasolier style reproduction fittings based on historical images consistent with the theatre's nineteenth century aesthetics or a contemporary fitting of similar size and scale.
- Upgrade aisle lighting to comply with NCC H1.7.
- Upgrade backstage and bio-box lighting controls and dimmer systems.
- Include additional emergency and exit luminaires to refurbishment works areas.
- Relocate stage electrical patch panels and wiring that conflicts with new BOH lift installation.

9.2.3 Mechanical Services

- Upgrade air handling plant serving the auditorium and stage to meet current standards based on maximum capacity of 1,000.
- Replace chilled water and heating water plant and equipment with new including increased capacity to meet new loads and upgrade whole plant system including building automation system, switchboard and control panel.
- Ensure redevelopment of the south and north stair provisions for new plant platforms including access for maintenance.
- Upgrade toilet exhaust in association with refurbishment of amenities areas.
- Upgrade outside air provisions to basement offices and dressing rooms.
- Review smoke exhaust system to stage area and allow to upgrade.

9.2.4 Hydraulic Services

- Extend water services to new or relocated positions.
- Install local domestic hot water systems to provide for new facilities.
- Undertake sanitary plumbing works to connect new or relocated facilities.

9.2.5 *Fire Protection Services*

The following ongoing actions are required to meet the deemed to satisfy and performance solutions outlined in the Fire Engineering Report for the building.

Construction and FRL's

The following fire rating levels are to be maintained throughout the building:

- Long Room north stair to be separated by 35mm thick solid core timber doors and protected by AS 2118.12 fast response pendant sprinkler to the long room side.
- Auditorium stair to be fire separated by 35mm thick solid core timber doors and protected by AS 2118.12 fast response pendant sprinkler to the auditorium side.
- Substation and switch board construction to FRL 120/120/120 with FRL -/120/30 self-closing fire doors.
- Basement level battery room construction to FRL 120/120/120 with FRL -/120/30 self-closing fire doors.
- Basement backstage to be separated from administration and organ with fire rated door FRL -/120/30 with vision panel.
- Fire wall compartments to be maintained and where penetrated be made good with penetrations to FRL -/120/120 and penetrations protected to NCC C3.15.
- Louvers in external wall of auditorium to bio-box to be covered in metal sheet and sprinkler protection above.
- Smoke walls are to be made good to NCC specification C2.5 Clause 2.

Sprinkler Protection

- Maintain sprinkler protection throughout the building to AS 2118 – 1982 with exception of the auditorium and organ areas.
- Bio-box glazed (and operable) openings between the bio-box and auditorium to be provided with AS 2118.12 fast response pendant sprinkler to the auditorium side.
- Long room north stair to be separated by 35mm thick solid core timber doors and protected by AS 2118.12 fast response pendant sprinkler to the long room side.
- Auditorium stair to be fire separated by 35mm thick solid core timber doors and protected by AS 2118.12 fast response pendant sprinkler to the auditorium side.

Fire Detection and Alarm

- Provide a manual call point at the sub-panel and FIP and at proscenium control.
- Provide a public address (PA) system in the bio-box and at the sub-panel.
- Ensure building occupants warning speaker and strobe is provided within the orchestra pit and organ areas.
- Ensure building occupant warning speaker and strobe is provided at far end of fly platform.

Management

- Implement hot works permits for contractors.
- Induct contractors into fire evacuation procedures.
- A designated fire warden to be present on site at all times.
- Manual call point to be available at each required exist.

- The stairs are to be adopted as a safe haven for occupants in wheelchairs. The stair is to be separated from the auditorium by inherently fire-resistant walls (masonry). Wall openings are to be protected by existing doors with sprinkler protection or self-closing minimum FRL -/120/30 door leaves with AS 1530.7 cool/medium temperature smoke seals and AS 1530.4 intumescent fire seals to the door heads, side and stiles.

To address remaining deficiencies in the system the following upgrade works are required when undertaking the proposed refurbishment works:

- Extend or alter automatic fire sprinklers system associated with alterations and additions.
- Installation of smoke detectors at basement level 1 and 2 and associated extension of existing fire alarm system coverage.
- Extend occupant warning system as required by alterations.
- Upgrade mechanical services fire brigade control panel in the event of mechanical services upgrades
- Relocate existing automatic fire sprinkler control valves in Unicorn Lane associated with new fire stair works.
- Review extent of hand fire extinguishers required and amend as necessary.

9.2.6 Lift Services

- Lift type to be commercial MRL suitable for the duty required in a public building, minimum dimensions based on two-sided lift that is DDA compliant.

9.3 Functionality Upgrades

9.3.1 Front of House

- Demolish the existing bar, ticket box and office.
- Construct a new bar with integrated fridges, storage and point of sale for refreshments and tickets.
- Close off the existing opening between the Foyer and the north vestibule with a fire rated infill.
- Widen the existing opening between the south vestibule and foyer.
- Reconfigure the existing ramp in the south vestibule.
- Install digital signage.

9.3.2 Auditorium

- Remove the adjudicator’s box from the front of the dress circle and reinstate balustrade to match existing profiles.

9.3.3 Administration Offices

- Upgrade the administration areas based on the area allocations.
- Continue to use the sanitary facilities located in basement level 1.
- Provide all new furniture associated with the fit out works, consisting of workstations, shelving, partitions, chairs, tables and the like.

9.3.4 Back of House

- Partition existing green room to create Artists dressing room at stage level.
- Refurbish the dressing rooms to basement level 1 including full upgrade of sanitary facilities, including modifications to accommodate new corridor for BOH lift.

- Upgrade sanitary facilities to basement level 2
- Provide all new fixtures, finishes and fittings including furniture to the dressing rooms.
- Install ramp at stage door to mediate the changes in level and improve path of travel.
- Investigate ability to open up the stage door lobby.
- **Future stage**: Remove the north link stair at east end of basement level 1 and 2.
- **Future stage**: Construct new two storey green room to the footprint of the rear skillion structure incorporating a new stair and unisex sanitary facilities.
- **Future stage**: Increase the wings capacity by extending the stage to the south by removing section of wall.
- **Future stage:** Construct a new props store.

9.3.5 Orchestra Pit

- Implement the works outlined in the specification for: Orchestra Pit Modules, Stalls Removable Wall, Drapery and Track dated June 2010.

9.3.6 Fly Tower

No action required.

9.3.7 Roof Access Systems

- Design and install a complaint roof access system to provide access to all roof areas for maintenance or roofs, gutters and access to plant and plant platforms.
- Initiate a maintenance regime for annual testing of all access systems from date of initial certification.
- Design an access system so that access can be gained to the rear wall of the fly tower (east wall) to install banners and other forms of temporary signage.

9.3.8 Organ and Organ Chambers

- Relocate the organ to the south of the stage.
- Upgrade the organ hoisting equipment.

9.4 Hazardous Materials Management

- A suitably qualified contractor should be engaged for the management, removal and disposal of all hazardous materials.
- Refer to the Part 6 Audit for details on hazardous materials and their location.
- Include a contingency to address latent conditions with respect to hazardous material management and removal.

9.5 Conservation Works

- Undertake paint sample analysis to interior spaces to inform repainting.
- Undertake conservation works associated with the works and repainting generally.
- Reinstate the mural inside the plaster dome of the auditorium.
- Install damp treatment to the west wall basement level 1 to address rising damp.
- At the completion of all works the CMP should be updated to reflect the alterations and to ensure that the building caretakers have guiding policies that are consistent with the buildings current form.

9.6 Building Structure

9.6.1 Seismic

It is anticipated that this compliance will not be triggered unless the Regulation 233 (2) 50% volume is exceeded by the works.

9.6.2 Loading capacity of the stalls and balconies

- Undertake investigation by exposure of structure at representative locations to verify existing loading capacity.

9.6.3 Balustrades to the dress circle and balcony and handrails

- Undertake investigation by exposure of structure at representative locations to verify existing loading capacity.
- Assume the balustrades and handrails require upgrading for costing purposes.

9.6.4 New lift installations

- Undertake investigation by exposure of footings and undertaking geotechnical cores at representative locations to verify type and extent of underpinning required early in the design phase.

9.6.5 Stage floor structure

- Where possible retain or minimise removal of loadbearing blockwork walls at basement level 1 dressing rooms and amenity area.

9.6.6 External stair to Unicorn Lane

- Undertake geotechnical investigation early in design phase to determine the construction methodology for the new enclosed fire stair to the north of the auditorium. Primary consideration must be given to minimal impact to the original heritage fabric of the building arising from construction of this stair.

9.6.7 Green Room additions

- Undertake geotechnical investigation of the footings and expose the steel structure to the existing green room in representative locations to determine the actual capacity of the structure for an additional level.

10.0 Cost Analysis

On the basis of the proposed works outlined in this report and captured schematically in the architectural drawings PlanCost Australia have prepared *Cost Plan 6 rev D, Future Works* arriving at a project total end cost of $20,600,000.00 excluding GST. The cost plan includes a design contingency, construction contingency, consultants' fees and escalation costs anticipating completion of works in February 2023.

A copy of this report is included in Appendix H.

In line with the intent of the stage 3 works to undertake works that address issues based on the following order of priority: **Accessibility**; **Safety and compliance**; and **Functionality** the cost plan also provides a more detailed breakdown of the works based on this order of priority.

The works proposed to be included in Stage 3 are summarised as follows:

Accessibility

- Establish DDA compliant access routes and vertical access within the building to FOH and BOH, including stage and Basement Level 1 dressing rooms, excluding the balcony.
- Refurbishment of sanitary facilities including new DDA compliant sanitary facilities.

Safety and compliance

- Upgrade of orchestra pit with 4 operable powered thrust lifts.
- Access to outdoor east façade to provide roof access and fixing points for banners.
- Electrical upgrade throughout including auditorium lighting.
- Fire services upgrades.
- Upgrade of mechanical services (air conditioning) to auditorium and refurbished spaces.

Amenity upgrade

- New box office and refreshment bar in foyer with display signage and improved DDA access.
- Refurbishment of dressing rooms to Basement 1 level and administration offices.
- Refurbishment of Green Room (incorporating Artist dressing room) at stage level.
- Refurbishment of Long Room (new bar layout).

Table 11 Cost estimate summary

Order of Priority	***$ Cost Estimate (Gross) inclusive of all contingencies, fees and allowances***	***$ Cost Estimate (Net) construction cost only***
0 – Essential services	$612,028	$350,000
1 – Base Stage 3 works	$12,395,323	$7,088,500
2 – Future works	$7,592,649	$4,342,000
Total	**$20,600,000**	**$11,780,500**

The design and construction contingencies are set at 10% each (total 20%) and a contingency of 2% for project management. The contingencies are appropriately high for the nature of the work contemplated and based on the high-level nature of the works scoping. As noted in section 6.2 of this report latent conditions are a risk in buildings of this age and type and typically only come to light after demolition work is undertaken. It is suggested there be close examination of the contingencies at each stage of design and consideration be given to maintaining appropriately conservative allowances to mitigate the cost risk associated with latent conditions.

The cost plan contains the following standard exclusions:

- Rock excavation
- Site decontamination (in ground only)
- Rainwater harvesting
- Landscaping
- Locality allowance
- Staging costs
- Procurement method costs
- Environmentally sustainable design initiatives
- Disbursements
- Management support costs
- Supply authority charges
- Prolongation and delay risk

- Client contingency
- Cost escalation after February, 2023
- GST
- Land purchase
- Seismic upgrades to the building structure

The following works are identified in the cost plan but are not included in the Stage 3 project budget (building works costs only):

• Sound equipment upgrade	$400,000
• Upgrade backstage and bio-box lighting controls and dimmer systems	$100,000
• Upgrade performance lighting, rigging bars and other associated mountings	$100,000
• Alterations to the balcony level seating and plats	$420,000
• Increase the capacity of the stage by extending the southern wing through removal of existing structure	$220,000
• Construction of additional floor to green room on the east and new props store	$415,000

The following items are not included in the cost plan:

- Seismic upgrade works.
- Section J compliance works.
- Structural modification associated with wind loading compliance.
- Consultant fees associated with preparation of updated Conservation Management Plan.

10.1 Stage 3 Budget

This report identifies the full scope of Stage 3 works necessary to implement Disability Discrimination Act (DDA) compliance works, compliance with the National Construction Code (NCC) and capital works to upgrade dated facilities and operational areas with associated services upgrades to the building.

The works as scoped result in a total end cost of $20,600,000 inclusive of all works, contingencies, escalation and fees. On the basis of the available funds at this time ($10m) it has been necessary to break the Stage 3 works down into two separable stages: 3a and 3b.

In consultation with the PCG prioritisation of the scope into the following categories was undertaken:

- Priority 0 – essential services compliance
- Priority 1 – accessibility and operational safety and compliance upgrades
- Priority 2 – functional improvements, future works

The recommended essential Stage 3a scope is for priority 0 and 1 works to be undertaken which results in a total end cost (TEC) of $13,007,351.

The following cost saving options have been identified to bring the total end cost value of the recommended Stage 3a works down to the available budget of $10 million (excluding GST). The identified saving options are considered to be scope items that while acknowledged to be essential to the theatre upgrade, are such that they can be straightforwardly removed to achieve savings and added back into the project during the detailed design phases, should additional funding become available.

At this stage with the scoping and costings being high-level it is not recommended that scope values for identified works be reduced or value managed down, until more detailed investigation and design can be undertaken.

Table 12 Identified cost saving options

Item	*Total $*
Reconfiguration of dressing rooms and upgrade of sanitary facilities to Basement Level 1 & 2	-461,644
All new fixtures, finishes and fittings including furniture to the dressing rooms Basement Level 1	-61,203
New lift to back of house	-306,014
Remove the adjudicator's box from the front of the dress circle and reinstate balustrade to match existing	-69,946
Reconfigure the sanitary facilities to the Basement Level 1 & 2 and the green rooms, including shower facilities	-1,661,220
Rewire whole of building to current codes and compliance	-1,432,146
Upgrade whole of mechanical plant system	-2,490,081
New computerized monitoring system	-87,433
New artist room within existing green room at stage level	-87,433

On the basis of the above cost saving options, a possible scenario for the scope separation in this final stage of upgrade works is as outlined below:

Stage 3A (Priority 0, 1 Works) - 2023

- New addressable FIP
- Removal of hazardous materials
- Compliant roof access system
- Compliant DDA access from Unicorn Lane to B1 via ramp
- Construct new stair and fire lobby to north side of auditorium
- Refurbishment of dressing rooms to B1
- Refurbishment and upgrade of sanitary facilities to B1 and B2
- New artist room at stage level
- Works to foyer to improve amenity and access
- New lift to front of house
- Works to Dress Circle and Balcony balustrades to improve compliance and remove adjudicators box, handrails to stairs within Dress Circle and Balcony
- Enhanced access/DDA seats to Dress Circle and Stalls
- Upgrade front of house sanitary facilities to B1
- Electrical services upgrades
- New wireless audio induction loop

- Upgrade existing front of house and back of house PA systems to integrate with EWIS
- New external plant platforms (north stair)
- Bio-box fire rating upgrade
- Sprinkler upgrades to maintain fire compartment separation in accordance with FER
- Relocation of sprinkler control valves

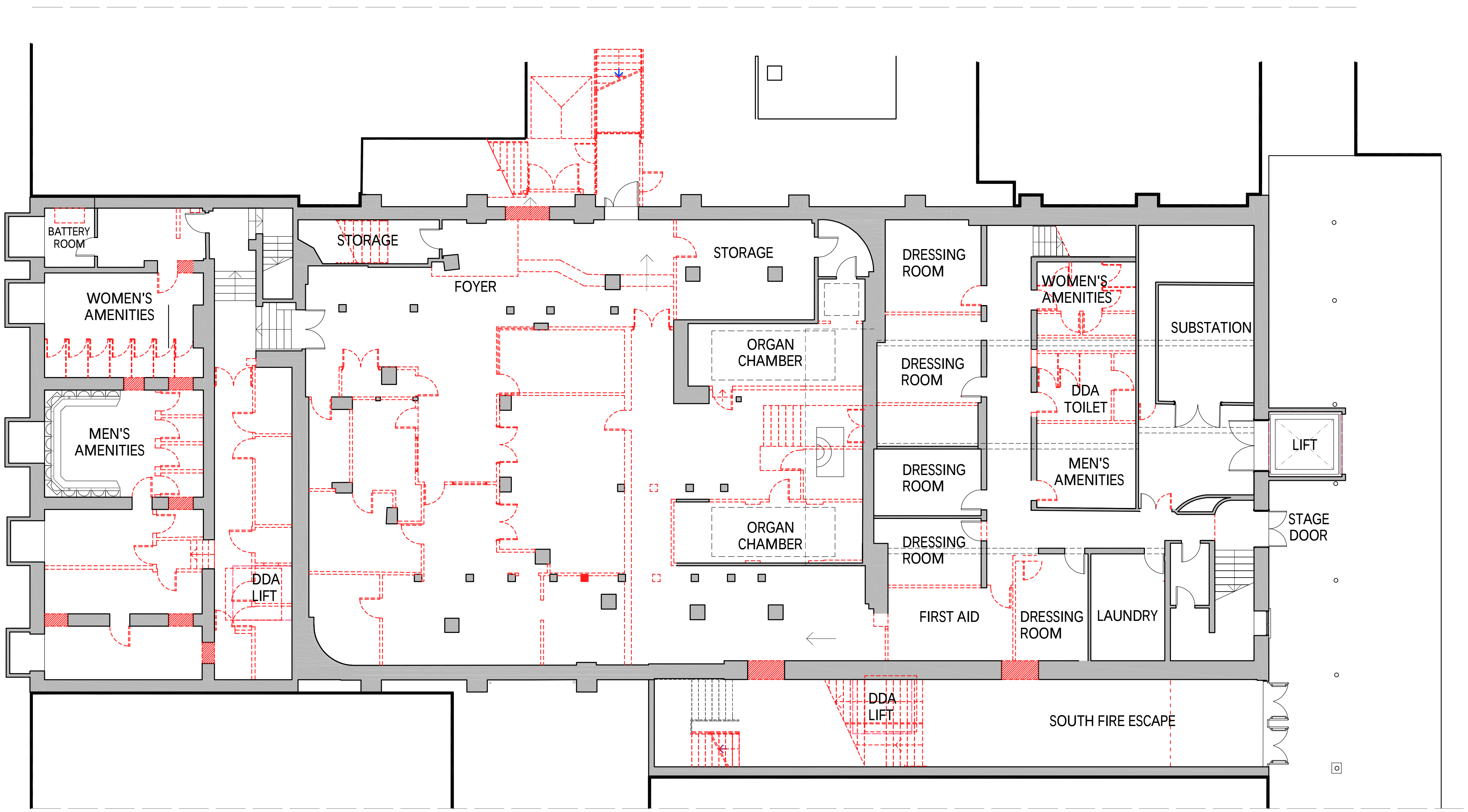
Stage 3B (Priority 2 Works) – date to be confirmed

- Compliant access system to rear wall of fly tower to install banners/temporary signage
- Damp treatment works to external walls along Lydiard Street
- New lift to back of house
- New administration offices fit out to B1
- Works to ceiling of auditorium
- Upgrade whole of mechanical plant system to auditorium
- Extension of stage to south
- Orchestra Pit thrust stage works including relocation of organ and upgrade to organ hoisting equipment
- Automated winches to fly system
- Additional Green Rooms
- Upgrade Long Room Bar
- Upgrade house lighting to auditorium (incl Chandeliers replacement)
- Upgrade stage area smoke exhaust system

APPENDIX A FEASIBILITY DRAWINGS PREPARED BY LOVELL CHEN

LEGEND:

---- TO DEMOLISH/DISMANTLE



01 -- BASEMENT 1 FLOOR PLAN
1:200

NOT FOR CONSTRUCTION

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SCALE 1:200 @ A3

NO.	DATE	REVISION
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P4	11/07/19	PRELIMINARY
P5	22/11/19	PRELIMINARY
P6	19/12/19	PRELIMINARY

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PROJECT
HER MAJESTY'S THEATRE BALLARAT FEASIBILITY STUDY

DRAWING TITLE
BASEMENT 1 - DEMOLITION FLOOR PLAN

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB /DT/KE/BM	AMT	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.01	P6

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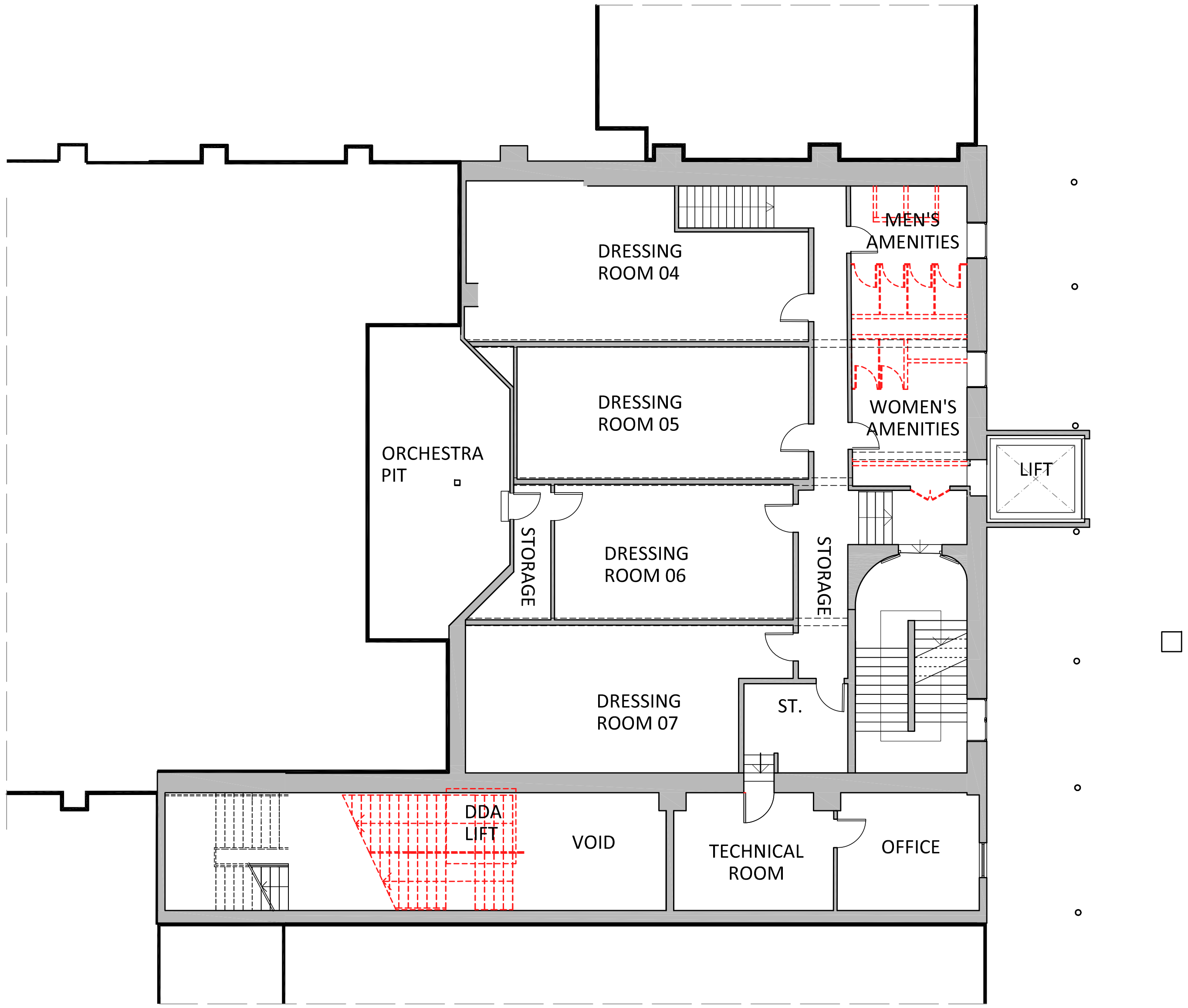
---- TO DEMOLISH/DISMANTLE



01 BASEMENT 2 FLOOR PLAN
-- 1:200

NOT FOR CONSTRUCTION

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SCALE 1:200 @ A3

NO.	DATE	REVISION
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P1	xx/11/18	PRELIMINARY
P3	13/06/19	PRELIMINARY
P4	11/07/19	PRELIMINARY
P5	22/11/19	PRELIMINARY
P6	19/12/19	PRELIMINARY

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PROJECT
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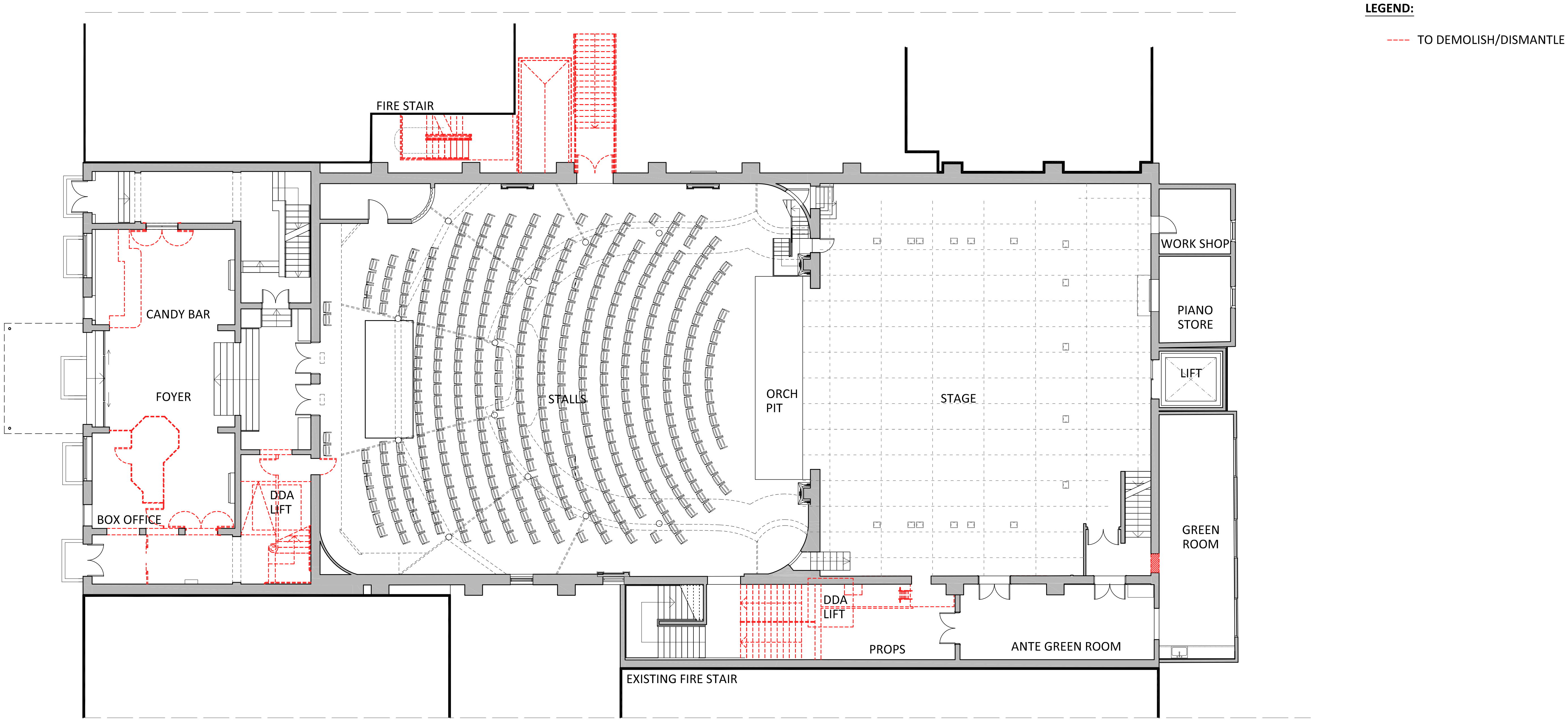
DRAWING TITLE
BASEMENT 2 - DEMOLITION
FLOOR PLAN

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB /DT/KE/BM	AMT	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.02	P6



01 GROUND FLOOR PLAN
-- 1:200

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
SCALE 1:200 @ A3

NO.	DATE	REVISION
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P1	xx/11/18	PRELIMINARY
P3	13/06/19	PRELIMINARY
P4	11/07/19	PRELIMINARY
P5	22/11/19	PRELIMINARY
P6	19/12/19	PRELIMINARY

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PROJECT
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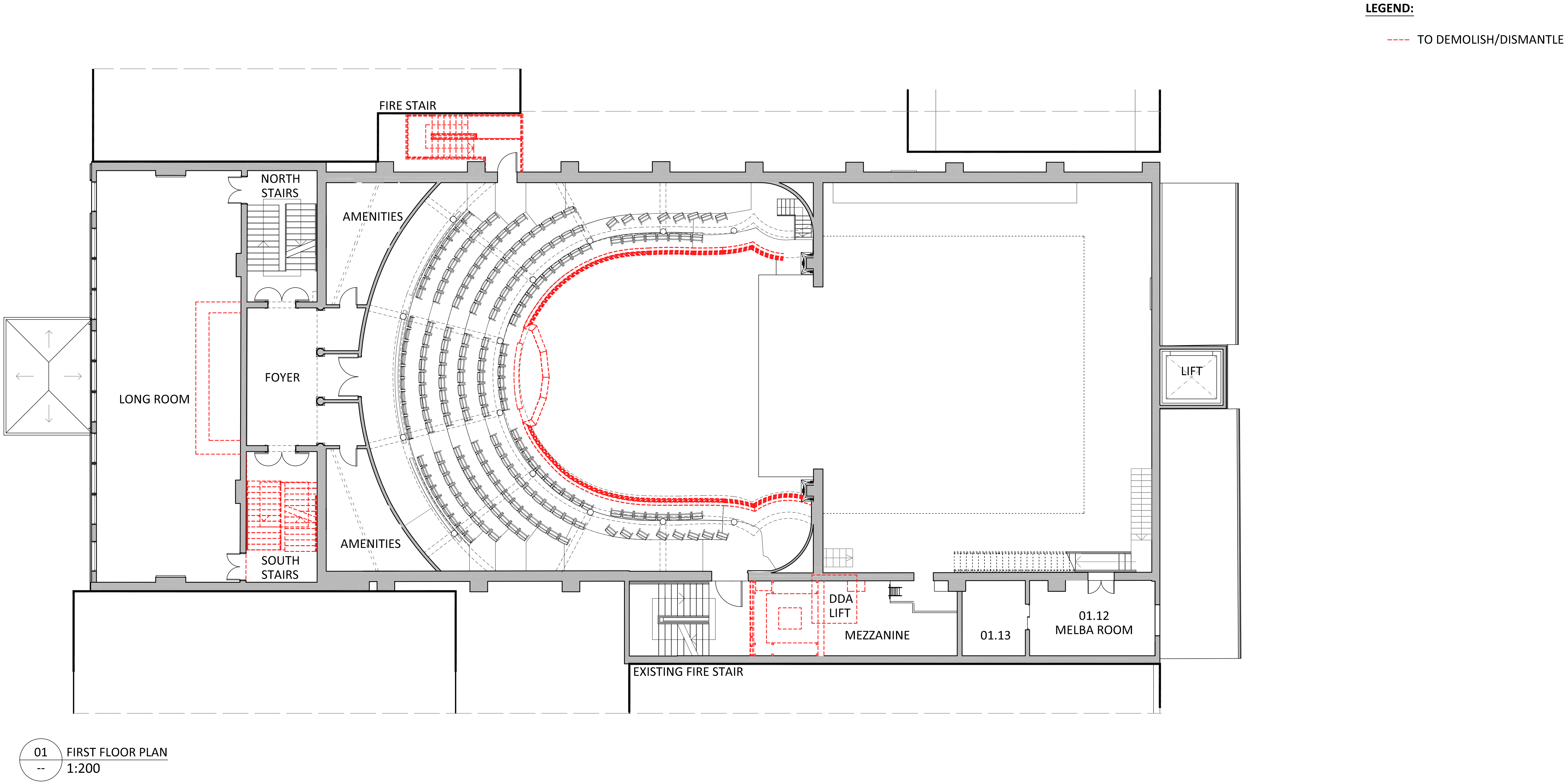
FEASIBILITY STUDY

DRAWING TITLE
GROUND FLOOR PLAN
DEMOLITION

DRAWN	CHECKED	PROJECT NO.	DATE	ISSUE	SCALE	DRAWING NO.	REVISION
CHL/MB /DT/KE/BM	AMT	7925	OCTOBER 2018	PRELIMINARY	1:200@A3	A.03	P6



01 FIRST FLOOR PLAN
-- 1:200

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
SCALE 1:200 @ A3

NO.	DATE	REVISION
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P1	xx/11/18	PRELIMINARY
P3	13/06/19	PRELIMINARY
P4	11/07/19	PRELIMINARY
P5	22/11/19	PRELIMINARY
P6	19/12/19	PRELIMINARY

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PROJECT
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BALLARAT
FEASIBILITY STUDY

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CHL/MB /DT/KE/BM	AMT	7925	OCTOBER 2018

DRAWING TITLE
FIRST FLOOR PLAN - DEMOLITION

ISSUE	SCALE	DRAWING NO.	REVISION
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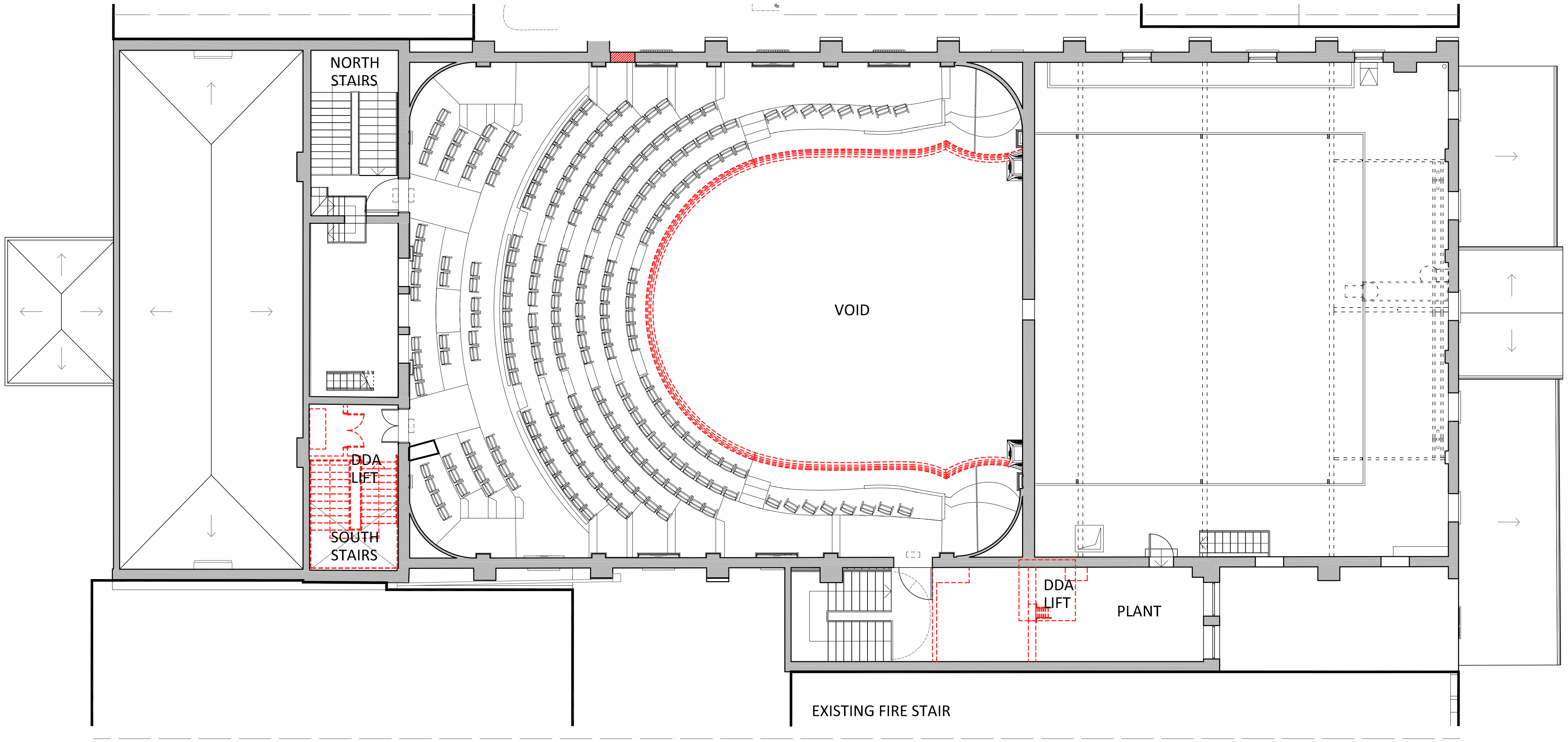

01 SECOND FLOOR PLAN
-- 1:200

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
SCALE 1:200 @ A3

NO.	DATE	REVISION
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P1	xx/11/18	PRELIMINARY
P3	13/06/19	PRELIMINARY
P4	11/07/19	PRELIMINARY
P5	22/11/19	PRELIMINARY
P6	19/12/19	PRELIMINARY

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PROJECT
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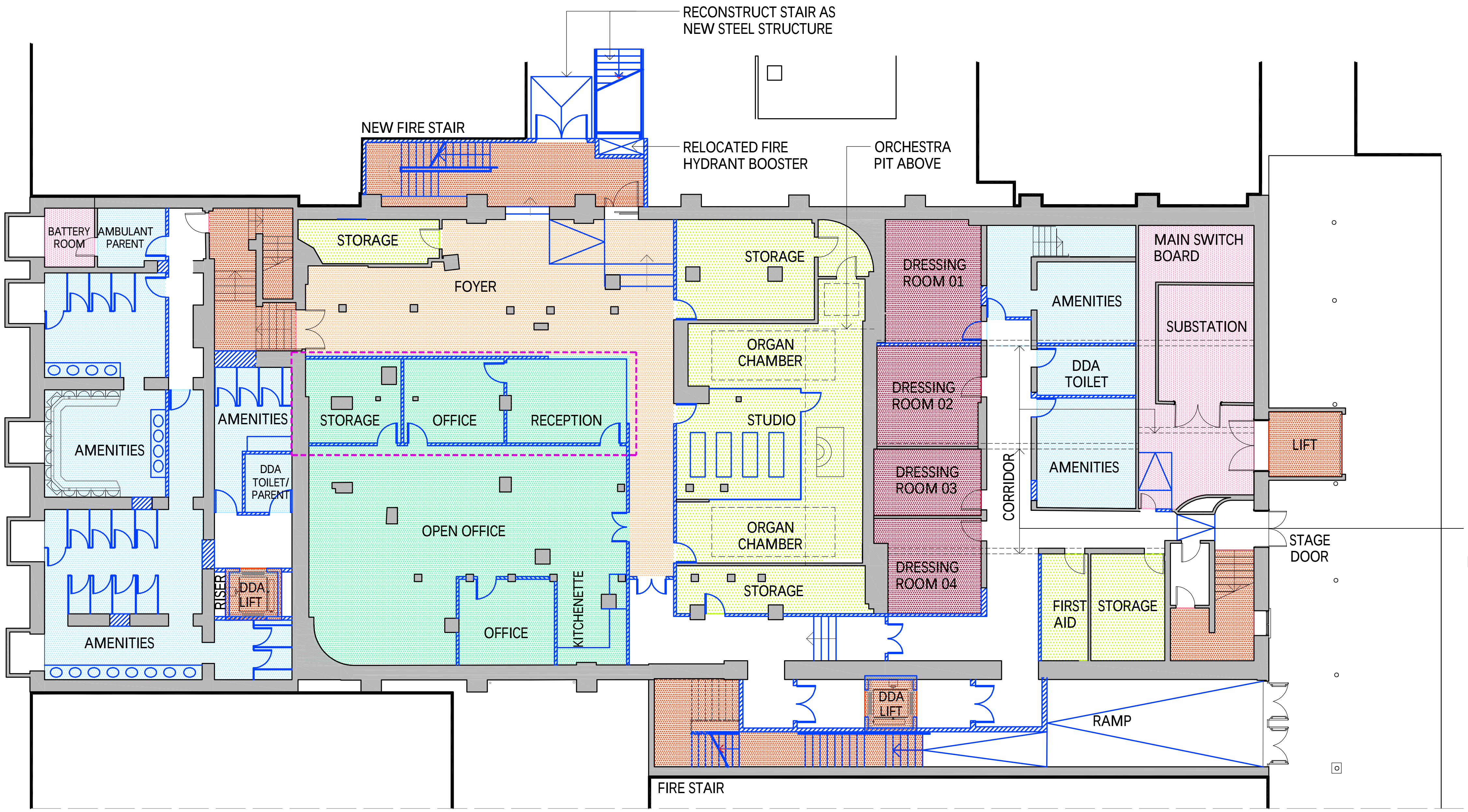
DRAWING TITLE
SECOND FLOOR PLAN
DEMOLITION

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB /DT/KE/BM	AMT	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.05	P6



LEGEND:

- ADMIN
- AMENITIES
- FOYER
- GREEN ROOMS
- TECHNICAL ROOMS
- STORAGE
- VERTICAL ACCESS
- DRESSING ROOMS
- TO DEMOLISH/DISMANTLE
- PROPOSED
- LONG ROOM
- ROYAL SOUTH STREET SOCIETY

01 BASEMENT 1 FLOOR PLAN
-- 1:200

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
SCALE 1:200 @ A3

NO.	DATE	REVISION
P3	13/06/19	PRELIMINARY
P4	11/07/19	PRELIMINARY
P5	22/11/19	PRELIMINARY
P6	19/12/19	PRELIMINARY

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PROJECT
HER MAJESTY'S THEATRE BALLARAT FEASIBILITY STUDY

DRAWING TITLE
PROPOSED BASEMENT 1 FLOOR PLAN

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB /DT/KE/BM	AMT	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
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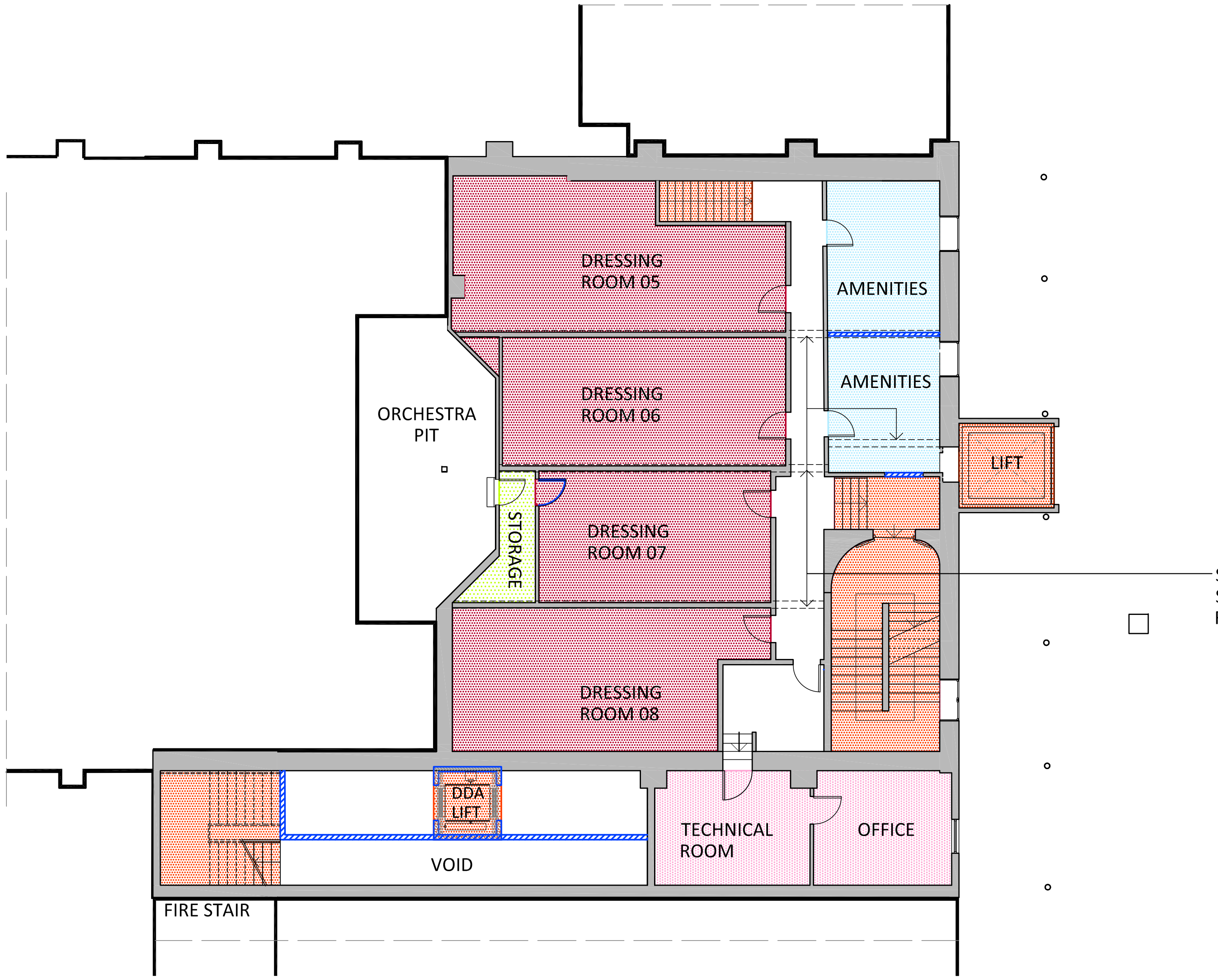

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- ADMIN
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- FOYER
- GREEN ROOMS
- TECHNICAL ROOMS
- STORAGE
- VERTICAL ACCESS
- DRESSING ROOMS
- TO DEMOLISH/DISMANTLE
- PROPOSED
- LONG ROOM
- ROYAL SOUTH STREET SOCIETY

01 BASEMENT 2 FLOOR PLAN
-- 1:200

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
SCALE 1:200 @ A3

NO.	DATE	REVISION
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PROJECT
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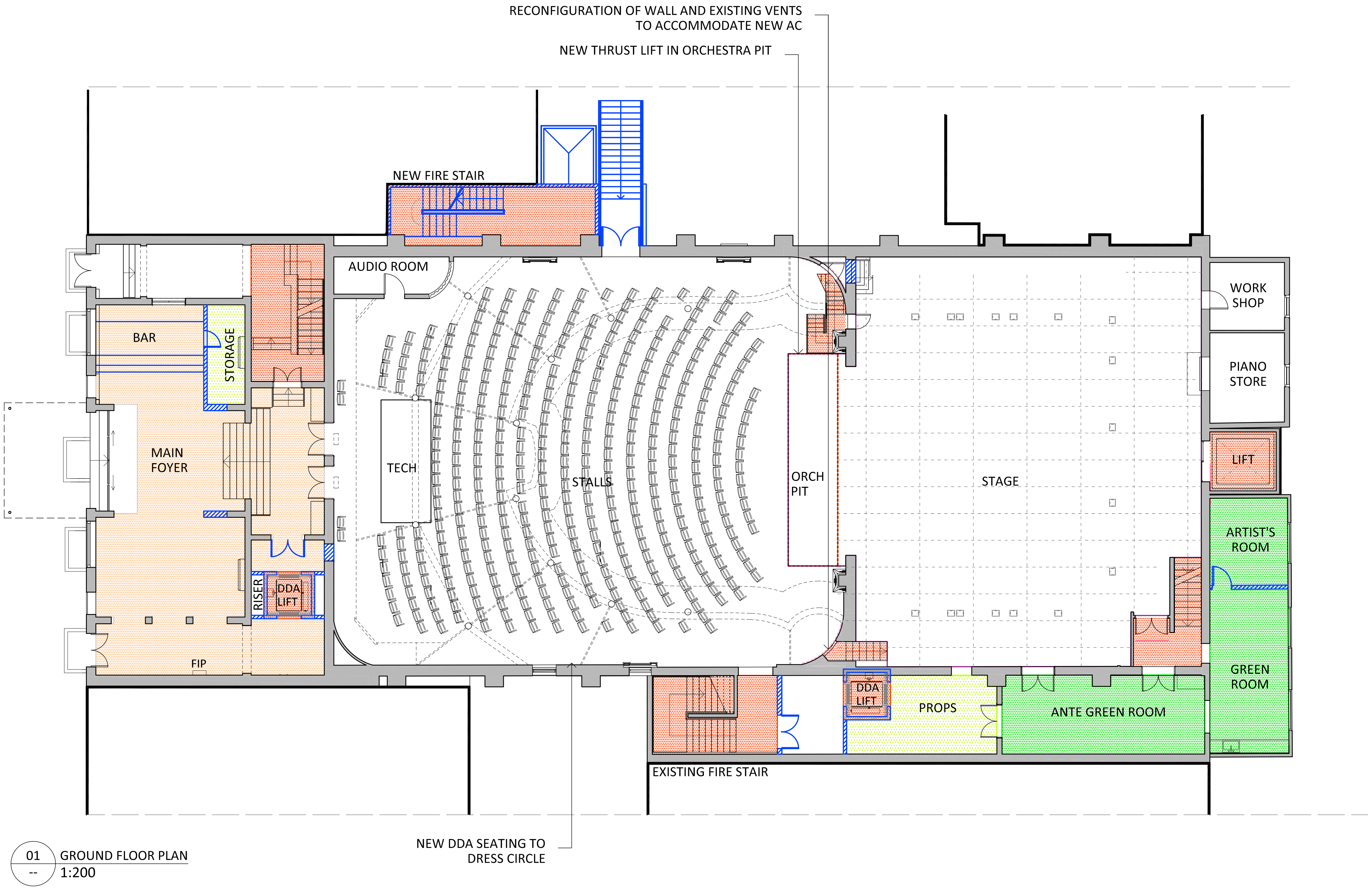
DRAWING TITLE
PROPOSED BASEMENT 2
FLOOR PLAN

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB /DT/KE/BM	AMT	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.08	P6



LEGEND:

- ADMIN
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- FOYER
- GREEN ROOMS
- TECHNICAL ROOMS
- STORAGE
- VERTICAL ACCESS
- DRESSING ROOMS
- TO DEMOLISH/DISMANTLE
- PROPOSED
- LONG ROOM
- ROYAL SOUTH STREET SOCIETY

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
SCALE 1:200 @ A3

NO.	DATE	REVISION
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PROJECT
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FEASIBILITY STUDY

DRAWING TITLE
PROPOSED GROUND FLOOR PLAN

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB /DT/KE/BM	AMT	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
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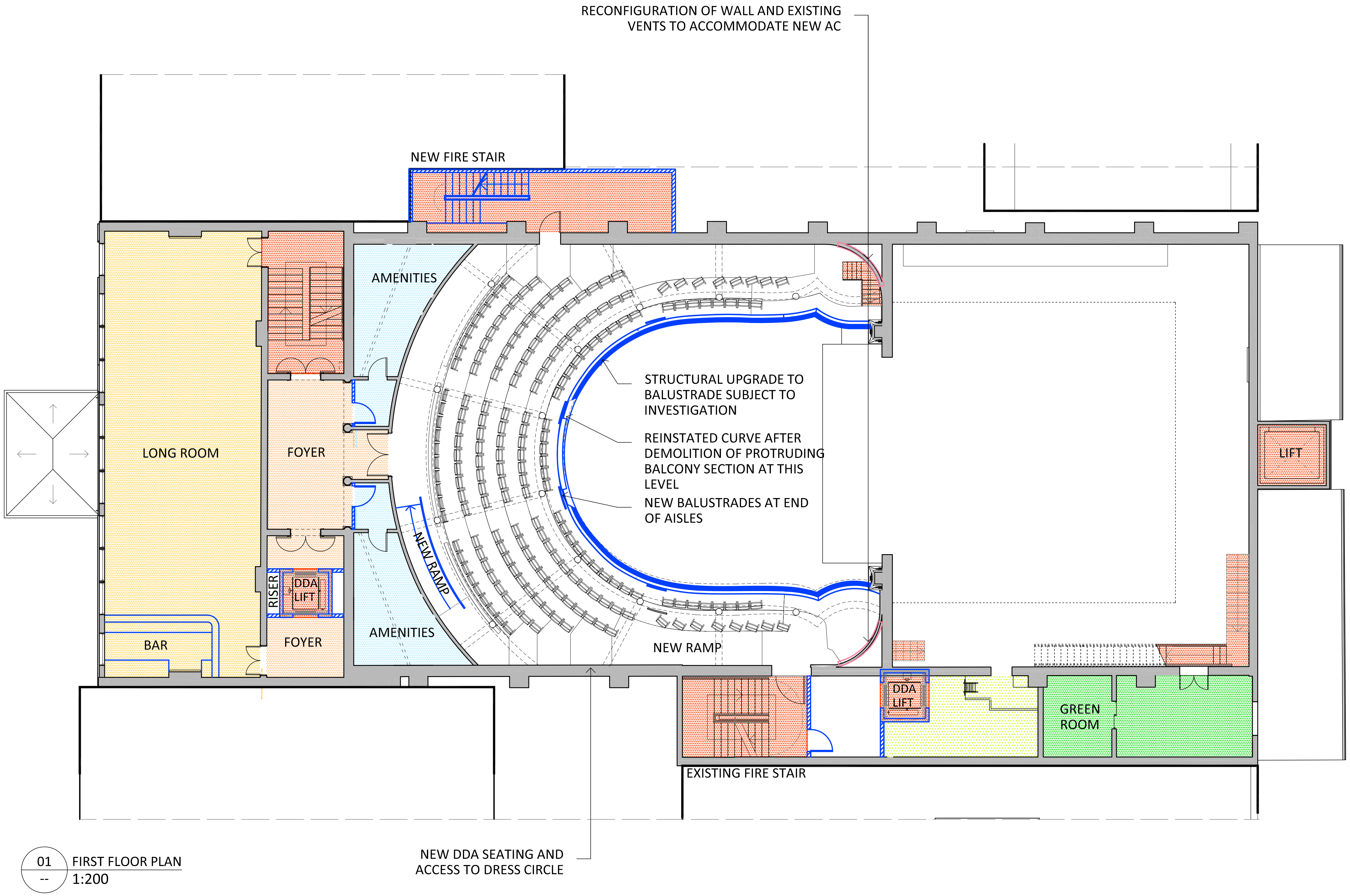

01 FIRST FLOOR PLAN
-- 1:200

LEGEND:

- ADMIN
- AMENITIES
- FOYER
- GREEN ROOMS
- TECHNICAL ROOMS
- STORAGE
- VERTICAL ACCESS
- DRESSING ROOMS
- TO DEMOLISH/DISMANTLE
- PROPOSED
- LONG ROOM
- ROYAL SOUTH STREET SOCIETY

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
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P6	19/12/19	PRELIMINARY

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DRAWING TITLE
PROPOSED FIRST FLOOR PLAN

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB /DT/KE/BM	AMT	7925	OCTOBER 2018

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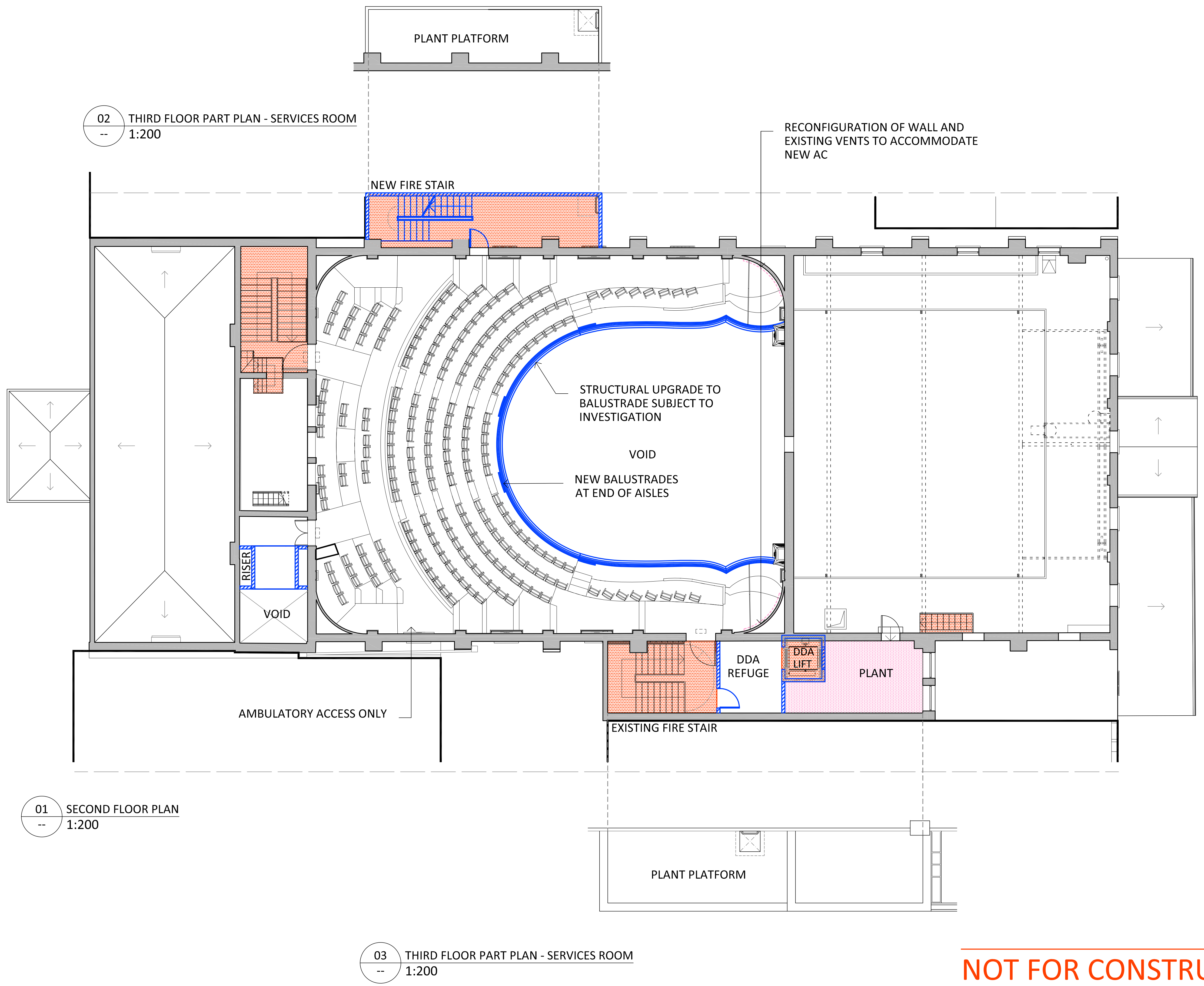
PRELIMINARY	1:200@A3	A.10	P6



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- ADMIN
- AMENITIES
- FOYER
- GREEN ROOMS
- TECHNICAL ROOMS
- STORAGE
- VERTICAL ACCESS
- DRESSING ROOMS
- TO DEMOLISH/DISMANTLE
- PROPOSED
- LONG ROOM
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NOT FOR CONSTRUCTION

0 2 4 6 8 10 M

SCALE 1:200 @ A3

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PROJECT
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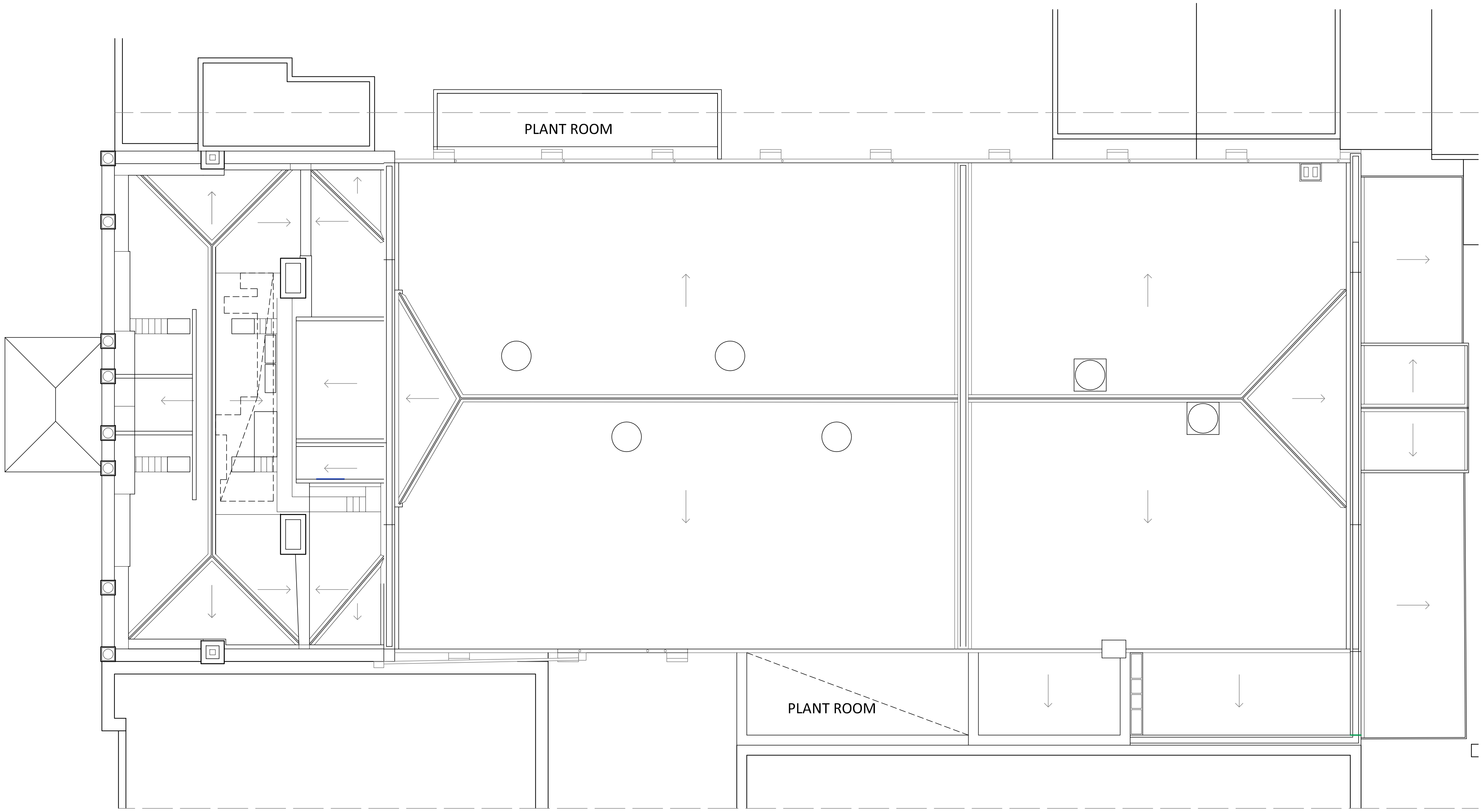
FEASIBILITY STUDY

DRAWING TITLE
PROPOSED SECOND FLOOR PLAN

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB /DT/KE/BM	AMT	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.11	P6



01 -- ROOF FLOOR PLAN 1:200

LEGEND:

- ADMIN
- AMENITIES
- FOYER
- GREEN ROOMS
- TECHNICAL ROOMS
- STORAGE
- VERTICAL ACCESS
- DRESSING ROOMS
- TO DEMOLISH/DISMANTLE
- PROPOSED
- LONG ROOM
- ROYAL SOUTH STREET SOCIETY

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
SCALE 1:200 @ A3

NO.	DATE	REVISION
P1	31/10/18	PRELIMINARY
P1	xx/11/18	PRELIMINARY
P3	13/06/19	PRELIMINARY
P4	11/07//19	PRELIMINARY
P5	22/11//19	PRELIMINARY
P6	19/12/19	PRELIMINARY

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PROJECT
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DRAWING TITLE
PROPOSED ROOF PLAN
AND SECTION

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB /DT/KE/BM	AMT	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.12	P6

APPENDIX B STRUCTURAL INVESTIGATIONS REPORT PREPARED BY MARK HODKINSON

24th February 2020

Ms Anne-Marie Treweeke
Lovell Chen Pty Ltd
Architects & Heritage Consultants
176 Wellington Street
East Melbourne 3002

Dear Anne-Marie,

Re : Stage 2 Feasibility Report
Her Majesty's Theatre
17 Lydiard Street South
Ballarat

We are writing to provide advice on the structural engineering aspects of the Stage 2 Feasibility Report for Her Majesty's Theatre (HMT) at 17 Lydiard Street South, Ballarat.

1 Introduction

From Lovell Chen Pty Ltd's report dated November 2018 we understand that the "*Stage 2 works will consist of a package of works associated with the design and investigation of the works to address balustrade heights in the dress circle and balcony, mechanical upgrades, upgrades to the long room, upgrades to the fly system and other minor works.*"

We are very familiar with the construction of HMT, having carried out an inspection of the roof structure in December 2017, and then the engineering design and documentation, and construction stage services of the structural component of the recently completed Stage 1 works.

2 Compliance Issues

Our comments that pertain to the Hendry Group Pty Ltd, Building Surveyors, (HGPL) Feasibility Consultancy Report dated June 2019 and the City of Ballarat's (CoB) queries follow :-

2.1 Seismic Solution

Section 5.2.10 of the HGPL report states "*consideration should potentially be given* *to a seismic solution that is formulated to AS3826-1998 Strengthening existing buildings for earthquake via a Performance Solution approach since compliance with AS1170.4 for a building like this is expected to be difficult".*

As the building does not comply with the 'Deemed-to-Satisfy Requirements' of *AS3826 – Strengthening existing buildings for earthquake,* the 'main' seismic standard *AS1170.4 – Structural Design Actions Part 4 : Earthquake actions in Australia* needs to be used to determine the seismic loadings. Section 2.2 of AS1170.4 specifies Earthquake Design Categories (EDC) for buildings which are partly a function of the site geology, and for HMT the EDC is likely to be either II or III. Section 2.4 of AS3826 states that the threshold loadings for EDCs of II and III are respectively one-third and two-thirds of the loads specified by AS1170.4. Given that the building is constructed from unreinforced brickwork, steel frames would need to be installed to stiffen the walls and ceilings, or the walls would need to be post-tensioned to new concrete footings, or a combination of both would be required. Clearly these options would be extremely onerous and have a significant impact on the fabric of the building. It should be noted that tying the roof and floor structures to the walls would improve the seismic performance of the building.

2.2 Loading Capacity of the Auditorium, Stalls and Balconies

The CoB has queried the live load capacity of the auditorium, stalls and balcony structures.

Section 3.4 of *AS1170.1 – Structural Design Actions Part 1 : Permanent, imposed and other actions* specifies that "areas with fixed seats" such as Auditoria be capable of sustaining a uniformly distributed live load of 4.0 kPa (408 kg/m2) or a concentrated live load of 2.7 kN (275 kg) (ie a type C2 loading). From our superficial inspection of the auditorium it would seem that the Ground Floor is constructed from timber joists, timber beams and timber posts. The two balcony levels appear to be constructed from steel beams, timber joists and cast iron (CI) columns. In order to determine the Live Load capacity of the floor structures the structures would need to be exposed at representative locations to enable the structures to be analysed. Please note that we would not recommend the use of non-exploratory type techniques.

2.3 Loading Capacity of Stage

As part of the Stage 1 Works the structure of the stage was strengthened in order to achieve a C5 type uniformly distributed live load capacity of 7.5 kPa (765 kg/m2) or a concentrated live load capacity of 4.5 kN (459 kg) in accordance *AS1170.1 – Structural Design Actions Part 1 : Permanent, imposed and other actions.* Any future works to the basement levels below the stage should be cognisant of the structure of the stage that bears on the walls and concrete slabs of the basement levels.

2.4 Loading Capacity of Fly Galleries

The live load capacity of the Fly Galleries was not investigated as part of the Stage

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Email mail@mhpl.net.au ABN 62 052 959 912

1 Works. It is our understanding that HMT adheres to the loadings prescribed in 1999 by Meinhardt Consulting Engineers, when they were the Structural Engineers for the then major works to the Theatre.

2.5 Loading Capacity of Fly Grid and Fly System

The live load capacity of the Fly Grid and Fly System was not investigated as part of the Stage 1 Works. We have now been engaged to investigate same.

2.6 Loading Capacity of Other Areas of the Theatre

If ultimately the Building Surveyor requires that the floor structures of the other areas of the Theatre need to comply with *AS1170.1 – Structural Design Actions Part 1 : Permanent, imposed and other actions* then a comprehensive investigation and analysis of the existing construction will need to be undertaken at the Stage 2 design and documentation stage,

2.7 Balustrades to the Dress Circle and Balcony

Section 5.2.13 of the HGPL report states *"the requirement for the balustrades to meet crowd loading requirements would need to be considered in more detail"*.

Section 3.6 of *AS1170.1 – Structural Design Actions Part 1 : Permanent, imposed and other actions* specifies that balconies in "areas susceptible to over-crowding" such as theatres be capable of withstanding "crush" loadings which includes a horizontal loading of 3.0 kN/m (306 kg/m) (C5 loading). The existing balustrades would need to be analysed in order to determine their compliance with a C5 loading, and as per the floor loadings the balcony structure will need to be exposed to enable this to occur. *Prima facie* it is unlikely that the existing structure would comply with a C5 loading.

2.8 Handrails

Similarly to the balconies, the various handrail constructions will need to be investigated in order to ascertain if they comply with the loading requirements of Section 3.6 of *AS1170.1 – Structural Design Actions Part 1 : Permanent, imposed and other actions,* noting that the minimum Live Loading is a function of the location of the handrail.

2.9 Compliance of the Existing Structure

It is our understanding that the existing structure would only need to comply with Section 2 of the BCA if required by the Building Surveyor.

3 Proposed Structural Works

Our comments that pertain to the proposed works that have a significant structural engineering component follow :-

3.1 New Lift Installations

It is proposed to install commercial DDA passenger lifts in the Foyer and in the Backstage area at the southern side of the building. Simpson Kotzman's Building Services Report dated 30th June 2019 states that both of these lifts will "*require lift pits and top over runs*". Whilst the depths of the lift pits is unknown at this time it is possible that they will be founded at depths greater than 1.5 m below the lowest floor levels. As such the existing footings adjacent to the proposed lift pits will need to be investigated in order to determine if the existing footings need to be locally underpinned and/or the existing footing outstands need to be locally demolished. It is also probable that the lift shafts will need to be designed for the loadings from the lift car rails, the floor loadings, the roof loadings, and the top overun loadings.

3.2 Basement B1 Alterations

The blockwork walls of the Basement B1 Dressing Rooms and the Women's and Men's Amenities are load bearing and support the c1960's reinforced concrete Basement B2 floor slab. The steel columns that were installed as part of the Stage 1 works to support the Stage floor steel beams bear on a number of the Basement B1 blockwork walls. Therefore prior to the demolition of the blockwork walls it may be necessary to install new structure to support the loads from the Basement B2 and the Stage floors, and this structure may include concrete footings and steelwork beams and columns.

3.3 Removal of the Adjudicators' Box

The structural support for the Adjudicators' Box has been welded to the balcony steelwork and therefore will be able to be removed.

3.4 External Stair to Unicorn Lane

We investigated the construction of the Unicorn Lane stair as part of the Stage 1 works and determined that it does not comply with Section 3.4 of *AS1170.1 – Structural Design Actions Part 1 : Permanent, imposed and other actions*. Subject to the findings of a future Geotechnical Engineering Investigation it may be necessary to construct the footings for the new stairwell structure off piles founded on rock, in order to eliminate future differential movement between the northern wall of the Auditorium and the new stair well structure.

3.5 Eastern Green Room Additions

It is proposed to construct an additional floor above the Green Room that is located on the outside of the eastern wall of the Fly Tower, and to extend the existing lift to that new floor level. The existing Green Room structure is supported from a series of very tall columns supported off pad footings. The existing structures will need to be investigated for the proposed additional loadings, and the structure may need to be strengthened for the proposed new loadings and for seismic loadings.

3.6 Upper Balcony Re-Set

The upper balcony appears to be constructed from steel beams, timber joists and cast iron (CI) columns and to re-set the balcony to address the sight lines would most probably require the replacement of the existing structure.

3.7 'Minor' Structural Brickwork Wall Demolition

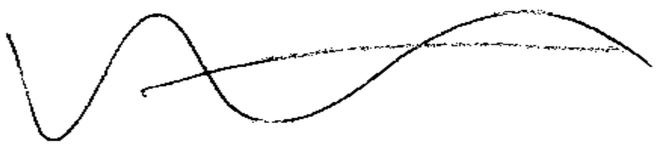
Where it is proposed to demolish 'minor' structural brickwork walls it may be necessary to install steel portal frames to replace the bracing effect that the walls have on the abutting wall.

4 Conclusion

We trust that the above is explanatory enough for your purposes and please do not hesitate to contact us on 9381 1239 or 0417 36 34 32 if you have any queries or require further information.

Yours faithfully,

Mark Hodkinson Pty Ltd



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3546/24022020

APPENDIX C DIVISION 6 HAZARDOUS MATERIALS REPORT PREPARED BY HAZARD ALERT

Asbestos Pre-Demolition (Division 6) and Hazardous Materials Survey Report for the City of Ballarat

Her Majesty's Theatre
17 Lydiard Street South, Ballarat

Site work and report by: Arthur Moutafis & George Brdar
Report checked by: Liam Jerinic

Contract No.: 6388

May & June 2018

Revision 1

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CONTENTS

EXECUTIVE SUMMARY

An asbestos and hazardous materials survey and risk assessment was conducted by Hazard Alert for City of Ballarat at Her Majesty's Theatre, 17 Lydiard Street Ballarat. The site audit was conducted on the 24th of May and the 18th of June, 2018. Lead testing on painted surfaces was conducted on Wednesday 17th July 2018. This Revision 1 document includes lead testing results.

This asbestos survey and risk assessment audit and report complies with the requirements of the Victorian Occupational Health & Safety Regulations 2017, Part 4.4 Asbestos - Division 6 and Part 4.3 Lead.

All accessible areas of the nominated refurbishment work areas were subject to inspection for the presence of asbestos containing materials (ACM) and other hazardous materials such as, lead, silica, polychlorinated biphenyls (PCB) and synthetic mineral fibres.

The survey report contains the asbestos register, an assessment of risk associated with the identified asbestos containing materials and the laboratory sample analysis report.

Please note that this report must be supplied in full to third parties such as asbestos removalist, demolition contractor, project manager etc. Interested parties must ensure that they review the whole report, not just the asbestos register.

The following asbestos containing materials were identified during this audit and are listed here according to the risk they pose and the class of asbestos removalist required to remove the asbestos containing materials.

RISK A – FRIABLE ASBESTOS CONTAINING MATERIALS

Friable ACM that may be disturbed therefore must be removed prior to demolition / construction works by a Class A licenced asbestos removalist.

- None identified

RISK B - NON-FRIABLE ASBESTOS CONTAINING MATERIALS

Non-friable ACM that are present and must be removed by either a Class A or Class B asbestos removalist prior to the commencement of demolition / construction works.

Sub-Basement

- Drum room has fibro cement loose sheeting against wall
- Store 5 has a Zelemite switchboard
- Switch room has wrapped asbestos labelled item
- Male WC 2 has fibro cement urinal surround

Basement

- Auditorium fire escape has fibro cement infill panels above exit doors

Externals

- Auditorium fire escape has fibro cement infill panels above exit doors

RISK C – AREA INACCESSIBLE

Material, area or structure not accessed and potentially may contain asbestos. Further investigations and testing required prior to demolition.

Sub-Basement

- Lift motor room lift motor internals
- Store 5 zelemite switchboard box internals
- Switch room metal switchboard internals
- High voltage switchroom

RISK C – AREA INACCESSIBLE

Sub-Basement
- Male WC 2 urinal base under ceramic tiles
- Male WC 2 shower base under ceramic tiles
- Male WC 2 shower surround behind ceramic tiles
- Female WC 2 shower base under ceramic tiles
- Female WC 2 shower surround behind ceramic tiles

Basement
- Dressing rooms 1, 2, 3, 4, 5 & 6 splashbacks behind ceramic tiles
- Male WC 3 urinal base and surround behind ceramic tiles
- Male WC 3 shower surround and base behind ceramic tiles
- Male WC 3 splashback behind ceramic tiles
- Female WC 3 shower surround and base behind ceramic tiles
- Female WC 3 splashback behind ceramic tiles

Stalls
- North and south exits floor under ceramic tiles
- North and south exits ceiling behind pressed metal

Dress circle
- Foyer upper ceiling
- Foyer skylight surrounds
- Male toilet splashback behind ceramic tiles
- Male toilet urinal surround behind ceramic tiles
- Female toilet splashback behind ceramic tiles

Balcony
- Plant room pipe lagging (SMF and styro foam where checked)

Throughout
- Fire door internals

Externals
- Roof area

OTHER HAZARDOUS MATERIALS IDENTIFIED

- Crystalline silica(may be generated from tile, brick or concrete cutting, grinding or crushing)
- Synthetic mineral fiber insulation
- Radiation source (within smoke alarms)
- Lead (containing paint and potentially lead flashing)

If this building is to undergo demolition/refurbishment all asbestos and other hazardous containing materials must be removed before any demolition works commence, to minimise any exposure to workers.

TERMS AND DEFINITIONS

Asbestos	The name given to a group of fibrous, rock forming, silicate minerals which occur naturally in the environment. Asbestos was used in many building materials before the early 1980s because of its durability, fire resistance and insulating properties. It belongs to the serpentine and amphibole groups of rock-forming minerals, including Actinolite, Amosite (brown asbestos), Crocidolite (blue asbestos), Chrysotile (white), tremolite, or any mixture of these.
AC	Asbestos Cement – A composite of asbestos fibre bound by cement material usually produced in the form of flat or moulded (i.e. corrugated) sheets. AC sheet generally contains chrysotile asbestos. Common applications include wall linings, guttering, downpipes, exhaust flues, ceramic tile backing, fusebox linings, moulded pits and shower recesses.
ACM	Asbestos Containing Material – an item, product or material that contains asbestos fibres.
Carcinogen	An agent which is responsible for the formation of a cancer.
Category A Asbestos Removalists	"A" Class Licensed asbestos removalists can be used to remove all forms of asbestos materials (both friable and non-friable asbestos containing materials).
Category B Asbestos Removalists	"B" Class Licensed asbestos removalists can only be used for removal of non-friable asbestos materials.
Friable asbestos	Any asbestos-containing material that can be crumbled, pulverised or reduced to powder by hand when dry (unlike non-friable materials such as asbestos cement or Zelemite).
Non-friable (bonded)	Asbestos containing material where the asbestos fibres are well encapsulated / bonded in a solid matrix such as concrete, cement, vinyl, resin, bitumen / tar etc. Non-friable asbestos products do not release significant amounts of fibre into the atmosphere under normal conditions, when the material is in good condition. The asbestos fibres in these matrices are normally well bound into the solid matrix, and are usually only released as atmospheric fibres when the material is physically disturbed (eg. by cutting, sawing, sanding, drilling or grinding).
Hazard	Any substance, product, process or situation with the potential to harm life, health or property.
HEPA	High Efficiency Particle Attenuation: Terminology applied typically to vacuum cleaners that are capable of capturing the finest of particles and fibres, including asbestos fibres. Fine dust and fibres may pass through the collection system of normal vacuum cleaners.
Lead and Lead paint	A heavy non-ferrous metal: exposure may cause blood poisoning and biological disturbance. May be found in paint (painted surfaces). Lead paint is defined as 'A paint film that contains greater than 0.1% lead by mass in the dry film'.
PACM	Presumed asbestos containing material.
Risk	The likelihood of injury, illness or disease arising from exposure to any hazard.
Risk A	Asbestos that is friable, either exposed or contained (sealed) and must only be removed by Class A Licensed Asbestos Removalist.
Risk B	Asbestos that is non-friable, either exposed or contained and can be removed by either a Class A or Class B Licensed Asbestos Removalist.
Risk C	Material, area or structure not accessed and potentially may contain asbestos. Further investigations and testing required prior to demolition.
SMF	Synthetic Mineral Fibre (Fibreglass, Rockwool, Ceramic fibre, etc) which may cause skin, respiratory system, eye irritation, and is a suspected carcinogen.
Zelemite	An asbestos-reinforced, black, phenolic material with excellent thermal and electrical properties used as an electrical switchboard backing board.

1 INTRODUCTION

A pre-demolition / refurbishment asbestos and hazardous materials survey and risk assessment was conducted by Hazard Alert for City of Ballarat at Her Majesty's Theatre, 17 Lydiard Street Ballarat over a 2 day, non-consecutive period on the 24th of May and 18th of June 2018.

This asbestos and hazardous materials survey report complies with the Victorian Occupational Health & Safety Regulations 2017,

- Part 4.4 Asbestos - D*ivision 6 Demolition & Refurbishment where asbestos is present*
- Part 4.3 Lead

The report incorporates the identification of asbestos, the site asbestos register, risk assessment, conclusions and control recommendations. A copy of this report must be made available under the circumstances detailed in Part 4.4 - *Regulation 243.*

The aim of this asbestos and other hazardous materials survey was to:

1. Assess the buildings that will be affected by refurbishment/demolition works for the presence of asbestos containing materials (ACM);
2. Identify, as far as is practicable, the type, location and friability of any ACM found;
3. Identify the presence of other hazardous materials, assess the risk to site personnel and to those involved in building works;
4. Assess the risks associated with the presence of any identified ACM;
5. Determine the class of licensed asbestos removalist most suitable to remove the ACM;
6. Make recommendations to ensure any risks identified are mitigated or reduced as far as is practicable; and
7. Develop an Asbestos Register which includes: (1) all ACM found in the area to be demolished, and (2) details of inaccessible areas that are likely to contain asbestos.

Division 6 in *Part 4.4* of the Regulations must be complied with when any ACM are disturbed or removed; such as during renovations or demolition works. City of Ballarat must:

- Provide a copy of the asbestos audit report to contractors and asbestos removalist working on the site;
- Engage the hygienist or other competent person to provide independent advise and hygiene services (air monitoring, asbestos clearances etc) during asbestos removal works;
- Inform all employees of any asbestos removal works to be undertaken on the site prior to the removal works commencing;
- Inform other employers, contractors and neighbouring properties of asbestos removal works to be undertaken on the site that may affect them;
- Retain all documents associated with any asbestos removal, repair or clean-up work (air monitoring reports, clearance reports and disposal records) on file with this report
- Forward all air monitoring results and asbestos clearance certificates to the licensed asbestos removalist who was engaged to undertake works on the site.

For further advice on asbestos exposure risk management or any element of this report, please contact our office.

2 SCOPE OF WORK

The scope of work for this assessment was to locate, identify, assess the risk, document and recommend risk control measures for asbestos-containing materials and other hazardous materials located in the proposed refurbishment/demolition areas of Her Majesty's Theatre, Ballarat.

This report covers internals and most externals (apart from roof area) of the theatre as well as the basement and sub-basement areas.

Site maps are provided in ATTACHMENT B of this report.

3 METHODOLOGY

A walk through inspection of the site was initially carried out by the consultant prior to commencing the audit in order to become familiar with the site layout, determine whether safe access could be gained into all spaces that require auditing.

Asbestos

Hand tools are used to remove a small section of the suspect asbestos material from inconspicuous areas. The sample is then placed in a uniquely numbered plastic snap-lock bag, securely sealed and the details are recorded on the sample register.

Preliminary examination of each sample is by Stereo Microscope and where necessary to assist with material identification, samples are submitted for Bulk Sample Analysis to LRM Global laboratory who is accredited by NATA (National Association of Testing Authorities) to undertake the asbestos identification testing. The laboratory sample analysis is by polarised light microscopy / dispersion staining and is in accordance with AS 4964-2004 *Method for qualitative identification of asbestos in bulk samples.* Refer to **Attachment A** in this report for the Laboratory Asbestos Identification Report.

Lead Containing Paints

Selected representative painted surfaces on doors, window frames, skirting / architraves, balustrades and walls were positively identified for the presence of lead and the percentage of lead measured by laboratory analysis. Samples were delivered to Eurofins laboratory at 2 Kingston Town Close, Oakleigh for analysis.

AS 4361.2 – 2017 *Guide to Lead Paint Management Part 2 – Residential and Commercial Buildings* defines lead paint as 'A paint film that contains greater than 0.1% lead by mass in the dry film'.

Paints manufactured since 1997 contain less than 0.1% of lead by mass, and this limit has been adopted for the definition of lead-containing paint in the updated Australian Standard.

Synthetic Mineral Fibre (SMF)

Ceiling spaces and wall voids were assessed visually where possible for the presence of synthetic mineral fibre insulation materials. Not all spaces could be inspected to determine whether SMF was present.

Polychlorinated Biphenols (PCBs)

PCBs potentially present in fluorescent light fittings, electrical fans and other electrical equipment could not be accessed during the current survey due to electrical hazard and height safety hazards, posing a health risk. When safe access does become available, capacitors can be removed with caution and referenced against the *ANZECC Identification of PCB containing capacitor Information Booklet 1997.* This booklet lists all capacitors up to that date manufactured with and without PCBs.

Any original aluminium cased capacitors in fluorescent light fittings which are located or stored in inaccessible locations should be assumed to contain PCB's unless it is known that the original fittings have been replaced during refurbishment works.

Radiation

Some domestic smoke alarms use the radiation from a small amount of radioactive material to detect smoke or heat sources. The radiation dose to the occupants of a house from these smoke alarms is very small and does not pose a health risk. At a distance of one metre the radiation is less than one thousandth of that from background radiation, which in Australia is on average 2 millisievert per year. At greater distances, the dose rate is much lower.

Smoke alarms should be tested annually by an electrician or smoke alarm tester, to have the battery replaced and to ensure they are performing correctly.

Regarding the disposal of smoke detectors containing a small amount of radioactivity, the Radiological Council has recommended that the disposal of individual or small numbers of smoke detectors be conducted via normal domestic rubbish.

If there a large number (say more than 10) of smoke detectors to dispose of, or if they are the older industrial type, they must be disposed of by an authorised authority.

4 LIMITATIONS

This report has been produced for the sole use of City of Ballarat and contracted asbestos removalist and other trades shall not be relied upon by any other third parties without authorisation from Hazard Alert.

This report shall be read in its entirety and shall not be reproduced except in full.

All physically accessible areas within the scope of works were inspected for asbestos materials as far as practicable and without causing unacceptable damage to the building. Areas that could not be accessed include some ceiling spaces, wall cavities and sub floors. In addition to areas that were not accessible, the possible presence of asbestos in materials or locations may not have been assessed as:

- access to the area was not granted by the client/tenant or was otherwise not possible.
- damage to some areas was deemed unacceptable by the client. These areas include, but are not limited to; behind/under ceramic tiles, behind laminated timber splashbacks and mirrors. Such areas have been labelled as unknown and are to be treated as having presumed ACM as per client.
- access to the area was considered to present an unacceptable health and safety risk to the consultant undertaking the audit; and
- the nature, extent and physical location of some materials was not considered practicable to fully assess. These include materials such as mastics, paints, sealants and adhesives.

Representative samples of suspect materials were collected for analysis. Some asbestos materials may be present within wall cavities, ceiling spaces, sub floors and below ground and may only be exposed during full access, when equipment is fully isolated, during more destructive inspections or during excavation works. Such materials may include AC linings, malthoid waterproofing membranes, AC storm water and sewer pipes, telecom pits, floor coverings covered by subsequent layers, asbestos materials within roof and wall cavities and buried waste.

Certain materials may be classified and included in the asbestos register based on our professional judgement, including current information available and visual inspection.

Any products that are suspected to contain asbestos must be classified as "Presumed YES" for ACM until laboratory analysis proves otherwise, unless the product is "known to contain asbestos" such as Zelemite and Tilux products. ***Where no access is gained it is to be deemed that asbestos is present unless otherwise confirmed as per the requirements of the Occupational Health and Safety Regulations 2017, Part 4.4 Asbestos***.

5 ASBESTOS MATERIALS AND ASSOCIATED RISKS

Asbestos fibres found within asbestos containing materials (ACM) and identified during analysis (as shown in the laboratory analytical report – Attachment A) may be reported as follows:-

- Chrysotile (white asbestos fibres)
- Amosite (brown asbestos fibres)
- Crocidolite (blue asbestos fibres)

ACMs may contain one fibre type, two fibre types (in any combination) or all three fibre types.

ACMs can be classified into two main groups, friable and non-friable.

ACMs considered to be friable can be crumbled, pulverised or reduced to powder by hand pressure when dry. Friable ACMs are considered higher risk materials as they are more readily damaged, and thus have a greater potential to release fibres into the air.

All other ACMs are considered to be non-friable and are generally considered to be 'low' risk if properly handled. Non-friable ACMs are bound in a matrix such as cement (e.g. cement sheeting) or various resin/binders (e.g. vinyl floor tiles).

The use of all forms of asbestos has been banned in Australia since 31 December 2003. Manufacture and importation of asbestos fibro cement products had ceased by the early 1990s, however some buildings built since then may have used fibro cement that contained asbestos.

Since the end of 2003, the import, export, manufacture, supply, sale, use or reuse of asbestos and asbestos-containing products is no longer permitted. The ban doesn't apply to asbestos installed prior to this date (eg in residential or commercial buildings). There is currently no requirement for asbestos containing materials to be removed if they are in a good condition, unless the ACM is likely to be disturbed during maintenance, refurbishment, renovation, demolition or other building works in which case the ACM must be removed prior to such works being undertaken.

Some countries also still manufacture building products that contain asbestos, and classify the goods as "asbestos free" even though they contain a small proportion of asbestos. This has led to ACM being inadvertently and unknowingly imported in a range of building products across Australia. An example is in Western Australia in July 2016 asbestos was found in composite roof panels at the new Perth Children's Hospital. The roof panels were imported from China and classified as "asbestos free", but testing by a National Association of Testing Authorities (NATA) accredited laboratory in Australia found they contained chrysotile (white) asbestos.

5.1 Risk Assessment

When considering the hazards associated with any workplace, it is essential to understand the relationship between 'hazard', 'exposure' and 'risk':

"Hazard" is the potential for an agent or process to cause harm. **"Risk"** is the likelihood that an agent will produce injury or disease under specified conditions. Health effects may occur if a worker is **exposed** to the hazard. The risk of injury or disease usually increases with the duration and frequency of exposure and the intensity, concentration and toxicity of the agent. "**Toxicity"** is the capacity of an agent to produce disease or injury. An evaluation of toxicity considers the route of exposure and the concentration of an agent within the body.

Asbestos presents a health *hazard*, since there is potential for harm, and risk looks at the likelihood or probability that the person will be affected by the asbestos fibres.

Asbestos fibres only present a risk when they become airborne. The health risk increases as the number of fibres inhaled increases. Increased exposure would therefore pose an increased health risk.

Non-friable asbestos, that is, asbestos which has been incorporated into a stable matrix can be found in many working environments and products. Provided the matrix of the ACM remains stable and no airborne fibres are produced, it presents no health risk. The presence of asbestos, therefore, does not necessarily indicate that a health risk exists. During the removal process however, fibres may be released into the atmosphere and the risk of asbestos fibre inhalation increases.

Friable asbestos materials present a higher risk of exposure during the removal process therefore requires more stringent monitoring and risk control methods to be employed during its removal and specific requirements for disposal.

The Division 6 asbestos survey or risk assessment should be carried out by an Occupational Hygienist or Occupational Hygiene Technician who is experienced in asbestos products and matters. This assessment is normally carried out without the need for air monitoring. However, air monitoring may be used to quantify the actual exposure risk if required. Settled dust analysis can also be used to indicate if asbestos fibres have been released in the past. The risk assessment also identifies the licence category of the asbestos removalist required for the removal of asbestos at the site.

Where ACM have been determined to not present an asbestos exposure or disturbance risk during demolition / refurbishment of the building, structure or plant, specific controls measures are not required provided that the ACM is left undisturbed and maintained in good condition.

5.2 Asbestos Exposure Standard

The current occupational exposure standard for all forms of asbestos fibres - Amphibole (brown and blue) and Serpentine (white) asbestos fibres is 0.1 fibres/ml of air as an 8-hour time weighted average exposure as per the Safe Work Australia - Hazardous Substances Information System (HSIS) maintained by Australian government health and safety regulatory bodies.

These limits are applicable to people working in asbestos related industry and are set so that most workers exposed to asbestos at or below this concentration, should not suffer any discomfort or illness as a result of working with asbestos or asbestos containing products.
For people not working in asbestos related industries, the generally accepted exposure limit is 0.01 fibre/ml.

5.3 Asbestos Removal Requirements

When the asbestos assessment indicates that there is a risk to health and safety of any employee from exposure to asbestos, the employer must ensure that the exposure is controlled. Where the asbestos containing material is likely to be disturbed as part of the refurbishment or demolition process then the asbestos must be appropriately removed.

The removal of asbestos materials must be carried out by an approved asbestos removalist and must be in accordance with the *Victorian Occupational Health and Safety Regulations* 2017. *Class "A" Asbestos Removalists* can be used to remove all forms of asbestos materials whereas *Class "B" Removalists* can only be used for removal of non-friable asbestos materials.

All removal must be done by a method that prevents the release of atmospheric fibers. At present, the Standard Specifications for Asbestos Removal is stipulated by the Victorian Asbestos Removal Industry Consultative Committee (VARICC) and the WorkSafe Victoria Compliance Code for Removing Asbestos in Workplaces 2008.

Where appropriate, the supervising Occupational Hygiene consultant will be required to:

- Conduct air monitoring during and following the removal of all friable asbestos containing materials and asbestos dust and make visual inspections to ensure the work has been performed satisfactorily, to ensure that the concentration of airborne asbestos fibers complies with the acceptable exposure levels.
- Conduct air monitoring where it is deemed necessary, during the removal of non-friable asbestos materials.
- Conduct visual clearance inspections following the removal of non-friable asbestos materials that are more than 10 square meters.

6 FINDINGS

6.1 ASBESTOS CONTAINING MATERIALS (ACM)

The type of ACM found at Her Majesty's Theatre, Ballarat and their associated risks are listed below:

Asbestos (Fibro) Cement Products
Asbestos (fibro) cement products do not release significant amounts of fibre into the atmosphere under normal conditions, when the material is in good condition. The asbestos fibres in these matrices are normally well bound into the cement material, and are usually only released as atmospheric fibres when the material is physically disturbed (eg. by cutting, sawing, sanding, drilling or grinding).

Pitch-Based Switchboards
Pitch-based switchboards, such as Zelemite or Miscolite, contain asbestos but normally will not release significant numbers of fibres into the atmosphere as the asbestos is firmly bound into the matrix. Atmospheric fibre release may occur when the material is physically disturbed (eg. by cutting, sawing, sanding, drilling or grinding).

6.2 OTHER HAZARDOUS MATERIALS

Other hazardous materials found or identified as potentially being present at Her Majesty's Theatre, 17 Lydiard Street Ballarat during the current audit are listed below.

Crystalline Silica
Fine silica dust may result from brick, ceramic tile, non-asbestos cement sheet or concrete cutting, sanding, grinding or crushing or may be found in siliceous filtering materials such as diatomaceous earth. Inhalation of the respirable silica dust must be avoided as prolonged exposure can cause silicosis or lung cancer. Dust suppression and/or personal protective equipment is recommended.

Synthetic Mineral Fibers (SMF) Insulation Material
SMF have potential irritant effects on the skin, eyes and airways. Some SMF forms may contribute to the development of malignant or non-malignant respiratory disease. Precautions need to be taken to avoid inhalation and skin and eye contact with SMF.

Lead Paint, Flashing and Pipes

Metallic lead and lead-containing paints will liberate lead-containing dust when abraded and lead-containing fumes when over-heated. Lead is toxic to humans. Inhalation and ingestion of lead can give rise to ill health. Precautions need to be taken to avoid inhalation and ingestion of lead-containing dust and fume.

7 ASBESTOS REGISTER DESCRIPTORS

FRIABILITY

Friable - Asbestos containing material that when dry, can be crumbled, pulverised or reduced to a powder by hand pressure or as a result of a work process.

Non-friable - Asbestos containing material that cannot be crumbled, pulverised or reduced to powder by hand pressure alone.

Unknown – Friability could not be determined due to inaccessibility to material.

ASBESTOS RISK PRIORITY

Risk A - Asbestos that is friable, either exposed or contained (sealed) and must only be removed by Class A Licensed Asbestos Removalist.

Risk B – Asbestos that is non-friable, either exposed or contained and can be removed by either a Class A or Class B Licensed Asbestos Removalist.

Risk C – Room, area or material could not be accessed. Further investigation and material testing is required if the material is likely to be disturbed during refurbishment, renovations or demolition works.

SAMPLE NO.

*6388-XX	Samples with an asterisk before the sample number have been analysed by an independent NATA Laboratory
6388-XX	Samples without an asterisk have been viewed under a stereo microscope

OTHER HAZARDS – may include the following

Animal faeces – bird or other animal droppings

Gases – carbon dioxide cylinders or within pipework may be present

Lead – may include lead painted surfaces and lead products such as roof flashing

Mould - visible as mould growth as a result of water damage, high humidity or through flooding

MDF – Medium Density Fibreboard

PCB – polychlorinated biphenols

Radiation – in smoke detectors or other sources

Silica (refers to α-quartz crystalline silica)– May be present during demolition, cutting, sawing and drilling of concrete, masonry, bricks, ceramic tiles and cement products. Ensure dust suppression is used to eliminate airborne dust and wear P2 dust masks if working in the vicinity of the demolition / other works where airborne dust is present.

SMF – synthetic mineral fibre insulation in wall and ceiling cavities as loose insulation or in bats

8 RESULTS - ASBESTOS & HAZARDOUS MATERIALS REGISTER

Site: **Her Majesty's Theatre, 17 Lydiard Street Ballarat**
Date: **June 2018**

AREA	LOCATION	MATERIAL	SAMPLE NO.	ASBESTOS CONTAINING	FRIABILITY	QTY (APPROX)	RISK A/B/C	PHOTO NUMBER	OTHER HAZARDS	COMMENTS / RECOMMENDATIONS
Sub-Basement										
Toilet hallway	Walls	Brick and rendered brick	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Concrete and plaster	-	No	-	-	-	-	Silica	-
Female WC 1	Walls	Rendered brick	-	No	-	-	-	-	Silica	-
	Floor	Non asbestos vinyl sheet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Concrete and timber	-	No	-	-	-	-	Silica	-
	Splashback	Ceramic tiles on concrete	-	No	-	-	-	-	Silica	-
	Partitions	Laminated timber	-	No	-	-	-	-	-	-
Disabled toilets x 2	Walls	Brick and rendered brick	-	No	-	-	-	-	Silica	-
	Floor	Non asbestos vinyl sheet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
	Splashback	Ceramic tiles on concrete	-	No	-	-	-	-	Silica	-
Male WC 1	Walls	Rendered brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Non asbestos vinyl sheet on concrete	-	No	-	-	-	-	Silica	On concrete where checked

AREA	LOCATION	MATERIAL	SAMPLE NO.	ASBESTOS CONTAINING	FRIABILITY	QTY (APPROX)	RISK A/B/C	PHOTO NUMBER	OTHER HAZARDS	COMMENTS / RECOMMENDATIONS
Sub-Basement										
Male WC 1 (cont'd)	Ceiling	Timber and metal	-	No	-	-	-	-	-	-
	Bulkhead	Plaster	-	No	-	-	-	-	-	-
	Washroom infill panel	Timber	-	No	-	-	-	-	-	-
	Splashbacks	Ceramic tiles on concrete	-	No	-	-	-	-	Silica	-
	Cubicle ceilings	Plaster and metal	-	No	-	-	-	-	-	-
Lift motor room	Walls	Brick	-	No	-	-	-	-	Silica	-
	Floor	Concrete	-	No	-	-	-	-	Silica	-
	Ceiling	Plaster	-	No	-	-	-	-	-	-
	Switchboard	Plastic	-	No	-	-	-	-	-	-
	Lift motor	Metal and unknown	-	**Presume Yes**	-	-	C	-	-	No access to internals available
Plant room adjacent male toilet	Walls	Brick and rendered brick	-	No	-	-	-	-	Silica	-
	Floor	Concrete	-	No	-	-	-	-	Silica	-
	Ceiling	Timber	-	No	-	-	-	-	-	-
	Pipe gaskets	Rubber and solid material	*6388-1	No	-	-	-	-	-	-
	Duct joins	Silicone	-	No	-	-	-	-	Silica	-
Store 1	Walls	Rendered brick and ceramic tiles on concrete	-	No	-	-	-	-	Silica	-

AREA	LOCATION	MATERIAL	SAMPLE NO.	ASBESTOS CONTAINING	FRIABILITY	QTY (APPROX)	RISK A/B/C	PHOTO NUMBER	OTHER HAZARDS	COMMENTS / RECOMMENDATIONS
Sub-Basement										
Store 1 (cont'd)	Floor	Concrete	-	No	-	-	-	-	Silica	-
	Ceiling	Concrete and metal	-	No	-	-	-	-	Silica	-
Lift	Walls	Laminated timber and metal	-	No	-	-	-	-	-	-
	Floor	Carpet on metal	-	No	-	-	-	-	-	On metal where checked
	Ceiling	Metal	-	No	-	-	-	-	-	-
Livery 1 & 2	Walls	Brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
Offices foyer	Walls	Plaster and brick	-	No	-	-	-	-	Silica	-
	Wall	Paint flakes - beige	6388-08L	No	-	-	-	14	-	Lead analysis result is <0.01 therefore NOT considered to be lead containing paint. Refer to Attachment C
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
	Switchboard	Metal, timber and plastic	-	No	-	-	-	-	-	-
Store 2	Walls	Brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Concrete	-	No	-	-	-	-	Silica	-
	Ceiling	Plaster	-	No	-	-	-	-	-	-

AREA	LOCATION	MATERIAL	SAMPLE NO.	ASBESTOS CONTAINING	FRIABILITY	QTY (APPROX)	RISK A/B/C	PHOTO NUMBER	OTHER HAZARDS	COMMENTS / RECOMMENDATIONS
Sub-Basement										
Store 2 (cont'd)	Ceiling space duct insulation	SMF	-	No	-	-	-	-	SMF	-
Store 3	Walls	Brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
Office 1	Walls	Plaster	-	No	-	-	-	-	-	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
Office 2	Walls	Brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
Office 3	Walls	Brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
	Switchboards	Metal and plastic	-	No	-	-	-	-	-	-
	Ceiling hatch	Laminated timber	-	No	-	-	-	-	-	-
Store 4	Walls	Brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked

Area	Location	Material	Sample No.	Asbestos Containing	Friability	Qty (approx)	Risk A/B/C	Photo Number	Other Hazards	Comments / Recommendations
Sub-Basement										
Store 4 (cont'd)	Ceiling	Plaster	-	No	-	-	-	-	-	-
	Duct	Timber	-	No	-	-	-	-	-	-
Files room	Walls	Brick, rendered brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
Cleaner's store	Walls	Brick and rendered brick	-	No	-	-	-	-	Silica	-
	Floor	Concrete	-	No	-	-	-	-	Silica	-
	Ceiling	Plaster	-	No	-	-	-	-	-	-
Kittson room	Walls	Brick, rendered brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
Office 5	Walls	Brick, rendered brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Carpet on timber	-	No	-	-	-	-	-	On timber where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
Archival room	Walls	Brick, rendered brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-

Area	Location	Material	Sample No.	Asbestos Containing	Friability	Qty (approx)	Risk A/B/C	Photo Number	Other Hazards	Comments / Recommendations
Sub-Basement										
Drum room	Walls	Masonite and brick	-	No	-	-	-	-	Silica	-
	Floor	Concrete and timber	-	No	-	-	-	-	Silica	On timber where checked
	Ceiling	Masonite and plaster	-	No	-	-	-	-	-	-
	Loose sheeting against wall	Fibro cement	*6388-2	**Yes**	Non friable	2 Sqm	B	1	Silica	To be removed prior to works affecting area
Office 4	Walls	Brick, concrete and timber	-	No	-	-	-	-	Silica	-
	Floor	Concrete and timber	-	No	-	-	-	-	Silica	-
	Ceiling	Masonite and stramit	-	No	-	-	-	-	-	-
Store 5	Walls	Brick, Masonite and plaster	-	No	-	-	-	-	Silica	-
	Floor	Non asbestos vinyl sheet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Timber	-	No	-	-	-	-	-	-
	Switchboard	Zelemite	-	**Yes**	Non friable	< 1 sqm	B	2	-	Known to contain asbestos. To be removed prior to works affecting area.
	Switchboard box lining	Unknown	-	**Presume Yes**	-	-	C	-	-	No access available
Compressor room	Walls	Brick and stramit	-	No	-	-	-	-	Silica	-
	Floor	Non asbestos vinyl sheet on concrete and non-asbestos vinyl sheet on timber	-	No	-	-	-	-	Silica	On timber and concrete where checked
	Ceiling	Masonite and stramit	-	No	-	-	-	-	-	-

Area	Location	Material	Sample No.	Asbestos Containing	Friability	Qty (approx)	Risk A/B/C	Photo Number	Other Hazards	Comments / Recommendations
Sub-Basement										
Compressor Room	Compressor	Metal	-	No	-	-	-	-	-	-
Organ 2	Walls	Masonite	-	No	-	-	-	-	-	-
	Floor	Non asbestos vinyl sheet on timber	-	No	-	-	-	-	-	On timber where checked
	Ceiling	Masonite	-	No	-	-	-	-	-	-
Organ SOC	Walls	Brick and timber	-	No	-	-	-	-	Silica	-
	Floor	Concrete and timber	-	No	-	-	-	-	Silica	-
	Ceiling	Masonite and strammit	-	No	-	-	-	-	-	-
Organ 3	Walls	Plaster	-	No	-	-	-	-	-	-
	Floor	Carpet on timber	-	No	-	-	-	-	-	On timber where checked
	Ceiling	Timber	-	No	-	-	-	-	-	-
Organ hallway	Walls	Plaster and brick	-	No	-	-	-	-	Silica	-
	Floor	Concrete	-	No	-	-	-	-	Silica	-
	Ceiling	Plaster	-	No	-	-	-	-	-	-
Dressing room hallway	Walls	Brick	-	No	-	-	-	-	Silica	-
	Floor	Concrete	-	No	-	-	-	-	Silica	-
	Ceiling	Concrete and plaster	-	No	-	-	-	-	Silica	-
	Duct joins	Silicone	-	No	-	-	-	-	Silica	-

AREA	LOCATION	MATERIAL	SAMPLE NO.	ASBESTOS CONTAINING	FRIABILITY	QTY (APPROX)	RISK A/B/C	PHOTO NUMBER	OTHER HAZARDS	COMMENTS / RECOMMENDATIONS
Sub-Basement										
Dressing room 7	Walls	Brick	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Concrete	-	No	-	-	-	-	Silica	-
	Splashback	Ceramic tiles on brick	-	No	-	-	-	-	Silica	-
Dressing room 8	Walls	Brick	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Concrete	-	No	-	-	-	-	Silica	-
	Splashback	Ceramic tiles on brick	-	No	-	-	-	-	Silica	-
Dressing room 9	Walls	Brick	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Concrete	-	No	-	-	-	-	Silica	-
	Splashback	Ceramic tiles on brick	-	No	-	-	-	-	Silica	-
Dressing room 10	Walls	Brick	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Concrete	-	No	-	-	-	-	Silica	-
	Splashback	Ceramic tiles on brick	-	No	-	-	-	-	Silica	-
Dressing room 11	Walls	Brick	-	No	-	-	-	-	Silica	-

AREA	LOCATION	MATERIAL	SAMPLE NO.	ASBESTOS CONTAINING	FRIABILITY	QTY (APPROX)	RISK A/B/C	PHOTO NUMBER	OTHER HAZARDS	COMMENTS / RECOMMENDATIONS
Sub-Basement										
Dressing room 11 (cont'd)	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Concrete	-	No	-	-	-	-	Silica	-
	Splashback	Ceramic tiles on brick	-	No	-	-	-	-	Silica	-
Dressing room 12	Walls	Brick	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Concrete	-	No	-	-	-	-	Silica	-
	Splashback	Ceramic tiles on brick	-	No	-	-	-	-	Silica	-
First aid	Walls	Brick	-	No	-	-	-	-	Silica	-
	Floor	Non asbestos vinyl sheet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Concrete	-	No	-	-	-	-	Silica	-
	Splashback	Ceramic tiles on brick	-	No	-	-	-	-	Silica	-
Laundry	Walls	Brick	-	No	-	-	-	-	Silica	-
	Floor	Non asbestos vinyl sheet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Concrete	-	No	-	-	-	-	Silica	-
	Splashback	Carpet on brick	-	No	-	-	-	-	Silica	-
	Duct joins	Silicone	-	No	-	-	-	-	Silica	-
Switch room	Walls	Brick	-	No	-	-	-	-	Silica	-

Area	Location	Material	Sample No.	Asbestos Containing	Friability	Qty (approx)	Risk A/B/C	Photo Number	Other Hazards	Comments / Recommendations
Sub-Basement										
Switch room (cont'd)	Floor & ceiling	Concrete	-	No	-	-	-	-	Silica	-
	Switchboard	Metal	-	**Presume Yes**	-	-	C	-	-	No access available to internals
	Wrapped asbestos item	Unknown	-	**Yes**	-	-		-	-	To be removed prior to works affecting area
Service elevator room	Walls	Concrete and brick	-	No	-	-	-	-	Silica	-
	Floor	Concrete	-	No	-	-	-	-	Silica	-
	Ceiling	Concrete	-	No	-	-	-	-	Silica	-
	Lift	Metal	-	No	-	-	-	-	-	-
High voltage	Switch room	Unknown	-	**Presume Yes**	-	-	C	-	-	No access available
Stage door office	Walls	Brick and timber	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Concrete and metal	-	No	-	-	-	-	Silica	-
	Stage door	Paint flakes	6388-07L	No	-	-	-	13	-	Lead analysis result is 0.04 therefore NOT considered to be lead containing paint. Refer to Attachment C
Storeroom off stage door office	Walls	Brick and timber	-	No	-	-	-	-	Silica	-
	Floor	Concrete	-	No	-	-	-	-	Silica	-
	Ceiling	Concrete	-	No	-	-	-	-	Silica	-
	Pipe lagging	SMF	-	No	-	-	-	-	SMF	-

AREA	LOCATION	MATERIAL	SAMPLE NO.	ASBESTOS CONTAINING	FRIABILITY	QTY (APPROX)	RISK A/B/C	PHOTO NUMBER	OTHER HAZARDS	COMMENTS / RECOMMENDATIONS
Sub-Basement										
Male WC 2	Walls	Brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Non asbestos vinyl sheet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Concrete	-	No	-	-	-	-	Silica	-
	Partitions	Fibro cement	*6388-3	No	-	-	-	-	Silica	-
	Splashbacks	Ceramic tiles on brick	-	No	-	-	-	-	Silica	-
	Urinal surround	Ceramic tiles on fibro cement	*6388-4	**Yes**	Non friable	2 Sqm	B	3	Silica	To be removed prior to works affecting area
	Urinal base	Ceramic tiles on unknown	-	**Presume Yes**	-	-	C	-	Silica	No access available
	Shower base	Ceramic tiles on unknown	-	**Presume Yes**	-	-	C	-	Silica	No access available
	Shower surround	Ceramic tiles on unknown	-	**Presume Yes**	-	-	C	-	Silica	No access available
Female WC 2	Walls	Brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Non asbestos vinyl sheet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Concrete	-	No	-	-	-	-	Silica	-
	Partitions	Fibro cement	Ref 6388-3	No	-	-	-	-	Silica	-
	Splashbacks	Ceramic tiles on brick	-	No	-	-	-	-	Silica	-
	Shower base	Ceramic tiles on unknown	-	**Presume Yes**	-	-	C	-	Silica	No access available
	Shower surround	Ceramic tiles on unknown	-	**Presume Yes**	-	-	C	-	Silica	No access available

AREA	LOCATION	MATERIAL	SAMPLE NO.	ASBESTOS CONTAINING	FRIABILITY	QTY (APPROX)	RISK A/B/C	PHOTO NUMBER	OTHER HAZARDS	COMMENTS / RECOMMENDATIONS
Basement										
North stairwell	Walls	Brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Concrete and timber	-	No	-	-	-	-	Silica	-
	Ceiling	Plaster	-	No	-	-	-	-	-	-
Dressing room 1	Walls	Plaster and brick	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
	Splashback	Ceramic tiles on unknown	-	Presume Yes	-	-	C	-	Silica	No access available
Dressing room 2	Walls	Plaster	-	No	-	-	-	-	-	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
	Splashback	Ceramic tiles on unknown	-	Presume Yes	-	-	C	-	Silica	No access available
Dressing room 3	Walls	Plaster	-	No	-	-	-	-	-	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
	Splashback	Ceramic tiles on unknown	-	Presume Yes	-	-	C	-	Silica	No access available
Dressing room 4	Walls	Plaster	-	No	-	-	-	-	-	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
	Splashback	Ceramic tiles on unknown	-	**Presume Yes**	-	-	C	-	Silica	No access available

AREA	LOCATION	MATERIAL	SAMPLE NO.	ASBESTOS CONTAINING	FRIABILITY	QTY (APPROX)	RISK A/B/C	PHOTO NUMBER	OTHER HAZARDS	COMMENTS / RECOMMENDATIONS
Basement										
Dressing room 5	Walls	Plaster	-	No	-	-	-	-	-	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
	Splashback	Ceramic tiles on unknown	-	**Presume Yes**	-	-	C	-	Silica	No access available
To orchestra pit	Walls	Brick, timber and plaster	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
Orchestra pit	Walls	Plaster and brick	-	No	-	-	-	-	Silica	-
	Floor	Timber	-	No	-	-	-	-	-	-
	Ceiling	Plaster	-	No	-	-	-	-	-	-
Dressing room 6	Walls	Plaster and brick	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
	Splashback	Ceramic tiles on unknown	-	**Presume Yes**	-	-	C	-	Silica	No access available
Stage hydraulics	Walls	Brick and timber	-	No	-	-	-	-	Silica	-
	Floor	Concrete	-	No	-	-	-	-	Silica	-
	Ceiling	Timber	-	No	-	-	-	-	-	-

Area	Location	Material	Sample No.	Asbestos Containing	Friability	Qty (approx)	Risk A/B/C	Photo Number	Other Hazards	Comments / Recommendations
Basement										
Dressing room hallway	Walls	Rendered brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Concrete and carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
Basement dresser	Door frame	Paint flakes - beige	6388-05L	No	-	-	-	11	Lead 0.1%	Lead paint - Remove as per AS/NZS 4361.2:2017 and OHS Regs Part 4.3 Lead. Refer to Sec 12 Recommendations
East stairwell landing	Walls	Rendered brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Timber	-	No	-	-	-	-	-	-
	Ceiling	Plaster	-	No	-	-	-	-	-	-
Male WC 3	Walls	Rendered brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Non asbestos vinyl sheet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
	Partitions	Metal	-	No	-	-	-	-	-	-
	Urinal surround and base	Ceramic tiles on unknown	-	**Presume Yes**	-	-	C	-	Silica	No access available
	Shower surround and base	Ceramic tiles on unknown	-	**Presume Yes**	-	-	C	-	Silica	No access available
	Splashback	Ceramic tiles on unknown	-	**Presume Yes**	-	-	C	-	Silica	No access available
Female WC 3	Walls	Rendered brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Non asbestos vinyl sheet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-

AREA	LOCATION	MATERIAL	SAMPLE NO.	ASBESTOS CONTAINING	FRIABILITY	QTY (APPROX)	RISK A/B/C	PHOTO NUMBER	OTHER HAZARDS	COMMENTS / RECOMMENDATIONS
Basement										
Female WC 3	Partitions	Metal	-	No	-	-	-	-	-	-
	Shower surround and base	Ceramic tiles on unknown	-	**Presume Yes**	-	-	C	-	Silica	No access available
	Splashback	Ceramic tiles on unknown	-	**Presume Yes**	-	-	C	-	Silica	No access available
Tech office 2	Walls	Timber, brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
Tech office 1	Walls	Brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked
	Ceiling	Metal	-	No	-	-	-	-	-	-
Auditorium fire escape	Walls	Brick	-	No	-	-	-	-	Silica	-
	Floor	Concrete	-	No	-	-	-	-	Silica	-
	Ceiling	Concrete, metal and timber	-	No	-	-	-	-	Silica	-
	Infill panels above exit doors	Fibro cement	*6388-5	**Yes**	Non friable	4 Sqm	B	4	Silica	To be removed prior to works affecting area
Stalls										
Entry foyer	Walls	Rendered brick	-	No	-	-	-	-	Silica	-
	Floor	Carpet on timber	-	No	-	-	-	-	-	On timber where checked
	Ceiling	Timber and render on timber	-	No	-	-	-	-	Silica	-
	Fireplaces	Metal and timber	-	No	-	-	-	-	-	-

AREA	LOCATION	MATERIAL	SAMPLE NO.	ASBESTOS CONTAINING	FRIABILITY	QTY (APPROX)	RISK A/B/C	PHOTO NUMBER	OTHER HAZARDS	COMMENTS / RECOMMENDATIONS
Stalls										
Candy bar	Walls	Rendered brick and timber	-	No	-	-	-	-	Silica	-
	Store wall	Paint flakes	6388-09L	No	-	-	-	15	Lead 0.66%	Lead paint - Remove as per AS/NZS 4361.2:2017 and OHS Regs Part 4.3 Lead. Refer to Sec 12 Recommendations
	Floor	Non asbestos vinyl sheet on timber	-	No	-	-	-	-	-	On timber where checked
	Ceiling	Timber	-	No	-	-	-	-	-	-
North and south exits	Walls	Rendered brick	-	No	-	-	-	-	Silica	-
	Floor	Ceramic tiles on unknown	-	**Presume Yes**	-	-	C	-	-	No access available
	Ceiling	Pressed metal on unknown and plaster	-	**Presume Yes**	-	-	C	-	-	No access available
	Switchboard	Metal and plastic	-	No	-	-	-	-	-	-
North entry / exit	Lower skirting	Paint flakes - brown	6388-11L	No	-	-	-	17	Lead 0.11	Lead paint - Remove as per AS/NZS 4361.2:2017 and OHS Regs Part 4.3 Lead. Refer to Sec 12 Recommendations
Ticket office	Walls	Rendered brick	-	No	-	-	-	-	Silica	-
	Floor	Carpet on timber	-	No	-	-	-	-	-	On timber where checked
	Ceiling	Timber	-	No	-	-	-	-	-	-
	Ticket booth (lead test)	Door frame	6388-06L	No	-	-	-	12	-	Lead analysis result is 0.05 therefore NOT considered to be lead containing paint. Refer to Attachment C

AREA	LOCATION	MATERIAL	SAMPLE NO.	ASBESTOS CONTAINING	FRIABILITY	QTY (APPROX)	RISK A/B/C	PHOTO NUMBER	OTHER HAZARDS	COMMENTS / RECOMMENDATIONS
Stalls										
Lower foyer to stalls	Walls	Rendered brick, plaster and timber	-	No	-	-	-	-	Silica	-
	Floor	Carpet on timber	-	No	-	-	-	-	-	On timber where checked
	Ceiling and bulkhead	Plaster	-	No	-	-	-	-	-	-
	Switchboard	Metal and plastic	-	No	-	-	-	-	-	-
Stalls	Walls	Rendered brick	-	No	-	-	-	-	Silica	-
	Floor	Timber and carpet on timber	-	No	-	-	-	-	-	On timber where checked
	Ceiling	Plaster and timber	-	No	-	-	-	-	-	-
	Wall Infills	Timber	-	No	-	-	-	-	-	-
	Pillars throughout	Paint flakes (Beige and green)	6388-10L	No	-	-	-	16	Lead 1.6%	Lead paint - Remove as per AS/NZS 4361.2:2017 and OHS Regs Part 4.3 Lead. Refer to Sec 12 Recommendations
Store off stalls	Walls	Brick and rendered brick	-	No	-	-	-	-	Silica	-
	Floor	Timber and concrete	-	No	-	-	-	-	Silica	-
	Ceiling	Metal	-	No	-	-	-	-	-	-
	Hot water services	Metal	-	No	-	-	-	-	-	-
	Pipe lagging	SMF	-	No	-	-	-	-	SMF	-
Stage	Walls	Brick	-	No	-	-	-	-	Silica	-

AREA	LOCATION	MATERIAL	SAMPLE NO.	ASBESTOS CONTAINING	FRIABILITY	QTY (APPROX)	RISK A/B/C	PHOTO NUMBER	OTHER HAZARDS	COMMENTS / RECOMMENDATIONS
Stalls										
Stage (cont'd)	Wall	Paint flakes - black	6388-03L	No	-	-	-	9	Lead 0.06%	Lead analysis result is 0.04 therefore NOT considered to be lead containing paint. Refer to Attachment C
	Floor	Timber	-	No	-	-	-	-	-	-
	Ceiling	None, Masonite roof lining	-	No	-	-	-	-	-	-
	Switchboards	Metal and plastic	-	No	-	-	-	-	-	-
	Mezzanine floor	Timber	-	No	-	-	-	-	-	-
	Duct joins	Silicone	-	No	-	-	-	-	Silica	Where checked
Stage Staircase	Balustrade	Paint flakes - green	6388-04L	No	-	-	-	10	-	Lead analysis result is 0.04 therefore NOT considered to be lead containing paint. Refer to Attachment C
Props	Walls	Brick	-	No	-	-	-	-	Silica	-
	Floor	Carpet on timber	-	No	-	-	-	-	-	On timber where checked
	Ceiling	Metal	-	No	-	-	-	-	-	-
	Pipe lagging	SMF	-	No	-	-	-	-	SMF	-
	Mezzanine floor	Timber	-	No	-	-	-	-	-	-
Ante room	Walls	Rendered brick and timber	-	No	-	-	-	-	Silica	-
	Floor	Carpet on fibro cement on timber	*6388-6	No	-	-	-	-	Silica	On timber where checked
	False ceiling	Plaster	-	No	-	-	-	-	-	-

AREA	LOCATION	MATERIAL	SAMPLE NO.	ASBESTOS CONTAINING	FRIABILITY	QTY (APPROX)	RISK A/B/C	PHOTO NUMBER	OTHER HAZARDS	COMMENTS / RECOMMENDATIONS
Stalls										
Ante room (cont'd)	Upper ceiling	Rendered timber	-	No	-	-	-	-	Silica	-
	Switchboard	Metal and plastic	-	No	-	-	-	-	-	-
Green room	Walls	Brick and plaster	-	No	-	-	-	-	Silica	-
	Floor	Carpet on timber & non asbestos vinyl sheet on Masonite on timber	-	No	-	-	-	-	-	-
	Floor skirting	Paint flakes – Beige / pink	6388-01L	No	-	-	-	7	Lead 3.5%	Lead paint - Remove as per AS/NZS 4361.2:2017 and OHS Regs Part 4.3 Lead. Refer to Sec 12 Recommendations
	Ceiling	Timber	-	No	-	-	-	-	-	-
	Metal door	Paint flakes	6388-02L	No	-	-	-	8	Lead 0.62%	Lead paint - Remove as per AS/NZS 4361.2:2017 and OHS Regs Part 4.3 Lead. Refer to Sec 12 Recommendations
External hoist	Ref basement service elevator	-	-	No	-	-	-	-	-	-
Pianos	Walls	Brick	-	No	-	-	-	-	Silica	-
	Floor	Timber	-	No	-	-	-	-	-	-
	Ceiling	Plaster	-	No	-	-	-	-	-	-
	Switchboard	Metal and plastic	-	No	-	-	-	-	-	-
	Duct joins	Foam	-	No	-	-	-	-	-	-
Workshop	Walls	Brick and plaster	-	No	-	-	-	-	Silica	-

AREA	LOCATION	MATERIAL	SAMPLE NO.	ASBESTOS CONTAINING	FRIABILITY	QTY (APPROX)	RISK A/B/C	PHOTO NUMBER	OTHER HAZARDS	COMMENTS / RECOMMENDATIONS
Stalls										
Workshop (cont'd)	Floor	Timber	-	No	-	-	-	-	-	-
	Ceiling	Plaster	-	No	-	-	-	-	-	-
Dress circle										
Melba room	Walls	Brick and timber	-	No	-	-	-	-	Silica	-
	Floor	Carpet on timber	-	No	-	-	-	-	-	On timber where checked
	Ceiling	Timber	-	No	-	-	-	-	-	-
Stalls	Walls	Rendered brick	-	No	-	-	-	-	Silica	-
	Floor	Carpet on timber and non-asbestos vinyl sheet on timber	-	No	-	-	-	-	-	On timber where checked
	Ceiling	Pressed metal	-	No	-	-	-	-	-	-
Foyer	Walls	Rendered brick	-	No	-	-	-	-	Silica	-
	Floor	Carpet on timber and ceramic tiles on concrete	-	No	-	-	-	-	Silica	Where checked
	Lower ceiling	Rendered timber	-	No	-	-	-	-	Silica	-
	Upper ceiling	Unknown	-	**Presume Yes**	-	-	C	-	-	No access available due to height
	Skylight surrounds	Unknown	-	**Presume Yes**	-	-	C	-	-	No access available due to height
Male toilet	Walls	Plaster, rendered brick and timber	-	No	-	-	-	-	Silica	-

AREA	LOCATION	MATERIAL	SAMPLE NO.	ASBESTOS CONTAINING	FRIABILITY	QTY (APPROX)	RISK A/B/C	PHOTO NUMBER	OTHER HAZARDS	COMMENTS / RECOMMENDATIONS
Dress circle										
Male toilet (cont'd)	Floor	Non asbestos vinyl sheet on Masonite on timber	*6388-7	No	-	-	-	-	-	On timber where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
	Splashback	Ceramic tiles on unknown	-	**Presume Yes**	-	-	C	-	Silica	No access available
	Urinal surround	Ceramic tiles on unknown	-	**Presume Yes**	-	-	C	-	Silica	No access available
	Partitions	Fibro cement	*6388-8	No	-	-	-	-	Silica	-
Female toilet	Walls	Plaster, rendered brick and timber	-	No	-	-	-	-	Silica	-
	Floor	Non asbestos vinyl sheet on Masonite on timber	Ref 6388-7	No	-	-	-	-	-	On timber where checked
	Ceiling	Plaster	-	No	-	-	-	-	-	-
	Splashback	Ceramic tiles on unknown	-	**Presume Yes**	-	-	C	-	Silica	No access available
	Partitions	Fibro cement	Ref 6388-8	No	-	-	-	-	Silica	-
Long room	Walls	Rendered brick	-	No	-	-	-	-	Silica	-
	Floor	Carpet on Masonite on timber and non asbestos vinyl sheet on timber	-	No	-	-	-	-	-	On timber where checked
	Ceiling	Rendered timber	-	No	-	-	-	-	Silica	-
	Fireplaces	Stone and metal	-	No	-	-	-	-	Silica	-

Area	Location	Material	Sample No.	Asbestos Containing	Friability	Qty (approx)	Risk A/B/C	Photo number	Other Hazards	Comments / Recommendations
Balcony										
Plant room	Walls	Brick	-	No	-	-	-	-	Silica	-
	Floor	Concrete	-	No	-	-	-	-	Silica	-
	Ceiling	None/ sarking	-	No	-	-	-	-	-	-
	Duct joins	Silicone	-	No	-	-	-	-	Silica	-
	Pipe lagging	SMF and polystyrene foam	-	**Presume Yes**	-	-	C	-	SMF	No all pipes were accessible through metal sheath and there is potential for asbestos lagging to be present in sheathed areas not checked.
	Switchboards	Metal and plastic	-	No	-	-	-	-	-	-
Stalls	Walls	Rendered brick	-	No	-	-	-	-	Silica	-
	Floor	Carpet on timber and non asbestos vinyl sheet on timber	-	No	-	-	-	-	-	On timber where checked
	Ceiling	Rendered timber	-	No	-	-	-	-	Silica	-
Emergency exit	Walls	Brick and Masonite	-	No	-	-	-	-	Silica	-
	Floor	Concrete	-	No	-	-	-	-	Silica	-
	Ceiling	Timber	-	No	-	-	-	-	-	-
Northwest and southwest stairwells	Walls	Rendered brick	-	No	-	-	-	-	Silica	-
	Floor	Carpet on concrete	-	No	-	-	-	-	Silica	On concrete where checked

AREA	LOCATION	MATERIAL	SAMPLE NO.	ASBESTOS CONTAINING	FRIABILITY	QTY (APPROX)	RISK A/B/C	PHOTO NUMBER	OTHER HAZARDS	COMMENTS / RECOMMENDATIONS
Balcony										
Northwest and southwest stairwells	Ceiling	Plaster and rendered timber	-	No	-	-	-	-	-	-
Bio box	Walls	Timber and plaster	-	No	-	-	-	-	-	-
	Floor	Carpet on timber	-	No	-	-	-	-	-	On timber where checked
	Ceiling	Metal and plaster	-	No	-	-	-	-	-	-
	Switchboard	Metal and plastic	-	No	-	-	-	-	-	-
Dome/ceiling space	Walls	Brick	-	No	-	-	-	-	Silica	-
	Floor	Timber	-	No	-	-	-	-	-	-
	Ceiling	None/ SMF bats	-	No	-	-	-	-	SMF	-
	Switchboard	Metal and plastic	-	No	-	-	-	-	-	-
Throughout										
	Duct joins	Silicone	-	No	-	-	-	-	Silica	-
	Fire door cores	Unknown		**Presume Yes**	-	-	C	-	-	No access available
Externals										
	Walls	Brick and metal	-	No	-	-	-	-	Silica	-
	Auditorium fire escape infill panel	Fibro cement	Ref 6388-5	**Yes**	Non friable	4 Sqm	B	5	Silica	To be removed prior to works affecting area
	Rear porch ceiling	Metal	-	No	-	-	-	-	-	-

AREA	LOCATION	MATERIAL	SAMPLE NO.	ASBESTOS CONTAINING	FRIABILITY	QTY (APPROX)	RISK A/B/C	PHOTO NUMBER	OTHER HAZARDS	COMMENTS / RECOMMENDATIONS
Externals										
	Roof	Metal and unknown	-	Unknown	-	-	C	5	-	No access to roof area due to height restrictions. Check prior to works likely to affect the roof.

9 RESULTS – Paint sample lead analysis

SAMPLE NO.	LOCATION	% LEAD CONCENTRATION	CONTAINS LEAD?	PHOTO NO.
6388-01L	Green room floor skirting	3.5	Yes	7
6388-02L	Green room metal door	0.62	Yes	8
6388-03L	Stage wall - black	0.06	No	9
6388-04L	Stage staircase balustrade	<0.01	No	10
6388-05L	Basement dresser door frame	0.1	Yes	11
6388-06L	Sub-basement ticket booth door frame	0.05	No	12
6388-07L	Sub-basement stage door	0.04	No	13
6388-08L	Offices foyer wall	<0.01	No	14
6388-09L	Candy bar store wall	0.66	Yes	15
6388-10L	Stalls pillars	1.6	Yes	16
6388-11L	North entrance lower skirting	0.11	Yes	17

Photos are shown on Section 10 of this report.
The laboratory analytical report for the lead analysis is in Attachment C in this report.

10 SITE PHOTOGRAPHS

Photo 1 – Sub Basement Drum room fibro cement loose sheeting against wall

Photo 2 – Sub Basement Store 5 Zelemite switchboard

Photo 3 – Sub Basement Switch room wrapped asbestos labelled item

Photo 4 – Sub Basement Male WC 2 fibro cement urinal surround

Photo 5 – Basement Auditorium fire escape fibro cement infill panels above exit doors

Photo 6 – Externals Auditorium fire escape fibro cement infill panels above exit doors

Photo 7 – Green room floor skirting has lead containing paint

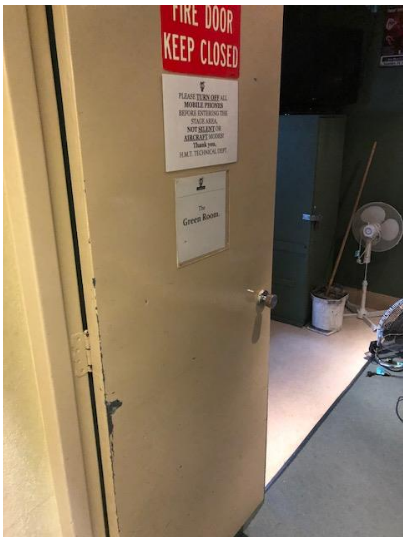

Photo 8 – Green room metal door has lead containing paint

Photo 9 – Stage wall does NOT have lead paint

Photo 10 – Stage stairs do NOT have lead paint

Photo 11 – Basement dresser door frame has lead coated paint

Photo 12 – Sub basement ticket booth door frame does NOT have lead coated paint


Photo 13 – Sub basement stage door
does NOT have lead containing paint


Photo 14 – Offices foyer wall
does NOT have lead containing paint


Photo 15 – Candy bar store wall has lead
containing paint

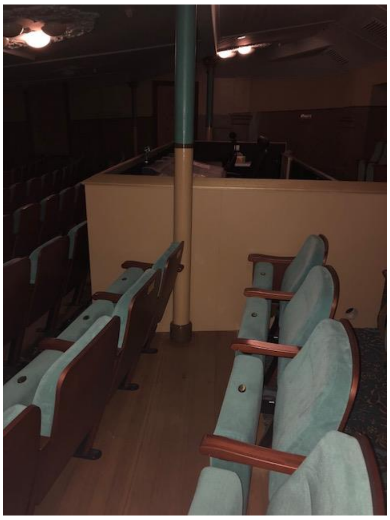
Photo 16 – Stalls pillars have lead
containing paint


Photo 17 – North entrance lower skirting
Has lead containing paint

11 CONCLUSIONS (EXPOSURE RISK ASSESSMENT)

Asbestos containing materials identified or presumed to be present within accessible areas of Her Majesty's Theatre, 17 Lydiard Street S, Ballarat are as follows -

RISK A – FRIABLE ASBESTOS CONTAINING MATERIAL

- None identified

RISK B – NON-FRIABLE ASBESTOS CONTAINING MATERIAL

Sub-Basement

- Drum room fibro cement loose sheeting against wall
- Store 5 Zelemite switchboard
- Switch room wrapped asbestos labelled item
- Male WC 2 fibro cement urinal surround

Basement

- Auditorium fire escape fibro cement infill panels above exit doors

Externals

- Auditorium fire escape fibro cement infill panels above exit doors

RISK C – AREA INACCESSIBLE FOR INSPECTION AND / OR SAMPLING

Sub-Basement

- Lift motor room lift motor internals
- Store 5 zelemite switchboard box internals
- Switch room metal switchboard internals
- High voltage switchroom
- Male WC 2 urinal base under ceramic tiles
- Male WC 2 shower base under ceramic tiles
- Male WC 2 shower surround behind ceramic tiles
- Female WC 2 shower base under ceramic tiles
- Female WC 2 shower surround behind ceramic tiles

Basement

- Dressing rooms 1-6 splashbacks behind ceramic tiles
- Male WC 3 urinal base and surround behind ceramic tiles
- Male WC 3 shower surround and base behind ceramic tiles
- Male WC 3 splashback behind ceramic tiles
- Female WC 3 shower surround and base behind ceramic tiles
- Female WC 3 splashback behind ceramic tiles

Stalls

- North and south exits floor under ceramic tiles
- North and south exits ceiling behind pressed metal

RISK C – AREA INACCESSIBLE FOR INSPECTION AND / OR SAMPLING

Dress circle

- Foyer upper ceiling
- Foyer skylight surrounds
- Male toilet splashback behind ceramic tiles
- Male toilet urinal surround behind ceramic tiles
- Female toilet splashback behind ceramic tiles

Balcony

- Plant room pipe lagging (SMF and styrofoam where checked)

Throughout

- Fire door internals

Externals

- Roof area

OTHER HAZARDOUS MATERIALS

- Crystalline silica (fine silica dust may be generated from tile, brick or concrete cutting, grinding or crushing or during major demolition works)
- Synthetic mineral fiber insulation
- Radiation source (within smoke alarms)
- Lead containing paint – throughout many areas

12 RECOMMENDATIONS

1. The person who has management and control of the site shall ensure the asbestos audit report and findings are made available to any internal maintenance persons, site contractors and asbestos removalists prior to any building structure / maintenance/ refurbishment works being undertaken on the site.
2. The person who has management and control of the site shall agree on suitable risk control measures with the licensed asbestos removalist and any other contractors on site before authorising any work. We recommend that this risk assessment be integrated with contractor OH&S procedures (Job Safety Analysis, control plan, SWMS).
3. Ensure that all areas that couldn't be accessed for inspection and/or sampling (Risk C) are inspected for asbestos materials prior to any building works likely to affect those areas.
4. Ensure all asbestos containing materials are removed by a Class A or Class B asbestos removalist prior to demolition works commencing. Refer to *Section 8 Results Register* for class of removalist required.
5. Following removal of the asbestos containing materials from the site and prior to refurbishment works commencing, an Asbestos Visual Clearance Inspection must be performed by a hygienist or competent and knowledgeable person and a Clearance Certificate describing the findings must be obtained prior to the area being re-occupied by unprotected persons.
6. The regulations do not require any form of air monitoring for non-friable asbestos removal work. However, the person who commissioned the removal work needs to consider providing air monitoring during removal of non-friable ACM that is being done in or next to a public location. The results of this air monitoring may assist in dealing with any potential concerns raised by persons occupying these areas.
7. The following work practices are recommended during removal of loose or unbonded SMF materials to prevent elevated dust concentrations which may arise during removal. This may or may not be due to other dusts being present.
   (a) Waste shall be placed in plastic bags or other containers which prevent fibre and/or dust emission, and
   (b) disposed of in accordance with local waste disposal authority requirements, and
   (c) Removalist to wear appropriate PPE including respiratory protection, coveralls, hand and eye protection.
8. In the event that previously unidentified suspected ACM are located at the site, the following procedure shall be followed:
   - All work in the immediate area where the suspected ACM has been located shall cease.
   - Site management shall be informed immediately.
   - Site management shall contact Hazard Alert 5244 5116 or preferred occupational hygiene supplier for further advice and/or have the sample collected for analysis.
   - Where the material is confirmed to contain asbestos, then the occupational hygienist shall assess the risk and provide any recommendations regarding control of the risk.
   - Any work in the affected area shall only recommence once suitable control measures have been implemented and the area is cleared for re-occupation of unprotected personnel.
9. In the event that mobile, fixed or underground fuel tanks are located at the site, ensure these are assessed and if required removed prior to building demolition works.
10. All materials containing silica can result in the generation of respirable silica particles during major demolition works or when chipping, cutting, drilling or grinding takes place. Silica exposure occurs through inhalation of silica containing particles and occurs through many construction and general industry methods. The most severe exposures generally occur during

abrasive disturbances concrete structures and other surfaces. Activities that may result in severe silica exposure include jack hammering, drilling, concrete mixing, concrete drilling, brick, tile and concrete cutting/sawing. Exposure to excessive silica dust over long periods of time can result in silicosis.

11. Any works that are likely to disturb lead containing painted surfaces should be conducted in accordance with AS 4361-2 2017 Guide to Hazardous Paint Management and the Victorian OH&S Regulations 2017 Part 4.3 Lead.
12. All lead containing products and lead containing paint materials must be removed and disposed of as per the regulatory requirements. Precautions need to be taken to avoid generating lead dust, paint flakes and contaminating surrounding air and ground surfaces. Precautions must also be undertaken to avoid inhalation and ingestion of lead-containing dust and fume. Always wear appropriate PPE when handling / removing timbers / structures with lead containing paint (particulate respirator, eye protection, coveralls to protect skin and clothing etc).
13. When working with hazards that may result in the presence of airborne silica, ensure that dust suppression control methods such as water spray or power tools with HEPA dust extraction are used and always wear the appropriate PPE including P2 dust mask to protect from potential dust exposures.
14. Regarding smoke detectors, do not dismantle any smoke alarms to access or remove the radiation source. If required to remove the detectors for the purpose of disposal, remove them as a whole.
15. Individual smoke detectors or small numbers of smoke detectors containing a small amount of radioactivity can be disposed of via normal domestic rubbish or placed in a skip bin along with other demolition waste.

13 REFERENCES & DIRECTORY

Information contained in this report is referenced from the following documents.

Victorian Occupational Health and Safety Act 2004

Victorian Occupational Health & Safety Regulations 2017

WorkSafe Victoria Compliance Code – Removing Asbestos in Workplaces 2008

WorkSafe Victoria Compliance Code – Managing Asbestos in Workplaces 2008

National Code of Practice for the Safe Use of Synthetic Mineral Fibres[NOHSC:2006(1990)]

National Standard for Synthetic Mineral Fibres [NOHSC:1004:1990]

AS/NZS 4361.2:2017 Guide to hazardous paint management - Part 2: Lead paint in residential, public and commercial buildings

These publications are available from InfoVic or AusInfo.
WorkSafe Victoria (Victorian WorkCover Authority): **www.workcover.vic.gov.au**
EPA Victoria: **www.epa.vic.gov.au**

ATTACHMENT A: ASBESTOS ANALYSIS LABORATORY REPORTS

Liability & Risk Management Consulting

LRM Global Pty Ltd
65 Stubbs Street
Kensington VIC 3031

Fax: (03) 9371 3499
Email: enquiries@lrmglobal.com.au
Web: www.lrmglobal.com.au
Telephone: (03) 9371 3400
ABN: 34 116 540 277

Hazard Alert
5-7/130, High St
Belmont Vic 3216

Client Ref: 6388-Her Majesty's Theatre 17 Lydiard St South, Ballarat
Job Number: 33031.000
Batch Number: -
Received Date: May 28, 2018
Analysed Date: May 30, 2018
No of Samples: 5

Dear Liam Jerinic,

This report presents the analytical results of samples forwarded by Hazard Alert for asbestos analysis.

Methodology:
The samples were examined under a Stereo Microscope and selected fibres were analysed by Polarized Light Microscopy in conjunction with Dispersion Staining Method. (**LRM Global ID Method 1**)

Analytical Results:

Sample No.	Sample Description	Result
6388-1	The sample consisted of solid material Location: Plant room adjacent male toilet pipe gasket Sample Dimensions: 0.3cm X 0.2cm X 0.2cm	No Asbestos Detected
6388-2	The sample consisted of fibro plaster cement Location: Drum room loose sheet against wall Sample Dimensions: 2.0cm X 1.5cm X 0.5cm	Chrysotile Asbestos Detected Organic Fibre Detected
6388-3	The sample consisted of fibro plaster cement Location: Male WC 2 toilet partitions Sample Dimensions: 5.0cm X 2.0cm X 0.5cm	No Asbestos Detected Organic Fibre Detected
6388-4	The sample consisted of fibro plaster cement Location: Male WC 2 urinal surrounds Sample Dimensions: 0.5cm X 0.2cm X 0.2cm	Chrysotile Asbestos Detected Organic Fibre Detected
6388-5	The sample consisted of fibro plaster cement Location: Auditorium fire escape - Infill panels above exit doors Sample Dimensions: 4.0cm X 3.0cm X 0.5cm	Amosite Asbestos Detected Chrysotile Asbestos Detected Crocidolite Asbestos Detected

Approved Identifier
Karu Jayasundara

Report Issued by
Karu Jayasundara

WORLD RECOGNISED
ACCREDITATION
Accreditation No: 15684

Accredited for compliance with ISO/IEC 17025
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian Standards.

Liability & Risk Management Consulting

LRM Global Pty Ltd
65 Stubbs Street
Kensington VIC 3031

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Web: www.lrmglobal.com.au
Telephone: (03) 9371 3400
ABN: 34 116 540 277

Hazard Alert
5-7/130, High St
Belmont Vic 3216

Client Ref: 6388-17 Lydiard St Ballarat

Job Number: 33396.000
Batch Number: -
Received Date: June 19, 2018
Analysed Date: June 25, 2018
No of Samples: 3

Dear Liam Jerinic,

This report presents the analytical results of samples forwarded by Hazard Alert for asbestos analysis.

Methodology:
The samples were examined under a Stereo Microscope and selected fibres were analysed by Polarized Light Microscopy in conjunction with Dispersion Staining Method. (**LRM Global ID Method 1**)

Analytical Results:

Sample No.	Sample Description	Result
6388-6	The sample consisted of fibro plaster cement Location: Level 3 ante room floor Sample Dimensions: 3.0cm X 3.0cm X 0.2cm	No Asbestos Detected Organic Fibre Detected
6388-7	The sample consisted of vinyl sheet (green) Location: Level 4 male toilet floor Sample Dimensions: 3.0cm X 3.0cm X 0.1cm	No Asbestos Detected Organic Fibre Detected
6388-8	The sample consisted of fibro plaster cement Location: Level 4 male toilet partition Sample Dimensions: 1.0cm X 1.0cm X 0.1cm	No Asbestos Detected Organic Fibre Detected

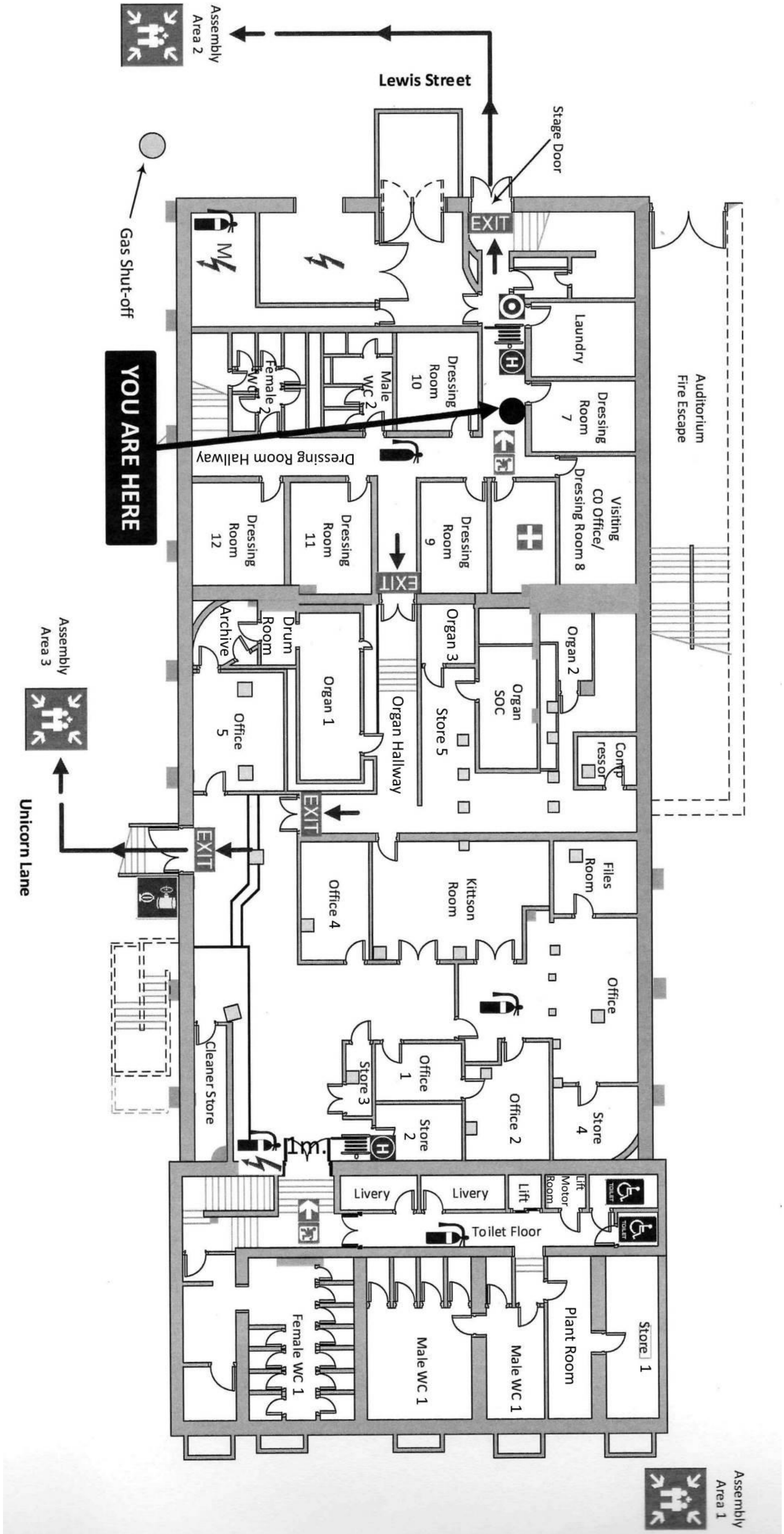
Approved Identifier
Karu Jayasundara

Report Issued by
Karu Jayasundara

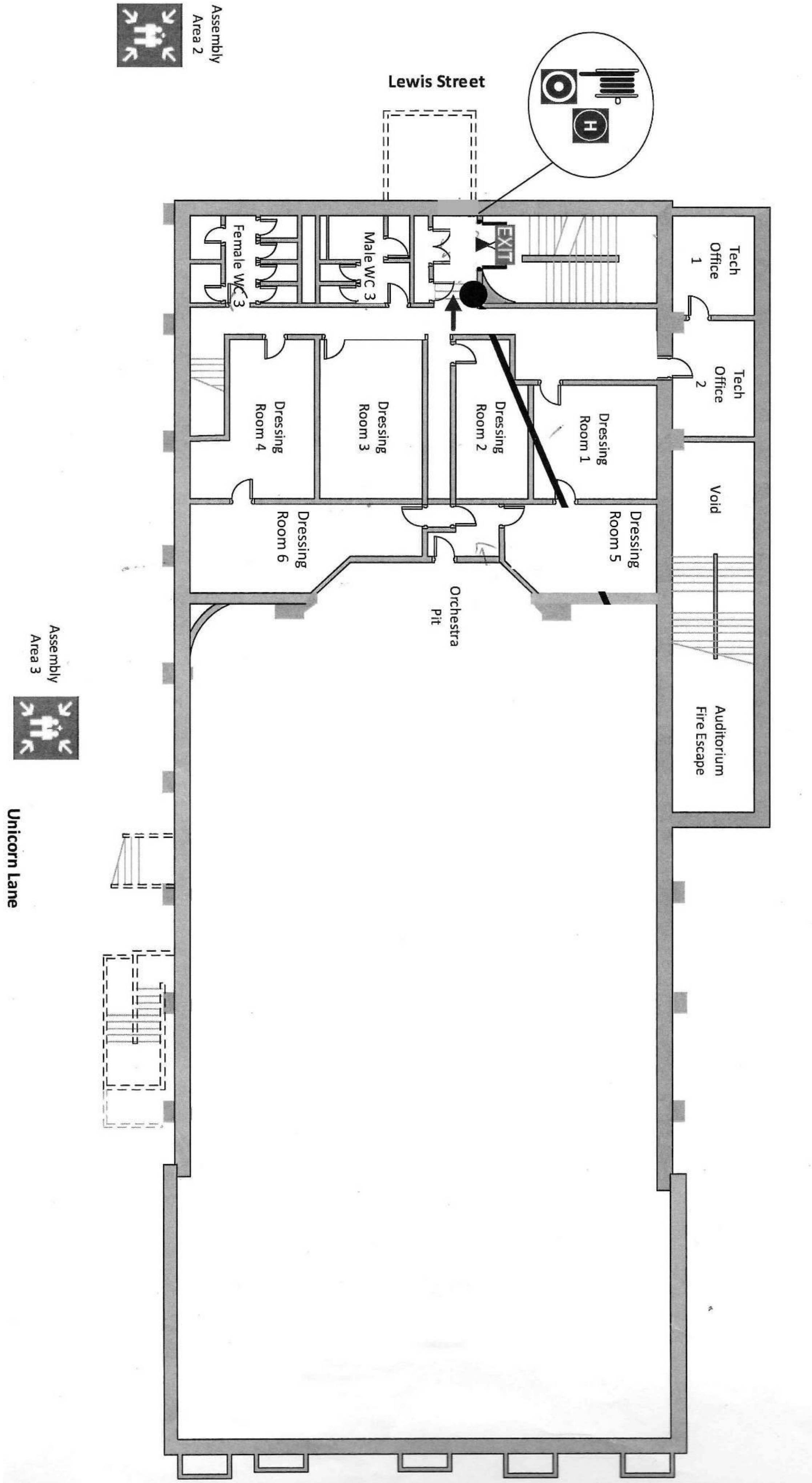
WORLD RECOGNISED
ACCREDITATION
Accreditation No: 15684

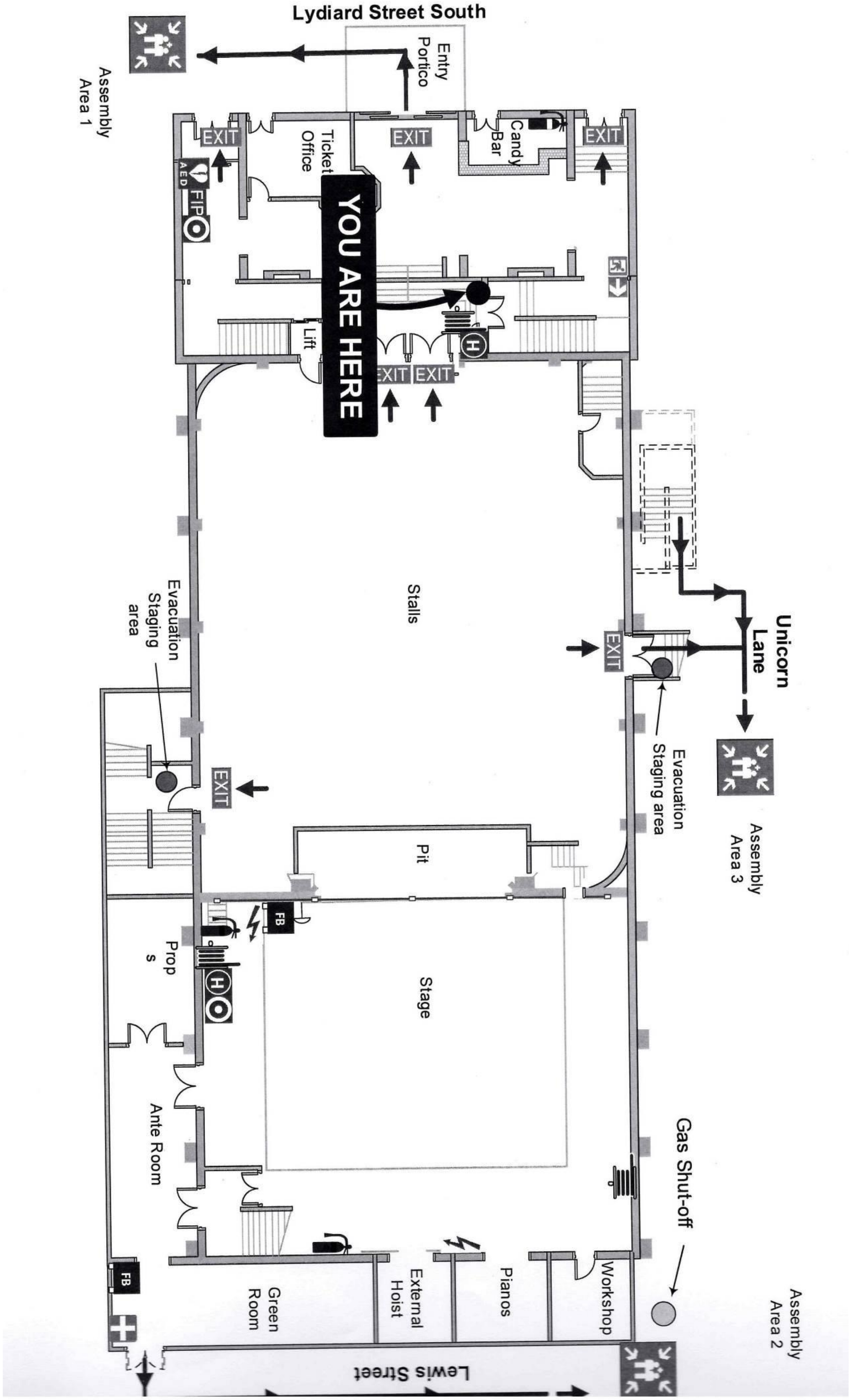
Accredited for compliance with ISO/IEC 17025
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian Standards.

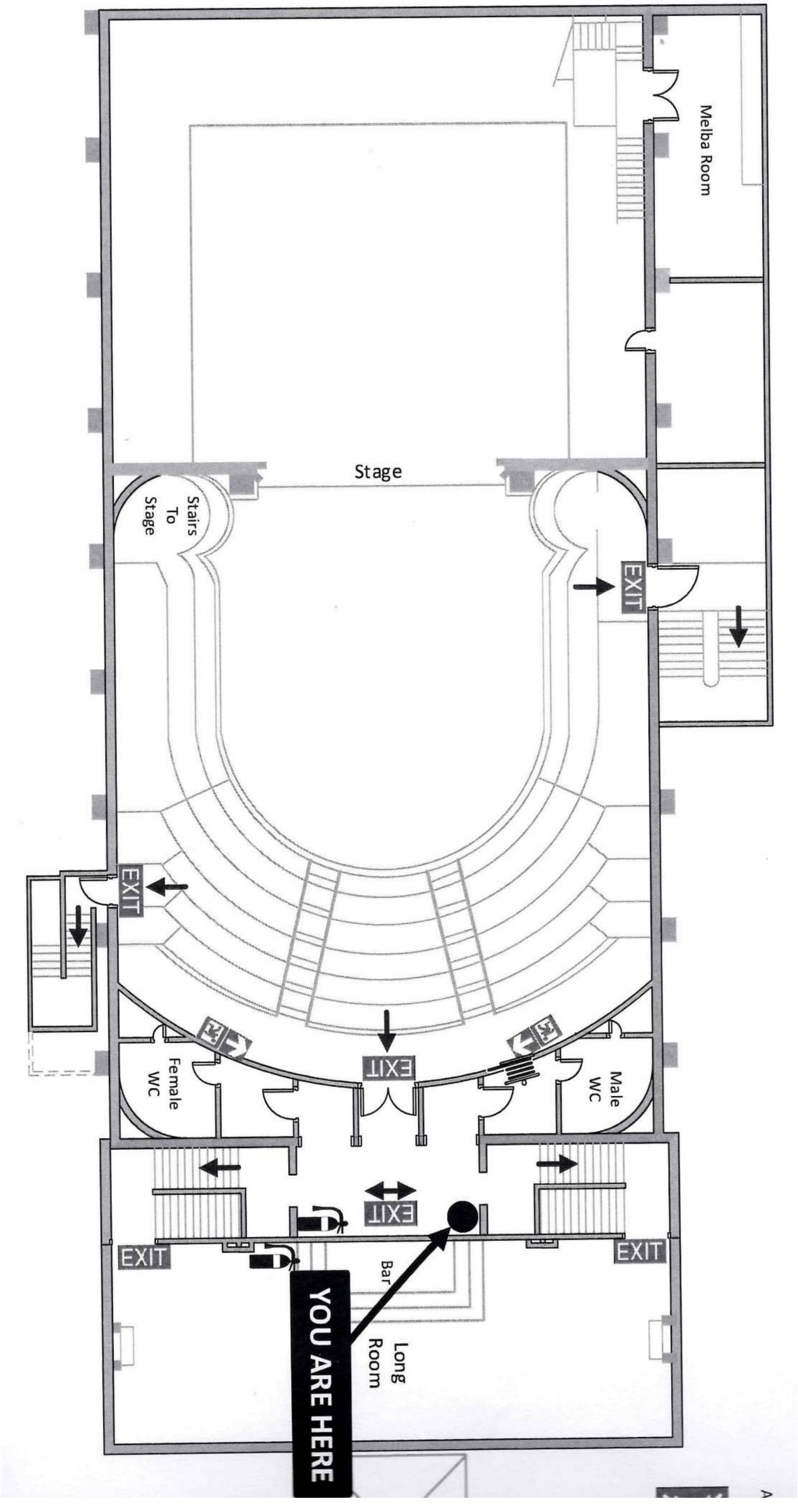
ATTACHMENT B: SITE MAPS

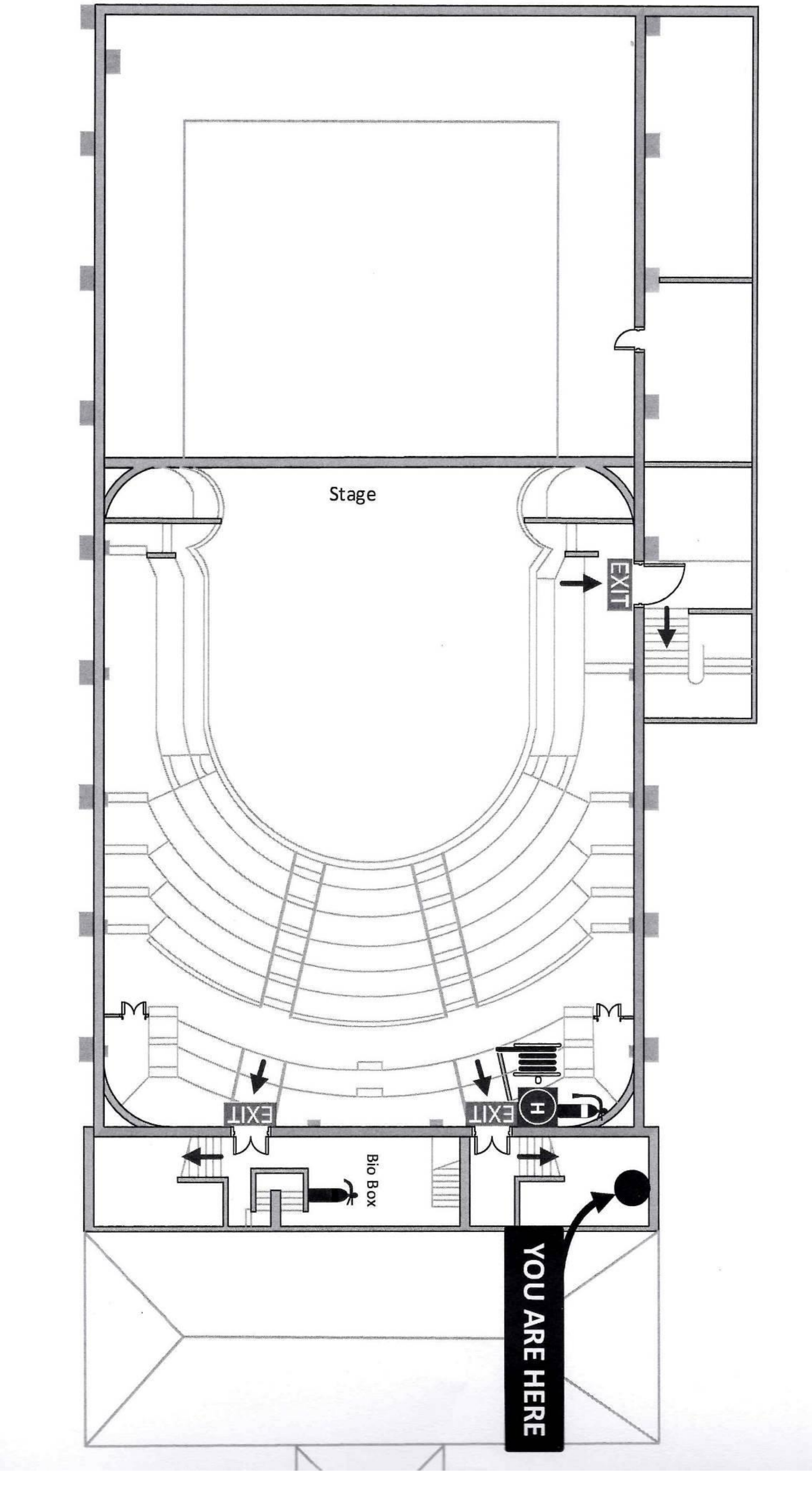


Assembly Area 2
Lewis Street
Stage Door
Gas Shut-off
EXIT
YOU ARE HERE
Laundry
Auditorium Fire Escape
Dressing Room 10
Male WC 2
Female WC 2
Dressing Room 7
Dressing Room Hallway
Visiting CO Office/ Dressing Room 8
Dressing Room 9
Dressing Room 11
Dressing Room 12
EXIT
Organ 3
Organ 2
Drum Room
Archive
Organ 1
Organ SOC
Organ Hallway
Store 5
Comp ressor
Office 5
Assembly Area 3
EXIT
EXIT
Unicorn Lane
Office 4
Kittson Room
Files Room
Office
Cleaner Store
Store 3
Office 1
Store 2
Office 2
Store 4
1m.
Livery
Livery
Lift
Lift Motor Room
Toilet Floor
Female WC 1
Male WC 1
Male WC 1
Plant Room
Store 1
Assembly Area 1


Assembly Area 2
Lewis Street
EXIT
H
Female WC 3
Male WC 3
Tech Office 1
Tech Office 2
Dressing Room 1
Dressing Room 2
Dressing Room 3
Dressing Room 4
Dressing Room 5
Dressing Room 6
Void
Orchestra Pit
Auditorium Fire Escape
Assembly Area 3
Unicorn Lane


Lydiard Street South
Assembly Area 1
Entry Portico
EXIT
Ticket Office
Candy Bar
AED
FIP
YOU ARE HERE
Lift
Stalls
Evacuation Staging area
Unicorn Lane
Assembly Area 3
Pit
FB
Props
Stage
Ante Room
Gas Shut-off
Green Room
External Hoist
Pianos
Workshop
Assembly Area 2
Lewis Street


Melba Room
Stage
Stairs
To
Stage
EXIT
EXIT
EXIT
Female
WC
Male
WC
EXIT
EXIT
EXIT
Bar
Long
Room
YOU ARE HERE


Stage
EXIT
EXIT
EXIT
H
Bio Box
YOU ARE HERE

ATTACHMENT C – LEAD PAINT ANALYTICAL REPORT

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Testing For Life 1987–2017
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Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Hazard Alert
2/75 High Street
Belmont
VIC 3216

Attention:	Mary Zalijevic
Report	608198-S
Project name	HER MAJESTYS THEATRE
Project ID	6388
Received Date	Jul 18, 2018

Client Sample ID Sample Matrix Eurofins I mgt Sample No. Date Sampled Test/Reference	LOR	Unit	6388-01L Paint M18-JI20616 Jul 17, 2018	6388-02L Paint M18-JI20617 Jul 17, 2018	6388-03L Paint M18-JI20618 Jul 17, 2018	6388-04L Paint M18-JI20619 Jul 17, 2018
Lead (% w/w)	0.01	%	3.5	0.02	0.06	< 0.01

Client Sample ID Sample Matrix Eurofins I mgt Sample No. Date Sampled Test/Reference	LOR	Unit	6388-05L Paint M18-JI20620 Jul 17, 2018	6388-06L Paint M18-JI20621 Jul 17, 2018	6388-07L Paint M18-JI20622 Jul 17, 2018	6388-08L Paint M18-JI20623 Jul 17, 2018
Lead (% w/w)	0.01	%	0.10	0.05	0.04	< 0.01

Client Sample ID Sample Matrix Eurofins I mgt Sample No. Date Sampled Test/Reference	LOR	Unit	6388-09L Paint M18-JI20624 Jul 17, 2018	6388-10L Paint M18-JI20625 Jul 17, 2018	6388-11L Paint M18-JI20626 Jul 17, 2018
Lead (% w/w)	0.01	%	0.60	1.6	0.11

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Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Lead (% w/w)	Sydney	Jul 18, 2018	6 Month

- Method: E022.5 - ACID EXTRACTABLE METALS IN PAINT IN LIQUID AND POWDERED FORM BY ICP-MS ANALYSIS

Company Name:	Hazard Alert	**Order No.:**	HA 1080	**Received:**	Jul 18, 2018 5:00 PM
Address:	2/75 High Street	**Report #:**	608198	**Due:**	Jul 20, 2018
	Belmont	**Phone:**		**Priority:**	2 Day
	VIC 3216	**Fax:**		**Contact Name:**	Mary Zalijevic
Project Name:	HER MAJESTYS THEATRE				
Project ID:	6388				

Eurofins | mgt Analytical Services Manager : Michael Cassidy

Sample Detail						Lead (% w/w)
Melbourne Laboratory - NATA Site # 1254 & 14271						
Sydney Laboratory - NATA Site # 18217						X
Brisbane Laboratory - NATA Site # 20794						
Perth Laboratory - NATA Site # 23736						
External Laboratory						
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**	
1	6388-01L	Jul 17, 2018		Paint	M18-Jl20616	X
2	6388-02L	Jul 17, 2018		Paint	M18-Jl20617	X
3	6388-03L	Jul 17, 2018		Paint	M18-Jl20618	X
4	6388-04L	Jul 17, 2018		Paint	M18-Jl20619	X
5	6388-05L	Jul 17, 2018		Paint	M18-Jl20620	X
6	6388-06L	Jul 17, 2018		Paint	M18-Jl20621	X
7	6388-07L	Jul 17, 2018		Paint	M18-Jl20622	X
8	6388-08L	Jul 17, 2018		Paint	M18-Jl20623	X
9	6388-09L	Jul 17, 2018		Paint	M18-Jl20624	X

Company Name:	Hazard Alert	**Order No.:**	HA 1080	**Received:**	Jul 18, 2018 5:00 PM
Address:	2/75 High Street	**Report #:**	608108	**Due:**	Jul 20, 2018
	Belmont	**Phone:**		**Priority:**	2 Day
	VIC 3216	**Fax:**		**Contact Name:**	Mary Zalijevic
Project Name:	HER MAJESTYS THEATRE				
Project ID:	6388				

Eurofins | mgt Analytical Services Manager : Michael Cassidy

Sample Detail						Lead (% w/w)
Melbourne Laboratory - NATA Site # 1254 & 14271						
Sydney Laboratory - NATA Site # 18217						X
Brisbane Laboratory - NATA Site # 20794						
Perth Laboratory - NATA Site # 23736						
10	6388-10L	Jul 17, 2018		Paint	M18-Jl20625	X
11	6388-11L	Jul 17, 2018		Paint	M18-Jl20626	X
Test Counts						11

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

**NOTE: pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	ug/L: micrograms per litre
ppm: Parts per million	ppb: Parts per billion	%: Percentage
org/100mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100mL: Most Probable Number of organisms per 100 millilitre

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	Quality Systems Manual ver 5.1 US Department of Defense
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

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Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	No
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised By

Michael Cassidy — Analytical Services Manager

Glenn Jackson
National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

APPENDIX D BUILDING SURVEYORS REPORTS PREPARED BY HENDRY GROUP

HENDRY
Hendry Group Pty Ltd
ABN: 13 006 693 232
Level 4, 90 Collins Street Melbourne VIC 3000
P 03 8417 6500 / F 03 8417 6599 / E melbourne@hendry.com.au
hendry.com.au

Feasibility Consultancy Report

Her Majesty's Theatre, Ballarat

FOR

Lovell Chen

Prepared By

HENDRY GROUP PTY LTD

June 2019

13th June 2019

Christophe Loustau
Senior Associate - Conservation
Lovell Chen
Level 5, 176 Wellington Parade
East Melbourne VIC 3002
Email: CLoustau@lovellchen.com.au

Dear Christophe,

RE: Her Majesty's Theatre, Ballarat – Conservation Project

1.0 Background

We understand that, as a result of deterioration and general and wear due to its age, upgrades to Her Majesty's Theatre, Ballarat are being considered. We further understand that Stage 1 of these upgrades are currently being carried out, including but not limited to façade repair works, remedial works to the roof structure, an upgrade of exit signage and emergency lighting, stormwater system alterations and fire-safety related works.

We have been advised that the scope of this report is to audit the building to determine levels of relative compliance with current legislation, as well as assessing the documentation that has been produced to date, including but not limited to:

1. Conservation Management Plan (CMP) prepared in 2006;
2. Building surveying and fire engineering approvals associated with the Stage 1 works;
3. Feasibility report for Stage 1 prepared for the City of Ballarat.
4. Stage 2 proposal works.

2.0 Building Description

Her Majesty's Theatre, Ballarat is the oldest continuously operating theatre on the mainland, operating since its opening in 1875. The building is listed on the Victorian Heritage Register and on the Register of the National Estate.

The building is of significant cultural importance to the Ballarat region and beyond.

3.0 Site Observations

To fully appreciate the intricacies of the site and the issues requiring consideration, an inspection was undertaken on the 8th of May 2019. The findings presented in Table 1 of this report outline our assessment of areas of concern, along with recommendations for remedial works or actions.

4.0 Legislation

4.1 Section 28 of the Building Act 1993

Section 28 of the Building Act 1993 permits a relevant building surveyor (RBS) to issue a building permit for works that do not comply with the building regulations, one of the few instances in which this may occur, for works carried out on, or in connection with, a building that is listed on the Heritage Register.

In issuing such a building permit, the RBS must have regard to the structural adequacy of the building and the safety, health and amenity of people using the building.

4.2 Regulation 233 of the Building Regulations 2018

Regulation 233 of the Building Regulations 2018 stipulate that, where alterations to a building within a 3 year period exceed 50% of the volume of the building, then the entire building must be brought into conformity with current requirements.

However, the RBS is granted significant powers of discretion in permitting partial compliance, based on the individual circumstances of any particular application.

Given the scope of what is proposed to the building, this regulation will apply. However, it is considered reasonable to expect less than full compliance for a building of this profile. As such, recommendations have been made in this report for the retention of existing conditions where appropriate and subject to specialist consultant input and verification as required.

4.3 Regulation 236 of the Building Regulations 2018

Regulation 236 of the Building Regulations 2018 stipulate that, where alterations to a building are being carried out such that the building contains a new part required to be accessible, then a compliant path from the principal pedestrian entrance to the new part must be provided. We note the long term intent to provide lift access to all areas.

The above notwithstanding, and considering the Heritage Victoria constraints associated with the building, it would be reasonable to engage an access consultant to rationalise any areas of accessibility shortfall into a partial compliance and management strategy in lieu of achieving full compliance.

The risk of such a strategy, with respect to the potential for claims under the DDA to arise and potential actions required to address those claims, would need to be accepted by the City of Ballarat, as the owner of the building.

5.0 Assessment of Feasibility Report and Associated Documents

5.1 Superseded Legislation

It is noted that there have been legislative changes since the drafting of the documents for Stage 1, including the introduction of the Building Regulations 2018.

These references should be updated in the next feasibility report, as appropriate.

5.2 Feasibility Report

Our assessment of the Feasibility Report, project number 7925, revision E has highlighted the following issues for consideration:

5.2.1 Section 4.1.2 - the required number of accessible seats in the auditorium is listed as **17** whereas the actual required number when calculated in accordance with BCA Clause D3.9 is **16**. The BCA has specific requirements on how the accessible seats are distributed that will need to be factored into future works packages.

5.2.2 Section 4.1.4 – the BCA does not prescribe toilet numbers for participants in single auditorium theatres. It would be logical to apply for participant numbers for other Class 9b performance venues. However, this results in required toilet numbers that greatly exceed what is proposed in the table for the Back-of-House / Staff areas. A Performance Solution could be considered here as part of the Stage 2 works.

5.2.3 Section 4.1.4 – the table seems to indicate that accessible and ambulant facilities are required in addition to standard male and female toilets. Recommend that this be clarified to account for the fact that accessible toilets can be counted once for each sex and that ambulant facilities are included in the overall numbers.

5.2.4 Section 4.1.4 - a Performance Solution / dispensation approach would be required to rationalise the proposed reduction in the number of showers provided to the building.

5.2.5 Section 4.2 - the number of receivers in the proposed induction (hearing) loop will need to meet BCA Clause D3.7 when compared to occupancy levels unless a Performance Solution approach is adopted.

5.2.6 Section 4.2.4 – replacing the stormwater system to the neighbouring property may require a separate building permit to be issued for that property.

5.2.7 Section 4.2.5 of the Feasibility Report nominates a rise in storeys of 3. Our assessment of the building has determined that the building has a rise in storeys of 4.

5.2.8 Section 4.3.2 – incorporation of a new lift into the southern fire-isolated stair will require fire engineering verification since the BCA does not permit the sharing of shafts that are required to be fire-rated.

5.2.9 Section 4.3.5 – consideration should be given to the installation of AS 1657 system for roof access, as appropriate and required.

5.2.10 Section 5.3 - consideration should potentially be given to a seismic solution that is formulated to *AS 3826-1998: Strengthening existing buildings for earthquake* via a Performance Solution approach since compliance with AS 1170.4 for a building like this is expected to be difficult.

5.2.11 Section 5.3 – recommend clarifying reference in this specifically to Regulation 233 of the Building Regulations 2018 in respect of the 50% volume trigger and deleting the change of use reference, since it is not applicable.

5.2.12 Section 5.3 – recommend also clarifying that full compliance would not be expected for a building like this and that the relevant building surveyor has significant powers of discretion in applying Regulation 233 in its entirety, when considering the individual characteristics of a particular building.

5.2.13 Section 5.3 – the requirement for the balustrades to meet crowd loading requirements would need to be considered in more detail.

5.2.14 Section 7.1.5 – recommend specifying that new switchboards are required to be in non-combustible enclosures and be provided with smoke seals.

5.3 Stage 1 Building Permit, Approved Building Permit Documents & Fire Engineering Report

Our review of the documents associated with the Stage 1 approvals has highlighted the following areas for discussion:

5.3.1 The FER has rationalised the inclusion of smoke doors to BCA Specification C3.4 where fire doors are required in certain areas. However, the Specification C3.4 requirement for such doors to swing in the egress direction was not included in the analysis for the Long Room.

5.3.2 The implementation of the fire compartmentation noted in the FER has resulted in fire hose reel shortfalls to the auditorium and the Long Room, since fire hose reels are not permitted to pass through fire doors or smoke doors to achieve coverage.

5.3.3 The FER addresses the enclosure of the space beneath one non-fire-isolated stair per BCA Clause D2.8, whereas multiple stairs within the building actually display non-compliance with this Clause but are not addressed.

5.3.4 We note the Exova peer review (MEE170028 PR1.0) of the Gincat FER rev 1.3 was issued on 29th October 2018 i.e. after the building permit for the Stage 1 works was issued. It is unclear which party instigated the peer review of the Gincat FER.

5.3.5 Gincat consultant advice notice (CAN) ref. P17247:20190117L1 and updated FER rev 1.4 issued on 29th January 2019 to address comments in Exova peer review.

5.3.6 Subsequent peer review (MEE170028 PR1.1) from now-WarringtonFire (formerly Exova) issued on 22nd February 2019, in which the conclusion (Section 5) notes WarringtonFire's opinion of items not addressed in Gincat FER rev 1.4.

5.3.7 No subsequent editions of the Gincat FER were provided to us for assessment, so we are unable to determine if another edition has been prepared to address the WarringtonFire concerns.

5.3.8 The FER enacted by the building issued on 10/10/2018 has now obviously been superseded. It is unclear if FER version 1.4 has been enacted by a building permit.

5.3.9 FER states that a designated fire warden is to be present at all times. Clarification required as to whether this means 24/7, whilst the building is occupied for performances or purely whilst construction works are ongoing.

5.3.10 The approved services documentation for Stage 1 does not appear to capture FER requirements for occupant warning speakers and visual alarm devices (VADs) i.e. strobes in the orchestra pit, organ chambers and fly platform, along with manual call points at all exits. There may be documents missing from the package provided to us that could explain the discrepancy.

5.3.11 The approved services documentation for Stage 1 does not appear to capture FER requirements sprinklers on the auditorium side of the non-fire-rated doors or the sprinklers to protect the Bio-Box openings. There may be documents missing from the package provided to us that could explain the discrepancy. That said, the sprinklers did not appear to have been installed during our audit, though works were clearly ongoing at that time.

5.3.12 The FER has required smoke walls in the Basement 1 as shown in Appendix F, including the replacement of several doors with solid core doors provided with smoke seals but this requirement does not appear to have been picked up in the approved building permit documents.

5.3.13 The approved building permit drawings associated with the Stage 1 works do not appear to include HA.214. Drawing HA.214 shows a 2.2m ceiling height in the B2.11 corridor serving the dressing rooms.

6.0 Items Requiring Clarification

The following factors will need to be considered as the project progresses:

6.1 From assessing the title documentation, it would seem that the northern egress stairs from the building to Unicorn Lane and the eastern projection containing the Green Room are not on Her Majesty's Theatre title. This will need to be further investigated, particularly in respect of the proposals for new works in these areas.

6.2 Amended Stage 1 building permit will be required to enact final version of Stage 1 FER once all peer reviewer issues have been closed out.

6.3 It appears that Stage 1 approved building permit documents will need to be amended to fully capture the requirements of the FER.

6.4 It appears that the Stage 1 approved building permit documents will need to be amended to capture the reduced ceiling height in the B2.11 corridor and rationalise through Regulation 233 dispensation.

7.0 Stage 2 Proposals

7.1 Scope

We note that, as part of the ongoing upgrade project, it is proposed to implement the following scope as part of the Stage 2 component:

7.1.1 Demolition of both existing escape stairs on the north elevation and replacement with a fully enclosed fire-isolated stair with a plant platform on top.

7.1.2 Consideration of options to increase levels of compliance in respect of access for persons with disabilities, including altering the main entry and providing lift access throughout.

7.1.3 Deletion of the south stair serving the foyer to make way for a new passenger lift serving front-of-house.

7.1.4 Installing a new passenger lift in the southern fire-isolated serving the auditorium and back-of-house.

7.1.5 Increasing the height of the balustrades to the Dress Circle and Balcony.

7.2 Implications & Additional Considerations

The following comments represent some factors to be considered in the Stage 2 works. This is guiding commentary only and does not constitute a full regulatory check.

7.2.1 The new fire-isolated stair is required to have a 2-hour fire-rated lid, meaning that any proposed access hatch to access the roof plant platform must be a tested, fire-rated system.

7.2.2 Any ladders and the like to access the new roof plant platform on top of the stair must not impede use of the fire-isolated stair.

7.2.3 A loading assessment of the plant equipment on the structure will need to be factored into the structural design and fire-ratings assessment.

7.2.4 The plant platform will require a full, BCA D2.16 compliant balustrade with no climbable elements.

7.2.5 Consider the installation of a fall arrest system to the plant platform.

7.2.6 The emphasis on the auditorium balustrades appears to be on increasing the height. Since the balustrades were measured to be approximately 700mm in height (exact height would need to be confirmed), an alternative proposal could be to extend the balustrade in a horizontal direction in lieu of a vertical direction. This could increase safety levels whilst maintaining sightlines and would be in accordance with BCA Table D2.16, Clause 1(c) – extract below.

Table D2.16a BARRIER CONSTRUCTION

1. Barrier heights	
Location	**Minimum height**
(a) Stairways or ramps with a gradient of 1:20 or steeper. (b) Landings to a stair or ramp where the barrier is provided along the inside edge of the landing and does not exceed 500 mm in length.	865 mm
(c) In front of fixed seating on a *mezzanine* or balcony within an auditorium in a Class 9b building, where the horizontal projection extends not less than 1 m outwards from the top of the barrier.	700 mm

7.2.7 The stairs in the Basement 1 technical room mean that the dressing rooms will still not be accessible, despite the new lift being extended to serve Basement 1. Consider ramping this change in level with compliant 1:14 ramp.

7.2.8 The access consultant will need to rationalise via Performance Solution not having an accessible unisex sanitary facility on each level containing toilets i.e. Basement 1.

7.2.9 The access consultant will need to rationalise via Performance Solution not having the new accessible unisex sanitary facilities at the existing banks of toilets.

7.2.10 The access consultant will need to rationalise the width of the B2.11 corridor since it is not wide enough to accommodate the circulation spaces required by AS 1428.1-2009.

7.2.11 Once the accessible unisex sanitary compartment is installed in Basement 1, the male and female toilets will need to be altered to include at least 1 compartment for use by people with ambulant disabilities.

7.2.12 The sliding door in Basement 1 leading to the new southern fire stair will need to be replaced with a swinging door or be assessed by the fire engineer.

7.2.13 The proposed alterations to Basement 1 will compromise the fire wall strategy implemented in Stage 1 i.e. the removal of part of the fire wall separating the back-of-house and auditorium fire compartments. This will need to be reassessed by the fire engineer as part of the Stage 2 works package.

7.2.14 The sprinkler control valves will need to be relocated due to the construction of the new northern fire stair since they currently sit in that footprint.

Where appropriate and required, we have considered the above intended scope for Stage 2 in the assessment and recommendations associated with the defects that were observed during our site inspection.

Scope Clarifications

The items presented in this report are based on our preliminary understanding of the proposed scope, along with our site inspection of those areas that were able to be accessed. The items presented in this report are intended to be general guidance discussion points only, pending firming of the scope. This report does not constitute any approval to carry out building works.

The advice in this report is also subject to change as the scope progresses, additional documents are provided, additional consultant advice is received (heritage, access consultant and fire engineer) and additional clarifications are made.

No assessment of the operational status of services was carried out during our inspection.

If you have any queries, please do not hesitate to contact the undersigned.

Yours sincerely,

Martin Ryan
Building Surveyor

Table 1					
Item	**Requirements**	**Location**	**Inspection Findings**	**Recommendation**	**Photo/Figure Reference**
C1.1 **Fire-resisting construction**	For a Class 9b building with a rise in storeys of 4 (see item C1.2), the building is required to be of Type A construction (the most fire-resisting construction methodology noted in the BCA) with the following requirements: 1. Floors to achieve 120 minute FRL. 2. Fire walls to achieve 120 minute FRL. 3. Beams, columns, trusses etc. to achieve 120 minute FRL.	Throughout	There were several issues in respect of fire-ratings, including: 1. Unprotected timber columns in various areas. 2. Unprotected steel beams supporting floors above. 3. Non-fire-rated timber floor structures in various areas. 4. Unprotected steel columns and floor structure at the east side (Lewis Street). 5. Unprotected steel columns in the auditorium.	Since the trigger for full upgrades per Regulation 233 will be activated, fire engineering analysis of retaining the existing structure in its current form will be required, possibly subject to some upgrades (Heritage constraints permitting). We do note the long-term intent to increase the height of the Green Room area which would increase the load on the existing Lewis Street columns. This would need to be included in the fire engineering and structural analysis.	 Unprotected steel beam  Non-fire-rated structural columns
C1.1 **Fire-resisting construction**	For a Class 9b building with a rise in storeys of 4 (see item C1.2), the building is required to be of Type A construction (the most fire-resisting construction methodology noted in the BCA) with the following particular requirements: 1. External walls within 1.5m of a fire-source feature must be fire-rated to 90 minutes.	Lewis Street elevation	External walls are exposed to the adjoining Mechanics Institute without protection of the openings. The FRL of the external walls at this point was not able to be established.	Address the exposure of the external walls and openings through fire engineering associated with the Stage 2 works.	 Exposure of external walls to adjacent building
C1.1 **Fire-resisting construction**	In a Type A building, the roof must achieve an FRL of 120/60/30, unless one of the following conditions are satisfied: 1. Sprinkler system installed throughout the building. 2. The building has a rise in storeys of 3 or less. 3. The building is Class 2 or Class 3. 4. The building has an effective height of less than 25m and the ceilings are treated to achieve a 60 minute FRL.	Roof space.	The original roof is constructed from timber beams and trusses which will not achieve the required fire-ratings, despite one of the conditions noted being satisfied. We do however note that some new steel trusses have been installed as part of the rectification works process.	Rationalise the lack of fire-rating to the roof as part of the fire engineering process associated the Stage 2 works. We note that the roof space itself is sprinkler-protected so this should be relatively easy to justify.	 Non-fire-rated timber roof structure
C1.2 **Calculation of rise in storeys**	The rise in storeys is the sum of the greatest number of storeys at any part of the external wall of the building and any storeys within the roof space above the finished ground next to that part. Rise in storeys is a key building feature that drives many other BCA requirements.	Throughout.	Given the slop of the land on which the building sites and the fact that the basement is freely accessible at the rear, the building has been determined to have a rise in storeys of 4.	Note only. However, since Stage 1 works determined a rise in storeys of 3, certain aspects will need to be reconsidered as stipulated in this report.	

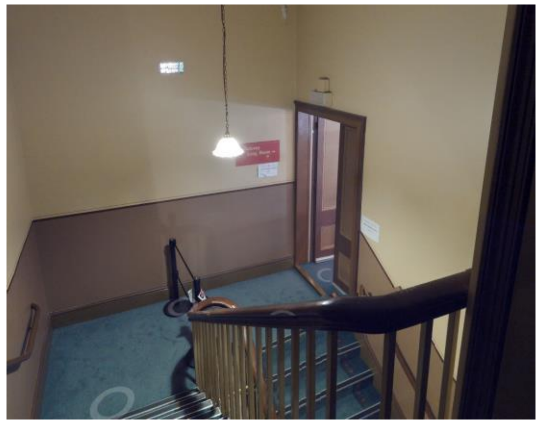
Table 1					
Item	**Requirements**	**Location**	**Inspection Findings**	**Recommendation**	**Photo/Figure Reference**
C2.2 **General floor area and volume limitations**	The fire engineering report nominates smoke compartmentation to the Basement 1 level.	Basement 1	We were unable to determine the integrity of the walls nominated as smoke walls and whether or not they fully extend above the ceiling to create a smoke wall and have all penetrations suitably sealed against the passage of smoke, including the provision of smoke dampers to the duct penetrations.	The requirements of the Stage 1 fire engineering report should be implemented in full, including the provision of solid core doors and smoke seals as required. We note however that significant alterations to the Basement 1 level are proposed as part of Stage 2. We recommend that the fire engineer be consulted as to the requirements for smoke compartmentation in Stage 2.	
C2.12 **Separation of equipment**	Equipment described in this Clause must be separated from the remainder of the building by construction having an FRL of 120/120/120.	Lift motor room	The lift motor room door is provided with a grille, but we were unable to see a fire damper in the grille to protect the opening.	Sicne this fire-rating is noted in the Stage 1 FER, verify that a damper is provided to the door grille to the lift motor room fire door. If no damper is installed, install a damper to reinstate the required separation. It is however noted that the Stage 2 scope will remove this room.	
C3.2 **Protection of openings in external walls** **C3.4** **Acceptable methods of protection**	Openings in an external wall that is required to have an FRL must be protected in accordance with C3.4. Acceptable methods of protection include the provision of wall-wetting sprinklers and fire-rated doors and windows.	Northern exit from Dress Circle Southern stair	The northern exit door from the Dress Circle appears to require protection since it is exposed to the adjacent building to the north. The southern stair has a grille opening to the boundary that is not protected.	Replace the northern exit door from the Dress Circle with a tested fire door or install internal / external wall-wetting sprinklers to the door opening. We do however note that it is intended to construct a new stair in this location as part of Stage 2. We note that the southern stair is to be demolished and this issue will likely be rectified at that time.	 Unproteced opening in external wall
C3.5 **Doorways in fire walls**	Openings in a fire wall must be protected by fire doors that do not reduce the FRL of the wall, except that the insulation criteria can be reduced to 30 minutes.	Basement 1 corridor	The doors in the newly designated fire wall in Basement 1 between the back-of-house and administration area i.e. in the corridor between B1.23 and B1.26 are required to be fire-rated but do not appear to be. Although the Stage 2 intent is to remove these doors and the corridor that they are in, the fact that the doors are not currently fire-rated contravenes the Stage 1 fire safety strategy.	Install new fire-rated doorset to protect the opening or arrange for this door to be included in the fire engineering assessment. Note that either option requires the updating of Stage 1 building approval documents.	 Non fire-rated doors in fire wall.

Table 1					
Item	**Requirements**	**Location**	**Inspection Findings**	**Recommendation**	**Photo/Figure Reference**
C3.15 **Openings for service installations**	The fire engineering report prepared for the Stage 1 works required the provision of 1 x 13mm fire-rated plasterboard to the underside of the basement floor structure including protecting any openings in accordance with C3.15.	Basement	It was noted during our inspection that access panels have been installed in the fire-rated ceilings. It was further noted that holes for downlights have been drilled into the fire-rated ceiling.	Although the current architectural drawings specify fire-rated access panels, verify that the access panels installed are tested systems that do not impair the FRL of the plasterboard linings and are installed in accordance with the manufacturer's specifications. Verify that the downlights proposed to be installed will be protected with tested systems.	 Verify FRLs of propsoed access panels
C3.15 **Openings for service installations**	Where fire-rated building elements are penetrated by services, those penetrations must be treated in accordance with this Clause so as not to detrimentally affect the fire-rating of the element concerned.	Various	Multiple unprotected penetrations were observed throughout the building, including: 1. Walls between switchroom (B1.42) and substation (B1.43). 2. PVC pipe and other penetrations through the Basement 1 fire wall between backstage and auditorium fire compartments.	A passive fire services contractor should be engaged to audit the building and prepare a matrix of tested fire-stopping systems for installation. Installation of the systems should then be carried out as part of the scope of a building permit; either an amendment to the Stage 1 building permit or as part of Stage 2.	 Unprotected PVC pipe penetrations  Unprotected opening in fire-rated wall
D1.3 **When fire-isolated stairways and ramps are required**	A stair must be fire-isolated where it connects more than 3 storeys in a sprinkler-protected building.	Northwest stair	The internal northwest stair connects four storeys (Basement 1, Ground, Level 1 and Level 2) but is not a fire-isolated stair. The doors leading to the fire-isolated stair have been addressed through the fire engineering process for Stage 1 i.e. having smoke doors in lieu of the required fire doors. The stair is open at the bottom.	The building is not provided with a sprinkler system throughout. Since the stair connects 4 storeys, address the additional non-compliances via the fire engineering process for Stage 2.	
D1.4 **Distance of travel**	Distances of travel to exits must not exceed BCA requirements. 20m to a single exit or a point of choice of exits. 40m to the closest exit through a point of choice within 20m of the start point.	Throughout	No distance of travel issues were apparent, except those included in the fire engineering report for Stage 1.	Distance of travel would need to be holistically assessed as part of Stage 2 works.	

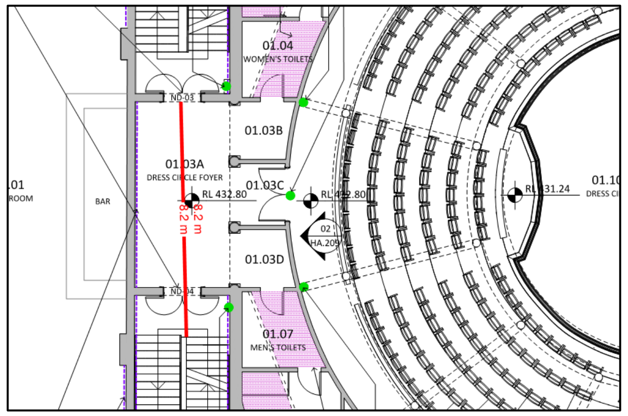
Table 1					
Item	**Requirements**	**Location**	**Inspection Findings**	**Recommendation**	**Photo/Figure Reference**
D1.5 **Separation of exits**	For exits to be considered as alternatives to each other, they must be a minimum of 9m apart.	Northwest & Southwest stairs - Foyer	The separation of the Northwest and Southwest stairs connecting the auditorium to the foyer is less than 9m, thereby meaning that they are considered to be one and the same exit, although with a large exit width.	Note only. No action required. It is noted that the South stair in the foyer is proposed to be demolished as part of the Stage 2 works.	 Separation of alternative exits
D1.6 **Dimensions of exits and paths of travel to exits**	The aggregate exit width of each storey must meet BCA requirements relating to the number of occupants of that storey.	Throughout	Since the Balcony accommodates 150 people, the required exit width is 1.5m, which is easily achieved. Since the Dress Circle accommodates 199 people, the required exit width is 2m, which is easily achieved. Since the Stalls accommodates 439 people, the required exit width is 4m, which is easily achieved. The exit width from the Long Room and back-of-house is sufficient.	We note that egress alterations and upgrades are proposed as part of Stage 2, so these assessments are notes only at this point. Egress width would need to be reassessed by fire engineering as part of Stage 2.	
D1.6 **Dimensions of exits and paths of travel to exits**	The unobstructed width of each exit or path of travel to an exit must be a minimum of 1m. Doors in the path of travel must have a minimum unobstructed width of 750mm for egress purposes, though 850mm clear is noted to be required for accessibility purposes.	Various doors	Melba Room is served by 2 x 610mm wide doors. Doors to Rear Stairwell (B2.15) are 2 x 720mm. Doors separating B1.02 from B1.01 are 2 x 740mm. Stage Doors D-B01 are 2 x 730mm. Doors from corridor to SAMS Room are 2 x 600mm. Doors in central B1 corridor are 2 x 680mm.	Consider replacing the doors with alternatives that achieve a minimum active leaf clear width of 750mm for egress purposes. Alternatively, retain and address reduced egress widths through fire engineering assessment. We note that egress alterations and upgrades are proposed as part of Stage 2.	
D1.6 **Dimensions of exits and paths of travel to exits**	The unobstructed width of each exit or path of travel to an exit must be a minimum of 1m. The unobstructed height of each exit or path of travel to an exit must be a minimum of 2.4m, except for doorways which may be 1980mm.	Various	Corridor in switchroom (B1.42) has a clear width of 790mm in lieu of minimum required 1m. Clearance of 720mm between columns and adjacent walls in B1.25 organ area. External northern escape stair is only 940mm wide in parts. Stair serving Bio Box is only 635mm wide. Stair from stalls to stage is 770mm wide. Door at the top of Bio Box stair is only 1740mm high.	Verify the existing situation via fire engineering. This issue will be resolved through the Stage 2 works. This issue will be resolved through the Stage 2 works. This stair should be demolished and a compliant alternative constructed. The door should be altered to achieve the minimum required height.	 Stair and door to BioBox

Table 1					
Item	**Requirements**	**Location**	**Inspection Findings**	**Recommendation**	**Photo/Figure Reference**
D1.7 **Travel via fire-isolated exits**	A door must not open directly to a fire-isolated stair unless it is from a public corridor / lobby, sanitary compartment or the like.	Long Room	The Long Room opens directly to the Northwest stair that is required to be fire-isolated. The auditorium opens directly to the south fire stair.	Validate the noted doors opening directly to the fire-isolated stairs through the fire engineering process.	 Door from Long Room opening directly to stair
D1.7 **Travel via fire-isolated exits**	Fire-isolated exits are required to discharge directly, or by way of a dedicated fire-isolated corridor, to a road or open space.	Northwest stair	The northwest stair, which is considered to be a fire-isolated stair, discharges inside the building in lieu of discharging directly to a road or open space.	Address the discharge of northwest stair in the Stage 2 works utilising fire engineering.	
D2.3 **Non-fire-isolated stairs and ramps**	Required non-fire-isolated stairs and ramps are required to be of concrete, 6mm steel or timber with specific characteristics.	Stair to Bio Box	The stair to the Bio Box is timber and will very likely not satisfy the requirements of this Clause.	Reconstruct the stair to fully comply with current requirements.	 Timber stair to Bio Box
D2.4 **Separation of rising and descending flights**	If a stairway is required to be fire-isolated, there must be no direct connection between flights serving storeys above ground level and flights serving storey below ground level.	Northwest stair	The northwest stair, which connects 4 storeys, is required to be fire-isolated and connects storeys above and below ground level at the Lydiard Street side.	As part of the Stage 2 works, rationalise the existing situation with fire engineering analysis.	

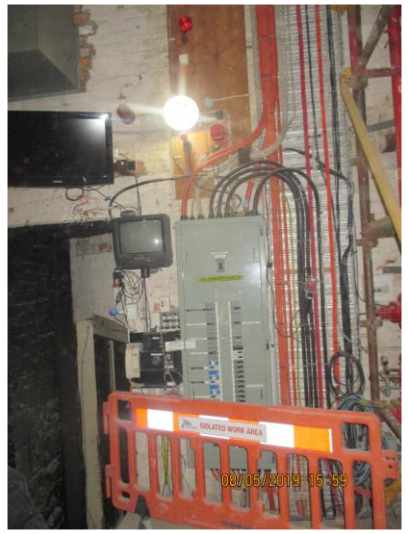
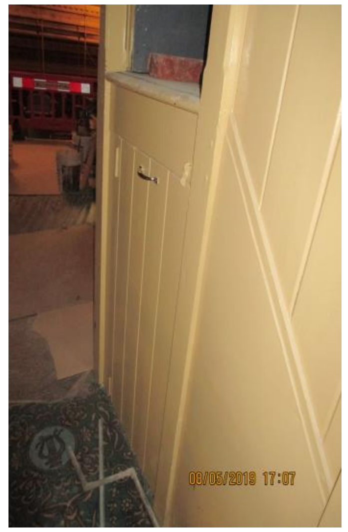
Item	Requirements	Location	Inspection Findings	Recommendation	Photo/Figure Reference
D2.7 **Installations in exits and paths of travel**	If switchboards are installed in paths of travel to exits, they must be enclosed in non-combustible construction and have doors fitted with smoke seals.	Stage	Switchboard in Stage area does not have doors or smoke seals.	Replace the switchboard with a compliant alternative or install a door fitted with smoke seals. Verify that all other switchboards in the building meet this requirement.	 Non-conforming swithcboard located on path of travel
D2.8 **Enclosure of space under stairs and ramps**	For a required, non-fire-isolated stairway, the space underneath must not be enclosed to form a cupboard unless 60 minute fire-rated construction is provided.	Unicorn Lane Fire Escape	The space underneath the Unicorn Lane fire escape has been enclosed to form the entrance lobby to Basement 1 but the construction is not fire-rated as required to be.	We do note the long term intention to construct a new fire-isolated stair to the north elevation, which would resolve the Unicorn Lane issue.	 Enclosure of space under required non-fire-isolated stair  Enclosure of space under Bio Box stair
		Room B1.46	The space beneath the southeast stair has been enclosed to form Room B1.46 and the mechanical plant area.	Rationalise the enclosure of the space beneath the other stairs using fire engineering analysis.	
		GF.078	The space beneath the South Stairs has been enclosed to form a lift shaft.	We understand that it is proposed to demolish the South Stair and lift as part of the Stage 2 works, thereby resolving this issue.	
		Stair serving Bio Box	The space beneath the stair serving the Bio Box has been enclosed to form a cupboard.	This stair should be demolished and a compliant alternative constructed in its place, without storage beneath.	
D2.10 **Pedestrian ramps**	Where a ramp is serving as a required exit, such as a fire-isolated ramp, it must have a gradient no steeper than 1:8.	South fire escape	The south fire escape stair discharges into a fire-isolated corridor at Basement 1 level which is connected to the exit door by a ramp. The gradient of the ramp is inconsistent and feels very steep in parts.	Verify the gradient of the ramp and, where found to be steeper than 1:8, carry out alterations to even out the surface to have a consistent gradient of not more than 1:8 at any point.	 Verify ramp gradient

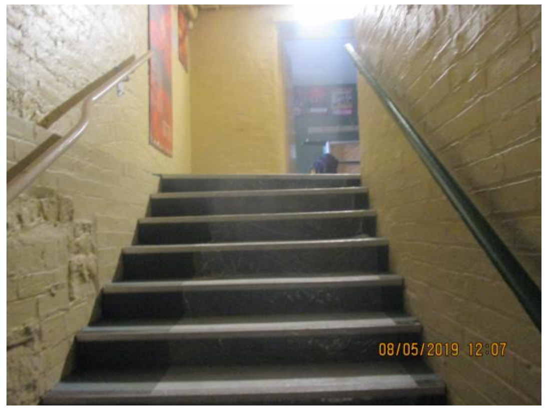
Table 1					
Item	**Requirements**	**Location**	**Inspection Findings**	**Recommendation**	**Photo/Figure Reference**
D2.13 **Goings and risers**	Stairs must satisfy BCA requirements in respect of dimensions, namely: • Riser heights between 115mm and 190mm. • Going dimensions between 250mm and 355mm (public stairs). In addition, a stair must have consistent dimensions throughout the same flight.	All stairs	The dimensions of individual stair components were found to vary significantly within the same component; for example, riser height 170mm at one end and 190mm at the opposite end. In addition, multiple stair flights within the building had inconsistent dimensions throughout the same flight.	Carry out remedial works to stairs where possible to achieve greater consistency of dimensions.	 Top riser show significant variance
D2.13 **Goings and risers**	Stairs must satisfy BCA requirements in respect of dimensions, namely: • Riser heights between 115mm and 190mm. • Going dimensions between 250mm and 355mm (public stairs). In addition, a stair must have consistent dimensions throughout the same flight.	Bio Box	The stair serving the Bio Box is non-compliant is most aspects.	It is noted from review of the Stage 2 documentation that the stair serving the Bio Box is not proposed to be altered. We would strongly recommend that, as a minimum, the installation of a compliant AS 1657 arrangement be considered for this area.	
D2.14 **Landings**	Stair treads and landings must satisfy minimum BCA slip resistance requirements.	Unicorn Lane fire escape	Unicorn Lane fire escape stair treads were observed to in poor condition.	Although it is noted that the stairs to the north of the building are proposed to be demolished as part of the Stage 2 scope, we recommend that non-slip nosing strips are provided in the interim.	 Stair treads in poor condition

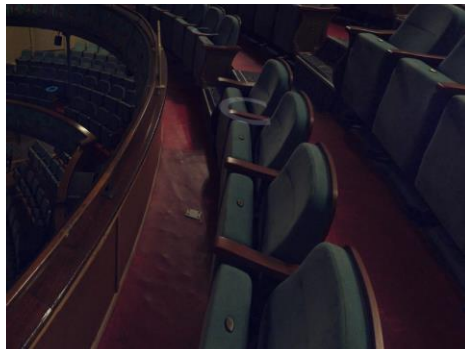
Table 1					
Item	**Requirements**	**Location**	**Inspection Findings**	**Recommendation**	**Photo/Figure Reference**
D2.15 **Thresholds**	The threshold of a doorway must not incorporate a step or ramp at any point closer to the doorway than the width of the door leaf.	Various	Various doors throughout the building incorporate steps directly in the door thresholds, reflective of building techniques at the time of construction, including: 1. Ground floor Audio Room (GF.108). 2. Doors from auditorium to south fire escape. 3. Organ rooms. 4. Archive room (B1.16). 5. Doors from Long Room (01.01). 6. Door to B1.21. 7. Door from B2.17 to B2.18. 8. Door from corridor to B1.25. Landing of only 500mm is provided at the base of the stair between front-of-house and back-of-house in Basement 1, in lieu of landing of at least one door width.	Given the unique heritage nature of the building, and where the issues will not be resolved as a result of Stage 2 works, apply for a building surveyor dispensation to permit the retention of the steps in the door thresholds as part of Stage 2 building permit works. Rationalise the existing situation via dispensation / Performance Solution as part of the Stage 2 works.	 Step incorproated in door threshold
D2.16 **Barriers to prevent falls**	Where a person could fall 1m or more, suitable barriers to prevent falls must be installed. Required barriers must have a minimum height of 1m above level surfaces and 865mm above the line of stair nosings. Where installed in front of fixed rows of seating, barrier height can be 700mm provided there is a horizontal projection of 1m from the top of the balustrade. Barriers must also contain no openings that are greater than 125mm in size.	Auditorium – Gallery & Dress Circle Northwest corner of Gallery	Barriers provided along the front edge of the Gallery and Dress Circle, preventing significant falls, were measured to be approximately 690mm in height in lieu of the minimum required 1m. It is possible to fall more than 1m from the top level of seating, thereby requiring a balustrade. Currently only a handrail is provided.	In tandem with the line of sight issues noted, formulate a solution to increasing the safety levels of the balustrade. One potential option could be to install a horizontal projection in lieu of increasing the height. This would increase safety levels whilst preserving sightlines. Consider the provision of a BCA-compliant balustrade to this area.	 Low balustrade in sight line  Barrier required to prevent falls
D2.16 **Barriers to prevent falls**	Where a person could fall 1m or more, suitable barriers to prevent falls must be installed. Required barriers must have a minimum height of 1m above level surfaces and 865mm above the line of stair nosings. Barriers must also contain no openings that are greater than 125mm in size. Where a person could 4m or more, the barriers must not have any horizontal elements that could facilitate climbing.	Unicorn Lane Fire Escape North External Fire Escape	The balustrade provided to the Unicorn Lane fire escape is 940mm in height in lieu of the minimum required 1m and has openings that exceed the maximum 125mm permitted by the BCA. The openings to the external north fire escape balustrade, at 460mm, exceed the maximum 125mm permitted by the BCA.	Whilst we understand that the Stage 2 aim is to demolish this stair, consideration should be given to augmenting the balustrade in the interim. Whilst we understand that the Stage 2 aim is to demolish this stair, consideration should be given to augmenting the balustrade in the interim.	 Balustrade to Unicorn Lane fire escape  North external fire escape

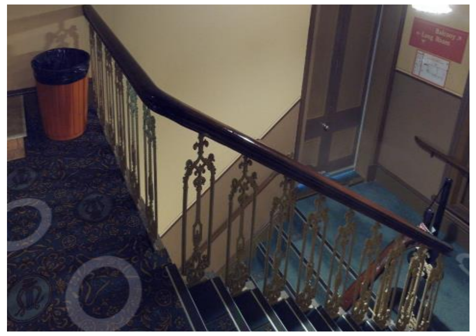
Table 1					
Item	**Requirements**	**Location**	**Inspection Findings**	**Recommendation**	**Photo/Figure Reference**
D2.16 **Barriers to prevent falls**	Where a person could fall 1m or more, suitable barriers to prevent falls must be installed. Required barriers must have a minimum height of 1m above level surfaces and 865mm above the line of stair nosings. Barriers must also contain no openings that are greater than 125mm in size. Where a person could 4m or more, the barriers must not have any horizontal elements that could facilitate climbing.	Northwest Stair (02.02)	The balustrade at the top of the internal northwest stair is only 820mm in height in lieu of the minimum required 1m.	Increase the height of the balustrade to be a minimum of 1m from FFL in line with BCA requirements.	 820mm balustrade to north stair  Balustrade to inside of Bio Box
		Stair serving Bio Box	There is effectively no balustrade provided to the stair serving the Bio Box on the northwest stair side, rather only a handrail mounted at 860mm. The section of balustrade on the inside of the Bio Box is too low.	This stair should be demolished, and a compliant alternative constructed including balustrades as required.	
		Basement 1 stair	It is possible to walk along a ledge on one side of the stair in the Basement 1 E-W corridor with no barrier to falls.	Erect a barrier to prevent people walking along the side of the stair in the corridor. We do note that this stair will not be present once Stage 2 works are implemented.	 Possible to walk along ledge with no barrier
D2.17 **Handrails**	A handrail must be provided along at least one side of every ramp or stairway.	South fire escape	The stair discharges to a ramp which leads to the outside. No handrails are provided to either side of the ramp.	Install a handrail to at least one side of the ramp.	 Handrail not continuous for full stair flight  No handrails to steep ramp
	Handrail terminations must comply with AS 1428.1-2009.	Rear stairwell	Handrail to the bottom flight is not continuous.	Extend the handrail to be continuous for the full stair flight.	
D2.19 **Doorways and doors**	A doorway serving as a required exit must not be fitted with a sliding door unless the door opens directly to a road or open space and cannot be opened manually under a force of not more than 110N. If the door is power-operated, it must open automatically on activation of any fire alarm serving the fire compartment in which the door is located.	Sliding doors at ground floor Lydiard Street entrance. Sliding doors at Basement 1 entrance airlock.	Automatic sliding doors are fitted to the ground floor and basement entrance doors.	Verify that the automatic sliding doors can be operated manually under a force of not more than 110N and that they are interfaced with the fire systems to automatically open on fire alarm or provided with battery backup as part of a dispensation approach.	

Table 1

Item	Requirements	Location	Inspection Findings	Recommendation	Photo/Figure Reference
D2.20 **Swinging doors**	A required exit door must swing in the direction of egress.	South entrance, ground floor. Long Room doors to fire-isolated stairs.	Required exit door swings against the egress direction. Fire engineering report for Stage 1 treats doors from Long Room to escape stairs as Specification C3.4 smoke doors but does not address that they swing against the egress direction.	Formulate a solution to permit the doors to remain swinging against the egress direction with fire engineering input. Re-hang doors to swing in the egress direction or assess the non-compliant door swing through the fire engineering process for Stage 2 works.	 Door swing against egress direction
D2.21 **Operation of latch**	Hardware to doors is required to be downward lever action mounted between 900mm and 1100mm from floor elvel.	Throughout	Multiple doors throughout the building are provided with old style knob-type hardware.	As part of Stage 2 scope, and Heritage constraints permitting, upgrade door hardware throughout the building as required. We note that this is in the feasibility report as being part of Stage 2 scope.	 Upgrade knob type hardware
D2.21 **Operation of latch**	A required exit serving a storey or room in a Class 9b building that accommodates more than 100 people must have panic bar hardware mounted at a height between 900mm and 1200mm from floor level.	Auditorium doors	The panic bar hardware provided to the northern ground floor exit from the auditorium requires the user to pull upwards in lieu of downwards or in the direction of travel. The doors from the auditorium into the foyer require the provision of panic bar hardware.	Replace the panic bar with an equivalent that requires a downward or horizontal push. Install panic bar hardware to those doors where Heritage constraints permit, obtaining dispensations for any remaining ones.	
D3.1 **General building access requirements**	For Class 9b buildings, access for persons with disabilities must be provided to and within all areas normally used by the occupants. AS 1428.1-2009 requires accessways within a building to be level.	Throughout	Floor surfaces were found to be very varied throughout with some areas having significant crossfalls and changes in level.	Consider the use of self-levelling screed or similar materials to attempt to ensure that surfaces are as level as can be. Where compliance cannot be achieved, access consultant verification should be obtained as part of Stage 2 approvals process.	

Table 1					
Item	**Requirements**	**Location**	**Inspection Findings**	**Recommendation**	**Photo/Figure Reference**
D3.1 **General building access requirements**	For Class 9b buildings, access for persons with disabilities must be provided to and within all areas normally used by the occupants. AS 1428.1-2009 requires accessways within a building to be level with no steps or other impediments.	Various	Numerous areas in the building are not accessible due to varying floor levels, including but not limited to: 1. A 125mm step exists in the Basement 1 back of house corridor outside B1.46. 2. B2.18 and B2.19 are only accessible by stairs.	In conjunction with the access consultant, and considering the Stage 2 works, formulate a holistic strategy for access within the building.	 125mm step in path of travel
D3.3 **Parts of buildings to be accessible**	For Class 9b buildings, access for persons with disabilities must be provided to and within all areas normally used by the occupants. All stairs in buildings required to be accessible must comply with AS 1428.1-2009 in respect of accessibility features.	All internal stairs.	No internal stairs are provided with complying handrails to both sides of the flight, tactile ground surface indicators (TGSIs) at the top and bottom or highlighted, non-slip nosing strips.	Considering the Heritage constraints of the building, and in conjunction with an access consultant, formulate a holistic solution to the provision of access for persons with disabilities with appropriate Performance Solutions being ratified by a building permit. We note from the Stage 1 Feasibility Report that this is a long term project aim. The stair from GF.06 to GF.05 can only be provided with a single handrail because of the fire hydrant and fire hose reel cupboard. The stair to B2.14 will not be able to have compliant handrail terminations at the bottom since it adjoins a corridor.	 Cupboard on stair and exmaple of non-conforming hadnrail
D3.6 **Signage**	In a building required to be accessible, signage must be provided to highlight certain facilities.	Throughout	Complying signage must be provided to indicate: 1. Exit doors (braille and tactile); 2. Accessible sanitary compartments. 3. Ambulant sanitary compartments. 4. Areas provided with hearing augmentation.	As part of the Stage 2 works, upgrade statutory signage throughout the building.	

Table 1

Item	Requirements	Location	Inspection Findings	Recommendation	Photo/Figure Reference
D3.8 **Tactile indicators**	In a building required to be accessible, tactile ground surface indicators (TGSIs) must be provided to warn people who are blind or have a vision impairment that they are approaching obstacles such as stairs, ramps, overhead obstructions etc.	Throughout	The provision of TGSIs in the building was inconsistent and not provided in all areas.	In conjunction with access consultant requirements, formulate a position with respect to the installation of TGSIs in the building.	
D3.9 **Wheelchair seating spaces in Class 9b assembly buildings**	Where fixed seating is provided in a Class 9b building, wheelchair seating spaces complying with AS 1428.1 must be provided and grouped in accordance with BCA requirements.	Auditorium	Whilst there are currently provisions for permitting wheelchair users to view a performance, they are not compliant with AS 1428.1 and could be argued as discriminatory.	We note that an increase in the number of wheelchair spaces exceeding BCA requirements is proposed in the future.	
D3.12 **Glazing on an accessway**	On an accessway, fully glazed walls and doors must be clearly marked in accordance with AS 1428.1. AS 1428.1 requires that glazing capable of being mistaken for an opening be provided with solid band visual decals of minimum thickness 75mm with the bottom edge at a height between 900mm and 1000mm from floor level.	Northern Basement 1 entrance lobby area	No visual decals provided to full height glazed panels comprising Basement 1 entrance lobby. We do note however that this area is scheduled for demolition as part of the future upgrade works.	Until the area is demolished, provide visual manifestation in accordance with AS 1428.1-2009 to these partitions.	 Visual manifestation required to full height glazed panels
E1.3 **Fire hydrants**	Since the size of the building exceeds 500m², full coverage from a compliant fire hydrant system is required.	Various	Several areas of the building are not provided with coverage from fire hydrants, notably: 1. Level 1 – rooms 01.12 to 01.15 inclusive. 2. Level 2 – 02.06.	As part of the fire brigade engagement process associated with the upgrade works, obtain report and consent for fire hydrant shortfalls to these areas.	

Table 1					
Item	**Requirements**	**Location**	**Inspection Findings**	**Recommendation**	**Photo/Figure Reference**
E1.3 **Fire hydrants**	Since the size of the building exceeds 500m², full coverage from a compliant fire hydrant system is required.	Throughout	All the existing fire hydrants were observed to have the following defects: 1. Threaded connections and lay flat hoses in lieu of Storz connections. 2. 80mm pipe size in lieu of current required 100mm. 3. The outlets point directly down to the ground in lieu of being angled at 35 degrees to the horizontal. 4. Being located more than 4m from an exit. Some of the internal hydrants were noted to have accessibility issues, being: 5. Level 2 hydrant in auditorium is obstructed by wooden panelling, making access difficult. 6. Ground floor fire hydrant and hose reel cabinet is located adjacent a stair flight, meaning that operators of this equipment would need to be standing on the stair.	1. Replace the threaded connections with Storz connections. 2. Rotate hydrant outlets to be maximum 35 degrees from the horizontal. 3. Obtain fire brigade consent for the undersized hydrant main and the non-compliant locations. 4. Alter the timber panelling in the Level 2 auditorium to provide unencumbered access to the fire hydrant and hose reel. 5. Obtain fire brigade consent to retain the ground floor fire hydrant in its current position.	 Fire hydrant installation obstructed access  Fire hydrant more than 4m from an exit
E1.3 **Fire hydrants**	Since the size of the building exceeds 500m², full coverage from a compliant fire hydrant system is required. Since the building is divided into fire compartments between 1000m2 and 5000m2 in area, 2 fire hydrants are required to flow simultaneously with a residual pressure in the system of 350kPa.	Throughout	Despite the information noted on the block plan at the booster assembly, test results from February 2018 show that the residual pressure when 2 hydrants are operating as required is 310kPa in lieu of the current minimum required 350kPa. It is however noted that previous editions of the AS 2419.1 permitted a pressure of 300kPa.	As part of the engagement process with the CFA for the major upgrade works, obtain report and consent for reduced pressure and flows, pursuant to Regulation 129 of the Building Regulation 2018.	
E1.3 **Fire hydrants**	Where internal fire hydrants are installed, a fire brigade booster assembly is required to serve the building. Where a fire hydrant booster assembly is incorporated in an external wall of a building, the surrounding construction must demonstrate an FRL of 90/90/90 for a height of 3m and 2m either side of the booster assembly and the booster assembly must be within sight of the main entrance of the building.	Unicorn Lane elevation	We were unable to determine if the fire brigade booster assembly is provided with the required fire separating construction at the back of the enclosure. Also, the window above the enclosure likely is within the 3m distance. The layout of the booster assembly, in terms of number of outlets and height does not meet current requirements.	We understand the fire hydrant and sprinkler booster is proposed to be relocated as part of the Stage 2 works but retained on the north side of the building. Compliance of the booster assembly, enclosure and fire-rated separation from the new stair shaft will need to be established as part of the Stage 2 works. CFA report and consent will be required to permit the booster to remain on the north elevation since it is not within sight of the main entrance of the building as required by AS 2419.1-2005.	

Table 1					
Item	**Requirements**	**Location**	**Inspection Findings**	**Recommendation**	**Photo/Figure Reference**
E1.4 **Fire hose reels**	Where fire hose reels are required, they are not permitted to pass through fire or smoke doors to achieve coverage. Where fire hose reels are installed, as far as is practically possible, they should be within 4m of an exit.	Auditorium & Long Room Various	The introduction of the new fire-rated walls in Stage 1 to compartment the building has resulted in fire hose shortfalls to the main auditorium and the Long Room. Most fire hose reels in the building are located more than 4m from an exit, including ground floor foyer, stage area, stage door etc.	Install additional fire hose reels to cover the areas of shortfall or rationalise the shortfalls via fire engineering analysis as part of the Stage 2 works. Relocate fire hose reels to be within 4m of exits or address through fire engineering process.	 Fire hose reel located more than 4m from an exit
E1.5 **Sprinklers**	Where some areas of buildings are protected by sprinklers and others are not, the areas must be separated from each other by construction having an FRL of 120/120/120.	Various	There were several areas with sprinklers missing that were not provided with fire-separating construction, including: 1. Level 2 storage cupboard in south stairs. 2. Ground floor Audio Room (GF.108). 3. Ground floor Piano Store (GF.13). 4. Canopy at Lydiard Street entrance. 5. Cupboard adjacent and north of B1.18 and B1.19. 6. Various concealed spaces. 7. Sprinklers obstructed in 02.06 plant room.	Since the fire engineering report for Stage 1 requires sprinkler protection throughout with the exception of the auditorium, ensure that sprinklers are provided to all noted areas that do not currently have them. Where sprinklers are obstructed, rectify to ensure no obstructions. Ensure also that sprinklers are provided to all doors rationalised by the Stage 1 fire engineering report to be smoke doors in lieu of fire doors are provided with the sprinklers stipulated in the report. It is also noted that the sprinkler installation is to the 1982 version of the AS 2118.1 in lieu of current editions. That said, recent test results confirm that the system is operational and functioning as required. Fire engineering verification of the retention of the outdated system will be required as part of the Stage 2 scope.	 No sprinklers to external canopy
E1.6 **Portable fire extinguishers**	Portable fire extinguishers are required to be installed and distributed throughout the building to cater for specific fire risks.	Throughout	There was a general lack of portable fire extinguishers in the building during our inspection, though it is noted that the site was a construction area at this time.	Once construction works are complete for Stage 1, install portable fire extinguishers in accordance with BCA E1.6 and AS 2444.	

Table 1

Item	Requirements	Location	Inspection Findings	Recommendation	Photo/Figure Reference
E2.2 **Smoke hazard management**	A Class 9b building having a rise in storeys of more than 3 must be provided with one of the following: 1. Stair pressurisation system to fire-isolated exits. 2. Zone smoke control system complying with AS 1668.1. 3. Smoke detection and alarm system. 4. Sprinkler system throughout.	Throughout	Rather than specifically being provided with one of the options, the building is actually provided with a hybrid mixture of sprinklers and smoke detection system.	As part of the fire engineering associated with the Stage 2 component of the upgrade works, rationalise the provision of an approach to satisfying this clause.	
E2.2 **Smoke hazard management**	A theatre that has a stage and associated rigging loft must be provided with an automatic smoke exhaust system if the building has more than one storey.	Throughout	During the inspection, it was noted that a fire fan control panel (FFCP) exists at the fire indicator panel (FIP). However, it was not immediately clear whether a fully compliant automatic smoke exhaust system exists in the building.	Since it is highly unlikely that any installed automatic smoke exhaust system would comply with current requirements, we would recommend that this be assessed by fire engineering in Stage 2, noting the restrictions around a building that has such onerous Heritage implications.	 Fire fan control panel
E3.6 **Passenger lifts**	Where passenger lifts are provided, they must satisfy minimum dimensional requirements and contain required accessibility features.	Passenger lift	It was observed that the passenger lift is non-compliant in multiple ways.	We note that it is proposed to install compliant passenger lifts to serve most areas of the building as part of the Stage 2 works.	
E4.2 **Emergency lighting requirements**	An emergency lighting system must be installed to serve any storey over 300m² in area and to cover other mandated areas; stairs, for example.	Throughout	There appeared to be a general lack of emergency lighting provided to the building, particularly over stairs.	We have had visibility of services documentation for the Stage 1 works and note the installation of emergency lights was ongoing during our inspection.	

Table 1

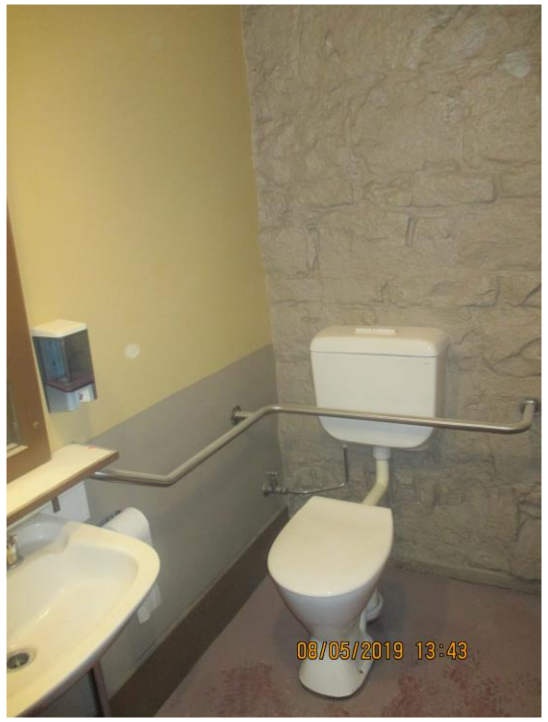
Item	Requirements	Location	Inspection Findings	Recommendation	Photo/Figure Reference
F2.2 **Calculation of number of occupants and facilities**	Class 9b theatres and sporting venues must be provided with one shower for every 10 participants or part thereof.	Back of house	The number of showers provided does not cater for the number of participants when strictly applying BCA requirements.	We note that it is proposed to increase the number of showers as part of the Stage 2 works. Performance Solution will likely be required to reduce the number from 25 showers due to space issues.	
F2.4 **Accessible sanitary facilities**	Where accessible sanitary facilities are provided within a building, there are required to comply with AS 1428.1-2009 in respect of dimensions and features.	Basement 1	The sanitary facilities signed as accessible display multiple non-compliances with AS 1428.1-2009 including but not limited to: 1. Non-conforming room dimensions. 2. No backrest provided. 3. No / non-compliant grabrails. 4. No coat hooks / shelf.	We understand that these toilets will be demolished and that new compliant accesible unisex sanitary facilites will be provided.	 Non-compliant sanitary facility signed as being accessible

Table 1					
Item	**Requirements**	**Location**	**Inspection Findings**	**Recommendation**	**Photo/Figure Reference**
F3.1 **Height of rooms and other spaces**	For a theatre building, where the area accommodates more than 100 people, the minimum ceiling height is required to be 2.7m. All other areas are required to have a ceiling height of 2.4m. Ceiling height above stairs is required to be a minimum 2m.	Various	There are multiple head height issues throughout the building, particularly beneath mechanical ducts and the like, including: 1. 1.58m head height in B1.15 due to duct. 2. 2.1m head height in corridor B1.30 due to duct. 3. 1.6m clearance on stairway to the roof from lighting control room. 4. 2.1m in the B2 corridor (B2.11) as a result of a bulkhead. 5. 1.84m head height in B1.21.	As part of the upgrade process, where ceiling heights are not being rectified by the new works package, obtain a building surveyor dspensation to eprmit the retention of the existing non-complying ceiling heights, based on the constraints of the existing building and the onerous implications of achieving compliance.	
F4.5 **Ventilation of rooms**	Ventilation must be provided naturally or by a system of ventilation complying with AS 1668.2	Throughout	We note that mechanical works are included in the scope of the Stage 1 works.	Full verification of the mechanical system would be required as part of the Regulation 233 process associated with Stage 2.	

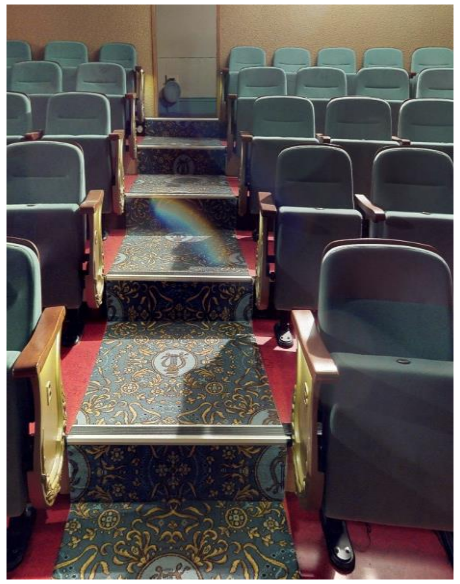
Table 1					
Item	**Requirements**	**Location**	**Inspection Findings**	**Recommendation**	**Photo/Figure Reference**
H1.3 **Seating area**	Line between nosings in the seating area must be at a pitch of not more than 30° to the horizontal and the height of steps between rows of seating does not exceed 600mm. Where an aisle divides the stepped floors, any steps exceeding 230mm in height must be provided with intermediate steps.	Auditorium	The pitch of the nosings does not exceed 30° and is in fact less than this at 22° in parts. Steps in aisles exceed 230mm in various areas, thereby requiring intermediate steps.	Consider the installation of intermediate steps in the aisles, Heritage constraints permitting. Alternatively, obtain a dispensation to allow retention of existing arrangements under the Regulation 233 process associated with Stage 2 works.	 Steps exceeding 230mm in height
H1.2 **Separation** **H1.3** **Proscenium**	Where a theatre does not have a sprinkler system, the stage, backstage and accessible under stage area must be separated from the audience by a proscenium wall complying with Specification H1.3.	Stage	A proscenium wall exists but we were unable to determine the levels of compliance during our audit.	As part of the Regulation 233 process associated with the Stage 2 works, the fire engineer will need to verify the compliance elvels of the existing proscenium curtain.	 Proscenium curtain required

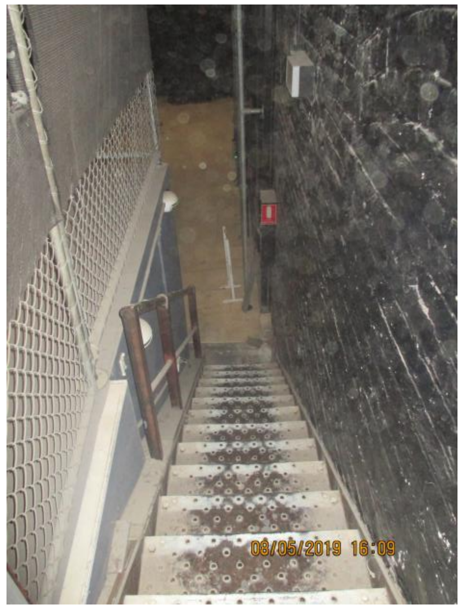
Table 1					
Item	**Requirements**	**Location**	**Inspection Findings**	**Recommendation**	**Photo/Figure Reference**
H1.6 **Access to platforms and lofts**	A stairway that provides access to a service platform, rigging loft, or the like, must comply with AS 1657.	Backstage area	The stairs and platforms serving the back-of-house areas display multiple non-compliances with AS 1657 in respect of the features, such as no toeboards to landings,	Replace or carry out alterations to backstage stairs, platforms and walkways to achieve a greater level of compliance with AS 1657.	 Non-conforming stair with non-contnuous handrails and gate opening halfway up.
H1.7 **Aisle lights**	In an auditorium, where the floor is stepped, aisle lights must be provided to illuminate the full length of the aisle and tread of each step.	Auditorium	Lights are provided on the side of the chairs along the aisle. No lights are provided to the tread of each step.	Upgrade aisle lighting to comply with BCA H1.7 as part of future works.	 Lights provided to sides of seats  No lighting to aisle treads

Table 1					
Item	**Requirements**	**Location**	**Inspection Findings**	**Recommendation**	**Photo/Figure Reference**
BCA Part J **Energy efficiency**	A building must comply with BCA energy efficiency requirements in respect of building fabric, services and energy usage.	Throughout	It is not considered practical that a building as old as Her Majesty's Theatre be expected to comply with current energy efficiency requirements.	Obtain a building surveyor dispensation as part of the Stage 2 works to delete the requirement to meet BCA energy efficiency requirements.	

HENDRY
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28 November 2019

Anne-Marie Treweeke
Practice Principal
Lovell Chen
Level 5, 176 Wellington Parade
East Melbourne VIC 3002
Email: Atreweeke@levellchen.com.au

Dear Anne-Marie,

RE: Her Majesty's Theatre, Ballarat – Conservation Project – Stage 3 Feasibility Study – Major Items

1.0 Background

We understand that, as a result of deterioration and general and wear due to its age, upgrades to Her Majesty's Theatre, Ballarat are being considered. We further understand that Stage 1 & 2 of these upgrades have been carried out, including but not limited to façade repair works, remedial works to the roof structure, an upgrade of exit signage and emergency lighting, stormwater system alterations and fire-safety related works.

A budget of an estimated 10 million dollars has been funded from the government in relation to this project, with the major items to be identified and upgraded being focused around disabled access (DDA), safety and functionality of the building. As the building is currently operational, it is planned to shut the theatre down late 2020 and deliver the project in 2021.

2.0 Report Scope

The scope of this report is to identify the 'big ticket' items in relation to possible issues, that could potentially expel the budget. Primarily an assessment based on Regulation 233 (2) of the Building Regulations 2018, which stipulates if the proposed alterations to an existing building, together with any other alterations completed or permitted within the previous 3 years, relate to more than half the original volume of the building, the entire building must be brought into conformity.

Due to the age of the building, it is not expected that full compliance be achieved. However, subsequently if alterations exceed the volume trigger further strategy will need to be implemented with the possibility of a number of further dispensations required to be sought.

The report has been generated based from the following documents and it is to be noted that if further alterations affecting volume are to take place, the regulation 233 (2) assessment will be required to be completed again:

- Area take off spreadsheet produced by Lovell Chen (Refer appendix 1); and
- Demolition floor plans revision (P5) produced by Lovell Chen (Refer Appendix 2); and
- Proposed floor plans revision (P5) produced by Lovell Chen (Refer Appendix 3)

It is noted that this is a preliminary, high-level assessment and does not conduit the exact requirements to issue a building permit, further detailed review is to be completed upon further design development and consultation.

1.0 GENERAL

1.1 **Regulation 233 (2) –** Calculations provided by Lovell Chen confirm that building work completed in the previous 3 years combined with the proposed building work in stage 3 will affect 44% of the building volume (refer appendix 1). Therefore, Hendry have determined that the building is not required to be brought into full conformity with the current regulations and BCA.
Please note - All new building work is required to comply with the BCA. If any of the new building work does not comply with the Deemed to Satisfy provisions of the BCA they will need to be addressed via performance solution.

1.2 **Title –** It appears the location of the new fire isolated stair at the north section is proposed to be constructed in unicorn lane. Although the construction of the canopy and stair have been completed in the past, this is not within the title boundaries and therefore building work is not permitted. The drawings will need to be amended to ensure construction within the title boundary.

1.3 **Combined allotment statement -** Understood the existing stair is constructed over two allotments, therefore a combined allotment statement will be required to consider the allotments as one for the purpose of the building work if the reconstruction of the stair is to take place. A copy of both titles will be required.

1.4 **Fire Engineering Report (FER) –** The FER will be required to be updated to reflect the latest set of proposed drawings, including the deletion of the south stairs, new south fire isolated stair not to discharge externally (if the passage is not fire isolated), etc.

1.5 **Building permit levy -** A building permit levy of 0.0128 cents in every dollar of the cost of works will be applicable. In accordance with section 205G of the Building Act, the building permit levy needs to be paid prior to the issue of the building permit.

1.6 **Builder's registration -** The building work involves both demolition and new building works. Therefore, the demolition works will need to be undertaken by a registered demolisher whilst the new building work will need to be undertaken by a registered commercial builder.

1.7 **Ballarat planning –** It is recommended that planning requirements are investigated. Written advice that a planning permit is not required, or a planning permit will be required, prior to the works commencing (the new stair could trigger the requirement for a planning permit).

1.8 **Heritage Victoria –** As the building is listed on the Victorian Heritage Register, a Heritage Exemption or Heritage Permit will be required prior to the works commencing for the building.

1.9 **Protection works –** Protection works may be required to be provided by the owner, in relation to an adjoining property, before and during the carrying out of any building work. (This will be required for the construction of the new fire stair if it goes ahead) refer Regulation 111.

1.10 **Protection of public -** Detailed precaution to protect the public to be submitted and approved prior to the issue of the building permit.

1.11 **Certificate of Compliances for Proposed Building Work -** A certificate of compliance will be required from the services engineers certifying that the construction issue documentation for the new work complies with the relevant structural provisions of the BCA or meet the intention of a performance solution.

2.0 STRUCTURE (SECTION B, BCA 2019)

2.1 Structural details for both new fire-isolated-stairs and any other structural works such as the balustrade alterations are to be provided. Stairs to be fire isolated construction and if local failure, stair will be capable of standing on its own.

3.0 FIRE RESISTANCE (SECTION C, BCA 2019)

3.1 **North Fire Isolated Stair -** New external walls to be constructed of non-combustible materials in accordance with C1.9 of the BCA. A copy of the manufacturer's fire testing documentation to be provided for external wall insulation to confirm that it has been tested and classified as non-combustible.

3.2 **Floor coverings -** Fire hazard properties of materials and assemblies to comply with Specification C1.10 of the BCA (i.e. floor coverings, wall and ceiling linings, any decorative ceiling attachments, etc.) A copy of the manufacturer's fire testing certificates to be provided for the various materials/assemblies nominated in the specifications.

3.3 **Lift Shaft -** Lift's are required to be separated from the remainder of the building by enclosure in a shaft with an FRL of 120/120/120 for loadbearing enclosure and -/120/120 for non-loadbearing enclosure.

3.4 **Separation of Equipment -** Details of the separation of lift motor room and equipment to be provided and the protection of any openings through fire rated elements to be provided.

4.0 ACCESS & EGRESS (SECTION D, BCA 2019)

4.1 **New Ramps -** Details of the new ramps including the grade, handrails, TGSI's, slip resistance, etc. are to be provided in accordance with AS 1428.1. An access consultant will be required to provide justification if any aspects of the new ramps do not comply.

4.2 **New Stairs –** Details of the new stairs are to be provided, including handrail, balustrades, goings, risers, nosing strips, slip resistance, etc.

4.3 **Auditorium Balustrades –** Further details of the proposed balustrade alterations to the auditorium are to be provided, including handrail heights, loading, etc.

4.4 **Disabled Access –** Various areas throughout the building do not comply with the disabled access provisions. Understood an access consultant has been engaged to assist in justifying non compliances. Major items to consider are:

4.4.1 To permit disabled access not via the principal pedestrian entrance; and

4.4.2 To permit various new ramps throughout the building to not have handrails to both sides, etc. installed.

4.4.3 To permit access via the use of two DDA lifts in lieu of providing a continual accessible path of travel.

4.4.4 To permit no disabled access to basement level 2.

4.5 **Signage -** Braille and tactile signage required to comply with D3.6 of the BCA. Please also note that for the room containing the hearing augmentation system, signage complying with clause D3.6(b) of the BCA will be required to identify the hearing augmentation system (i.e. type, area covered, etc.).

5.0 SERVICES & EQUIPMENT (SECTION E, BCA 2016)

5.1 **Possible Regulation 129 items** – Report and consent of the Chief Officer will be required to be obtained in relation to any non-compliances for the following items.

5.1.1 Fire hydrant system, including; hydrant coverage, pressures and flows; and

5.1.2 Report and consent will be required to be obtained in relation to the relocation of the hydrant booster system, due to it not being within sight of the main entrance; and

5.1.3 Fire indicator panel (if any alterations are to take place and do not comply)

5.2 **Fire Hose Reel (FHR) -** Due to the proposed new layout and extensive alterations to the basement, fire hose reel coverage is required to be assessed. Service drawings required to be provided. Please note FHR coverage is achieved by a 36m length of hose issued with a 4m spray.

5.3 **Fire Services –** Alterations to the sprinkler system will need to be updated and documented, require fire service drawings for assessment.

5.4 **Lifts -** Specifications to be provided for the elevator to confirm that it will comply with Part E3 of the BCA, including the accessibility requirements i.e. minimum car size, grab rail, etc.

5.5 **Emergency lighting and exit signage -** Emergency lighting and exit required to comply with AS 2293, due to the new layout, updated signage required, therefore, please provide updated emergency lighting and exit signs

6.0 HEALTH & AMENITY AND ENERGY EFFICIENCY (SECTION F & J, BCA 2016)

6.1 **New External wall -** External wall systems required to comply with performance requirement FP1.4 of the BCA. The BCA does not currently have any deemed-to-satisfy provisions for weatherproofing of external walls. Please provide a copy of the Certificate of Conformity/Codemark Certification for the Exotec cladding to confirm that it complies with performance requirement FP1.4 of the BCA. The manufacturer should be able to provide this information.

6.2 **Sanitary Facilities –** Understood that as part of the upgrades, the refurbishment of the sanitary facilities will take place therefore;

6.2.1 As part of this, the BCA requires an accessible sanitary facility to be provided at each bank of toilets. Understood that no unisex disabled toilet will be provided basement 2. This will need to be addressed via a performance-based approach (access consultant).

6.2.2 Understood one shower for every 10 participants or part thereof is required. Shower numbers are required to be provided for calculations.

6.2.3 Please note that a compliant ambulant toilet will be required to be provided at each bank of toilets.

6.2.4 Unisex sanitary facilities are not permitted by the BCA within the building. Understand that these facilities may be considered as additional to the BCA. These will be required to be full height individual partitions.

6.3 **Mechanical system -** Understand as part of the works it is proposed to upgrade the mechanical ventilation system. Mechanical ventilation is required to comply with AS 1668.2, therefore, mechanical drawings will be required for assessment with schedules of air flow rates, etc.

6.4 **Energy Efficiency -** Verification from the services engineers in relation to part J5 and J6 will be required.

Please do not hesitate to contact me via telephone (03) 8417 6503 or e-mail: jacob.halstead@hendry.com.au if you have any queries regarding the above information.

Yours faithfully

Jacob Halstead

JHalstead

Appendix 1

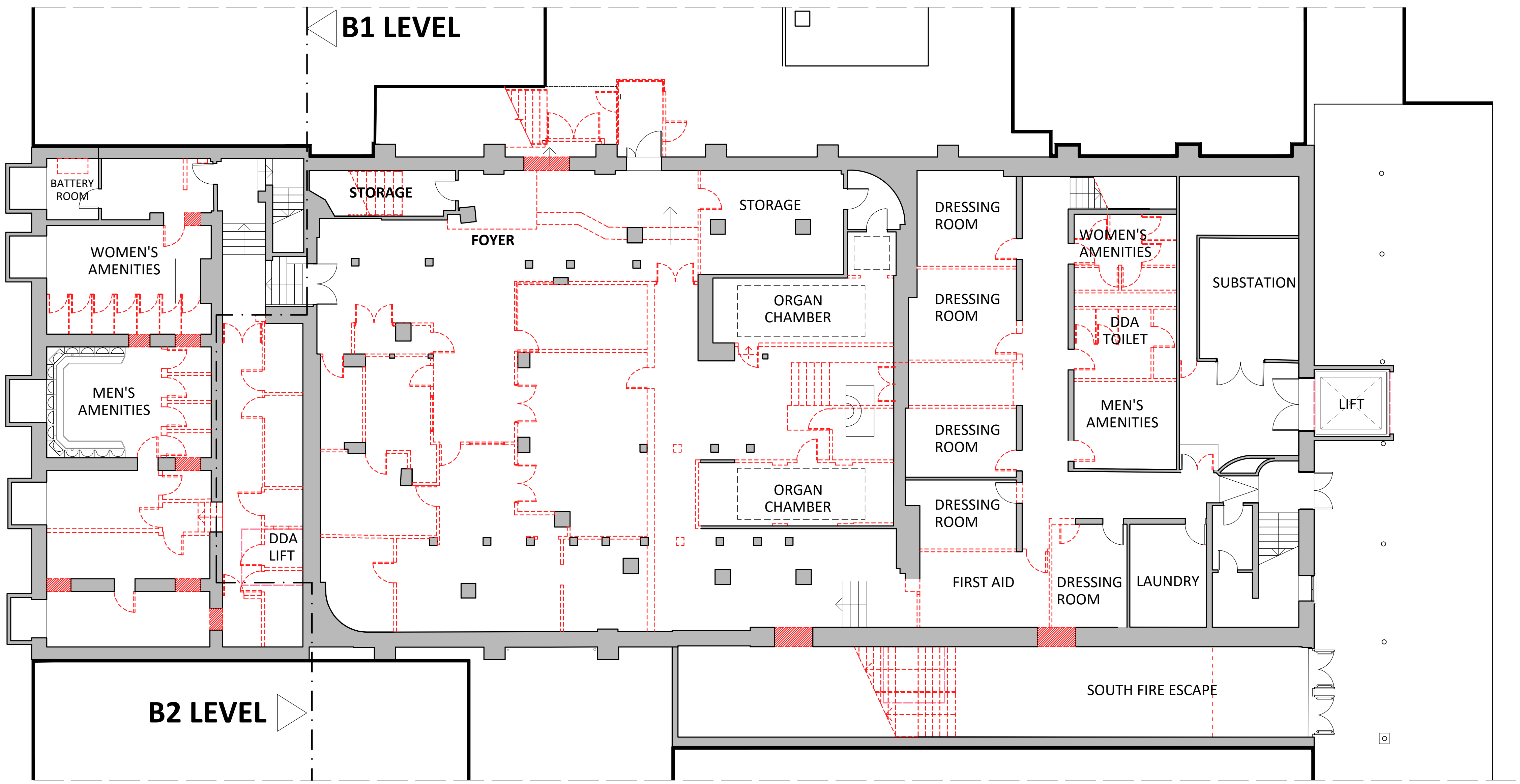
	Existing	Height	Ex. Volume	Proposed	Height	Pr. Volume	Changed	Height	Changed Volume	%
Basement 1										
SP1 (Front of House)	122.5	2.95	361.375				145	2.95	427.75	118.4%
SP1 (lower floor level area)	72	2.47	177.84				18.5	2.47	45.695	25.7%
SP1 (Fire stairs)				27.1	2.95	79.945	27.1	2.95	79.945	100.0%
Back of House	407.8	2.36	962.408				300.5	2.36	709.18	73.7%
Back of House (under stage area)	276.9	2.43	672.867				147.2	2.43	357.696	53.2%
SP2 (BOH access + fire stair)	87.8	5.2	456.56				68.2	5.2	354.64	77.7%
Total			2631.05			79.945			1974.906	72.8%
Basement 2										
Back of House	261.3	2.44	637.572				33.1	2.44	80.764	12.7%
Orchestra Pit	36.5	1.52	55.48							0.0%
SP2 (fire stair + technical room)	45.2	2.44	110.288							0.0%
Total			803.34						80.764	10.1%
Ground										
SP1 (Front of House)	139.1	4.35	605.085				57	4.35	247.95	41.0%
SP1 (Auditorim entry)	27.1	3.11	84.281				0	3.11		0.0%
SP1 (Fire stairs)				29.2	3.96	115.632	29.2	3.96	115.632	100.0%
Back of House	45.1	3	135.3				13.6	3	40.8	30.2%
Stage	293.7	11.53	3386.361				282.6	11.53	3258.378	96.2%
Stalls	165.2	13.55	2238.46							0.0%
Stalls below balcony	215.1	2.71	582.921					2.71		0.0%
SP2 (side of stage, fire stair, etc)	101.2	2.8	283.36				12.7	2.8	35.56	12.5%
Total			6626.402			115.632			3698.32	54.9%
First										
SP1 (Long Room)	130	4.87	633.1				25	4.87	121.75	19.2%
SP1 (Foyer, stairwell, amenities)	118.5	5.89	697.965				20.6	5.89	121.334	17.4%
SP1 (Fire stairs)				28.8	3.96	114.048	28.8	3.96	114.048	100.0%
Balcony	215.1	2.72	585.072	0			36.3	1	36.3	6.2%
Balcony projection	4.4	10.53	46.332				4.4	1	4.4	9.5%
SP2 (green room, fire stair, etc)	95.6	3.2	305.92	0			12.7	3.2	40.64	13.3%
Total			2268.389			114.048			438.472	18.4%

Second										
SP1 (stairwell, etc)	49.5	2.2	108.9				4.8	2.2	10.56	9.7%
SP1 (Fire stairs)				28	2.2	61.6	28	2.2	61.6	100.0%
Balcony	264.7	4.95	1310.265				34.9	1	34.9	2.7%
SP2 (plant, access, etc.)	48.1	4	192.4				12.7	4	50.8	26.4%
Total			1611.565			61.6			157.86	9.4%
Grand Total:			13940.746			371.225			6350.322	44.4%

Appendix 2

LEGEND:

TO DEMOLISH/DISMANTLE



01 BASEMENT 1 FLOOR PLAN
-- 1:200

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
SCALE 1:200 @ A3

NO.	DATE	REVISION
P3	13/06/19	PRELIMINARY
P4	11/07/19	PRELIMINARY
P5	22/11/19	PRELIMINARY

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PROJECT
HER MAJESTY'S THEATRE
BALLARAT
FEASIBILITY STUDY

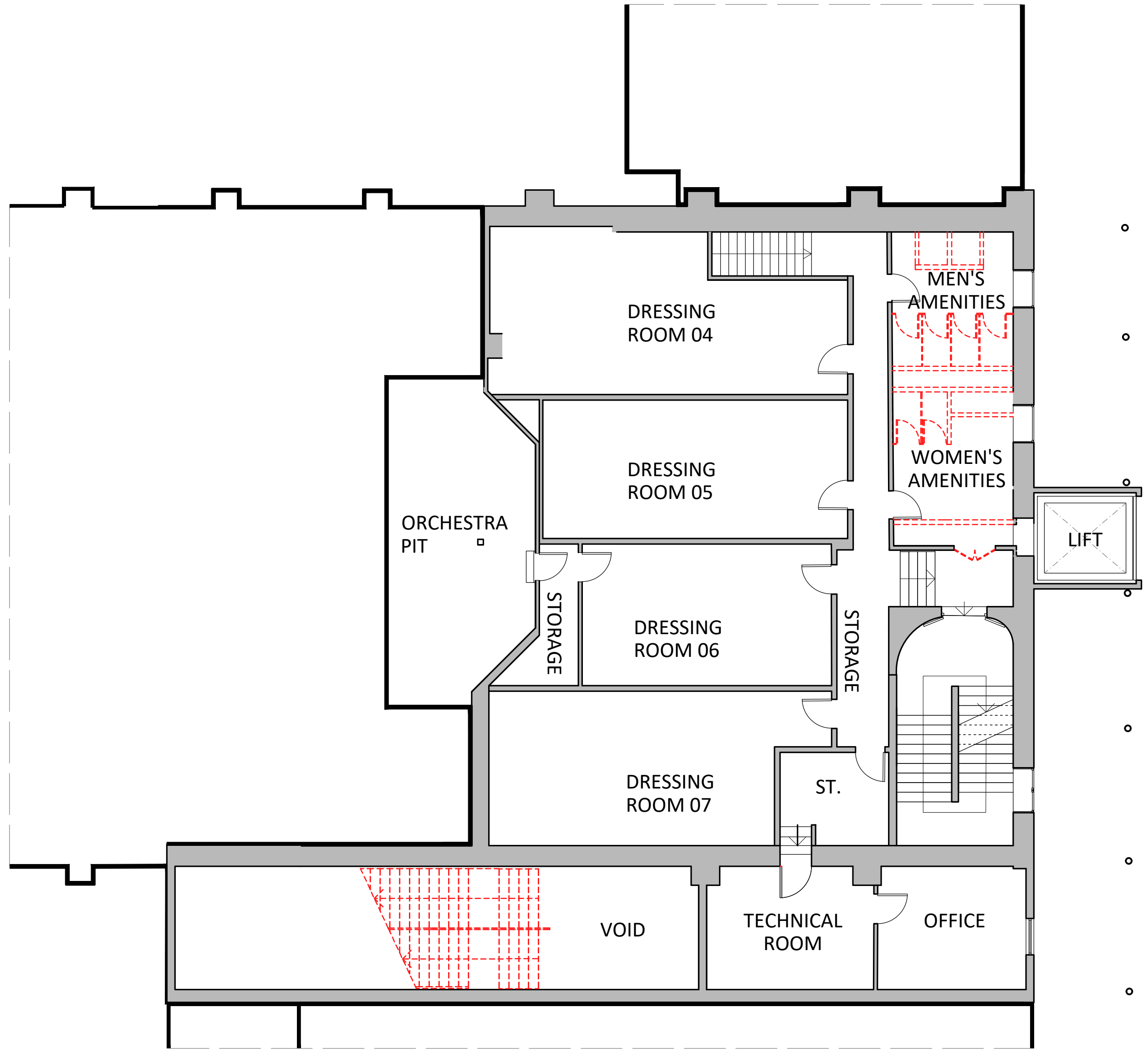
DRAWING TITLE
BASEMENT 1 - DEMOLITION
FLOOR PLAN

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB/DT/CB	CB	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.01	P5

LEGEND:

---- TO DEMOLISH/DISMANTLE



01 -- BASEMENT 2 FLOOR PLAN
1:200

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
SCALE 1:200 @ A3

NO.	DATE	REVISION
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P1	xx/11/18	PRELIMINARY
P3	13/06/19	PRELIMINARY
P4	11/07/19	PRELIMINARY
P5	22/11/19	PRELIMINARY

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PROJECT
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BALLARAT
FEASIBILITY STUDY

DRAWING TITLE
BASEMENT 2 - DEMOLITION
FLOOR PLAN

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB/DT/CB	CB	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.02	P5

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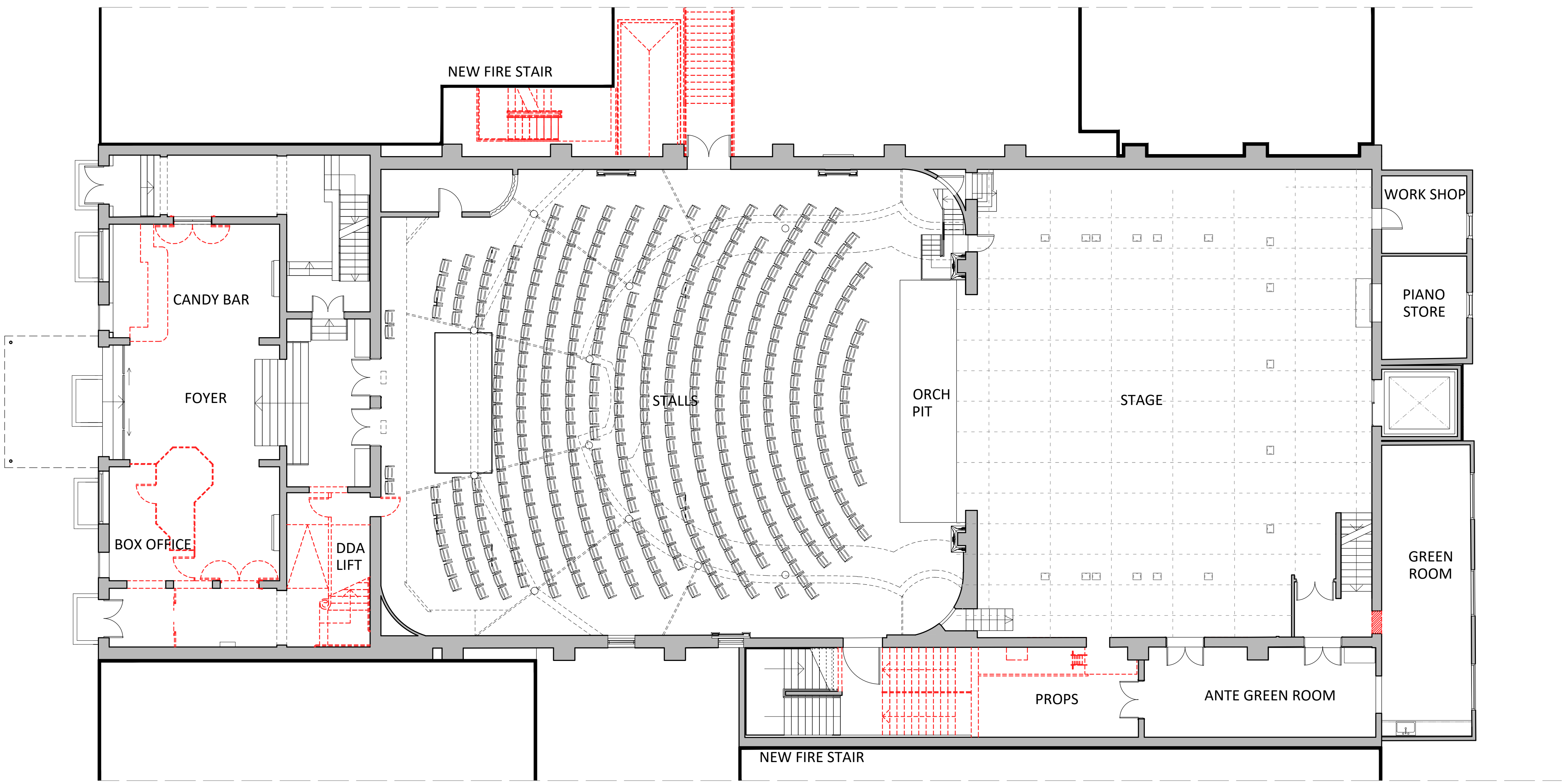
---- TO DEMOLISH/DISMANTLE



01 GROUND FLOOR PLAN
-- 1:200

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
SCALE 1:200 @ A3

NO.	DATE	REVISION
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P1	xx/11/18	PRELIMINARY
P3	13/06/19	PRELIMINARY
P4	11/07/19	PRELIMINARY
P5	22/11/19	PRELIMINARY

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PROJECT
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BALLARAT
FEASIBILITY STUDY

DRAWING TITLE
GROUND FLOOR PLAN
DEMOLITION

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB/DT/KB	CB	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.03	P5

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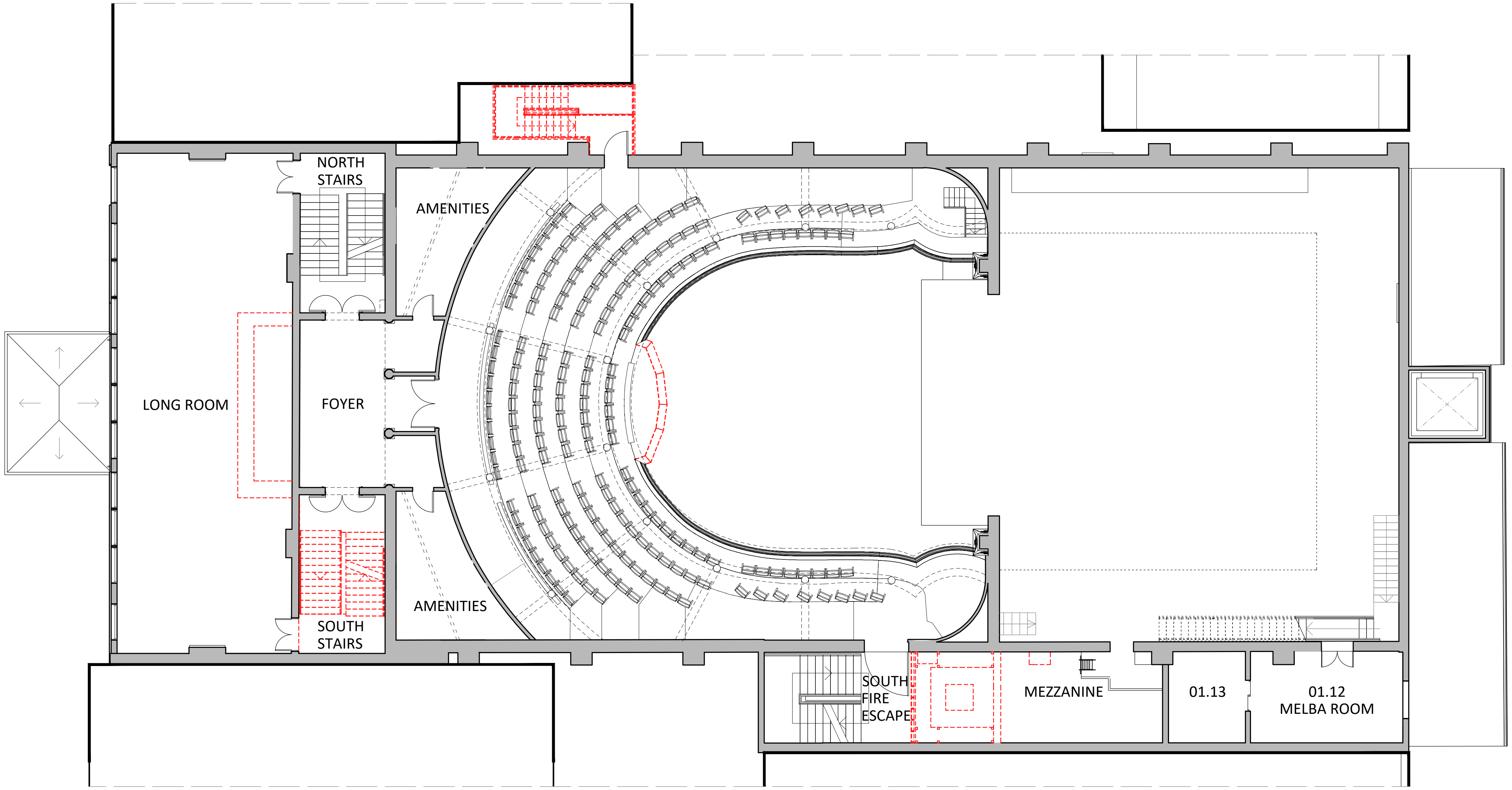
---- TO DEMOLISH/DISMANTLE



01 FIRST FLOOR PLAN
-- 1:200

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
SCALE 1:200 @ A3

NO.	DATE	REVISION
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P1	xx/11/18	PRELIMINARY
P3	13/06/19	PRELIMINARY
P4	11/07/19	PRELIMINARY
P5	22/11/19	PRELIMINARY

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PROJECT
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BALLARAT
FEASIBILITY STUDY

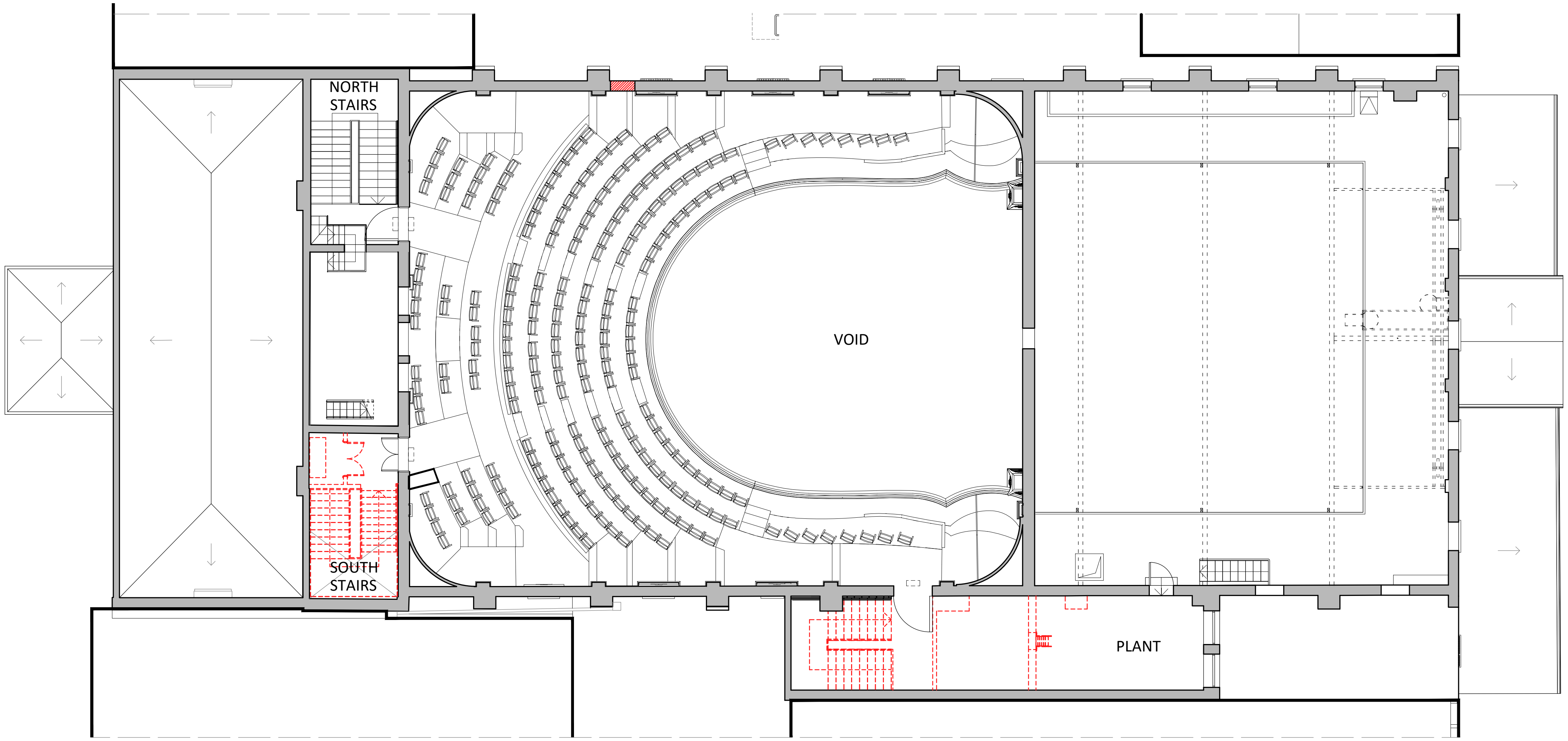
DRAWING TITLE
FIRST FLOOR PLAN - DEMOLITION

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB/DT/KB	CB	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.04	P5

LEGEND:

TO DEMOLISH/DISMANTLE



01 SECOND FLOOR PLAN
-- 1:200

NOT FOR CONSTRUCTION

0 2 4 6 8 10M
SCALE 1:200 @ A3

NO.	DATE	REVISION
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P1	xx/11/18	PRELIMINARY
P3	13/06/19	PRELIMINARY
P4	11/07/19	PRELIMINARY
P5	22/11/19	PRELIMINARY

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PROJECT
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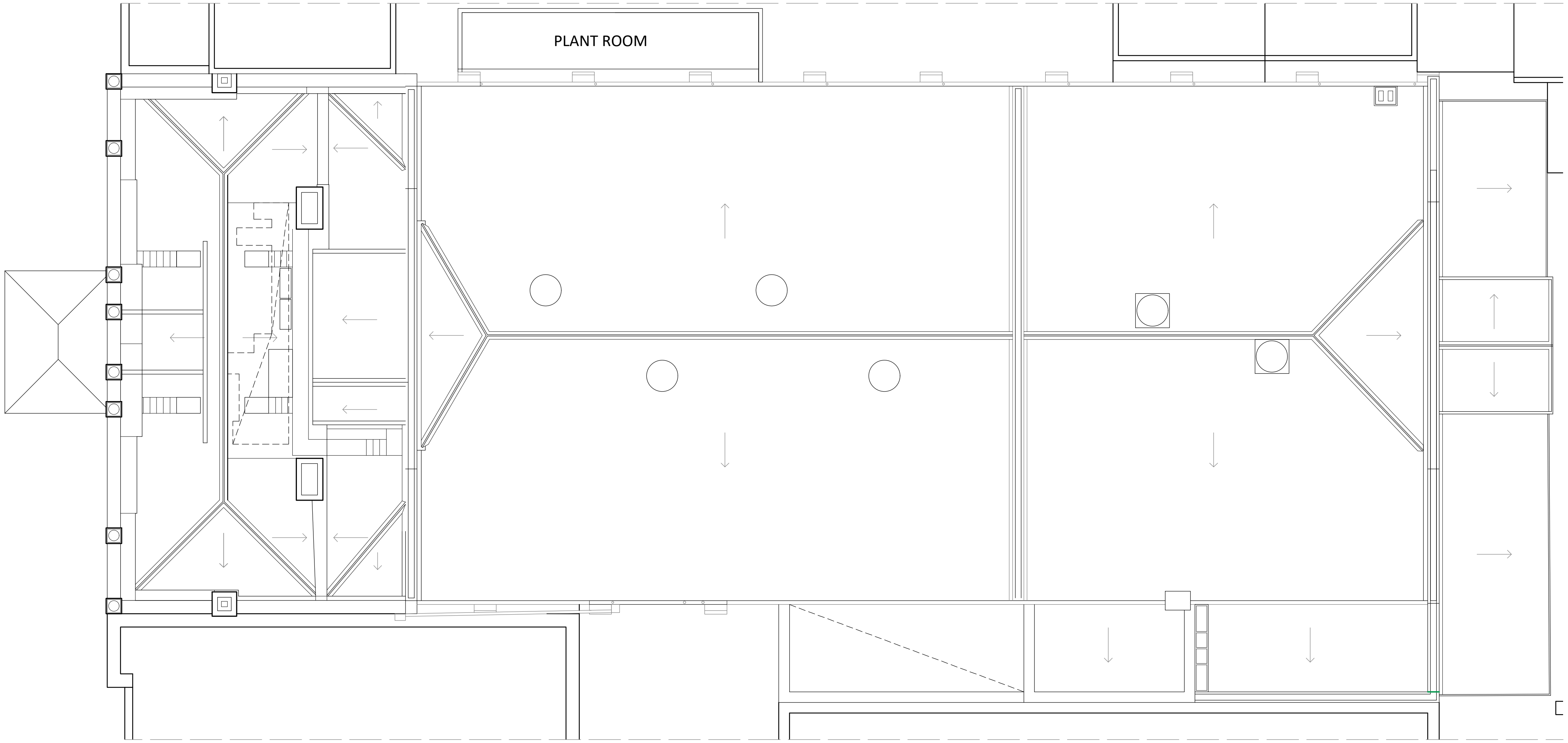
FEASIBILITY STUDY

DRAWING TITLE
SECOND FLOOR PLAN
DEMOLITION

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB/DT/CB	CB	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.05	P5



01 ROOF FLOOR PLAN
-- 1:200

LEGEND:

---- TO DEMOLISH/DISMANTLE

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
SCALE 1:200 @ A3

NO.	DATE	REVISION
P1	31/10/18	PRELIMINARY
P1	xx/11/18	PRELIMINARY
P3	13/06/19	PRELIMINARY
P4	11/07//19	PRELIMINARY
P5	22/11//19	PRELIMINARY

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PROJECT
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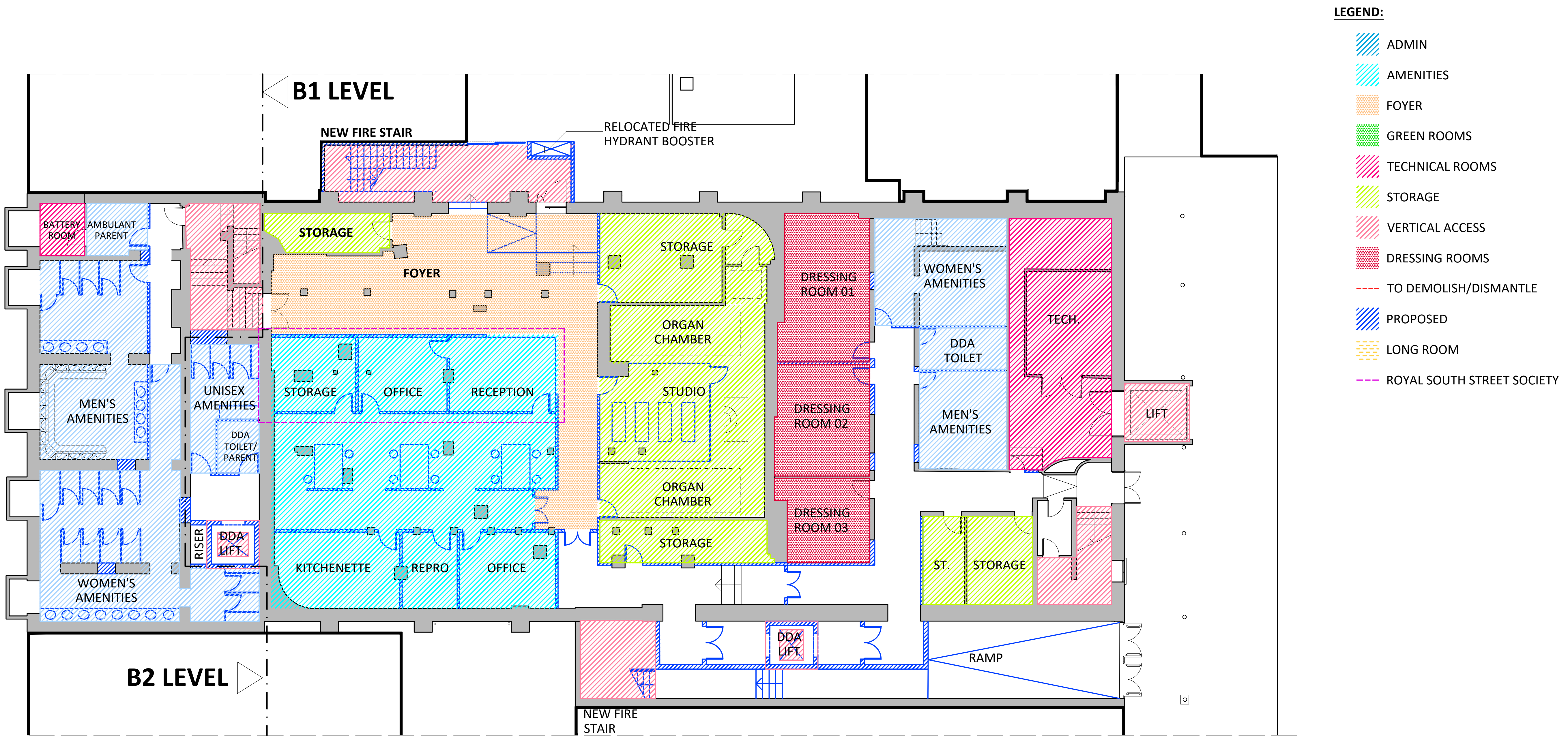
FEASIBILITY STUDY

DRAWING TITLE
ROOF PLAN - DEMOLITION

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB/DT/	CB	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.06	P5

Appendix 3



01 BASEMENT 1 FLOOR PLAN
-- 1:200

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
SCALE 1:200 @ A3

NO.	DATE	REVISION
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P4	11/07/19	PRELIMINARY
P5	22/11/19	PRELIMINARY

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PROJECT
HER MAJESTY'S THEATRE BALLARAT
FEASIBILITY STUDY

DRAWING TITLE
PROPOSED BASEMENT 1 FLOOR PLAN

DRAWN	CHECKED	PROJECT NO.	DATE	ISSUE	SCALE	DRAWING NO.	REVISION
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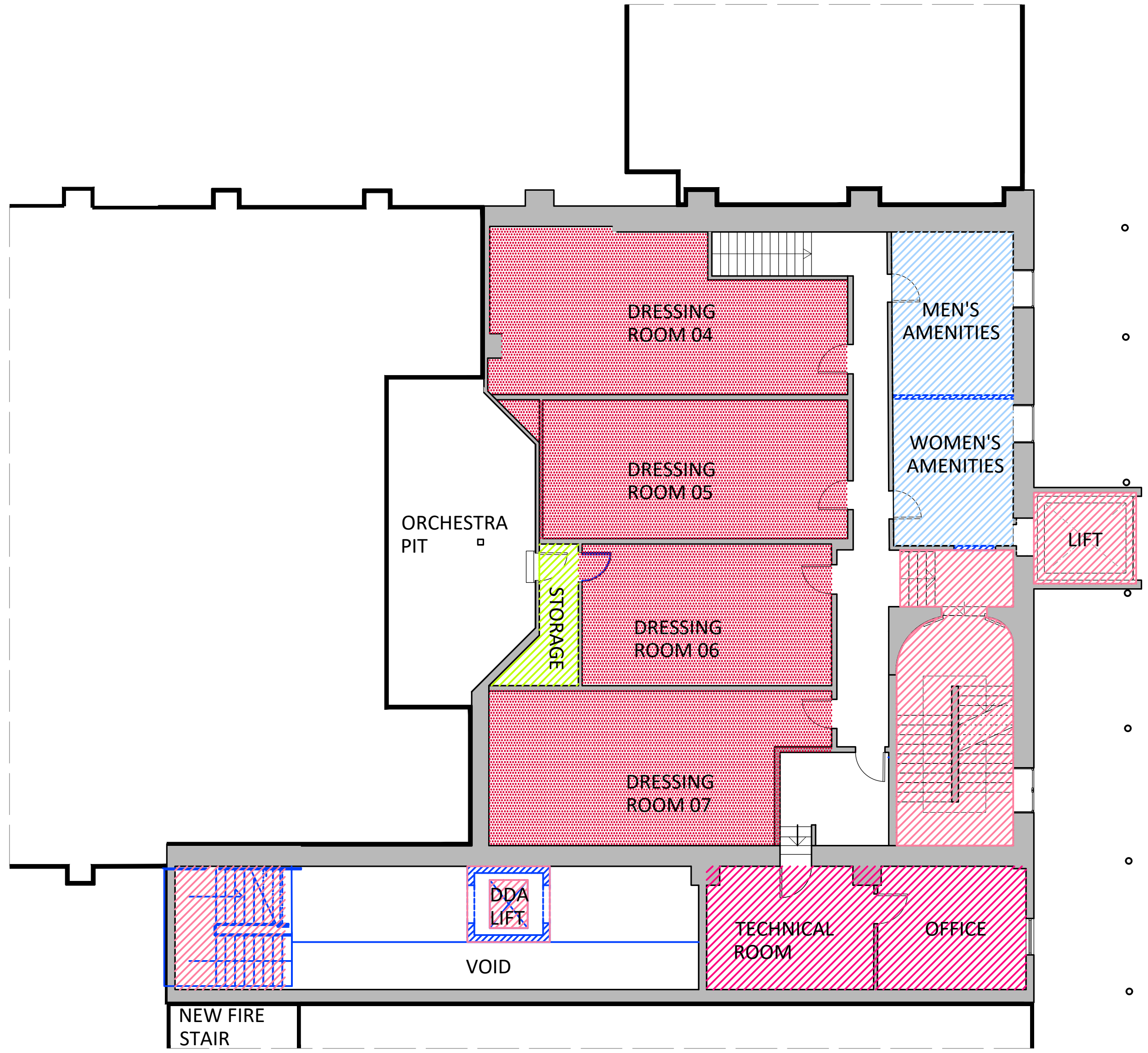

LEGEND:

- ADMIN
- AMENITIES
- FOYER
- GREEN ROOMS
- TECHNICAL ROOMS
- STORAGE
- VERTICAL ACCESS
- DRESSING ROOMS
- TO DEMOLISH/DISMANTLE
- PROPOSED
- LONG ROOM
- ROYAL SOUTH STREET SOCIETY

01 BASEMENT 2 FLOOR PLAN
-- 1:200

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
SCALE 1:200 @ A3

NO.	DATE	REVISION
P1	31/10/18	PRELIMINARY
P1	xx/11/18	PRELIMINARY
P3	13/06/19	PRELIMINARY
P4	11/07/19	PRELIMINARY
P5	22/11/19	PRELIMINARY

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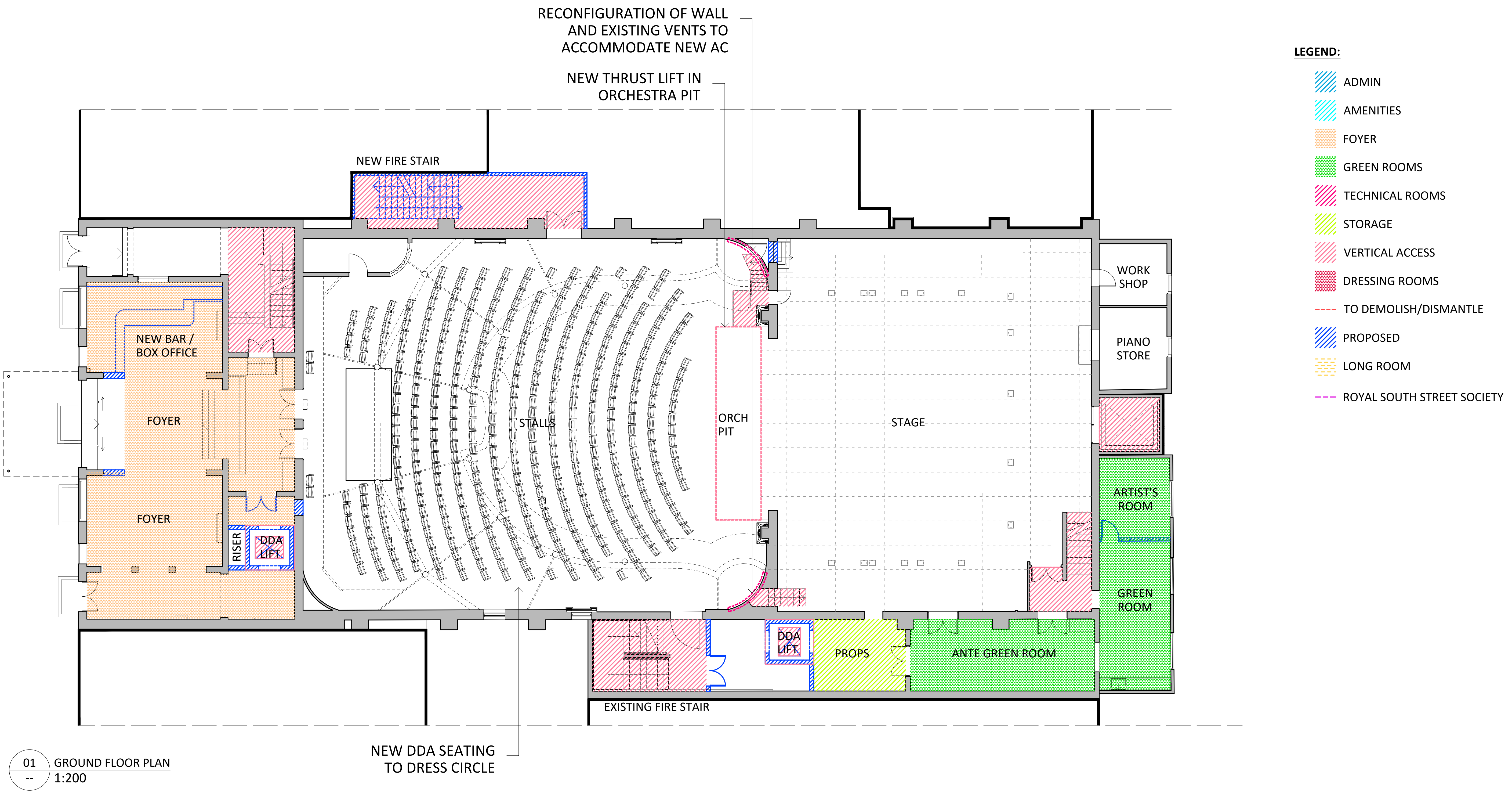
PROJECT
HER MAJESTY'S THEATRE BALLARAT FEASIBILITY STUDY

DRAWING TITLE
PROPOSED BASEMENT 2 FLOOR PLAN

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB/DT/CB	CB	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.02	P5



NOT FOR CONSTRUCTION

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SCALE 1:200 @ A3

NO.	DATE	REVISION
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P1	xx/11/18	PRELIMINARY
P3	13/06/19	PRELIMINARY
P4	11/07/19	PRELIMINARY
P5	22/11/19	PRELIMINARY

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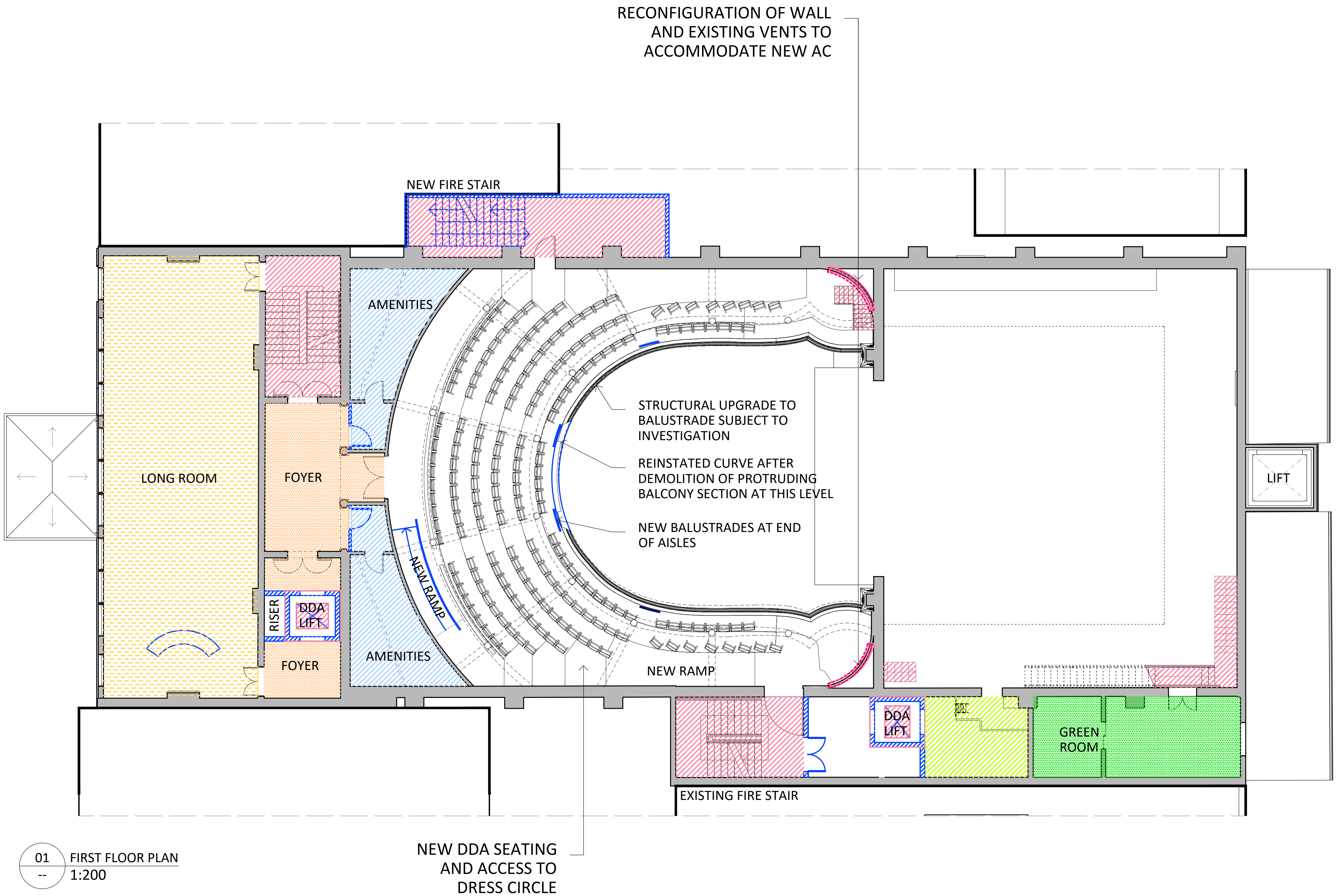
PROJECT
HER MAJESTY'S THEATRE
BALLARAT
FEASIBILITY STUDY

DRAWING TITLE
PROPOSED GROUND FLOOR PLAN

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB/DT/CB		7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.03	P5



01 FIRST FLOOR PLAN
-- 1:200

LEGEND:

- ADMIN
- AMENITIES
- FOYER
- GREEN ROOMS
- TECHNICAL ROOMS
- STORAGE
- VERTICAL ACCESS
- DRESSING ROOMS
- TO DEMOLISH/DISMANTLE
- PROPOSED
- LONG ROOM
- ROYAL SOUTH STREET SOCIETY

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
SCALE 1:200 @ A3

NO.	DATE	REVISION
P1	31/10/18	PRELIMINARY
P1	xx/11/18	PRELIMINARY
P3	13/06/19	PRELIMINARY
P4	11/07/19	PRELIMINARY
P5	22/11/19	PRELIMINARY

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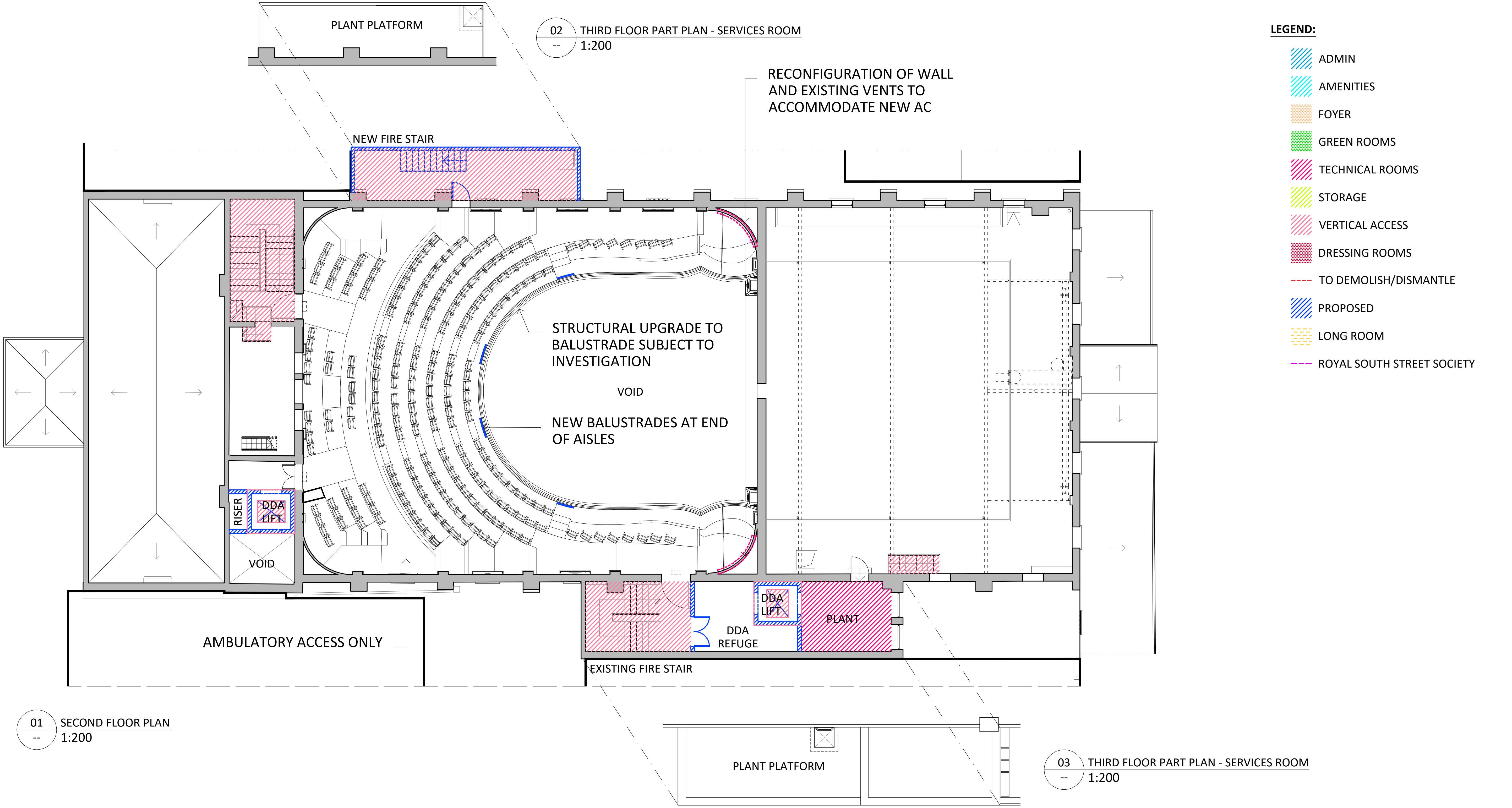
FEASIBILITY STUDY

DRAWING TITLE
PROPOSED FIRST FLOOR PLAN

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB/DT/	CB	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.04	P5



NOT FOR CONSTRUCTION

NO.	DATE	REVISION
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P4	11/07/19	PRELIMINARY
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PROJECT
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BALLARAT
FEASIBILITY STUDY

DRAWING TITLE
PROPOSED SECOND FLOOR PLAN

DRAWN	CHECKED	PROJECT NO.	DATE	ISSUE	SCALE	DRAWING NO.	REVISION
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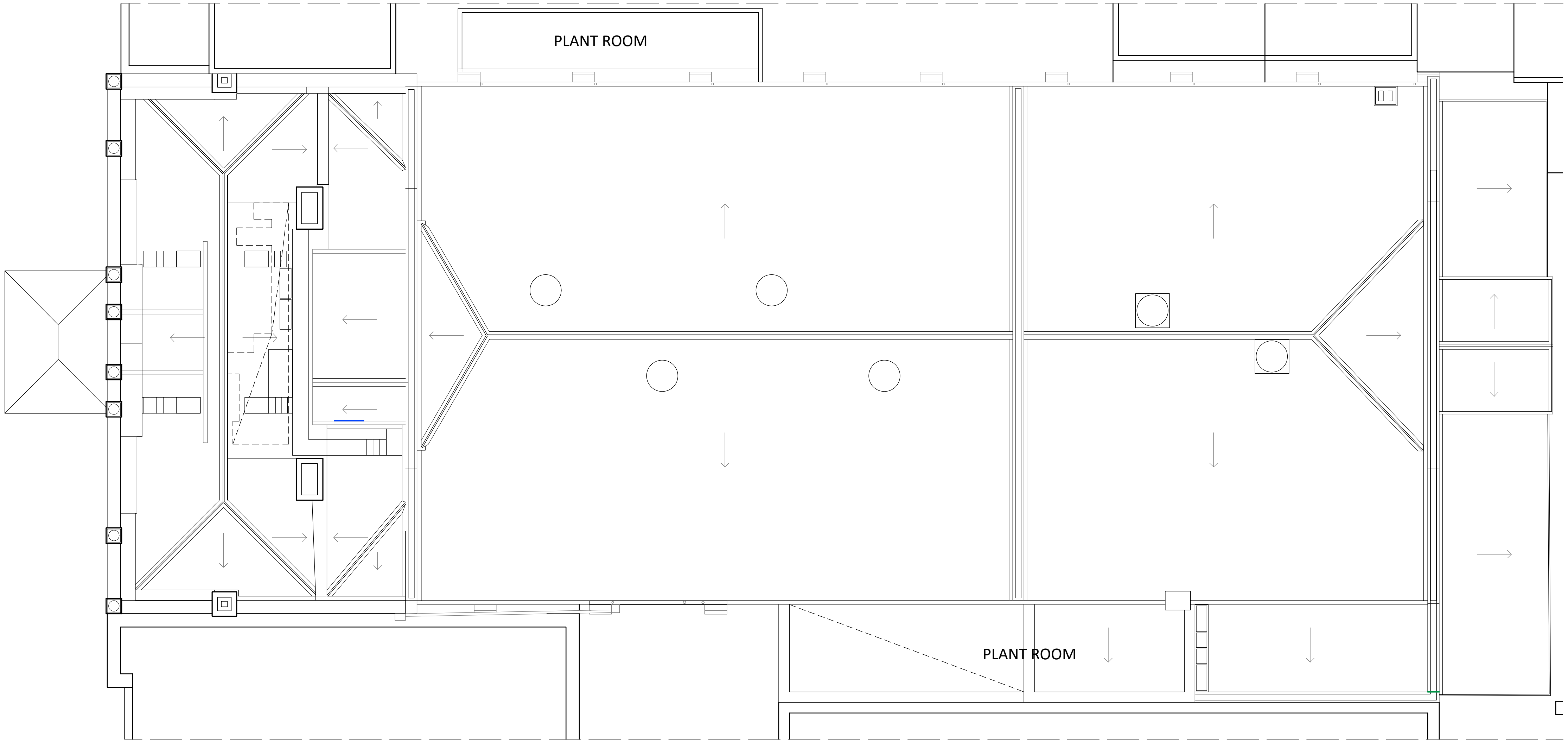

01 ROOF FLOOR PLAN
-- 1:200

LEGEND:

- ADMIN
- AMENITIES
- FOYER
- GREEN ROOMS
- TECHNICAL ROOMS
- STORAGE
- VERTICAL ACCESS
- DRESSING ROOMS
- TO DEMOLISH/DISMANTLE
- PROPOSED
- LONG ROOM
- ROYAL SOUTH STREET SOCIETY

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
SCALE 1:200 @ A3

NO.	DATE	REVISION
P1	31/10/18	PRELIMINARY
P1	xx/11/18	PRELIMINARY
P3	13/06/19	PRELIMINARY
P4	11/07//19	PRELIMINARY
P5	22/11//19	PRELIMINARY

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PROJECT
HER MAJESTY'S THEATRE
BALLARAT
FEASIBILITY STUDY

DRAWING TITLE
PROPOSED ROOF PLAN
AND SECTION

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB/DT/CB	CB	7925	OCTOBER 2018

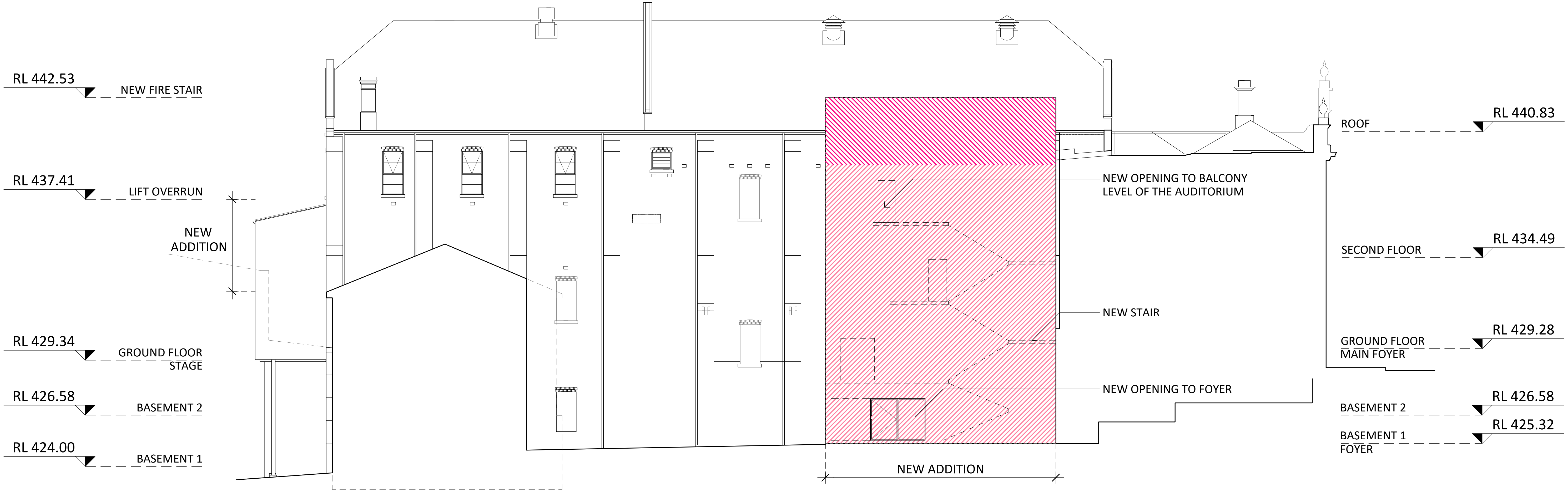
ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.06	P5

LEGEND:

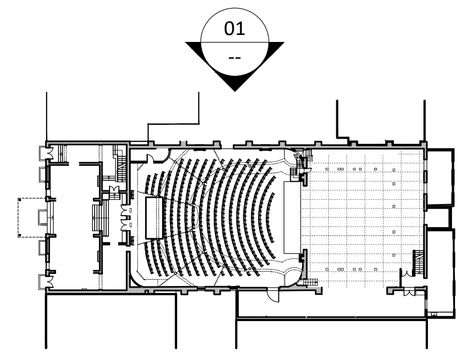
TECHNICAL ROOMS

PUBLIC SPACE

VERTICAL ACCESS



01 -- NORTH ELEVATION 1:200



KEY PLAN

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
SCALE 1:200 @ A3

NO.	DATE	REVISION
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P3	13/06/19	PRELIMINARY
P4	11/07/19	PRELIMINARY

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PROJECT
HER MAJESTY'S THEATRE
BALLARAT
FEASIBILITY STUDY

DRAWING TITLE
PROPOSED NORTH ELEVATION

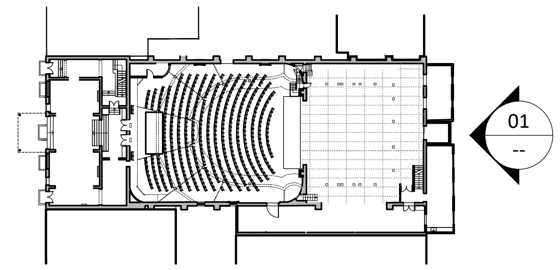
DRAWN	CHECKED	PROJECT NO.	DATE
AO/MB/KE	DB	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.07	P4

LEGEND:

- TECHNICAL ROOMS
- PUBLIC SPACE
- VERTICAL ACCESS

01 EAST ELEVATION
-- 1:200



KEY PLAN

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
SCALE 1:200 @ A3

NO.	DATE	REVISION
P2	05/07/19	PRELIMINARY
P3	13/06/19	PRELIMINARY

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PROJECT
HER MAJESTY'S THEATRE
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FEASIBILITY STUDY

DRAWING TITLE
PROPOSED EAST ELEVATION

DRAWN	CHECKED	PROJECT NO.	DATE
AO/MB/KE	DB	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.08	P3

APPENDIX E ACCESS MEMORANDUM PREPARED BY MORRIS GODING

Morris Goding
Access Consulting

Her Majesty's Theatre, Ballarat

Feasibility Report

Attention: Christophe Loustau
Lovell Chen Architects

From: Colin Earle
Senior Access Consultant

Date: **28th November 2019**

Re: Her Majesty Theatre, Ballarat Feasibility

Unit 308, 87 Gladstone St, South Melbourne 3205
W www.mgac.com.au | E colin@mgac.com.au | M 0418 999 052

Morris Goding
Access Consulting

Table of Contents

Morris Goding
Access Consulting

1. INTRODUCTION

Morris Goding Accessibility Consulting (MGAC) has reviewed the feasibility report and the proposed floor plans for Her Majesty's Theatre in Ballarat and have carried out a physical inspection of the site. The proposed refurbishment of the theatre space will include new opportunities for enhanced Accessibility and Universal Design (UD).

It is MGAC's role to assist the project and design team to implement UD and accessibility design requirements. Along with the "smart design", we will ensure that the minimum design compliance with the National Construction Code (NCC) will be met, either through meeting the Deemed to Satisfy provisions of the NCC or via performance solution provisions.

The UD and Accessibility components identified as needing key consideration included:

- Entrance - principle pedestrian entry
- Front of House – lobby, box office / sales / bar
- Vertical access – stairs, ramps & lifts
- Accessible toilets and changing places facility
- Long room.
- Auditorium accessible and enhanced amenity seating.
- Offices & facilities
- Back of House areas / dressing rooms
- Hearing augmentation
- Wayfinding signage
- Door hardware

2. DOCUMENTATION

This correspondence is specific to the following key stage drawings:

Drawing	Revision	Drawing / Correspondence Title
A.07	P5	Basement 1
A.08	P5	Basement 2
A.09	P5	Ground floor proposed
A.10	P5	First floor proposed
A.11	P5	Second floor proposed
A.13	P5	North Elevation
A14	P3	East Elevation

3. UNIVERSAL DESIGN PRINCIPLES

The following highlights the key considerations of Universal Design. Universal Design allows everyone to the greatest extent possible and regardless of age or disability, to use buildings, transport, products and services without the need for specialised or adapted features. It helps to provide more inclusive facilities than relying on minimum standards prescribed in building codes.

While this strategic document primarily focuses on physical accessibility to the built environment, it is important to also consider other dimensions of accessibility such as the social, communication and information systems within the built environment.

When applied successfully the key beneficiaries include:

- Families who use strollers or have young children
- The aging population
- People with temporary injuries, fatigue easily or those with recurring illnesses
- Performers with diverse community members
- Non-English speaking residents and tourists
- Service and Emergency services personnel
- Mass movement of people

UNIVERSAL DESIGN PRINCIPLES

Equitable Use	• The design encapsulates the needs of the whole community without disadvantaging or stigmatising any one individual or group e.g. encompasses diversity and inclusion.
Flexibility in Use	• The design accommodates a wide range of individual preferences and abilities e.g. different event modes.
Simple and Intuitive Use	• Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level e.g. seamless and predictable movement.
Perceptible Information	• The design communicates necessary information effectively to the user, regardless of the ambient conditions or the user's sensory abilities e.g. new wayfinding technologies such as "Blind Square".
Tolerance for error	• The design minimises hazards and the adverse consequences, do accidental or unintended actions e.g. the primary pathway is the accessible pathway for all.
Low physical effort	• The design can be used efficiently and comfortably with a minimum of fatigue e.g. large vertical rises have lifts and / or rest hubs along extensive pathways.
Size and Space for approach and use	• Appropriate size and space are provided for approach, reach, manipulation and use regardless of the user's body size, posture, or mobility.

3.1 Entrance - Principle Pedestrian Entry

Accessibility is not provided into the theatre via the main principal pedestrian entry due to the location of steps, however there is an alternative wheelchair accessible entry point located adjacent to the main entry.

The accessible entry point is provided with heritage doors that do not comply as they are non-compliant in width and will either need to be automated or operated via a staff management plan where they are on hold open prior to events to allow independent access. The detailing of the solution may require to be included as a performance solution.

Access to Premises requirements

NCC Clauses	AS 1428 references
D3.2	AS1428.1 Section 13

3.2 Front of House – Lobby, Box Office/Sales/Bar

A new FOH bar & ticket box office is proposed which will be provided with compliant access for a person in a wheelchair or with an ambulant disability regarding reach ranges & point of sale transactions. The existing stairs leading to the theatre will be upgraded to provide compliant handrails, stair nosing's & TGSIs.

Consider the use of digital media screens for front of house areas/lobby areas to assist wayfinding and direction.

Access to Premises requirements

NCC Clauses	AS1428 references
D3.3	AS1428.1 Section 10, 11, 12, AS 1428.2 Section 22

3.3 Vertical Access – Lifts

Two new DDA compliant lifts are proposed, the FOH lift which will provide compliant access to basement, level 1, ground floor, dress circle & long room levels. The second lift will provide access to, basement, level 1, ground floor, dress circle both FOH & BOH. The lifts highlight appropriate locations for orientation and ease of use; however, capacities will need to be clarified, particularly for the mobility impaired and elderly.

Vertical access will not be provided to basement level two.

Access to Premises requirements

NCC Clauses	AS 1428 references
E3.6	AS1735.12 Sections 2 & 3

3.4 Vertical Access – Stairs & Ramps

All existing stairs throughout the theatre are proposed to be upgraded with compliant handrails/handrail extensions, stair nosing's with 30% luminance contrast & Tactile Ground Surface Indicators (TGSIs). New handrails are to be provided to stairs within the dress circle & balcony levels.

All existing ramps throughout the theatre are proposed to be upgraded with compliant handrails/handrail extensions, & Tactile Ground Surface Indicators (TGSIs). New ramps to comply with AS 1428.1 2009

Access to Premises requirements

NCC Clauses	AS1428 references
D3.2, DP1	AS1428.1 Section 10, 11, 12

3.5 Accessible Toilets

There are three new compliant unisex accessible sanitary facilities being proposed which will be located on basement level 1 - two accessible toilets and one accessible toilet located on the ground floor level (DDA toilet to first floor TBC). The new accessible toilets will be provided with a baby change table for enhanced use for families.

Ambulant male & female sanitary facilities are proposed to each bank of sanitary facilities to the following levels: Basement level 2 (BOH) Basement level 1 (FOH/BOH) & First floor level (FOH).

Also being provided is a Changing Places facility. Under F2.9 (iii) of the NCC an Accessible adult change facility is not required in class 9b facilities, where there are less than 1500 patrons. Given there are 788 seats total in the theatre, a changing places facility is technically not required. The City of Ballarat, however, has indicated that they would like to be proactive to ensure a "Changing Places" facility is provided for whole community use.

Access to Premises requirements

NCC Clauses	AS1428 references
D3.6, F2.4, F2.9	AS1428.1 Sections 8, 15 & 16

3.6 Long Room

The existing long room is proposed to have minor upgrade/replacement works undertaken to the bar to provide compliant access for a person who uses a wheelchair or have an ambulant disability regarding reach ranges & point of sale transactions. Existing bar height is 1200mm AFL.

Currently the long room does not provide compliant access as there is a 40mm high step at both entry door points, additionally the heritage doors are non-compliant in width. It is proposed that the step be removed and created as a threshold ramp, while the doors continue as hold open types. Should they need to be closed in the future, consideration should be given to automation.

A performance solution may need to be detailed for non-compliant door widths. Provide step free threshold entry into the long room.

Access to Premises requirements

NCC Clauses	AS1428 references
D3.3	AS1428.1 Section 6 & 13, AS 1428.2, section 22

3.7 Auditorium Seating

The auditorium seating is proposed to be provide accessible seating to the ground floor stalls and the level 1 dress circle. It should be noted that no accessible seating is able to be provided on the balcony due to existing structural and heritage constraints. This situation is further supported by the accessible seating being in preferred locations with enhanced sightlines

It is also recommended that the companion seating be raised to a height of 500mm and setback at least 500mm from the seating in front. Where possible the accessible seating spaces should also allow additional seating to be put back in, when demand is low. This would allow the infill seating to become enhanced amenity seating for people with mobility impairments.

The seating numbers below highlight the NCC requirements. It should be noted that there is no NCC requirement for enhanced amenity seating, however this is strongly recommended.

Seating location	Seating numbers	Wheelchair seating required
Stalls	439	9
Dress circle	199	4
Balcony	150	0

Access to Premises requirements

NCC Clauses	AS1428 references
D3.9	AS1428.1 Section 18

3.8 Offices & Facilities

The offices & facilities are located on basement level 1 and are proposed to be upgraded into an individual office, open plan office layout, staff kitchenette & storage areas.

The key considerations are continuous accessible path of travel/circulation space to corridors, doorways (hinged & sliding) open office layout, kitchenette & storage rooms, kitchenettes with a universal bench height of 900mm above floor level & appliances (taps/GPOs/microwave/vending machines) within reach range zones.

Access to Premises requirements

NCC Clauses	AS1428 references
D3.3	AS1428.1 Section 6, 10, 11, 12 & 13, AS 1428.2 Section 22

3.9 Back of House Areas - Stage/Dressing Rooms/Green Rooms/Showers & Amenities

The back of house area is proposed to be upgraded to provide an increased capacity of the stage, dressing rooms, green room, storage areas & sanitary facilities.

Ensure BOH areas are accessible for performers regarding dressing rooms, green room sanitary facilities & showers, consider provision of a unisex accessible toilet with shower/change facilities. Provide a continuous accessible path of travel/circulation space to corridors & doorways (hinged & sliding).

Access to Premises requirements

NCC Clauses	AS1428 references
D3.6, F2.4	AS1428.1 Sections 6,13,15 & 16

3.10 Hearing Augmentation

Hearing augmentation will be provided via a new wireless FM system to the auditorium, cry room & the long room. A key consideration is ensuring sufficient receivers/headphones are provided for the number of persons accommodated as per NCC D1.13.

Provision of compliant braille & tactile signage as per NCC D3.6, is also required.

Access to Premises requirements

NCC Clauses	AS1428 references
D3.7, D3.6	AS1428.5 Sections 2 & 3 AS 1428.1, Section 8

3.11 Wayfinding

Existing statutory signage will be upgraded to compliant standard.

There are several new technologies such as beacons etc. which negate the reliance on WiFi, which should be considered as the design progresses.

Given the accessible front entry is off to the side of the main entry, appropriate signage will be provided along with lift and accessible amenity signage.

Signage utilising plain English and pictograms ensure direct wayfinding and allow use by technology such as AI See, which uses PR Codes to read a sign.

Provision of compliant braille & tactile signage as per NCC D3.6, is also required.

Access to Premises requirements

NCC Clauses	AS1428 references
D3.6	AS1428.1 Section 8

3.12 Door Hardware

The door hardware throughout the theatre is proposed to be upgraded to a compliant standard.

As a minimum, all doorways in the public areas to have D shaped door lever handles, located between 900-1100mm AFL, enhanced clear opening widths, circulation spaces and latch side clearances. Doors to have an operating force not exceeding 20n for manual doors or should be automated.

Access to Premises requirements

NCC Clauses	AS1428 references
D3.2, 3.3	AS1428.1 Section 13

4. SUMMARY

The development of accessible and universally designed multi-purpose venues such as the Her Majesty's Theatre in Ballarat, should be seamless and flexible in use for all people. Base level accessibility is encompassed by the NCC which references AS1428.1 2009, however there are many components highlighted which should be considered to create "best practice or Universal Design". An example of this is enhanced amenity seating which is not required under the NCC, but due to the ageing population, a necessity.

The recommendations are by no means an exhaustive list, rather a start of the options and opportunities to create seamless, accessible yet flexible environments depending on the mode of operation or event.

As the design progresses, reviewing the design against the principles of this report, will ensure accessibility and Universal Design have been implemented successfully.

Colin Earle
Dip. (Bldg Const/Insp)

5. APPENDIX - Design Checklist

The following summarises the primary project technical requirements as required to satisfy the National Construction Code and relevant referenced standards including the AS1428 suite.

1) Slip Resistance

Slip Resistance of Ramps, Steps and Landings: (D2.10, D2.13, D2.14) • Ramp Surfaces, stair tread surfaces or nosing strips, and stair landings, or landing nosing strips to a flight below, must achieve slip-resistance classifications to AS4586-2013 as follows: • Application: • 1:14 or steeper- dry surface conditions P4 or R11, wet surface condition P5 of R12 • Ramps of 1:14 to 1:20- dry surface conditions P3 or R10, wet surface condition P4 of R11 • Tread of Landing Surface- dry surface conditions P3 or R10, wet surface condition P4 of R10 • Nosing Strip to Landing Strip- dry surface conditions P3, wet surface condition P4

2) Entrances

Key entrance recommendations • Main entry must be accessible (new buildings) or locate accessible entry within 50m of inaccessible entry (existing buildings). • 50% of all entrances are required to be accessible (new buildings). • Entry requires single door leaf width clearance of 850mm (920mm door size). • Circulation space of 1450mm required either side of entry. Minimum grade & cross fall 1:40. • Entrance doors to have operational weight of less than 20N of force or be automated. • All frameless glazed doors must be marked with contrasting marking not less than 75mm wide for full width of doors with lowest edge at 900-1000mm.

3) Lifts

Key lift design recommendations: • Lift dimensions to be 1400mm x 1600mm minimum. Where stretcher use indicated (in at least one lift for lifts travelling >12m) provision of 2000mm length is required. • 1450mm floor circulation space required at lift entrances. • Lift doorway clearance to be 900mm • Fit out of lifts to include: Handrail 600mm (min) length; at height between 850-950mm, Tactile and Braille symbols on control buttons and panels, Automatic auditory information detailing lift stops. • Lift controls to be installed at height between 700-1250mm. At lift landings controls to be located 500mm clear of any obstruction with 1350mm circulation space in front of controls. This is inclusive of side walls.
Vertical Platform Lift (VPL) Specifications: • Lift dimensions to be 1100mm x 1400mm minimum • Lift doorway clearance to be 900mm • Fit out of lift to include duel sided controls, automatic door operation, bilateral handrails, control operation via constant hold to run pressure.

Morris Goding
Access Consulting

4) Stairs

Key stair design recommendations:

- Stairs to be set back 900mm at property boundaries or sufficient space to accommodate required handrails internal corners.
- Where the intersection is at an internal corridor, the stair shall be set back in 300mm, so the handrails do not protrude into transverse path of travel.
- Circular or spiral stairs are generally unsafe due to their inconsistent tread width.
- Stairs shall have opaque risers.
- Stair nosing shall not project beyond the face of the riser and the riser may be vertical or have a splay backwards up to a maximum 25mm.
- Stair nosing profiles shall:
    a. Have a sharp intersection;
    b. Be rounded up to 5mm radius; or
    c. Be chamfered up to 5mm x 5mm
- At the nosing, each tread shall have a strip not less than 50mm and not more than 75mm deep across the full width of the path of travel. The strip may be set back a maximum of 15mm from the front of the nosing. The strip shall have a minimum luminance contrast of 30% to the background. Where the luminous contrasting strip is affixed to the surface of the tread, any change in level shall not exceed a difference of 5mm
- Common use stairs require AS1428 series compliant handrails, tread features and TGSI.
- Fire stairs require AS1428 series compliant stair nosing. They are exempt from other features although these are recommended to enhance safety of steps.

5) Ramps

Key ramp design recommendations:

- Total vertical rise cannot exceed 3.6m.
- Ramps to be set back 900mm at property boundaries or 400mm at internal corners.
- Minimum gradient of a ramp exceeding 1900mm is 1:14. Gradient to be consistent throughout ramp.
- Ramp required to have unobstructed width of 1000mm
- Ramps to be provided with landings at bottom and top of ramp.
- Landings required every 9m where grade 1:14.
- Landings required every 15m where grade 1:20.
- Landings in direction of travel 1200mm long; landings at 90° directional change 1500mm x 1500mm. Landings at 180° directional change 1540mm x 2070mm length.
- Ramps require AS1428 series compliant handrailing and TGSI.

6) Information, Reception and Enquiries

Key information and reception design recommendations

- Provide 1450mm approach space in front of reception areas.
- Reception height to be 900mm or if higher an 850mm wide section of 850mm height is provided.
- If transactions to occur at counter total counter depth to not exceed 1100mm.
- On the staff approach an accessible under clearance of 680mm height is required.
- On the customer side if paperwork requires completion provide an 850mm wide section of 680mm high desk under clearance.

7) Internal Walkways and Surfaces

Key internal walkway and surface recommendations:

- Walkways to be 1800mm wide or 1500mm with passing bays (1800 x 2000mm) every 20m in high trafficable zones.
- Minimum width of internal walkway 1000mm.
- Path of travel in front of major thoroughfare doorways or those accessed from a frontal approach required to be 1450mm width (minimum).
- Path of travel in front of minor thoroughfare doorways accessed from the latch side to be 1240mm minimum width (for example corridor widths in low traffic areas).
- Landing spaces at directional changes of: at 90° - 1500mm x 1500mm (corner can be truncated); at 180°- 1540mm x 2070mm.
- Turning space at corridor terminations to be 1540mm width x 2070mm length.
- Tactile indicators are required to be provided to warn occupants of all stairs (except Fire Isolated stairs) and ramps regardless of public nature or private environment and where an overhead obstruction occurs less than 2.0m above the finished floor level.

Accessibility within building:

- A building required to be accessible is required to be equipped with either a 1428.1 compliant lift or 1428.1 compliant ramp, (but the maximum vertical rise of a ramp must not exceed 3.6m).

8) Internal Doorways

Key internal doorway recommendations

- All doors require 850mm clearance width (920mm doors) inc. active leaf of double doors.
- Latch side clearance of 510mm to inward opening doors; 530mm to outward opening doors.
- Automated doors can negate latch side clearance and are preferred on entry/ outside opening doors.
- Circulation space of 1450mm required either side of doors in high traffic areas or that are approached from the front.
- Circulation space of 1240mm required in front of inward opening doors approached from latch side (for example corridor widths within low traffic areas).
- All frameless glazed doors must be marked with contrasting marking not less than 75mm wide for full width of doors with lowest edge at 900-1000mm.

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11) Sanitary and Parenting Facilities

Key sanitary facility recommendations

- Accessible sanitary facilities to be in same location as gender facilities and located on all levels of a multi-level building.
- Room dimension with WC and basin: 1900mm x 2630mm or 2330mm x 2200mm.
- Room dimension with WC, basin, shower: 2300mm x 2690mm.
- Provide AS1428 series compliant fixtures inclusive of shelf, clothes hooks, full length mirror.
- Consider provision of baby change and/or shower to enhance operational flexibility for all users.
- Must contain a closet pan, washbasin, shelf or bench top and adequate means of disposal of sanitary towels and as per the following:
  - Building Type- Retail
  - Minimum accessible unisex sanitary compartments to be provided:
    - a) 1 on every storey containing sanitary compartments; and
    - b) Where a storey has more than 1 bank of sanitary compartments containing male and female sanitary compartments, at not less than 50% of those banks.

- At each bank of toilets where there are one or more toilets in addition to an accessible unisex sanitary compartment at that bank of toilets, a sanitary compartment suitable for a person with an ambulant disability in accordance with AS 1428.1 must be provided for use by males and females; and

- Where male sanitary facilities are provided at a separate location to female sanitary facilities, accessible unisex sanitary facilities are only required at one of those locations.

12) Emergency Evacuation

Key emergency evacuation recommendations:

- Consideration of individuals with disabilities is required as part of emergency evacuation planning. The types of accessible emergency evacuation include “protect in place” i.e. 1 hour rated hotel rooms on non-fire effected levels; smoke isolated lift lobbies with managed lift access; horizontal evacuation movement to other building areas; or provision of fire refuges within fire stairs or identified zones.
- If areas of refuge are provided spaces of 1300mm x 800mm are required per individual. This space needs to be set back from the main egress thoroughfare.
- Fire evacuation plans should include provision of management plans to assist individuals with disabilities or access requirements. Individuals with accessible requirements should be provided with a “fire buddy” to escort them to pre-determined areas of refuge.
- Fire engineering reports should detail accessible evacuation within a sub section of the plan.

13) Signage

Key Signage design recommendations

- Accessible way finding should highlight the pathway from entrance to reception to lifts/stairs, amenities and to key components of the facility.
- Ensure accessible way finding signage is:
  - Located at appropriate viewing heights
  - Perpendicular to the path of travel or beside identifiable features (e.g. door faces)
  - Of suitable colour contrast
  - Of compliant notation inclusive of use of the international symbol of access.
- Signage to accessible sanitary facilities requires identification with the international symbol of access, raised tactile and Braille signage and letters RH or LH to indicate side of transfer to the WC pan.
- Ensure parenting symbols are used to identify baby change locations.

14) Hearing Augmentation

Key Hearing augmentation recommendations

- Hearing Augmentation systems must be provided where inbuilt amplification is provided in rooms (e.g. auditoriums, conference rooms or meeting rooms)
- Hearing Augmentation systems must be provided where inbuilt amplification is provided to ticket offices, tellers booths, reception areas or the like where the public is screened from the service provider.
- Hearing augmentation systems can be permanent or portable. The nature of the built environment will dictate the desired outcome.

APPENDIX F FIRE ENGINEERING REPORT PREPARED BY GINCAT FIRE SAFETY

Document:
Fire Engineering Report

Project:

Her Majesty's Theatre

(17 Lydiard St S, Ballarat Central VIC 3350)

Client:
City of Ballarat

Project Ref: P17247
FER Revision: 1.4
Date: 29/1/19
Issue Status: Client Issue

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Report Issue/Authorisation

FER Rev.	Date	Issue Status/Description	Prepared/ Authorised By
FER 1.0	14/6/18	FER Draft for comment/ review by relevant stakeholders.	G.G. Catania EF 44651
FER 1.1	11/7/18	FER Draft for comment/ review by relevant stakeholders. Deleted one-way fire rating performance solution. New Figure 12 to illustrate setback of sprinklers from doors. Updated construction requirements and Table 9. Updated §1.3 design additions.	G.G. Catania EF 44651
FER 1.2	30/7/18	FER Draft for comment/ review by relevant stakeholders. Includes comment/clarification required Architect dated 18/7/18.	G.G. Catania EF 44651
FER 1.3	10/1018	FER – Client Issue. Includes EVACNET 4 Calculations for egress from auditorium – Refer Appendix C1.1.5A and C2. Updated factors of safety to 1.5 in event of failure of 1 of 2 subsystems and 1.0 for failure of 2 sub-subsystems. Updated occupant numbers to include additional occupants from 1058 up to 1128 occupants in total with 120 in long room.	**G.G. Catania** **EF 44651**
FER 1.4	29/1/19	FER – Client Issue. Post Independent Review. Updated Appendix headers. Updated §6.2.9.1 for inherent FRL's (no impact on outcome of solution). Bio-box solution added within New §6.5 (as DtS Clauses vary from Doors in §6.1). Acceptance criteria for convective exposure of 100°C re-confirmed for sprinkler failure and 60°C for sprinkler operating (as per IFEG 1996). Original Tables included 60°C in error for non sprinkler cases.	**G.G. Catania** **EF 44651**

Conditions of Use

Executive Summary

This Fire Engineering Report presents a Performance Solution, for the Her Majesty's Theatre located at 17 Lydiard St S, Ballarat Central and will form the basis for an Interim Fire Safety Strategy.

The building development is understood to comprise an existing 4-storey theatre (public assembly – Class 9b with an administration area (Class 5) in the basement). The building is heritage listed with sprinkler protection throughout except for the auditorium and organ areas below. A proscenium curtain separates the stage/backstage areas. The existing building is to be fire separated into 3 fire compartments.

The objective of this Fire Engineering Report (FER) is to demonstrate a level of compliance of the Performance Solution (that will form the Interim Fire Safety Strategy), with relevant performance requirements of the BCA, and therefore the relevant building regulations and the Building Act 1993, as far as practicable, for an existing building.

Where new works are required, it is expected that the Relevant Building Surveyor will assess the development in accordance with Building Regulation 608.

Table 1: Key BCA Parameters/Characteristics

BCA Clause		Description		
A1.1	Effective Height	< 25m		
A3.2	Occupancy Classification	Class 9b/5		
C1.1	Minimum Type of Construction	Type A		
C1.2	Rise in Storeys	3 (4-storeys contained)		
C2.2	Fire Compartment	West (m^2)	Mid (m^2)	East (m^2)
	(excludes south fire stairs 160m^2)	957	1765	873

The Fire Engineering Report characterises the fire safety systems within the building, describes the variations from the BCA Deemed-to-Satisfy (DtS) provisions, consider the potential hazards associated with these variations and details the subsequent technical analysis including the acceptance criteria and methodology, to demonstrate compliance of the Performance Solution that forms the Interim Fire Safety Strategy, with the performance requirements of the BCA.

The analysis performed, will include a combination of qualitative and quantitative techniques as applicable, consistent with the methodology outlined within the International Fire Engineering Guidelines [IFEG 2005].

The following variation from the DtS provisions, will be permitted as part of the Interim Fire Safety Strategy, and have been assessed in a fire engineering performance assessment against the relevant performance requirements of the BCA:

gincat FIRE SAFETY ENGINEERS

Table 2: Variations from BCA DtS Provisions associated with Refurbishment Works

DtS Clause	Description of Variation from BCA DtS Provisions	Performance Requirements
C3.5(a)(iii)* inter-Alia C3.8	The provision of a Specification C3.4 smoke door protected by a pendant sprinkler on the exposure side only in lieu of an FRL -/60/30 self closing fire door	CP2, CP8
D1.4(d)	The provision of an extended distance of travel of 30m in lieu of 20m in platform areas	DP4, EP2.2
BCA Clause D2.8(a)	A non fire isolated stair is provided with storage below (as per BCA Clause D2.8(b)) in lieu of no storage	CP2, DP5, EP2.2
BCA Clause E1.5 Spec E1.5 Clause 3 Inter-alia AS 2118.1 Clause 3.1.1.3	The provision of a sprinklers system that does not include fire separation between sprinkler protected and non sprinkler protected areas. [Sprinkler protection above, though not within the auditorium]	CP2, CP8, EP1.4
C2.7(a)(ii) inter-alia C3.4(a)(i)(A) and C3.4(a)(iii)(A)	The provision existing openings in Bio Box bounding wall that aligns with proposed fire wall, protected by pendant sprinkler each side	CP2, CP8

Note

The scope of this report is limited to the assessment of the relevant variations from the deemed-to-satisfy provisions of the BCA as outlined above, with regard to the Refurbishment Works. The building is otherwise assumed to comply with the Building Regulations at the time of construction in matters of fire safety. The scope of this report does not extend to any other variations from the deemed to satisfy provisions of the BCA and does not address non-fire related issues.

Any Performance Solution proposed associated with the provision of fire hydrant and fire hose reel protection for the site will under Regulation 309 require the report and consent/Opinion of the Chief Officer of the MFB.

The following design additions are prescribed as part of the Performance Solution, that verifies the Interim Fire Safety Strategy:

- **Construction and FRL's**
  - Bio Box – Glazed (and operable) openings between Bio box and Auditorium to be provided with AS 2118.1 fast response pendant sprinkler provided on the auditorium side and Bio box side of the wall/openings (<450mm above <600mm away). Bio box doors to be provided with AS 1503.4 intumescent fire and AS 1530.7 smoke seals.
  - Long Room - The west stairs are to be separated from the Long Room at first floor by minimum 35mm thick solid core timber doors (with minimum infill panel of 20mm thick hardwood permitted) protected by AS 2118.1 fast response pendant sprinkler provided on the Long Room Side (<1000mm away from the door).
  - Auditorium - The stairs are to be fire separated from the Auditorium by minimum 35mm thick solid core timber doors (with minimum infill panel of 20mm thick hardwood permitted) protected by AS 2118.1 fast response pendant sprinkler provided on the auditorium side (<450mm above <600mm away from the door).
  - Basement Level Substations and switchroom to be provided with minimum FRL 120/120/120 construction and FRL -/120/30 self closing fire doors.
  - Basement Level Battery room to be fire-isolated by minimum FRL 120/120/120 construction and new FRL -/120/30 self closing fire doorset.
  - Provide new fire door between basement backstage and administration areas/organ areas of FRL /120/30 fitted with a vision panel
  - Sub-Basement Level - Ceiling to comprise 1 x 13mm fire grade plasterboard with penetrations protected to BCA Clause C3.15

- The fire walls are to be made good with penetrations infilled by FRL -/120/120 construction , protected in accordance with BCA Specification C3.15 or protected as nominated above.
- Louvres at external wall from Auditorium Compartment to Bio-Box to be provided with metal sheeting and sprinkler protection above
- Smoke walls are to be made good to meet BCA Specification C2.5 Clause 2.
- Existing doors adopted as fire/smoke doors for the purpose of Performance Solution are to be provided with AS 1530.7 smoke seals on the sides and head of the door(s).
- Existing north east non fire isolated stair provided with storage below permitted to be lined with 10mm standard grade plasterboard and 35mm thick self closing solid core door subject to sprinkler protection within.

- **Sprinkler Protection**
  - AS 2118 – 1982 sprinkler protection throughout the building with the exception of the auditorium and organ areas.
  - Bio Box – Glazed (and operable) openings between Bio box and Auditorium to be provided with AS 2118.1 fast response pendant sprinkler provided on the auditorium side and Bio box side of the wall/openings (<450mm above <600mm away). Bio box doors to be provided with AS 1503.4 intumescent fire and AS 1530.7 smoke seals.
  - Long Room - The west stairs are to be separated from the Long Room at first floor by minimum 35mm thick solid core timber doors (with minimum infill panel of 20mm thick hardwood permitted) protected by AS 2118.1 fast response pendant sprinkler provided on the Long Room Side (<1000mm away from the door).
  - Auditorium - The stairs are to be fire separated from the Auditorium by minimum 35mm thick solid core timber doors (with minimum infill panel of 20mm thick hardwood permitted) protected by AS 2118.1 fast response pendant sprinkler provided on the auditorium side (<450mm above <600mm away from the door).

- **Fire Detection/Alarms**
  - Ensure the auditorium is to be provided AS1670.1 smoke detection except in areas likely to provide spurious alarm, eg windy, dusty, cooking, steam, where heat detection/alarms can be provided.
  - A manual call point at the sub-panel and FIP and at proscenium controls
  - A public address (PA) system is to be provided at the BIO box and at the sub-panel
  - Ensure building occupant warning speaker and strobe is provided within the orchestra pit and organ chambers.
  - Ensure building occupant warning speaker and strobe is provided at far end of fly platform

- **Contractor Safety/Management**
  - Hot Works Permits
  - Contractor procedures/Inductions

- **Fire Wardens and Occupant Numbers**
  - A designated Fire Warden to be present at all times
  - Manual call point to be available at each required exit
  - The stairs are to be adopted as a safer haven for occupants in wheelchairs. The stair is separated from the auditorium by inherently fire resistant walls (masonry). Wall openings are to be protected by existing doors with sprinkler protection or self closing minimum FRL -/120/30 doors leaves with AS 1530.7 cool/medium temperature smoke seals and AS 1530.4 intumescent fire seals to the door heads, side and stiles

- Occupant numbers shall not exceed 858 in Auditorium, 250 Back of House/Stage and 20 Staff (=**1128** Total).

Occupant Numbers	
Stalls Level	439
Dress Circle	199
Long Room	70*
Balcony	150
Sub Total	**858**
Back of House/Stage	250
Staff	20
Sub Total	**270**
Total	**1128**

Note if Long Room occupants increase to 120 (= 70 base occupant load + 50 restricted from balance of building) to ensure that 1128 is maintained overall.

- **Emergency Management and Evacuation Plans -**
  - An Emergency Management Plan in accordance with AS3745 is to be prepared for the facility; and
  - Evacuation plans and fire orders shall be prepared for the site consistent with BCA Clause G4.9. It is required that these plans and fire orders be reviewed to be provided such that they are consistent with the building structure, emergency plan, procedures and fire safety equipment.

Based on the analysis and discussion presented, it is considered that with regard to the variations from the DtS provisions identified above, the relevant performance requirements CP2, CP8, DP4, DP5, EP1.4 and EP2.2, are satisfied to the degree necessary (as far as practicable, in an existing building).

Table of Contents

gincat FIRE SAFETY ENGINEERS

1 Introduction

1.1 Background/Description

The building development is understood to comprise an existing 4-storey theatre (public assembly – Class 9b with an administration area (Class 5) in the basement). The building is heritage listed with sprinkler protection throughout except for the auditorium and organ areas below. A proscenium curtain separates the stage/backstage areas. The existing building is to be fire separated into 3 fire compartments.

The objective of this Fire Engineering Report (FER) is to demonstrate a level of compliance of the Performance Solution (that will form the Interim Fire Safety Strategy), with relevant performance requirements of the BCA, and therefore the relevant building regulations and the Building Act 1993, as far as practicable, for an existing building.

Where new works are required, it is expected that the Relevant Building Surveyor will assess the development in accordance with Building Regulation 608.

Table 3: Key BCA Parameters/Characteristics

BCA Clause		Description		
A1.1	Effective Height	< 25m		
A3.2	Occupancy Classification	Class 9b/5		
C1.1	Minimum Type of Construction	Type A		
C1.2	Rise in Storeys	3 (4-storeys contained)		
C2.2	Fire Compartment	West (m^2)	Mid (m^2)	East (m^2)
	(excludes south fire stairs 160m^2)	957	1765	873

The Fire Engineering Report characterises the fire safety systems within the building, describes the variations from the BCA Deemed-to-Satisfy (DtS) provisions, consider the potential hazards associated with these variations and details the subsequent technical analysis including the acceptance criteria and methodology, to demonstrate compliance of the Performance Solution that forms the Interim Fire Safety Strategy, with the performance requirements of the BCA.

The analysis performed, will include a combination of qualitative and quantitative techniques as applicable, consistent with the methodology outlined within the International Fire Engineering Guidelines [IFEG 2005].

1.2 Variations from Deemed-to-Satisfy Provisions of the BCA

The following variation from the DtS provisions, will be permitted as part of the Interim Fire Safety Strategy, and have been assessed in a fire engineering performance assessment against the relevant performance requirements of the BCA:

Table 4: Variations from BCA DtS Provisions associated with Refurbishment Works

DtS Clause	Description of Variation from BCA DtS Provisions	Performance Requirements
C3.5(a)(iii)* inter-Alia C3.8	The provision of a Specification C3.4 smoke door protected by a pendant sprinkler on the exposure side only in lieu of an FRL -/60/30 self closing fire door	CP2, CP8
D1.4(d)	The provision of an extended distance of travel of 30m in lieu of 20m in platform areas	DP4, EP2.2
BCA Clause D2.8(a)	A non fire isolated stair is provided with storage below (as per BCA Clause D2.8(b)) in lieu of no storage	CP2, DP5, EP2.2
BCA Clause E1.5 Spec E1.5 Clause 3 Inter-alia AS 2118.1 Clause 3.1.1.3	The provision of a sprinklers system that does not include fire separation between sprinkler protected and non sprinkler protected areas. [Sprinkler protection above, though not within the auditorium]	CP2, CP8, EP1.4
C2.7(a)(ii) inter-alia C3.4(a)(i)(A) and C3.4(a)(iii)(A)	The provision existing openings in Bio Box bounding wall that aligns with proposed fire wall, protected by pendant sprinkler each side	CP2, CP8

<u>Note</u>

The scope of this report is limited to the assessment of the relevant variations from the deemed-to-satisfy provisions of the BCA as outlined above, with regard to the Refurbishment Works. The building is otherwise assumed to comply with the Building Regulations at the time of construction in matters of fire safety. The scope of this report does not extend to any other variations from the deemed to satisfy provisions of the BCA and does not address non-fire related issues.

Any Performance Solution proposed associated with the provision of fire hydrant and fire hose reel protection for the site will under Regulation 309 require the report and consent/Opinion of the Chief Officer of the MFB.

1.3 Design Additions

The following design additions are prescribed as part of the Performance Solution, that verifies the Interim Fire Safety Strategy:

- **Construction and FRL's**
    - Bio Box – Glazed (and operable) openings between Bio box and Auditorium to be provided with AS 2118.1 fast response pendant sprinkler provided on the auditorium side and Bio box side of the wall/openings (<450mm above <600mm away). Bio box doors to be provided with AS 1503.4 intumescent fire and AS 1530.7 smoke seals.
    - Long Room - The west stairs are to be separated from the Long Room at first floor by minimum 35mm thick solid core timber doors (with minimum infill panel of 20mm thick hardwood permitted) protected by AS 2118.1 fast response pendant sprinkler provided on the Long Room Side (<1000mm away from the door).
    - Auditorium - The stairs are to be fire separated from the Auditorium by minimum 35mm thick solid core timber doors (with minimum infill panel of 20mm thick hardwood permitted) protected by AS 2118.1 fast response pendant sprinkler provided on the auditorium side (<450mm above <600mm away from the door).
    - Basement Level Substations and switchroom to be provided with minimum FRL 120/120/120 construction and FRL -/120/30 self closing fire doors.
    - Basement Level Battery room to be fire-isolated by minimum FRL 120/120/120 construction and new FRL -/120/30 self closing fire doorset.
    - Provide new fire door between basement backstage and administration areas/organ areas of FRL /120/30 fitted with a vision panel
    - Sub-Basement Level - Ceiling to comprise 1 x 13mm fire grade plasterboard with penetrations protected to BCA Clause C3.15
    - The fire walls are to be made good with penetrations infilled by FRL -/120/120 construction , protected in accordance with BCA Specification C3.15 or protected as nominated above.
    - Louvres at external wall from Auditorium Compartment to Bio-Box to be provided with metal sheeting and sprinkler protection above
    - Smoke walls are to be made good to meet BCA Specification C2.5 Clause 2.
    - Existing doors adopted as fire/smoke doors for the purpose of Performance Solution are to be provided with AS 1530.7 smoke seals on the sides and head of the door(s).
    - Existing north east non fire isolated stair provided with storage below permitted to be lined with 10mm standard grade plasterboard and 35mm thick self closing solid core door subject to sprinkler protection within.

- **Sprinkler Protection**
    - AS 2118 – 1982 sprinkler protection throughout the building with the exception of the auditorium and organ areas.
    - Bio Box – Glazed (and operable) openings between Bio box and Auditorium to be provided with AS 2118.1 fast response pendant sprinkler provided on the auditorium side and Bio box side of the wall/openings (<450mm above <600mm away). Bio box doors to be provided with AS 1503.4 intumescent fire and AS 1530.7 smoke seals.
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- **Fire Detection/Alarms**
  - Ensure the auditorium is to be provided AS1670.1 smoke detection except in areas likely to provide spurious alarm, eg windy, dusty, cooking, steam, where heat detection/alarms can be provided.
  - A manual call point at the sub-panel and FIP and at proscenium controls
  - A public address (PA) system is to be provided at the BIO box and at the sub-panel
  - Ensure building occupant warning speaker and strobe is provided within the orchestra pit and organ chambers.
  - Ensure building occupant warning speaker and strobe is provided at far end of fly platform

- **Contractor Safety/Management**
  - Hot Works Permits
  - Contractor procedures/Inductions

- **Fire Wardens and Occupant Numbers**
  - A designated Fire Warden to be present at all times
  - Manual call point to be available at each required exit
  - The stairs are to be adopted as a safer haven for occupants in wheelchairs. The stair is separated from the auditorium by inherently fire resistant walls (masonry). Wall openings are to be protected by existing doors with sprinkler protection or self closing minimum FRL -/120/30 doors leaves with AS 1530.7 cool/medium temperature smoke seals and AS 1530.4 intumescent fire seals to the door heads, side and stiles

  - Occupant numbers shall not exceed 858 in Auditorium, 250 Back of House/Stage and 20 Staff (=**1128** Total).

Occupant Numbers	
Stalls Level	439
Dress Circle	199
Long Room	70*
Balcony	150
Sub Total	**858**
Back of House/Stage	250
Staff	20
Sub Total	**270**
Total	**1128**

Note if Long Room occupants increase to 120 (= 70 base occupant load + 50 restricted from balance of building) to ensure that 1128 is maintained overall.

- **Emergency Management and Evacuation Plans -**
  - An Emergency Management Plan in accordance with AS3745 is to be prepared for the facility; and
  - Evacuation plans and fire orders shall be prepared for the site consistent with BCA Clause G4.9. It is required that these plans and fire orders be reviewed to be provided such that they are consistent with the building structure, emergency plan, procedures and fire safety equipment.

1.4 Regulatory Framework and Authorities Having Jurisdiction

1.4.1 Legislation

The primary legislation applicable to the development is the Victorian Building Act and the Victorian Building Regulations which references BCA 2016: Building Code of Australia (BCA).

The BCA is a performance based document, where compliance is can be demonstrated by either of two approaches:

(i) Meeting the relevant Performance Requirements; or
(ii) Meeting the prescriptive requirements of the Deemed-to-Satisfy Provisions

The assessment of an Alternative Solution can be undertaken using a variety of methods. These are defined in BCA Clause A0.5. One or more, or a combination of these methods are adopted to determine whether the proposed Alternative Solution complies with the BCA Performance Requirements.

The Deemed-to-Satisfy (DtS) Provisions, provides an acceptable level of safety. Variations from the DtS Provisions may be addressed as an Alternative Solution, to determine if it complies with the relevant BCA Performance Requirements; as determined in accordance with BCA Clause A0.7.

BCA Clause A0.3 requires an Alternative Solution (Performance Solution), to either comply with the Performance Requirements or be at least equivalent to the Deemed-to-Satisfy Provisions.

1.4.2 Regulatory Framework

The following Victoria Legislation is applicable:

- VIC Building Act, 1993 and subsequent amendments
- VIC Building Interim Regulations, 2017 and subsequent amendments

1.4.3 Building Regulation 113

A Relevant Building Surveyor (RBS) can determine that an Alternative Solution complies with a fire performance requirement of the BCA, when they have the prerequisite qualifications under Building Regulation 113 or if they rely on certificate under Section 238 of the Building Act, by a fire safety engineer/registered building surveyor, who did not design the building work, which states that the alternative solution complies with that performance requirement.

Note in the instance of a Building Regulation 309 report and consent/notification item, the Fire Brigade are a Reporting Authority/Authority Having Jurisdiction. In this instance, in accordance with Building Regulation 113, for that alternative solution, the RBS may rely on report by the Chief officer of the Relevant Fire Brigade under Building Regulation 309, which states that the chief officer is satisfied that a satisfactory degree of fire safety is achieved by that alternative solution.

1.4.4 Building Regulation 608

Building Regulation 608 applies to alterations to an existing building and requires that building work to alter an existing building must comply with the Regulations. There is also a threshold measure where the balance of the existing building must also comply with the Regulations if the proposed alterations, together with any other alterations completed or permitted within the previous 3 years, represent more than half the original volume of the building.

The relevant building surveyor, when deciding whether to give to a consent partial compliance under sub regulation (4) [associated with Regulations 116(4) and 609], must consider any report of a reporting authority before deciding the application and that he or she must implement the recommendations of a prescribed reporting authority in relation to a prescribed matter (as per clause 7 of Schedule 2 to the Act) Alterations to buildings.

In determining whether to consent to partial compliance with sub regulation (2) or (3) in respect of any alteration to a building, the relevant building surveyor must take into account—

(a) the structural adequacy of the building; and
(b) the requirements necessary to make reasonable provision for—
  (i) the amenity of the building and the safety and health of people using the building; and
  (ii) avoiding the spread of fire to or from any adjoining building.

1.4.5 Building Regulation 609

Regulation 609 of the Regulations is a discretionary power in relation to proposed alterations to a Class 2, 3, 4, 5, 6, 7, 8 or 9 building that would adversely affect any exit or path of travel to an exit. In this case the building must comply with Section D of Volume One of the BCA and the accredited relevant building surveyor may consent to partial compliance with the BCA in certain circumstances.

In determining whether to consent to partial compliance with sub regulation (1) the relevant building surveyor must take into account the requirements necessary to make reasonable provision for—

(a) the amenity of the building; and
(b) the safety and health of people using the building.

1.4.6 Fire Engineering Process and MFB CFA Guideline 33

In accordance with the International Fire Engineering Guidelines (IFEG), the fire engineer typically undertakes a Fire Engineering Brief (FEB) process for every project.

The Fire Engineering Brief (FEB), is a briefing document that defines the Trial Performance Solution(s), the scope of work for the fire engineering analysis, the method of analysis and acceptance criteria, for each variation from the DtS provisions, for agreement by the relevant stakeholders.

In the case where the variations from the DtS provisions are minor and the building development is not likely to be the subject of the Building Regulation 309 consent and report/notification items, an FEB is not typically required to be prepared, unless requested and agreed to, by the relevant stakeholders.

When the building is likely to be the subject of Building Regulation 309 report and consent/notification items, the Fire Brigade are a Reporting Authority and also a stakeholder in the FEB process. An FEB is required to be prepared and forwarded to the Chief Officer of the Relevant Fire Brigade, for review/comment, prior to proceeding with the FER, in accordance with MFB CFA Guideline 33.

Subsequent to FEB review/comment by the relevant stakeholders, the revised/confirmed fire safety strategy will form the basis of the proposed Performance Solution to be considered within the FER.

The Fire Engineering Report (FER) contains all the relevant design calculations and justifications to demonstrate that the proposed Performance Solution complies with the relevant BCA Performance Requirements. Stakeholder approval of the FER is to be gained before submission to the RBS for their assessment of compliance to the BCA Performance Requirements.

The approved FER is also required to be included as part of the supporting documentation in an Application for a Building Regulation 309 report and consent/notification item.

1.4.7 Relevant Stakeholders

The relevant stakeholders in the design of this development are listed in Table 5.

Table 5: Relevant Stakeholders

Name	Organisation	Role
Christophe Loustau	Lovell Chen	Client
Jahan Trevena	Lighthouse Building Permits Pty. Ltd	Relevant Building Surveyor
-	Mark Hodkinson Pty. Ltd.	Heritage Structural Engineer
-	Simpson Kotzman Pty. Ltd.	Services Engineer
-	TGM Group Pty. Ltd.	Land Surveyor
Rob Siemensma	City of Ballart	Project Manager
Peter Hamilton	CFA	Fire Safety Co-ordinator
Gino Catania	GinCat Fire Engineering	Fire Safety Engineer

1.4.8 Relevant Documentation

This report has been prepared based on the following documentation provided:

(a) Planning Property Report, Department of Environment Land Water and Planning – State Government of Victoria (and provided in Appendix A).

(b) This proposal has been prepared based on a briefing by Christopher Loustau of Lovell Chen (dated 19/01/18) and the following documents:

- Consultants Advice Note by Exova (dated 13/12/17)
- Fire Engineering Report by Exova (dates 9/7/10)
- Preliminary Fire Safety Strategy Report by Exova (dates 9/7/10)
- Report and Commentary on Proposed Upgrade Works at Her Majesty's Ballarat by Jahan Trevena

(c) Drawings prepared by Lovell Chen:

Drawing Name	Job No.	Drawing No.	Revision	Date

Drawing Name	Job No.	Drawing No.	Revision	Date
Basement Level 1	7637	#	#	DEC 2017
Basement Level 2	7637	#	#	DEC 2017
Ground Floor	7637	#	#	DEC 2017
First Floor Plan	7637	#	#	DEC 2017
Second Floor Plan	7637	#	#	DEC 2017
Aerial View	7637	HA.001	T1	04/06/18
Conservation Works – Basement 1	7637	HA.201	T1	04/06/18
Proposed Conservation Works – Basement 2	7637	HA.301	T1	04/06/18
Proposed Conservation Works – Ground Floor	7637	HA.203	T1	04/06/18
Proposed Conservation Works – Dress Circle	7637	HA.204	T1	04/06/18
Proposed Conservation Works – Second Floor Gallery Dress Circle	7637	HA.205	T1	04/06/18
General Section East West	7637	HA.206	T1	04/06/18
Auditorium North Elevation	7637	HA.207	T1	04/06/18
Auditorium South Elevation	7637	HA.208	T1	04/06/18
Auditorium East and West Elevation	7637	HA.209	T1	04/06/18
Auditorium Colour Scheme	7637	HA.210	T1	04/06/18
Trafficable Light Pavement	7637	HA.301	T1	04/06/18
Toilets	7637	HA.401	T1	04/06/18
Door and Window Schedule	7637	HA.501	T1	04/06/18

(d) Supplementary drawings prepared by Swanbury Penglase Architects

Drawing Name	Job No.	Drawing No.	Revision	Date
Section A-A	05639/EX-35	Section AA	-	13/12/2006

1.4.9 References

The following documents, where referenced in the report will utilise the following abbreviations.

1.4.9.1 Legislation and Regulatory Documents

[VIC Act]	VIC Building Act, 1993 and subsequent amendments
[VIC Reg]	VIC Building Regulations, 2006 and subsequent amendments
[BCA]	National Construction Code Series Volume 1: Class 2 to 9 buildings – Building Code of Australia 2016, Australian Building Codes Board.

1.4.9.2 Australian Standards

[AS 1851]	AS 1851, Maintenance of fire protection systems and equipment s
[AS 2293.2]	AS 2293.2-1995, Emergency evacuation lighting for buildings - Inspection and maintenance.
[AS 2419.1]]	AS 2419.1, Fire hydrant installations - System design, installation and commissioning.
[AS 2441]	AS 2441, 2005, Installation of hose reels.
[AS 2444]	AS 2444, 2001, Portable fire extinguishers and fire blankets – Selection and location.
[AS 1170.0]	AS 1170.1, 2002, Structural design actions Part 0: General principles.
[AS 1670.1]	AS 1670.1 2015, Fire detection, warning, control and intercom systems - System design, installation and commissioning Fire
[AS 1530.4]	AS 1530.4 – 2014, Methods for fire tests on building materials, components and structures Fire-resistance tests for elements of construction
[AS 1530.7]	AS 1530.7 – 2007, Methods for fire tests on building materials, components and structures Smoke control assemblies - Ambient and medium temperature leakage test procedure
[AS 1720.4]	AS 1720.4 – 2006, Timber structures Fire resistance for structural adequacy of timber members

1.4.9.3 Guidelines

[BCA Guide]	Australian Building Codes Board, 2016 Amendment 1, Guide to the Building Code of Australia, Australia.
[IFEG 2005]	International Fire Engineering Guidelines, 2005.
[FEG 1996]	Fire Engineering Guidelines 1996, Fire Code Reform Centre Project 5A
[MFB GL16]	MFB Guideline No 16, 2009. Selection, installation and Maintenance of portable fire extinguishers. Version No. 8, MFESB Community Safety Policy Group, Australia
[MFB GL-17]	MFB Guideline No 17, 2010, Fire Brigade Intervention Model (FBIM) General Provisions, Version No. 3, MFESB Community Safety Policy Group, Australia
[MFB GL 33]	MFB Guideline No. 33 Performance Based Design within the Built Environment, Version 2, November 2010, Community Safety Advisory Group (MFB), Community Infrastructure Department (CFA)

1.4.9.4 Reference Text Books / Journal Articles /International Standards

[Drysdale]	Drysdale, D., Introduction to Fire Dynamics, John Wiley & Sons, Sydney, 1985

[PD 7974-3]	PD 7974-3 : 2003, "Application of fire safety engineering principles to the design of buildings – Part 3: Structural response and fire spread beyond the enclosure of origin (Sub-System 3), British Standards Institution, Jan 2003
[Fircalc]	Firecalc Version 2.3, CSIRO Division of Building, Construction & Engineering, 1993
[Proulx]	Proulx, G. & Fahy, R.F., "The Time Delay to Start Evacuation: Review of Five Case Studies", 1997, *Fire Safety Science – Proceedings of the Fifth International Symposium*, pp. 783-794
[England]	England et al, 2000, Guide for the Design of Fire Resistant Barriers and Structures, Warrington Fire Research, VIC.
[Nelson/Mowrer]	Nelson, H. E. and Mowrer, F.W., " Emergency Movement", 2002, Section 3, Chapter 14, SFPE Handbook of Fire Protection Engineering 3rd Edition, Society of Fire Protection Engineers, pp. 3-367
[BSI DD240 : Part 1:1997]	British Standards Institute, "DD240:Part 1:1997 – Fire Safety Engineering in Buildings, Part 1. Guide to the application of fire engineering principles", 1997, BSI
[SFS NSW]	Society of Fire Safety NSW Chapter "Practice Note For Fire and Life Safety in Existing Buildings During Construction", Version 1.0, dated 08/3/12.
[NSWFB 05/06]	NSW Fire Brigades Annual Statistical Report 2005/2006", New South Wales Fire Brigades
[NSWFB 06/07]	NSW Fire Brigades Annual Statistical Report 2006/2007", New South Wales Fire Brigades
[NIST HRR]	D. Madrzykowski, "Heat Release Rate Tests of Plastic Trash Containers", National Institute of Standards and Technology U.S. Department of Commerce Gaithersburg, MD 20899
[Kim and Lougheed]	*Fire Protection of Windows Using Sprinklers*, National Research Council Canada, 1997.
[Kim 1993]	Sprinkler Protection of Exterior Glazing, National Research Council Canada, 1993.
[Richardson]	Richardson, J.K. and Chown G.A., "CBD-248. Glazing in Fire-Resistant Wall Assemblies" Originally published April 1988. NRC-IRC
[Nelson/Mowrer]	Nelson, H. E. and Mowrer, F.W., " Emergency Movement", 2002, Section 3, Chapter 14, SFPE Handbook of Fire Protection Engineering 3rd Edition, Society of Fire Protection Engineers, pp. 3-367
[Babrauskas]	Vytenis Babrauskas, Ph.D., "Wood Char Depth: Interpretation In Fire Investigations", Presented at International Symposium on Fire Investigation, Fire Service College, Moreton-in-Marsh, United Kingdom, 28 June 2004. Fire Science and Technology Inc., 9000 – 300, Place SE, Issaquah WA 98027, USA
NZS 4541	NZS 4541:2013, "AUTOMATIC FIRE SPRINKLER SYSTEMS", Standards New Zealand
[PD 7974-7]	PD 7974-7 : 2003, "Application of fire safety engineering principles to the design of buildings – Part 7: Probabilistic Risk Assessment, British Standards Institution, Jan 2003
[Marsh]	Marsh , "Effectiveness of Fire Safety Systems for Use in Quantitative Risk Assessments", New Zealand Fire Service Commission Research Report Number 89, June 2008.
[HB 147]	Barry Lee., HB 147, "Sprinklers Simplified, FPA Standards Australia, 2000.
[CIBSE TM19:1995]	CIBSE Technical Memorandum TM 19 - Relationships for Smoke Control Calculations, Chartered Institution of Building Services Engineers, January 1995.

[NFPA 2016]	Marty Ahrens, NPFA 2016, "Structure Fires Started by Hot Work", September 2016
[NFPA 72]	NFPA 72 Annex B 2002 Edition – "Engineering Guide for Automatic Fire Detector Spacing"

1.4.9.5 Computer Models

[Firecalc]	Firecalc Version 2.3, CSIRO Division of Building, Construction & Engineering, 1993
[CFAST]	Jones, W.W., Forney, G.P., Reneke, P.A. & Peacock, R.D, "CFAST, the Consolidated Model of Fire Growth and Smoke Transport Technical Reference Guide : NIST Special Publication 1026", 2005, National Institute of Standards & Technology, US Department of Commerce, 126pp.
[Evacnet4]	Kisko, T.M., Francis, R.L. & Nobel, C.R., "Evacnet 4 User's Guide", Version 10/29/98, University of Florida

1.4.10 Limitations

This report has been prepared on the basis of the documentation provided as detailed in §1.4.8.

The report assumes that the new fire safety systems will be installed as detailed within this report, or are otherwise compliant with the deemed-to-satisfy provisions of the BCA.

Existing construction is assumed to comply with the Building regulation at the time of construction.

The report assumed they will be maintained as required by the relevant Australian Standards, and Essential Services Legislation.

Any modifications or changes to the building, fire safety management system, or building usage from that described in this report, may adversely impact the fire safety strategy and thereby invalidate the findings of this report.

As is consistent with a building designed in accordance with the deemed-to-satisfy provisions of the BCA, the safety of all occupants from fire cannot be guaranteed. It is not possible to totally eradicate the risk of injury or death from fire. The report will not assess the risk of an individual involved intimately with the fire ignition.

The fire safety strategy outlined in this report and protection of occupants assume a completed/commissioned building, and do not address protection of the building during construction, renovation or demolition, when systems are likely to be incomplete or isolated.

The report will not address fire development associated with criminal acts including terrorism, arson, vandalism, explosives and/or multiple ignition sources or malicious acts, which deliberately result in fire ignition or interference with the fire safety systems for the building.

The report will assume all hazardous substances/dangerous goods are stored as prescribed by the relevant legislative requirements.

This report does not consider issues associated with health and amenity, disability access issues or other non-fire related matters.

The report will not consider the protection of contents of in the considered building from damage in fire.

2 Building Description and Location

2.1 Size and Function of the Building

The building development is understood to comprise an existing 4-storey theatre (public assembly – Class 9b with an administration area (Class 5) in the basement). The building is heritage listed with sprinkler protection throughout except for the auditorium and organ areas below. A proscenium curtain separates the stage/backstage areas. The existing building is to be fire separated into 3 fire compartments.

Table 6: Key BCA Parameters/Characteristics

BCA Clause		**Description**		
A1.1	Effective Height	< 25m		
A3.2	Occupancy Classification	Class 9b/5		
C1.1	Minimum Type of Construction	Type A		
C1.2	Rise in Storeys	3 (4-storeys contained)		
C2.2	Fire Compartment	West (m^2)	Mid (m^2)	East (m^2)
	(excludes south fire stairs 160m^2)	957	1,765	873

2.2 Existing Conditions

The building is provided with 2-off pre-existing walls that can form the basis for fire walls, one of which is provided with a proscenium curtain to separate the stage/back stage areas from the auditorium.

A proscenium masonry wall is provided and will inhibit fire/smoke spread from the stage/backstage area to the audience side.

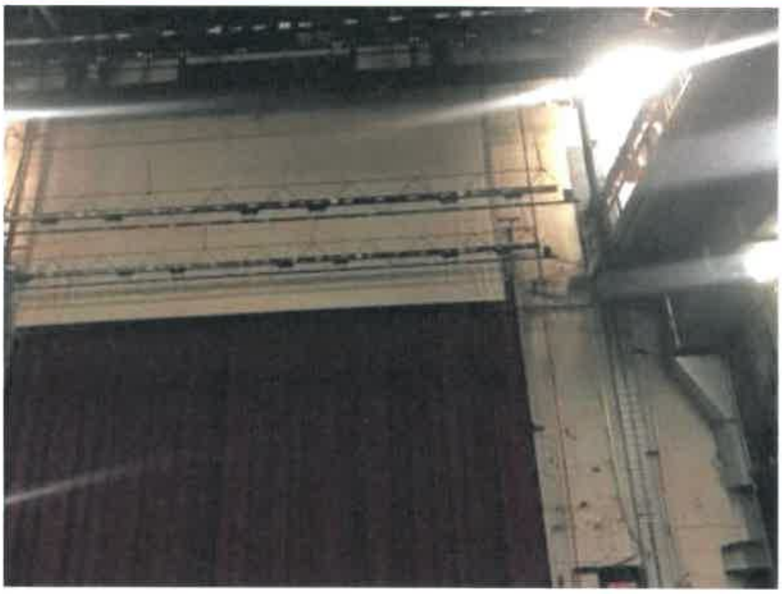

Figure 1: Proscenium Curtain (from stage side)

Figure 2: Existing West Wall Proposed Fire Wall in roof space (typical required upgrades)

2.3 Description Building Usage and Areas per Level

The usage of the building and areas per level is summarised as follows:

Table 7: Description and Usage of the Building Areas

Floor	Building Section	BCA Classification	Smoke Comp Size/Area(m^2)	Fire Compartment (m^2)
Basement	Battery Store	Class 9b	8	West Fire Comp
Basement	Toilets/stores	Class 9b	180	
Basement	Stair	Class 9b	25	
Basement	Admin West	Class 9b/5	250	Mid Fire Comp
Basement	Admin East/Organ room	Class 9b/5	150	
Basement	Backstage	Class 9b/5	240	East Fire Comp
Basement	Substations	Class 9b/8	33	
Basement	South Fire Escape	Class 9b/8	84	South Stairs
Sub Basement	Dressing Room	Class 9b/8	244	West Fire Comp
Sub Basement	Orchestra Pit	Class 9b	100	Mid Fire Comp
Ground	North Stair	Class 9b	40	West Fire Comp
Ground	South Stair	Class 9b	40	
Ground	Foyer/Candy Bar	Class 9b	120	
Ground	Auditorium Stalls	Class 9b	425	Mid Fire Comp
Ground	Stage	Class 9b	410	East Fire Comp
Ground	Fire Stairs	Class 9b	32	South Stairs
First	Long Room	Class 9b	140	West Fire Comp
First	Stairs/Dress Circle Foyer	Class 9b	80	West Fire Comp
First	Auditorium Dress Circle	Class 9b	410	West Fire Comp
First	Stage Fly	Class 9b	40	East Comp
First	Fire Stairs	Class 9b	20	South Stairs
Second	Stairs/Balcony Foyer	Class 9b	80	West Fire Comp
Second	Auditorium Balcony	Class 9b	430	Mid Fire Comp
Second	Stage Platforms	Class 9b	150	East Comp
Second	Fire Stairs	Class 9b	20	South Stairs
		Total Area	**3751**	

2.4 Site Location

2.4.1 Fire Brigade Access to the Building

The building development is located at 17 Lydiard St S, Ballarat Central. The site is bounded by street frontage on 2 sides. Refer Figure 3 below.

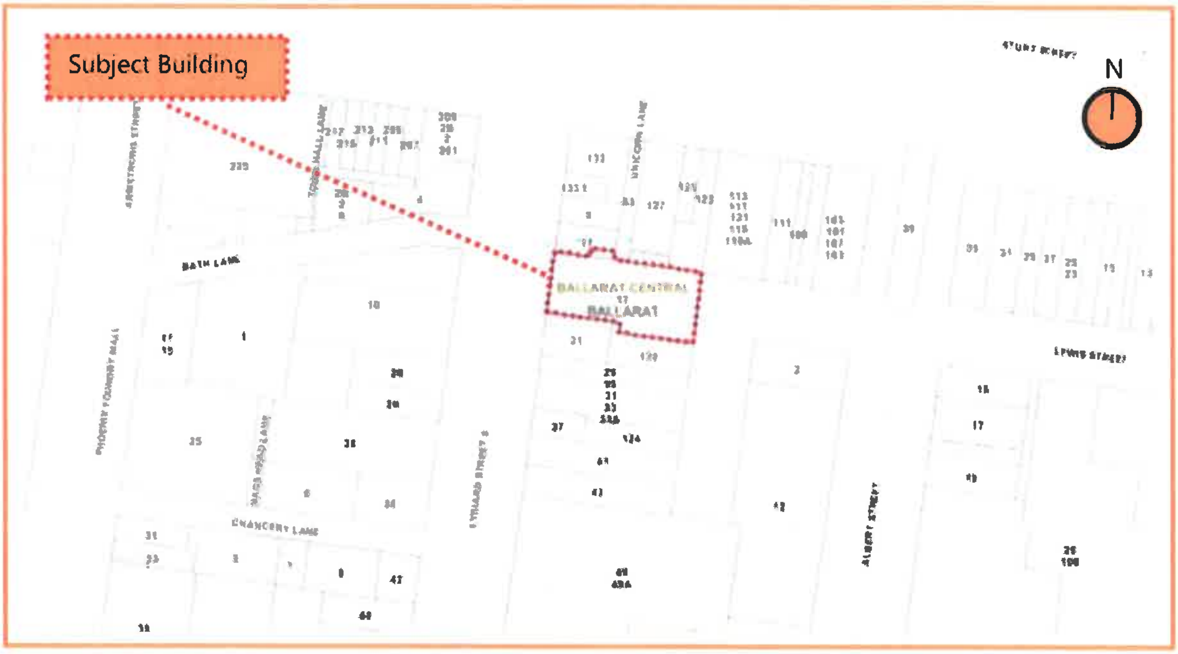

Figure 3: Location of site (from Planning Online - Victorian State Government Department of Environment Water land and Planning)

2.4.2 Nearest Fire Brigade Stations

The Fire Service can access the building from Lydiard Street S, as shown in Figure 3. The two nearest fire brigade stations are listed in Table 8.

Table 8: Responding fire services

Station Location	Radial Distance (Street-Directory.com)
Ballarat CFA	1.40 km
Sebastopol CFA	4.50 km

2.4.3 Fire Brigade Intervention Model (FBIM)

2.4.3.1 Methodology Assumptions

Fire brigade intervention will be estimated using the Fire Brigade Intervention Model (FBIM), published by the Australasian Fire Authorities Council (AFAC) [FBIM]. The following has been assumed in the Fire Brigade Intervention Analysis (Refer Appendix A) –

- Fire brigade notification is via ASE
- Inner city travel speeds have been assumed in this analysis.
- 85th percentile calculations have been used throughout

2.4.3.2 FBIM Results

The following is a summary of the estimation of fire brigade response:

- First fire brigade appliance arrives on scene at 701 seconds (= 11.7 minutes) after alarm.
- Fire brigade setup completed, intervention underway on uppermost level 1762 seconds (=29.4 minutes) after alarm.

3 Occupant Profile

3.1 Staff

Staff are expected to be familiar with the layout of the building and the location of exits. Given it a place of employment, it is expected that occupants are alert, cognisant and able to respond to cues of fire.
Any mobility challenged staff are assumed to be able to self-evacuate.

The building shall have evacuation procedures and staff are expected to be trained and familiar with all procedures in the event of a fire or emergency.

Any hearing, visual or mobility impaired staff are assumed to be able to self-evacuate or be assisted by other staff.

3.2 Visitors

Visitors may be aware of the route they entered the building and are more likely to evacuate the building via this route even if other exits are closer.

Most visiting occupants, however, are expected to be mostly transient and it cannot be guaranteed that all occupants would be familiar with the building, its layout and the exit points; consistent with visitors in any other public building.

Any hearing, visual or mobility impaired visitors are assumed to be accompanied at all times or be able to evacuate without assistance.

3.3 Students/children

Students/children will rely on a staff managed evacuation for guidance.

4 Review of Available Statistics

4.1 Public Assembly Buildings

4.1.1 Introduction

Reference has been made to fire incident statistics which have been published by the New South Wales Fire Brigades [NSWFB 05/06], [NSWFB 06/07], which are the most recent body of statistics available in Australia.

The statistical classification of the building would be under "Public Assembly Building" though the areas under consideration will be the most appropriate for the use of in part of these buildings although it must be noted that the characteristics of a shop differ considerably from an Office, Store and Storage building. E.g. Shops can include restaurants, with cooking an introduced for of ignition that can skew the results, as shown below where cooking kitchen areas accounted for approximately 9.7% of the area of fire origin

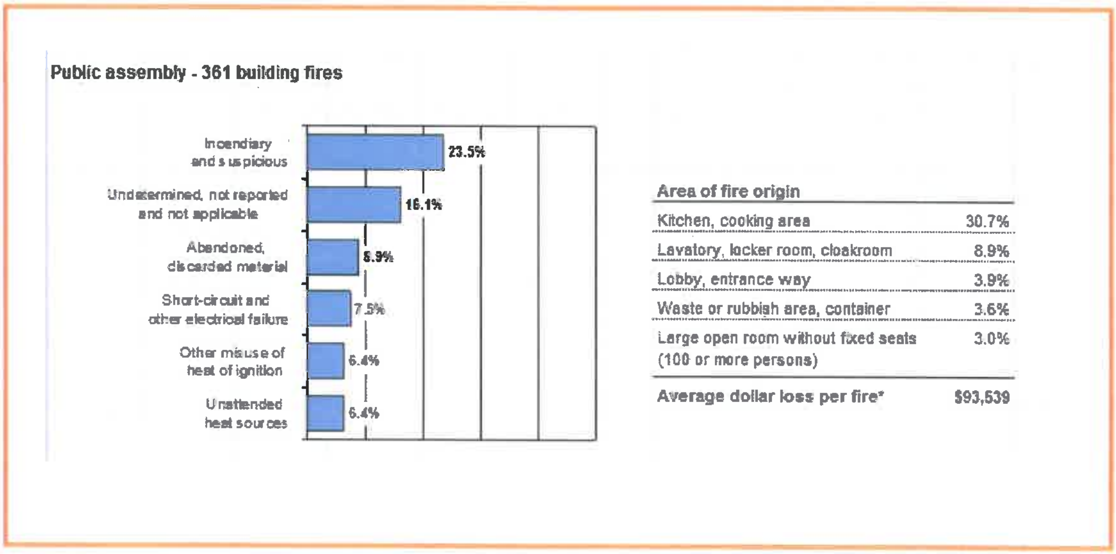

Figure 4: NSWFB Annual Statistics – ignition factor and area of origin (2005/06 Figure 8)

4.1.2 Area of Fire Origin – Public Assembly Buildings

In terms of a likely location of fire originating within the Subject building area, reference is drawn to the proportion of fires starting by location.

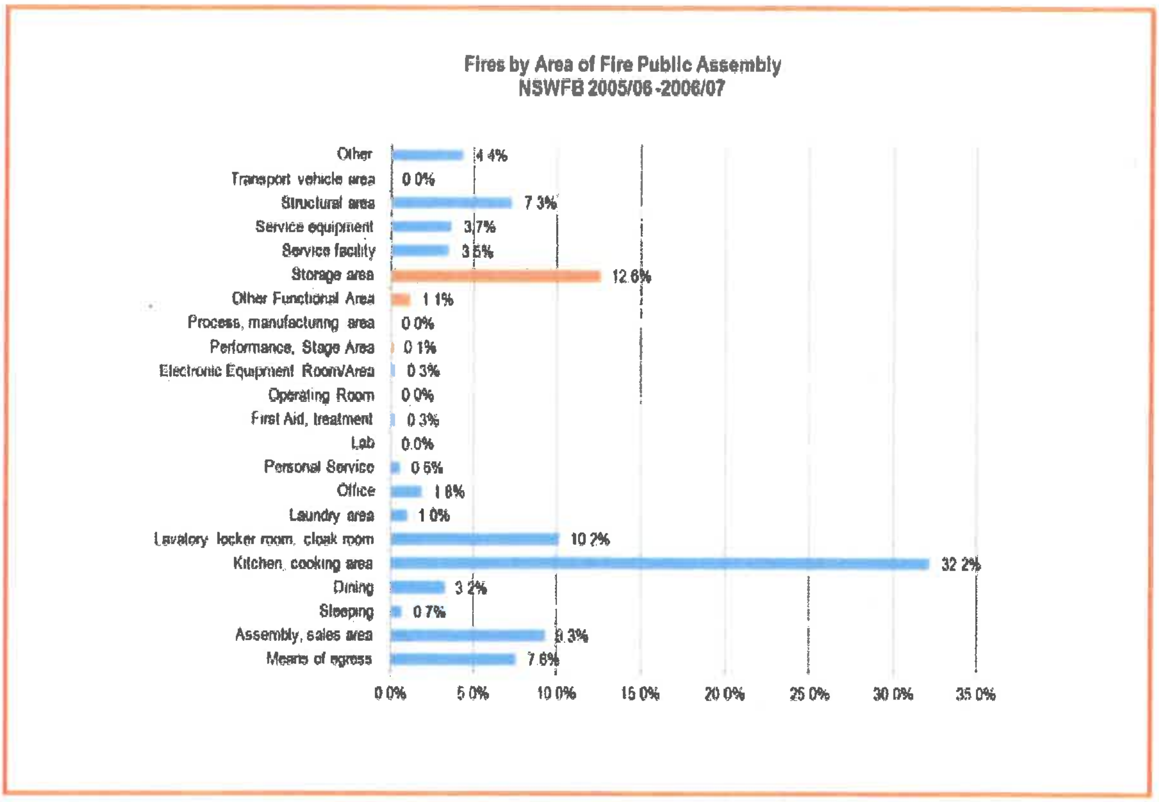

Figure 5: NSWFB Annual Statistics 2005/06 and 2006/07 – Fire by Area of Ignition

4.1.3 Form of Heat of Ignition - Public Assembly Buildings

For the purpose of identifying the relative increase in risk of fire spread to the Subject building areas via external exposures/fire, reference was made to the form of heat of ignition. Note these statistics will generally be for buildings that are setback in accordance with the DtS provisions.

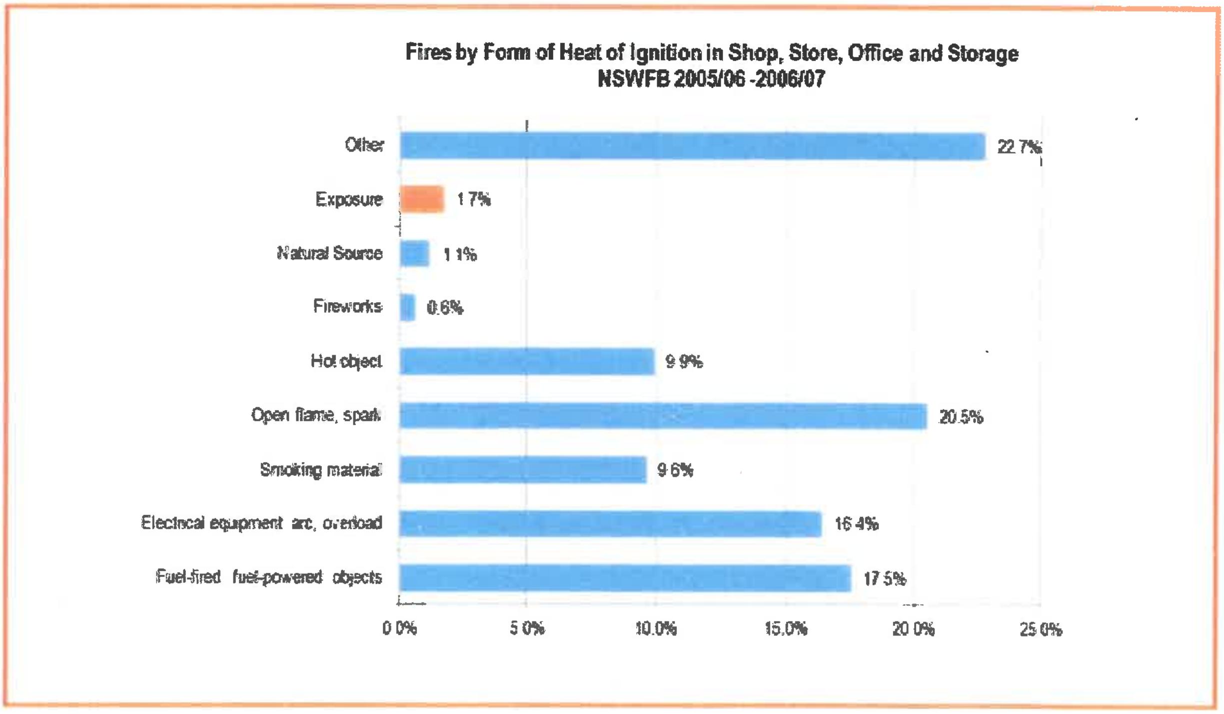

Figure 6: NSWFB Annual Statistics 2005/06 and 2006/07 – Form of heat of Ignition

4.2 Risk to Occupants

Due to the facility being a place of work occupants are likely to be alert, awake and able to respond to the cue fire. As shown from the referenced statistics (excerpt) below, the number of fatalities in a building of this nature is comparatively low.

NSWFB Annual Statistical Report 2006/07 — Injuries and Fatalities from Fires

Table 31 - Fatalities in building fires by property type

Property Type	Average Fatalities Over 5 Years*	Total Fatalities 2006/07
Public assembly property	0	0
Institutional property	1	0
Residential property		
One family and two family dwelling	19	10
Apartments, units, flats	7	6
Other	1	1
Total	27	17
Shop, store, office property	1	1
Basic industry, utility, defence property	0	0
Storage property	0	0
Special property	0	0
Grand Total	29	18

*Five year average is calculated for the period 2002/03 to 2006/07

Figure 7: Excerpt from NSWFB Annual Statistics 2006/07 –Fatalities in Buildings by Property Type

In addition, outside of business hours when the building is not lawfully occupied, the number of fatalities would also be expected to be of the same magnitude or lower

4.3 Sprinkler Operation

4.3.1 Sprinkler Reliability

An estimation of the reliability of sprinklers can be deduced from the statistics, based on the ratio of when they are installed in the Room/space of Fire Origin (RFO) and operated as expected, versus when they did not operate as expected. In this instance because of the small pool of data they operated as expected 100% of the time.

However other publications have sprinkler reliability varying from 90% to 99.5% [PD 7974-7:2003][NZS 4541]. Given the range of failure criteria also varies, so too does the reported reliability. In this instance it is expected that the sprinkler will operate as intended 95% of the time.

The Table below is an excerpt from other studies [Marsh], which illustrates that operation is assumed to be the successful outcome.

System Performance	Warrington Delphi Group	Australian Fire Engineering Design Guidelines			Japanese Incident Data Studies
		Smouldering	Flaming	Flashover	Tokyo FD
Sprinklers Operate	95	50	95	99	97
Sprinklers Control but do not extinguish	64	NA			NA
Sprinklers Extinguish	48	NA			96

Figure 8: Excerpt from New Zealand Fire Service Commission Research Report Number 89

With 86.5% of fires protected by 3 sprinkler heads or less [Marryatt] (and reproduced in HB 147- Sprinklers Simplified), the 3 head operation is expected to contain the fire at least 86.5% of the time, with expectation that fire separation is provided for redundancy.

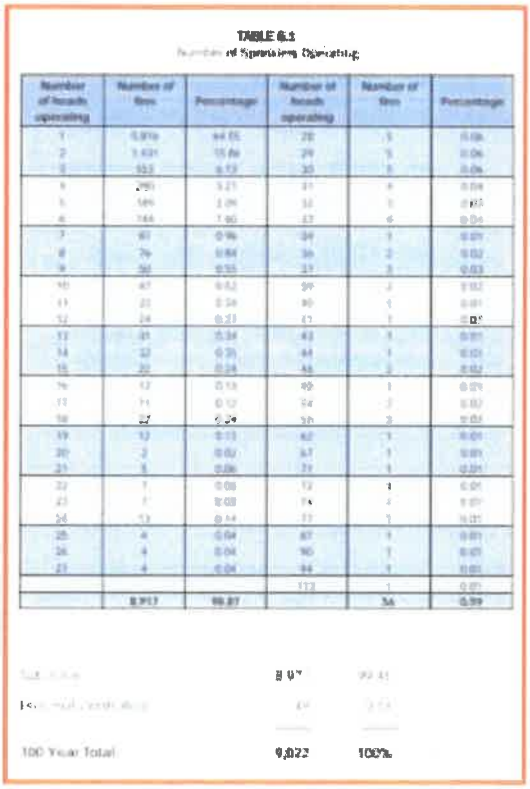
TABLE 6.1

Number of heads operating	Number of fires	Percentage	Number of heads operating	Number of fires	Percentage
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

100 Year Total 9,022 100%

Figure 9: Excerpt from HB-147 Sprinkler simplified

4.3.2 Benefits of Sprinkler Protection

When sprinklers are provided, they are likely to be effective in limiting fire spread and hence the hazards to occupants outside the room of fire origin.

The reduction in hot-layer temperatures by both sprinkler suppressed and sprinkler shielded fires is supported in the literature [CIBSE TM19:1995] for smoke control states a reasonable assumption for the maximum smoke layer temperature in a sprinkler controlled fire is 100°C.

The above is consistent with findings by England et al (2000) which states that "temperatures outside the immediate area of operation of the sprinkler system are below 100°C, and temperatures within the area of operation are generally below 200°C except in the immediate vicinity of the flames."

5 Building Fire Safety Measures and Fire Safety Strategy

5.1 Building Fire Safety Measures

The building under consideration is prescribed to be provided with the following active and passive measures, defined in Table 9 below.

Table 9: Fire Safety Measures

Fire Safety Measure	Description
Fire Resistance Construction	**Fire Resistance, Stability and Hazard Properties** BCA Type A Construction to BCA Spec C1.1 for the new Building Extension, except as varied below: ▪ The provision of a Specification C3.4 smoke door protected by a pendant sprinkler on the exposure side only in lieu of an FRL -/60/30 self closing fire door– Refer §6.1 ▪ The provision existing openings in Bio Box bounding wall that aligns with proposed fire wall, protected by pendant sprinkler each side– Refer §6.5 As part of the Alternative Building Solution, design measures (refer §1.3) are prescribed with regard to fire separation and compartmentation, and does not preclude those required by the DtS provisions (unless explicitly considered in §1.2), and are required to form part of the schedule of essential safety measures for the building: o Bio Box – Glazed (and operable) openings between Bio box and Auditorium to be provided with AS 2118.1 fast response pendant sprinkler provided on the auditorium side and Bio box side of the wall/openings (<450mm above <600mm away). Bio box doors to be provided with AS 1503.4 intumescent fire and AS 1530.7 smoke seals. o Long Room - The west stairs are to be separated from the Long Room at first floor by minimum 35mm thick solid core timber doors (with minimum infill panel of 20mm thick hardwood permitted) protected by AS 2118.1 fast response pendant sprinkler provided on the Long Room Side (<1000mm away from the door). o Auditorium - The stairs are to be fire separated from the Auditorium by minimum 35mm thick solid core timber doors (with minimum infill panel of 20mm thick hardwood permitted) protected by AS 2118.1 fast response pendant sprinkler provided on the auditorium side (<450mm above <600mm away from the door). o Basement Level Substations and switchroom to be provided with minimum FRL 120/120/120 construction and FRL -/120/30 self closing fire doors. o Basement Level Battery room to be fire-isolated by minimum FRL 120/120/120 construction and new FRL -/120/30 self closing fire doorset. o Provide new fire door between basement backstage and administration areas/organ areas of FRL /120/30 fitted with a vision panel o Sub-Basement Level - Ceiling to comprise 1 x 13mm fire grade plasterboard with penetrations protected to BCA Clause C3.15 o The fire walls are to be made good with penetrations infilled by FRL

Fire Safety Measure	Description
	-/120/120 construction , protected in accordance with BCA Specification C3.15 or protected as nominated above. o Louvres at external wall from Auditorium Compartment to Bio-Box to be provided with metal sheeting and sprinkler protection above o Smoke walls are to be made good to meet BCA Specification C2.5 Clause 2. o Existing doors adopted as fire/smoke doors for the purpose of Performance Solution are to be provided with AS 1530.7 smoke seals on the sides and head of the door(s). o Existing north east non fire isolated stair provided with storage below permitted to be lined with 10mm standard grade plasterboard and 35mm thick self closing solid core door subject to sprinkler protection within.
Egress	The provisions for escape from the building are to comply with BCA DtS Clauses except for the following - • The provision of an extended distance of travel of 30m in lieu of 20m in platform areas - Refer §6.3 • A non fire isolated stair is provided with storage below (as per BCA Clause D2.8(b)) in lieu of no storage – Refer §6.2 As part of the Alternative Building Solution, design measures (refer §1.3) are prescribed with regard to egress, and does not preclude those required by the DtS provisions (unless explicitly considered in §1.2), and are required to form part of the schedule of essential safety measures for the building: ▪ The non-fire-isolated-stairs at western mid level (west) exit is to be adopted as a safer haven for occupants in wheelchairs. The stair is separated from the auditorium by inherently fire resistant walls (masonry). Wall openings are to be protected by self closing minimum FRL -/60/30 door leaves with AS 1530.7 cool/medium temperature smoke seals and AS 1530.4 intumescent fire seals to the door heads, side and stiles. Door latches are not prescribed to be provided to the western auto opening door or the eastern self closing fire door. ▪ East self closing mid level fire-door is to be provided with a latch and AS 1530.7 cool/medium temperature seals. ▪ Existing north east non fire isolated stair provided with storage below permitted to be lined with 10mm standard grade plasterboard and 35mm thick self closing solid core door subject to sprinkler protection within.
Fire hydrant system	The building is to be served by a hydrant system in accordance with BCA DtS Clause E1.3 and AS 2419.1. Variation from the required provisions will otherwise require the report and consent of the Chief Officer of the Relevant Fire Brigade.
Fire hose reels	The building is to be served by a fire hose reel system in accordance with BCA DtS Clause E1.4 and AS 2441. Variation from the required provisions will otherwise require the report and consent of the Chief Officer of the Relevant Fire Brigade.
Portable fire extinguishers	Portable fire extinguishers are to be provided throughout the building in accordance with BCA Clause E1.6 and AS 2444 with guidance from MFB Community Safety Directorate Guideline No. GL-16.
Automatic fire	The building is provided with sprinkler protection to AS 2118-1982 (OH3 Density

Fire Safety Measure	Description
sprinkler system	5mm/min over 216m²), generally throughout the entire building, with the exception of the auditorium space. Accordingly the existing automatic fire sprinkler system varies for the DtS provisions as follows - • The provision of a sprinklers system that does not include fire separation between sprinkler protected and non sprinkler protected areas (auditorium) - Refer §6.3 As part of the Alternative Building Solution, design measures (refer §1.2) are prescribed with regard to fire sprinkler protection and are required to form part of the schedule of essential safety measures for the building (refer §0): o Bio Box – Glazed (and operable) openings between Bio box and Auditorium to be provided with AS 2118.1 fast response pendant sprinkler provided on the auditorium side and Bio box side of the wall/openings (<450mm above <600mm away). Bio box doors to be provided with AS 1503.4 intumescent fire and AS 1530.7 smoke seals. o Long Room - The west stairs are to be separated from the Long Room at first floor by minimum 35mm thick solid core timber doors (with minimum infill panel of 20mm thick hardwood permitted) protected by AS 2118.1 fast response pendant sprinkler provided on the Long Room Side (<1000mm away from the door). o Auditorium - The stairs are to be fire separated from the Auditorium by minimum 35mm thick solid core timber doors (with minimum infill panel of 20mm thick hardwood permitted) protected by AS 2118.1 fast response pendant sprinkler provided on the auditorium side (<450mm above <600mm away from the door o Existing north east non fire isolated stair provided with storage below permitted to be lined with 10mm standard grade plasterboard and 35mm thick self closing solid core door subject to sprinkler protection within.
Active Smoke Hazard Management	A building of this size and classification is required to be served by active smoke hazard management measures under the BCA DtS provisions and are provided over the stage areas.

Automatic fire detection & alarm systems	A building of this size and classification is required to be served by a fire detection system under the BCA DtS provisions (Class 9b rise on storey of >2) and shall include the following -
	▪ **Fire Detection/Alarms**
	  ▪ Ensure the auditorium is to be provided AS1670.1 smoke detection except in areas likely to provide spurious alarm, eg windy, dusty, cooking, steam, where heat detection/alarms can be provided.
	
	As part of the Alternative Building Solution, design measures (refer §1.3) are prescribed with regard to fire detection and building occupant warning and are required to form part of the schedule of essential safety measures for the building (refer §1.2):
	  ▪ A manual call point at the sub-panel and FIP and at proscenium controls

Fire Safety Measure	Description
	▪ A public address (PA) system is to be provided at the BIO box and at the sub-panel ▪ Ensure building occupant warning speaker and strobe is provided within the orchestra pit and organ chambers. ▪ Ensure building occupant warning speaker and strobe is provided at far end of fly platform
Building Occupant Warning System (OWS)	The building is required to be provided with an AS1670.4 sound system and intercom system for emergency purposes (Class 9b >1,000m² and RIS of > 2). As part of the Alternative Building Solution, design measures (refer §1.3) are prescribed with regard to fire detection and building occupant warning and are required to form part of the schedule of essential safety measures for the building (refer §1.2): ▪ A public address (PA) system or extension of existing EWIS system is to be provided at the at the sub-panel ▪ Building occupant Warning shall be provided in accordance with BCA Specification E2.2a Clause 6
Emergency Lighting System	Emergency lighting is to be provided in accordance with BCA DtS Clause E4.2 and be designed and operate to BCA Clause E4.4.
Exit and Directional Signage System	Exit and directional signage is to be provided in accordance with BCA Clauses E4.5 and E4.6 and be designed and operate to BCA Clause E4.8.
Emergency Management Plans	An Emergency Management Plan in accordance with AS3745 is to be prepared for the facility. Evacuation plans and fire orders shall be prepared for the site consistent with BCA Clause G4.9. It is required that these plans and fire orders be reviewed to be provided such that they are consistent with the building structure, emergency plan, procedures and fire safety equipment.

Fire Safety Measure	Description
Management in use & maintenance	A maintenance program is to be developed with all essential safety measures (active, passive and management) maintained in accordance Part 12 of the Building Interim Regulations 2017, AS 1851 and AS 2293.2, and is to incorporate system interface testing, where relevant. As part of the Alternative Building Solution, design measures are prescribed with regard to management procedures (refer §1.3): ▪ **Fire Wardens and Occupant Numbers** o A designated Fire Warden to be present at all times o Manual call point to be available at each required exit o The stairs are to be adopted as a safer haven for occupants in wheelchairs. The stair is separated from the auditorium by inherently fire resistant walls (masonry). Wall openings are to be protected by existing doors with sprinkler protection or self closing minimum FRL -/120/30 doors leaves with AS 1530.7 cool/medium temperature smoke seals and AS 1530.4 intumescent fire seals to the door heads, side and stiles o Occupant numbers shall not exceed 858 in Auditorium, 250 Back of House/Stage and 20 Staff (=**1128** Total). **Occupant Numbers** Stalls Level 439 Dress Circle 199 Long Room 70* Balcony 150 **Sub Total 858** Back of House/Stage 250 Staff 20 **Sub Total 270** **Total 1128** *Note if Long Room occupants increase to 120 (= 70* base occupant load + 50 restricted from balance of building) to ensure that 1128 is maintained overall.

5.2 Fire Safety Strategy

5.2.1 General Fire Safety Strategy

The ability of occupants to evacuate a facility in the event of a fire is a very significant factor in determining the fire protection features needed to achieve an acceptable level of life safety for the facility.

The general fire protection strategy for the building may be based around the following broad requirements:

- Controls to prevent ignition (some limitations) – *Limitations are prescribed under the deemed-to-satisfy provisions with regard to lining materials provided within a building of this size and classification.*
- Egress – *The building is provided with Dts distance of travel to exits. The time to egress is therefore consistent with a DtS building. Fire orders are to be provided.*
- Provision of fire suppression equipment to allow a fire size to be minimised to reduce the impact on occupants – facilities provided for the fire brigade and occupants to undertake manual suppression activities – *note that reliance on occupants undertaking suppression activities does not form a component of the fire safety strategy for this building.*
- Maintained fire safety systems, to increase the likelihood of correct operation in the event of a fire. *Ongoing requirements for maintenance of essential services – legislative requirement.*

5.2.2 Extent of Sprinkler Protection

The building is provided with automatic sprinkler protection in general accordance with AS 2118 throughout the building with the exception of the auditorium and minor areas in the basement associated with the organ areas (that connect back to the auditorium space).

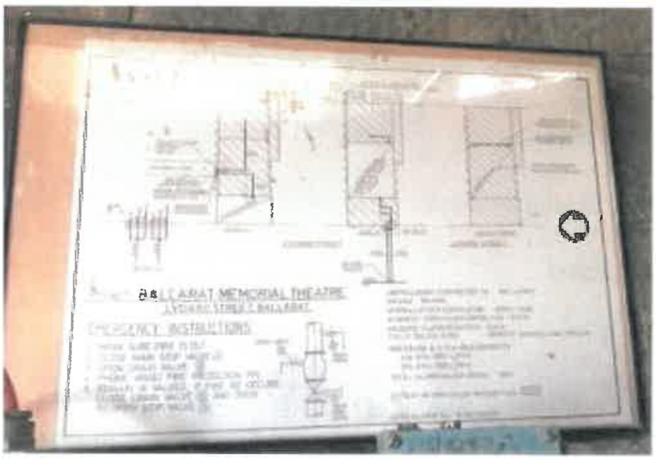

Figure 10: Sprinkler block Plan

The organ rooms are provided with MJC sprinkler heads immediately outside, which drain back to an open head, to identify the location of a fire in the organ areas. The open/deluge heads are likely to wet down the immediate area and provide a water curtain between sprinkler protected and non sprinkler protected areas.

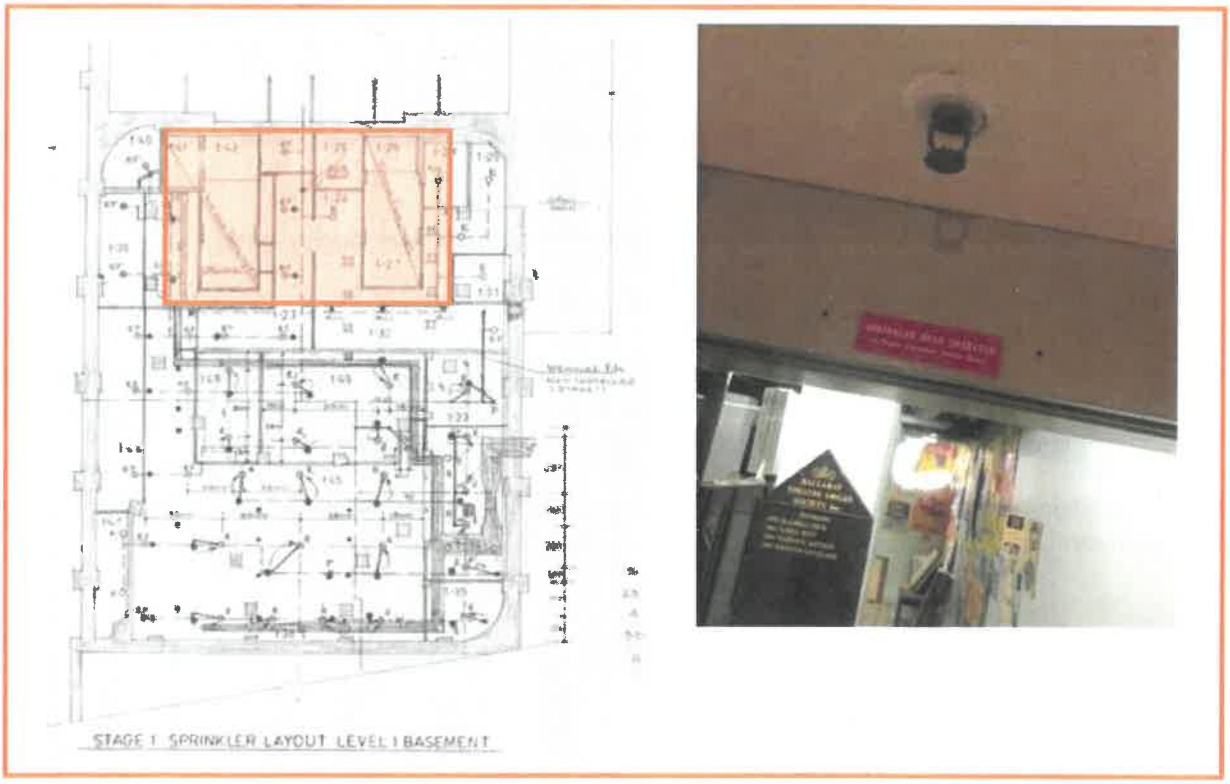

Figure 11: Non sprinkler protected area (organ areas)

5.2.3 Sprinkler Upgrades at Existing Doors

5.2.3.1 One hour Inherent FRL

Where prescribed to protect existing doors and window openings, pendant sprinklers shall be setback < 600mm horizontally and offset < 450 mm above door head/glazing.

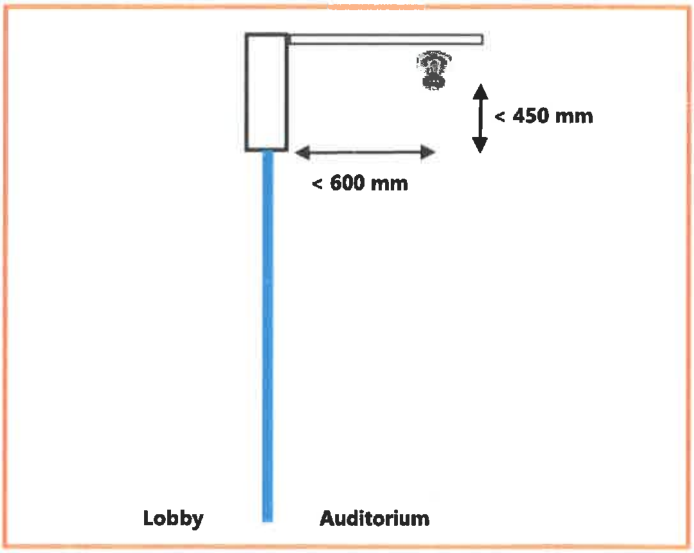

Figure 12: Location of Pendant Wetting Sprinklers

This geometry has been proven to activate and protect glazed window openings when exposed to an AS1530.4 Standard Fire for one hour [Kim and Lougheed].

5.2.3.2 Sprinkler as Water Curtain

Where a pendant sprinkler is –

(i) outside the bounds of be setback < 600mm horizontally and offset < 450 mm above door head/glazing; or
(ii) where shielding may occur
(iii) there is no barrier for the water film to flow over (eg open door/window)

the sprinkler will provide a curtain of water, to limit the radiant heat flux to the non-fire side.

An AS2118.1 sprinkler head typically sprays 60L/min or an AS 2118.1 sprinkler head. This is expected to be sufficient to protect a single glazed opening/timber door (and also approximate with BCA Specification G3.8 where 0.25 L/s/m² is deemed equivalent to 1 hr protection for glazing in atriums).

In addition to protecting the opening, the overspray will fall directly onto the areas below, wetting down combustibles and decreasing the fire intensity (up to 50% - refer Appendix E).

5.3 Egress and Fire Compartmentation Strategy

5.3.1 Section of Fire Compartments

Three fire compartments are to be provided throughout the building; West, Mid and East.

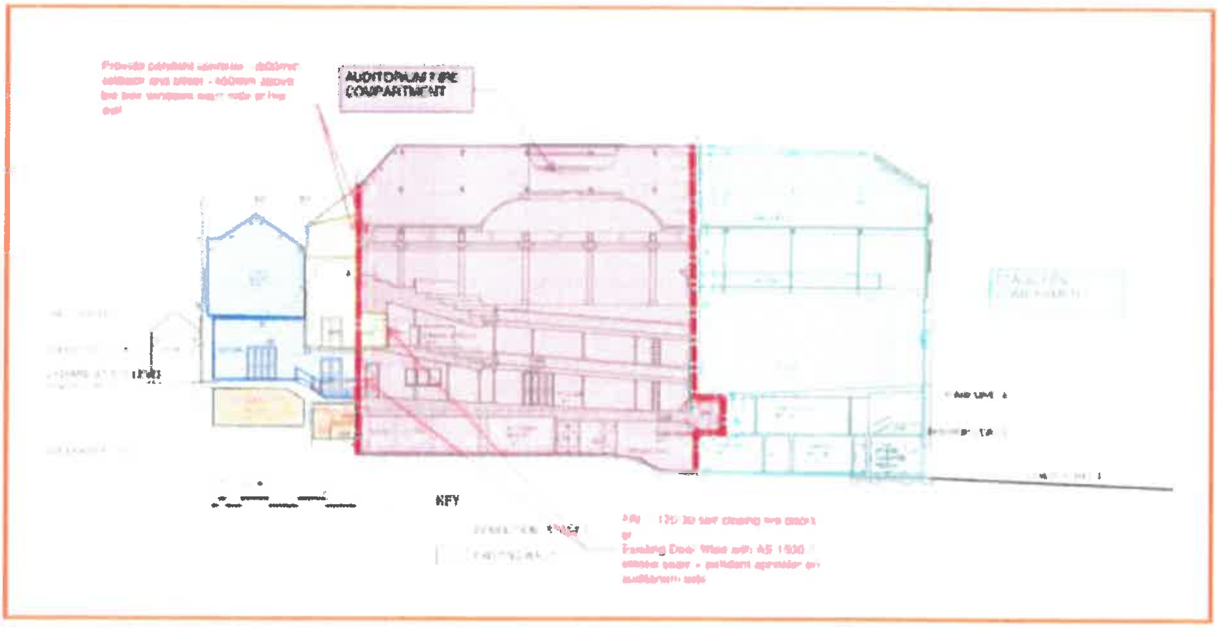

Figure 13: Section showing 3-off fire compartments

5.3.2 Plans of Compartments and Egress

Basement Level Egress is provided with distances of travel to exits that are <20m to a point of choice to an exit and <40m to the nearest of two exits consistent with BCA Clause D1.4.

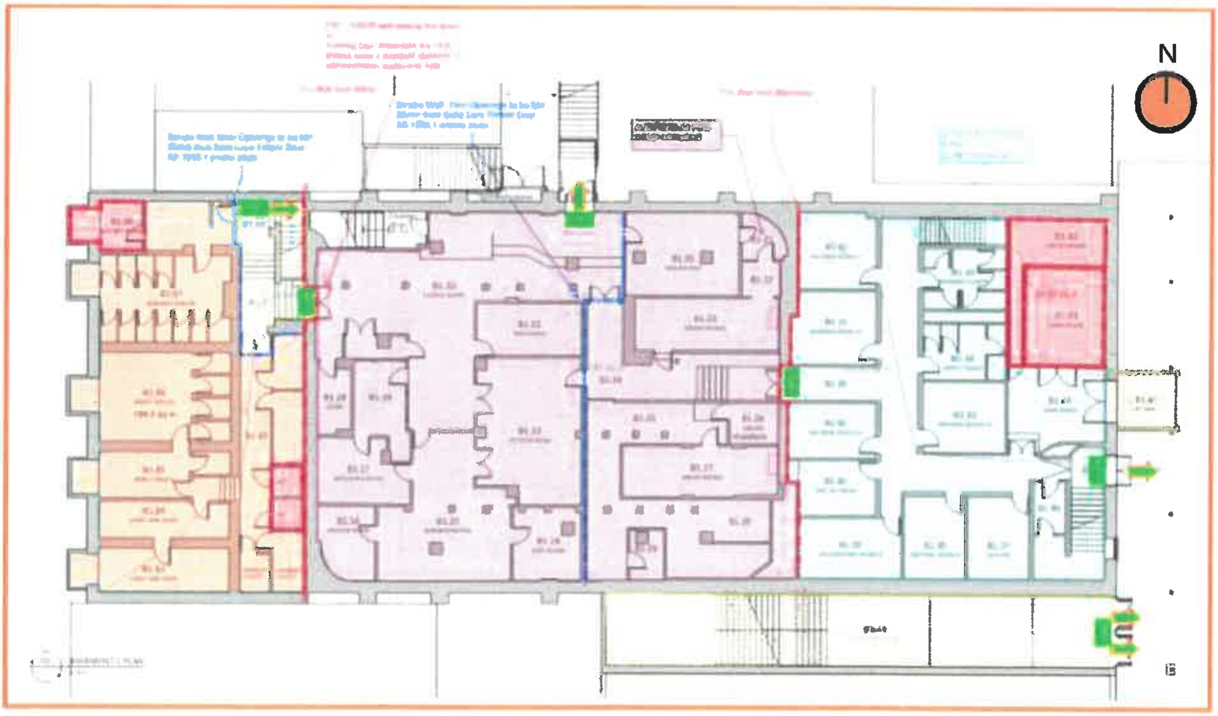

Figure 14: Egress via Basement

Sub-Basement Level Egress is provided with distances of travel to exits that are <20m to a point of choice to an exit and <40m to the nearest of two exits consistent with BCA Clause D1.4.

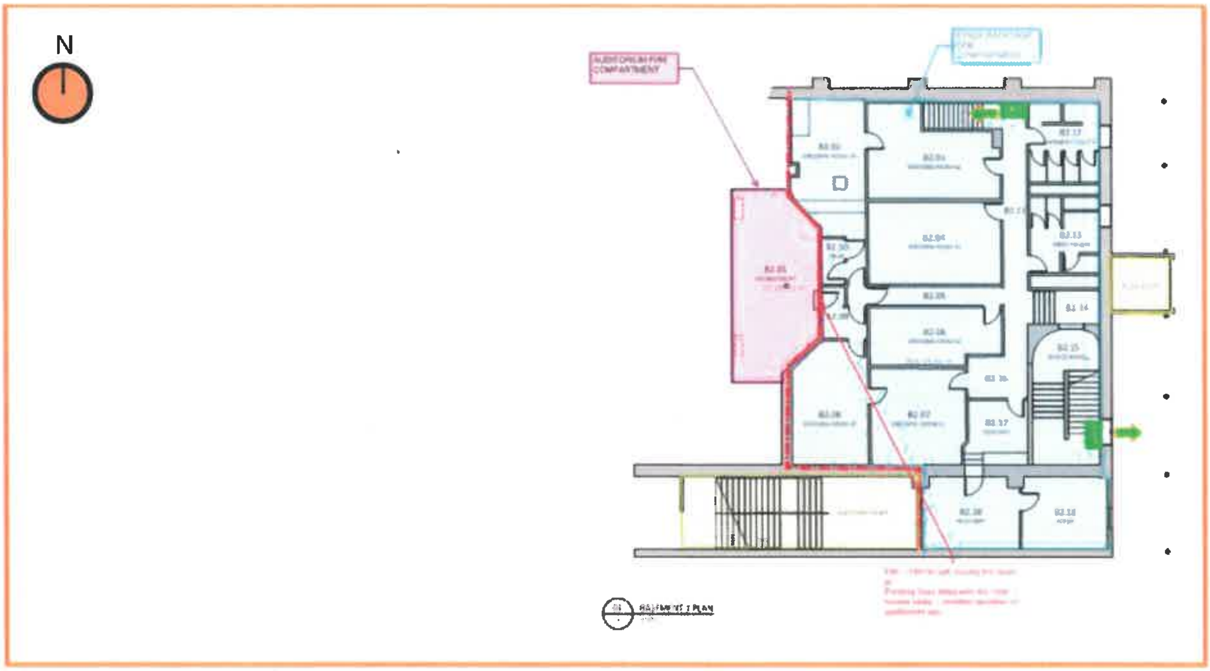

Figure 15: Egress via Sub Basement

Ground Floor Egress is provided with distances of travel to exits that are <20m to a point of choice to an exit and <40m to the nearest of two exits consistent with BCA Clause D1.4.

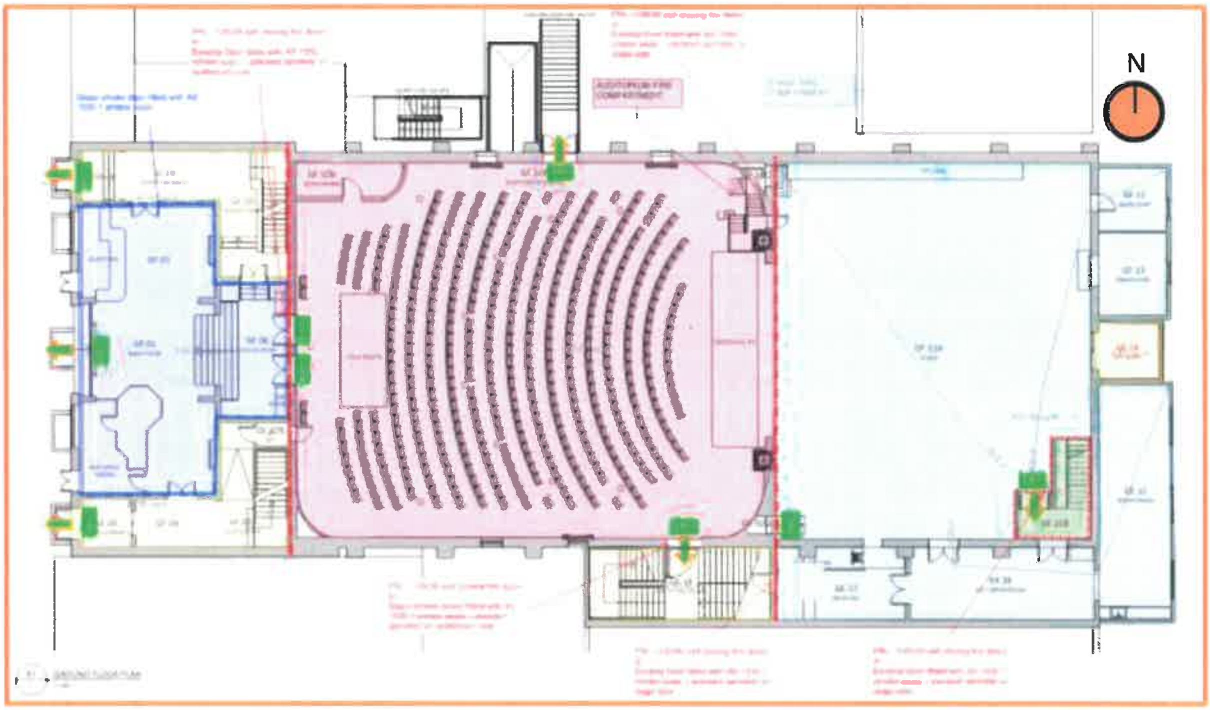

Figure 16: Egress via Ground Floor

First Floor Egress is provided with distances of travel to exits that are <20m to a point of choice to an exit and <40m to the nearest of two exits consistent with BCA Clause D1.4.

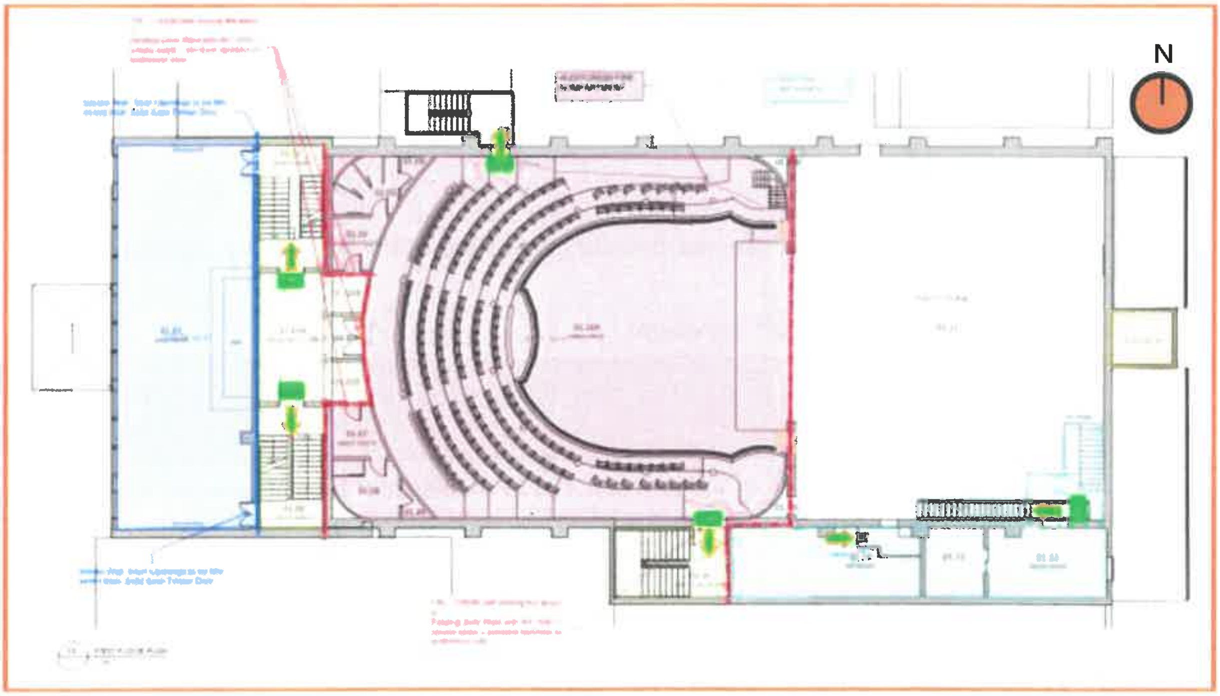

Figure 17: Egress via First Floor

Second Floor Egress is provided with distances of travel to exits that are >20m to a single exit in the platform area stage side (30m). Bio Box adjoins the auditorium via glazed/operable openings in the existing fire wall.

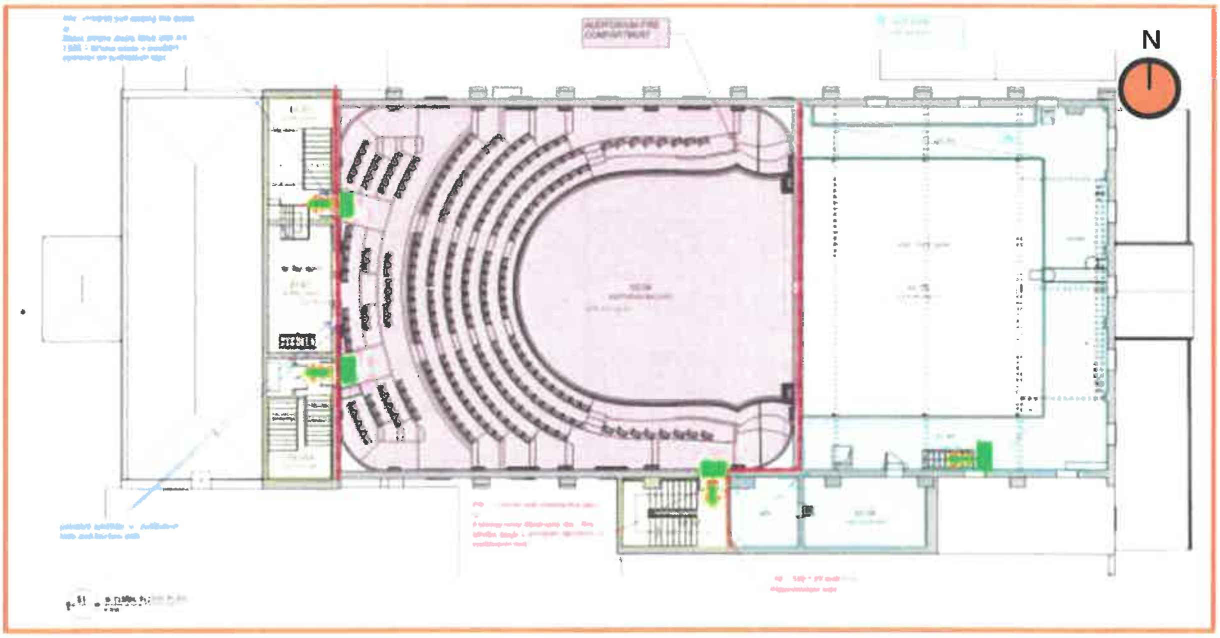

Figure 18: Egress via Second Floor

6 Performance Solution

6.1 Sprinkler Protected Smoke Door in lieu of Fire Door

6.1.1 Introduction

The following variations from the deemed-to-satisfy provisions of the BCA will be considered within this section of the report:

Table 10: Variations from BCA DtS Provisions

DtS Clause	Description of Variation from BCA DtS Provisions	Performance Requirements
C3.5(a)(iii)* inter-Alia C3.8	The provision of a Specification C3.4 smoke door protected by a pendant sprinkler on the exposure side only in lieu of an FRL -/60/30 self closing fire door	CP2, CP8

*Exceeds DtS requirements under C2.8(a) though aligns with C2.8(c)

6.1.2 Identification of Areas under Consideration

Figure 19 to Figure 22 shows the areas under consideration (highlighted in orange box).

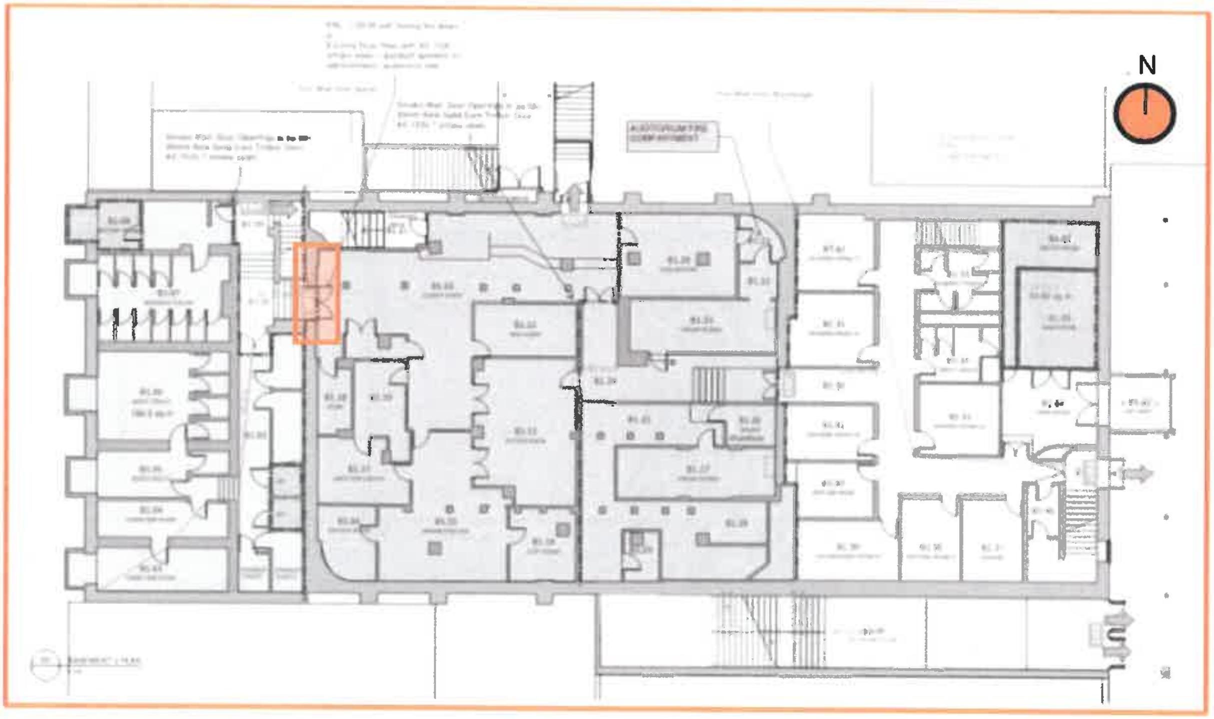

Figure 19: Sprinkler Protection of Existing Doors - Basement

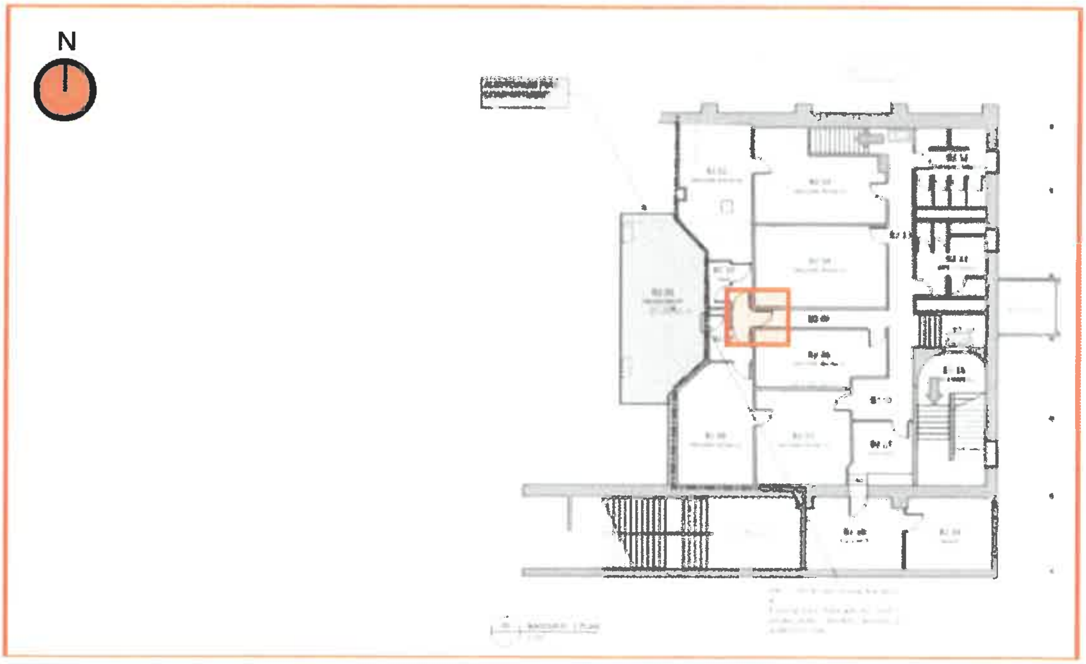

Figure 20: Sprinkler Protection of Existing Doors - Sub Basement

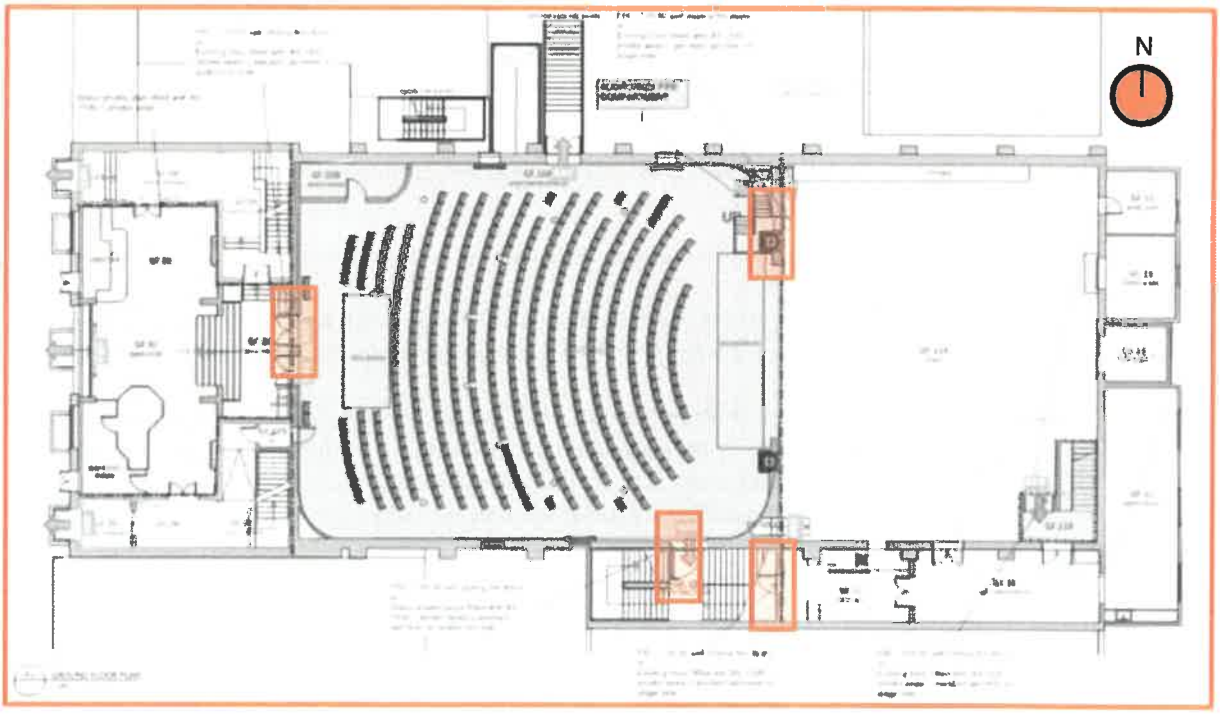

Figure 21: Sprinkler Protection of Existing Doors – Ground Floor

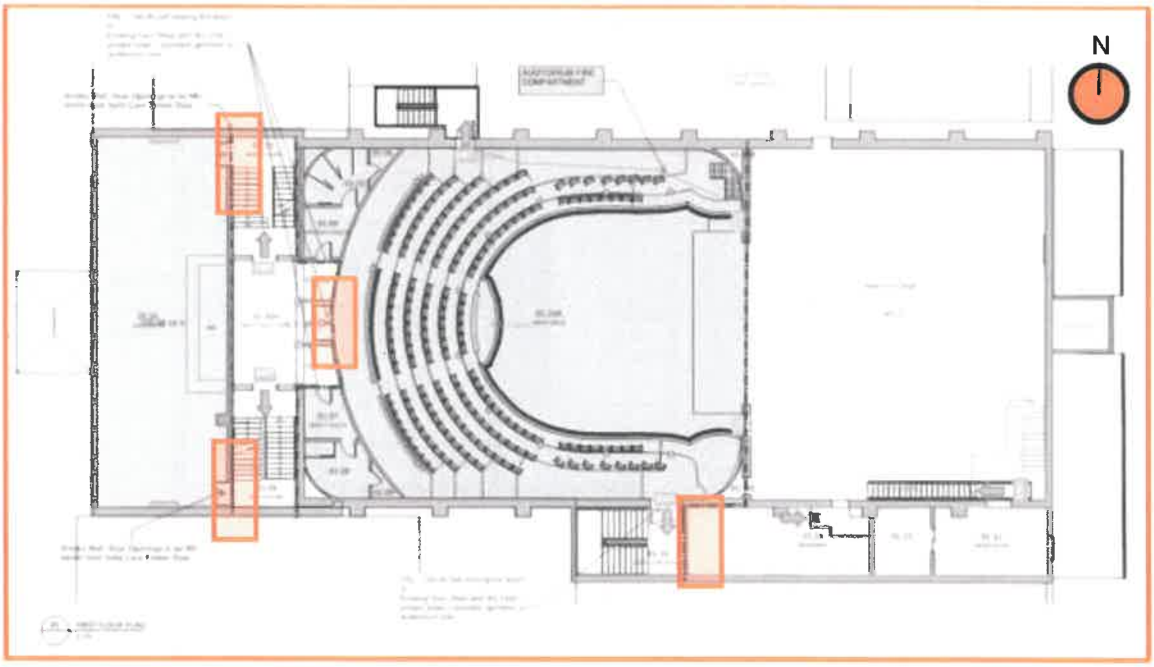

Figure 22: Sprinkler Protection of Existing Doors - Second Floor

6.1.3 BCA Requirements and Intent

6.1.3.1 Relevant Deemed-to-Satisfy Provisions

6.1.3.1.1 Openings in Fire Walls

The Relevant Deemed-to-Satisfy Provisions associated with the protection openings in fire walls is BCA Clause C3.5(a)(iii), reproduced below.

C3.5 Doorways in fire walls

(a) The aggregate width of openings for doorways in a fire wall, which are not part of a horizontal exit, must not exceed ½ of the length of the fire wall, and each doorway must be protected by—

- (i) 2 fire doors or fire shutters, one on each side of the doorway, each of which has an FRL of not less than ½ that required by Specification C1.1 for the fire wall except that each door or shutter must have an insulation level of at least 30; or
- (ii) a fire door on one side and a fire shutter on the other side of the doorway, each of which complies with (i); or
- (iii) a single fire door or fire shutter which has an FRL of not less than that required by Specification C1.1 for the fire wall except that each door or shutter must have an insulation level of at least 30.

(b)

- (i) A fire door or fire shutter required by (a)(i), (a)(ii) or (a)(iii) must be self-closing, or automatic closing in accordance with (ii) and (iii).
- (ii) The automatic closing operation must be initiated by the activation of a smoke detector, or any other detector deemed suitable in accordance with AS 1670.1 if smoke detectors are unsuitable in the atmosphere, installed in accordance with the relevant provisions of AS 1670.1 and located on each side of the fire wall not more than 1.5 m horizontal distance from the opening.
- (iii) Where any other required suitable fire alarm system, including a sprinkler system complying with Specification E1.5, is installed in the building, activation of the system in either fire compartment separated by the fire wall must also initiate the automatic closing operation.

6.1.3.1.2 Openings in Fire Isolated Exits

The Relevant Deemed-to-Satisfy Provisions associated with the protection openings in fire walls is BCA Clause C3.8, reproduced below.

> **C3.8 Openings in fire-isolated exits**
> (a)
> (i) Doorways that open to fire-isolated stairways, fire-isolated passageways or fire-isolated ramps, and are not doorways opening to a road or open space, must be protected by –/60/30 fire doors that are self-closing, or automatic-closing in accordance with (ii) and (iii)
>
> (ii) the automatic-closing operation must be initiated by the activation of a smoke detector, or any other detector deemed suitable in accordance with AS 1670 if smoke detectors are unsuitable in the atmosphere, installed in accordance with the relevant provisions of AS 1670.1 and located not more than 1.5 m horizontal distance from the approach side of the doorway.
>
> (iii)Where any other required suitable fire alarm system, including a sprinkler system complying with Specification E1.5, is installed in the building, activation of the system must also initiate the automatic-closing operation.
>
> (b) A window in an external wall of a fire-isolated stairway, fire-isolated passageway or fire-isolated ramp must be protected in accordance with C3.4 if it is within 6 m of, and exposed to, a window or other opening in a wall of the same building, other than in the same fire-isolated enclosure.

6.1.3.2 Relevant BCA Performance Requirements

The relevant BCA performance requirements associated with the requirement for the avoidance of the spread of fire is CP2, reproduced below.

> **CP2**
> (a) A building must have elements which will, to the degree necessary, avoid the spread of fire —
>
> (i) to *exits*; and
> (ii) to *sole-occupancy units* and *public corridors*; and
> (iii) between buildings; and
> (iv) in a building.
>
> (b) Avoidance of the spread of fire referred to in **(a)** must be appropriate to—
>
> (i) the function or use of the building; and
> (ii) the *fire load*; and
> (iii) the potential *fire intensity*; and
> (iv) the *fire hazard*; and
> (v) the number of *storeys* in the building; and
> (vi) its proximity to *other property*; and
> (vii) any active *fire safety systems* installed in the building; and
> (viii) the size of any *fire compartment*; and
> (ix) *fire brigade* intervention; and
> (x) other elements they support; and
> (xi) the *evacuation time*.

The Relevant Performance Requirements associated with the protection of openings is CP8, reproduced below:

> **CP8**
> Any building element provided to resist the spread of fire must be protected, to the degree necessary, so that an adequate level of performance is maintained—
>
> (a) where openings, construction joints and the like occur; and
> (b) where penetrations occur for building services.

6.1.3.3 Intent of the BCA

The Guide to the BCA states that the intent of BCA Clause C3.5 is maintain the integrity of fire walls by limiting the spread of fire through doorways.

The Guide to the BCA states that the intent of BCA Clause C3.8 is to maintain the integrity of a fire-isolated exit and to protect people using fire-isolated exits by providing adequately protected door and window openings.

Performance Requirement CP2 is intended to deal with spread of fire both within the building and between buildings. Performance requirement CP8 requires openings and penetrations in building elements to resist the spread of fire. The BCA Guide states that CP8 should be read in conjunction with CP2; CP8 deals with any opening or penetration within a building element, and CP2 deals with the building element itself.

FRLs are only included as part of the Deemed-to-Satisfy Provisions. The BCA Guide also states that it may be determined by a building proponent using an Alternative Solution that applying FRLs to building element is not necessary because other methods, can satisfy the Performance Requirements.

6.1.4 Hazard Identification

6.1.4.1 Key Hazards

Doorways leading into a fire walls are a possible source of fire and/or smoke spreading into an adjoining fire compartment or exit. The spread of fire or smoke into an egress route may threaten occupant egress. It is therefore important that such doorways are protected by fire doors.

These fire doors must be self-closing (see C3.8(a)(i)) or automatic-closing initiated by smoke detectors or (in specified circumstances) heat detectors (see C3.8(a)(ii)).

Statistics from the National Fire Protection Association (NFPA) (Hall, 2010) provides recorded statistics on buildings fitted with automatic fire sprinkler systems between the years 2007 – 2011 in United States. Based on the NFPA's data, sprinkler operated 91% of the time when they were installed. When they operate, they were found to be effective 96 % of the time, resulting in a combined performance of operating effectively in 86 % of all reported fires where sprinklers were present in the fire area and the fire was large enough to activate them. The reliability of sprinkler system in Australia and New Zealand is generally considered significantly higher than in the US as researched by Marryatt (1988).

6.1.4.2 Referenced Statistics

Within public assembly buildings, the greatest proportion of fire starts are by open suspicious incendiary causes (22%) as shown in Figure **4** with 7.6% of fires being located within egress routes (Figure **5**). These areas have a greater degree of public access and may skew the results. The greatest proportion of fire by area of origin is within the cooking areas at 32.2%, storage areas at 12.6%, lavatories etc at 10.2% - refer Figure **5**.

US statistics report that 4,800 construction fires (noting the backstage area is treated as a construction site) occur annually [2011 Fire Safety International Conference]. The primary reported cases of construction fires are were attributed to hot works (58%), 41% suspicious acts, and 5% smoking [NFPA 2016]. NFPA indicated that construction fires represent 6% of those reported and 13% financial loss. Portable heating accounts for 25%, cutting/welding equipment 20% and smoking/matches 15% [SFS NSW].

6.1.5 BCA Clause A0.5 Assessment Method

The approach adopted will utilise a quantitative and deterministic analysis for the purposes of utilising an Alternative Verification Method which comply with the BCA as described by A0.5 (b)(ii) as shown below.

Table 11: Assessment Methods in accordance with BCA Clause A0.5

BCA Clause A0.5
The following Assessment Methods, or any combination of them, can be used to determine that a Performance Solution or a Deemed-to-Satisfy Solution complies with the Performance Requirements, as appropriate: (a) Evidence to support that the use of a material or product, form of construction or design meets a Performance Requirement or a Deemed-to-Satisfy Provision as described in A2.2. (b) Verification Methods such as — (i) the Verification Methods in the NCC; or (ii) **such other Verification Methods as the appropriate authority accepts for determining compliance with the Performance Requirements.** (c) Expert Judgement. (d) Comparison with the Deemed-to-Satisfy Provisions.

6.1.6 Fire Safety Measures for the Performance Solution

The fire safety measures listed in Table 9 form the holistic fire safety design for the Performance Solution, and incorporate the Design Additions within §1.3.

6.1.7 Method of Fire Engineering Analysis

6.1.7.1 Introduction

A quantitative and qualitative comparative analysis will be undertaken to assess the risk to occupants and the attending fire brigade associated by the provision of a partial smoke separation and sprinkler protection in lieu of fire separation between fire compartments.

6.1.7.2 Fire Scenario and Fire Size

6.1.7.2.1 Fire Scenarios

This analysis will considered a fire in the following areas -

- AS 1530.4 fire in a habitable area

6.1.7.2.2 Discounted Fire Scenarios

A fire originating within the egress route has not been considered, given the variation under consideration will not impact on the occupant egress, when compared with a DtS building. i.e. in either instance occupants would not be able to egress despite the opportunities and the distances of travel are equivalent.

With regard to fire spread from the stairs/adjoining egress routes the fire size likely to be of limited size and intensity, given the limitations on linings and combustible stored in the egress route. The risk from the egress route is implied to be low within the BCA DtS provisions, where Nil FRL from the egress route side is permitted in fire-isolated passageways under BCA Clause D2.11.

6.1.7.3 Referenced Data

6.1.7.3.1 Inherent FRL of Solid Core Timber Doors

The relative performance of solid core doors in inhibiting fire/smoke spread from the room of fire origin, when provided with/without hot smoke seals, observed by Young [Young/ England] for AS1530.4 Standard Fire and Hydrocarbon Fire heating regimes.

The provision of intumescent fire seals also inhibited hot gases from threatening the door edges on the non fire side, improving the integrity performance of the solid core timber doors from 15 minutes to 25 minutes.

Standard Fire Tests have an average radiant equivalent heat flux exposure of 93kW/m² for 1 hour exposure and an approximate char rate of 0.7mm/min for the timber framing for timber density of density 550 kg/m³ (Radiata Pine - From Table 2.2 of AS1720.1).

The tested 35mm thick solid core timber doors in the reference test [Young/England], of inherent FRL 25 minutes also exhibited a char rate of 0.7mm/min.

Within the reference test, the door swing was into the furnace. i.e. hinges on fire side.

The above will be adopted to determine the inherent FRL of the minimum 20mm thick solid core timber doors infills.

6.1.7.3.2 Char Rate of Timber When Exposed to a Constant Radiant Heat Flux

The char rate of timber for constant radiant heat flux exposures was correlated from standard fire tests, accounting for the time of exposure and the density of the wood, as presented by Babrauskas [Babrauskas].

$$\beta = 113 \frac{q''^{\,0.5}_{tot}}{\rho t^{0.3}}$$

where $\beta =$ the notional charring rate, in millimetres per minute (mm/min)

$q''_{tot} =$ the constant radiant heat flux exposure (kW/m²)

ρ = the timber density at a moisture content of 12%, in kilograms/m^3. Note that seasoned timber (as defined by AS1720.1) has a moisture content as between 10% and 15%.

t = exposure time (mins); accounting for the charring rate not being constant and reduces with time of exposure

Note the char rate varies with moisture content and exposure time, as shown below [Buchanan].

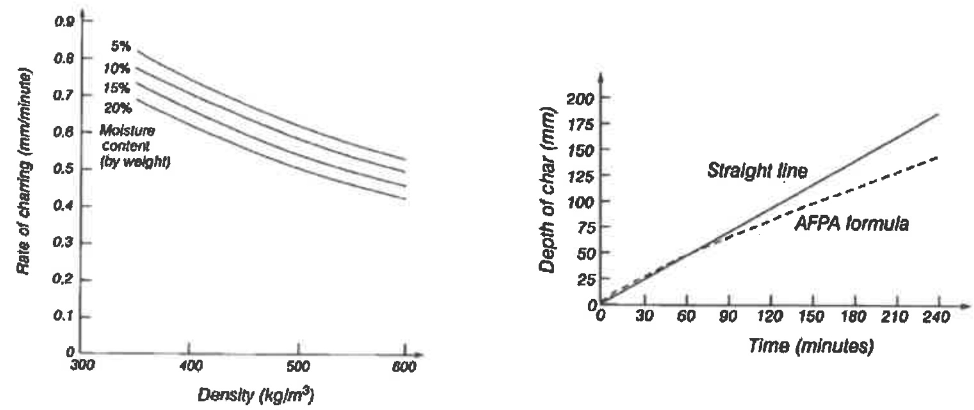

Figure 23: Char Rate varying with Moisture Content and Overall Exposure Time [Buchanan]

For a short period of exposure (<60 minutes), the char rate is not expected to vary markedly. The moisture content can cause the char rate to vary by 30%.

The above will be adopted to determine the time for the char layer (7.5mm deep) will reach the non fire side of 20mm thick panels, for an AS 1530.4 fire.

The depth of charring d_c is assumed to be 7.5mm greater, where AS 1720.4 assumes that the timber within this region has reached an elevated temperature and is assumed to have no mechanical strength. i.e. AS1720.4 assumes a loss in bearing strength at 120°C.

$$d_c = \beta t + 7.5mm$$

where t_c= the period of time in minutes

6.1.7.3.3 Inherent FRL of 6mm thick Toughened safety glass

Under BCA Specification C3.4 smoke wall/door must be able to withstand 200°C for 30 minutes.

However a 6mm thick toughened glass smoke door is assumed to fracture at higher peak temperatures of up to 300°C based on the following -

- Standard tests conducted by National Fire Laboratory (NFL), National Research Council of Canada (NRCC) which included 1516mm x 1105mm x 6mm toughened glass panes that achieved integrity performance levels of 5 minutes to 6.5 minutes (furnace temperature 580°C to 615°C) [Richardson].

The above will be adopted for consideration of glazed infills.

6.1.7.3.4 Wall Wetting Sprinklers over a Barrier

Kim and Lougheed [Kim and Lougheed] found that for flow rates consistent with AS 2118.1, that horizontal pendant sprinklers setback 13mm from the glazing and 50mm below the top of the window frame could protect glazed window openings when exposed to an AS1530.4 Standard Fire for one hour; where there is no pony wall and combustibles adjacent to the glazing.

For the Subject solution, it is proposed that pendant sprinklers in horizontal orientation be setback <600mm from the glazing and <450mm above the top of the window frame.

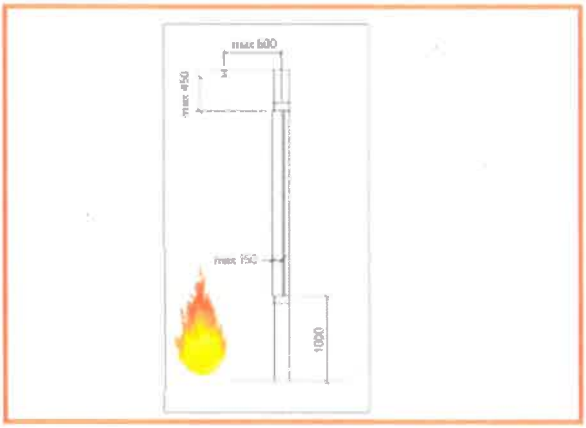

Figure 24: Excerpt from "*Fire Protection of Windows Using Sprinklers*", showing limiting distances of ceiling mounted pendant type sprinklers to protect for an Internal Exposure

For the above data, it is assumed there are combustibles near the window/wall assembly and hence the requirement for a "pony wall" to limit direct flame impingement.

For our alternative solution, the openings to door are an egress route, with limited opportunity for the storage of combustibles. The data is therefore is applicable to this scenario.

The above will be adopted to determine the inherent FRL of timber or glazed panes when protected by pendant sprinklers at the same setback and offset.

6.1.7.3.5 AS 2118.1 as a Water Curtain

An AS2118.1 sprinkler head typically sprays 60L/min or an AS 2118.1 sprinkler head. This is expected to be sufficient to protect a single glazed opening/timber door (and also approximate with BCA Specification G3.8 where 0.25 L/s/m² is deemed equivalent to 1 hr protection for glazing in atriums).

In addition to protecting the glazing, the overspray will fall directly onto the areas below, wetting down combustibles and decreasing the fire intensity (up to 50% - refer Appendix E).

6.1.8 Acceptance Criteria (Alternative Verification Method)

The acceptance criterion for this particular non-compliance is that -

(a) The timber doors when protected by sprinklers will withstand the likely imposed radiant heat flux and limit fire spread into the building egress routes

6.1.9 Analysis

6.1.9.1 Fire in Close Proximity from the Timber Door

The proposed solution is prescribed to be within the bounds of the Kim and Lougheed and therefore would be expected to achieve similar levels of performance. i.e. a one hour fire rating for an internal exposure.

The temperatures on the non-fire side of a specimen would not be likely to be in the order of 200 °C (noting a 180 °C rise is required for insulation failure of a wall/barrier system) after 1 hour (versus a DTS FRL -/60/30, fire door with a 30 minute insulation rating)

For the above data, it is assumed there are combustibles near the window/wall assembly and hence the requirement for a "pony wall" to limit direct flame impingement. For our alternative solution, the opening is a timber door in an egress route, with limited opportunity for the storage of combustibles.

It is considered that in the event that the door is shut (as required by the solution) that fire spread would not occur from the habitable areas side to the egress routes.

6.1.9.2 Door Fails to Close (Failure of One Sub-system)

In the event the door fails to close or a delay in closure, the sprinklers will provide a 50% reduction in radiant heat transfer to the non fire side (by the sprinkler acting as a water curtain).

For an assume 93kW/m^2 imposed fluxed for an AS 1530.4 fire, the transmission to the non fire side is likely to be in the order of 46.5kW/m^2, which would typically cause piloted ignition on the non fire side (>25kW/m^2) [Drysdale].

The wetting down of the immediate area by continuous application of water, however would limit the likelihood of drying out and ignition of combustibles (leading to ignition).

6.1.9.3 Sprinkler Outside 450mm vertical offset and 600mm setback bounds or shielding of protected Area

In the event the sprinklers are outside the bounds of the 450mm vertical offset and 600mm setback requirement for 1hr system or shielding of protected area, the sprinklers will provide a 50% reduction in radiant heat transfer to the non fire side (by the sprinkler acting as a water curtain).

For an assume 93kW/m^2 imposed fluxed for an AS 1530.4 fire, the transmission to the non fire side is likely to be in the order of 46.5kW/m^2, which would typically cause piloted ignition on the non fire side (>25kW/m^2) [Drysdale]. The wetting down of the immediate area by continuous application of water, however would limit the likelihood of drying out and ignition of combustibles (leading to ignition).

6.1.9.4 Sprinkler Failure (Failure of One Sub-system)

6.1.9.4.1 Glazed panels and sprinkler failure

The risk in the event of sprinkler failure is not adverse when compared with a DtS building, where sprinkler protection of is permitted to limit exposures to an egress route (namely BCA Clause D1.7).

Standard tests conducted by National Fire Laboratory (NFL), National Research Council of Canada (NRCC) which included 1516mm x 1105mm x 6mm toughened glass panes that achieved integrity performance levels of 5 minutes to 6.5 minutes (furnace temperature 580°C to 615°C) [Richardson]; will provide protection of up to 30kW/m^2 for extended (though not indefinite period) and is an improvement of a typical DtS solution under BCA Clause D1.7 with no prescribed glazing requirements when protecting an egress route is required to be fire isolated.

6.1.9.4.2 Time to Reach Limiting Char Depth

Standard Fire Tests have an average radiant equivalent heat flux exposure of 93kW/m² for 1 hour exposure and an approximate char rate of 0.7mm/min for the timber framing for timber density of density 550 kg/m^3 (Radiata Pine - From Table 2.2 of AS1720.1).

The tested 35mm thick solid core timber doors in the reference test [Young/England], of inherent FRL 25 minutes also exhibited a char rate of 0.7mm/min.

Note hardwood char rate is in the order of 0.5-0.6mm/min => Adopt 0.6 mm/min.

The depth of charring d_c is assumed to be 7.5mm greater, where AS 1720.4 assumes that the timber within this region has reached an elevated temperature and is assumed to have no mechanical strength. i.e. AS1720.4 assumes a loss in bearing strength at 120°C.

$$d_c = \beta t + 7.5mm$$

(a) Time to char to limiting char depth of 20mm thick infills

The door infill thickness is 20mm, however the limiting char depth is however 7.5mm less.

The time taken to char to the limiting char depth at **12.5mm** (= 20mm from face to non fire side – 7.5mm char with no strength) is likely to be in the order of 21 minutes (= 12.5mm/0.6mm/min).

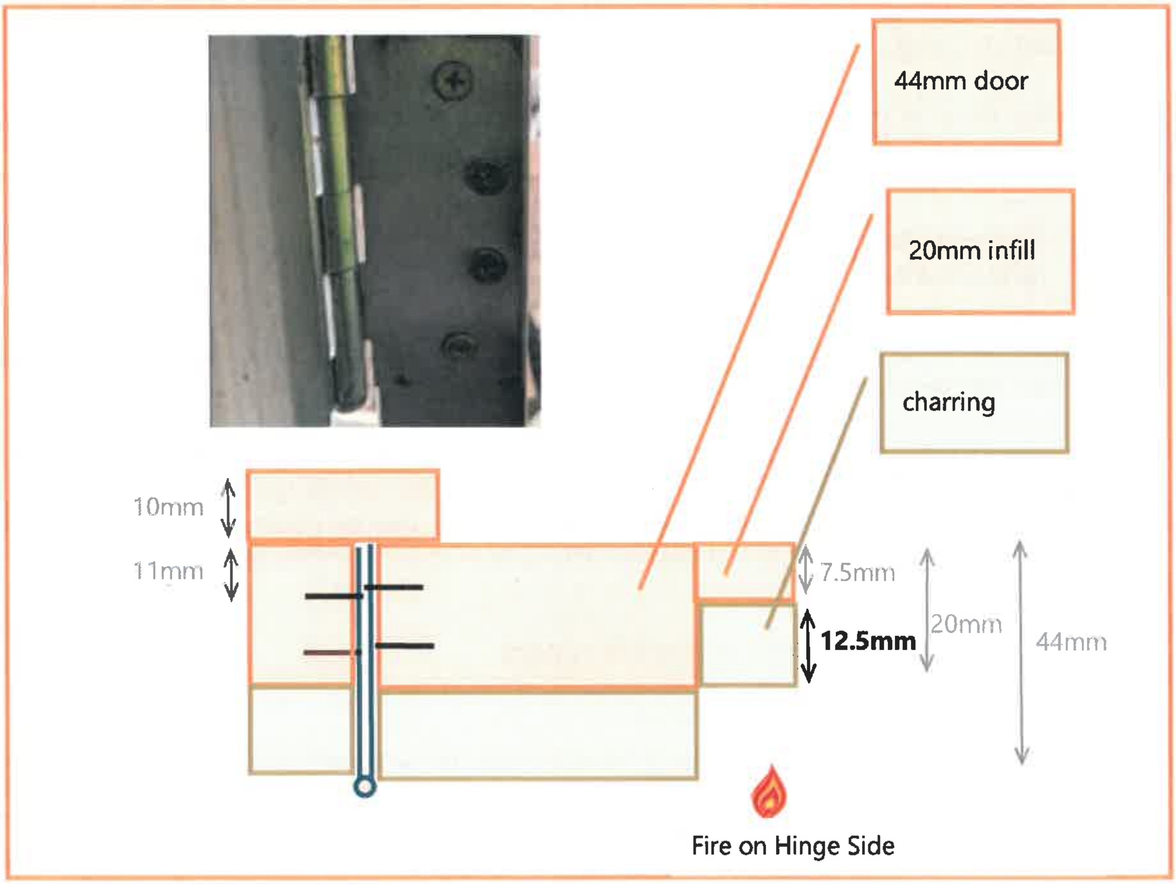

Figure 25: 44mm thick door with 20mm infills with closest screw fixings at mid-depth (– Fire on Hinge Side – Same for Door Stop Side)

Therefore ASET to the egress route for an AS 1530.4 fire on either side = 21 minutes via the 20mm thick infills.

(b) Time to Char to limiting char depth for mid-point (½) fixings of 44mm thick door – Fire From Hinge Side

The first layer screws for a fire from the hinge side are the mid-point (½) of the door thickness at 22mm = (44mm/2). The limiting char depth is 7.5mm less.

The time taken to char to the limiting char depth for the mid-point (½) fixings of **14.5mm** (= 22mm – 7.5mm char with no strength) is likely to be in the order of 24.2 minutes (=14.5mm/0.6mm/min).

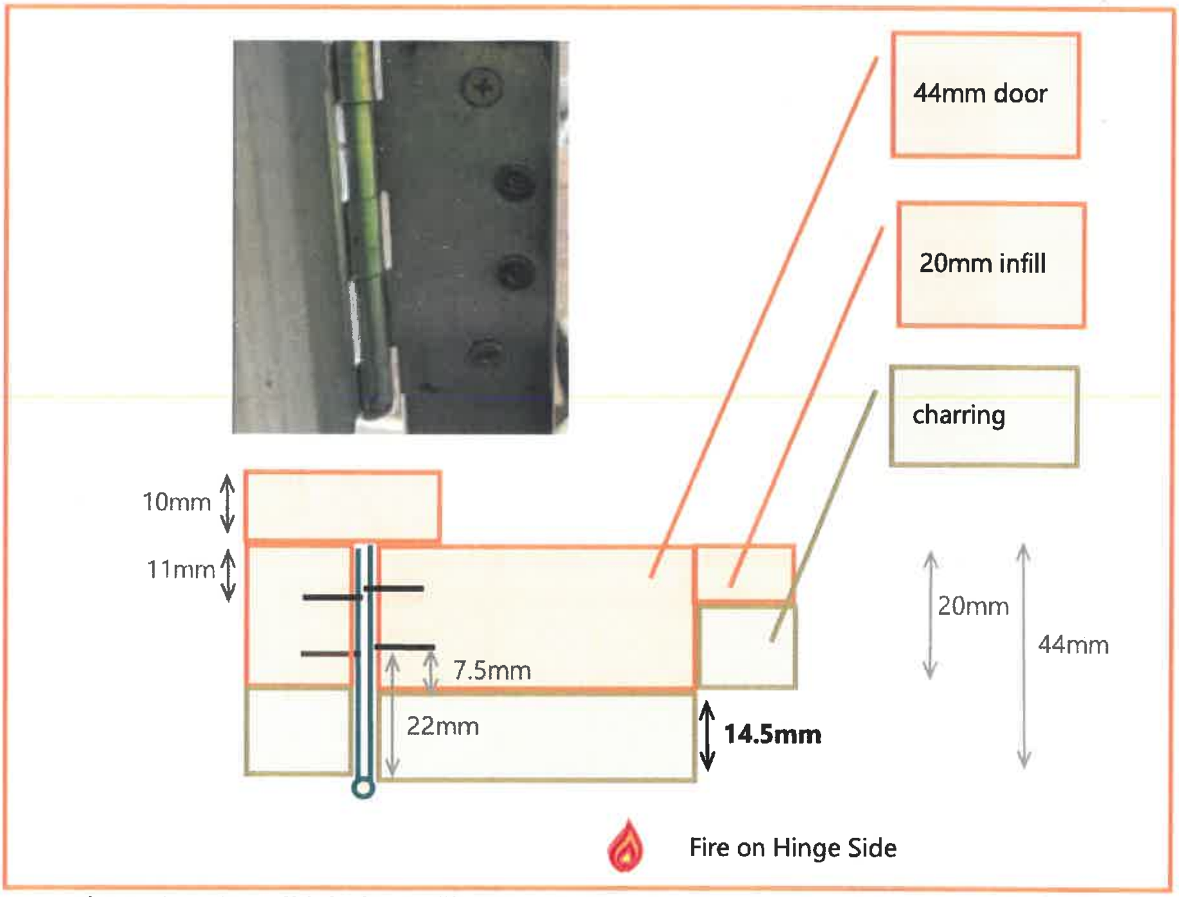

Figure 26: 44mm thick door with 20mm infills with closest screw fixings at mid-depth (– Fire on Hinge Side – Same for Door Stop Side)

Therefore ASET to the egress route for a fire AS 1530.4 on the hinge side = 24.2 minutes via the mid-point (½) fixings of 44mm thick door

(c) Time to Char to limiting char depth for quarter-point (1/4) fixings of 44mm thick door – Fire From Hinge Side

Doors stops are minimum 10mm deep and protect the fixings. The first layer screws are at the quarter-point (¼) of the door thickness at 11mm.

The time taken to char to the limiting char depth for the quarter-point (¼) fixings of **13.5mm** (= 10mm door stop + 11mm from face to closest fixings at ¼ point – 7.5mm char with no strength) is likely to be in the order of 22.5 minutes (=13.5mm/0.6mm/min).

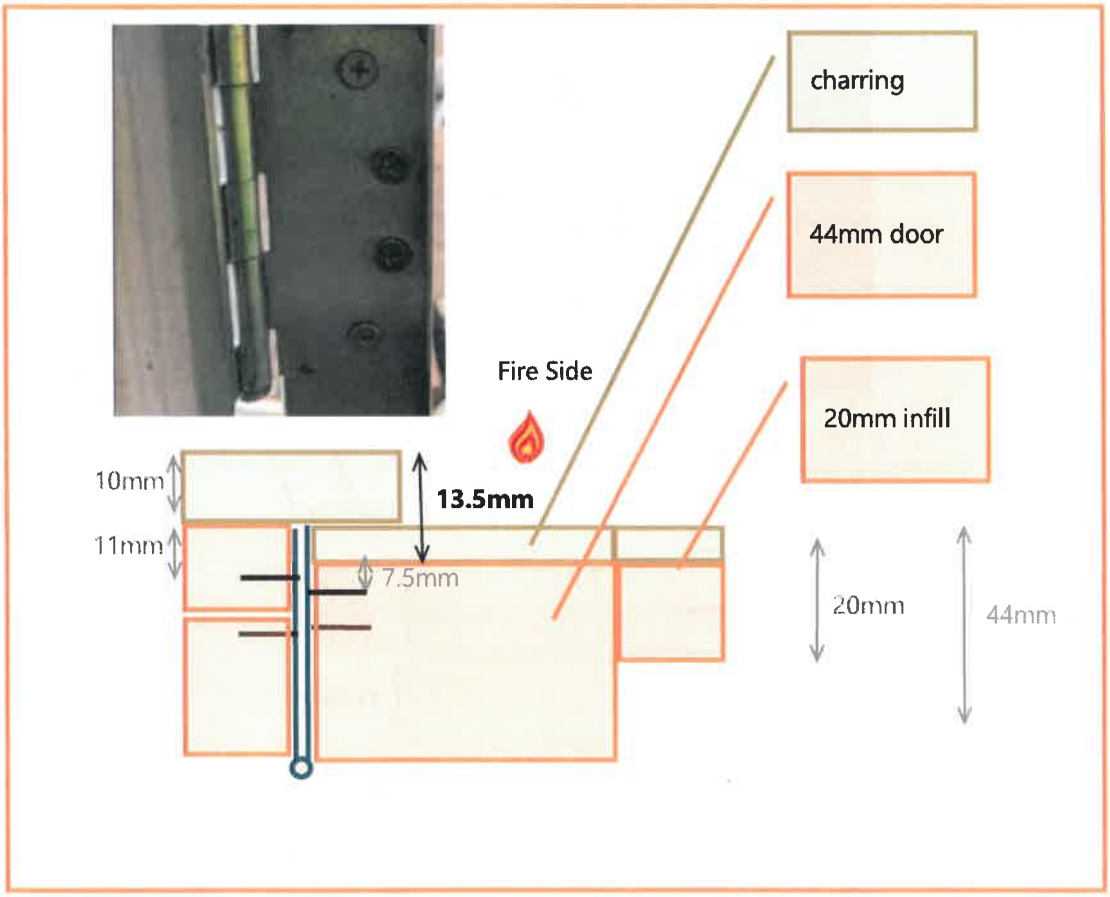

Figure 27: 44mm thick door with 20mm infills with clostest screw fixings at door ¼ point – Fire Door Stop Side

Therefore ASET to the egress route for an AS 1530.4 fire on the Door Stop side = 22.5 minutes via the quarter-point (¼) fixings of 44mm thick door

(d) Summary

Based on the **ASET** = **21** minutes, for an AS 1503.4 fire, governed by the 20mm thick infill limiting char depth.

6.1.9.5 Occupant Egress

6.1.9.5.1 General Evacuation Relationships

The time for evacuation of a building, t_{evac}, using the evacuation methodology outlined in by Nelson and Mowrer [Nelson and Mowrer] and BSI DD240:Part 1:1997 [BSI DD240 : Part 1:1997] is represented by the equation:

$$t_{evac} = t_{alarm} + t_{pre} + kt_{flow} \qquad \text{(C1)}$$

where t_{alarm} = time for alarm to be raised
t_{pre} = time for pre-movement
k = factor of safety for travel time (assumed to be **2.0** correct operation of sub-systems and **1.5** for failure of a sub-system (eg sprinkler failure or proscenium)
t_{flow} = time for travel

Appendix C1 presents the methodology for occupant alarm time/cue times, movement and pre-movement times.

6.1.9.5.2 Pre-movement

Typically within the building, a pre-movement time of 6 minutes (=360 seconds) has been assumed from Table 3-13 of the SFPE handbook [SFPE], applicable to Shops, museums, leisure sports centres, and other assembly buildings – a category described broadly as occupants being awake and predominantly unfamiliar with the building, alarm systems and procedures.

This assumption is not applicable to occupants within the immediate vicinity of the fire, where visual, aural and olfactory cues are likely to alert these occupants of the occurrence of a fire, far sooner.

For occupants within the room of fire origin is assumed to be 60 minutes.

$t_{pre\ RFO}$ = time for pre-movement inside RFO = 60 seconds
t_{pre} remote $_{RFO}$ = time for pre-movement remote from fire though within RFO = 360 seconds
t_{pre} outside $_{RFO}$ = time for pre-movement outside RFO = 720 seconds*

*Which is unlikely given the bulk of the occupants used in the egress analysis are within the RFO.

Note the above is similar orders of magnitude by Proulx who found that 95% of occupants will commence evacuation by 10 minutes (refer Figure 28).

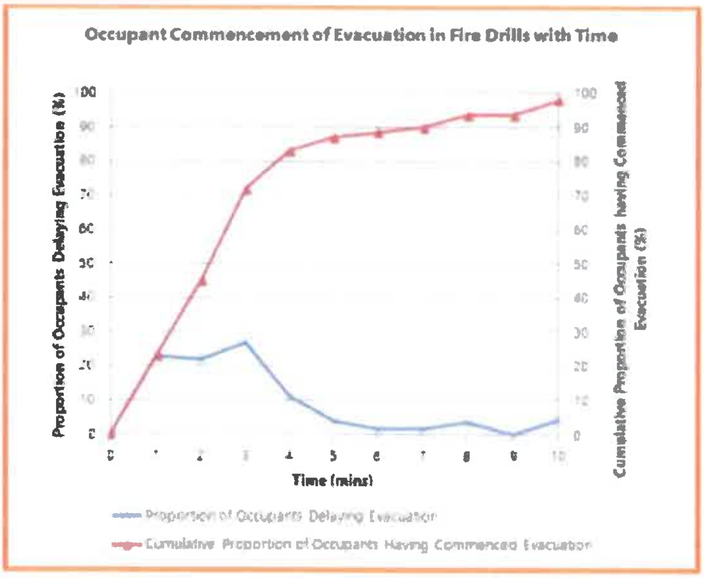

Figure 28: Occupant Commencement of Evacuation in Fire Drills With Time

Studies in conducting fire drills for buildings with a "good" alarm system, that approximately 50% would commence evacuation two minutes after the alarm occurred, 85% after five minutes and 95% after ten minutes [Proulx].

6.1.9.5.3 Flow Time

The travel time can be expressed as a function of distance and speed. Refer Appendix C2.2 for egress analysis.

The unfactored flow time through the exits (which is governed by the queuing at the mid-level dress circle stair is 310 seconds (=5.1 mins).

6.1.9.5.4 Egress versus Pre-movement Time (Δt_{pre})

The following Required Safe Egress Time(RSET) was determined for occupants egressing from the building and past a solid core timber (and a sprinkler failure to pendant sprinkler protecting the door).

Table 12: RSET for an AS1530.4 fire

Scenario	Occupant Location	t_{alarm} (s)	t_{pre} (s)	k $t_{travel\ time}$ (s) k = 1.0 sprinkler failure	RSET (s)	ASET
AS 1530.4 fire habitable area	Egress Route	60*	720*	465 =1.5 x (310)	**1,245 (20.7 mins)**	**21 mins**

*At 60 seconds an AS 1530.4 fire the entire fire compartment is at 350°C sufficient to cause glass fracture and hence activate the occupant warning system.

Note this assumes a factor of safety of 1.5 for movement in the event of sprinkler failure (where typically no of factor safety is adopted for a redundancy consideration) and a 720* second pre-movement time within the evacuation (RSET) considerations in the instance where the fire safety measures operate.

*Which is unlikely given the bulk of the occupants used in the egress analysis are within the RFO.

ASET (21 mins) > RSET (20.7 mins).

When closed the timber door is likely to protect the egress route in the event of sprinkler failure, sufficient to allow occupant egress.

6.1.9.6 Fire Brigade Intervention Considerations

The following is a summary of the key results from the FBIM Estimation:

- First fire brigade appliance arrives on scene at 701 seconds (= 11.7 minutes) after alarm.
- Fire brigade setup completed, intervention underway on uppermost level 1762 seconds (=29.4 minutes) after alarm.

When the sprinkler operates, the opening protection wall has a proven resistance to as AS1530.4 Standard Fire for 60 minutes, equivalent to that for a DtS building given a higher insulation rating, providing the attending fire brigade with an opportunity to enter adjoining compartment of origin, consistent with a DtS building.

6.1.10 Consideration against Performance Requirements CP2 and CP8

The provision of protection of openings in elements that are required to be fire rated has been demonstrated to be sufficient to limit fire spread at least consistent with a building that meets the DtS requirements in the event of correct operation of the sprinkler system.

In the instance of provision of timber door it is expected that the door will protect the egress route for approximately 21 minutes, which is likely to afford sufficient protection to the egress routes.

Accordingly it is considered that the relevant performance requirements CP2 and CP8 are met.

6.1.11 Conclusion

Based on the above, with regard to the provision of the smoke doors protected by pendant wall wetting sprinklers on the habitable areas side in lieu of fire doors, it is considered that the performance requirements CP2 and CP8, are satisfied to the degree necessary.

6.2 Cupboard situated directly beneath the non fire-isolated stair

6.2.1 Introduction

The following variations from the deemed-to-satisfy provisions of the BCA will be considered within this section of the report:

Table 13: Variations from BCA DtS Provisions

DtS Clause	Description of Variation from BCA DtS Provisions	Performance Requirements
BCA Clause D2.8(a)	A non fire isolated stair is provided with storage below (as per BCA Clause D2.8(b)) in lieu of no storage	CP2, DP5, EP2.2

6.2.2 Identification of Egress Provisions under Consideration

Figure 29 shows the egress provisions that vary from the relevant BCA DtS Provision.

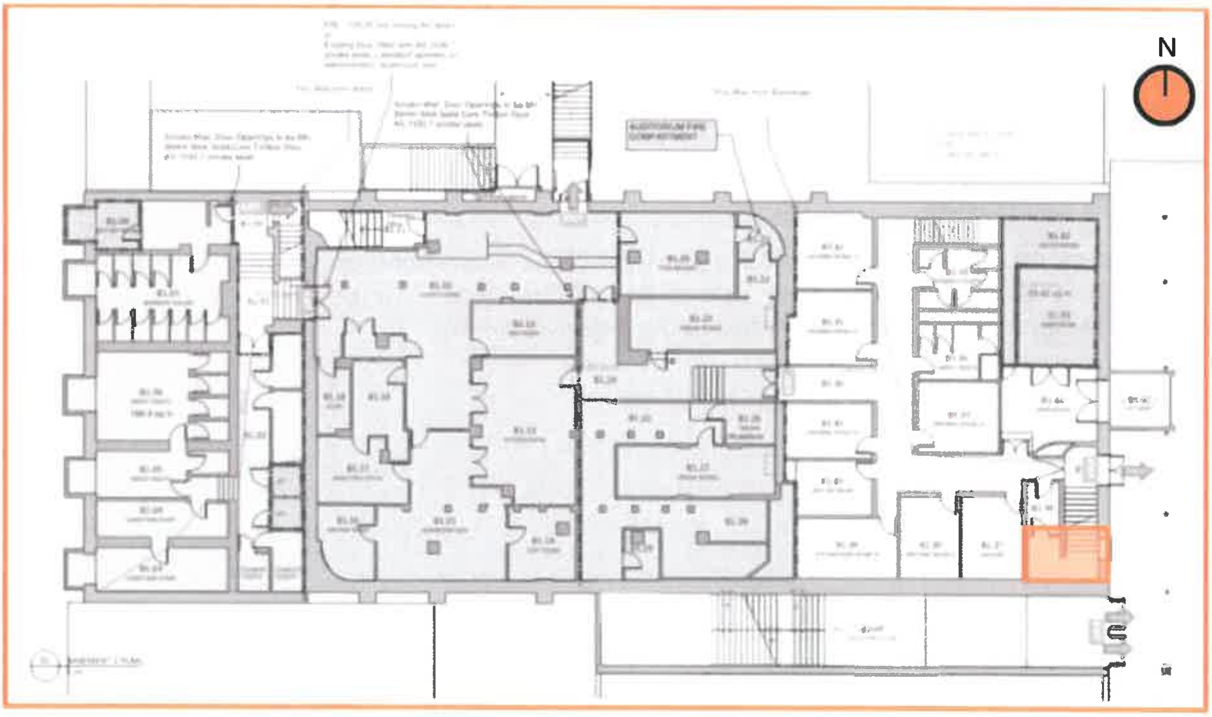

Figure 29: Ground Floor – Provision of Storage Under Stairs

6.2.3 BCA Requirements and Intent

6.2.3.1 Relevant Deemed-to-Satisfy Provisions

The relevant deemed-to-satisfy requirements associated with provision of enclosures under stairs is Clause D2.8, as depicted below.

D2.8 Enclosure of space under stairs and ramps
(a) Fire-isolated stairways and ramps—If the space below a required fire-isolated stairway or fire-isolated ramp is within the fire-isolated shaft, it must not be enclosed to form a cupboard or similar enclosed space.

(b) Non fire-isolated stairways and ramps—The space below a required non fire-isolated stairway (including an external stairway) or non fire-isolated ramp must not be enclosed to form a cupboard or other enclosed space unless—
  (i) the enclosing walls and ceilings have an FRL of not less than 60/60/60; and
  (ii) any access doorway to the enclosed space is fitted with a self-closing –/60/30 fire door.

6.2.3.2 Relevant BCA Performance Requirements

The relevant BCA performance requirement associated with the provision of fire-isolated exits is DP5 (which is associated with the protection of egress routes).

DP5 To protect evacuating occupants from a fire in the building exits must be fire isolated, to the degree necessary, appropriate to-
(a) the number of storeys connected by the exits; and
(b) the fire safety system installed in the building; and
(c) the function or use of the building; and
(d) the number of storeys passed through by the exits; and
(e) fire brigade intervention.

The relevant BCA performance requirement associated with the protection of egress routes is CP2.

CP2
(a) A building must have elements which will, to the degree necessary, avoid the spread of fire —
  (i) to *exits*; and
  (ii) to *sole-occupancy units* and *public corridors*; and
  (iii) between buildings; and
  (iv) in a building.

(b) Avoidance of the spread of fire referred to in **(a)** must be appropriate to—
  (i) the function or use of the building; and
  (ii) the *fire load*; and
  (iii) the potential *fire intensity*; and
  (iv) the *fire hazard*; and
  (v) the number of *storeys* in the building; and
  (vi) its proximity to *other property*; and
  (vii) any active *fire safety systems* installed in the building; and
  (viii) the size of any *fire compartment*; and
  (ix) *fire brigade* intervention; and
  (x) other elements they support; and
  (xi) the *evacuation time*.

The relevant BCA performance requirements associated with the provision of maintaining tenable conditions in the egress route is EP2.2, reproduced below:

EP2.2

(a) In the event of a fire in a building the conditions in any evacuation route must be maintained for the period of time occupants take to evacuate the part of the building so that-
   (i) the temperature will not endanger human life; and
   (ii) the level of visibility will enable the evacuation route to be determined; and
   (iii) the level of toxicity will not endanger human life.

(b) The period of time occupants take to evacuate referred to in (a) must be appropriate to-
   (i) the number, mobility and other characteristics of the occupants; and
   (ii) the function or use of the building; and
   (iii) the travel distance and other characteristics of the building; and
   (iv) the fire load; and
   (v) the potential fire intensity; and
   (vi) the fire hazard; and
   (vii) any active fire safety systems installed in the building; and
   (viii) fire brigade intervention.

6.2.3.3 Intent of the BCA

The BCA Guide states that the intent of D2.8 is to minimise the risk of a fire starting under a stairway and endangering the safe evacuation of the building occupants.

The BCA Guide states that DP5 is the Performance Requirement for determining when fire-isolated exits are necessary to provide protection for evacuating occupants. Fire isolated exist are intended to –

- enable people to evacuate safely past a storey on fire;
- facilitate fire brigade access to carry out operations such as search and rescue and fire-fighting; and
- minimise the distance people need to travel in a fire affected area before they are able to access a "safe place", such as a fire-isolated stairway.

6.2.4 Hazard Identification

6.2.4.1 Key Hazards

The BCA Guide states that spaces under stairways are often used for a range of purposes. It is common practice to have a cleaner's store located in such spaces. These stores often contain flammable cleaning agents.

Allowing storage below a stair that is required to be fire-isolated may increase the risk to occupants, by the compromising the egress route in the event of large fire below.

6.2.4.2 Referenced Statistics

In terms of a likely location of fire originating within the Subject building, reference is drawn to the proportion of fires starting by location (Refer Figure **5**). The highest incidence of fire occur within kitchens (32.2% for public assembly within Figure **5**). The next highest areas of fire origin being 10.2% for lavatory and locker rooms and 7.6% for egress routes.

The form of heat of ignition within a building is by open spark at 20.5%, fuel powered objects 17.5% and then electrical overload at 16.4% (Refer Figure **6**).

6.2.5 BCA Clause A0.5 Assessment Method

The approach adopted will utilise a quantitative and qualitative inter-comparison as described by A0.5(d), to demonstrate compliance with the Performance Requirements, as shown below.

Table 14: Assessment Methods in accordance with BCA Clause A0.5

BCA Clause A0.5
The following Assessment Methods, or any combination of them, can be used to determine that a Performance Solution or a Deemed-to-Satisfy Solution complies with the Performance Requirements, as appropriate:
(a) Evidence to support that the use of a material or product, form of construction or design meets a Performance Requirement or a Deemed-to-Satisfy Provision as described in A2.2.
(b) Verification Methods such as —
(i) the Verification Methods in the NCC; or
(ii) such other Verification Methods as the appropriate authority accepts for determining compliance with the Performance Requirements.
(c) Expert Judgement.
(d) Comparison with the Deemed-to-Satisfy Provisions.

6.2.6 Fire Safety Measures for the Alternative Building Solution

The fire safety measures listed in Table 9 form the holistic fire safety design for the Alternative Building Solution, and incorporate the additional design measures prescribed within §1.3.

6.2.7 Methodology of Fire Engineering Analysis

6.2.7.1 Fire Engineering Assessment Methods in accordance with IFEG 2005

The risk of fire spread to evacuating occupants will be qualitatively compared having regard for inherent protection afforded and comparison with other solutions that meet the BCA prescriptive requirements having regard for –

(a) The likely conditions in the egress route
(b) The likelihood of fire compromising the egress route

6.2.7.2 Comparative Solution

The Subject building solution will be compared with a Class 9b building (non sprinkler protected) of Type B construction, permitted storage below the stair under BCA Clause D2.8(b) when provided with FRL 60/60/60 protection and an FRL -/60/30 self closing fire door.

6.2.7.3 Fire Scenarios, Fire Size and Models

6.2.7.3.1 Fire Scenarios

The analysis will consider the development of a fire in the enclosure provided below the stair, separated by with FRL 60/60/60 separation from the balance of the building.

6.2.7.3.2 Discounted Fire Scenarios

A fully developed fire outside the stair has not been considered.

The building is required to be provided with a non fire-isolated stair (at this location only 2-storeys are connected). The risk in this instance/scenario in the considered building and DtS building are considered equivalent.

6.2.7.3.3 Fire Size

The fire size will be implicitly the same for the Subject building and the comparative building, for the comparative assessment. An AS1530.4 is assumed.

6.2.8 Acceptance criteria

The acceptance criterion for this performance assessment is that the building solution shall provide equivalent or higher levels of safety with regard to egress, when compared with a building solution that meets the deemed-to-satisfy provisions of the BCA.

6.2.9 Analysis and Discussion

6.2.9.1 Inherent FRL of 10mm Standard Grade Plasterboard Linings and Timber Framing

6.2.9.1.1 Referenced Testing of Lightweight Walls

The Component Additive Method (CAM) as presented in the SFPE Handbook [SFPE 3rd Ed] was developed by the National Research Council of Canada (NRCC) and has gained code approval in both the United States and Canada. This method permits the relative contributions of the components of construction of lightweight partitions to be added together and is consistent with Harmathy's Rule of Endurance

Based on observations within Standard Fire Resistance test, the sub-components within lightweight timber framed can be assigned a contributing FRL [White].

Within these tests the 10mm standard grade plasterboard is attributed 10 minutes. The timber studs (100mm x 51mm) were attributed 20 minutes inherent fire resistance.

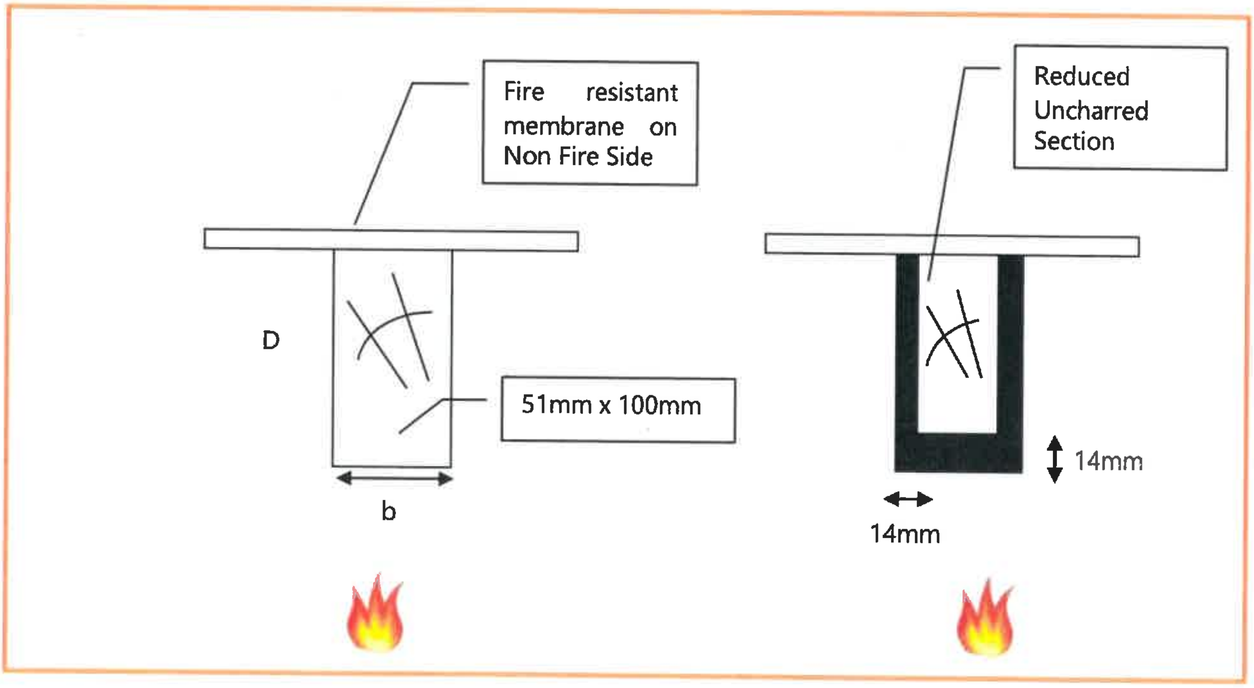

Figure 30: Reduction in section size of referenced tested system

The char rate of timber is attributed typically 0.7mm/min in Standard Fire Tests [AS1720.4][Buchanan].

Subsequent to fire side sheet falling away, and the timber being exposed the studs will being to char. At 20 minutes exposure, the original 100mm x 51mm studs would be expected to have charred approximately 14mm at each exposed side. For the referenced systems, the section size would have reduced to 86mm x 23mm.

6.2.9.1.2 Timber Framing Inherent FRL

As noted above the 10mm standard grade plasterboard would be expected to protect the timber framing and cavity for 10 minutes from direct exposure. The non fire side sheet 10mm standard grade board is also likely to fall away after 10 minutes exposure.

Accordingly the for the timber framing for a 10 minute AS 1530.4 exposure -

- Depth (D), is assumed 1 side exposure for 10 minutes (while the non fire side sheet stays in place)
- Breadth (b) is assumed 2 side exposure for 10 minutes

The 90mm x 45mm timber studs may be expected to be compromised after 10 minutes exposure to a fire of approximate intensity to an AS1530.4 fire, based on typical charring rates of 0.7mm/min for softer radiata wood flooring and full scale fire resistance tests. i.e. 10 minutes x 0.7mm/min = 7mm

After 10 minutes the section size would be likely to reduce from 90mm x 45mm to 83mm x 31mm wide. [where 83mm = 90mm-(10 mins x 0.7mm/min) and 31mm = 45mm-(10 mins x 2 x 0.7mm/min)]

The overall second moment of area of the timber framing, I_{xx} (= $bD^3/12$, which is directly related to the stiffness of flexural rigidity of the stud) at 10 minutes exposure is greater than the referenced tests at 20 minutes exposure, and allows some conservatism in the analysis for the likely period of structural adequacy.

Table 15: Determination of Times to Equivalent (or Greater Stiffness) to Tested System

System			Char rate	Char time	Uncharred section		Second moment of Area
					2 sides	1 side	I_{xx}
	b	D	b	t	b	D	$bD^3/12$
	mm	mm	mm/min	mins	mm	mm	($\times 10^{-6}mm^4$)
Tested	51	100	0.7	**20**	23	86	**1.22**
Subject	45	90	0.7	**10**	31	83	**1.48**

6.2.9.1.3 Summary of Inherent FRL of Timber Framing protected by 10mm standard grade plasterboard

Based on the above an inherent FRL of 20 minutes can be attributed to the timber framed walls including 90mm x 45mm timber framing clad with and 10mm standard grade plasterboard each side (10 minutes for 90mm x 45mm timber framing and 10 minutes for 10mm standard grade plasterboard).

6.2.9.2 Inherent FRL of Solid Core Timber Door

The relative performance of solid core doors in inhibiting fire/smoke spread from the room of fire origin, when provided with/without hot smoke seals, observed by Young [Young/ England] for AS1530.4 Standard Fire and Hydrocarbon Fire heating regimes.

The solid core doors were found to have an inherent FRL of 15 minutes (without seals) for an AS1530.4 exposure, which provides some redundancy protection to occupants utilising the stair (noting the building is however one fire compartment).

In the event of fire at the cupboard it is considered that the door will provide sufficient inherent separation in the initial stage of the fire.

6.2.9.3 Fire Severity

6.2.9.3.1 Correct Operation of Sprinkler

In the event of correct operation of t he sprinkler system, it is likely the that the temperature of a sprinkler protected fire would be likely to be in the order 200°C or lower, which is likely to be resisted by the smoke resistant construction, prescribed. Noting smoke resistant construction is required to withstand 200°C for 30 minutes, under BCA Specification C3.4

Based on the above the provision of storage under the stairs is not likely to impact on occupant egress, in the event of correct operation of the sprinkler system within the cupboard.

6.2.9.3.2 Sprinkler Failure

The size of the enclosure and ventilation is not conductive to the development of a fire that will have the intensity of an AS 1530.4 Standard Fire for 60 minutes.

The fire severity is likely to be low when the door is closed, with flashover being improbable due to the lack of ventilation.

The inherent FRL's are likely to limit spread for approximately 10 minutes.

6.2.9.4 Detection and Pre-movement

The sprinkler head will also provide occupant warning for a fire within the enclosure and I notify occupants of the potential risk to the egress route sooner than for a deemed-to-satisfy building provided with FRL 60/60/60 fire separation and FRL -/60/30 self closing fire doors (however with no form of detection).

Studies in conducting fire drills for buildings with a "good" alarm system, that approximately 50% would commence evacuation two minutes after the alarm occurred, 85% after five minutes and 95% after ten minutes [Proulx].

Occupants are likely to be alert and able to respond to cues of fires/alarms.

There would be some delay before occupants become aware of a fire occurring in a deemed-to-satisfy building (up to a matter of minutes). A fire would have to develop within a deemed-to-satisfy cupboard and present olfactory, visual, aural or tactile cues.

This is confirmed in the assumed pre-movement times within both BS DD:240 and where they are reproduced in the Fire Engineering Guidelines and the SFPE Handbook. Reference to Tables 12.6 and 12.7 of this document provide an indication of the different times (for comparative purposes) for the response to cues with an "alarm bell" is provided – listed as 7 minutes for an "Average Scenario" and for those where the warning system is dependent "On an intrinsic cue other than visual and to warn next person outside enclosure of fire origin or >10m from fire" – listed as 12 minutes for an "Average scenario". An approximate 5 minute improvement in pre-movement.

The proposed sprinkler system is likely to warn occupants, early in the development phases of a fire, where the separation is not likely to be exposed to threatening temperatures.

It is therefore considered that the risk to occupants from fire spread to the stair via the storage does not present any appreciable increase in risk, in comparison with a building that meets the deemed-to-satisfy provisions of the BCA.

6.2.10 Assessment against the Relevant Performance Requirement CP2, DP5 and EP2.2

The analysis has considered whether sufficient protection has been afforded to the egress route with regard to –

(a) the number of storeys connected by the exits – The number of storeys was implicitly considered in the inter-comparative assessment (2 storeys)

(b) The fire safety systems installed – Active systems were considered within the analyses. The building is provided with a smoke detection system and sprinkler protection The passive protection has been assessed with regard to the fire separation afforded to occupants

(c) Function or use of the building – The stairs are located within a public assembly building. The analysis has considered occupant egress, which has implicitly had regard for the:

 (i) the ventilation available
 (ii) the area of the compartment
 (iii) the fire load

 The time to intervention by the fire brigade will however dictate the period of fire exposure, which in this instance is expected to be consistent (or less) with that of a deemed-to-satisfy building solution.

(d) The number of storeys through passed by the exit – The above explicitly considers the number of storeys connected by the exit (2) and the number of storeys passed through by the exit (2). This is not adverse when compared with a 2-storey Class 9b of Type B construction with 200m² mezzanine, permitted a non-fire-isolated stair

(e) Fire brigade Intervention - Fire brigade intervention is not likely to be adversely affected for a fire in the ground floor, where the storage under the stair occurs. In the event of search and rescue a protective stream will also cover the distance to the stairs.

 It is therefore considered that the performance requirements CP2, DP5 and EP2.2 are satisfied to the degree necessary.

6.2.11 Conclusion

Based on the above, with regard to the provision of storage below the stairs that are required to be fire-isolated, it is considered that the performance requirement CP2, DP5 and EP2.2 are satisfied to the degree necessary.

6.3 Egress from the Platform Areas

6.3.1 Introduction

The following variations from the deemed-to-satisfy provisions of the BCA will be considered within this section of the report:

Table 16: Variations from BCA DtS Provisions

DtS Clause	Description of Variation from BCA DtS Provisions	Performance Requirements
D1.4(d)	The provision of an extended distance of travel of 30m in lieu of 20m in platform areas	DP4, EP2.2

6.3.2 Identification of Egress Provisions under Consideration

Figure 31 shows the egress provisions that vary from the relevant BCA DtS Provision.

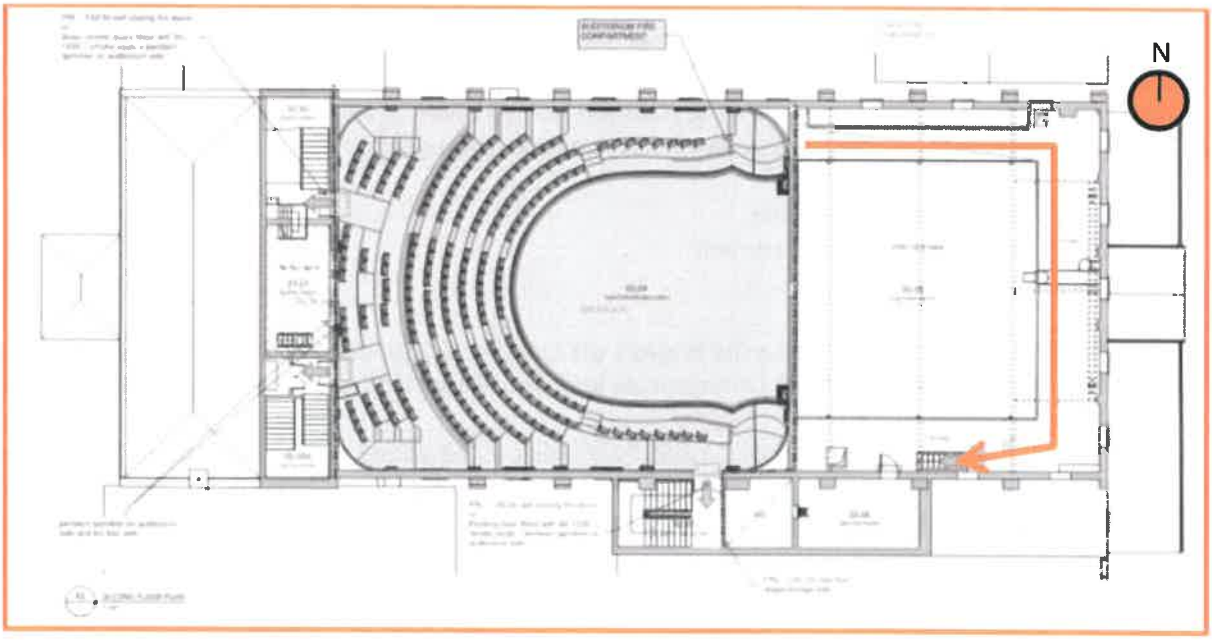

Figure 31: Egress via Second Floor Platform of 30m to single exit and non sprinkle protected auditorium

6.3.2.1 Relevant BCA Performance Requirements

6.3.2.1.1 Distance of Travel and Number of Exits

The relevant BCA performance requirements associated with the provision of number and exits and the distance of travel to an exit is DP4, reproduced below.

DP4 Exits must be provided from a building to allow occupants to evacuate safely, with their number, location and dimensions being appropriate to-
(a) the travel distance; and
(b) the number, mobility and other characteristics of occupants; and
(c) the function or use of the building; and
(d) the height of the building; and
(e) whether the exit is from above or below ground level.

6.3.2.1.2 Condition in Egress Routes (General)

Performance requirement EP2.2, is associated with maintaining tenable conditions within the egress route, reproduced below.

EP2.2
(a) In the event of a fire in a building the conditions in any evacuation route must be maintained for the period of time occupants take to evacuate the part of the building so that-
  (i) the temperature will not endanger human life; and
  (ii) the level of visibility will enable the evacuation route to be determined; and
  (iii) the level of toxicity will not endanger human life.

(b) The period of time occupants take to evacuate referred to in (a) must be appropriate to-
  (i) the number, mobility and other characteristics of the occupants; and
  (ii) the function or use of the building; and
  (iii) the travel distance and other characteristics of the building; and
  (iv) the fire load; and
  (v) the potential fire intensity; and
  (vi) the fire hazard; and
  (vii) any active fire safety systems installed in the building; and
  (viii) fire brigade intervention.

6.3.2.2 Intent of the BCA

6.3.2.2.1 BCA Clause D1.4 – Distance of Travel

BCA DtS Provision D1.4 prescribes that in Class 5 to 9 buildings, "no point on a floor must be more than 20 m from a single exit, or a point from which travel in different directions to 2 exits is available ("point of choice"), in which case the maximum distance to one of those exits must not exceed 40 m."

The BCA Guide states that the intent with D1.4 is to maximise the safety of occupants by enabling them to be close enough to an exit to safely evacuate. However the guide acknowledges that the travel distances specified in the DtS Provisions are arbitrary.

Performance requirement EP2.2 state that occupants must be given time to evacuate before the onset of untenable conditions. EP2.2(a) specifies these conditions as dangerous temperatures, low visibility and dangerous levels of toxicity.

6.3.3 Hazard Identification

6.3.3.1 Key Hazards

With an extended travel distance it could take longer for the occupants to evacuate than in a compliant building, putting occupants at undue risk in the event of fire. There is also an increased risk that the egress path could be blocked by fire or that occupants would have to travel through hazardous smoke conditions to get out of the building.

6.3.3.2 Referenced Statistics

For the purpose of identifying the relative increase to occupants by the provision of an extended distance of travel to an exits reference is drawn to the area of fire origin.

Within public assembly buildings, the greatest proportion of fire starts are by open suspicious incendiary causes (22%) as shown in Figure **4** with 7.6% of fires being located within egress routes (Figure **5**). These areas have a greater degree of public access and may skew the results. The greatest proportion of fire by area of origin is within the cooking areas at 32.2%, storage areas at 12.6%, lavatories etc at 10.2% - refer Figure **5**.

US statistics report that 4,800 construction fires (noting the backstage area is treated as a construction site) occur annually [2011 Fire Safety International Conference]. The primary reported cases of construction fires are 41% suspicious acts, 30% open flame and 5% smoking . NFPA indicated that construction fired represent 6% of those reported and 13% financial loss. Portable heating accounts for 25%, cutting/welding equipment 20% and smoking/matches 15% [SFS NSW].

6.3.4 BCA Clause A0.5 Assessment Method

The approach adopted will utilise a quantitative deterministic and qualitative inter-comparison as described by A0.5(b)(ii) and A0.5(d), respectively to demonstrate compliance with the Performance Requirements, as shown below.

Table 17: Assessment Methods in accordance with BCA Clause A0.5

BCA Clause A0.5
The following Assessment Methods, or any combination of them, can be used to determine that a Performance Solution or a Deemed-to-Satisfy Solution complies with the Performance Requirements, as appropriate: (a) Evidence to support that the use of a material or product, form of construction or design meets a Performance Requirement or a Deemed-to-Satisfy Provision as described in A2.2. **(b) Verification Methods such as —** (i) the Verification Methods in the NCC; or **(ii) such other Verification Methods as the appropriate authority accepts for determining compliance with the Performance Requirements.** (c) Expert Judgement. **(d) Comparison with the Deemed-to-Satisfy Provisions.**

6.3.5 Fire Safety Measures for the Alternative Building Solution

The fire safety measures listed in Table 9 form the holistic fire safety design for the Alternative Building Solution, and incorporate the additional design measures prescribed within §1.3.

6.3.6 Methodology of Fire Engineering Analysis

6.3.6.1 Introduction

A quantitative and deterministic and qualitative and comparative analysis will be undertaken for the following –

(i) A comparison of the Available Safe Egress Time (ASET) versus the Required Safe Egress Time (RSET), for occupant egress, will be made using –

a. Fire Modelling to ascertain the available time before the onset of untenable condition; and
b. Egress Calculations to ascertain time required to evacuate the building

6.3.6.2 Fire Scenario and Fire Size

6.3.6.2.1 Fire Scenarios

This analysis will considered a fire in the following areas -

(i) Scenario 2 - fire in the centre stage area – no sprinkler activation /proscenium closed – Refer Appendix D2

With proscenium shut the volume for filling is reduced, providing a more conservative outcome.

6.3.6.2.2 Discounted Fire Scenarios

A fire in the backstage areas that are fire separated has not been considered.

6.3.6.2.3 Fire Size

The fire sizes have been assumed be

(i) Smoke filling - A 5MW medium t^2 fire* in the stage/back stage area consistent with the maximum fire size to be catered for under BCA Specification E2.2b, in a Class 9b sprinkler protected building. The area under consideration is sprinkler protected, though the sprinklers are not assumed to activate.

For reference wooden pallets 10ft high (approx 3.05m high) yield a heat release rate of 6,800kW/m² of paletts [Quintiere].

6.3.6.2.4 Fire Growth Rate

In NFPA 72 Appendix B a series of growth rates are presented timber pallets (B2.3.2.2.2) were assigned medium growth (where the heat release 1MW at 150 seconds).

A sofa with test data present in MFPA 72 B2.3.2.3.5 shows a sofa reaching 1MW at 150 seconds (which aligns with a medium t^2 fire).

It is expected that larger potential fuel sources on the stage would align with a medium t^2 growth rate – Refer Appendix F.

6.3.6.2.5 Fire Modelling/Methods – Smoke Filling

The growth and development of a fire within the compartment will be predicted to determine the available safe egress time for occupants, assuming a severe credible fire scenario within a building.

The time fire growth and fire spread have been predicted using CFAST 6.2.0 [Jones] (Consolidated Fire And Smoke Transport model). Experimental comparisons are contained within the supporting literature for this software demonstrating the efficacy in using the software to predict fires in small compartments, and spread through corridors and multiple compartments. The use of CFAST for modelling fires in relatively large volumes has successfully been demonstrated in studies by Chow and Duong [Chow WK] [Duong].

For very large compartments, outside the range of experimental validity, a multi-cell approach to the fire modelling has been implemented. The validity in using such an approach for large compartments has been demonstrated by Chow [Chow]. The results obtained were demonstrated as being conservative as there would be an additional drop in smoke layer through the horizontal opening connecting the compartments. CFAST V6.2.0 has the additional capability of simulating spread spatially between zones given each zone may be defined relative to each other, and openings are defined relative to the position of the zone.

The major limitation of zone models is the lack of details within the zone. Variations of temperatures and densities within the zone (eg. stratification and turbulence) are not modelled. Similarly any locally turbulent mixing induced by a sprinkler system activating is not considered. For the purposes of this analysis, details of such effects are not necessary and therefore it is considered appropriate to use the zone model approach.

Compartment dimensions, opening locations and sizes were determined from the drawings provided.

6.3.6.3 Occupant Egress Modelling/Methods

6.3.6.3.1 General Evacuation Relationships

The time for evacuation of a building, t_{evac}, using the evacuation methodology outlined in by Nelson and Mowrer [Nelson and Mowrer] and BSI DD240:Part 1:1997 [BSI DD240 : Part 1:1997] is represented by the equation:

$$t_{evac} = t_{alarm} + t_{pre} + kt_{flow} \tag{C1}$$

where t_{alarm} = time for alarm to be raised
t_{pre} = time for pre-movement
k = factor of safety for travel time (assumed to be **2.0** correct operation of sub-systems and **1.5** for failure of a sub-system (eg sprinkler failure or proscenium)
t_{flow} = time for travel

Appendix C1 presents the methodology for occupant alarm time/cue times, movement and pre-movement times.

6.3.7 Acceptance criteria (Alternative Verification Method)

6.3.7.1 Smoke Filling Exposure Limits for Occupants

The tenability criteria for occupants, selected to determine ASET for this analysis are as follows:

(i) Visibility limit exceeded when smoke layer is below 2.0m and an increase in smoke layer temperature of 15°C.

(ii) Movement through smoke limit exceeded when smoke layer is below 2.0m and smoke layer temperature exceeds **100°C***

(iii) Smoke layer >183°C, the conventional tenability criterion based on radiation, where the radiation imposed by the smoke layer exceeds 2.5kW/m² - equivalent to a temperature of the smoke layer exceeding 183°C. This value has been identified in the Fire Engineering Guidelines as having a tolerance time for an occupant of >5 minutes, which would permit them to move away from the immediate area. This criterion has been discounted when in the local vicinity of the fire, where the cues presented to occupants are considered likely to result in a rapid evacuation from this area.

* From the Fire Engineering Guidelines a convective heat exposure of **100°C is adopted when sprinklers are not provided (or do not operate).**

In the event of sprinkler activation there is a high degree of moisture in the smoke layer a temperature of 60 °C is adopted as the maximum temperature for smoke exposure.

- **Convected Heat**

Breathing of fire gases can cause heat stroke (or hypothermia). Convected heat can also cause skin burns. In both cases the degree of saturation of the air by water vapour is important.

Table 4.2 provides some useful data on convected heat.

Table 4.1 Limiting Conditions for Tenability Caused by Heat

Temperature / Humidity Conditions	Tolerance Time
< 60°C saturated	> 30 min
60°C, < 1% H_2O	12 min
160°C, < 1% H_2O	1 min

For most buildings, a temperature limit of 100°C is reasonable for exposure to convected heat. However, for particularly susceptible occupants, such as hospital patients, where escape times will be long, consideration should be given to using 60°C as one life safety criteria.

Figure 32: FEG 1996

6.3.7.2 Smoke Filling Exposure Limits – Fire Brigade

The criteria for tenability and safety, for fire brigade personnel as prescribed within MFB Guidelines GL-17, as depicted below –

<u>Extreme Condition</u>

These conditions would be encountered in a snatch rescue situation or a retreat from a flashover.

- Maximum Time: 1 minute
- Maximum Air Temperature: 160 °C (in lower layer)
- Maximum Radiation: 4 - 4.5 kW/m^2

Critical Conditions
Fire-fighters would not be expected to operate in these conditions, but could be encountered. These conditions are considered to be life threatening:

- Time: < 1 minute
- Air Temperature: > 235 °C (in lower layer)
- Radiation: > 10 kW/m2

6.3.8 Analysis and Discussion

6.3.8.1 Quantitative Analysis – Available Safe Egress Time (ASET)

The time to exceed the nominated acceptance criterion for the proposed Performance Solution at 2m above the platform at 7m are presented within Table 18 below (Refer Appendix D2.2 for fire modelling)

The time to exceed the nominated acceptance criterion for the proposed Performance Solution -

Table 18: ASET

Scenario	Compartment	Smoke Layer Height <2.0m and Temp > 35°C (Seconds) At 9m elevation	Smoke Layer Height <2.0m and Temp > 100°C (Seconds) At 9m elevation	Smoke Layer Temperature >183°C (2.5kW/m²) (Seconds) At 9m elevation
5MW Fire in Stage Proscenium Shut	**Compartment 6** Stage	396	519	643

6.3.8.2 Quantitative Analysis – Required Safe Egress Time (RSET)

6.3.8.2.1 General Egress Relationship for RSET

The Required Safe Egress time can be expressed by the following relationship.

$$t_{evac} = t_{alarm} + t_{pre} + kt_{flow}$$

6.3.8.2.2 Stage Fire Fire Key Events (t_{alarm})

The following key events were modelled:

- Smoke layer 10% of floor to ceiling height in 35 seconds
- Smoke layer 20% of floor to ceiling height in 50 seconds
- Fire at 1MW at >290 Seconds
- Sprinkler operate at 409 seconds (assumed not to suppress or control the 5MW fire for conservatism)

6.3.8.2.3 Flow Time (kt_{Flow})

The maximum distance of travel to the exit is as follows (noting two exits are provided):

- From Remote Corner: (30m /1.25) *1.5 = 36 i.e. $k\,t_{travel}$ = 36s

6.3.8.3 ASET versus RSET

The following table depicts the comparison between the Available Safe Egress Time (ASET), versus the Required Safe Egress Time (RSET)

Table 19: ASET versus REST

Scenario	Occupant Location	t_{alarm} (s)	t_{pre} (s)	k $t_{travel\ time}$ (s) Where k = 1.5	RSET (s)	ASET (s)		
						Smoke Layer Height <2.0m and Temp > 35°C (Seconds) At 9m elevation	Smoke Layer Height <2.0m and Temp > 100°C (Seconds) At 9m elevation	Smoke Layer Temperature >183°C (2.5kW/m²) (Seconds) At 9m elevation
5MW Fire in Stage Proscenium Shut	**Comp 6** Stage	120*	120	36	**276**	**396**	519	643

*When proscenium begins to close (visual cue)

The acceptance criterion is satisfied if the time to untenable conditions in the considered building (ASET) is greater than the potential increase in flow time attributed to the extended distance of travel i.e. ASET > RSET = >396 > 276 => O.K

Note this assumes a factor of safety of **1.5** (sprinkler failure) and a 120 second pre-movement time within the evacuation (RSET) considerations.

The analysis and discussion presented, the proposed Performance Solution, has been demonstrated to have a level of safety in fire associated with egress at least consistent or better than building solutions, which comply with the deemed-to-satisfy provisions of the BCA (and consistent with the referenced statistics in Figure **7**, the risk to life in auditoriums is likely to be low).

6.3.8.4 Qualitative – Risk of being blocked in the compartment of fire origin

6.3.8.4.1 Introduction

The ASET/RSET quantitative analysis has implicitly considered the risk of entrapment to the exit. However the exit is in larger 2-storey fire compartment with up to 80m permitted to outside (or once in a fire stair the distance is no longer included).

The following will consider the overall risk of entrapment in the compartment of origin (permitted to be up to 80m under BCA Clause D1.9).

6.3.8.4.2 Relative Likelihood of Fire Blocking Egress on the Way to the exit

It is considered that occupant in the Performance Solution, are more likely to be blocked on their way the single exit (30m away), when compared with a DtS Class 9b building permitted to travel up to 20m from a "dead end" or before they can be directed to the nearest of two exits up to 40m away.

When comparing the risk of entrapment from a dead end in a DtS building (which can be up to 20m), the risk to occupants in the Subject building, is likely to be 50% greater than that of DtS building (=30m/20m)

6.3.8.4.3 Relative Likelihood of Fire Blocking Egress from the Stair Discharge to Outside

In a DtS building occupants are permitted to travel from up to a further 20m from the point of discharge from a non fire-isolated stair (or 40m when 2 directions are available).

For the subject building it is 10m horizontally in the stair, plus further 6m to safe haven to proscenium fire wall (a separate fire compartment or 6m to a smoke stair).

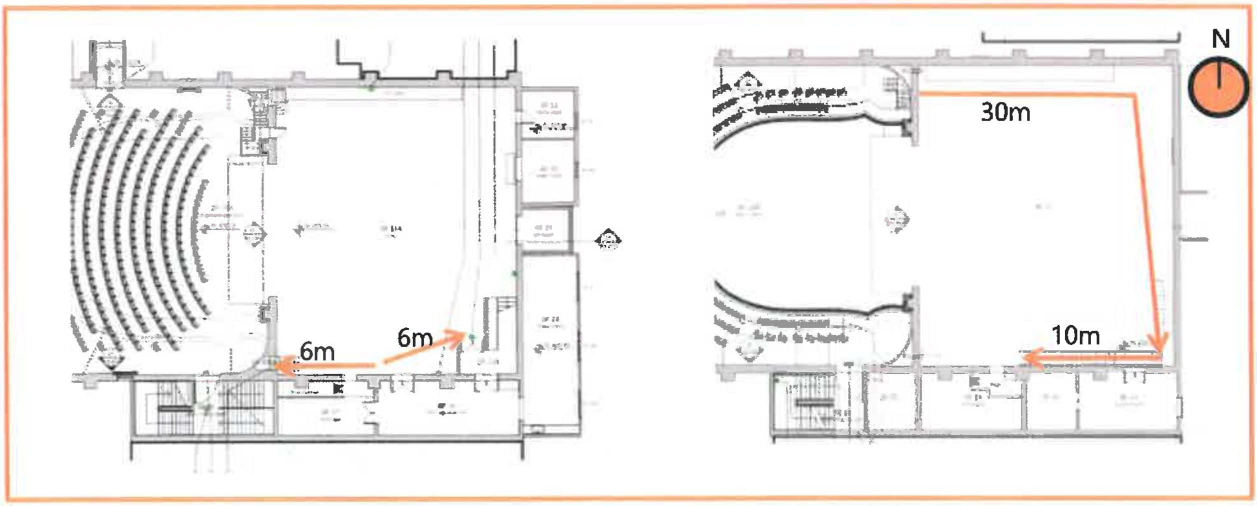

Figure 33: Overall distance to Safe Haven in compartment of origin (46m)

When comparing the risk of entrapment from the point of discharge to a safe haven when 2 directions are available with a DtS building (which can be up to an additional 40m), the risk to occupants in the Subject building, is likely to be 15% that of DtS building (=6m/40m) .

6.3.8.4.4 Summary of Relative Risk Based on Number of Exits and Distance to Exits and overall compartment size

With regard to the relative risk to occupants when compared with a DtS building -

(a) the relative risk to that of a DtS solution is immediately 1.5 times greater at the mezzanine level; and

(b) the relative risk based on the distance of travel to the outside is 0.15 times that of a DtS solution that of a DtS solution

Based on the above the combined risk of entrapment within the fire compartment when compared to a DtS Building over two levels -

= 1.5 x 0.15 x DtS solution = 0.225 that of DtS solution.

Noting travel overall travel is permitted in a single fire compartment (and up to 80m permitted under BCA Clause D1.9).

It is therefore expected that the overall risk to occupants is lower than for a DtS building solution (given sprinklers are provided).

6.3.8.5 Improvement in Occupant Warning

Note the following is provided to improve occupant warning in the event that the occupant either does not hear the occupant warning system or does not smell the smoke within the compartment of origin –

- Ensure building occupant warning speaker and strobe is provided at far end of fly platform

6.3.9 Assessment against the Relevant Performance Requirement of DP4 and EP2.2

A quantitative and qualitative analysis has been performed to examine the relative safety in fire of the proposed building solution. The quantitative analysis undertaken has considered the likely conditions within the egress route, taking into account the size and height of the building.

The larger area increases the volume for potential smoke filling and hence increases the time available before the visibility criteria and exceeded. It was determined that the additional occupant warning and increase in visibility would offset the extended distance of travel, thus demonstrating that the proposed building solution would be as safe, or safer than, a building solution with compliant number of exits on the basement or ground floor.

The analysis has had regard for the following parameters of performance requirements DP4 and EP2.2 -

(a) *The travel distance* – the overall distance of travel was explicitly considered within the analysis. Note it is not adverse when compared with overall distance permitted within a fire compartment, permitted to be up 80m under BCA Clause D1.9.

(b) *The number, mobility and other characteristics of occupants* - The mobility and characteristics of occupant are likely to be equivalent to DtS building.

(c) *The function of the building* – The building functions as a stage area. Occupants are likely to be alert, awake and able to respond to cues of fire.

(d) *The height of the building* – Height dictates the fire safety systems required, the overall distance for occupant to travel and fire brigade access. In this instance, the building is provided with a sprinkler system. The available volume has extended the time for smoke filling and allows occupants to egress prior to the onset of untenable conditions. Provided fire hydrant coverage is achieved to AS2419.1, it is considered that fire brigade activities will not be adversely affected in this sprinkle protected fire compartment.

(e) *Whether the exits are above or below ground level* - The exit is above ground level, where the provision of sprinklers are likely to limit the fire size (though do not operate prior to occupant egress). The exits are fire isolated in this instance, thereby limiting the risk of occupants travelling in the same direction as smoke flow. The fire brigade will be likely to be presented with a sprinkler protected fire, facilitating fire brigade intervention activities.

(f) *The fire load, fire intensity and fire hazard* – The fire load density is expected to be consistent with a DtS building. The fire scenario included a 5MW fire, consistent with that prescribed in BCA Clause E2.2b for smoke hazard management in Class 9b (the non sprinkler protected case for conservatism). The fire intensity in latter stages of the fire would not be expected to be adverse when compared with any other DtS Class 9b building of Type A construction < 5,000m² with sprinkler protection

(g) *active fire safety systems in the building* – sprinklers provide a more reliable means of warning to occupants in the event that other cues have not been recognized and suppression/control of the fire. The sprinklers also provide direct notification to the fire brigade and will be likely to limit fire development

(h) *fire brigade intervention* – fire brigade activities are not likely to be adversely affected provided AS2419.1 fire hydrant coverage is provided. The fire brigade is also likely to be presented with a sprinkler-controlled fire, thereby facilitating intervention activities.

6.3.10 Conclusion

Based on the above, with regard to the provision of an extended distance of travel of 30m in lieu of 20m to a single exit, it is considered that the performance requirements DP4 and EP2.2, are satisfied to the degree necessary.

6.4 Provision of Non Sprinkler Protected Areas (Auditorium)

6.4.1 Introduction

The following variations from the deemed-to-satisfy provisions of the BCA will be considered within this section of the report:

Table 20: Variations from BCA DtS Provisions associated with New Refurbishment Works

DtS Clause	Description of Variation from BCA DtS Provisions	Performance Requirements
BCA Clause E1.5 Spec E1.5 Clause 3 Inter-alia AS 2118.1 Clause 3.1.1.3	The provision of a sprinklers system that does not include fire separation between sprinkler protected and non sprinkler protected areas. [Sprinkler protection above, though not within the auditorium]	CP2, EP1.4

6.4.2 Identification of Variations From DtS Provisions

Figure 34 shows the extent and location variations from DtS the provisions.

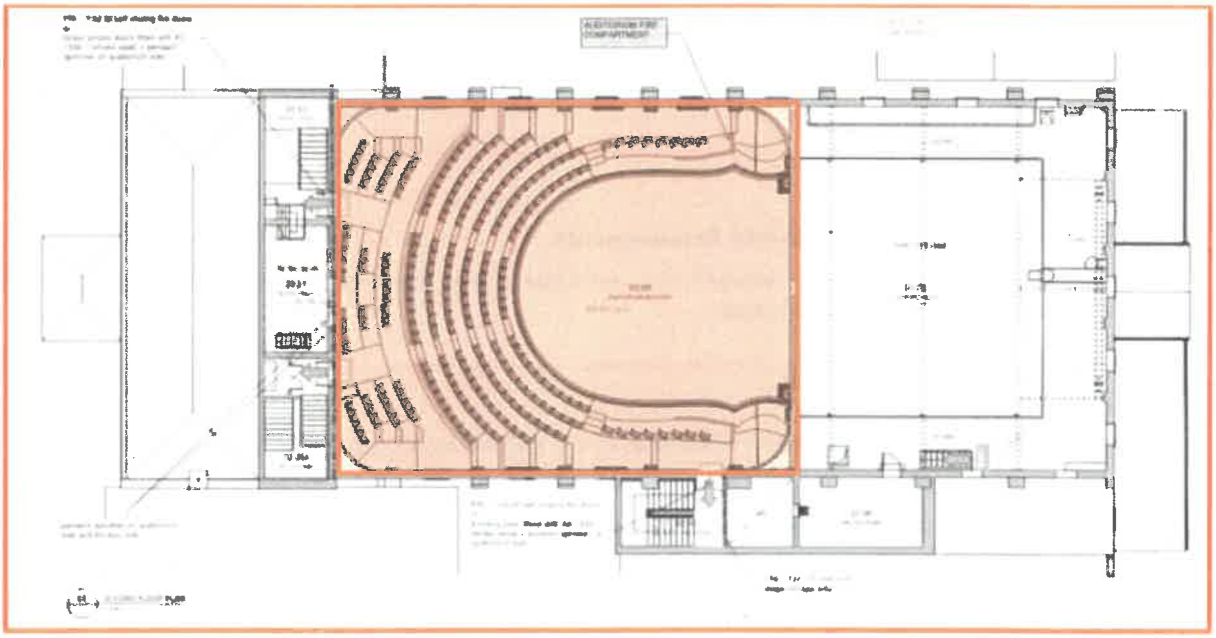

Figure 34: Egress via Second Floor Platform of 30m to single exit and non sprinkle protected auditorium

6.4.3 BCA Requirements and Intent

6.4.3.1 Relevant Deemed-to-Satisfy Provisions

6.4.3.1.1 Sprinkler Protection

When not provided with a proscenium curtain, the building is required to be provided with AS 2118.1 sprinkler protection throughout. Where sprinkler protected and non sprinkler protected areas are provide they are to be fire separated under BCA Specification 1.5 Clause 3/AS 2118.1 Clause 3.1.1.3 (reproduced below).

3. Separation of sprinklered and non-sprinklered areas

Where a part of a building is not protected with sprinklers, the sprinklered and non-sprinklered parts must be fire-separated with a wall or floor which must—

(a) comply with any specific requirement of the Deemed-to-Satisfy Provisions of the BCA; or

(b) where there is no specific requirement, comply with the relevant part of AS 2118

3.1.1.3 Classification as sprinkler-protected area

Where it is proposed to protect a portion of a building only, for that portion to be classified as a sprinkler-protected area, it shall be sprinkler-protected throughout and shall be separated from non-sprinkler-protected areas by a construction having an FRL of not less than –/120/120 with the exception of those areas contained in Clause 3.1.3.

Where the sprinkler-protected building is linked to a non-sprinkler-protected area by a roofed connection (e.g. roofed passageway, roofed ramp or tunnel), protection shall extend to a wall having an FRL of not less than –/120/120. The wall shall extend from top to bottom and side to side of the passageway, ramp or tunnel, with any door or shutter in the wall being a listed fire door or fire shutter. Where the wall is located at the junction with the non-sprinkler-protected building, the link shall be sprinkler-protected.

6.4.3.2 Relevant BCA Performance Requirements

The relevant BCA performance requirements associated with the avoidance of the spread of fire in a building is and CP2, reproduced below:

CP2

(a) A building must have elements which will, to the degree necessary, avoid the spread of fire —

- (i) to *exits*; and
- (ii) to *sole-occupancy units* and *public corridors*; and
- (iii) between buildings; and
- (iv) in a building.

(b) Avoidance of the spread of fire referred to in **(a)** must be appropriate to—

- (i) the function or use of the building; and
- (ii) the *fire load*; and
- (iii) the potential *fire intensity*; and
- (iv) the *fire hazard*; and
- (v) the number of *storeys* in the building; and
- (vi) its proximity to *other property*; and
- (vii) any active *fire safety systems* installed in the building; and
- (viii) the size of any *fire compartment*; and
- (ix) *fire brigade* intervention; and
- (x) other elements they support; and
- (xi) the *evacuation time*.

The relevant BCA performance requirements associated with the provision of an automatic fire sprinkler system is EP1.4. This performance requirement is stated as follows:

> **EP1.4** An automatic fire suppression system must be installed to the degree necessary to control the development and spread of fire appropriate to-
> (a) the size of the fire compartment; and
> (b) the function or use of the building; and
> (c) the fire hazard; and
> (d) the height of the building.

The relevant BCA performance requirements associated with the provision of maintaining tenable conditions in the egress route is EP2.2, reproduced below:

> **EP2.2**
> (a) In the event of a fire in a building the conditions in any evacuation route must be maintained for the period of time occupants take to evacuate the part of the building so that-
> (i) the temperature will not endanger human life; and
> (ii) the level of visibility will enable the evacuation route to be determined; and
> (iii) the level of toxicity will not endanger human life.
>
> (b) The period of time occupants take to evacuate referred to in (a) must be appropriate to-
> (i) the number, mobility and other characteristics of the occupants; and
> (ii) the function or use of the building; and
> (iii) the travel distance and other characteristics of the building; and
> (iv) the fire load; and
> (v) the potential fire intensity; and
> (vi) the fire hazard; and
> (vii) any active fire safety systems installed in the building; and
> (viii) fire brigade intervention.

6.4.3.3 Intent of the BCA

6.4.3.3.1 Proscenium Curtain DtS Provisions

The Guide to the BCA state the intent of BCA Clause H1.2 is protect the audience in a theatre or public hall from a fire on the **stage** by either -

- the installation of a sprinkler system; or
- the construction of a proscenium wall between the stage and the audience area.

Accordingly the provision of a proscenium curtain and sprinkler protection is likely to cover the greatest risk to occupants. i.e. from the stage.

6.4.3.3.2 Sprinklers DtS Provisions

The Guide to the BCA states that the intent of BCA Clause E1.5, requires the installation of suitable fire sprinkler systems where necessary to address specific hazards.

The design of a sprinkler system is based on the size and intensity of an assumed fire in the building. The BCA assumes that fire size is controlled by the sprinkler system.

Unless a fire wall or other construction with the appropriate FRLs separates parts of a building required to have sprinklers from a part of a building not required to have sprinklers, then the sprinkler requirements must be applied to the whole building.

Separation between sprinklered and non-sprinklered parts Clause 3(a) applies wherever there is a specific Deemed-to-Satisfy Provision.

The fire separation required by AS 2118.1 may differ from that required by the BCA. Clause 3(b) clarifies that if a difference exists between AS 2118.1 and the BCA, the BCA takes precedence.

AS 2118.1 generally requires a 120/120/120 FRL separation between the sprinklered and non-sprinklered parts of a building to minimise the risk of fire spread from non-sprinklered parts.

6.4.3.3.3 Performance Requirements

Performance Requirement CP2 is intended to deal with spread of fire both within the building and between buildings. Performance requirement CP8 requires openings and penetrations in building elements to resist the spread of fire.

The BCA Guide states that CP8 should be read in conjunction with CP2; CP8 deals with any opening or penetration within a building element, and CP2 deals with the building element itself.

FRLs are only included as part of the Deemed-to-Satisfy Provisions. The BCA Guide also states that it may be determined by a building proponent using an Alternative Solution that applying FRLs to building element is not necessary because other methods, can satisfy the Performance Requirements.

Performance requirement EP1.4 states that an automatic fire suppression system is regarded as part of a building's life safety package because:

- if the system extinguishes the fire before it fully develops, the fire will not endanger the occupants; and
- if the system limits or controls the spread of a fire, it allows occupants more time to evacuate to a safe place.

Performance requirement EP2.2 state that occupants must be given time to evacuate before the onset of untenable conditions. EP2.2(a) specifies these conditions as dangerous temperatures, low visibility and dangerous levels of toxicity.

6.4.4 Hazards Identification

6.4.4.1 Key Hazards

A stage and backstage area (>200m²) of a theatre or public hall has a high fire load due to the storage of props and scenery/etc.

If a fire starts in a non-sprinklered part of the building, its development will be uncontrolled. It can even reach a size which could over-run the sprinkler system if it spreads to the sprinklered part of the building (i.e. it could be beyond the design capacity of the system).

For a theatre, the area of greatest risk to occupants is the stage and back stage areas/areas above, which are either fire separation and sprinkler protection.

6.4.4.2 Referenced Statistics

Within public assembly buildings, the greatest proportion of fire starts are by open suspicious incendiary causes (22%) as shown in Figure **4** with 7.6% of fires being located within egress routes (Figure **5**). These areas have a greater degree of public access and may skew the results. The greatest proportion of fire by area of origin is within the cooking areas at 32.2%, storage areas at 12.6%, lavatories etc at 10.2% - refer Figure **5**.

US statistics report that 4,800 construction fires (noting the backstage area is treated as a construction site) occur annually [2011 Fire Safety International Conference]. The primary reported cases of construction fires are 41% suspicious acts, 30% open flame and 5% smoking . NFPA indicated that construction fired represent 6% of those reported and 13% financial loss. Portable heating accounts for 25%, cutting/welding equipment 20% and smoking/matches 15% [SFS NSW].

6.4.5 Fire Safety Measures for the Alternative Building Solution

The fire safety measures listed in Table 9 form the holistic fire safety design for the Alternative Building Solution, and incorporate the additional design measures prescribed within §1.3.

6.4.6 BCA Clause A0.5 Assessment Method

The approach adopted will utilise a quantitative, comparative analysis for the purposes of utilising a combination of the Verification Method and a comparison with other building solutions, which comply with the BCA as described by A0.5 (b)(ii) and A0.5(d), as shown below.

Table 21: Assessment Methods in accordance with BCA Clause A0.5

BCA Clause A0.5
The following Assessment Methods, or any combination of them, can be used to determine that a Performance Solution or a Deemed-to-Satisfy Solution complies with the Performance Requirements, as appropriate: (a) Evidence to support that the use of a material or product, form of construction or design meets a Performance Requirement or a Deemed-to-Satisfy Provision as described in A2.2. (b) Verification Methods such as — (i) the Verification Methods in the NCC; or (ii) **such other Verification Methods as the appropriate authority accepts for determining compliance with the Performance Requirements.** (c) Expert Judgement. (d) **Comparison with the Deemed-to-Satisfy Provisions.**

6.4.7 Methodology of Fire Engineering Analysis

6.4.7.1 Introduction

An assessment incorporating a combination of quantitative and qualitative analysis has been performed. The analysis will review the intent of providing a proscenium curtain within the Guide to the BCA, and review the likely hazard to the occupants of the building in considering the following:

1. Comparing the relative safety with a building solution, which complies with the deemed-to-satisfy provisions of the BCA i.e. Stage/Auditorium of similar size sprinkler protected throughout in accordance with BCA Specification E1.5, which does not require a proscenium curtain; and
2. Comparing the relative safety with a building solution, which complies with the deemed-to-satisfy provisions of the BCA i.e. Stage/Auditorium of similar size non sprinkler protected throughout in accordance with BCA Specification E1.5, which is provided with a proscenium curtain; and
3. A combination of qualitative and quantitative analysis to assess the proposed altered building solution to meet the performance requirements of the BCA.

The assessment utilised the current performance requirements of the BCA and the requirements under the deemed-to-satisfy provisions of the BCA to form a benchmark in establishing the suitability of the building solution.

6.4.7.2 Quantitative Fire Engineering Assessment Methods in accordance with IFEG 2005

A quantitative and deterministic and qualitative and comparative analysis will be undertaken for the following –

(ii) A comparison of the Available Safe Egress Time (ASET) versus the Required Safe Egress Time (RSET), for occupant egress, will be made using –

a. Fire Modelling to ascertain the available time before the onset of untenable condition; and
b. Egress Calculations to ascertain time required to evacuate the building

6.4.7.3 Fire Scenario and Fire Size

6.4.7.3.1 Fire Scenarios

This analysis will considered a fire in the following areas -

(i) Scenario 1 - fire in the centre stage area – no sprinkler activation /proscenium open
(ii) Scenario 2 - fire in the centre stage area – no sprinkler activation /proscenium closed
(iii) Scenario 3 - A fire in auditorium*

*Note for a fire in the auditorium section a DtS building 2000m² (provided with a proscenium curtain) or the Subject building would present similar levels of risk to egressing occupants. This scenario has been presented for completeness, though is equivalent in risk to a DtS building.

6.4.7.3.2 Discounted Fire Scenarios

A fire in the backstage areas that are fire separated has not been considered.

6.4.7.3.3 Fire Size

The fire sizes have been assumed be

(ii) Smoke filling - A 5MW medium t^2 fire in the stage/back stage area consistent with the maximum fire size to be catered for under BCA Specification E2.2b, in a Class 9b sprinkler protected building. Note sprinkler not assumed to activate.

For reference wooden pallets 10ft high (approx 3.05m high) yield a heat release rate of 6,800kW/m² of paletts [Quintiere].

6.4.7.3.4 Fire Modelling/Methods – Smoke Filling

The growth and development of a fire within the compartment will be predicted to determine the available safe egress time for occupants.

The time fire growth and fire spread have been predicted using CFAST 6.2.0 [Jones] (Consolidated Fire And Smoke Transport model). Experimental comparisons are contained within the supporting literature for this software demonstrating the efficacy in using the software to predict fires in small compartments, and spread through corridors and multiple compartments. The use of CFAST for modelling fires in relatively large volumes has successfully been [Chow WK] [Duong].

For very large compartments, outside the range of experimental validity, a multi-cell approach to the fire modelling has been implemented. The validity in using such an approach for large compartments has been demonstrated by Chow [Chow]. The results obtained were demonstrated as being conservative as there would be an additional drop in smoke layer through the horizontal opening connecting the compartments. CFAST V6.2.0 has the additional capability of simulating spread spatially between zones given each zone may be defined relative to each other, and openings are defined relative to the position of the zone.

The major limitation of zone models is the lack of details within the zone. Variations of temperatures and densities within the zone (eg. stratification and turbulence) are not modelled. Similarly any locally turbulent mixing induced by a sprinkler system activating is not considered. For the purposes of this analysis, details of such effects are not necessary and therefore it is considered appropriate to use the zone model approach.

Compartment dimensions, opening locations and sizes were determined from the drawings provided.

6.4.7.3.5 Radiant of Flame to a Target (Seating)

For a fire developing on the stage that may impose a high radiant heat flux on the adjoining seating and at the proscenium controls, the following relationship will be adopted.

The relationship by Modak [Quintiere] will be adopted to determine the radiant heat flux to a target surface –

$$q_r'' = \frac{\chi Q}{R^2 4\pi}$$

Where R radius to the target

Q is the heat release rate = 5MW fire

χ fraction of total energy radiated based on soot yield of fire, from 0.15 for alcohol to 0.6 for sooty fires (0.3 adopted)

6.4.7.4 Occupant Egress Modelling/Methods

6.4.7.4.1 General Evacuation Relationships

The time for evacuation of a building, t_{evac}, using the evacuation methodology outlined in by Nelson and Mowrer [Nelson and Mowrer] and BSI DD240:Part 1:1997 [BSI DD240 : Part 1:1997] is represented by the equation:

$$t_{evac} = t_{alarm} + t_{pre} + kt_{flow} \quad (C1)$$

where t_{alarm} = time for alarm to be raised
t_{pre} = time for pre-movement
k = factor of safety for travel time (assumed to be **2.0** correct operation of sub-systems and **1.5** for failure of a sub-system (eg sprinkler failure or proscenium)
t_{flow} = time for travel

Appendix C1 presents the methodology for occupant alarm time/cue times, movement and pre-movement times.

6.4.7.4.2 Flow Time

The travel time can be expressed as a function of distance and speed. Refer Appendix C1.1.5.B for egress analysis methodology.

6.4.8 Acceptance criteria (Alternative Verification Method)

6.4.8.1 General

The acceptance criterion of this assessment shall be the objectives and functional statements associated with the performance requirements of CP2, CP8, EP1.4 and EP2.2 are satisfied by demonstrating the following:

1. The risk of fire spread from the Stage area to the adjoining auditorium area shall be consistent with a building solution, which complies with the deemed-to-satisfy provisions of the BCA.
2. In the event of sprinkler failure, quantitative analysis performed shall demonstrate for a severe credible fire scenario that occupants of the auditorium shall have sufficient time available to safely evacuate from this space before untenable conditions are likely to be reached.

6.4.8.2 Smoke Filling Exposure Limits for Occupants

The tenability criteria for occupants, selected to determine ASET for this analysis are as follows:

(i) Visibility limit exceeded when smoke layer is below 2.0m and an increase in smoke layer temperature of 15°C.

(ii) Movement through smoke limit exceeded when smoke layer is below 2.0m and smoke layer temperature exceeds **100°C***

(iii) Smoke layer >183°C, the conventional tenability criterion based on radiation, where the radiation imposed by the smoke layer exceeds 2.5kW/m² - equivalent to a temperature of the smoke layer exceeding 183°C. This value has been identified in the Fire Engineering Guidelines as having a tolerance time for an occupant of >5 minutes, which would permit them to move away from the immediate area. This criterion has been discounted when in the local vicinity of the fire, where the cues presented to occupants are considered likely to result in a rapid evacuation from this area.

* From the Fire Engineering Guidelines a convective heat exposure of **100°C is adopted when sprinklers are not provided** (or do not operate).

In the event of sprinkler activation there is a high degree of moisture in the smoke layer a temperature of 60 °C is adopted as the maximum temperature for smoke exposure – Refer Figure 32 .

6.4.8.3 Smoke Filling Exposure Limits – Fire Brigade

The criteria for tenability and safety, for fire brigade personnel as prescribed within MFB Guidelines GL-17, as depicted below –

Extreme Condition

These conditions would be encountered in a snatch rescue situation or a retreat from a flashover.

- Maximum Time: 1 minute
- Maximum Air Temperature: 160 °C (in lower layer)
- Maximum Radiation: 4 - 4.5 kW/m^2

Critical Conditions

Fire-fighters would not be expected to operate in these conditions, but could be encountered. These conditions are considered to be life threatening:

- Time: < 1 minute
- Air Temperature: > 235 °C (in lower layer)
- Radiation: > 10 kW/m2

6.4.8.4 Radiant Heat Flux Limits

The limiting radiant heat fluxes from on receiving surfaces and occupants have been based on those described within AS1530.4 Table A3, reproduced below:

TABLE A3

TYPICAL RADIANT HEAT INTENSITIES FOR VARIOUS PHENOMENA

Phenomena	kW/m^2
Maximum for indefinite exposure for humans	
Pain after 10 s to 20 s	4
Pain after 3 s	10
Piloted ignition of cotton fabric after a long time	13
Piloted ignition of timber after a long time	13
Non-piloted ignition of cotton fabric after a long time	25
Non-piloted ignition of timber after a long time	25
Non-piloted ignition of gaberdine fabric after a long time	27
Non-piloted ignition of black drill fabric after a long time	38
Non-piloted ignition of cotton fabric after 5 s	42
Non-piloted ignition of timber in 20 s	45
Non-piloted ignition of timber in 10 s	55

Therefore the following radiant heat flux limits are to be adopted –

(i) the radiant heat flux on adjoining combustibles shall not exceed 13kW/m^2.

(ii) the radiant heat flux shall not exceed 4kW/m^2 on occupants/staff..

6.4.9 Analysis and Discussion

6.4.9.1 Quantitative Fire Engineering Analysis

6.4.9.1.1 Introduction - Available Safe Egress Time (ASET) – Smoke Filling for Fires in Auditorium

A quantitative fire engineering analysis has been performed within Appendix D to assess the consequence of a rapidly growing fire occurring within the Stage area and potentially threatening the audience.

For conservatism, the operation of the fire sprinkler system within the stage area to suppress/control a fire was ignored. Reliance was placed on the smoke reservoir at the proscenium wall, large volume for smoke filling and an assumed 1% leakage of the building fabric.

Several conservative assumptions were made within the analysis including the following:

- Ignoring operation of fire sprinklers in the Central Stage Area
- Ignoring the operation of the smoke exhaust for Medium t^2 fire in centre stage and front of stage area
- Use of a factor of safety of **1.5** in considering the flow time in the calculation of RSET for a failure of a sub-system (eg sprinkler failure or proscenium failure).

This analysis demonstrated that the occupants are likely to be capable of evacuating from the auditorium, with some margin of safety before tenability criteria are threatened. i.e. the Available Safe Egress Time (ASET) is greater than the Required Safe Egress Time (RSET).

6.4.9.2 Scenario 1 - Fire in the Centre Stage Area Medium t^2 5MW Fire (Compartment 6) – No Sprinkler Operation – Proscenium Open (two fire safety sub-systems fail)

6.4.9.2.1 Smoke Filling Rate – ASET Considerations – Sprinkler Failure medium t^2 5MW Fire in Centre Stage Area (Compartment 6) – Refer Appendix D1 for Input and D2.1 for Results

The time to exceed the nominated acceptance criterion for the proposed Performance Solution in the tiered egress routes for a 5MW fire in the stage area are presented within Table 22 below (Refer Appendix D2.1 for fire modelling).

Table 22: Available Safe Egress Times (ASET) for Occupants for a Sprinkler Failure 5MW Fire in Centre Stage Area – Proscenium Open

Scenario	Occupant Location	Smoke Layer Height <2.0m and Temp > 35°C (Seconds)	Smoke Layer Height <2.0m and Temp > 100°C (Seconds)	Smoke Layer Temperature >183°C (2.5kW/m²) (Seconds)
5MW Fire in Stage Proscenium Open	Comp 13 (Rear SF- Balcony)	340	710	Did not occur

Note that occupants will be queuing at compartment second floor at the door (Compartment 13).

6.4.9.2.2 Fire Key Events (t_{alarm}) - Sprinkler Failure 5MW Fire in Stage Area (Compartment 6)

The following key events were modelled (Refer Appendix D2.1) and will impact occupant movement with regard to cues of fire:

- Smoke layer 20% of floor to ceiling height at **110** seconds
- Fire at 1MW at 290 seconds
- Sprinkler break at 490second (not assumed to suppress fire)

6.4.9.2.3 Flow Time (kt_{Flow})

The un-factored flow time from the balcony was determined in Appendix C2.2 (Table 46) to be 280. A factor of **1.5** is applied for to the movement time for the failure of one sub system.

Table 23: RSET for a 5MW Fire in Stage Area

Scenario	Occupant Location	t_{alarm} (s)	t_{pre} (s)	k $t_{travel\ time}$ (s) k = 1.5 sprinkler failure and proscenium failure	RSET (s)
5MW Fire in Stage Proscenium Open	Comp 13 (Rear SF- Balcony)	**110**	60	420 =**1.5** x (280)	**590**

6.4.9.2.4 ASET versus RSET – Sprinkler Failure 5MW Fire in Stage Area – Proscenium Open

The following table depicts the comparison between the Available Safe Egress Time (ASET), versus the Required Safe Egress Time (RSET)

Table 24: ASET versus REST for a Sprinkler Failure 5MW Fire in Stage Area

Scenario	Occupant Location	t_{alarm} (s)	t_{pre} (s)	k $t_{travel\ time}$ (s) k = 1.5 sprinkler failure and proscenium failure	RSET (s)	ASET (s)		
						Smoke Layer <2.0m and > 35°C	Smoke Layer <2.0m and > 100°C	Smoke Layer >183°C (2.5kW/m²)
5MW Fire in Stage Proscenium Open	Comp 13	**110**	60	420 =**1.5** x (280)	**590**	340	710	Did not occur

For sprinkler failure, the acceptance criterion for visibility limits is **NOT** satisfied as the time to untenable conditions in the considered building (ASET) is **NOT** greater than the potential flow time
i.e. ASET < RSET = 340 < 590 => **NOT O.K.**

The occupant queuing at the door are less reliant on the visibility criteria -

ASET > RSET = 710 > 590 => **O.K.**

Note this solution is not adverse when compared with a DtS building with a sprinkler failure and not required to be provided with a proscenium curtain. For the Subject building two fire safety subsystems have failed (the sprinklers and the proscenium).

The outcomes are equivalent to a DtS building with sprinkler failure (and not required to be provided with a proscenium) – and only one fire safety sub-system failure.

6.4.9.3 Scenario 2 - Fire in the Centre Stage Area Medium t^2 5MW Fire (Compartment 6) – No Sprinkler Operation – Proscenium Closes at 300 second (one fire safety sub-system fails)

6.4.9.3.1 Smoke Filling Rate – ASET Considerations – Sprinkler Failure medium t^2 5MW Fire in Centre Stage Area (Compartment 6) – Refer Appendix D1 for Input and D2.2 for Results

The time to exceed the nominated acceptance criterion for the proposed Alternative Building Solution in the tiered egress routes for a 5MW fire in the stage area are presented within Table 25 below (Refer Appendix D2.2 for fire modelling).

Table 25: Available Safe Egress Times (ASET) for Occupants for a Sprinkler Failure 5MW Fire in Centre Stage Area – Proscenium Shut at 300s

Scenario	Occupant Location	Smoke Layer Height <2.0m and Temp > 35°C (Seconds)	Smoke Layer Height <2.0m and Temp > 100°C (Seconds)	Smoke Layer Temperature >183°C (2.5kW/m²) (Seconds)
5MW Fire in Stage Sprinkler Failure Proscenium Closes	Comp 13 (Rear SF- Balcony)	720	Did not occur	Did not occur

Note that occupants will be queuing at compartment second floor at the door (Compartment 13).

6.4.9.3.2 Fire Key Events (t_{alarm}) - Sprinkler Failure 5MW Fire in Stage Area (Compartment 6)

The following key events were modelled (Refer Appendix D2.2) and will impact occupant movement with regard to cues of fire:

- Smoke layer 20% of floor to ceiling height at 110 seconds
- Proscenium begins to shut at **120s** – refer Appendix C1.1.3b (via warden over-ride)
- Proscenium half-way shut at **180s** – refer Appendix C1.1.3b (assumed occupant visual cue)
- Fire at 1MW at 290 seconds
- Proscenium shuts by 300s
- Sprinkler break at 490second (not assumed to suppress fire)

6.4.9.3.3 Flow Time (kt_{Flow})

The un-factored flow time from the balcony was determined in Appendix C2.2 (Table 46) to be 280. . A factor of **1.5** is applied for to the movement time for the failure of one sub system.

Table 26: RSET for a 5MW Fire in Stage Area

Scenario	Occupant Location	t_{alarm} (s)	t_{pre} (s)	k $t_{travel\ time}$ (s) k = 1.5 sprinkler failure	RSET (s)
5MW Fire in Stage Sprinkler Failure Proscenium Closes	Comp 13 (Rear SF- Balcony)	**180** proscenium halfway closed	60	420 =**1.5** x (280)	**660**

6.4.9.3.4 ASET versus RSET – Sprinkler Failure 5MW Fire in Stage Area – Proscenium Shuts

The following table depicts the comparison between the Available Safe Egress Time (ASET), versus the Required Safe Egress Time (RSET)

Table 27: ASET versus REST for a Sprinkler Failure 5MW Fire in Stage Area

Scenario	Occupant Location	t_{alarm} (s)	t_{pre} (s)	k $t_{travel\ time}$ (s) k = 1.5	RSET (s)	ASET (s)		
						Smoke Layer <2.0m and > 35°C	Smoke Layer <2.0m and > 100°C	Smoke Layer >183°C (2.5kW/m²)
5MW Fire in Stage Sprinkler Failure Proscenium Closes	Comp 13 (Rear SF-Balcony)	**180** proscenium halfway closed	60	420 =1.5 x (280)	**660**	720	Did not occur	Did not occur

The acceptance criterion is satisfied if the time to untenable conditions in the considered building (ASET) is greater than the potential flow time a i.e. ASET > RSET = **720** > **660** => O.K.

The safety of occupants relies on the presence of a fire warden to close the proscenium (for sprinkler failure).

6.4.9.4 Scenario 3 - Fire in the Auditorium Medium t² 5MW Fire (Compartment 8) – No Sprinklers

6.4.9.4.1 Smoke Filling Rate – ASET Considerations – Medium t² 5MW Fire in Auditorium (Compartment 8) – Refer Appendix D1 for Input and D2.3 for Results

The time to exceed the nominated acceptance criterion for the proposed Alternative Building Solution in the tiered egress routes for a 5MW fire in the auditorium are presented within Table 28 below (Refer Appendix D2.3 for fire modelling).

Table 28: Available Safe Egress Times (ASET) for Occupants for a Sprinkler Failure 5MW Fire in Centre Stage Area – Proscenium Shut at 300s

Scenario	Occupant Location	Smoke Layer Height <2.0m and Temp > 35°C (Seconds)	Smoke Layer Height <2.0m and Temp > 100°C (Seconds)	Smoke Layer Temperature >183°C (2.5kW/m²) (Seconds)
5MW Fire in Auditorium Lower	Comp 13 (Rear SF- Balcony)	430	855	Did not occur
	Comp 8 (Right Rear GF)	575	800	Did not occur

Note that occupants will be queuing at compartment second floor at the door (Compartment 13).

6.4.9.4.2 Fire Key Events (t_{alarm}) – Medium t² 5MW Fire in Auditorium (Compartment 8) – Refer Appendix D1 for Input and D2.3 for Result

The following key events were modelled (Refer Appendix D2.1) and will impact occupant movement with regard to cues of fire:

- Smoke layer 20% of floor to ceiling height at **64** seconds
- Fire at 1MW at 290 seconds

6.4.9.4.3 Flow Time (kt_{Flow})

The un-factored flow time from the balcony was determined in Appendix C2.2 (Table 46) to be 280. A factor of safety of **2.0** to movement time is applied (as technically no sub-systems have failed).

Table 29: RSET for a 5MW Fire in Stage Area

Scenario	Occupant Location	t_{alarm} (s)	t_{pre} (s)	k $t_{travel\ time}$ (s) k = 1.5 sprinkler failure	RSET (s)
5MW Fire in Auditorium Lower	Comp 13 (Rear SF- Balcony)	**64**	60	560 =**2.0** x (280)	**684**

6.4.9.4.4 ASET versus RSET – Medium t² 5MW Fire in Auditorium (Compartment 8) – Refer Appendix D1 for Input and D2.3 for Result

The following table depicts the comparison between the Available Safe Egress Time (ASET), versus the Required Safe Egress Time (RSET)

Table 30: ASET versus REST for a Medium t² 5MW Fire in Auditorium (Compartment 8)

Scenario	Occupant Location	t_{alarm} (s)	t_{pre} (s)	k $t_{travel\ time}$ (s) k = 1.5 proscenium closes though sprinkler failure	RSET (s)	ASET (s)		
						Smoke Layer <2.0m and > 35°C	Smoke Layer <2.0m and > 100°C	Smoke Layer >183°C (2.5kW/m²)
5MW Fire in Auditorium Lower	Comp 13 (Rear SF- Balcony)	**64**	60	560 =**2.0** x (280)	**684**	**430**	855	Did not occur

The acceptance criterion is **NOT** satisfied as the time to untenable conditions in the considered building (ASET) is not greater than the potential flow time

i.e. ASET < RSET = **430** < **684** => **NOT O.K visibility limit exceeded at the rear of balcony areas.**

The occupant queuing at the door are less reliant on the visibility criteria. Convective exposure limit not exceeded.

ASET > RSET = **855** > **684** => **O.K.**

Note however, for this scenario of an auditorium fire, the results are not adverse when compared with a DtS building provided with a proscenium curtain only and no sprinklers throughout the building.

6.4.9.5 Radiant Heat Flux Considerations

6.4.9.5.1 Radiant Heat Flux from Flames on Operator of Proscenium Curtain

A proscenium curtain is not required to be self closing. It is permitted to be closed manually by an operator. It is assumed that the building and the proscenium controls will be staffed when the audience numbers are high.

In a comparable DtS building (non sprinkler protected and provided with a proscenium curtain), the radiant heat fluxes imposed at location where an operator is required to manually close the curtain, can be imposed high radiant heat fluxes in the latter stages of a fire. Eg for a 10MW fire (2 x that to be designed for under smoke hazard requirements) the radiant heat flux can exceed 4kW/m².

Using the same dimensions as the Subject Building, for a fire at approximately centre stage the radiant heat flux at the proscenium controls was ascertained at 6m setback-

$$R = 6.0m$$

$$Q = 10{,}000kW$$

$$q_r'' = \frac{\chi Q}{R^2 4\pi} = 6.6kW/m^2$$

For a delayed response, in a DtS non sprinkler protected building, it cannot be guaranteed that the proscenium curtain can be shut. A high reliance is placed on (trained) staff being in attendance.

6.4.9.6 Safe Haven from Auditorium

Egress at the first and second floors, with protection to the stairs (from the auditorium) afforded by inherently fire resistant walls (of masonry construction).

It is intended that while the hot layer remains buoyant, that the inherent fire separation will provide a safe haven for wheel chair occupants, that are directed to not use the lift during a fire emergency.

6.4.10 Back of House Fire

6.4.10.1.1 Correct Operation of the Sprinkler System

The reduction in hot-layer temperatures by both sprinkler suppressed and sprinkler shielded fires is supported in the literature - reference to the CIBSE TM19:1995 [CIBSE TM19] for smoke control states a reasonable assumption for the maximum smoke layer temperature in a sprinkler controlled fire is 100°C. Mawhinney et al reported maximum temperatures of approximately 200°C from tests performed in enclosures up to 3.6m high (also [Madrzykowski][England]).

The corridors are expected to remain tenable in the event of sprinkler operation, with the areas of greater risk (organ areas), fire separated by a fire wall.

i.e. ASET > 20 mins.

6.4.10.1.2 Flow Time Results From Backstage Areas

The un-factored flow time from the backstage area was determined in Appendix C2.2 (Table 46) to be 325. A factor of **2.0** is applied to the movement time as no sub-systems have failed. Sprinklers operate and proscenium operates to protect occupants in the auditorium also.

Table 31: RSET for sprinkler protected fire backstage

Scenario	Occupant Location	t_{alarm} (s)	t_{pre} (s)	k $t_{travel\ time}$ (s) k = 1.0 or 1.5	RSET (s)	ASET (s)
Sprinkler protected Fire	Backstage	120	120	650 =2.0 x (325)s	890s (=14.8mins)	> 1200s

6.4.10.2 Fire Brigade Intervention Considerations

The following is a summary of the key results from the FBIM Estimation:

- First fire brigade appliance arrives on scene at 701 seconds (= 11.7 minutes) after alarm.
- Fire brigade setup completed, intervention underway on uppermost level 1762 seconds (=29.4 minutes) after alarm.

From a fire brigade intervention viewpoint, the building has access around the perimeter on 2 of 4 sides of the building via the street frontage and via the side stairs.

The impact on fire fighting is not likely to be adverse when considering the following -

- Stage Fire – the stage area is provided with sprinkler protection with the backstage area fire separated. For a fire commencing at in the stage area the fire brigade would be presented with a fire scenario consistent with a DtS sprinkler protected building
- Backstage Fire – The backstage area is fire separated (and sprinkle protected). For a fire commencing at in the backstage area the fire brigade would be presented with a fire scenario of intensity that is consistent or lower that for DtS sprinkler protected building (permitted no fire separation)
- Fire in the Auditorium – for a fire in a larger auditorium and provided with a proscenium curtain, is not required to be proved with sprinkler protection, the fire size could feasibly involve all of the seating.

Based on the above, the opportunity for fire brigade intervention and exposure activities, is likely to be equivalent or better than other deemed-to-satisfy building solutions.

6.4.10.3 Qualitative Inter-comparison

6.4.10.3.1 Base DtS Comparative Building Solution

The deemed-to-satisfy provisions of the BCA do not require a proscenium curtain be installed when the building is provided with sprinkler protection throughout in accordance with BCA Specification E1.5.

The following Table summarises the general fire protection requirements within such a building, for a fire compartment up to 2,000m² in floor area and comparison with the Subject building/stage area.

Such a building, assuming the fire compartment is less than 2,000m², which from a smoke management viewpoint is consistent with the Subject Building. The Subject building has a fire/smoke compartment containing the Stage, Auditorium and Entrance foyer of approximately 1,795m², would have essentially identical fire protection provisions as one, which complies with the deemed-to-satisfy provisions of the BCA (with the exception of a proscenium curtain).

The Subject Building is to be compared with a BCA DtS Reference Building provided with a sprinkler protection throughout.

Table 32: Summary of Comparative Fire Safety Characteristics – Building Compliant with BCA DtS provisions and Subject Building

Fire Safety Characteristic	Subject Building	BCA DtS – Sprinkler protected	BCA DtS – Non Sprinkler protected
Building Area Usage/Classification	Auditorium/Stage/Foyer Class 9b	Auditorium/Stage/Foyer Class 9b	Auditorium/Stage/Foyer Class 9b
Fire/Smoke Compartment Area (m²)	<2,000	2,000	2,000
Area of Stage Enclosure	Approx 410m²	200+	200+
Back Stage Areas	Approx 270m² (fire separated and sprinkler protected)	200+	200+
Construction Type Provided/Required	4 storey Type A	2 storey Type B	2 storey Type B
Separations from Boundaries / Other Buildings on Site	3m where non-fire resistant external non-load bearing walls. Fire rated at boundaries	3m where non-fire resistant external non-load bearing walls	3m where non-fire resistant external non-load bearing walls
Fire detection system	AS1670.1 throughout	BCA Specification E2.2a Clause 5 within auditorium, not required to activate occupant warning when provided for shut down of air handling only system	BCA Specification E2.2a Clause 5 within auditorium, not required to activate occupant warning when provided for shut down of air handling only system
Fire sprinkler system	Partial – AS 2118 throughout except auditorium	AS2118.1 throughout	Nil
Required Separation of Backstage Ancillary Areas from Main Exit Paths/Stage Areas e.g. Workshops, Dressing Rooms etc	At least 2-hour fire separation from Stage/Auditorium	None Required	Fire separation of stage and backstage >200m² and Proscenium wall and curtain required under BCA H1.2(b)
Proscenium Wall	Solid Masonry above Stage (up to 5.5m smoke baffle) – will achieve FRL of at least 60/60/60	None Required	Proscenium wall and curtain required under BCA H1.2(b)
Egress Distances	Comply with BCA Clauses D1.4, D1.5, D1.9	Comply with BCA Clauses D1.4, D1.5, D1.9	Comply with BCA Clauses D1.4, D1.5, D1.9
Aggregate Exit Width	Greater width than required under BCA Clause D1.6	Comply with BCA Clause D1.6	Comply with BCA Clause D1.6
Building Occupant Warning System	AS1670.1 EWS	AS1670.4 EWIS	AS1670.4 EWIS
Smoke Management	Air handling shutdown within auditorium Mechanical Smoke Exhaust System	Air handling shutdown within auditorium Smoke/Heat Vents / Mechanical Smoke Exhaust System	Air handling shutdown within auditorium Smoke/Heat Vents / Mechanical Smoke Exhaust System
Proscenium Curtain	Maintained	Is permitted to be	Is permitted to be

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Fire Safety Characteristic	Subject Building	BCA DtS – Sprinkler protected	BCA DtS – Non Sprinkler protected
		manually operable under BCA Specification H1.3 Clause 5	manually operable under BCA Specification H1.3 Clause 5

In summary, when compared to a newly constructed building, which complies with the deemed-to-satisfy provisions of the BCA, in considering the hazard associated with fire spread from the Stage and adjoining Back of House/Ancillary areas to threaten the audience, which is the intent under the requirements of BCA Clause H1.2 in requiring either sprinkler protection or a proscenium curtain, the following is notable:

1. There is no requirement to fire separate the back of house ancillary areas e.g. workshops, stores, dressing rooms etc from egress routes within a sprinkler protected building – the Subject building has these areas full sprinkler protected and fire separated from the Stage/Auditorium areas.

   Thus the hazard associated with a fire within these areas is considerably greater for a building, which complies with the deemed-to-satisfy provisions of the BCA, when compared with the Subject building.

2. The hazard associated with a fire on the Stage area is consistent for both building solutions – fire sprinkler protection is provided throughout the stage, with performance to AS2118. This system allows up to 18 sprinkler heads to operate simultaneously (OH3) and will essentially allow all sprinkler heads within the Stage area of the Subject building to operate simultaneously.

   A fire within the Stage area will tend to be contained within this area due to the high ceiling of this space (up to 16m high) and the space being bounded by a masonry proscenium wall above the opening, which is approximately 5.5m in height.

3. A building which complies with the deemed-to-satisfy provisions of the BCA in being sprinkler protected may have considerably larger stage and back of house areas, with no proscenium wall.

   The hazard for fire spread from the Stage area to the auditorium areas is considered consistent or less than for a solution, which complies with the deemed-to-satisfy provisions of the BCA, when compared with the Subject building.

4. A DtS building does not require sprinkler protection to the auditorium side (when provided with a proscenium curtain). Accordingly the risk of fire initiation and development on the auditorium side present a risk to occupants consistent with a DtS building (notwithstanding a proscenium curtain is designed for a fire on the proscenium side).

5. For the purposes of a redundancy consideration (i.e. sprinkler systems failing to operate correctly to prevent fire growth within the Stage area), the building solution, which complies with the deemed-to-satisfy provisions of the BCA with sprinkler protection in accordance with BCA Specification E1.5 is considered to have a lesser degree of redundancy due to there being no requirement to provide any form of fire separation between back of house areas or having a fire resistant proscenium curtain.

6. The difference in the time for occupant warning associated with an EWIS or AS1670.1 EWS within such a small stage/auditorium, where occupants can readily view the stage area is considered negligible (with visual cues adopted in the quantitative analysis).

7. The aggregate exit width provided within the Subject building is greater than that required under BCA Clause D1.6, most significantly for the Balcony level where the smoke filling is likely to be more significant. Thus the evacuation time for this building will be less than one, which complies with the deemed-to-satisfy provisions of the BCA.

8. A proscenium curtain is permitted to be manually operable under BCA Specification H1.3 Clause 5. Without adequate staffing or training, the likelihood of reliable closure may be impacted. Closure is not required to be automatic and the curtain can feasibly be left open in a fire situation in a DtS building. Trained staff are required at all times of performances.
9. Under the DtS Clause H1.3 provisions a curtain must be—

    (a) a fire safety curtain—
    (i) made of non-combustible material; and
    (ii) capable of withstanding a pressure differential of 0.5 kPa over its entire surface area; and
    (iii) so fitted that when fully lowered it inhibits the penetration of smoke around the perimeter of the opening, from the stage; or

    (b) a curtain—
    (i) having fire hazard properties complying with Specification C1.10; and
    (ii) protected by a deluge system of open sprinklers installed along the full width of the curtain

    Under (a) the curtain need only be non combustible and inhibit the passage of smoke. It is not required to be fire rated. i.e. resist an AS1530.4 Standard Fire.

    Under (b) the curtain need only meet Specification C1.10 (early fire hazard properties) and protected by a deluge system of open sprinklers. No standard is specified for the deluge system (eg AS 2118.3 is not specified) and given the curtain is permitted to be manually operable, the open sprinkler are also be surmised to be permitted to be manually operable.

    It is therefore considered that as no FRL is prescribed and no performance fire resistance parameters specified, that the DtS solution can feasibly be of Nil FRL and only need to inhibit smoke spread. The provided solution has been demonstrated to sufficiently limit fire and smoke spread from the stage to the audience side, to allow the egress of occupants from the building.

Based on this discussion, it is considered that in meeting the intent of BCA Clause H1.2, it is considered that the hazard to the audience within the auditorium from fire on the Stage for the Subject building without the proscenium curtain is at least consistent with a building solution that is sprinkler protected throughout, which complies with the deemed-to-satisfy provisions of the BCA.

6.4.11 Assessment Against Relevant BCA Performance Requirements CP2, CP8, EP1.4, EP2.2

6.4.11.1 Assessment via Comparison with BCA d.t.s. Compliant Building – Assessment Method A0.9(c)

The comparative qualitative analysis performed within Section 6.4.10.3 has demonstrated that the relative hazard from fire to the audience associated with a fire on Stage/Back of House areas are likely to be consistent than that for a DtS building solution (noting a fire on the stage is expected to be contained to the stage side) as shown below.

i.e. Typically a fire is contained by 3 heads 86% of fire incidences, 4 heads for 90%, and 9 heads controlling 96% of fires [HB 147]; noting OH13 allows for 19 head operation.

Assembly buildings fitted with sprinkler systems have fire controlled by 4 to 5 heads [HB 147].

TABLE 6.3
Cumulative Number of Sprinklers Operating

No. of sprinklers Operating	No. of fires 1886 – 1989 inclusive	%
1	4,614	64.16
2 or less	5,796	80.60
3 or less	6,224	86.55
4 or less	6,473	90.01
5 or less	6,613	91.96
6 or less	6,728	93.56
7 or less	6,801	94.58
8 or less	6,850	95.26
9 or less	6,894	95.87
10 or less	6,931	96.38
Over 10	260	3.62
	7,191	100.00%

Figure 35: Excerpt from HB 147

For a fire in the Stage/Back of House areas, the e risk is not adverse when compared with a DtS building solution (noting a fire on the stage is expected to be contained to the stage side).

6.4.11.2 Absolute Assessment via Comparison with BCA d.t.s. Compliant Building – Assessment Method A0.9(b)(ii) – ASET>RSET

A combination of quantitative and qualitative fire safety engineering analysis has been performed. Smoke modelling has been performed with a rapidly flaming fire within the Stage area. The following summarises the consideration of the relevant BCA Performance Requirements having regard for the intent of being required to provide a proscenium curtain.

The following Table summarises the discussion/detail against each of the components of CP2 and EP2.2.

CP2 (a) A building must have elements which will, to the degree necessary, avoid the spread of fire- (i) to exits; and (ii) to sole-occupancy units and public corridors; and (iii) between buildings; and (iv) in a building. (b) Avoidance of the spread of fire referred to in (a) must be appropriate to-	
(i) the function or use of the building; and	The subject area of the building functions as a stage/auditorium. The area of consideration is the stage as this is deemed by the BCA as presenting a hazard to a potentially high number of occupants within the auditorium.
(ii) the fire load; and	The fire load within the stage area is considered to be relatively low. This is due to the relatively small floor area (approximately 270m²) and fire separated from the 235m² back stage area, and limited capacity for storage within this space. The workshops, stores and back of house areas are fire separated from the stage and auditorium areas (and sprinkler protected), thus the hazard is considered relatively low compared with other larger stage areas, or those with back of house areas that connect directly to the stage areas with no fire separation.
(iii) the potential fire intensity; and	As discussed above, due to the relatively low fire load, the potential fire intensity is considered relatively low. Combustible backdrops are required to be treated with a fire retardant paint, which is likely to reduce the potential fire intensity within the Stage area as the quantities of highly combustible materials will be relatively limited.
(iv) the fire hazard; and	The fire hazard within the stage space is considered relatively low – the cause of fire is considered to be most likely related to an electrical fault, lighting or audiovisual requirements.
(v) the number of storeys in the building; and	The auditorium area is two storey due to the raking over the foyer and passageway/bridges this has been considered in the smoke modelling analysis (though is a single compartment).
(vi) its proximity to other property; and	Not applicable – the proscenium curtain is required to prevent fire spread within the building.
(vii) any active fire safety systems installed in the building; and	The building is provided with AS1670.1 smoke detection and occupant warning systems, fire sprinkler protection within the Stage and back of house areas (+ 2-off lines of sprinkler in auditorium + mid height wall sprinklers at stage back-drop + 1m² venting)
(viii) the size of any fire compartment; and	The size of the area formed by the Stage is very small – approximately 270m² - back of house areas are fire separated – hence the potential fire compartment area associated with fire spread from Stage areas to the auditorium are considered very small.
(ix) fire brigade intervention; and	It is important to note that whilst the provision of a proscenium curtain is a matter falling under Regulation 309, the intent in providing a proscenium curtain is related to protecting the audience from a fire on stage, and is not related to protecting fire fighters/fire brigade operations. The proscenium curtains are not a type/tested fire resistant system.

CP2 (a) A building must have elements which will, to the degree necessary, avoid the spread of fire- (i) to exits; and (ii) to sole-occupancy units and public corridors; and (iii) between buildings; and (iv) in a building, (b) Avoidance of the spread of fire referred to in (a) must be appropriate to-	
	The intent of such fire protection systems, which do not have specific FRL or quantitatively defined performance is considered consistent with that specified within the Guide to the BCA in providing a degree of protection sufficient to limit fire/smoke spread relatively early in fire development to permit the audience to safely evacuate. However, for a well-developed large fire, the ability of such construction to sustain fire exposure for an extended period and reliably provide protection is not guaranteed. The period required for fire brigade arrival/setup as detailed within Appendix B)
(x) other elements they support; and	Not applicable – proscenium curtain separation
(xi) the evacuation time.	Determined in quantitative analysis – conservative calculations demonstrated that occupants could evacuate, with some margin of safety before the adequacy of the exit path was threatened. i.e. ASET>RSET.

EP2.2 (a) In the event of a fire in a building the conditions in any evacuation route must be maintained for the period of time occupants take to evacuate the part of the building so that-	
(i) the temperature will not endanger human life; and (ii) the level of visibility will enable the evacuation route to be determined; and (iii) the level of toxicity will not endanger human life.	The quantitative fire engineering analysis determined that the time for occupant evacuation (RSET) for the Subject building solution was less than the available safe egress time (ASET). The analysis utilised conservative assumptions and the acceptance criterion was based on the visibility criterion (10m) within the egress route not being exceeded. The criterion for visibility are likely to be exceeded well before the level of toxicity will endanger human life.
(b) The period of time occupants take to evacuate referred to in (a) must be appropriate to-	
(i) the number, mobility and other characteristics of the occupants; and	The numbers of occupants have been implicitly considered in the quantitative analysis. The aggregate exit width provided is greater for this building than one, which complies with the deemed-to-satisfy provisions of the BCA. The provision of ramps/double doors and at-ground egress is considered to permit disabled occupants to evacuate consistent with the requirements of the deemed-to-satisfy provisions of the BCA.
(ii) the function or use of the building	The function or use of the building has been implicitly considered in the analysis.
(iii) the travel distance and other characteristics of the building	The analysis has explicitly considered the distance of travel to an exit – the distances of travel to the nearest exit will comply with the deemed-to-satisfy provisions of the BCA.
(iv) the fire load	The fire load within the stage area is considered to be relatively low. This is due to the relatively small floor area (approximately 270m²), and limited capacity for storage within this space. The workshops, stores and back of house areas are fire separated from the stage and auditorium areas and sprinkler protected, thus the hazard is considered relatively low compared with other larger stage areas, or those with back of house areas that connect directly to the stage areas with no fire separation.
(v) the potential fire intensity	As discussed above, due to the relatively low fire load, the potential fire

EP2.2 (a) In the event of a fire in a building the conditions in any evacuation route must be maintained for the period of time occupants take to evacuate the part of the building so that-	
	intensity is considered relatively low. Combustible backdrops are required to be treated with a fire retardant paint, which is likely to reduce the potential fire intensity within the Stage area as the quantities of highly combustible materials will be relatively limited.
(vi) the fire hazard	The fire hazard within the stage space is considered relatively low – the cause of fire is considered to be most likely related to an electrical fault, lighting or audiovisual requirements.
(vii) any active fire safety systems installed in the building	The building is provided with AS1670.1 smoke detection and occupant warning systems, fire sprinkler protection within the Stage and back of house areas (+ 2-off lines of sprinkler in auditorium + mid height wall sprinklers at stage back-drop + 1m² venting)
(viii) fire brigade intervention.	It is important to note that whilst the provision of a proscenium curtain is a matter falling under Regulation 309, the intent in providing a proscenium curtain is related to protecting the audience from a fire on stage, and is not related to protecting fire fighters/fire brigade operations. The proscenium curtains are not a type/tested fire resistant system. The intent of such fire protection systems, which do not have specific FRL or quantitatively defined performance is considered consistent with that specified within the Guide to the BCA in providing a degree of protection sufficient to limit fire/smoke spread relatively early in fire development to permit the audience to safely evacuate. However, for a well-developed large fire, the ability of such construction to sustain fire exposure for an extended period and reliably provide protection is not guaranteed. The period required for fire brigade arrival/setup as detailed within Appendix B)

A qualitative comparative assessment will be undertaken to assess the risk to the life safety of occupants associated with the deletion of fire rated protection to proscenium opening (as per CP8).

Table 33: Assessment against the Relevant Performance Requirements CP8

Performance Requirement	Comment
CP8 Any building element provided to resist the spread of fire must be protected, to the degree necessary, so that an adequate level of performance is maintained—	
(a) where openings, construction joints and the like occur	The proscenium opening is protected, however the spread of fire and smoke has been demonstrated to be sufficiently reduced in with presence of a warden Fire rated protection to the opening in this instance is not required, nor is it required to provided under the DtS provisions. The specified curtain system need only be non combustible and inhibit smoke spread. The provided solution has been demonstrated to sufficiently limit fire and smoke spread from the stage to the audience side, to allow the egress of occupants from the building.

Table 34: Assessment against the Relevant Performance Requirements EP1.4

Performance Requirement	**Comment**
A qualitative comparative assessment will be undertaken to assess the risk to the life safety of occupants associated with the proposal to provide sprinkler protection to stage and back stage areas only (in lieu of throughout), having regard for the following (as per EP1.4) -	
(a) *the size of the fire compartment which is a measure of the size of any potential fire* –	The building is <2,000m² and would not normally require sprinkler protection when provide with a proscenium curtain (in either the auditorium or stage and backstage areas). For a fire from the auditorium side, the size of the fire would not be adverse when compared with a DtS non sprinkler protected building provided with a proscenium curtain. The critical area from which occupants are to be protected (the stage and backstage areas) are however provided with sprinkler protection and fire separation.
(b) the function or use of the building will affect the fire load in the building	The subject area of the building functions as a stage/auditorium. The area of consideration is the stage as this is deemed by the BCA as presenting a hazard to a potentially high number of occupants within the auditorium. For a fire from the auditorium side, the fire load would not be adverse when compared with a DtS non sprinkler protected building provided with a proscenium curtain. The critical area from which occupants are to be protected (the stage and backstage areas) are however provided with sprinkler protection and fire separation.
(a) the fire hazard which means the danger in terms of potential harm and degree of exposure arising from the start and spread of fire, and the smoke and gases generated by a fire	The fire hazard within the stage space is considered relatively low – the cause of fire is considered to be most likely related to an electrical fault, lighting or audiovisual requirements. The critical areas from which occupants are to be protected (the stage and backstage areas) are however provided with sprinkler protection and fire separation. The quantitative has shown that the occupants are able to egress the building for the considered scenario of fire in the stage area (and sprinkler failure) and fire at the stage edge.
(b) the height of the building,	the height of the building, because once a building gets above a certain height it becomes extremely difficult (and eventually impossible) for the fire brigade to undertake external rescue or fire fighting from ladders and the like. The height also affects evacuation time – The building is less than 25m high and is provided with sprinkler protection in stage and backstage areas. When compared with a DtS building (<25m), provided with sprinkler protection the risk from fire from the stage and back stage areas is not adverse when compared with other DtS solutions.

Based on the quantitative and qualitative analysis performed, and having regard for the intent of being required to provide a proscenium curtain to separate the stage from the auditorium under the deemed-to-satisfy provisions of the BCA, it is considered that the building solution with the proscenium curtain and smoke and heat vents deleted and partial sprinkler protection shall satisfy the relevant BCA performance requirements CP2, CP8 and EP1.4, EP2.2, *to the degree necessary (as applicable).*

6.5 Opening in Wall between Bio-Box and Auditorium that aligns with Fire Wall is openable though with Sprinkler Protection Each Side

6.5.1 Introduction

The following variations from the deemed-to-satisfy provisions of the BCA will be considered within this section of the report:

Table 35: Variations from BCA DtS Provisions

DtS Clause	Description of Variation from BCA DtS Provisions	Performance Requirements
C2.7(a)(ii) inter-alia C3.4(a)(i)(A) and C3.4(a)(iii)(A)	The provision existing openings in Bio Box bounding wall that aligns with proposed fire wall, protected by pendant sprinkler each side	CP2, CP8

6.5.2 Identification of Areas under Consideration

Figure 19 shows the areas under consideration (highlighted in orange box).

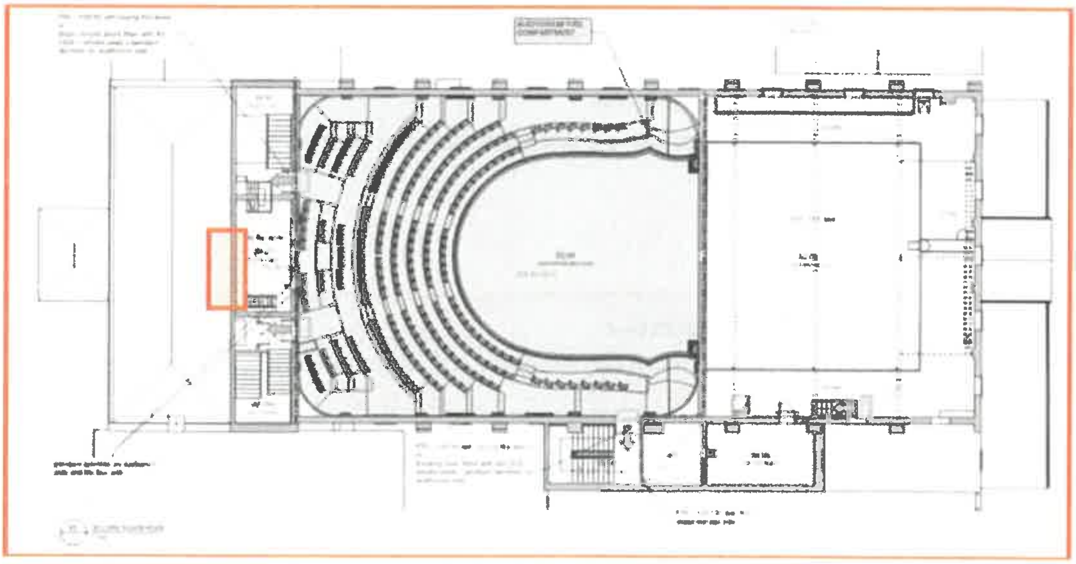


Figure 36: Bio Box adjoins the auditorium via glazed/operable openings in the existing fire wall.

Openings – View From Bio-box

Openings – View From Auditorium

Figure 37: Openable Windows in Bio Box

6.5.3 BCA Requirements and Intent

6.5.3.1 Relevant Deemed-to-Satisfy Provisions

6.5.3.1.1 Openings in Fire Walls

The Relevant Deemed-to-Satisfy Provisions associated with the requirement to not reduce the FRL by the provision of openings is BCA Clause C2.7(a)(ii), reproduced below.

C2.7 Separation by fire walls

(a) Construction — A fire wall must be constructed in accordance with the following:

(i) The fire wall has the relevant FRL prescribed by Specification C1.1 for each of the adjoining parts, and if these are different, the greater FRL, except where Tables 3.9, 4.2 and 5.2 of Specification C1.1 permit a lower FRL on the carpark side.

(ii) Any openings in a fire wall must not reduce the FRL required by Specification C1.1 for the fire wall, except where permitted by the Deemed-to-Satisfy Provisions of **Part C3**.

(iii) Building elements, other than roof battens with dimensions of 75 mm x 50 mm or less or sarking-type material, must not pass through or cross the fire wall unless the required fire resisting performance of the fire wall is maintained.

6.5.3.1.2 Acceptable Methods of Protection

The Relevant Deemed-to-Satisfy Provisions associated with the protection of opening (where required) is BCA Clause C3.4, reproduced below.

C3.4 Acceptable methods of protection

(a) Where protection is required, doorways, windows and other openings must be protected as follows:

(i) Doorways—

(A) internal or external wall-wetting sprinklers as appropriate used with doors that are self-closing or automatic closing; or

(B) –/60/30 fire doors that are self-closing or automatic closing.

(ii) Windows—

(A) internal or external wall-wetting sprinklers as appropriate used with windows that are automatic closing or permanently fixed in the closed position; or

(B) –/60/– fire windows that are automatic closing or permanently fixed in the closed position; or

(C) –/60/– automatic closing fire shutters.

(iii) Other openings—

(A) excluding voids — internal or external wall-wetting sprinklers, as appropriate; or

(B) construction having an FRL not less than –/60/–.

(b) Fire doors, fire windows and fire shutters must comply with Specification C3.4.

6.5.3.2 Relevant BCA Performance Requirements

The relevant BCA performance requirements associated with the requirement for the avoidance of the spread of fire is CP2, reproduced below:

> **CP2**
>
> (a) A building must have elements which will, to the degree necessary, avoid the spread of fire —
>
> (i) to *exits*; and
> (ii) to *sole-occupancy units* and *public corridors*; and
> (iii) between buildings; and
> (iv) in a building.
>
> (b) Avoidance of the spread of fire referred to in **(a)** must be appropriate to—
>
> (i) the function or use of the building; and
> (ii) the *fire load*; and
> (iii) the potential *fire intensity*; and
> (iv) the *fire hazard*; and
> (v) the number of *storeys* in the building; and
> (vi) its proximity to *other property*; and
> (vii) any active *fire safety systems* installed in the building; and
> (viii) the size of any *fire compartment*; and
> (ix) *fire brigade* intervention; and
> (x) other elements they support; and
> (xi) the *evacuation time*.

The Relevant Performance Requirements associated with the protection of openings is CP8, reproduced below:

> **CP8**
> Any building element provided to resist the spread of fire must be protected, to the degree necessary, so that an adequate level of performance is maintained—
>
> (a) where openings, construction joints and the like occur; and
> (b) where penetrations occur for building services.

6.5.3.3 Intent of the BCA

The Guide to the BCA states that the intent of BCA Clause C2.7 is to explain that buildings separated by a fire wall may be considered as fire compartments.

The Guide to the BCA states that the intent of BCA Clause C3.4 is to set out acceptable methods of protection required for different types of openings in a building.

Conventional wall-wetting sprinklers need a medium or surface to act on. An opening consisting of a void does not provide such a medium or surface (as clarified by BCA Clause C3.4(a)(iii)(A) where internal or external wall-wetting sprinklers are not recognised as an acceptable method of protection for voids under the Deemed-to-Satisfy Provisions. However a Performance Solution is not specifically excluded.

Performance Requirement CP2 is intended to deal with spread of fire both within the building and between buildings. Performance requirement CP8 requires openings and penetrations in building elements to resist the spread of fire. The BCA Guide states that CP8 should be read in conjunction with

CP2; CP8 deals with any opening or penetration within a building element, and CP2 deals with the building element itself.

FRLs are only included as part of the Deemed-to-Satisfy Provisions. The BCA Guide also states that it may be determined by a building proponent using an Alternative Solution that applying FRLs to building element is not necessary because other methods, can satisfy the Performance Requirements.

6.5.4 Hazard Identification

6.5.4.1 Key Hazards

The provision of windows that do not self close, will limit the availability for a medium for the water to act on, if left open.

Consideration is required for the potential reduced efficiency of the sprinklers and the potential for smoke spread between compartments.

Note that sprinkler protection will be provided on each side of the bounding wall.

Statistics from the National Fire Protection Association (NFPA) (Hall, 2010) provides recorded statistics on buildings fitted with automatic fire sprinkler systems between the years 2007 – 2011 in United States. Based on the NFPA's data, sprinkler operated 91% of the time when they were installed. When they operate, they were found to be effective 96 % of the time, resulting in a combined performance of operating effectively in 86 % of all reported fires where sprinklers were present in the fire area and the fire was large enough to activate them. The reliability of sprinkler system in Australia and New Zealand is generally considered significantly higher than in the US as researched by Marryatt (1988).

6.5.4.2 Referenced Statistics

Within public assembly buildings, the greatest proportion of fire starts are by open suspicious incendiary causes (22%) as shown in Figure **4** with 7.6% of fires being located within egress routes (Figure **5**). These areas have a greater degree of public access and may skew the results. The greatest proportion of fire by area of origin is within the cooking areas at 32.2%, storage areas at 12.6%, lavatories etc at 10.2% - refer Figure **5**.

US statistics report that 4,800 construction fires (noting the backstage area is treated as a construction site) occur annually [2011 Fire Safety International Conference]. The primary reported cases of construction fires are 41% suspicious acts, 30% open flame and 5% smoking . NFPA indicated that construction fired represent 6% of those reported and 13% financial loss. Portable heating accounts for 25%, cutting/welding equipment 20% and smoking/matches 15% [SFS NSW].

6.5.5 BCA Clause A0.5 Assessment Method

The approach adopted will utilise a quantitative and deterministic analysis for the purposes of utilising an Alternative Verification Method which comply with the BCA as described by A0.5 (b)(ii) as shown below.

Table 36: Assessment Methods in accordance with BCA Clause A0.5

BCA Clause A0.5
The following Assessment Methods, or any combination of them, can be used to determine that a Performance Solution or a Deemed-to-Satisfy Solution complies with the Performance Requirements, as appropriate: (a) Evidence to support that the use of a material or product, form of construction or design meets a Performance Requirement or a Deemed-to-Satisfy Provision as described in A2.2. (b) Verification Methods such as — (i) the Verification Methods in the NCC; or (ii) **such other Verification Methods as the appropriate authority accepts for determining compliance with the Performance Requirements.** (c) Expert Judgement. (d) Comparison with the Deemed-to-Satisfy Provisions.

6.5.6 Fire Safety Measures for the Performance Solution

The fire safety measures listed in Table 9 form the holistic fire safety design for the Performance Solution, and incorporate the Design Additions within §1.3.

6.5.7 Method of Fire Engineering Analysis

6.5.7.1 Introduction

A qualitative comparative analysis will be undertaken to assess the risk to occupants and the attending fire brigade associated by the provision of a partial smoke separation and sprinkler protection in lieu of fire separation between fire compartments.

6.5.7.2 Fire Scenario and Fire Size

6.5.7.2.1 Fire Scenarios

This analysis will considered a fire in the following areas -

- A fire in the Bio-Box
- A fire in the auditorium

6.5.7.2.2 Discounted Fire Scenarios

Sprinkler failure is not considered, with the expectation of reliability consistent with a DtS solution complying with BCA Clause C3.4 (which has no consideration for sprinkler failure).

6.5.7.2.3 Fire Size

The following fire sizes were adopted –

(i) FRL's and radiant exposures - An AS 1530.4 fire is assumed to allow inter-comparison with test data

(ii) Smoke filling – A 5MW fire is assumed, note that this not adverse when compared with the smoke hazard management requirements in a public assembly building under BCA Specification E2.2b.
This reduced fire size is considered suitable as the roof/ceilings are of Nil FRL and would soon vent and reduce the fire intensity by releasing a significant amount of energy from the fire direct to outside (70%)[Modak][Quintiere].

Note this fire approximate to an AS1550.4 fire (refer Appendix D2.4)

6.5.7.2.4 Smoke Spread/Smoke Filling Data

Bio Box Smoke Spread - The fire modelling data for a fire in the auditorium will adopted for reference (Appendix D2.4, with methodology in §6.3.6.2.5) as the likely smoke filling of the auditorium.

Note - Sprinkler Operates adopt 60°C for convection exposures to reduce the radiation.

6.5.7.3 Occupant Egress – Required Safe Egress Time

The time for evacuation of a building, t_{evac}, using the evacuation methodology outlined in by Nelson and Mowrer [Nelson and Mowrer] and BSI DD240:Part 1:1997 [BSI DD240 : Part 1:1997] is represented by the equation:

$$t_{evac} = t_{alarm} + t_{pre} + kt_{flow} \qquad \text{(C1)}$$

where t_{alarm} = time for alarm to be raised
t_{pre} = time for pre-movement
k = factor of safety for travel time (assumed to be **2.0** correct operation of sub-systems and **1.5** for failure of a sub-system (eg sprinkler failure or proscenium)
t_{flow} = time for travel

Appendix C1 presents the methodology for occupant alarm time/cue times, movement and pre-movement times. Results in Appendix C4.

6.5.7.3.1 Pre-movement

Typically within the building, a pre-movement time of 6 minutes (=360 seconds) is assumed from Table 3-13 of the SFPE handbook [SFPE], applicable to Shops, museums, leisure sports centres, and other assembly buildings – a category described broadly as occupants being awake and predominantly unfamiliar with the building, alarm systems and procedures.

This assumption is not applicable to occupants within the immediate vicinity of the fire, where visual, aural and olfactory cues are likely to alert these occupants of the occurrence of a fire, far sooner.

For occupants within the room of fire origin is assumed to be 60 minutes.

$t_{pre\ RFO}$ = time for pre-movement inside RFO = 60 seconds
t_{pre} adjacent $_{RFO}$ = time for pre-movement adjacent to RFO = 120 seconds
t_{pre} remote $_{RFO}$ = time for pre-movement outside RFO = 360 seconds

6.5.7.4 Referenced Test Data

6.5.7.4.1 Wall Wetting Sprinklers – Windows Closed

Kim and Lougheed [Kim and Lougheed] found that for flow rates consistent with AS 2118.1, that horizontal pendant sprinklers setback 13mm from the glazing and 50mm below the top of the window frame could protect glazed window openings when exposed to an AS1530.4 Standard Fire for one hour; where there is no pony wall and combustibles adjacent to the glazing.

For the Subject solution, it is proposed that pendant sprinklers in horizontal orientation be setback <600mm from the glazing and <450mm above the top of the window frame.

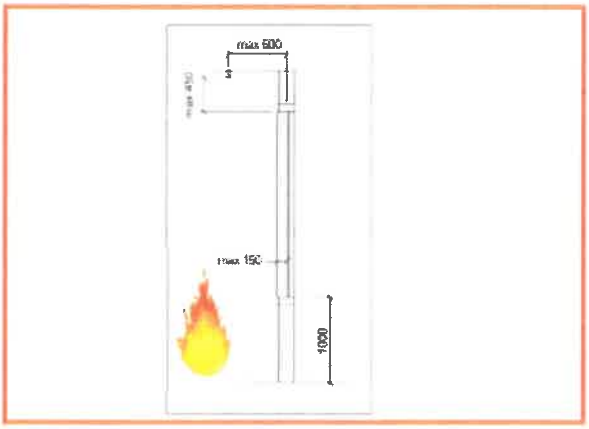


Figure 38: Excerpt from "*Fire Protection of Windows Using Sprinklers*", showing limiting distances of ceiling mounted pendant type sprinklers to protect for an Internal Exposure

For the above data, it is assumed there are combustibles near the window/wall assembly and hence the requirement for a "pony wall" to limit direct flame impingement.

Given there is s a "pony-wall", the data is therefore is applicable to this scenario.

6.5.7.4.2 AS 2118.1 Sprinklers as a Water Curtain

An AS2118.1 sprinkler head typically sprays 60L/min or an AS 2118.1 sprinkler head. This is expected to be sufficient to protect a single glazed opening/timber door (and also approximate with BCA Specification G3.8 where 0.25 L/s/m² is deemed equivalent to 1 hr protection for glazing in atriums).

In addition to protecting the glazing, the overspray will fall directly onto the areas below, wetting down combustibles and decreasing the fire intensity (up to 50% - refer Appendix E).

6.5.8 Acceptance Criteria (Alternative Verification Method)

6.5.8.1 Smoke Filling Exposure Limits for Occupants

The tenability criteria for occupants, selected to determine ASET for this analysis are as follows:

(i) Visibility limit exceeded when smoke layer is below 2.0m and an increase in smoke layer temperature of 15°C.

(ii) Movement through smoke limit exceeded when smoke layer is below 2.0m and smoke layer temperature exceeds **60°C****

(iii) Smoke layer >183°C, the conventional tenability criterion based on radiation, where the radiation imposed by the smoke layer exceeds 2.5kW/m² - equivalent to a temperature of the smoke layer exceeding 183°C. This value has been identified in the Fire Engineering Guidelines as having a tolerance time for an occupant of >5 minutes, which would permit them to move away from the immediate area. This criterion has been discounted when in the local vicinity of the fire, where the cues presented to occupants are considered likely to result in a rapid evacuation from this area.

* From the Fire Engineering Guidelines a convective heat exposure of 100°C is adopted when sprinklers are not provided (or do not operate).

In the event of sprinkler activation there is a high degree of moisture in the smoke layer a temperature of **60 °C** is adopted as the maximum temperature for smoke exposure – Refer Figure 32.

6.5.8.2 Smoke Filling Exposure Limits – Fire Brigade

The criteria for tenability and safety, for fire brigade personnel as prescribed within MFB Guidelines GL-17, as depicted below –

<u>Extreme Condition</u>

These conditions would be encountered in a snatch rescue situation or a retreat from a flashover.

- Maximum Time: 1 minute
- Maximum Air Temperature: 160 °C (in lower layer)
- Maximum Radiation: 4 - 4.5 kW/m^2

<u>Critical Conditions</u>

Fire-fighters would not be expected to operate in these conditions, but could be encountered. These conditions are considered to be life threatening:

- Time: < 1 minute
- Air Temperature: > 235 °C (in lower layer)
- Radiation: > 10 kW/m2

6.5.8.3 Radiant Heat Flux Limits

The limiting radiant heat fluxes on receiving surfaces and occupants have been based on those described within AS1530.4 Table A3, reproduced below:

TABLE A3

TYPICAL RADIANT HEAT INTENSITIES FOR VARIOUS PHENOMENA

Phenomena	kW/m^2
Maximum for indefinite exposure for humans	
Pain after 10 s to 20 s	4
Pain after 3 s	10
Piloted ignition of cotton fabric after a long time	13
Piloted ignition of timber after a long time	13
Non-piloted ignition of cotton fabric after a long time	25
Non-piloted ignition of timber after a long time	25
Non-piloted ignition of gaberdine fabric after a long time	27
Non-piloted ignition of black drill fabric after a long time	38
Non-piloted ignition of cotton fabric after 5 s	42
Non-piloted ignition of timber in 20 s	45
Non-piloted ignition of timber in 10 s	55

Therefore the following radiant heat flux limits are to be adopted –

(i) the radiant heat flux on adjoining combustibles shall not exceed $25kW/m^2$.
(ii) the radiant heat flux shall not exceed $4kW/m^2$ on occupants/staff.

6.5.9 Analysis

6.5.9.1 Fire in Bio Box – Radiation to Non Fire Side

6.5.9.1.1 Fire in Bio Box Window Closed – AS 1530.4

The proposed solution is prescribed to be within the bounds of the Kim and Lougheed and therefore would be expected to achieve similar levels of performance. i.e. a one hour fire rating for an internal exposure.

The temperatures on the non-fire side of a specimen would not be likely to be in the order of 200 °C (noting a 180 °C rise is required for insulation failure of a wall/barrier system) after 1 hour (versus a DTS FRL -/60/30, fire door with a 30 minute insulation rating)

For the above data, it is assumed there are combustibles near the window/wall assembly and hence the requirement for a "pony wall" to limit direct flame impingement (provided).

It is considered that in the event that the window is shut that fire spread would not occur from the Bio box to the auditorium.

6.5.9.1.2 Fire in Bio Box - Window Open to Auditorium AS 1530.4 – Sprinkler as a Spray Only

In the event the window is open the sprinklers will provide a 50% reduction in radiant heat transfer to the non fire side (by the sprinkler acting as a water curtain).

For an assume $93kW/m^2$ imposed fluxed for an AS 1530.4 fire, the transmission to the non fire side is likely to be in the order of $46.5kW/m^2$ (=680°C), which would typically cause piloted ignition on the non fire side (>$25kW/m^2$) [Drysdale].

The wetting down of the immediate area by continuous application of water, however would limit the likelihood of drying out and ignition of combustibles (leading to ignition).

6.5.9.1.3 Fire in Bio Box - Window Open – Sprinkler as a Spray Only - Radiation to Non Fire Side

To determine the imposed radiant flux on the adjoining surfaces, the imposed flux has been calculated using the FireCalc [FireCalc].

For a fire source 3.0m w x 1.0m h @ 680°C, the received radiant heat flux on the adjoining fire compartment was determined as follows:

Table 37: *Imposed Flux on Adjoining Fire Compartment from Open Window – Sprinkler Activates*

Fire Source Width (w) x Height (h)	Setback Distance X From Source Centre to receiving surface (m)	Horizontal Offset Y From Source Centre to receiving surface (m)	Vertical Offset Z From Source Centre to receiving surface (m)	Radiant Heat Flux Received (kW/m²)
Radiant Flux to Linings at Seats/Combustibles				
3.0m x 1.0m	0.5	0.0	-2.0	2.1
3.0m x 1.0m	1.0	0.0	-2.0	3.3
3.0m x 1.0m	1.5	0.0	-2.0	3.6
3.0m x 1.0m	2.0	0.0	-2.0	3.4
3.0m x 1.0m	3.0	0.0	-2.0	2.5
Radiant Flux to Occupants				
3.0m x 1.0m	0.5	0.0	-1.50	4.20
3.0m x 1.0m	1.0	0.0	-1.50	5.7*
3.0m x 1.0m	1.5	0.0	-1.50	5.5*
3.0m x 1.0m	2.0	0.0	-1.50	4.7
3.0m x 1.0m	3.0	0.0	-1.50	3.1
Base Case No (Vertical Offset)				
3.0m x 1.0m	1.0	0.0	0.0	19.1

Given the vertical offset, combustibles in the auditorium are not likely to ignite <25kW/m².

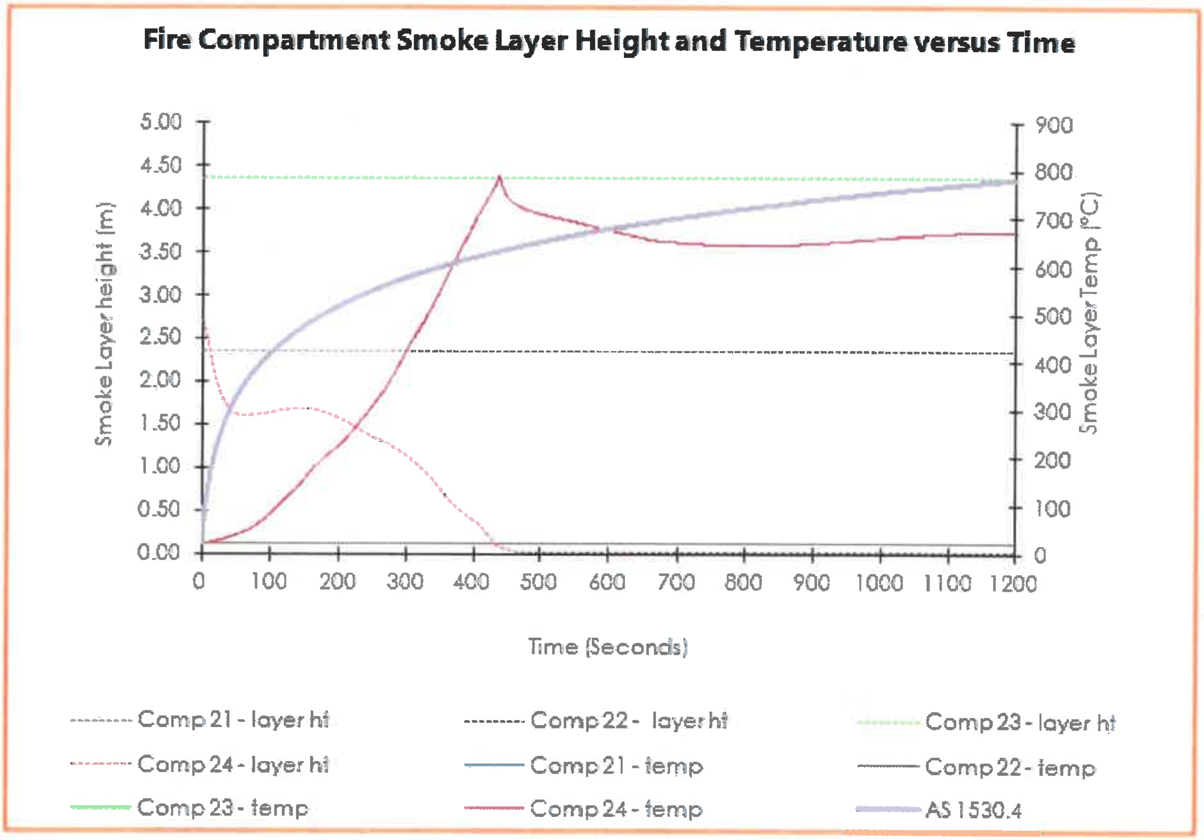
For occupants in close proximity to the glazing <3.0m away there is the potential for occupant to be at risk from adverse radiative exposures from the non fire side of the window (>4kW/m²).

It however unlikely that occupants will remain in place, with the activation of the building occupant warning system, occupants would be expected to move away from the fire threat towards to the south east door.

6.5.9.2 Fire in Bio Box – Smoke Spread for 5MW fire (that approximates to AS 1530.4)

6.5.9.2.1 Scenario 4 - Fire in Bio Box - Smoke Filling Rate – ASET Considerations – Sprinkler Partially Operates - Medium t² 5MW Fire approximates to AS1530.4 – Refer Appendix D2.4 for Results

In the unlikely event of smoke spread from the Bio-Box (for a 5MW fire as per BCA Specification E2.2b and noting the roof/ceiling is of Nil FRL) - Refer Appendix D2.4.2 for fire modelling.



The 5MW Bio Box input fire approximates to AS 1530.4 fire exposure temperature.

The time to exceed the nominated acceptance criterion for the proposed Alternative Building Solution in the tiered egress routes for a 5MW fire is presented within Table 25 below (Refer Appendix D2.4.2 for fire modelling).

Table 38: Available Safe Egress Times (ASET) for Occupants for a Sprinkler Partially Operates in Bio Box

Scenario	Compartment	Smoke Layer Height <2.0m and Temp > 35°C (Seconds)	Smoke Layer Height <2.0m and Temp > 60°C (Seconds)	Smoke Layer Temperature >183°C (2.5kW/m²) (Seconds)
5MW Fire in Bio Box	Comp 16	1800	1800	1800
5MW Fire in Bio Box	Comp 24 (RFO)	42	80	166

Note that occupants will be queuing at compartment second floor at the door (Compartment 16).

Note - Occupants are likely to adopt the most remote exit (150 occupants through 1 door) at the south east, away from the threat and lower in elevation (at Balcony compartment lower - Comp 16).

6.5.9.2.2 Fire Key Events (t_{alarm}) - Sprinkler Operates in Bio Box (Compartment 24)

The following key events were modelled (Refer Appendix D2.4) and will impact occupant movement with regard to cues of fire:

- Sprinkler activates at 122 seconds.
- Fire does NOT reach 1MW.

6.5.9.2.3 Flow Time (kt_{Flow})

The un-factored flow time from the balcony was determined in Appendix C2.2 (Table 46) to be 280. A factor of safety of **2.0** to movement time is applied (sprinkler operates).

Table 39: RSET for a 5MW Fire For Smoke Spread from Bio-Box

Scenario	Occupant Location	t_{alarm} (s)	t_{pre} (s)	k $t_{travel\ time}$ (s) k = 2.0 sprinkler operates	RSET (s)
5MW Fire in Bio Box	Comp 13 (Rear SF-Balcony)	122	120	560 =**2.0** x (280s)	**802 (13.4 minutes)**

6.5.9.2.4 ASET versus RSET – Sprinkler Operates though 5MW Fire in Bio Box

The following table depicts the comparison between the Available Safe Egress Time (ASET), versus the Required Safe Egress Time (RSET)

Table 40: ASET versus REST for a Sprinkler Partially Operates 5MW Fire in Bio Box

Scenario	Occupant Location	t_{alarm} (s)	t_{pre} (s)	k $t_{travel\ time}$ (s) k = 2.0 sprinkler operates	RSET (s)	ASET (s)		
						Smoke Layer <2.0m and > 35°C	Smoke Layer <2.0m and > 60°C	Smoke Layer >183°C (2.5kW/m²)
5W Fire in Stage Area	Comp 13 (Rear SF-Balcony)	122	120	560 =**2.0** x (280s)	**802 (13.4 minutes)**	**Did not occur**	**Did not occur**	**Did not occur**

The acceptance criterion is satisfied if the time to untenable conditions in the considered building (ASET) is greater than the potential flow time

ASET > RSET = minimum 30 mins >13.4 mins => **O.K.**

Note this assumes a factor of safety of **2.0** (as sprinkler operates) and a 120 second pre-movement time within the evacuation (RSET) considerations in the instance where the fire safety measures operate.

6.5.9.3 Fire in Auditorium to Bio Box

6.5.9.3.1 Radiation Protection

The auditorium is not provided with sprinkler protection at ceiling level though there are pendant sprinklers protecting the openings from the auditorium side.

The radiation protection from the Auditorium side will be equivalent to that as discussed for a Bio Box fire (§6.5.9.1). i.e. will not impose radiant heat fluxes n excess of 25kW/m² on the non fire side.

6.5.9.3.2 Smoke ingress

In the event of smoke spread to the Bio Box, it is proposed that the doors from the Bio Box to the egress route be provided with AS 1530.4 intumescent fire and AS 1530.7 smoke seals.

6.5.9.4 Fire Brigade Intervention Considerations

The following is a summary of the key results from the FBIM Estimation:

- First fire brigade appliance arrives on scene at 701 seconds (= 11.7 minutes) after alarm.
- Fire brigade setup completed, intervention underway on uppermost level 1762 seconds (=29.4 minutes) after alarm.

From a fire brigade intervention viewpoint, the building has access around the perimeter on 2 of 4 sides of the building via the street frontage and via the side stairs.

The impact on fire fighting is not likely to be adverse when considering the following -

- Bio Box Fire – the area is provided with sprinkler protection. For a fire commencing in this areas the fire brigade would be presented with a fire scenario consistent with a DtS sprinkler protected building

Based on the above, the opportunity for fire brigade intervention and exposure activities, is likely to be equivalent or better than other deemed-to-satisfy building solutions.

6.5.10 Consideration against Performance Requirements CP2 and CP8

The provision of protection of openings in elements that are required to be fire rated has been demonstrated to be sufficient to limit fire spread at least consistent with a building that meets the DtS requirements in the event of correct operation of the sprinkler system.

Accordingly it is considered that the relevant performance requirements CP2 and CP8 are met.

6.5.11 Conclusion

Based on the above, with regard to the provision of the bios box with openable windows protected by pendant wall wetting sprinklers, it is considered that the performance requirements CP2 and CP8, are satisfied to the degree necessary.

7 Conclusions

This Fire Engineering Report has presented a Performance Solution, for the Her Majesty's Theatre located at 17 Lydiard St S, Ballarat Central and will form the basis for an Interim Fire Safety Strategy.

Where new works are required, it is expected that the Relevant Building Surveyor will assess the development in accordance with Building Regulation 608.

The following variation from the DtS provisions, will be permitted as part of the Interim Fire Safety Strategy, and have been assessed in a fire engineering performance assessment against the relevant performance requirements of the BCA:

Table 41: Variations from BCA DtS Provisions associated with Refurbishment Works

DtS Clause	Description of Variation from BCA DtS Provisions	Performance Requirements
C3.5(a)(iii)* inter-Alia C3.8	The provision of a Specification C3.4 smoke door protected by a pendant sprinkler on the exposure side only in lieu of an FRL -/60/30 self closing fire door	CP2, CP8
D1.4(d)	The provision of an extended distance of travel of 30m in lieu of 20m in platform areas	DP4, EP2.2
BCA Clause D2.8(a)	A non fire isolated stair is provided with storage below (as per BCA Clause D2.8(b)) in lieu of no storage	CP2, DP5, EP2.2
BCA Clause E1.5 Spec E1.5 Clause 3 Inter-alia AS 2118.1 Clause 3.1.1.3	The provision of a sprinklers system that does not include fire separation between sprinkler protected and non sprinkler protected areas. [Sprinkler protection above, though not within the auditorium]	CP2, CP8, EP1.4
C2.7(a)(ii) inter-alia C3.4(a)(i)(A) and C3.4(a)(iii)(A)	The provision existing openings in Bio Box bounding wall that aligns with proposed fire wall, protected by pendant sprinkler each side	CP2, CP8

Note

The scope of this report is limited to the assessment of the relevant variations from the deemed-to-satisfy provisions of the BCA as outlined above, with regard to the Refurbishment Works. The building is otherwise assumed to comply with the Building Regulations at the time of construction in matters of fire safety. The scope of this report does not extend to any other variations from the deemed to satisfy provisions of the BCA and does not address non-fire related issues.

Any Performance Solution proposed associated with the provision of fire hydrant and fire hose reel protection for the site will under Regulation 309 require the report and consent/Opinion of the Chief Officer of the MFB.

The following design additions are prescribed as part of the Performance Solution, that verifies the Interim Fire Safety Strategy:

- **Construction and FRL's**
  - Bio Box – Glazed (and operable) openings between Bio box and Auditorium to be provided with AS 2118.1 fast response pendant sprinkler provided on the auditorium side and Bio box side of the wall/openings (<450mm above <600mm away). Bio box doors to be provided with AS 1503.4 intumescent fire and AS 1530.7 smoke seals.
  - Long Room - The west stairs are to be separated from the Long Room at first floor by minimum 35mm thick solid core timber doors (with minimum infill panel of 20mm thick hardwood permitted) protected by AS 2118.1 fast response pendant sprinkler provided on the Long Room Side (<1000mm away from the door).

- Auditorium - The stairs are to be fire separated from the Auditorium by minimum 35mm thick solid core timber doors (with minimum infill panel of 20mm thick hardwood permitted) protected by AS 2118.1 fast response pendant sprinkler provided on the auditorium side (<450mm above <600mm away from the door).
- Basement Level Substations and switchroom to be provided with minimum FRL 120/120/120 construction and FRL -/120/30 self closing fire doors.
- Basement Level Battery room to be fire-isolated by minimum FRL 120/120/120 construction and new FRL -/120/30 self closing fire doorset.
- Provide new fire door between basement backstage and administration areas/organ areas of FRL /120/30 fitted with a vision panel
- Sub-Basement Level - Ceiling to comprise 1 x 13mm fire grade plasterboard with penetrations protected to BCA Clause C3.15
- The fire walls are to be made good with penetrations infilled by FRL -/120/120 construction , protected in accordance with BCA Specification C3.15 or protected as nominated above.
- Louvres at external wall from Auditorium Compartment to Bio-Box to be provided with metal sheeting and sprinkler protection above
- Smoke walls are to be made good to meet BCA Specification C2.5 Clause 2.
- Existing doors adopted as fire/smoke doors for the purpose of Performance Solution are to be provided with AS 1530.7 smoke seals on the sides and head of the door(s).
- Existing north east non fire isolated stair provided with storage below permitted to be lined with 10mm standard grade plasterboard and 35mm thick self closing solid core door subject to sprinkler protection within.

- **Sprinkler Protection**
  - AS 2118 – 1982 sprinkler protection throughout the building with the exception of the auditorium and organ areas.
  - Bio Box – Glazed (and operable) openings between Bio box and Auditorium to be provided with AS 2118.1 fast response pendant sprinkler provided on the auditorium side and Bio box side of the wall/openings (<450mm above <600mm away). Bio box doors to be provided with AS 1503.4 intumescent fire and AS 1530.7 smoke seals.
  - Long Room - The west stairs are to be separated from the Long Room at first floor by minimum 35mm thick solid core timber doors (with minimum infill panel of 20mm thick hardwood permitted) protected by AS 2118.1 fast response pendant sprinkler provided on the Long Room Side (<1000mm away from the door).
  - Auditorium - The stairs are to be fire separated from the Auditorium by minimum 35mm thick solid core timber doors (with minimum infill panel of 20mm thick hardwood permitted) protected by AS 2118.1 fast response pendant sprinkler provided on the auditorium side (<450mm above <600mm away from the door).

- **Fire Detection/Alarms**
  - Ensure the auditorium is to be provided AS1670.1 smoke detection except in areas likely to provide spurious alarm, eg windy, dusty, cooking, steam, where heat detection/alarms can be provided.
  - A manual call point at the sub-panel and FIP and at proscenium controls
  - A public address (PA) system is to be provided at the BIO box and at the sub-panel
  - Ensure building occupant warning speaker and strobe is provided within the orchestra pit and organ chambers.
  - Ensure building occupant warning speaker and strobe is provided at far end of fly platform

- **Contractor Safety/Management**
  - Hot Works Permits
  - Contractor procedures/Inductions

- **Fire Wardens and Occupant Numbers**
  - A designated Fire Warden to be present at all times
  - Manual call point to be available at each required exit
  - The stairs are to be adopted as a safer haven for occupants in wheelchairs. The stair is separated from the auditorium by inherently fire resistant walls (masonry). Wall openings are to be protected by existing doors with sprinkler protection or self closing minimum FRL -/120/30 doors leaves with AS 1530.7 cool/medium temperature smoke seals and AS 1530.4 intumescent fire seals to the door heads, side and stiles

  - Occupant numbers shall not exceed 858 in Auditorium, 250 Back of House/Stage and 20 Staff (=1128 Total).

Occupant Numbers	
Stalls Level	439
Dress Circle	199
Long Room	70*
Balcony	150
Sub Total	**858**
Back of House/Stage	250
Staff	20
Total	**1128**

*Note if Long Room occupants increase to 120 (=70 +50 occupant to be a from balance of building)

- **Emergency Management and Evacuation Plans -**
  - An Emergency Management Plan in accordance with AS3745 is to be prepared for the facility; and
  - Evacuation plans and fire orders shall be prepared for the site consistent with BCA Clause G4.9. It is required that these plans and fire orders be reviewed to be provided such that they are consistent with the building structure, emergency plan, procedures and fire safety equipment.

Based on the analysis and discussion presented, it is considered that with regard to the variations from the DtS provisions identified above, the relevant performance requirements CP2, CP8, DP4, DP5, EP1.4 and EP2.2, are satisfied to the degree necessary (as far as practicable, in an existing building).

This report has been prepared subject to several conditions detailed within Section 8.

8 Conditions

This report has been prepared based on the following conditions:

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- The preparation of this report has been based on the information and drawings provided as detailed within this report. The use and occupancy should not change to the degree that assumptions made about the building fabric, function, occupant characteristics no longer valid. Any alterations to the proposed development and fire safety systems as provided and stated may invalidate the results of this report.

- This assessment does not include design aspects that are not explicitly specified in the Assessment Brief of this report. All non-specified design aspects are assumed to be fully BCA compliant or otherwise meet the Building Regulations. Consideration of all other issues associated with fire safety within the proposed development has not been made, nor has consideration been made for property protection, insurance and related risks and potential losses.

- The conclusions of this report assume that all essential services, including equipment, systems and procedures / occupant and staff training, are maintained to achieve their design intention, as required under essential services legislation, relevant Australian Standards or designer/manufacturer requirements.

- This report applies to this site only and shall not be applied to other buildings.

- Fire development associated with criminal acts including terrorism, arson, vandalism, explosives and/or multiple ignition sources or malicious acts, which deliberately result in fire ignition or interference with the fire safety systems for the building is outside the scope of this report

- It should be noted that it is not possible to totally eradicate the risk from fire, particularly those intimately involved with fire ignition.

- The reduction in the fire resistance levels of building construction elements compared with the deemed-to-satisfy provisions of the BCA may result in increased property damage, interruption of service and reconstruction costs in the event of a severe fire.

- Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety

Appendix A – Planning Report

Department of
Environment, Land
Water and Planning

Planning Property Report

from www.planning.vic.gov.au on 31 May 2018 05:29 PM

Address: 17 LYDIARD STREET SOUTH BALLARAT CENTRAL 3350
Lot and Plan Number: Lot 1 TP893826
Local Government (Council): BALLARAT **Council Property Number:** 2020975
Directory Reference: VicRoads 566 D8

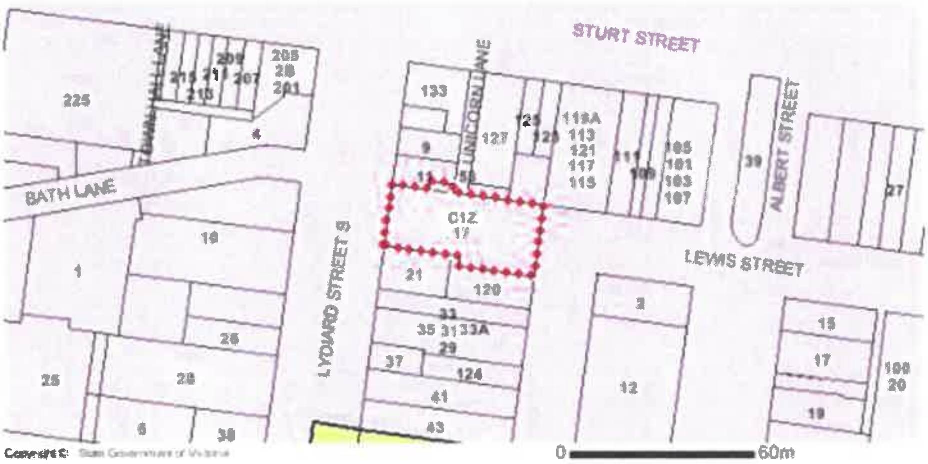
This property has 3 parcels.

For full parcel details get the free Basic Property report at Property Reports

Planning Zone

COMMERCIAL 1 ZONE (C1Z)

SCHEDULE TO THE COMMERCIAL 1 ZONE (C1Z)



Note: labels for zones may appear outside the actual zone - please compare the labels with the legend.

Zones Legend

- ACZ - Activity Centre
- B1Z - Commercial 1
- B2Z - Commercial 1
- B3Z - Commercial 2
- B4Z - Commercial 2
- B5Z - Commercial 1
- C1Z - Commercial 1
- C2Z - Commercial 2
- CA - Commonwealth Land
- CCZ - Capital City
- CDZ - Comprehensive Development
- DZ - Dockland
- ERZ - Environmental Rural
- FZ - Farming
- GRZ - General Residential
- GWAZ - Green Wedge A
- GWZ - Green Wedge
- IN1Z - Industrial 1
- IN2Z - Industrial 2
- IN3Z - Industrial 3
- LDRZ - Low Density Residential
- MUZ - Mixed Use
- NRZ - Neighbourhood Residential
- PCRZ - Public Conservation & Resource
- PDZ - Priority Development
- PPRZ - Public Park & Recreation
- PUZ1 - Public Use - Service & Utility
- PUZ2 - Public Use - Education
- PUZ3 - Public Use - Health Community
- PUZ4 - Public Use - Transport
- PUZ5 - Public Use - Cemetery/Crematorium
- PUZ6 - Public Use - Local Government
- PUZ7 - Public Use - Other Public Use
- PZ - Port
- R1Z - General Residential
- R2Z - General Residential
- R3Z - General Residential
- RAZ - Rural Activity
- RCZ - Rural Conservation
- RDZ1 - Road - Category 1
- RDZ2 - Road - Category 2
- RGZ - Residential Growth
- RLZ - Rural Living
- RUZ - Rural
- SUZ - Special Use
- TZ - Township
- UFZ - Urban Floodway
- UGZ - Urban Growth
- Urban Growth Boundary

Railway Tram River, stream Lake, waterbody

Appendix B – FBIM

Activity	Resources	Comments/Calculations	Activity Time (s)	Elapsed Time (s)
Detection of Fire and Signal To Brigade (Chart 1)				
Time to de-pressurise AS2118.1 system and activate pressure/flow switches		Table A	0	0
Time Delay for Verification		Table B	0	0
Time to Verify		Table B	0	0
Time delay until notification by FireBrigade - Day-time		Table B	0	0
Time Delay for Access, Dial and Connection		Table B	20	20
Time Taken to Dispatch Resources (Chart 2 and 3)				
Time to relay dispatch information by fully electronic CAD systen		Table D	30	50
Time to travel to fire station, dress, assemble, assimilate information and leave station	FF1-3	Chart 3 Table E (24 hr manned)	480	530
Time to travel to fire station, dress, assemble, assimilate information and leave station	FF4-6	Chart 3 Table E (24 hr manned)	90	140
Time Taken to Reach Fire Scene (Kerb Side) - (Chart 4)				
MFESB outer Suburb, use 90th percentile Design Speed		60.5km/hr - 1.28 x 16.2km/h = 39.764 km/hr		
Ballarat CFA	FF1-3	1.4km *1.5 @ 39.764km/hr	171	701
Sebastopol CFA	FF4-6	4.5km *1.5 @ 39.764km/hr	549	689
Time to Access and Assess Fire (Charts 5, 6, 7)				
Don BA and Gather Initial Equipment				
Dismount and Don BA (Chart 6)	FF1-3	Table M - (88 + 1.28 x 34.9 =132)	132	833
Remove necessary hydrant tools from truck	FF3	Table P - (32.5 + 1.28 x 18.1 = 55)	55	888
Dismount and Don BA (Chart 6)	FF4-6	Table M - (88 + 1.28 x 34.9 =132)	132	821
Remove necessary hydrant tools from truck	FF6	Table P - (32.5 + 1.28 x 18.1 = 55)	55	876
Determine fire location and investigate				
Time to Force Entry (Table I)	FF1	Table I - Glass door	15	903
Time to resolve wayfinding (Chart 5)	FF1	multi level open plan Table K = 10s	10	913
Time for internal travel to primary information target - assume 40m horiz (Chart 9)	FF1	Table Q - 40/(1.4-1.28 x 0.6)	63	976
travel up stairs (Chart 9)	FF1	Table T - ascend 72 steps in BA with equip. - 72/(0.9 - 1.28 x 0.4)	186	1162
travel down stairs (Chart 9)	FF1	Table T - descend 72 steps in BA with equip. - 72/(1.0 - 1.28 x 0.5)	200	1362
Survey Fire and Building Surrounds, Determine Additional Resources				
Time Taken for OIC to Walk Perimeter of Fire Area (Chart 7)	FF1	Table Q - Rise Storeys of 3, 1/4 perim. 3x(50m+ 20m)/4 /(1.4-1.28 x 0.6)	166	1528
Radio for Additional Resources (Chart 2)	FF1	Table D - Disptach by radio 30s	30	1558
Time to Travel to Setup Area (Charts 8,9)				
Setup is outside the building	FF1-3	0	0	1558
Time For Water Setup (Charts 10, 11)				
position appliance (assume move 40m)	FF2	Chart 10 Table U 40m @ 2m/s (40m/2m/s)	20	853
flush hydrant	FF3	Chart 5 Table 0 (32.8+1.28 x 20.6)	59	947
remove connect and charge hose from hydrant to appliance	FF2-3	Chart 10 Table V, note 1-off lines = (1 x (60.2 +1.28 x 30.2))	99	952
lay, connect and charge hose from appliance to branch	FF2-3	Chart 10 Table V, note 2-off lines = (2 x (33.3 +1.28 x 15.4))	106	1053
charge delivery hose from appliance	FF3	Chart 10 Table V = (18.4 +1.28 x 10.2)	31	1084
position appliance (assume move 0m) - second appliance to await OIC to have completed initial investigation and communicated to second unit via radio	FF6	Chart 10 Table U 40m @ 2m/s (40m/2m/s)	20	841
flush hydrant	FF4	Chart 5 Table 0 (32.8+1.28 x 20.6)	59	1035
remove connect and charge hose from hydrant to appliance	FF4-5	Chart 10 Table V, note 1-off lines = (1 x (60.2 +1.28 x 30.2))	99	1134
lay, connect and charge hose from appliance to branch	FF4-5	Chart 10 Table V, note 2-off lines = (2 x (33.3 +1.28 x 15.4))	106	1240
charge delivery hose from appliance	FF6	Chart 10 Table V = (18.4 +1.28 x 10.2)	31	1271
Time to Apply Water				
travel up stairs in stair with 38mm hose	FF1-2	Table T - ascend 72 steps with 38mm hose - 72/(0.8 - 1.28 x 0.3)	173	1731
travel to fire affected area with charged hose (assume 20m)	FF1-2	Table Q - 20/(1.4-1.28 x 0.6)	32	1762

First unit on scene at 701 seconds (approx 11.68) AFTER NOTIFICATION
Estimate Water applied at approx 1762 seconds (approx 29.37 mins) AFTER NOTIFICATION

gincat FIRE SAFETY ENGINEERS

Appendix C – Evacuation Approximations

C1.1 Egress Considerations

C1.1.1 Assumed Occupants Numbers Served per Exits

Occupant numbers shall not exceed 858 in Auditorium, 250 Back of House/Stage and 20 Staff (=**1128** Total).

Occupant Numbers	
Stalls Level	439
Dress Circle	199
Long Room	70*
Balcony	150
Sub Total	**858**
Back of House/Stage	250
Staff	20
Sub Total	**270**
Total	**1128**

Note if Long Room occupants increase to 120 (= 70 base occupant load + 50 restricted from balance of building) to ensure that 1128 is maintained overall.

The Subject building is provided with 3-off exits from the Balcony level serving 150 occupants. Under D1.6 the required aggregate width is 1500mm. At least 3m aggregate width is provided via 3-off stairs.

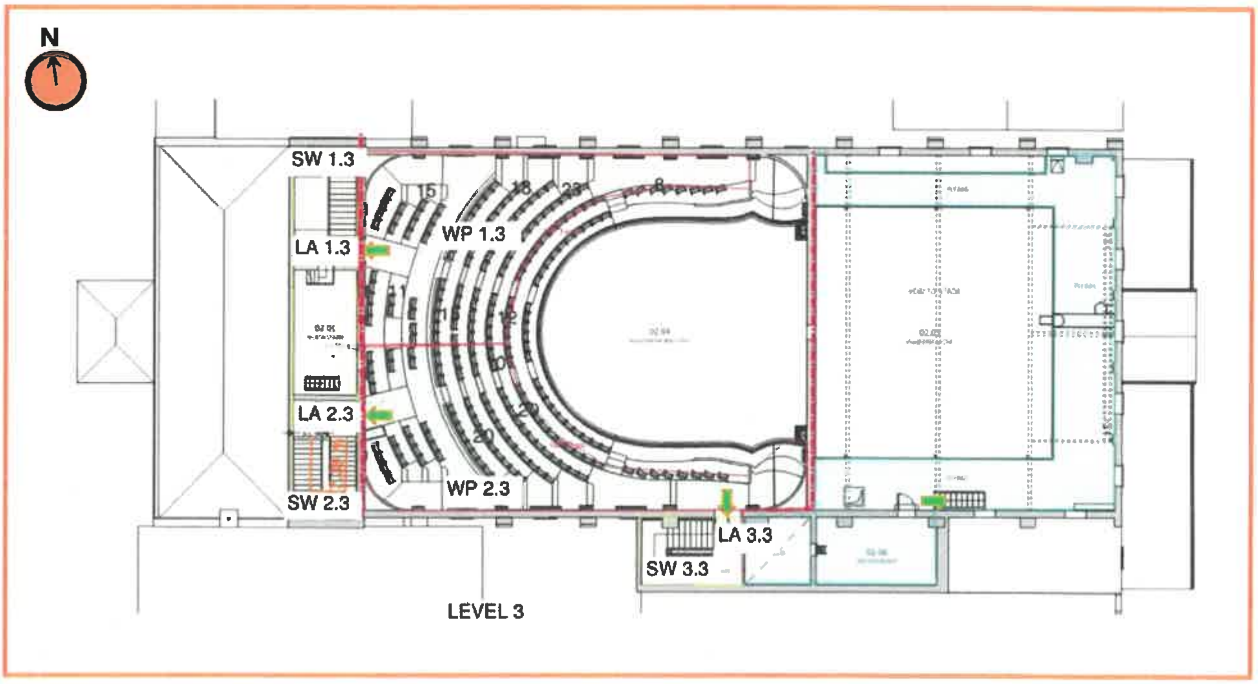


Figure 39: Balcony Level (150 occupants)

The Subject building is provided with 4-off exits from the Dress Circle level serving 199 occupants. Under D1.6 the required aggregate width is 2000mm. At least 4m aggregate width is provided via 4-off stairs.

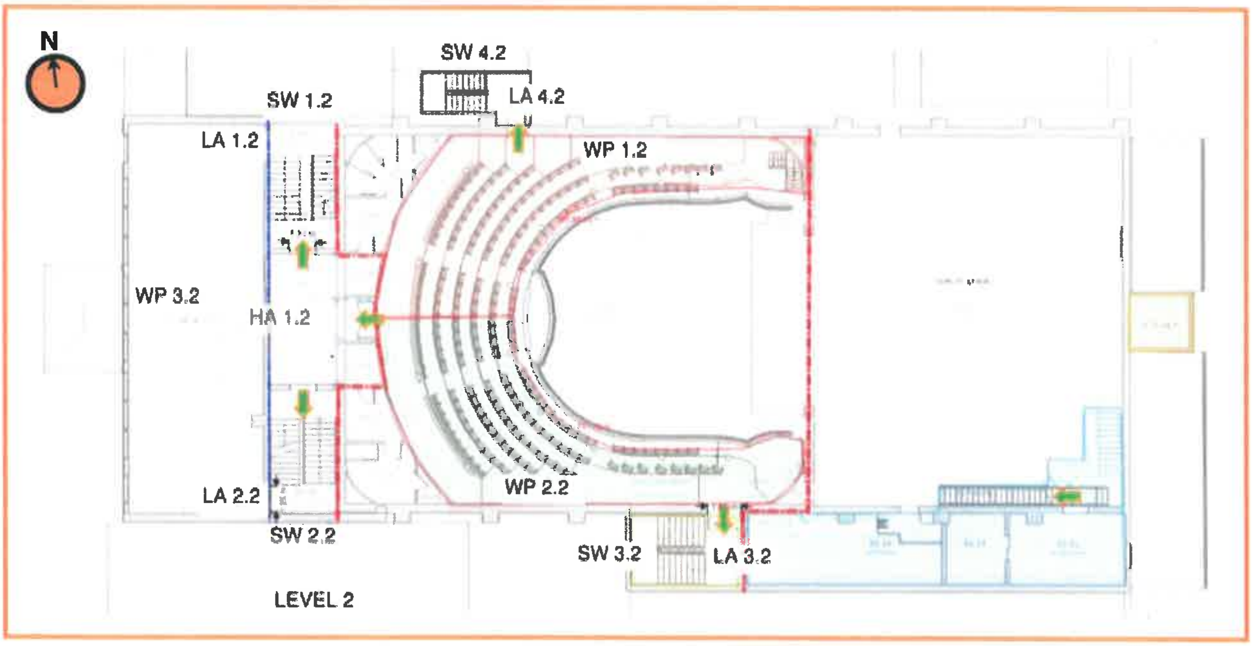


Figure 40: Dress Circle (199 + 70 in Long Room)

The Subject building is provided with 3-off exits from the Stalls serving 439 occupants. Under D1.6 the required aggregate width is 4000mm. At least 4.9m aggregate width is provided via 3-off exits (1.6m +1.3m + 2m)

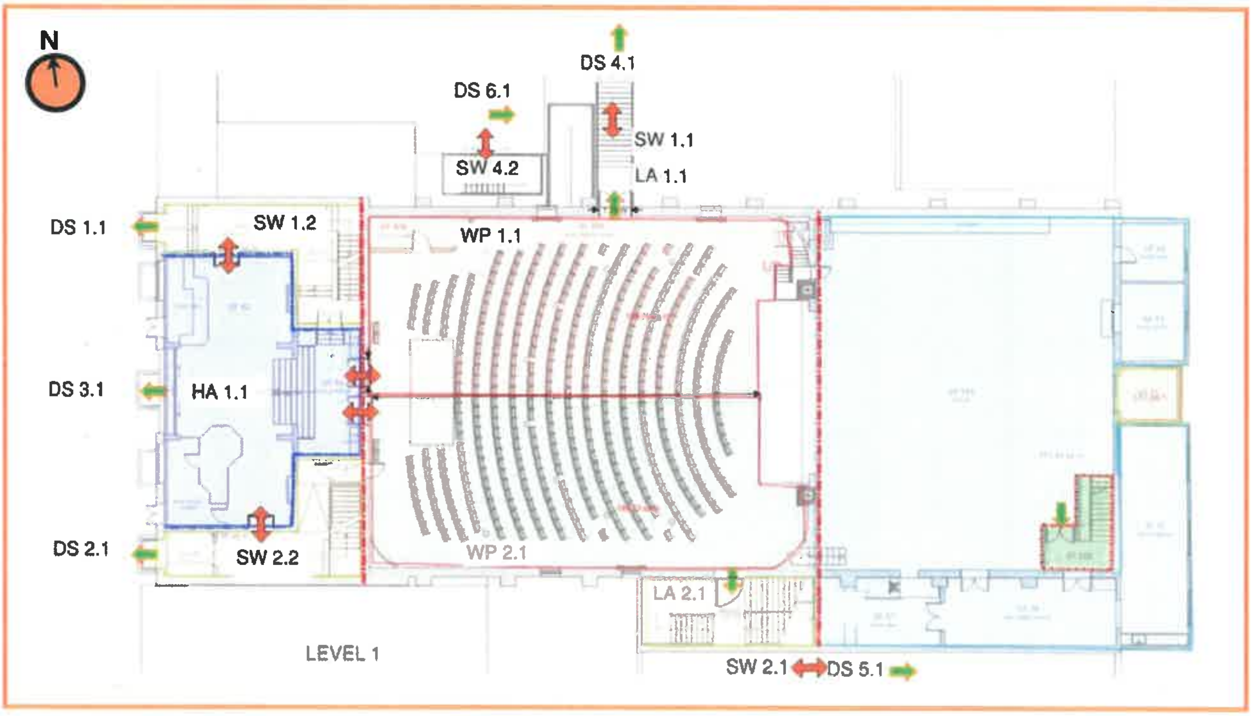


Figure 41: Stalls (439 occupants)

Note occupants in the ground level occupant of the Stalls are not expected to access the north and south corridors (with new smoke doors).

C1.1.2 Required Safe Egress Time (RSET)

The time for evacuation of a building, t_{evac}, using the evacuation methodology outlined in by Nelson and Mowrer [Nelson and Mowrer] and BSI DD240:Part 1:1997 [BSI DD240 : Part 1:1997] is represented by the equation:

$$t_{evac} = t_{alarm} + t_{pre} + kt_{flow} \qquad \text{(D1)}$$

where t_{alarm} = time for alarm to be raised
t_{pre} = time for pre-movement
k = factor of safety for travel time (assumed to be **2.0** correct operation of sub-systems and **1.5** for failure of a sub-system (eg sprinkler failure or proscenium)
t_{flow} = time for travel

The evacuation analysis will assume that all occupants will commence evacuation at the same time, therefore creating a bottleneck within the egress routes.

C1.1.3a Alarm Time, t_{alarm} – Auditorium Occupants

The building is provided with sprinkler protection at the stage/backstage area (the long room and within roof space over the auditorium) and a building occupant warning system.

Occupants are warned of the presence of fire aural, visual, tactile or olfactory cues. For the considered analysis they are assumed to be aware of fire by (and will depend on location of occupants relative to the fire :

(c) Aural Cues
(d) Visual Cues

(a) Aural Cues
Consistent with a BCA deemed-to-satisfy compliant building solution which would require an occupant to become aware of a fire through cues presented by olfactory, visual or aural means. Eg Detection system, Warden directions.

(b) Visual Cues

Occupants can be aware of a fire from the cues presented, before fire detection system [Bryan].

(1) The recognition of visual cues was calculated based on the time for activation of the fire detection system, or alternatively the fire size reaching 1MW is size and being observed by occupants. This is a relatively large fire size. E.g. refer to NIST photos of 1MW for fires involving a mattress and couch below.


(2) 10% Smoke layer Depth for 3m high ceiling - A second visual cue of when the smoke later depth is 10% of the floor to ceiling height is also adopted as occupants are closer to the ceiling layer and is 2 x greater than the 5% adopted in other references [BRRTF]

(3) 20% Smoke layer Depth for >3m high ceiling - A second visual cue of when the smoke later depth is 20% of the floor to ceiling height is also adopted as occupants are closer to the ceiling layer and is 2 x greater than the 5% adopted in other references [BRRTF]

C1.1.3b Alarm Time, t_{alarm} – Wardens

In the event of delays in activation, it is likely that visual cues would be available from 120 seconds for Wardens to operate the proscenium curtain.

t	slow t²	med t²	fast t²	ultra fast t²
alpha	0.00293	0.0117	0.0466	0.1874
k	600	300	150	75
0	0	0	0	0
30	2.637	10.53	41.94	168.66
60	10.548	42.12	167.76	674.64
75	16.48125	65.8125	262.125	1054.125
90	23.733	94.77	377.46	1517.94
120	42.192	168.48	671.04	2698.56
150	65.925	263.25	1048.5	4216.5
180	94.932	379.08	1509.84	6071.76
210	129.213	515.97	2055.06	8264.34
240	168.768	673.92	2684.16	10794.24
270	213.597	852.93	3397.14	13661.46
300	263.7	1053	4194	16866

At 2 minutes a medium t^2 fire is 168kW, this size fire aligns with trash can fire from 150kW to 300kW [NIST HRR]. This is likely to be observed by a Warden in the immediate vicinity of the stage.

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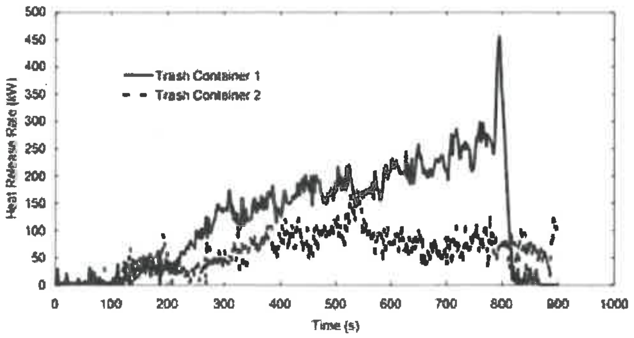


Figure 2. Graph of Heat Release Rate versus Time for Trash Containers 1 and 2.

Figure 6 Fire continues to grow in Trash Container 1

Figure 42: 300kW trash can fire

Given the rate of heat release, the average height of the continuous flaming region for an unconfined plume may be calculated using the equation below (McCaffrey 1979)

$$L_c = C_c Q^{2/5}$$

where

L_c	is the height of continuous flame	m	ft
C_c	is the coefficient	0.08 m/kW$^{2/5}$	0.258 ft/(Btu/s)$^{2/5}$
Q	is the total rate of heat release	kW	Btu/s

The height of the intermittent flame region may be calculated using the equation below (McCaffrey 1979)

$$L_i = C_i Q^{2/5}$$

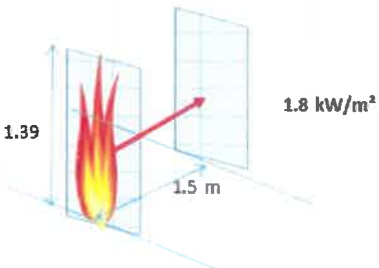
where

L_i	is the height of intermittent flame	m	ft
C_i	is the coefficient	0.20 m/kW$^{2/5}$	0.67 ft/(Btu/s)$^{2/5}$
Q	is the total rate of heat release	kW	Btu/s

HRR (kW) at distance R
Q= 167

			Fire HRR Q (kW)	Flame Height (m)	0.5 L1	Average Flame Height 0.5 L1 +Lc	
Continuous Flame Length	Lc	0.08	167.00	0.62			
Intermittent Flame Length	L1	0.2	167.00	1.55	0.77	1.39	m

setback from wall 1.5 m



POOL
MODAK

$$\dot{q}'' = \frac{\chi_r \dot{Q}}{4\pi R_o^2}$$

	Horiz kW/m²
Fraction of total energy radiated c_r =	0.3
Total heat release rate of fire, =	167
Distance from target to centre of fire, R_0 =	1.50
Radiant heat flux =	1.8

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The above flame height aligns with the test data.

$T_{visual\ alarm\ warden}$ = 120 seconds (proscenium shut at 300 seconds).
$T_{visual\ alarm\ occupants}$ = 180 seconds (upon half-way closure of proscenium); or
$T_{visual\ alarm\ occupants}$ = 300 seconds (no closure of proscenium and fire at 1MW)

C1.1.4 Occupant Pre-movement

Typically within the building, a pre-movement time of 6 minutes (=360 seconds) has been assumed from Table 3-13 of the SFPE handbook [SFPE], applicable to Shops, museums, leisure sports centres, and other assembly buildings – a category described broadly as occupants being awake and predominantly unfamiliar with the building, alarm systems and procedures.

This assumption is not applicable to occupants within the immediate vicinity of the fire, where visual, aural and olfactory cues are likely to alert these occupants of the occurrence of a fire, far sooner.

For occupants within the room of fire origin is assumed to be 60 seconds.

$t_{pre\ RFO}$ = time for pre-movement inside RFO = 60 seconds
t_{pre} remote $_{RFO}$ = time for pre-movement remote from fire though within RFO = 360 seconds
t_{pre} outside $_{RFO}$ = time for pre-movement outside RFO = 720 seconds

C1.1.5A Flow Time (t_{flow}) from Auditorium

The flow time, t_{flow}, will be predicted using the Evacnet 4[1] software package published by the College of Engineering, University of Florida.

Evacnet 4 requires the use of networks arranged as groups of nodes connected by arcs to define the evacuation process. Nodes are used to define a specific area of floor. Arcs are used to represent the connection and direction of travel between nodes.

The software determines the optimal time for the evacuation of a building, it is therefore a lower bound result. However, this is considered to be addressed in that several safety factors have been various at stages in the analysis.

The nodes require the maximum capacity and initial person contents to be specified. The maximum node capacity has been taken as the density for that level of service divided by the useable area. The data associated with the level of service ie. average density and speed has been based on that of Fruin[2].

[1] Kisko, T.M., Francis, R.L. & Nobel, C.R., "Evacnet 4 User's Guide", Version 10/29/98, University of Florida
[2] Fruin, J.J., "Pedestrian Planning & Design", 1971, Metropolitan Association of Urban Designers and Environmental Planners, New York

C1.1.5B Flow Time (t_{flow}) from Backstage

The flow time is a cumulation of the time to travel across the building and the queuing time at the exit, which can be expressed as follows:

$$t_{flow} = \max(t_{travel} + t_{queue}) \qquad - (2)$$

C1.1.5B.1 Travel Time from Backstage

The travel time travel can be expressed as a function of distance and speed as follows :

$$t_{travel} = \frac{dist}{speed} \qquad - (3)$$

The travel speed through the tenancy has been assumed to be 1.25m/s. The distance to an exit is expressed in metres.

For low occupant density (and free movement) a speed of 1.25m/s can be adopted (refer SFPE 3rd edition Figure 3-14.4) for uncongested travel

More congested areas will have a reduced travel speed.

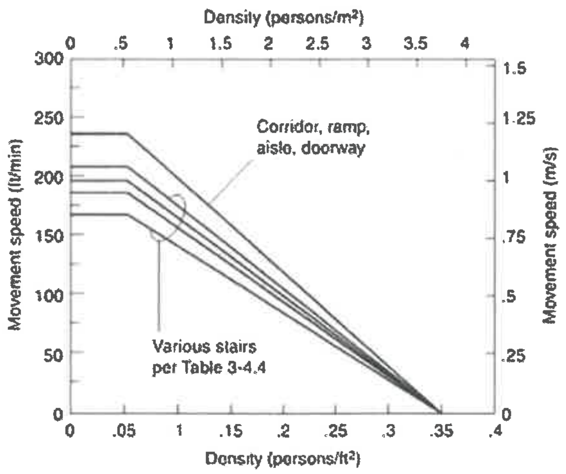

Figure 3-14.4. ***Evacuation speed as a function of density. S = k − akD, where D = density in persons/ft² and k is given in Table 3-14.2. Note that speed is along line of travel.***

Figure 43: Travel Speed from SFPE

C1.1.5B2.2 Queuing Time from Backstage

The occupant travel in a stair/aisles is dictated by the queuing time at the top of the exit; "the bottleneck" rather the free flow with no impediment.

In determining the occupant flow time through an exit, the effective width of the exit is to be determined having regard for boundary layer effects from walls, obstructions, handrails etc. where occupants need a clearance to accommodate the lateral body sway and assure balance" [Nelson].

The boundary layer widths are adopted from the SFPE Handbook of Fire Protection Engineering [Nelson] as shown in Figure 44. Assuming the stairs have handrails on both sides, the effective widths are taken from the clear stair width less the width of the boundary layers.

The total flow rate of the occupants is calculated by multiplying the effective width and the specific flow rate. The specific flow rate of 1.0 people/m/s is the prescribed value from SFPE Table 3-14.5 for the flow of occupants through an exit.

The queuing time of the occupants has then been calculated by dividing the total flow rate by the number of occupants.

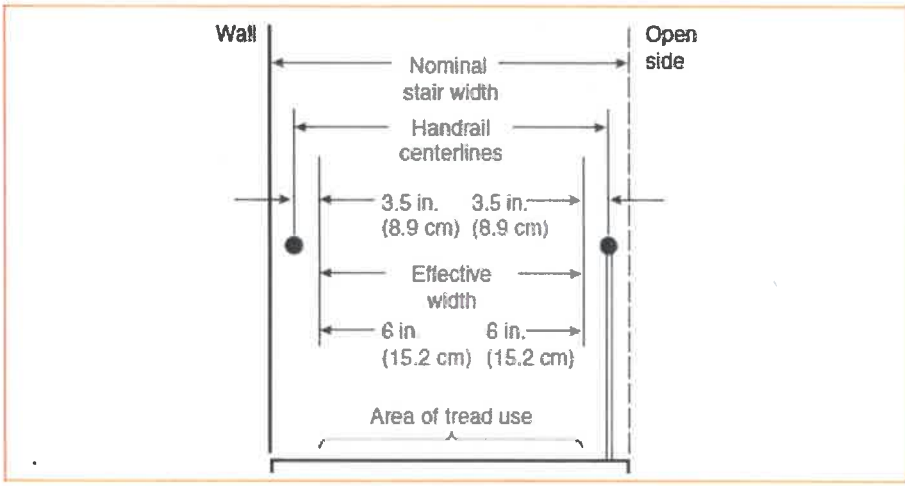

Figure 44: Measurement of effective width in stairs [Nelson]

The time to queue at an exit has been calculated using the following equation:

$$t_{queue} = \frac{p}{F_c} \qquad - (4)$$

Where p= population, calculated based on the area of the building as defined under BCA Table D1.13.

The population and tributary areas per exit, are shown in Figure 39 and arranged into quadrants with approximately 70% of the population served by the mid level exits.

F_c is the calculated flow, determined in accordance with the method presented in the SFPE Handbook, using the equation:

$$F_c = F_s W_e \qquad - (5)$$

Where W_e is the total effective width of the exits

Table C1.1.6 EVACNET 4 – NODE INPUTS from AUDITORIUM

FROM LEVEL 1 TO LEVEL 3 Description	Node No.	ASSUMED DIMENSIONS NODE INFORMATION Node Desig	Floor	Length L m	Width W m	Area m²	Useable Area UA (built as seats) m²	LOS	APAU m²/person	cf. Table D1.13 OCCUPANTS (theatre fixed seats) bca CAPACITY	m²/person	EVACNET 4 INPUTS NODE	Node Capacity NC	Initial Content IC
LEVEL 1														
Hall 1 level 1	1	HA1 1	1	10	11	110	110	D	0.48	220		HA1 1	237	[illegible]
North Hall	2	WP1 1	1	11	20	220	110	D	0.48	220		WP1 1	237	220
South Hall	3	WP2 1	1	11	20	220	110	D	0.48	220		WP2 1	237	200
Landing Stair 1 Level 1		LA1 1	1	1	1	1	1.5	D	0.48	3		LA1 1	3	0
Landing Stair 2 Level 1		LA2 1	1	1	1	1	1.5	D	0.48	3		LA2 1	3	0
Stair 1 Level 1	4	SW1 1	1	4.5	1.5	6.75	6.75	D	0.48	14		SW1 1	15	0
Stair 2 Level 1	5	SW2 1	1	4.5	1.5	6.75	6.75	D	0.48	14		SW2 1	15	0
													Sub-total	[illegible]
Destination Node 1 Level 1	6	DS1 1	1											
Destination Node 2 Level 1	7	DS2 1	1											
Destination Node 3 Level 1	8	DS3 1	1											
Destination Node 4 Level 1	9	DS4 1	1											
Destination Node 5 Level 1	10	DS5 1	1											
Destination Node 6 Level 1	11	DS6 1	1											
LEVEL 2														
Hall 1 level 2	12	HA1 2	2	6	6	36	36	D	0.48	72		HA1 2	75	0
North Hall	13	WP1 2	2	10	10	100	50	D	0.48	100		WP1 2	108	95
South Hall	14	WP2 2	2	10	10	100	50	D	0.48	100		WP2 2	108	100
Long Room	15	WP3 2	2	10	13	130	65	D	0.48	130		WP3 2	140	75
Landing Stair 1 Level 2		LA1 2	3	1	1	1	1.5	D	0.48	3		LA1 2	3	0
Landing Stair 2 Level 2		LA2 2	3	1	1	1	1.5	D	0.48	3		LA2 2	3	0
Landing Stair 3 Level 2		LA3 2	3	1	1	1	1.5	D	0.48	3		LA3 2	3	0
Landing Stair 3 Level 2		LA4 2	3	1	1	1	1.5	D	0.48	3		LA4 2	3	0
Stair 1 Level 2	16	SW1 2	2	7.5	1.5		11.25	D	0.48	23		SW1 2	24	0
Stair 2 Level 2	17	SW2 2	2	7.5	1.5		11.25	D	0.48	23		SW2 2	24	0
Stair 3 Level 2	18	SW3 2	2	7.5	1.5		11.25	D	0.48	23		SW3 2	24	0
Stair 4 Level 2		SW4 2	2	7.5	1.5		11.25	D	0.48	23		SW4 2	24	0
													Sub-total	[illegible]
LEVEL 3														
North Hall	19	WP1 3	3	10	11.2	112	56	D	0.48	112		WP1 3	121	100
South Hall	20	WP2 3	3	10	10.8	108	54	D	0.48	108		WP2 3	116	[illegible]
Landing Stair 1 Level 3		LA1 3	3	1	1	1	1.5	D	0.48	3		LA1 3	3	0
Landing Stair 2 Level 3		LA2 3	3	1	1	1	1.5	D	0.48	3		LA2 3	3	0
Landing Stair 3 Level 3		LA3 3	3	1	1	1	1.5	D	0.48	3		LA3 3	3	0
Stair 1 Level 3	21	SW1 3	3	7.5	1.5		11.25	D	0.48	23		SW1 3	24	0
Stair 2 Level 3	22	SW2 3	3	7.5	1.5		11.25	D	0.48	23		SW2 3	24	0
Stair 3 Level 3	23	SW3 3	3	7.5	1.5		11.25	D	0.48	23		SW3 3	24	0
													Sub-total	158
													TOTAL	836

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Table C1.1.7 EVACNET 4 – ARC INPUTS FROM AUDITORIUM

ARC	Level	NODES	Minimum Effective Width		[illegible]	Pedestrian Flow Volume	[illegible]	Dynamic Capacity OK (People/Interval)	Arc Length (m)	Avg Speed	Min Trav Time (Sec)	Traversal Time No. Intervals
INTRA FLOOR ARCS												
LEVEL [illegible]												
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
LEVEL [illegible]												
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
LEVEL 1												
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
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[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	17.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
INTER FLOOR ARCS												
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	18.48	[illegible]	2	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	18.48	[illegible]	2	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	18.48	[illegible]	2	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	18.48	[illegible]	2	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	18.48	[illegible]	2	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	18.48	[illegible]	2	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	18.48	[illegible]	2	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	18.48	[illegible]	2	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	18.48	[illegible]	2	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	18.48	[illegible]	2	[illegible]	[illegible]	[illegible]	2
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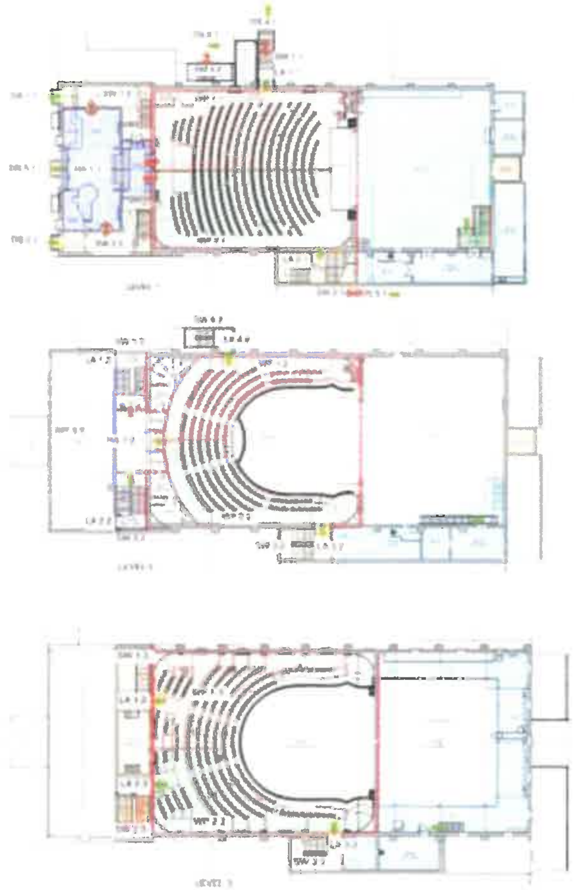
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	18.48	[illegible]	2	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	18.48	[illegible]	2	[illegible]	[illegible]	[illegible]	2



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C2.0 EVACNET 4 - RESULTS - AUDITORIUM EGERSS

```
EVACNET+ SUMMARY OF RESULTS FOR MODEL ID 'N=25'

      62   TIME PERIODS TO EVACUATE BUILDING (    310 SECONDS)

      10   TIME PERIODS FOR UNCONGESTED BUILDING EVACUATION (  50 SECONDS)

     6.2   CONGESTION FACTOR (RATIO OF BUILDING EVACUATION TIME TO
           UNCONGESTED BUILDING EVACUATION TIME)

    32.8   AVERAGE # OF PERIODS FOR AN EVACUEE TO EVACUATE (  164 SECONDS)

     13.8   AVERAGE NUMBER OF EVACUEES PER TIME PERIOD

     858   NUMBER OF SUCCESSFUL EVACUEES

     100   MAXIMUM # OF TIME PERIODS ALLOWED FOR EVACUATION ( 500 SECONDS)

      38   UNNECESSARY TIME PERIODS ( 190 SECONDS)
```

C2.1 EVACNET 4 - Flow Time Levels (Balcony is Level 3)

```
FLOOR NUMBER        TIME PERIOD LAST
                    EVACUEE LEFT FOOR

3                   56 (280 SECONDS)
2                   60 (300 SECONDS)
1                   60 (300 SECONDS)

DOES NOT INLCUDE TRANSIT TO OUTSIDE (310 SEOCONDS)
```

C2.2 EVACNET 4 - Flow Time Results Balcony

Un-factored Flow time results for egress from Balcony to stairs and outside respectively

Table 42: Un-factored Flow Time

Occupant Location	$t_{travel\ time}$ (s)
Balcony to stairs	**280**
Balcony to outside	**310**

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C3.0 Flow Time Results From Backstage Areas – First Order Approximate

C3.1 Aggregate Exit Width

Under BCA DtS Clause D1.6 the minimum aggregate exit width is 2500mm for an occupant load of 250.

Check	
D1.6	2m plus 500mm for every 60 persons above 200 occupanst
if occs >200	250
Width Reqd	2500

The two exit doors provide 2600mm (=2 x 1.3m) with not more than 50% constituting a horizontal exit as per BCA Clause D2.11.

C3.2 Flow Time Results From Backstage Areas

The unfactored flow time through the exits stair is 325 seconds and is governed by the hallway exits at 1m (refer Table C3.2 overpage).

Table 43: Un-factored Flow Time

Occupant Location	$t_{travel\ time}$ (s)
Backstage	**325**

Table C3.2 Flow Time Results in Back of House (250)

Prelim Sizes

	Total Area (m^2)	Total No Exits	Limiting Exit Trib. Area (m^2)	AVERGA OF BCA Table D1.13 (m^2/person)	Total No Persons in Exit	Cum No Persons	Revised Population Density D (person/m^2)	BCA Stair (mm) 180.00	Table 3-14.5 inches 7.48
Stage Door			135	1.00	135	135	1.00	250.00	9.84
Horiz Exit to Admins			135	1.00	135	270	1.00		
					135				

Flow through the Exits

Note	Limiting Width (m)	Effective Width W_e (m)	Maximum Specific Flow Table 3-14.5 F_{sc} (persons/sec/m eff width)	Calculated Flow F_s=F_s x W_e (persons/sec)	GOVERNING FLOWS Min Flow (persons/sec)	
Hall Condor	1.00	0.70	1.3	0.91	0.91	bottleneck at hall
Hall Condor	1.00	0.70	1.3	0.91	0.91	
Stage Door Door	1.32	1.02	1.3	1.33	0.91	
Horiz Exit Front Entry Door	1.32	1.02	1.3	1.33	0.91	

Speed through Stair/Exit / **Stair Travel Time**

	Evac Speed Constant k_1	Speed of Travel S=k_1 - a k_1 D (m/sec)	Conversion Factor Table 3-14.3	Horizontal Distance (m)	Linear Dist (m)	Inter-floor Time (secs/floor)
Hall	1.40	1.03	1.85	0.00	0.00	0.00
Hall	1.40	1.03	1.85	0.00	0.00	0.00
Stage Door	1.40	1.40	1.85	0.00	0.00	0.00
Horiz Exit	1.40	1.40		0.00	0.00	0.00
					Total	0.00

Horiz Prelim Floor Travel Speeds

	Intra Floor Exit Dist (m)	Evac Speed Constant k_2	Speed of Travel S=k_2 - a k_2 D (m/sec)	Travel Time To Exit (secs/floor)	Flow time from floor t_{flow} (secs)
Hall	40.00	1.40	1.03	38.93	38.9
Hall	40.00	1.40	1.03	38.93	38.9
Stage Door	40.00	1.40	1.40	28.57	28.6
Horiz Exit	40.00	1.40	1.40	28.57	28.6
				Max Flow Time	38.93

Travel Time for Last Person to Flow Through Stair

	Min Population Flow	0.91 persons/sec
	Cum Pop in Stair	270 persons
Time for Cum Pop. to pass thru a point in Stair		296.70 secs
Check	Travel time to exit	38.93 secs
	Travel time in stair	0.00
	Total	38.93 secs
	Max Flow Time	296.70 secs

First Order Approximate to Evacuate the Building (For the Last Person in Queue for Level 2)

Flow times			k x Flow time from building k t_{flow} secs	
Last Person to Leave Queue	296.70 s			
Travel to Door from queue	28.57 s	k=	1.0	
Total Flow Time	325.27 s		325.3	s
			5.4	mins

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C4.0 Flow Time Results From Balcony For Bio Box Fires – First Order Approximate

C4.1 Occupants Egress at Remote Stair

In the event that 150 occupants file through a single exit remote from the fire (and at a lower elevation) the time to egress was determined below:

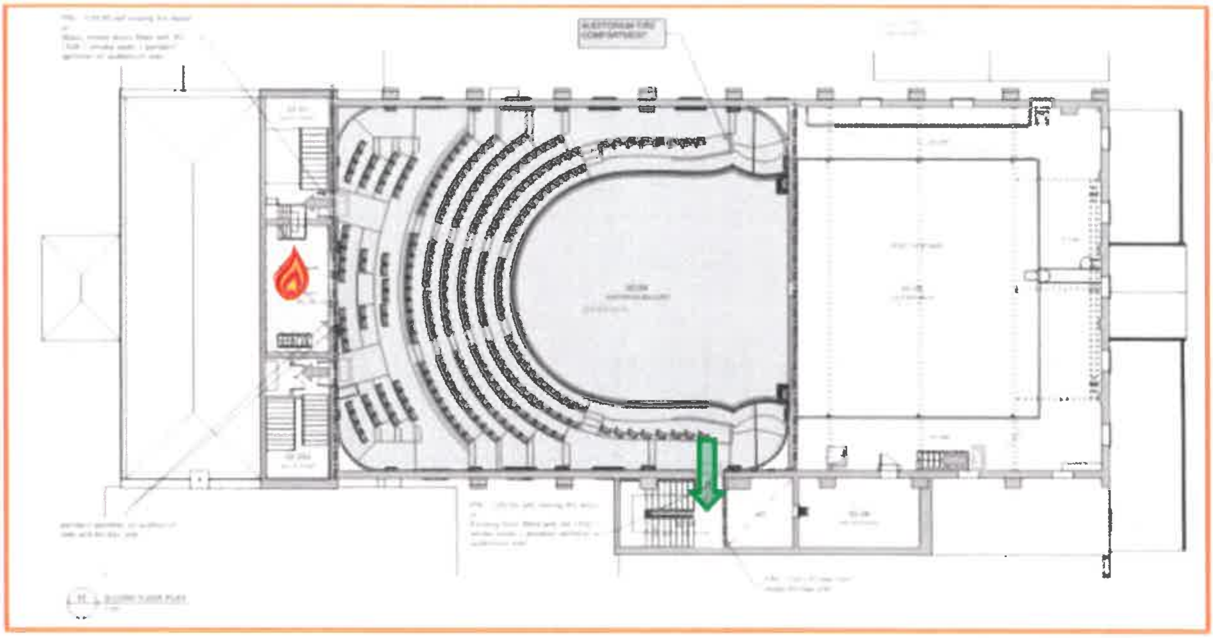


Figure 45: Egress via Second Floor

C4.2 Flow Time Results From Balcony

The unfactored flow time through the exits stair is 370 seconds and is governed by the hallway exits at 1m (refer Table C4.2 over page).

Table 44: Un-factored Flow Time

Occupant Location	$t_{travel\ time}$ (s)
Backstage	**370**

Table C4.2 Flow Time Results in Balcony adopting 1 exit

	Area m²		Area m²	Table D1.13 m²/person	Persons in Exit	Persons in Exit	Density D person/m²
2	150	1	150	1	150	150	1.00
1	0	1	0.001	1	0.001	150	1.00
G	0	1	0.001	1	0.001	150	1.00
	150				150		

(mm)	inches
190.00	7.48
250.00	9.84

Flow through the Exits

	Limiting Width m	Effective Width W_e m	Maximum Specific Flow Table 3-14.5 F_{sm} persons/sec/m eff width	Calculated Flow $F_c = F_s \times W_e$ persons/sec	GOVERNING FLOWS Min Flow persons/sec
Stairs	1.00	0.70	0.94	0.66	0.66
Door	1.00	0.70	1.3	0.91	0.66
Ground	1.05	0.75	1.3	0.98	0.66

Speed through Exits

	Evac Speed Constant k_1 (metric)	Table 3-14.2 Speed of Travel $S = k_1 - a\,k_1\,D$ m/sec
Stairs	1.00	1.00
Landings	1.40	1.40
Ground	1.40	1.40

Base Travel Time in Exits

	Conversion Factor Table 3-14.3 or 1	Planar Horizontal Distance m	Linear Dist m	Inter-floor Time secs/floor
Stairs	1.66	5.00	8.30	8.30
Landings	1	4.00	4.00	2.86
Ground	1	26.00	26.00	18.57

Horiz Prelim Floor Travel Speeds

Intra Floor Exit Dist m	Evac Speed Constant k_1	Speed of Travel $S = k_1 - a\,k_1\,D$ m/sec	Travel Time To Exit secs/floor
27.50	1.40	1.00	27.50

Overall Travel Time in Exits for storeys

Stairs Flights	5	41.5
Landings	5	14.3
Ground	1	2.9
	Total	58.64

Overall Linear Distance (including Fire Stairs)

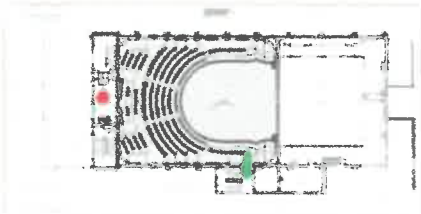
Intra Floor Distance		27.5
Stairs Flights	5	41.5
Landings	5	20.0
Ground	1	26.0
Total		89.0

Travel Time for Last Person to Flow Through Exit

Min Population Flow	0.66 persons/sec
Cum Pop in Stair	150.0 persons
Flow Time thru Bottleneck	228.0 secs
OR	
Travel time to exit	27.5 secs
Travel time in stair	58.6
Total	86.1 secs
Governing Flow Time	228.0 secs

First Order Approximation to Evacuate the Building (For the Last Person in Queue for Level 2)

Flow times		k x Flow time from building k t_{flow} secs
Last Person to Leave Queue	227.87 s	
Travel to Door from queue	18.57 s	k= 1.5
	s	
Total Flow Time	246.54 s	369.8 s
		6.2 mins



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Appendix D – CFAST Analysis

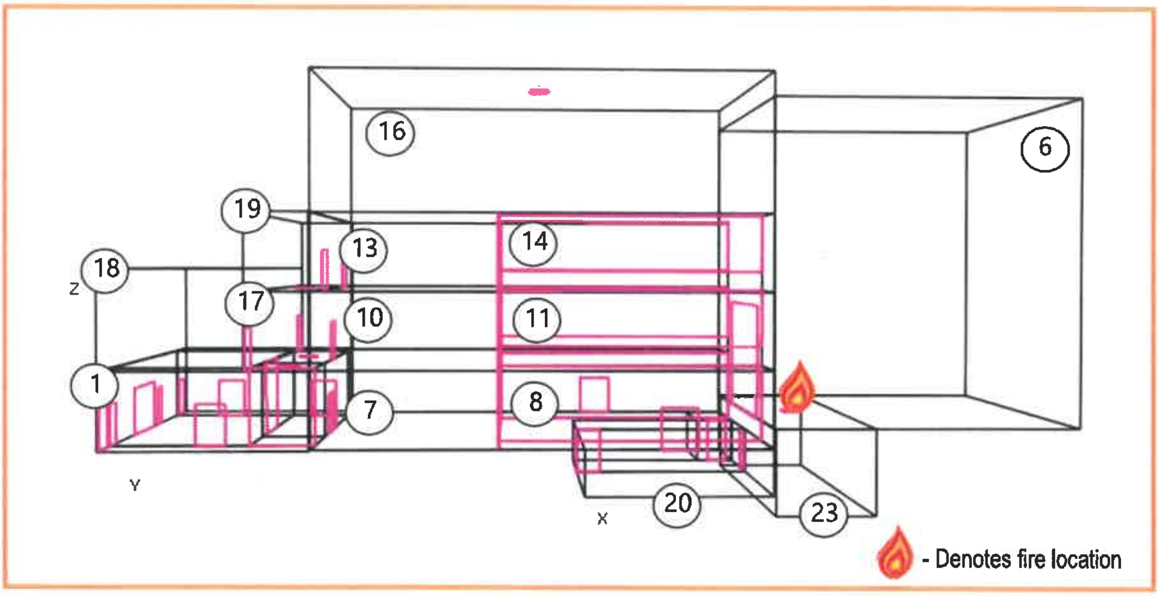
D1 CFAST Input Details

D1.1 CFAST Input Details – Proposed Building Solution

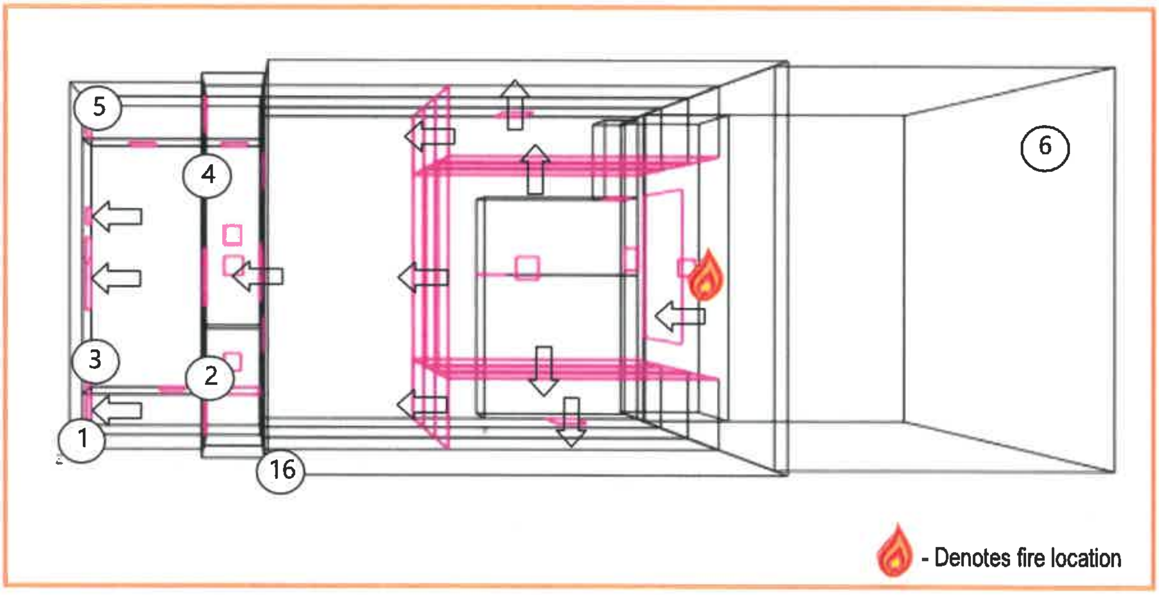
	Width x Depth x Height	Openings	Opening Size (m)
Compartment 1 South Entrance	10.2 x 2.3 x 3.9	1 → Outside 1 → 2 1 → 3	1.5 x 2.1 3.27 x 3.9 100% open 1.5 x 2.1
Compartment 2 South Staircase	3.27 x 3.75 x 3.9	-	-
Compartment 3 Main Foyer	6.95 x 14.62 x 3.9	3 → Outside 3 → Outside 3 → Outside 3 → 4	1 x 2.1 1 x 2.1 4.3 x 2.5 3.4 x 3.9 100% open
Compartment 4 North Stairs	3.27 x 10.87 x 3.9	4 → 5 4 → 7 4 → 7	1.5 x 2.1 1.5 x 2.1 1.5 x 2.1
Compartment 5 North Entrance	10.2 x 2.43 x 3.9	5 → Outside 5 → 3	1.5 x 2.1 1.5 x 2.1
Compartment 6 Stage (RFO)	**15.5 x 18.3 x 16.5**	**6 → 16**	**8.45 x 11.7 100% open**
Compartment 7 Rear Seating GF	9.25 x 18.3 x 3.9	7 → 8 7 → 9 7 → 16	3.55 x 3.9 100% open 3.55 x 3.9 100% open 11.2 x 3.9 100% open
Compartment 8 Right Seating GF	13.75 x 3.55 x 3.9	8 → Outside 8 → 16	1.84 x 2.1 13.75 x 3.9 100% open
Compartment 9 Left Seating GF	13.75 x 3.55 x 3.9	9 → Outside 9 → 16	1.84 x 2.1 13.75 x 3.9 100% open
Compartment 10 Rear Seating FF	9.25 x 18.3 x 3.9	10 → 11 10 → 12 10 → 16 10 → 17	3.55 x 3.9 100% open 3.55 x 3.9 100% open 11.2 x 3.9 100% open 1.84 x 2.1
Compartment 11 Right Seating FF	13.75 x 3.55 x 3.9	11 → 16	13.75 x 3.9 100% open
Compartment 12 Left Seating FF	13.75 x 3.55 x 3.9	12 → 16	13.75 x 3.9 100% open
Compartment 13 Rear Seating SF	9.25 x 18.3 x 3.9	13 → 14 13 → 15 13 → 16 13 → 19 13 → 19	3.55 x 3.9 100% open 3.55 x 3.9 100% open 11.2 x 3.9 100% open 1.84 x 2.1 1.84 x 2.1
Compartment 14 Right Seating SF	13.75 x 3.55 x 3.9	14 → 16	13.75 x 3.9 100% open
Compartment 15 Left Seating SF	13.75 x 3.55 x 3.9	15 → 16	13.75 x 3.9 100% open
Compartment 16 Volume above Seating Area	23.0 x 18.3 x 18.75	-	-
Compartment 17 Entrance to Long Room	3.12 x 19.35 x 3.9	17 → 18 17 → 18	1.84 x 2.1 1.84 x 2.1
Compartment 18 Long Room	7.1 x 19.35 x 5.0	-	-
Compartment 19 SF Theatre Entrance	3.12 x 19.35 x 3.9	-	-
Compartment 20 Basement Right	9.4 x 8.7 x 2.35	20 → 21	1.28 x 2.35 100% open
Compartment 21 Basement Middle	9.4 x 4.7 x 2.35	21 → 22 21 → 22	1.06 x 2.35 100% open 1.36 x 2.1
Compartment 22 Basement End	2.0 x 4.7 x 2.35	-	-
Compartment 23 Orchestra Pit	5.0 x 18.3 x 4.35	-	-

5% Building Leakage Assumed

D1.2 CFAST Input Details – Model



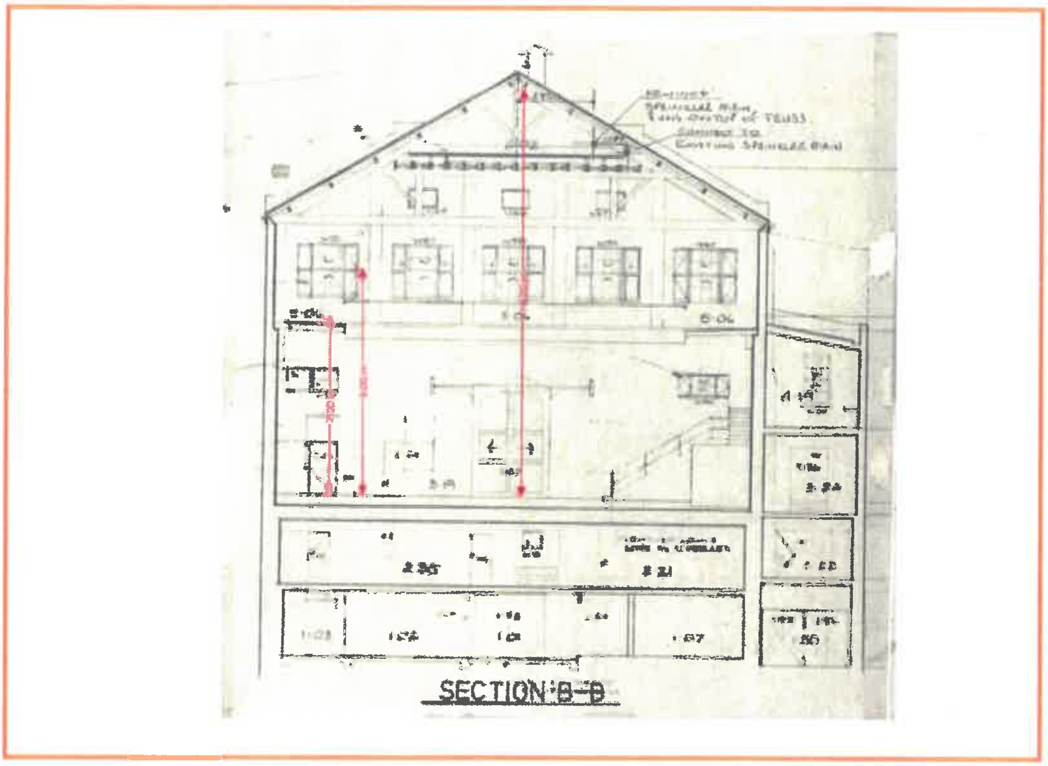
SIDE VIEW



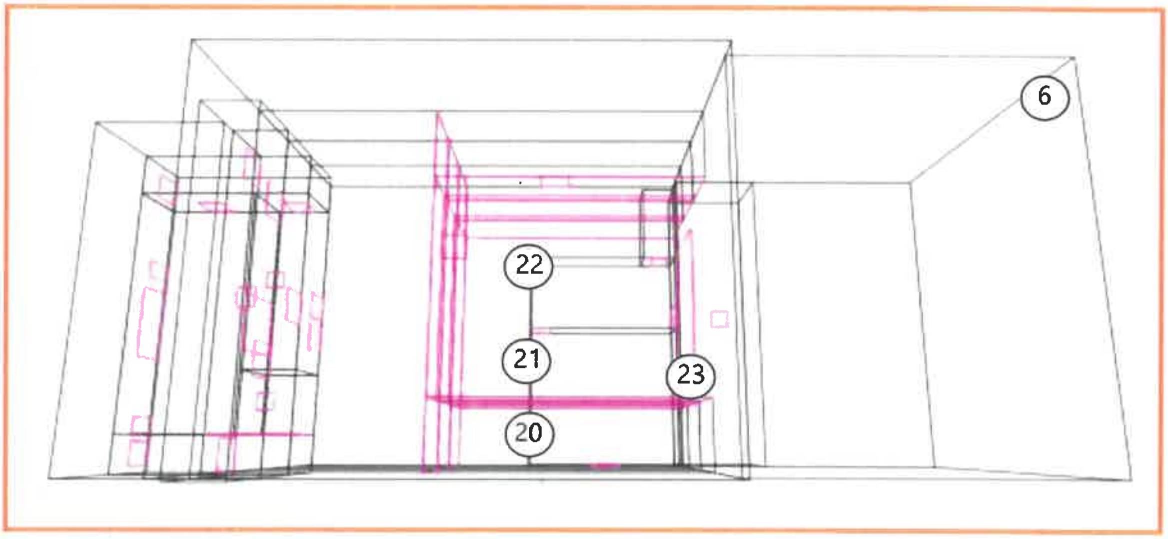
BIRDS EYE GROUND LEVEL FOYER AREA + STAGE

Platform fly is at 7m elevation

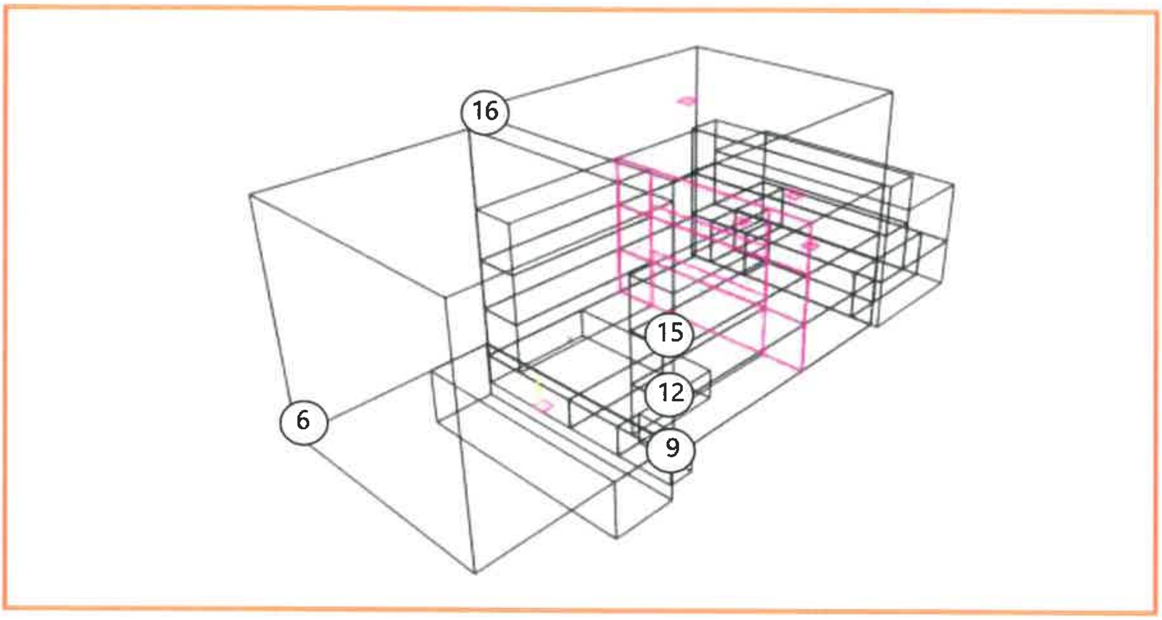
Basement + STAGE



Other Side



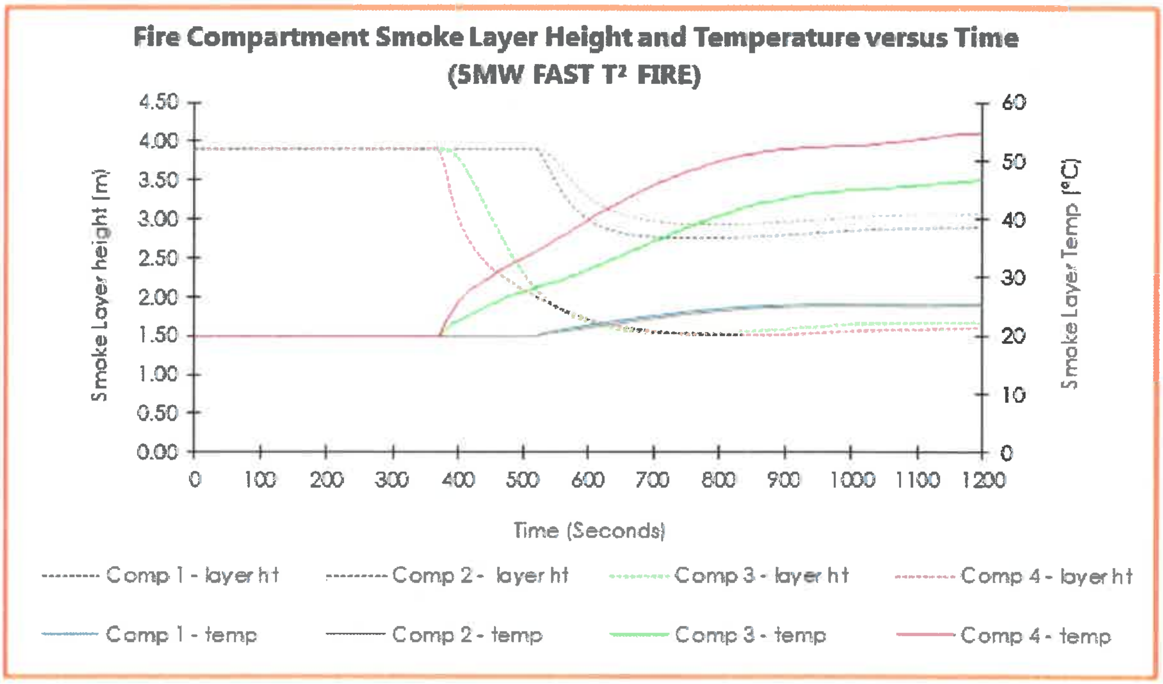
Basement + STAGE

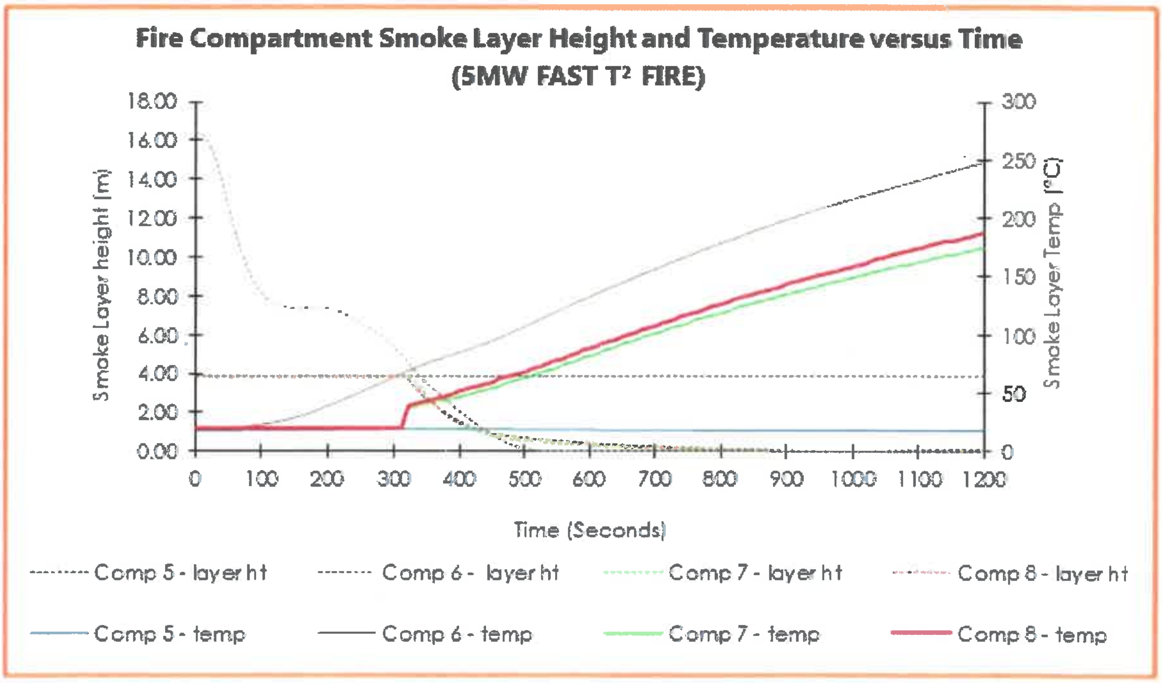


Other Side

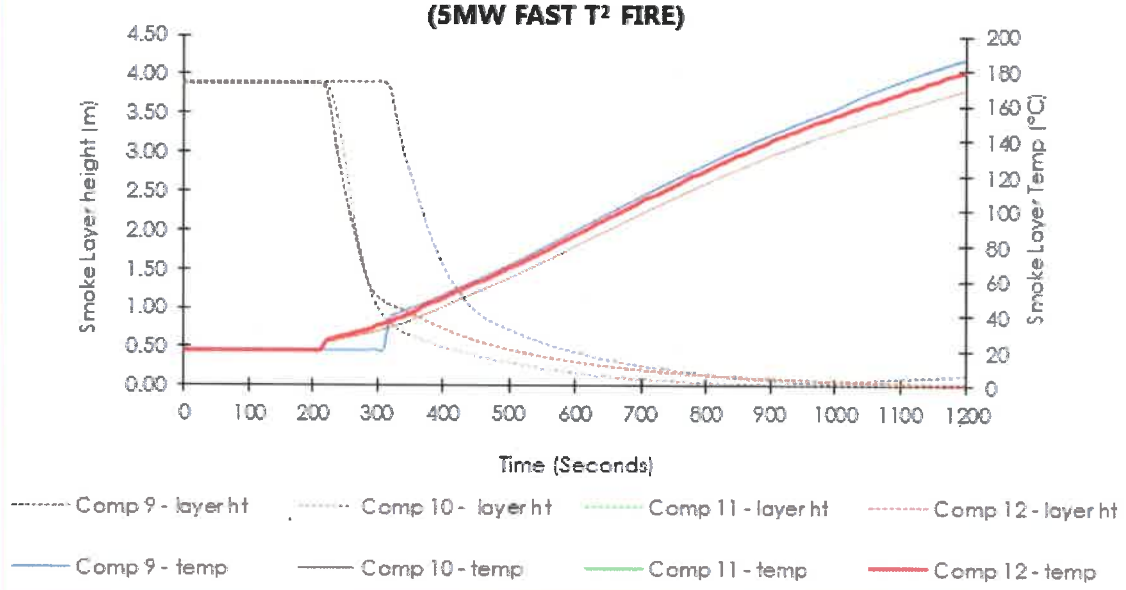
D2 Results from CFAST Analysis

D2.1 Scenario 1 - Fire in the Centre Stage Area Medium t² 5MW Fire (Compartment 6) – No Sprinkler Operation Proscenium Open (two fire safety sub-systems fail)

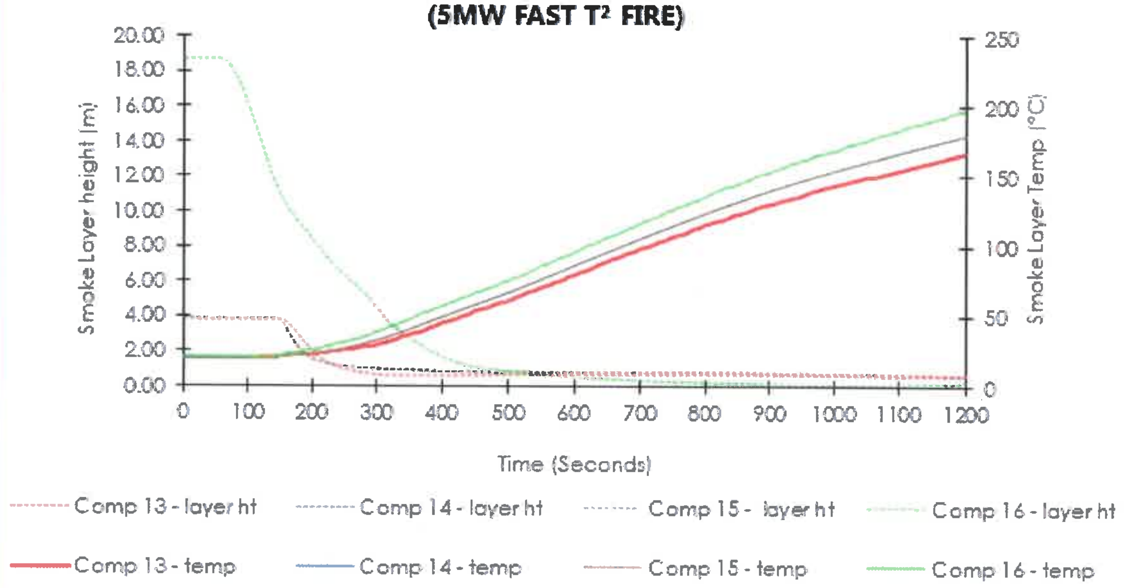


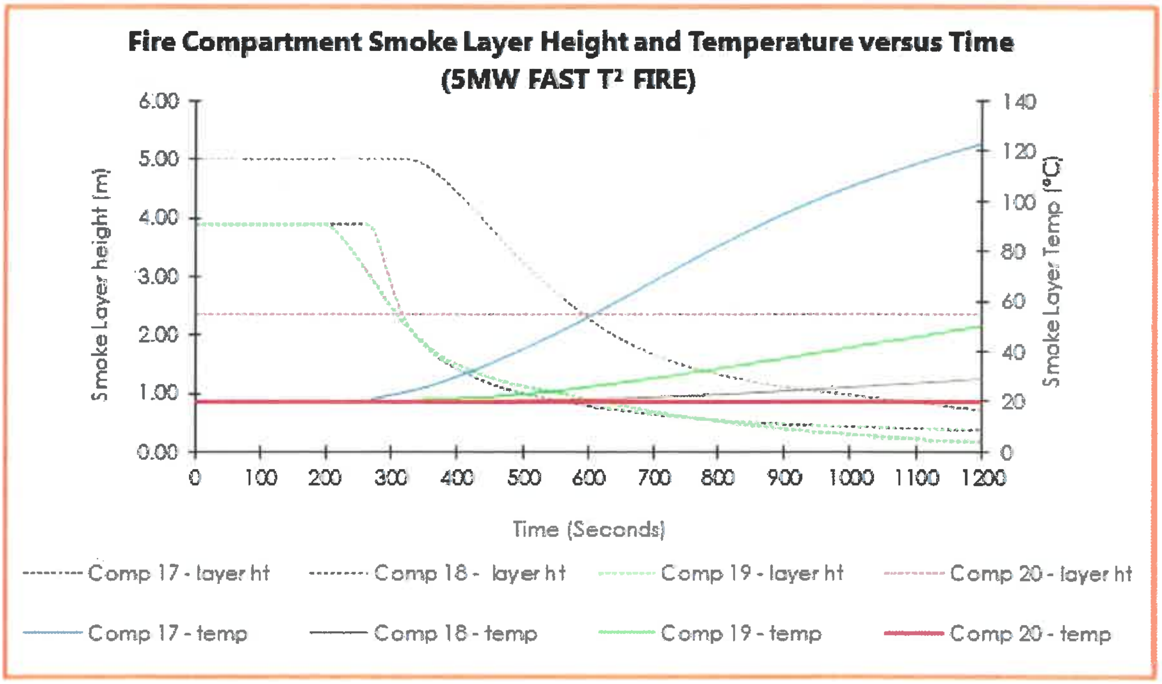


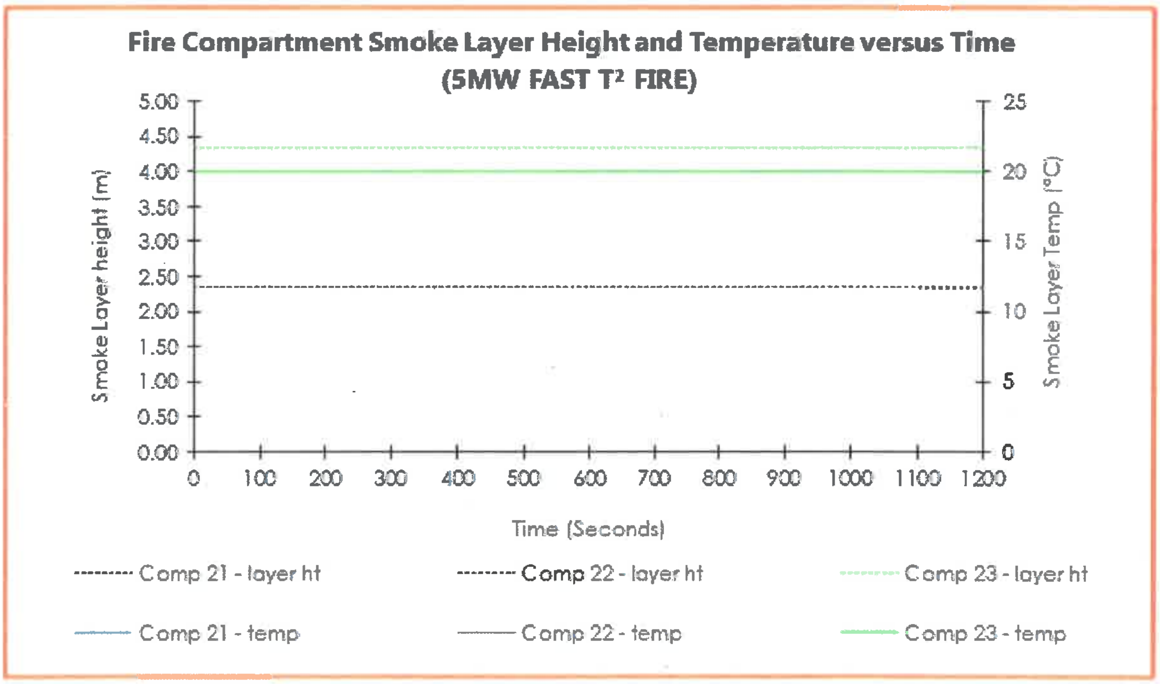
Fire Compartment Smoke Layer Height and Temperature versus Time (5MW FAST T² FIRE)



Fire Compartment Smoke Layer Height and Temperature versus Time (5MW FAST T² FIRE)







The following key events were modelled:

- Smoke layer 20% of floor to ceiling height at **110** seconds
- Fire at 1MW at **290** seconds

Scenario	Smoke Layer Height <2.0m and Temp > 35°C (Seconds)	Smoke Layer Height <2.0m and Temp > 100°C (Seconds)	Smoke Layer Temperature >183°C (2.5kW/m²) (Seconds)
Compartment 1 South Entrance	Did not occur	Did not occur	Did not occur
Compartment 2 South Staircase	Did not occur	Did not occur	Did not occur
Compartment 3 Main Foyer	670	Did not occur	Did not occur
Compartment 4 North Stairs	530	Did not occur	Did not occur
Compartment 5 North Entrance	Did not occur	Did not occur	Did not occur
Compartment 6 Stage (RFO)	402	471	820
Compartment 7 Rear Seating GF	376	694	Did not occur
Compartment 8 Right Seating GF	379	660	1165
Compartment 9 Left Seating GF	379	660	1165
Compartment 10 Rear Seating FF	330	710	Did not occur
Compartment 11 Right Seating FF	305	670	Did not occur
Compartment 12 Left Seating FF	305	670	Did not occur
Compartment 13 Rear Seating SF	**340**	**710**	**Did not occur**
Compartment 14 Right Seating SF	310	670	Did not occur
Compartment 15 Left Seating SF	310	670	Did not occur
Compartment 16 Volume above Seating Area	385	620	1095
Compartment 17 Entrance to Long Room	336	945	945
Compartment 18 Long Room	Did not occur	Did not occur	Did not occur
Compartment 19 SF Theatre Entrance	840	Did not occur	Did not occur
Compartment 20 Basement Right	Did not occur	Did not occur	Did not occur
Compartment 21 Basement Middle	Did not occur	Did not occur	Did not occur
Compartment 22 Basement End	Did not occur	Did not occur	Did not occur
Compartment 23 Orchestra Pit	Did not occur	Did not occur	Did not occur

Table 45: Available Safe Egress Times (ASET) for Occupants for a Sprinkler Failure 5MW Fire in Centre Stage Area – Proscenium Open

Scenario	Compartment	Smoke Layer Height <2.0m and Temp > 35°C (Seconds)	Smoke Layer Height <2.0m and Temp > 100°C (Seconds)	Smoke Layer Temperature >183°C (2.5kW/m²) (Seconds)
5MW Fire in Stage Area	Comp 13	340	710	Did not occur

Note that occupants will be queuing at compartment second floor at the door (Compartment 13).

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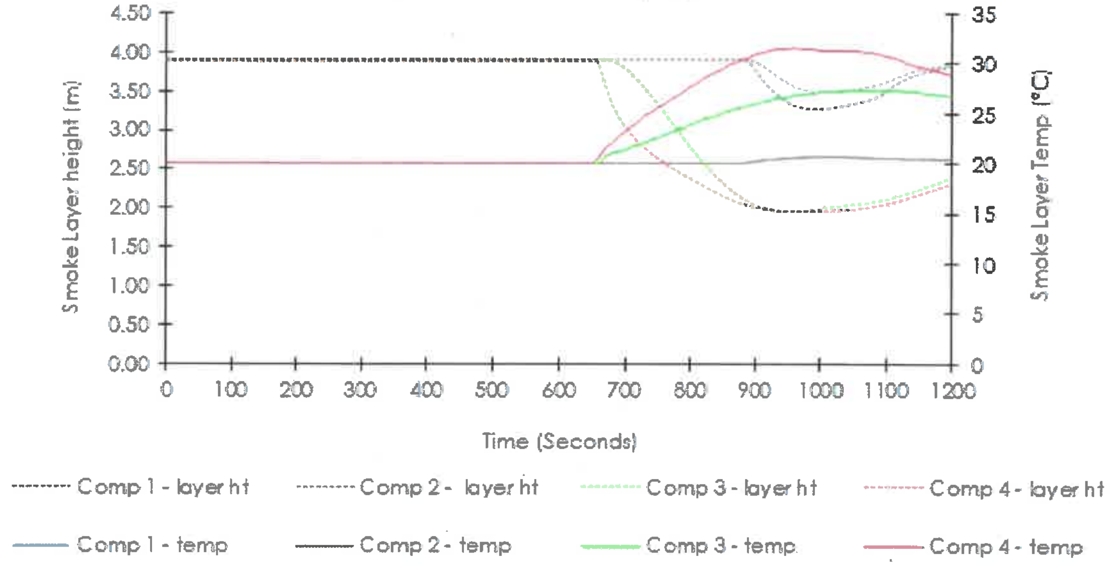
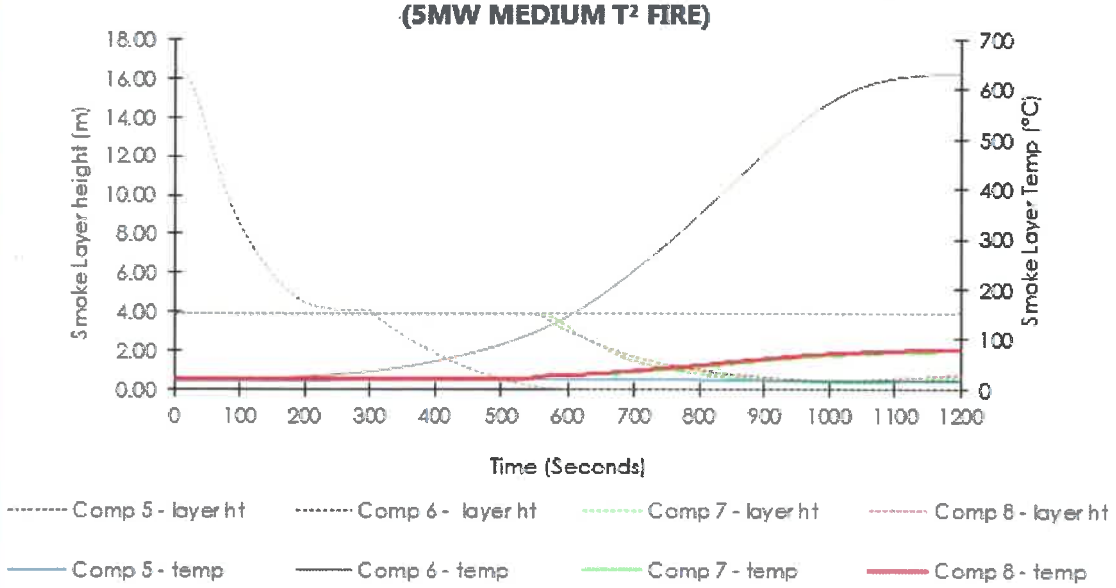
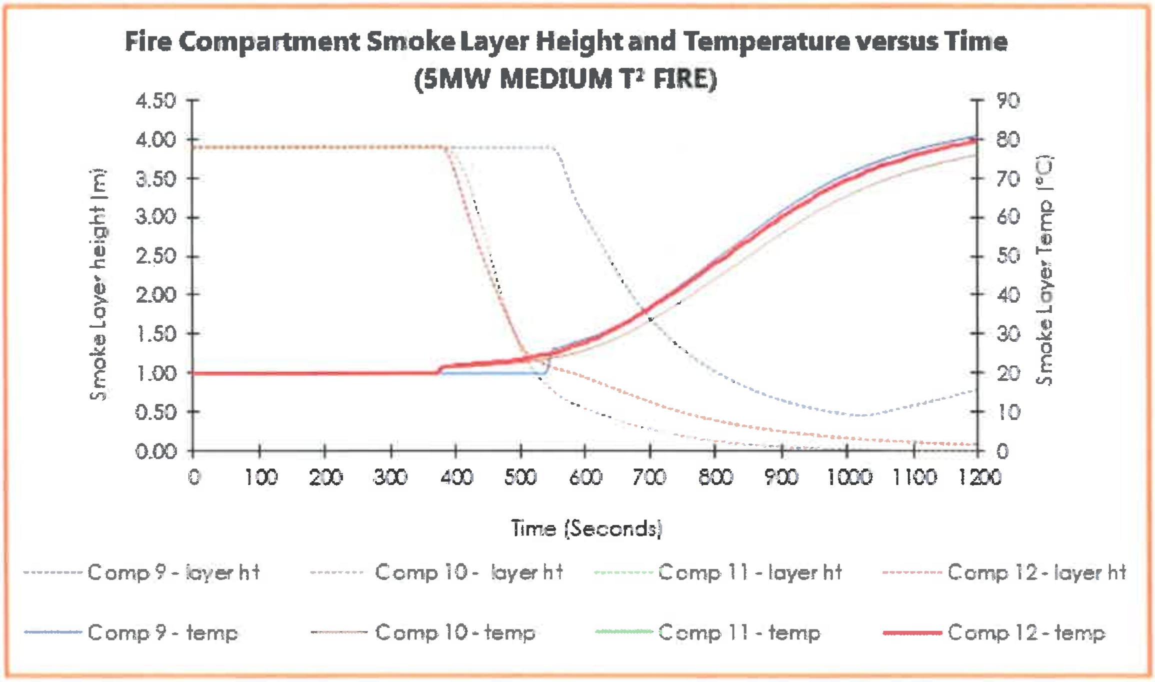
D2.2 Scenario 2 - Fire in the Centre Stage Area Medium t² 5MW Fire (Compartment 6) – No Sprinkler Operation Proscenium Closed at 300s

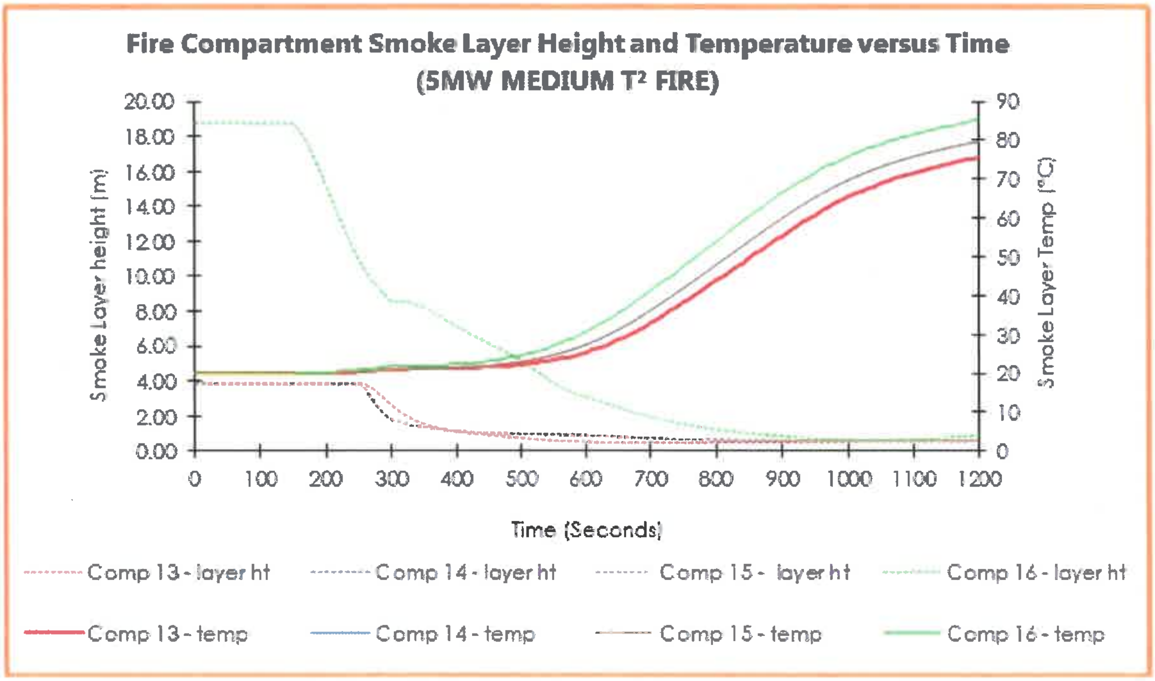
Fire Compartment Smoke Layer Height and Temperature versus Time (5MW MEDIUM T² FIRE)

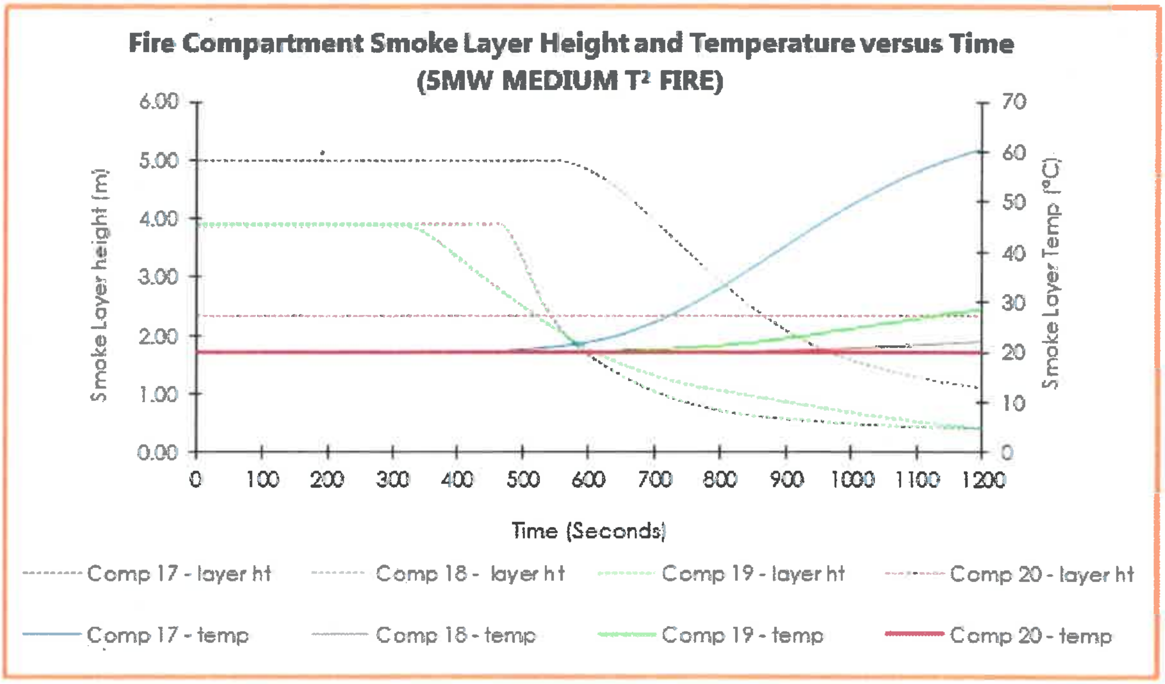


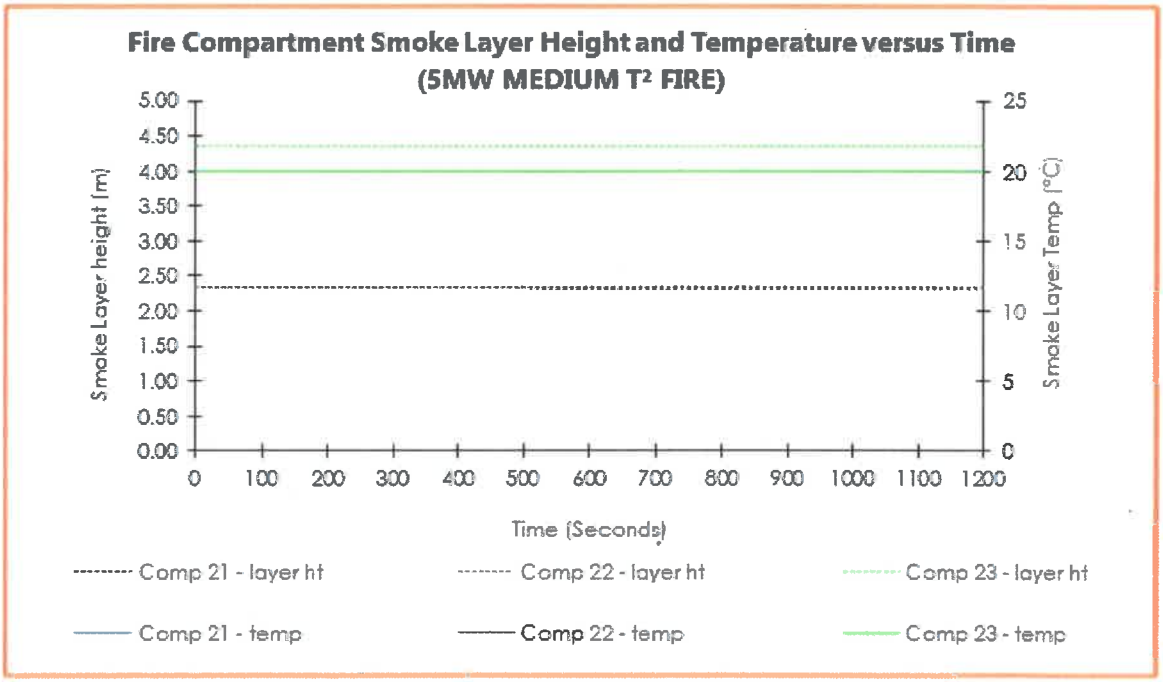
Fire Compartment Smoke Layer Height and Temperature versus Time (5MW MEDIUM T² FIRE)




Fire Compartment Smoke Layer Height and Temperature versus Time
(5MW MEDIUM T² FIRE)
Smoke Layer height (m)
Smoke Layer Temp (°C)
Time (Seconds)
Comp 9 - layer ht
Comp 10 - layer ht
Comp 11 - layer ht
Comp 12 - layer ht
Comp 9 - temp
Comp 10 - temp
Comp 11 - temp
Comp 12 - temp


Fire Compartment Smoke Layer Height and Temperature versus Time
(5MW MEDIUM T² FIRE)
Smoke Layer height (m)
Smoke Layer Temp (°C)
Time (Seconds)
Comp 13 - layer ht
Comp 14 - layer ht
Comp 15 - layer ht
Comp 16 - layer ht
Comp 13 - temp
Comp 14 - temp
Comp 15 - temp
Comp 16 - temp





The following key events were modelled:

- Smoke layer 20% of floor to ceiling height at **110** seconds
- Proscenium begins to shut at **120s** – refer Appendix C1.1.3b (via warden over-ride)
- Fire at 1MW at 290 seconds
- Proscenium shuts by 300s
- Sprinkler break at 490second (not assumed to suppress fire)

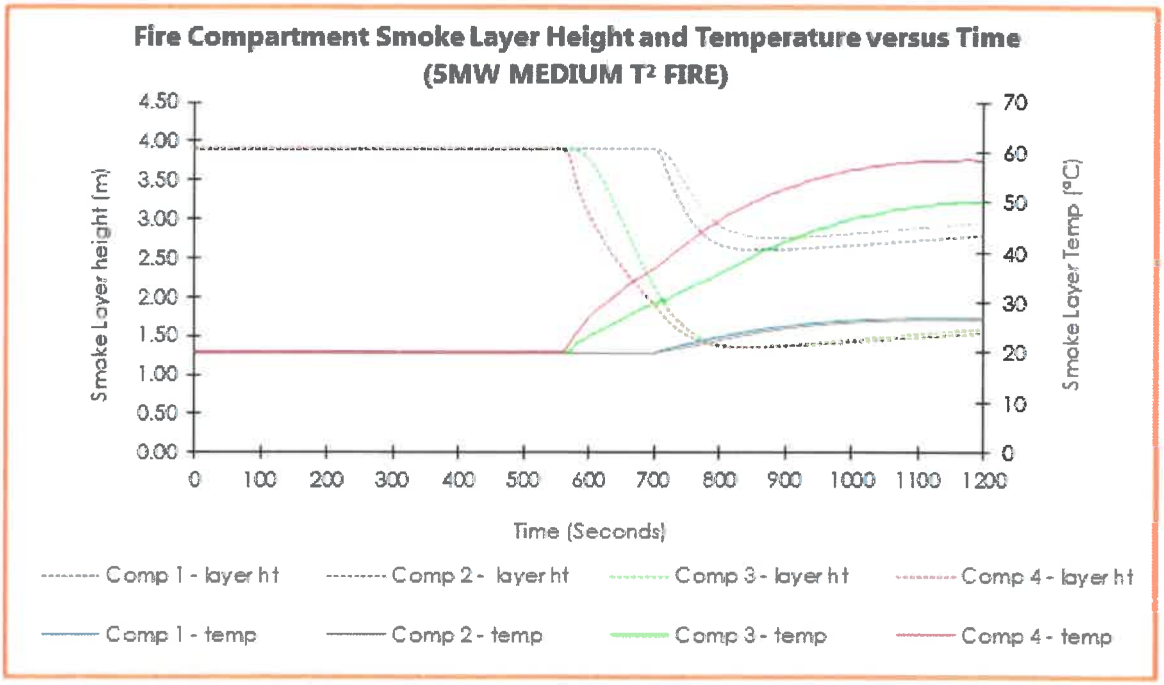
Scenario	Smoke Layer Height <2.0m and Temp > 35°C (Seconds)	Smoke Layer Height <2.0m and Temp > 100°C (Seconds)	Smoke Layer Temperature >183°C (2.5kW/m²) (Seconds)
Compartment 1 South Entrance	Did not occur	Did not occur	Did not occur
Compartment 2 South Staircase	Did not occur	Did not occur	Did not occur
Compartment 3 Main Foyer	Did not occur	Did not occur	Did not occur
Compartment 4 North Stairs	Did not occur	Did not occur	Did not occur
Compartment 5 North Entrance	Did not occur	Did not occur	Did not occur
Compartment 6 Stage (RFO)	396	519	643
Compartment 7 Rear Seating GF	710	Did not occur	Did not occur
Compartment 8 Right Seating GF	680	Did not occur	Did not occur
Compartment 9 Left Seating GF	680	Did not occur	Did not occur
Compartment 10 Rear Seating FF	720	Did not occur	Did not occur
Compartment 11 Right Seating FF	685	Did not occur	Did not occur
Compartment 12 Left Seating FF	685	Did not occur	Did not occur
Compartment 13 Rear Seating SF	**720**	**Did not occur**	**Did not occur**
Compartment 14 Right Seating SF	690	Did not occur	Did not occur
Compartment 15 Left Seating SF	690	Did not occur	Did not occur
Compartment 16 Volume above Seating Area	690	Did not occur	Did not occur
Compartment 17 Entrance to Long Room	830	Did not occur	Did not occur
Compartment 18 Long Room	Did not occur	Did not occur	Did not occur
Compartment 19 SF Theatre Entrance	Did not occur	Did not occur	Did not occur
Compartment 20 Basement Right	Did not occur	Did not occur	Did not occur
Compartment 21 Basement Middle	Did not occur	Did not occur	Did not occur
Compartment 22 Basement End	Did not occur	Did not occur	Did not occur
Compartment 23 Orchestra Pit	Did not occur	Did not occur	Did not occur

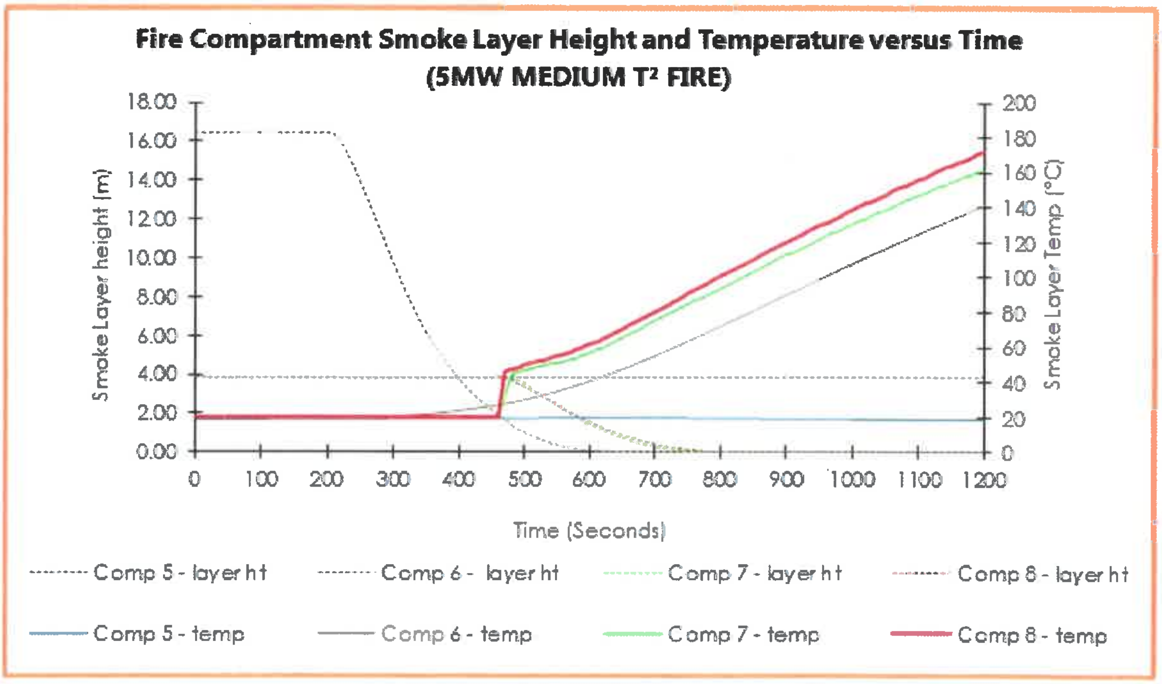
Table 46: Available Safe Egress Times (ASET) for Occupants for a Sprinkler Failure 5MW Fire in Centre Stage Area – Proscenium Shut at 300s

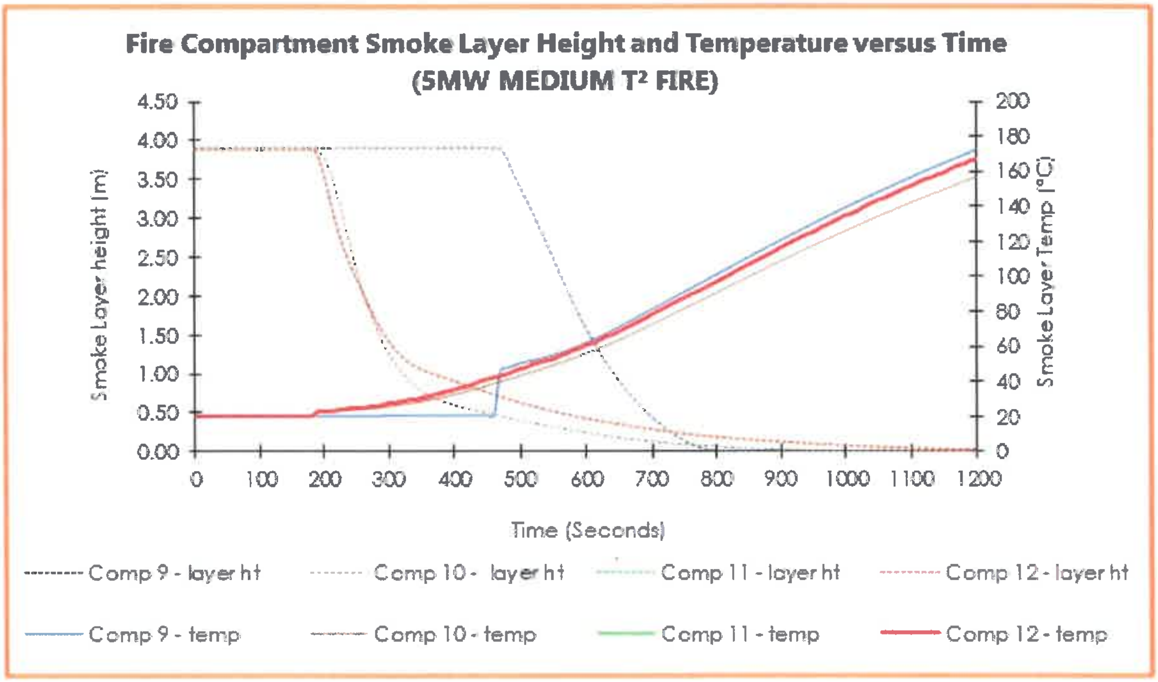
Scenario	Compartment	Smoke Layer Height <2.0m and Temp > 35°C (Seconds)	Smoke Layer Height <2.0m and Temp > 100°C (Seconds)	Smoke Layer Temperature >183°C (2.5kW/m²) (Seconds)
5MW Fire in Stage Area	Comp 13	720	Did not occur	Did not occur

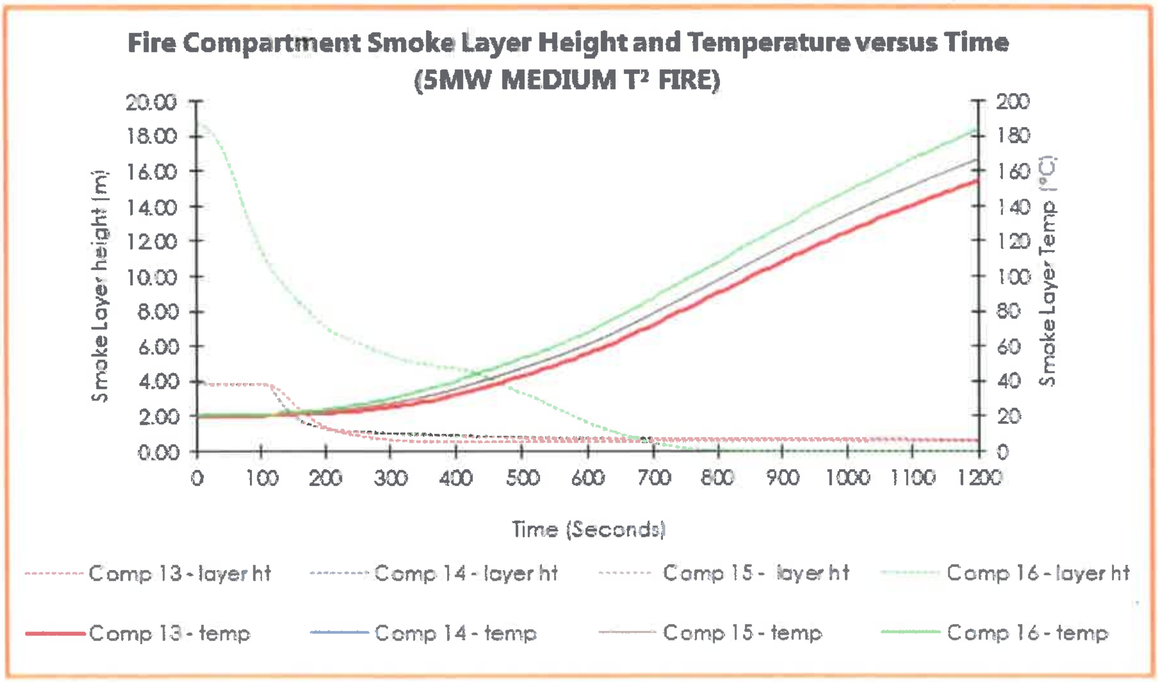
Note that occupants will be queuing at compartment second floor at the door (Compartment 13).

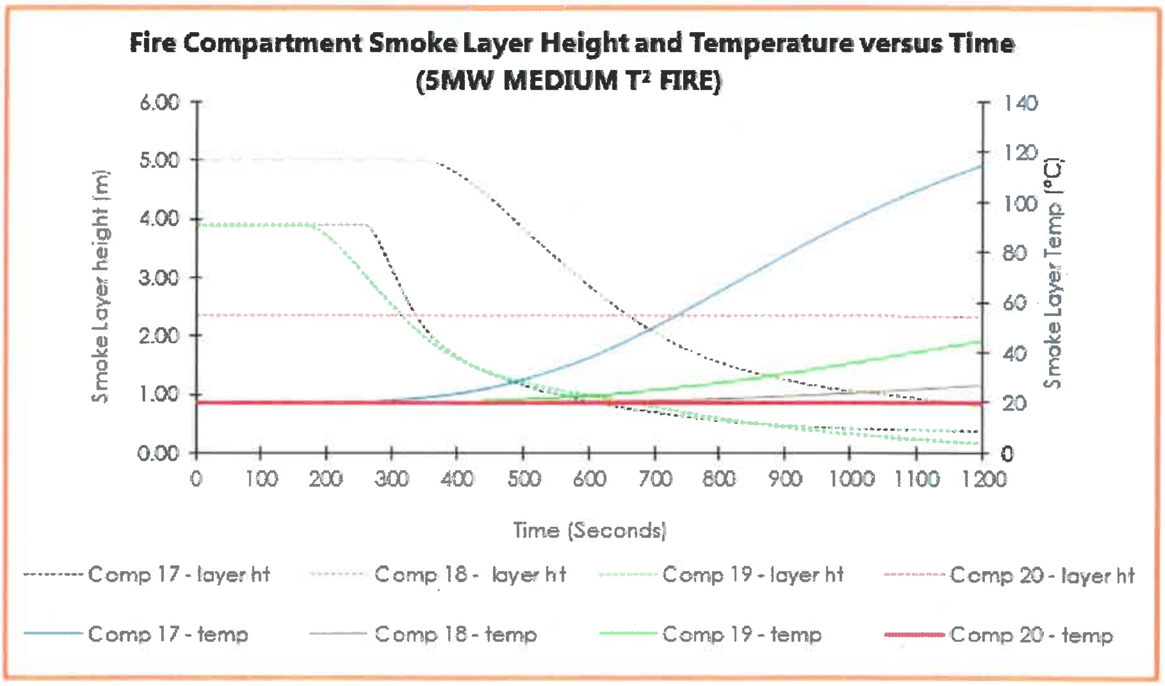
D2.3 Scenario 3 - Fire in the Auditorium Medium t² 5MW Fire (Compartment 6) – No Sprinkler

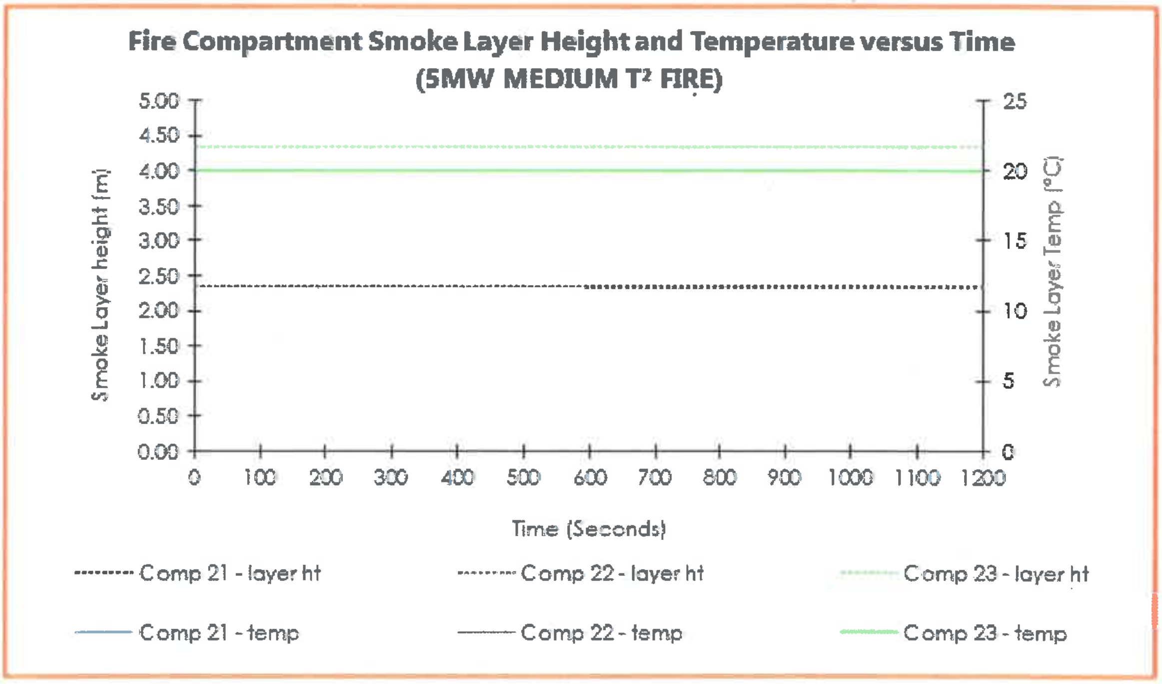





Fire Compartment Smoke Layer Height and Temperature versus Time
(5MW MEDIUM T² FIRE)
Smoke Layer height (m)
Smoke Layer Temp (°C)
Time (Seconds)
Comp 9 - layer ht
Comp 10 - layer ht
Comp 11 - layer ht
Comp 12 - layer ht
Comp 9 - temp
Comp 10 - temp
Comp 11 - temp
Comp 12 - temp


Fire Compartment Smoke Layer Height and Temperature versus Time
(5MW MEDIUM T² FIRE)
Smoke Layer height (m)
Smoke Layer Temp (°C)
Time (Seconds)
Comp 13 - layer ht
Comp 14 - layer ht
Comp 15 - layer ht
Comp 16 - layer ht
Comp 13 - temp
Comp 14 - temp
Comp 15 - temp
Comp 16 - temp


Fire Compartment Smoke Layer Height and Temperature versus Time
(5MW MEDIUM T² FIRE)
Smoke Layer height (m)
Smoke Layer Temp (°C)
Time (Seconds)
Comp 17 - layer ht
Comp 18 - layer ht
Comp 19 - layer ht
Comp 20 - layer ht
Comp 17 - temp
Comp 18 - temp
Comp 19 - temp
Comp 20 - temp


Fire Compartment Smoke Layer Height and Temperature versus Time
(5MW MEDIUM T² FIRE)
Smoke Layer height (m)
Smoke Layer Temp (°C)
Time (Seconds)
Comp 21 - layer ht
Comp 22 - layer ht
Comp 23 - layer ht
Comp 21 - temp
Comp 22 - temp
Comp 23 - temp

The following key events were modelled:

- Smoke layer 20% of floor to ceiling height at 64.1 seconds
- Fire at 1MW at 290 seconds

Scenario	Smoke Layer Height <2.0m and Temp > 35°C (Seconds)	Smoke Layer Height <2.0m and Temp > 100°C (Seconds)	Smoke Layer Temperature >183°C (2.5kW/m²) (Seconds)
Compartment 1 South Entrance	Did not occur	Did not occur	Did not occur
Compartment 2 South Staircase	Did not occur	Did not occur	Did not occur
Compartment 3 Main Foyer	790	Did not occur	Did not occur
Compartment 4 North Stairs	690	Did not occur	Did not occur
Compartment 5 North Entrance	Did not occur	Did not occur	Did not occur
Compartment 6 Stage	550	955	Did not occur
Compartment 7 Rear Seating GF	570	830	Did not occur
Compartment 8 Right Seating GF (RFO)	575	800	Did not occur
Compartment 9 Left Seating GF	575	800	Did not occur
Compartment 10 Rear Seating FF	420	850	Did not occur
Compartment 11 Right Seating FF	390	815	Did not occur
Compartment 12 Left Seating FF	390	815	Did not occur
Compartment 13 Rear Seating SF	**430**	**855**	**Did not occur**
Compartment 14 Right Seating SF	400	810	Did not occur
Compartment 15 Left Seating SF	400	810	Did not occur
Compartment 16 Volume above Seating Area	582	761	1195
Compartment 17 Entrance to Long Room	570	1060	Did not occur
Compartment 18 Long Room	Did not occur	Did not occur	Did not occur
Compartment 19 SF Theatre Entrance	980	Did not occur	Did not occur
Compartment 20 Basement Right	Did not occur	Did not occur	Did not occur
Compartment 21 Basement Middle	Did not occur	Did not occur	Did not occur
Compartment 22 Basement End	Did not occur	Did not occur	Did not occur
Compartment 23 Orchestra Pit	Did not occur	Did not occur	Did not occur

Table 47: Available Safe Egress Times (ASET) for Occupants for a Sprinkler Failure 5MW Fire in Auditorium Fire

Scenario	Compartment	Smoke Layer Height <2.0m and Temp > 35°C (Seconds)	Smoke Layer Height <2.0m and Temp > 100°C (Seconds)	Smoke Layer Temperature >183°C (2.5kW/m²) (Seconds)
5MW Fire in Lower Auditorium	Comp 13	430	855	Did not occur
	Comp 8 – RFO (Right Seating))	575	800	Did not occur

Note that occupants will be queuing at compartment second floor at the door (Compartment 13).

D2.4 Scenario 4 - Fire in the Bio Box approximates to Medium t² 5MW Fire (Compartment 24) – Sprinkler Activates

D2.4.1 CFAST Input Details – Proposed Building Solution

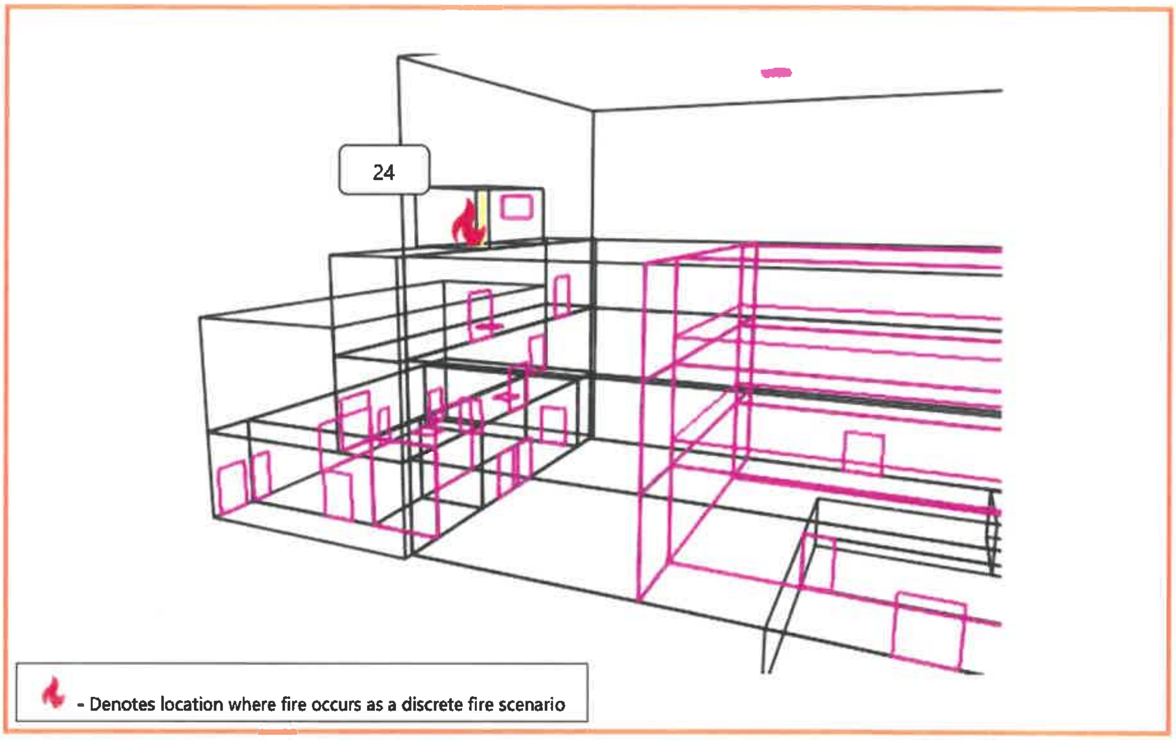
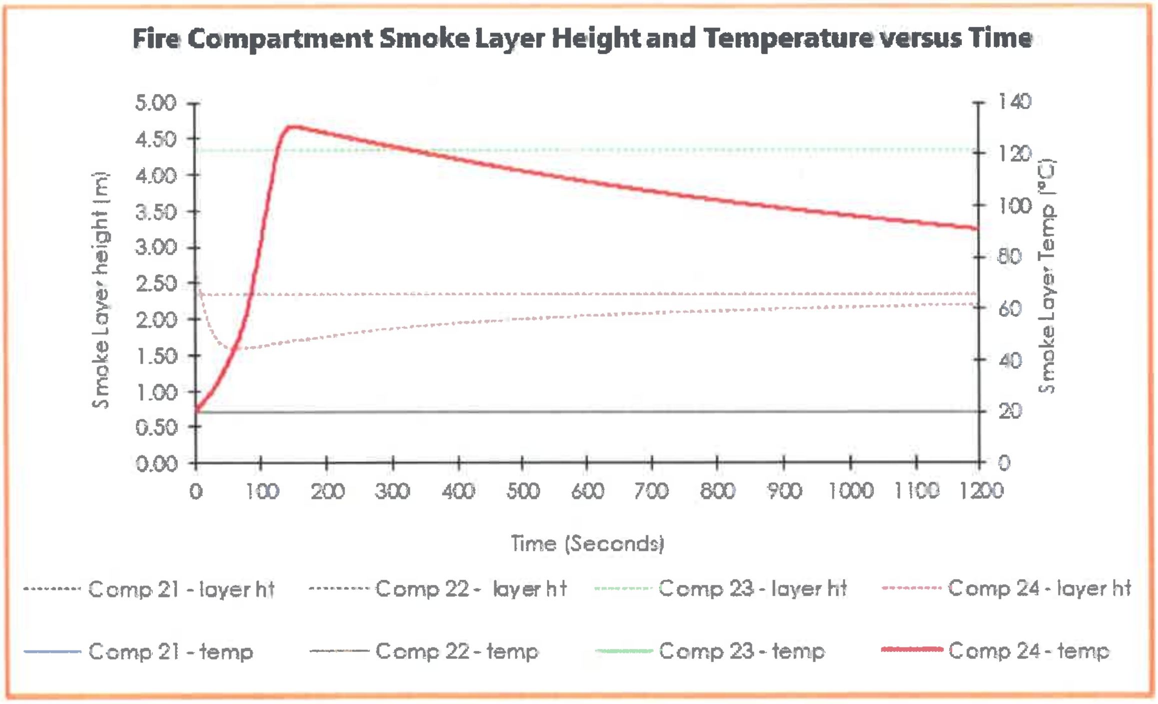


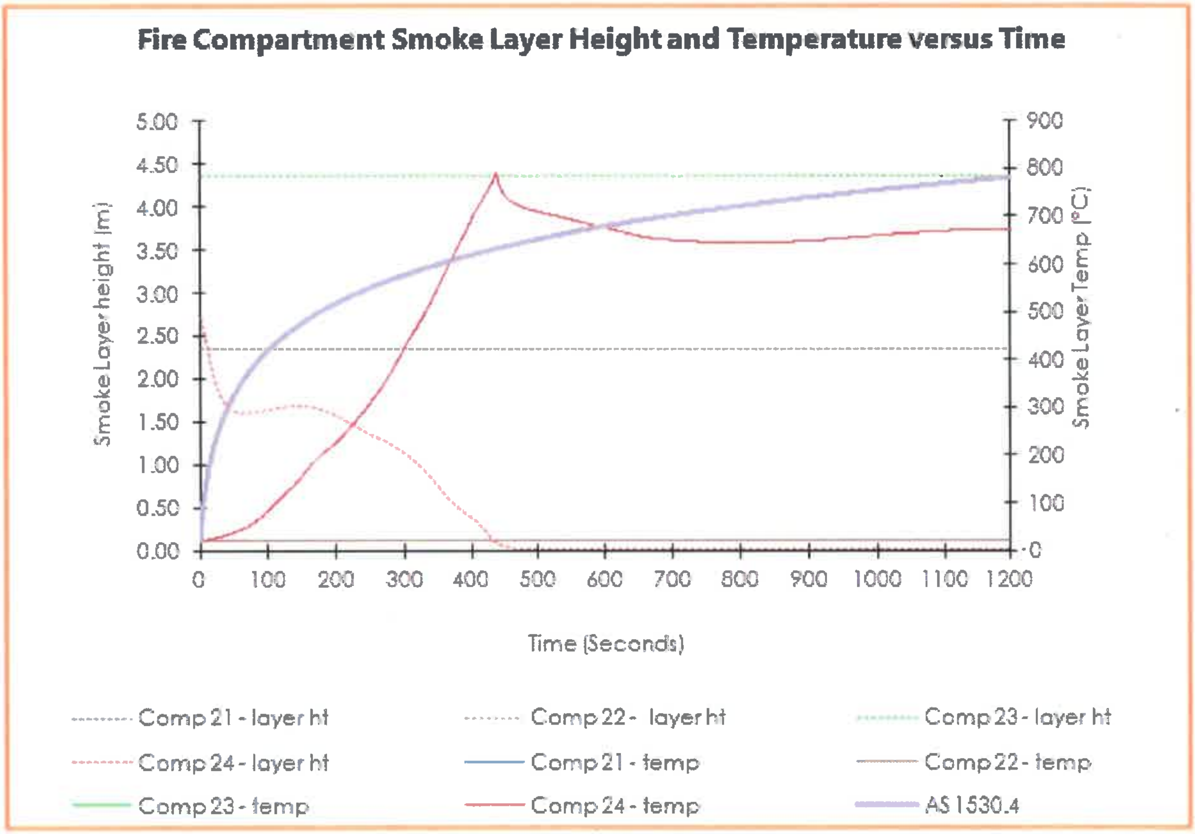
Figure D4.2 CFAST Model of Considered Building Solution

Compartments	Width x Depth x Height	Openings	Opening Size (m)
24	3.8 x 5.5 x 2.7	24 → 16	3 x 1

D2.4.2 Results from CFAST Analysis



Sprinkler Protected in Bio Box



Non/Partial Sprinkler Protected in Bio Box

The following key events were modelled:

- Sprinkler activates at 122 seconds.
- Fire does NOT reach 1MW.

The time to exceed the nominated acceptance criterion for the proposed Alternative Building Solution Sprinkler Protected

Scenario	Smoke Layer Height <2.0m and Temp > 35°C (Seconds)	Smoke Layer Height <2.0m and Temp > 60°C (Seconds)	Smoke Layer Height <2.0m and Temp > 100°C (Seconds)	Smoke Layer Temperature >183°C (2.5kW/m²) (Seconds)
Compartment 1	1800	1800	1800	1800
Compartment 2	1800	1800	1800	1800
Compartment 3	1800	1800	1800	1800
Compartment 4	1800	1800	1800	1800
Compartment 5	1800	1800	1800	1800
Compartment 6	1800	1800	1800	1800
Compartment 7	1800	1800	1800	1800
Compartment 8	1800	1800	1800	1800
Compartment 9	1800	1800	1800	1800
Compartment 10	1800	1800	1800	1800
Compartment 11	1800	1800	1800	1800
Compartment 12	1800	1800	1800	1800
Compartment 13	1800	1800	1800	1800
Compartment 14	1800	1800	1800	1800
Compartment 15	1800	1800	1800	1800
Compartment 16	1800	1800	1800	1800
Compartment 17	1800	1800	1800	1800
Compartment 18	1800	1800	1800	1800
Compartment 19	1800	1800	1800	1800
Compartment 20	1800	1800	1800	1800
Compartment 21	1800	1800	1800	1800
Compartment 22	1800	1800	1800	1800
Compartment 23	1800	1800	1800	1800
Compartment 24 (RFO)	42	80	111	166

Table 48: Available Safe Egress Times (ASET) for Occupants for a Sprinkler Partially Operates in Bio Box

Scenario	Compartment	Smoke Layer Height <2.0m and Temp > 35°C (Seconds)	Smoke Layer Height <2.0m and Temp > 60°C (Seconds)	Smoke Layer Temperature >183°C (2.5kW/m²) (Seconds)
5MW Fire in Bio Box	Comp 13	1800	1800	1800
5MW Fire in Bio Box	Comp 24	42	80	166

Note that occupants will be queuing at compartment second floor at the door (Compartment 16).

Appendix E – Reductions in Radiant Heat Transfer by Water Curtains

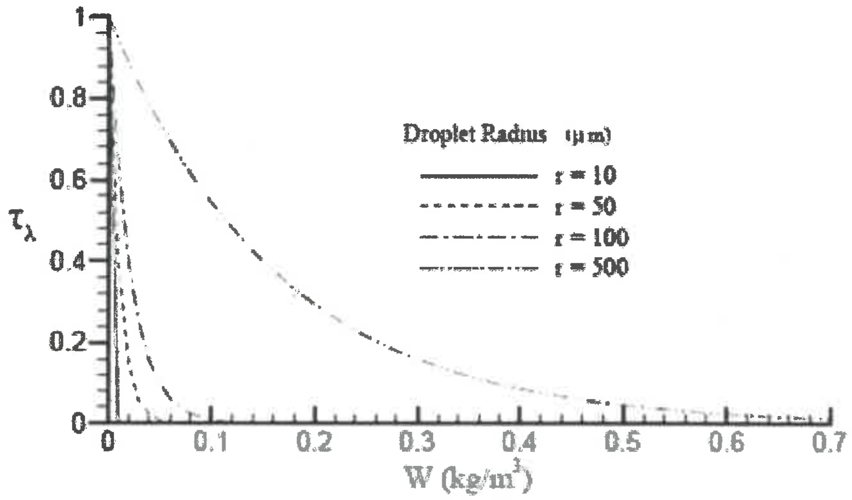
E1.1 Sprinkler Activation

Typically a sprinkler head will activate for a radiant head flux of 12kW/m² [Grubits]. Grubits also found that when water is in direct contact with the glazing the film has the ability to protect the glazing for exposures of up to 40kW/m².

When remote from the glazing or shielded, the sprinkler flow may not develop a film over the glazing and acts more like a water curtain/spray to attenuate radiation to the non fire side; the reduction is however dependent on the amount of water and droplet size.

E1.2 General Water Spray Mass Concentration W (kg/m²) versus Transmissivity τ_λ by Doolan

The operation of the sprinklers is expected to reduce the radiative heat transfer to the non fire side, based on studies by Doolan [Doolan], where reductions from 10% to 90% were determined for water spray mass concentration (W) 0.01 to 0.7 (kg/m³) as shown below and varying droplet size.



Transmissivity results for water droplets of different sizes and λ = 3 μm.

Figure 46: Excerpt from Doolan showing the reduction in transmissivity of radiation with the increase in mass concentration of water spray – Note Fire sprinklers have a droplet radius of 100μm

As can be seen above, for low water spray mass concentrations W(kg/m³), the transmissivity (τ_λ) is high and vice versa.

The reduction in heat transfer to the non fire side is described as the Attenuation factor (the energy absorbed/stopped by the water curtain) and given by -

Attenuation = 1-τ_λ

E1.3 Determination of AS 2118.1 Water Spray Concentration, W (kg/m³)

For an AS 2118.1 sprinkler spray a droplet size of 100μm is adopted.

Table 1. Droplet Radii used in this study.

Droplet radius (μm)	Description
10	Fog
50	Mist
100	Spray
500	Rain

Figure 47: Droplet Description by Doolan

To ascertain the effectiveness of an AS2118.1 system in reducing the heat transfer to the non fire side (its Transmissivity), the discharge density of 5mm/min needs to be expressed as a water spray mass concentration W (kg/m³) in a unit volume of air, to coincide with the data/units presented by Doolan.

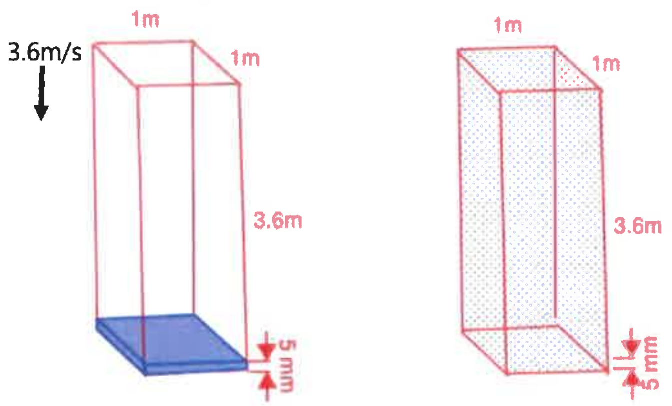


Figure 48: The AS 2118.1 discharge density (5mm/min) in a 1m³ volume versus the water spray mass concentration

The 5mm/min is actually 5mm/min/m² which can be expressed as a volume of water in mm³/min = (5mm*1000mm*1000mm) mm³/min = 5 x 10^6 mm³/min (or alternatively 5L/min*).

The velocity from an AS 2118.1 head is 3.6 m/s [Kiyoto]. For a snapshot in time (at 1 second) would yield a discharge density = 5 x 10^6/60/3.6 m³/s = 2.31 x 10^4 mm³/s = 2.3 x 10^{-5} m³/s.

This water discharge density is assumed to be dispersed over the entire 3.6m³ volume in the 1 second snap shot in time = 2.3 x 10^{-5} m³ of water per 1m³ of volume (of air).

In the AS 2118.1 system, the mass concentration W (kg/m³) of water in the 1m³ volume of air can be expressed as 1000kg/m³ x 2.3 x 10^{-5} m³ of water per 1m³ of volume (of air) = 0.023 kg/m³ of water per 1m³ volume of air.

*As a check/verification an AS 2118.1 sprinkler head typically sprays over 12m². At 60L/min over 12m²/head yields 5L/min/m².

E1.4 Determination of Attenuation of AS 2118.1 System

For a water spray mass concentration of 0.023 kg/m³ and droplet size of 100µm, the transmissivity (τ_λ) is 0.36 (= 36% is transmitted to the non fire side or **64%** attenuated). These reductions were for radiant heat fluxes of 12kW/m² = 405°C.

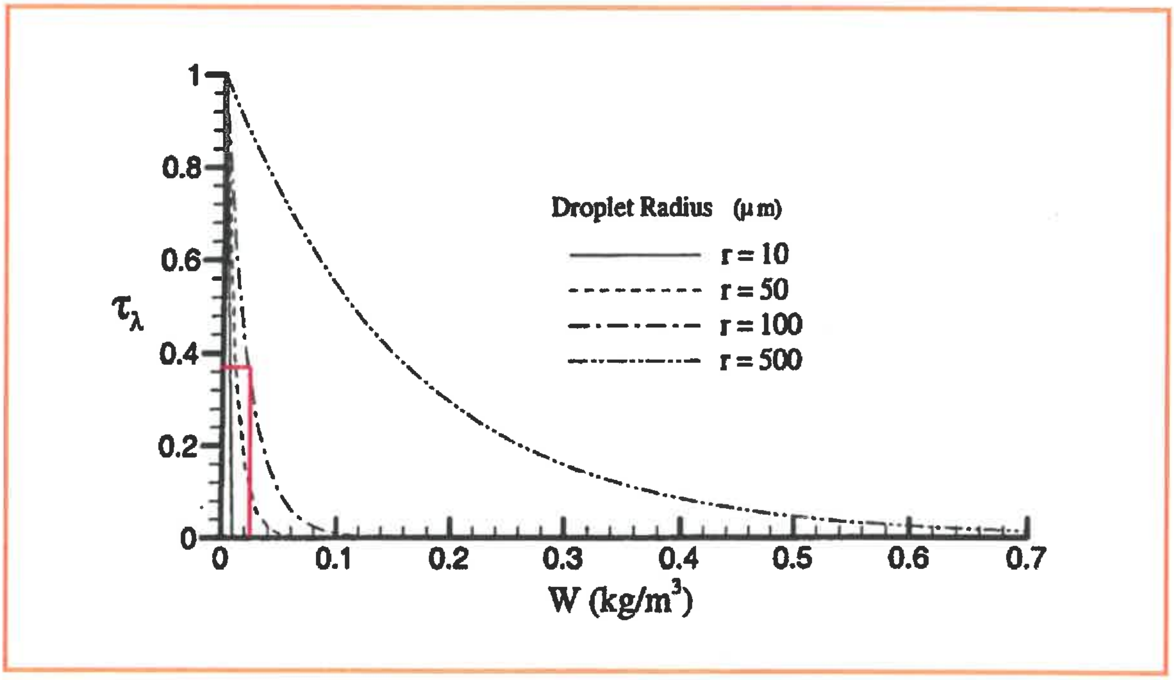


Figure 49: Excerpt from Doolan showing the reduction in transmissivity of radiation with the increase in mass concentration of water spray – Note Fire sprinklers have a droplet radius of 100µm

Further studies by Kiyoto [Kiyoto] for significantly higher exposures (200 kW/m² = 1,100°C), found that for a flow rate of 60l/min and a 50% larger droplet size of 150µm, that the attenuation was closer to **40%.**

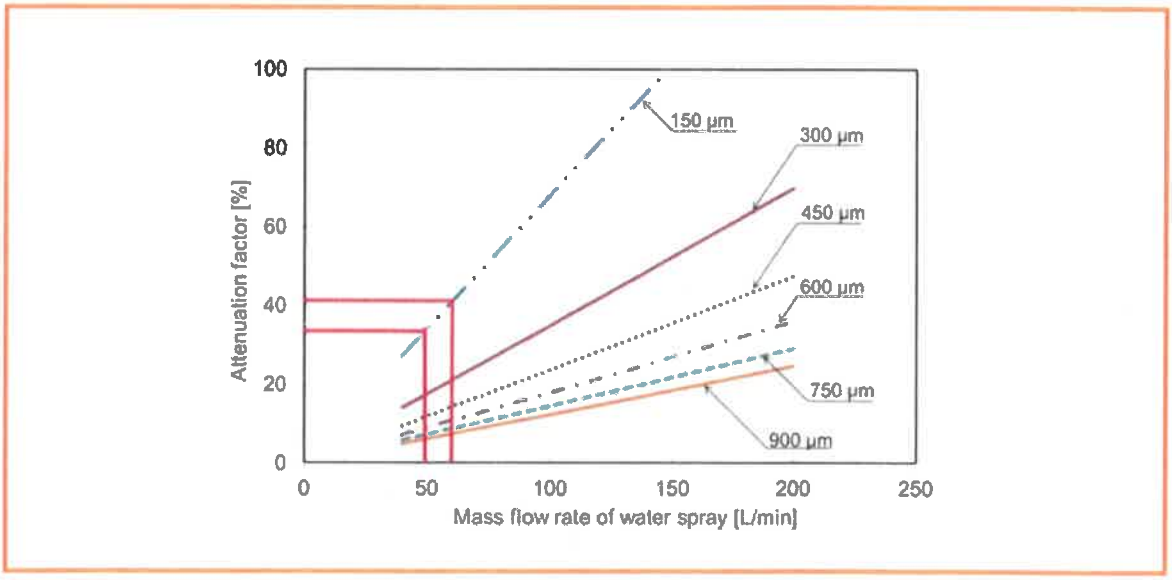


Figure 50: Excerpt from Kiyoto showing attenuation versus droplet radius of 150µm

Using the above the AS 2118.1 attenuation would be expected to be in the order of **52%** (the average of the Doolan and Kiyoto test data; noting the Kiyoto data had a 50% greater droplet size].

Appendix F – Fire Grow Rates

F1.1 Fire Growth Rate

In NFPA 72 Appendix B a series of growth rates.

Originally developed in the 1970s for predicting fire detector activation, the t2 fire gained popularity when it was included in the appendix of NFPA-72E (now NFPA-72) with three categories for fire growth;slow, medium, and fast. These definitions are simply determined by the time required for the fire to reach 1.05 MW.

A slow fire is defined as taking 600 seconds (10 minutes), a medium fire 300 seconds (5 minutes) and a fast fire less than 150 seconds to reach 1.05 MW.

Within NFPA 72 timber pallets (B2.3.2.2.2) were assigned medium growth (where the heat release rate reaches 1MW at 150 seconds). A sofa with test data present in B2.3.2.3.5 shows a sofa reaching 1MW at 150 seconds (on the cusp of a medium t^2 fire and fast t^2 fire).

It is expected that larger potential fuel sources, on the stage would align with a medium t^2 growth rate – where 1.05MW occurs at > 150 seconds.

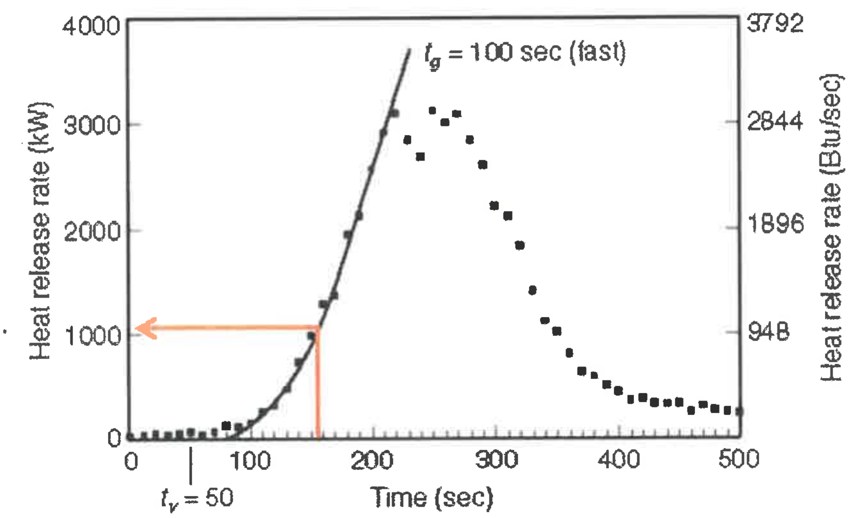


FIGURE B.2.3.2.3.5 Test 38, Foam Sofa.

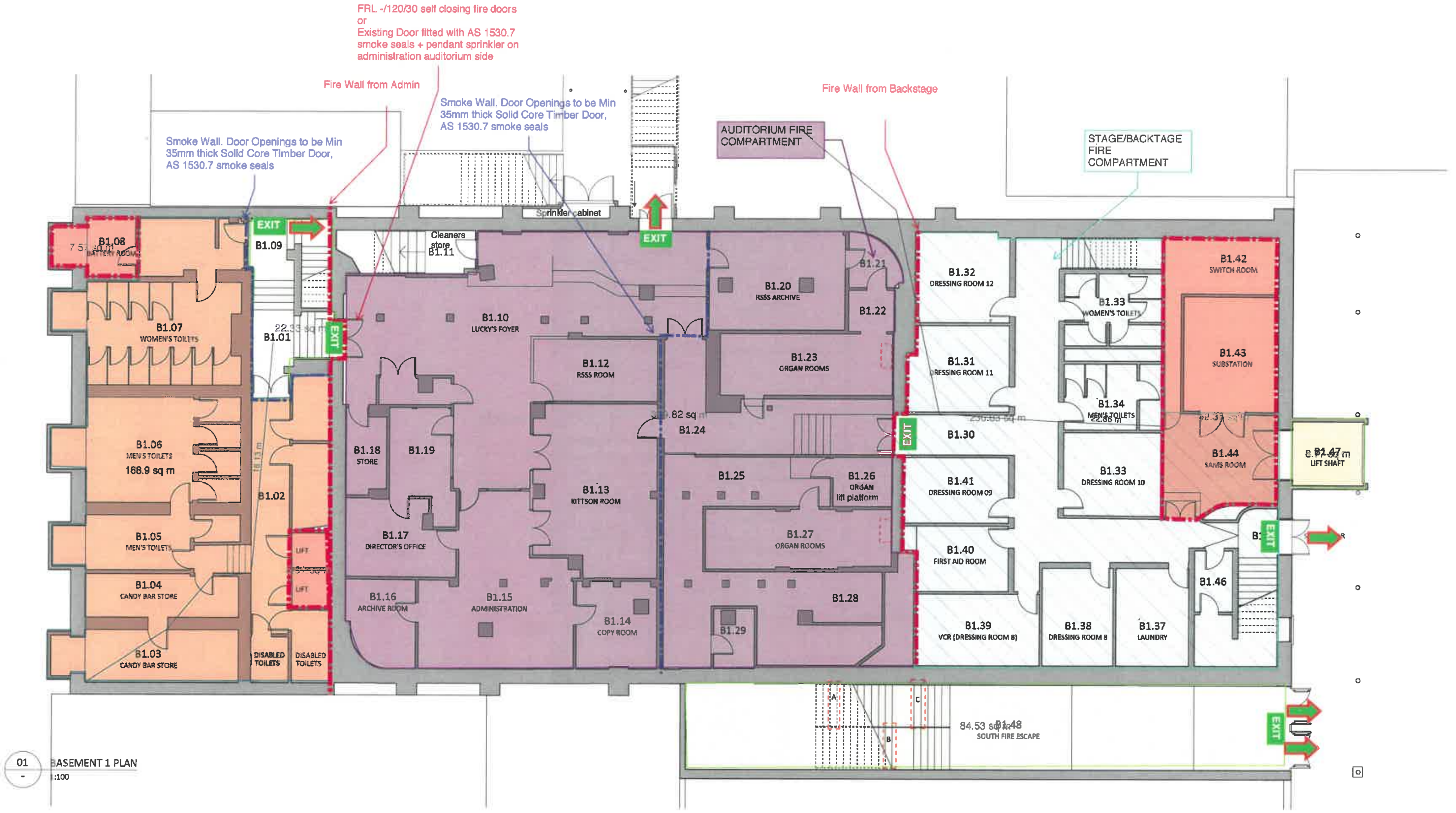
B.2.3.2.3.6 For purposes of this annex, fires are classified as being either slow-, medium-, or fast-developing from the time that established burning occurs until the fire reaches a heat release rate of 1055 kW (1000 Btu/sec). Table B.2.3.2.3.6 results from using the relationships discussed above. *[See also Table B.2.3.2.6.2(a).]*

Table B.2.3.2.3.6 Power Law Heat Release F

Fire Growth Rate	Growth Time (t_g)	α (kW/sec²)
Slow	$t_g \geq 400$ sec	$\alpha \leq 0.0066$
Medium	$150 \leq t_g < 400$ sec	$0.0066 < \alpha \leq 0.0469$
Fast	$t_g < 150$ sec	$\alpha > 0.0469$

Figure 51: NFPA 72 Appendix B

Appendix G – DRAWINGS



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PROJECT: HER MAJESTY'S THEATRE DESIGN DEVELOPMENT

DRAWING TITLE: PROPOSED CONSERVATION WORKS BASEMENT 1

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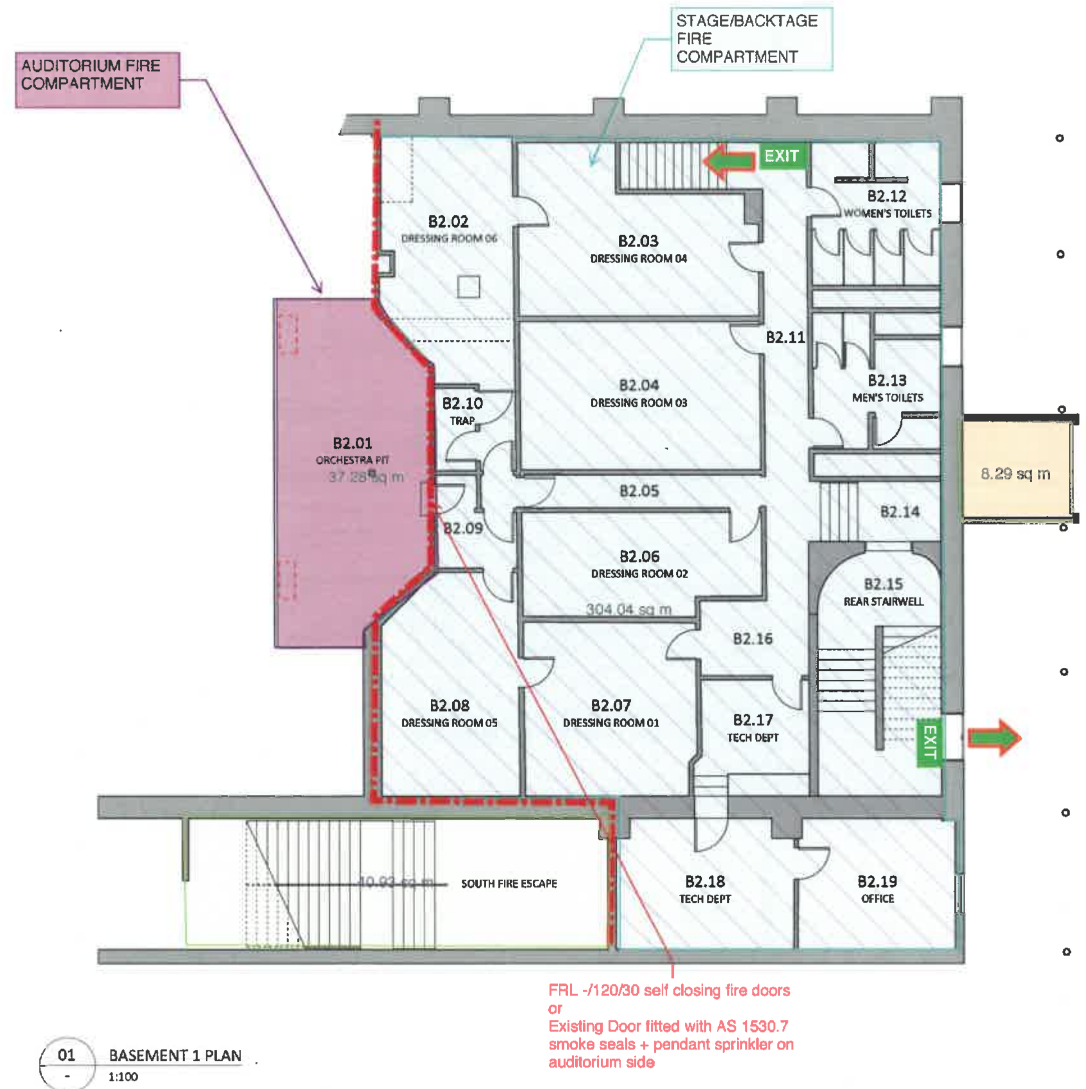

01 BASEMENT 1 PLAN
1:100

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PROPOSED CONSERVATION WORKS
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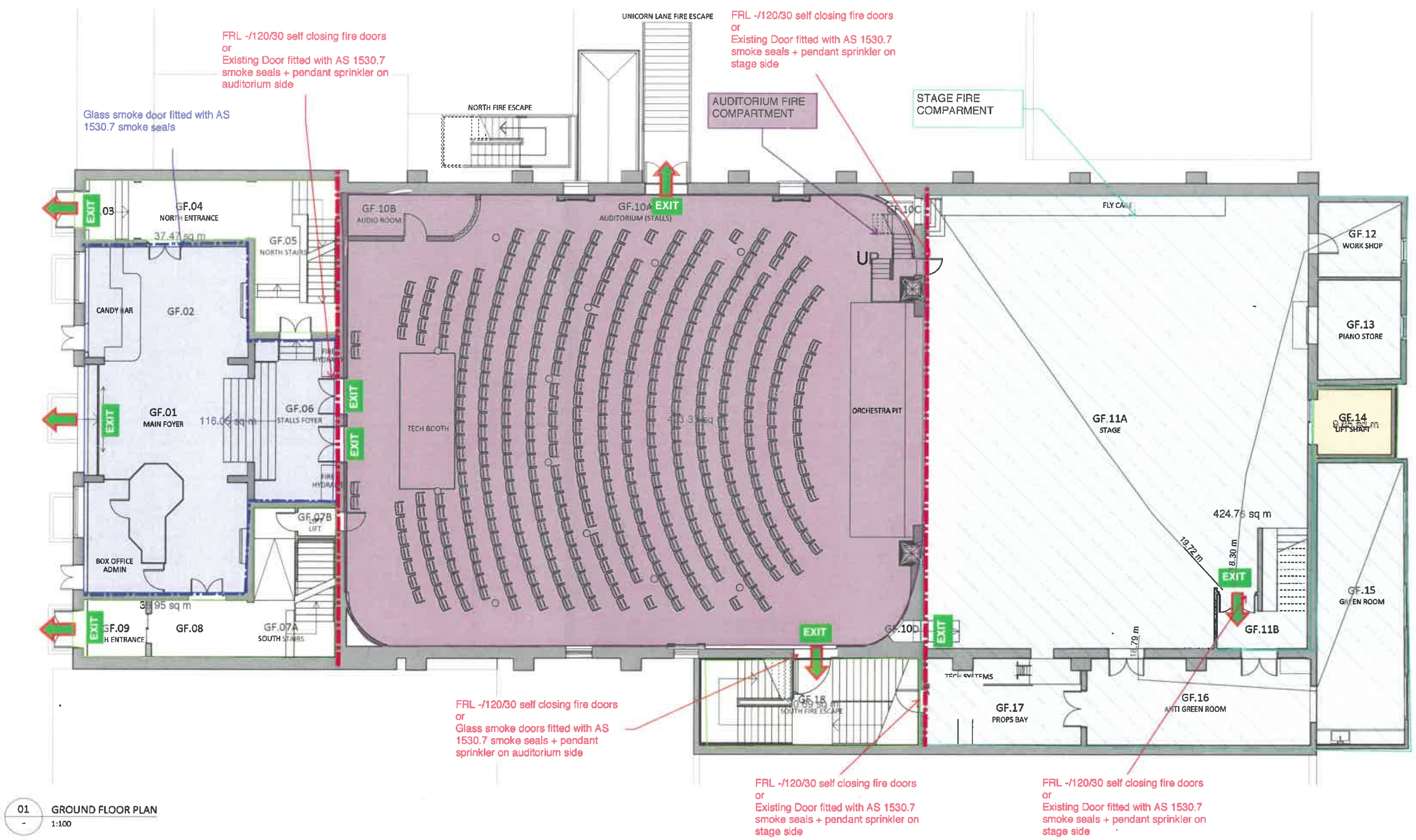

01 GROUND FLOOR PLAN
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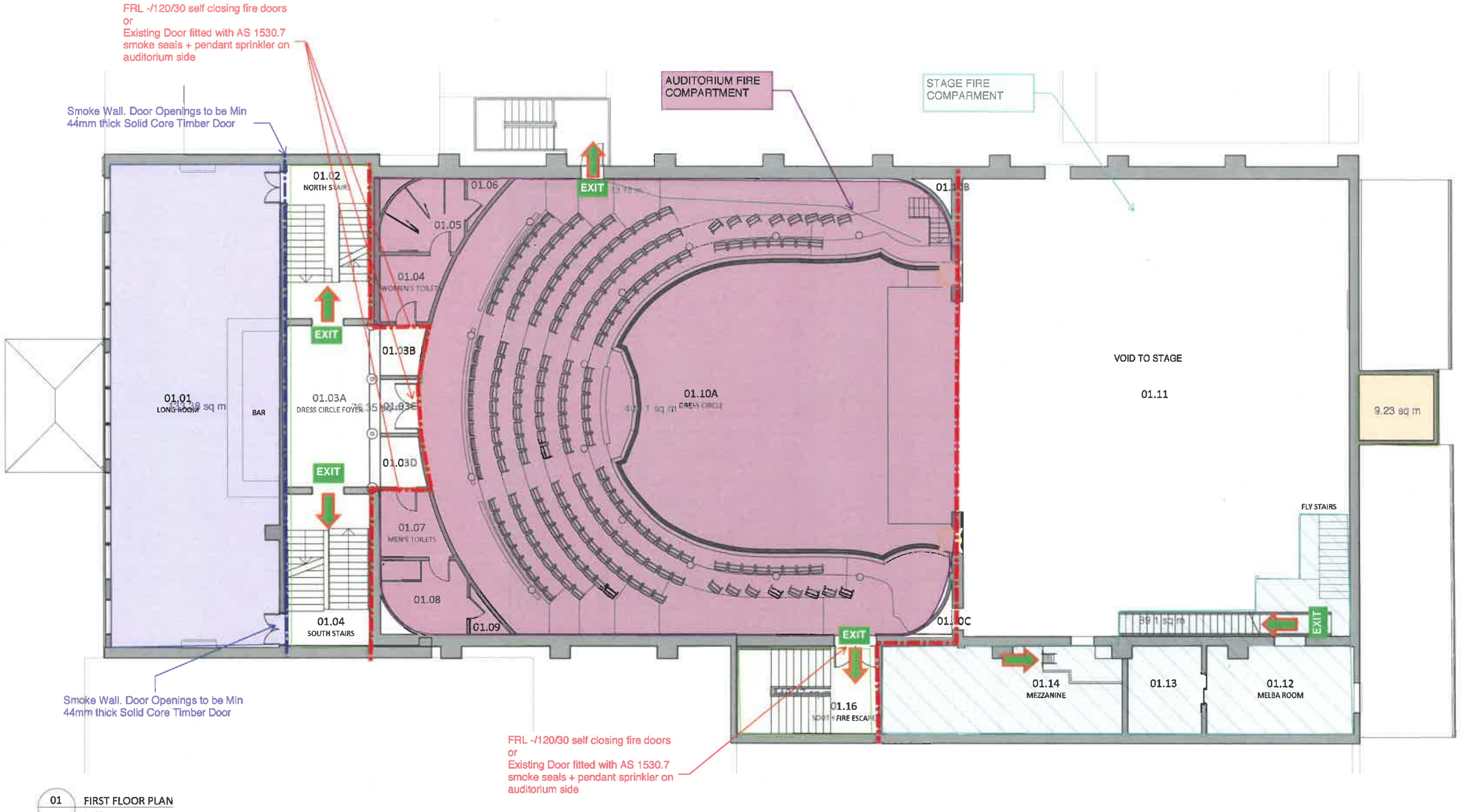

01 FIRST FLOOR PLAN
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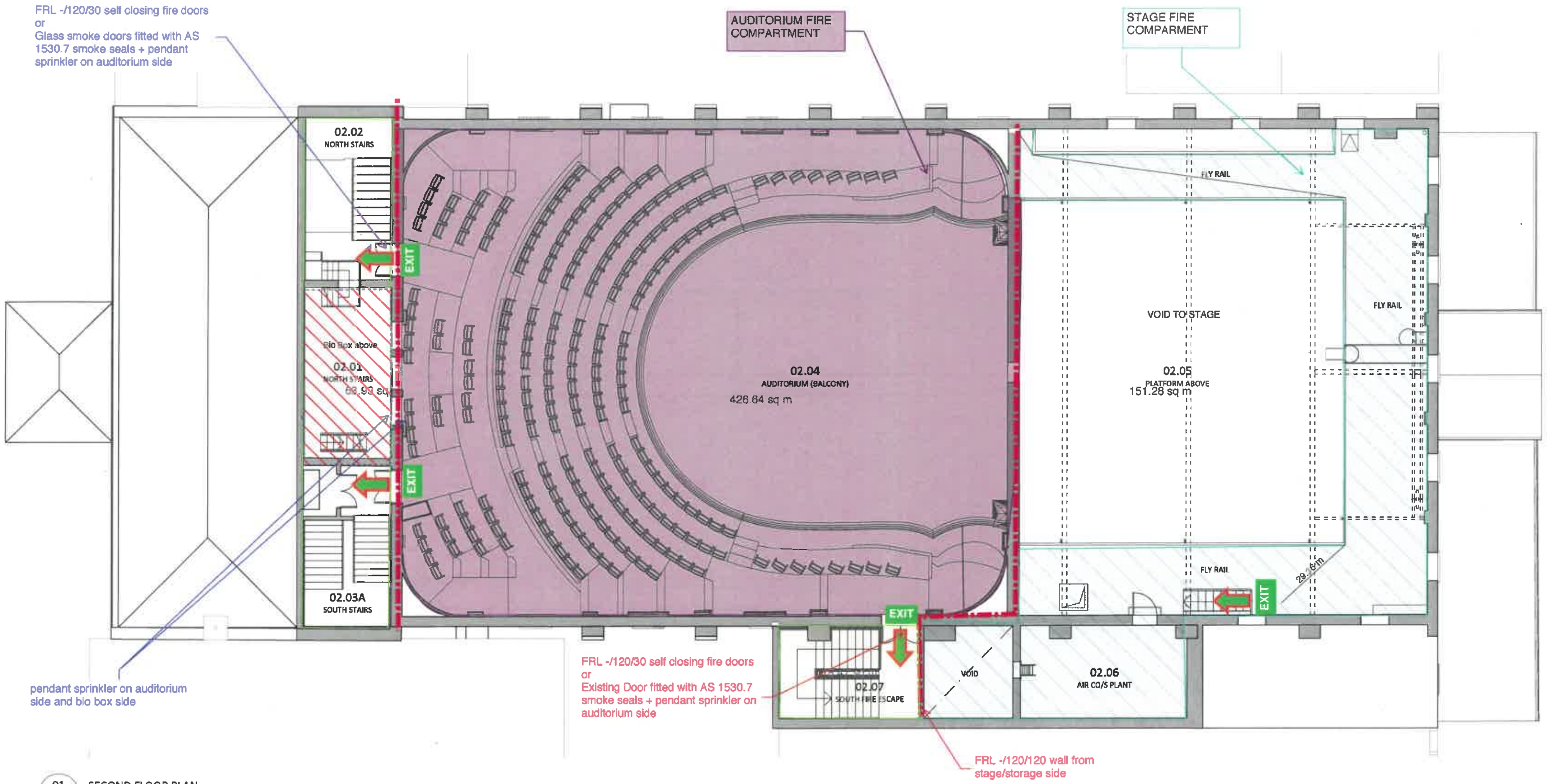

01 SECOND FLOOR PLAN
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SECOND FLOOR

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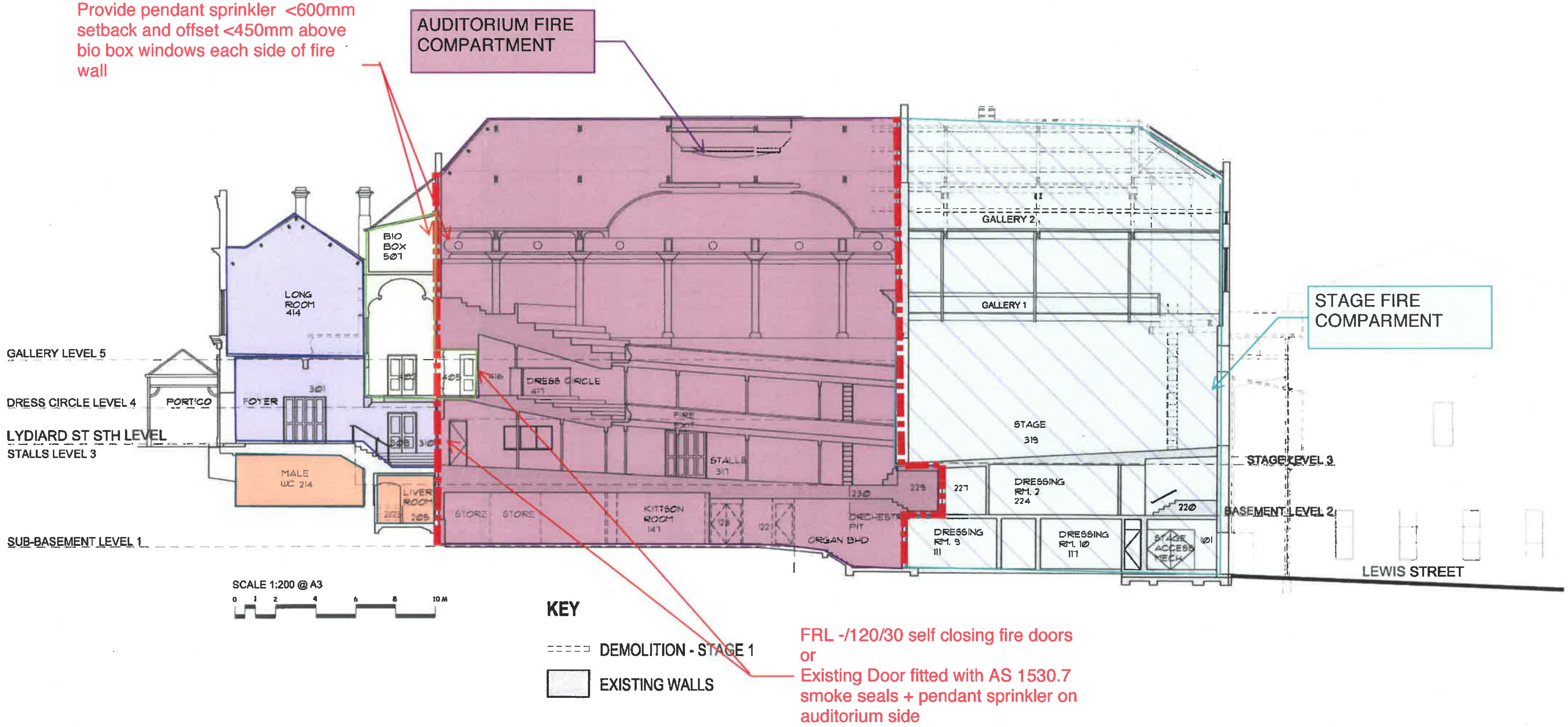

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SECTION A-A

EXISTING

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SWANBURY PENGLASE ARCHITECTS

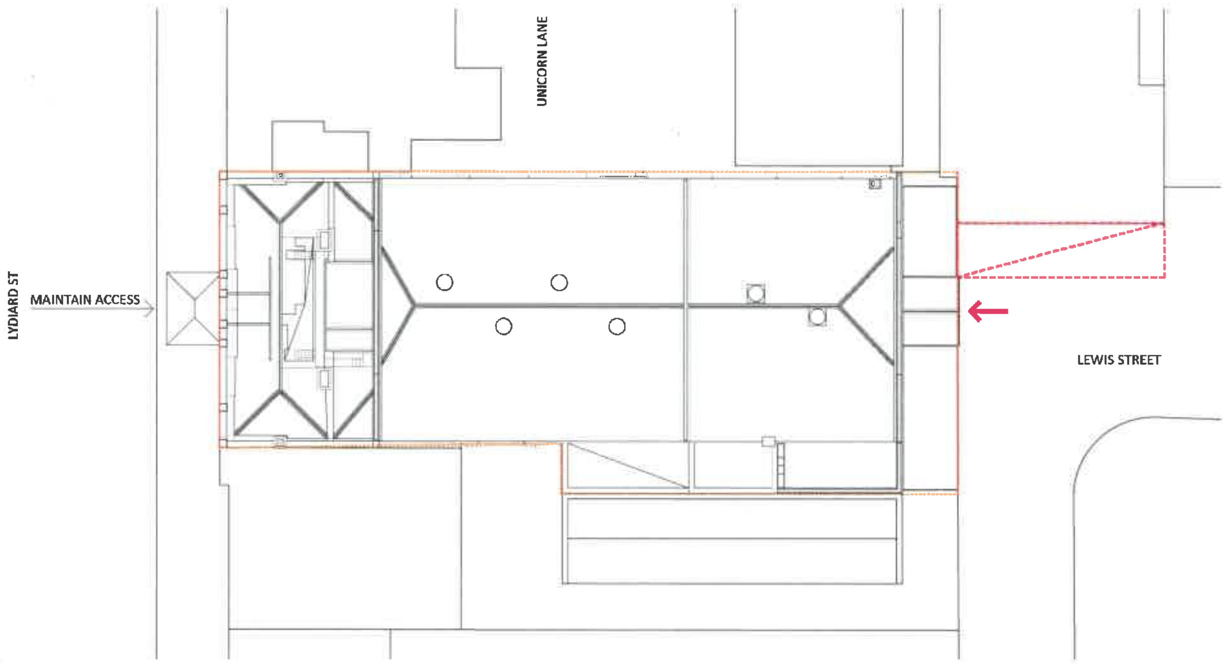
HER MAJESTY'S THEATRE BALLARAT

CONSERVATION WORKS - STAGE 2

17 LYDIARD STREET S, BALLARAT CENTRAL, VIC 3350

01 AERIAL VIEW
NTS

DRAWING No.	DRAWING REGISTER
HA.001	AERIAL VIEW AND DRAWING REGISTER
HA.201	BASEMENT 2 PLAN
HA.202	BASEMENT 1 PLAN
HA.203	GROUND FLOOR PLAN (STALLS)
HA.204	FIRST FLOOR PLAN (DRESS CIRCLE)
HA.205	SECOND FLOOR PLAN (GALLERY)
HA.206	GENERAL SECTION - EAST-WEST
HA.207	AUDITORIUM - NORTH ELEVATION
HA.208	AUDITORIUM - SOUTH ELEVATION
HA.209	AUDITORIUM - EAST AND WEST ELEVATION
HA.210	AUDITORIUM - COLOUR SCHEME
HA.301	GLASS BLOCK PAVEMENT
HA.401	HERITAGE URINALS
HA.501	DOOR AND WINDOW SCHEDULE



LEGEND:
- EXTENT OF INTERNAL WORKS
- SITE COMPOUND
- MAIN ACCESS
- SECONDARY ACCESS

02 LOCATION PLAN
NTS

GENERAL NOTES:

- THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION, THE SCHEDULE OF CONSERVATION WORKS AND THE MENU OF METHODS FOR REPAIR.
- THE DRAWINGS ARE NOT MEASURED DRAWINGS. CONTRACTOR IS TO CHECK ALL DIMENSIONS AND OTHER NECESSARY INFORMATION ON SITE PRIOR TO COMMENCING WORKS OR PREPARING SHOP DRAWINGS. NOTIFY THE CONSERVATION ARCHITECT AND SUPERINTENDENT OF ANY OMISSIONS OR DISCREPANCIES AND SEEK WRITTEN ADVICE PRIOR TO PROCEEDING.
- ALL WORK IS TO COMPLY WITH THE RELEVANT AUSTRALIAN STANDARDS.
- ANY GLAZING MUST COMPLY WITH AS 1288-2006.
- ALL STAINLESS STEEL PRODUCTS MUST BE GRADE 316.

SITE ESTABLISHMENT NOTES:

- CONTRACTOR IS TO CLEAN THE SITE DAILY AND TO LEAVE THE SITE CLEAN AND FREE OF ALL DEBRIS AT COMPLETION OF WORKS. ALL DEBRIS AND RUBBLE IS TO BE DISPOSED OFF SITE.
- CONTRACTOR TO SIGN IN AND OUT OF THE VENUE EACH DAY AT BOX OFFICE.
- LUNCHROOM, KITCHENETTE, TOILETS AND FIRST AID FACILITIES AVAILABLE. LOCATION TO BE CONFIRMED WITH PRINCIPAL.
- NO PARKING IS PROVIDED ON SITE.

SCAFFOLDING AND ACCESS EQUIPMENT NOTES:

- CONTRACTOR IS TO PROVIDE ALL SCAFFOLDING/ACCESS TO THE WORKS. CONTRACTOR IS TO PROVIDE SHOP DRAWINGS AND A METHODOLOGY FOR REVIEW AND APPROVAL PRIOR TO PROCEEDING WITH THE SCAFFOLDING WORKS. NO DIRECT FIXING INTO MASONRY.
- ALL SCAFFOLDING IS TO BE TAGGED AND HAVE HOARDING AND SHADE CLOTH MESH. SCAFFOLD IS TO BE KEPT CLEAN AND SHADE CLOTH IS TO BE REGULARLY REPAIRED AND REPLACED AS NEEDED TO MAINTAIN THE SITE. THE MAINTENANCE OF THE SCAFFOLD IS THE CONTRACTOR'S RESPONSIBILITY.

DEMOLITION / DISMANTLING NOTES:

- ALL DEMOLITION WORK TO BE CARRIED OUT IN ACCORDANCE WITH AS 2601.
- CONTRACTOR IS TO SUBMIT DILAPIDATION RECORD OF THE FABRIC FOR SIGN OFF IN RELATION TO THE CONSERVATION WORKS PRIOR TO THE COMMENCEMENT OF WORKS.
- CONTRACTOR IS TO CONFIRM SCOPE OF WORKS ON SITE WITH CONSERVATION ARCHITECT FOR THE DISMANTLING / STORAGE OF ANY FABRIC AND SUBMIT METHODOLOGY OF DISMANTLING AND STORAGE PRIOR TO THE COMMENCEMENT OF WORKS.
- FOLLOWING DEMOLITION, ALL RUBBLE, DEBRIS AND DUST ARE TO BE REMOVED AND DISPOSED OFF SITE IN ACCORDANCE WITH ALL RELEVANT AUTHORITIES REQUIREMENTS AND GUIDELINES.
- FOR HAZARDOUS MATERIAL, REFER TO HAZARDOUS MATERIALS DIVISION 6 ASBESTOS AND HAZARDOUS MATERIALS AUDIT.
- CONTRACTOR TO MAKE GOOD ANY DAMAGE CAUSED DUE TO DEMOLITION. LIAISE WITH CONSERVATION ARCHITECT FOR REMEDIATION WORKS.

CONSERVATION NOTES:

- ALL QUANTITIES RELATED TO THE CONSERVATION WORKS PROVIDED IN THE SCHEDULES ARE NOMINAL ONLY AND THE CONTRACTOR SHALL VERIFY ON SITE AND NOTIFY THE CONSERVATION ARCHITECT AS SOON AS ANY DISCREPANCIES ARE FOUND.
- PROVIDE ALL SAMPLES FOR APPROVAL BY CONSERVATION ARCHITECT PRIOR COMMENCEMENT OF WORKS.

PAINTING NOTES:

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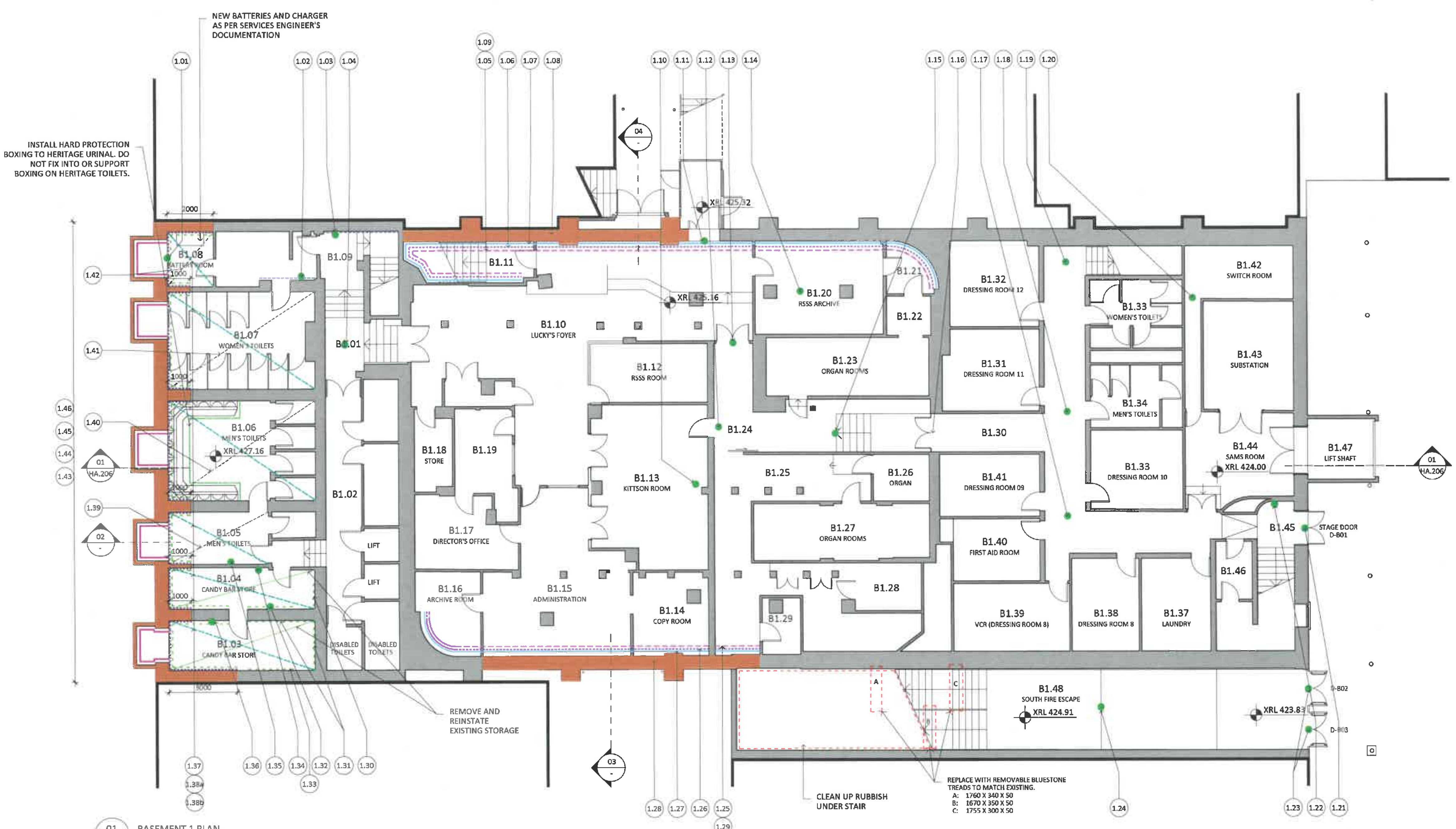
PROJECT
HER MAJESTY'S THEATRE
CONSERVATION WORKS

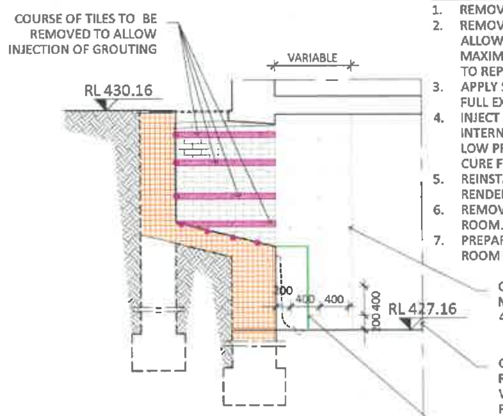
DRAWN	CHECKED	PROJECT NO.	DATE
AO	CHL	7637	DECEMBER 2017

DRAWING TITLE
AERIAL VIEW, LOCATION PLAN,
DRAWING REGISTER AND GENERAL NOTES

ISSUE	SCALE	DRAWING NO.	REVISION
TENDER	NTS	HA.001	T1



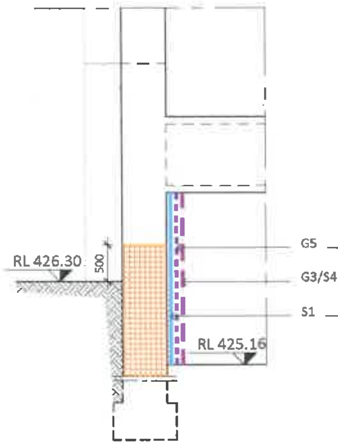
01 BASEMENT 1 PLAN
1:100



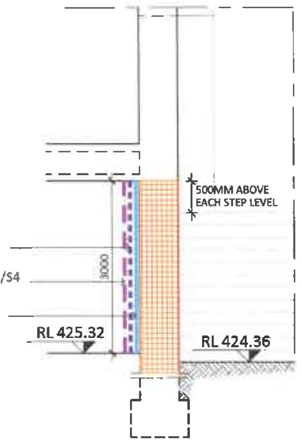
02 LYDIARD STREET LIGTHWELL SECTION
1:50

DAMP REMEDIATION WORKS-WEST AREA:

1. REMOVE FULL EXTENT OF EXISTING RENDER.
2. REMOVE LOCALISED COURSE OF TILES TO ALLOW INJECTION OF GROUNTING ON A MAXIMUM GRID OF 400 X 400MM. ALLOW TO REPLACE 75% OF THE TILES.
3. APPLY SALT REMOVAL POULTICE TO THE FULL EXTENT OF WALL.
4. INJECT APPROVED GROUTING INTO INTERNAL VOID OF THE MASONRY USING LOW PRESSURE. ALLOW THE GROUT TO CURE FOR 28 DAYS.
5. REINSTATE WALL SUBSTRATE WITH NEW RENDER FINISH.
6. REMOVE FULL EXTENT OF PAINTING IN THE ROOM.
7. PREPARE AND PAINT FULL EXTENT OF THE ROOM AS SPECIFIED.



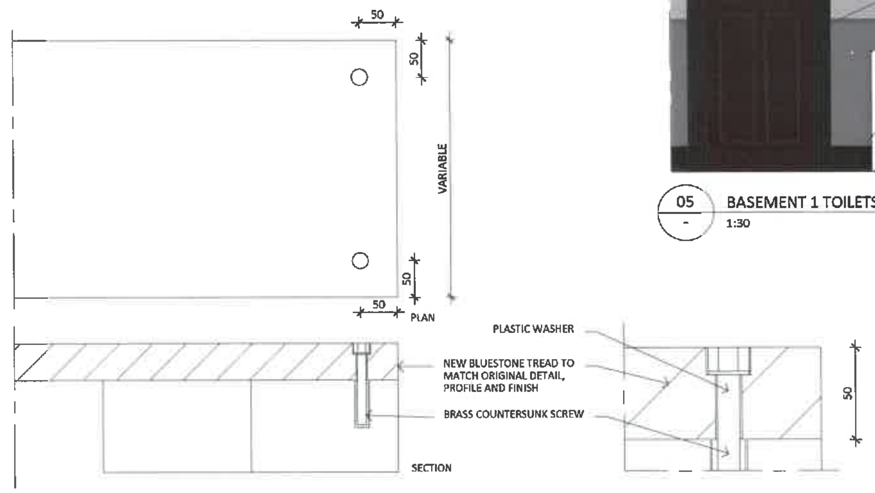
03 SOUTH WALL SECTION
1:50



04 NORTH WALL SECTION
1:50

DAMP REMEDIATION WORKS-SOUTH AND NORTH AREAS:

1. REMOVE FULL EXTENT OF PAINTING OR / AND LIMEWASH.
2. APPLY SALT REMOVAL POULTICE TO THE FULL EXTENT OF WALL IN THE BASEMENT.
3. REPOINT FULL EXTENT OF WALL IN THE BASEMENT.
4. INJECT APPROVED GROUTING INTO INTERNAL VOID OF THE MASONRY USING LOW PRESSURE LIMITED TO AREA UP TO 500MM ABOVE SOIL OR EXTERNAL STAIRS. ALLOW THE GROUT TO CURE FOR 28 DAYS.
5. APPLY PIGMENTED LIME WASH TO THE WALL IN THE BASEMENT.



04 SOUTH STAIRCASE STEP SECTION DETAIL
1:5

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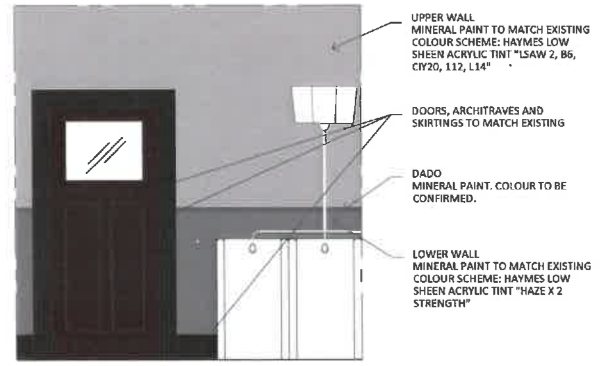
CONSERVATION WORKS LEGEND

- S1 - REPOINT STONEWORK
- G3/S4 - PAINT REMOVAL / APPLY LIME WASH
- G3/P5 - PAINT REMOVAL / PREPARE AND PAINT RENDERWORK - MINERAL PAINT
- G5 - SALT REMOVAL
- G6 - GROUTING INJECTION
- G9- NEW RENDER TO PLAIN/FLAT SURFACES
- REPLACE TILE
- ASSOCIATED WORKS WITH FIRE/ELECTRICAL ENGINEER'S DOCUMENTATION



05 BASEMENT 1 TOILETS COLOUR SCHEME
1:30

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PROJECT
HER MAJESTY'S THEATRE
CONSERVATION WORKS

DRAWING TITLE
PROPOSED CONSERVATION WORKS
BASEMENT 1

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AO	CHL	7637	DECEMBER 2017	TENDER	1:100@A1 1:50@A1	HA.201	T1

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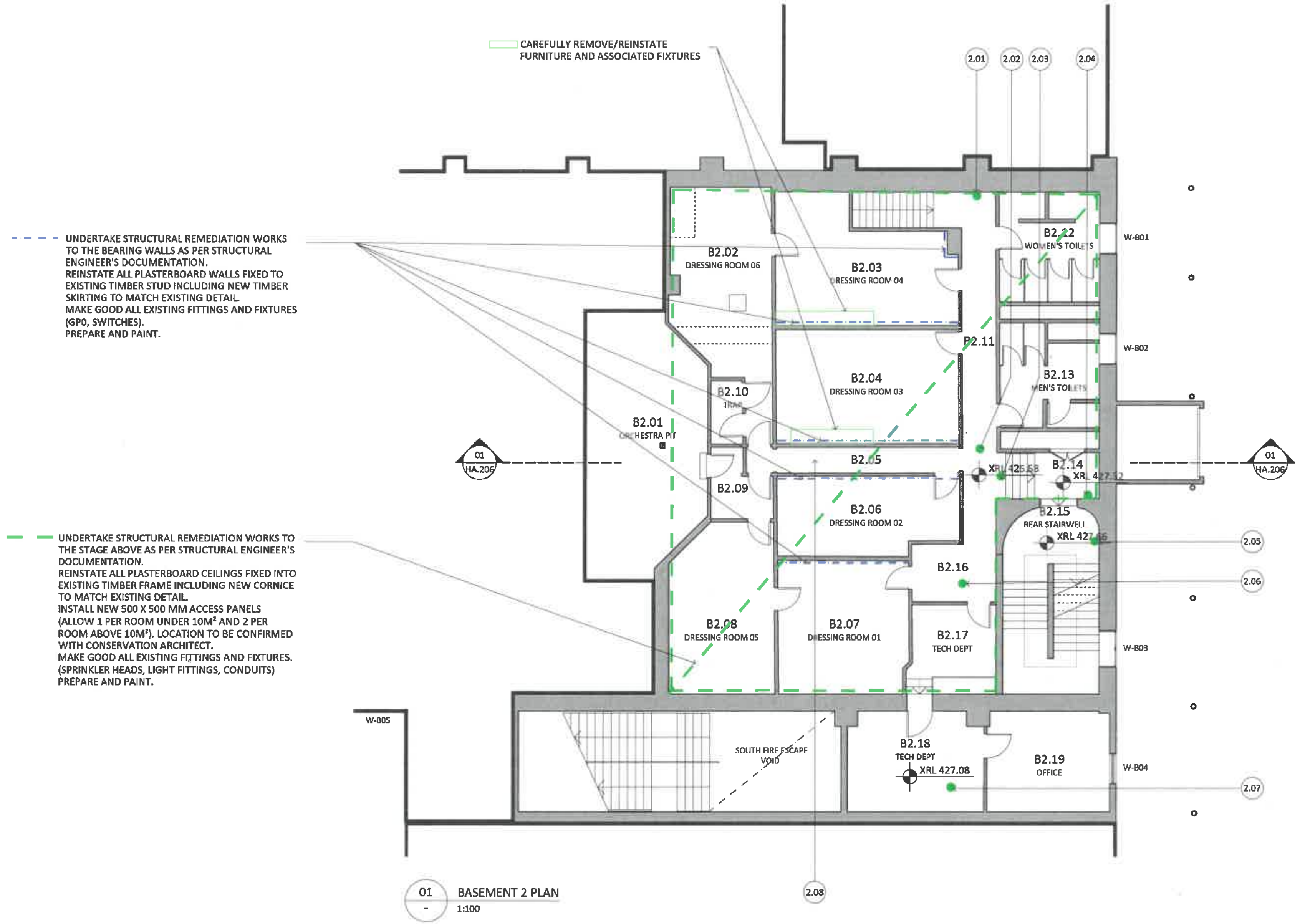

01 BASEMENT 2 PLAN
1:100

CONSERVATION WORKS LEGEND

- G2 - REMOVE EMBEDDED ITEMS
- G3 - INTERNAL PAINT REMOVAL
- G4 - SALT REMOVAL
- G5 - PIGMENTED MORTAR MIX REPAIR
- G6 - REPAIR LINING PAPER
- R1/R2 - RENDER REPAIR
- R3 - CRACK REPAIR
- R4 - RENDER COPING/PARGING
- B1 - REPOINT BRICKWORK
- B1 - REPOINT BRICKWORK
- B2 - REPLACE BRICKWORK
- C1 - REPAIR TIMBER WORK
- C2 - REPLACE TIMBER WORK
- RG2 - REPLACE INTERNAL GUTTER
- HP1 - CRACK REPAIR
- HP2 - STRUCTURAL CRACK REPAIR
- HP3/HP4 - HARD PLASTER REPAIR
- HP5 - PIN HARD PLASTER
- HP6 - CAST AND INSTALL DECORATIVE PLASTER ITEM
- S1 - REPOINT STONEWORK
- S2 - RESET STONEWORK
- S5 - CARVE AND INSTALL NEW STONE
- S1 - TERRA-COTTA CRACK REPAIR
- S1 - REPOINT TERRA-COTTA
- S2 - PATCH REPAIR TERRA-COTTA
- S5 - CARVE AND INSTALL NEW ARCHITECTURAL TERRA-COTTA
- ASSOCIATED WORKS WITH FIRE/ELECTRICAL ENGINEER'S DOCUMENTATION

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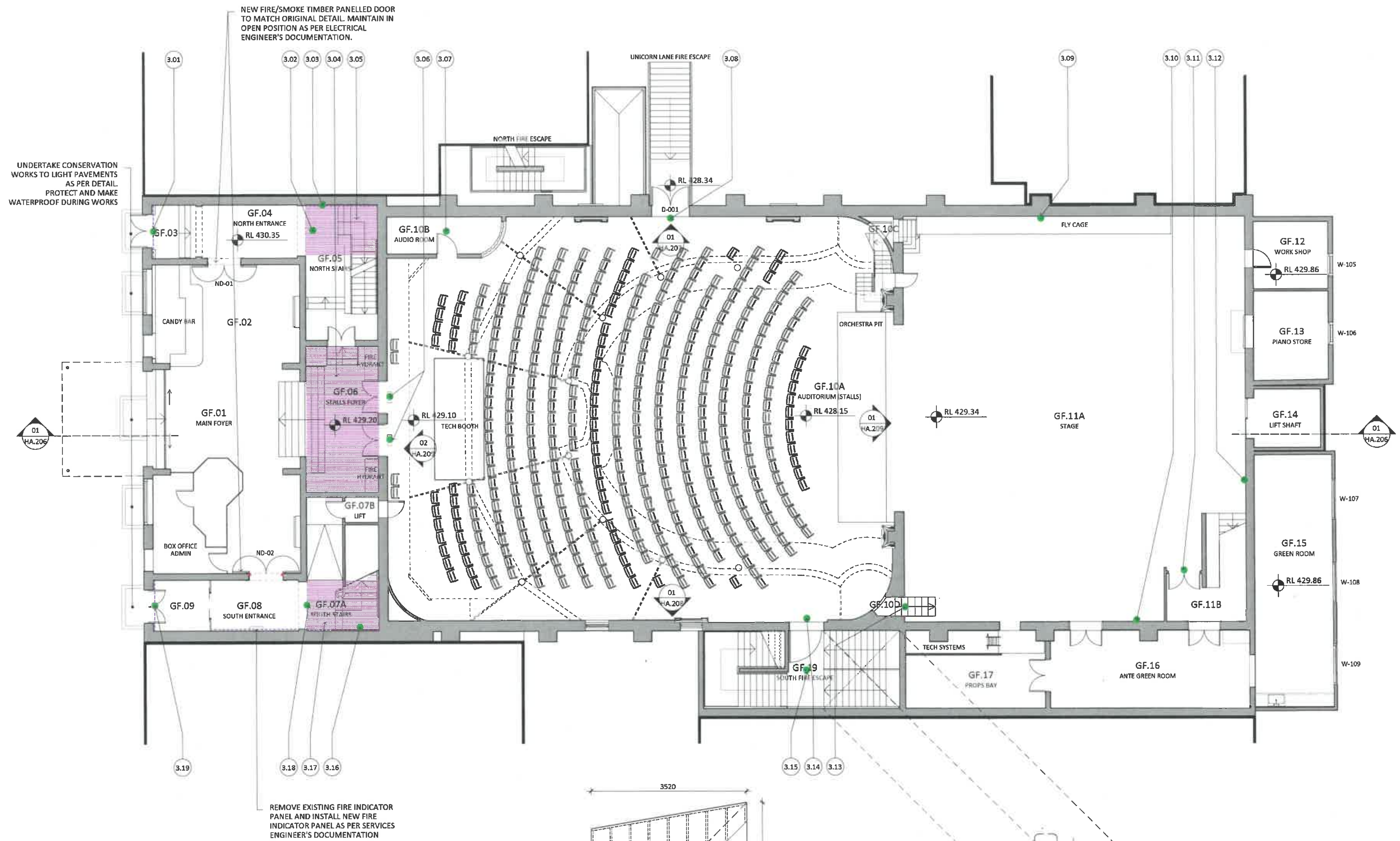
PROJECT
HER MAJESTY'S THEATRE
CONSERVATION WORKS

DRAWN	CHECKED	PROJECT NO.	DATE
AO	CHL	7637	DECEMBER 2017

DRAWING TITLE
PROPOSED CONSERVATION WORKS
BASEMENT 2

ISSUE	SCALE	DRAWING NO.	REVISION
TENDER	1:100@A1	HA.202	T1



01 GROUND FLOOR PLAN
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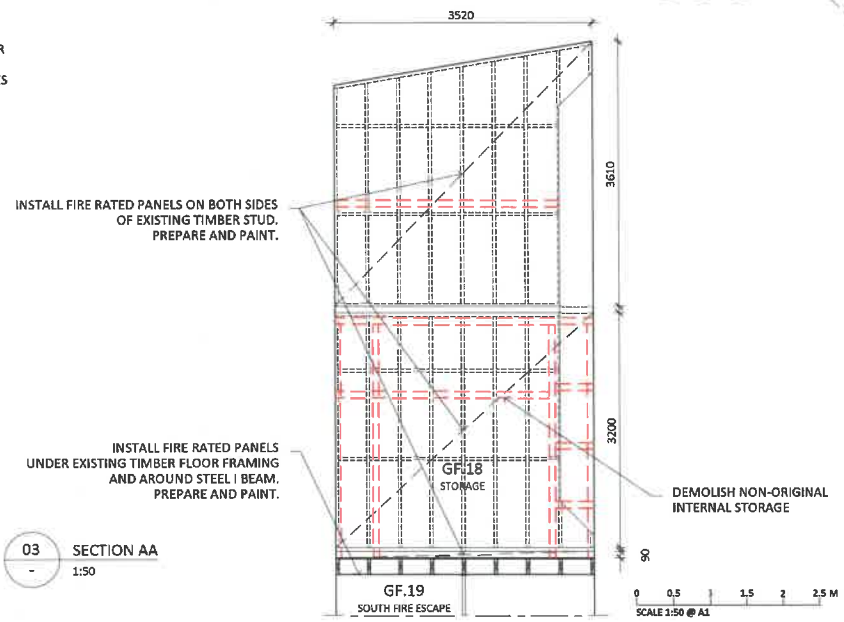

03 SECTION AA
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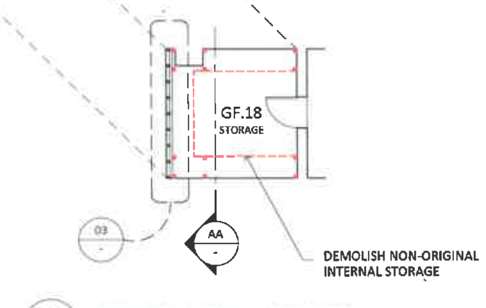

02 GROUND FLOOR PLAN - MEZZANINE
1:100

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PROJECT
HER MAJESTY'S THEATRE
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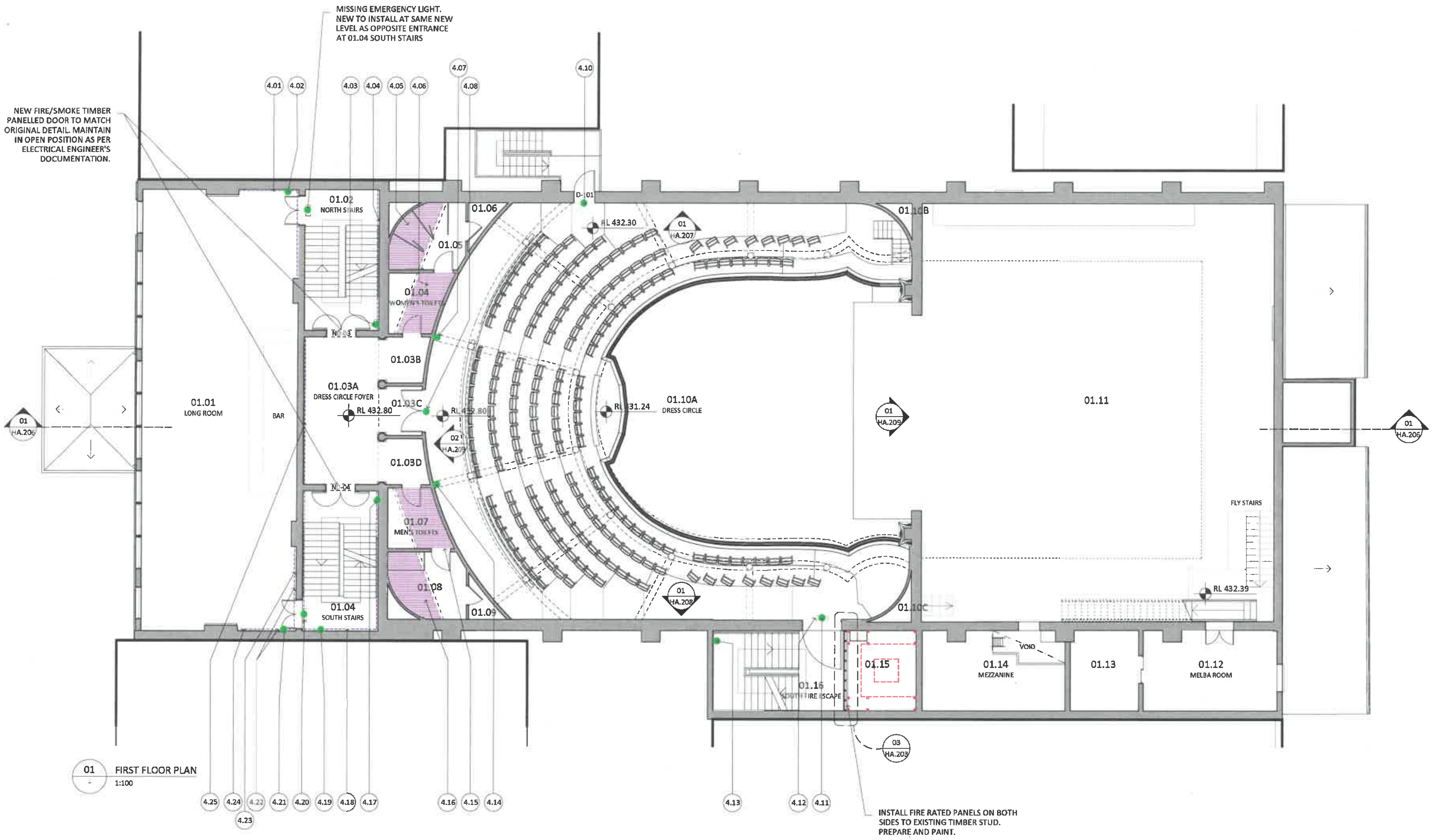
DRAWN	CHECKED	PROJECT NO.	DATE
AO	CHL	7637	DECEMBER 2017

DRAWING TITLE
PROPOSED CONSERVATION WORKS
GROUND FLOOR

ISSUE	SCALE	DRAWING NO.	REVISION
TENDER	1:100@A1	HA.203	T1



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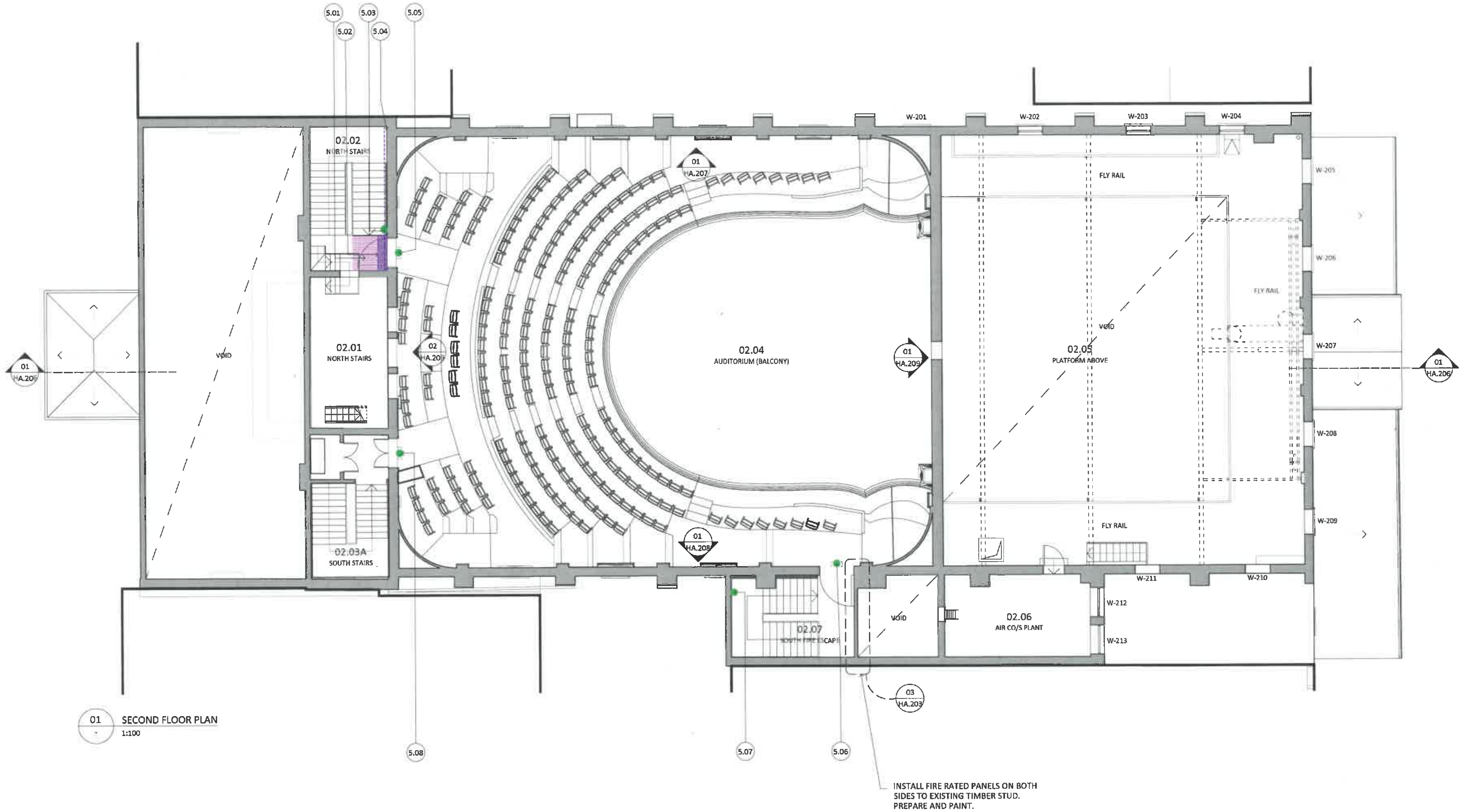
PROJECT
HER MAJESTY'S THEATRE
CONSERVATION WORKS

DRAWING TITLE
PROPOSED CONSERVATION WORKS
FIRST FLOOR (DRESS CIRCLE)

DRAWN	CHECKED	PROJECT NO.	DATE	ISSUE	SCALE	DRAWING NO.	REVISION
AO	CHL	7637	DECEMBER 2017	TENDER	1:100@A1	HA.204	T1



01 SECOND FLOOR PLAN
1:100

GENERAL NOTES:

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- ANY GLAZING MUST COMPLY WITH AS 1288-2006.
- ALL STAINLESS STEEL PRODUCTS MUST BE GRADE 316.

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- PROVIDE ALL SAMPLES FOR APPROVAL BY CONSERVATION ARCHITECT PRIOR COMMENCEMENT OF WORKS.

PAINTING NOTES:

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- ENSURE WINDOWS ARE OPERABLE. DO NOT PAINT SHUT.
- PREPARE, PRIME, UNDERCOAT AND PAINT ALL NEW TIMBER AND STEEL WORKS (EXCEPT COPPER AND LEAD WORKS)

CONSERVATION WORKS LEGEND

- G2 - REMOVE EMBEDDED ITEMS
- G3 - INTERNAL PAINT REMOVAL
- G4 - SALT REMOVAL
- G5 - PIGMENTED MORTAR MIX REPAIR
- G6 - REPAIR LINING PAPER
- R1/R2- RENDER REPAIR
- R3- CRACK REPAIR
- R4- RENDER COPING/PARGING
- B1 - REPOINT BRICKWORK
- B1 - REPOINT BRICKWORK
- B2 - REPLACE BRICKWORK
- C1 - REPAIR TIMBER WORK
- C2 - REPLACE TIMBER WORK
- RG2 - REPLACE INTERNAL GUTTER
- HP1- CRACK REPAIR
- HP2 - STRUCTURAL CRACK REPAIR
- HP3/HP4 - HARD PLASTER REPAIR
- HP5 - PIN HARD PLASTER
- HP6 - CAST AND INSTALL DECORATIVE PLASTER ITEM
- S1 - REPOINT STONEWORK
- S2 - RESET STONEWORK
- S5 - CARVE AND INSTALL NEW STONE
- S1 - TERRA-COTTA CRACK REPAIR
- S1 - REPOINT TERRA-COTTA
- S2 - PATCH REPAIR TERRA-COTTA
- S5 - CARVE AND INSTALL NEW ARCHITECTURAL TERRA-COTTA
- ASSOCIATED WORKS WITH FIRE/ELECTRICAL ENGINEER'S DOCUMENTATION

NOT FOR CONSTRUCTION

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SCALE 1:100 @ A1

NO.	DATE	REVISION
T1	04/[illegible]/2018	ISSUE TO CLIENT FOR INFORMATION

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PROJECT
HER MAJESTY'S THEATRE
CONSERVATION WORKS

DRAWN	CHECKED	PROJECT NO.	DATE
AO	CHL	7637	DECEMBER 2017

DRAWING TITLE
PROPOSED CONSERVATION WORKS
SECOND FLOOR (GALLERY)

ISSUE	SCALE	DRAWING NO.	REVISION
TENDER	1:100@A1	HA.205	T1

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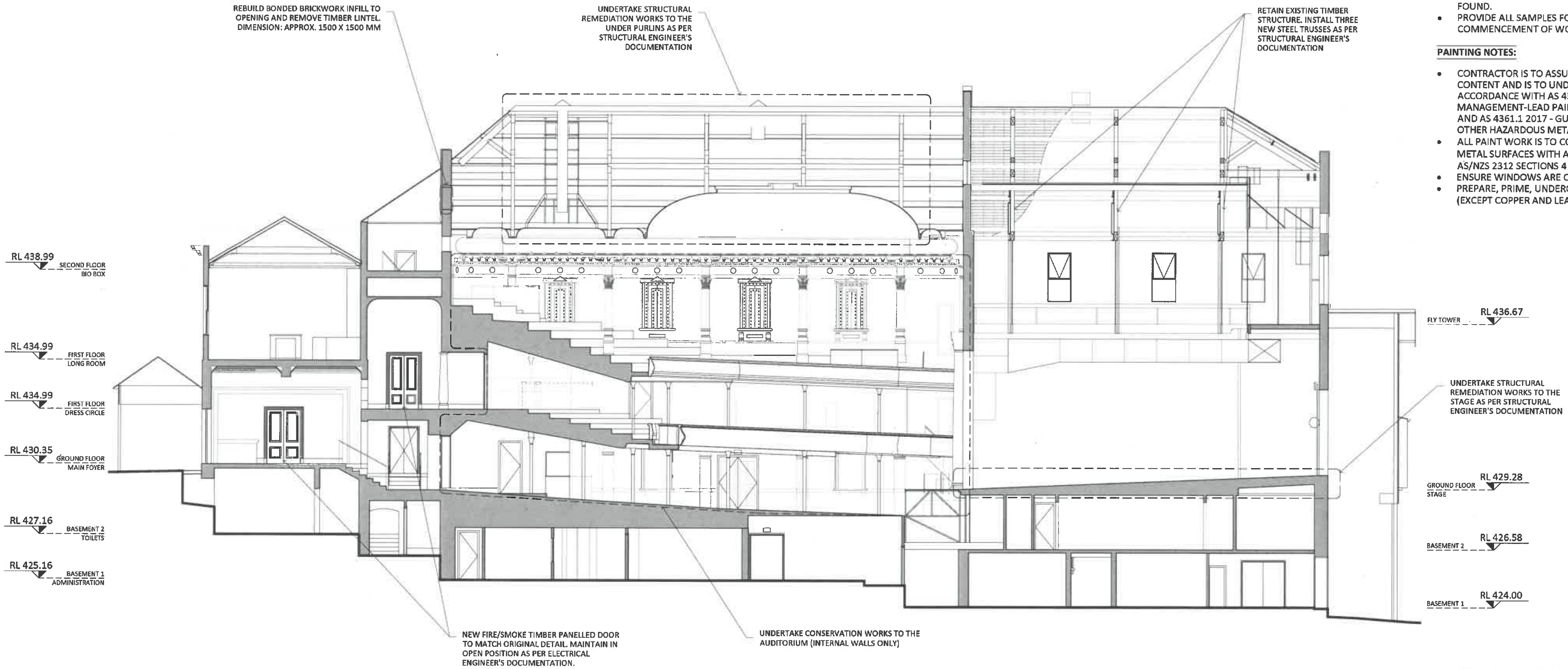

01 SECTION A-A
- 1:100

CONSERVATION WORKS LEGEND

- G2 - REMOVE EMBEDDED ITEMS
- G3 - INTERNAL PAINT REMOVAL
- G4 - SALT REMOVAL
- G5 - PIGMENTED MORTAR MIX REPAIR
- G6 - REPAIR LINING PAPER
- R1/R2- RENDER REPAIR
- R3- CRACK REPAIR
- R4- RENDER COPING/PARGING
- B1 - REPOINT BRICKWORK
- B1 - REPOINT BRICKWORK
- B2 - REPLACE BRICKWORK
- C1 - REPAIR TIMBER WORK
- C2 - REPLACE TIMBER WORK
- RG2 - REPLACE INTERNAL GUTTER
- HP1- CRACK REPAIR
- HP2 - STRUCTURAL CRACK REPAIR
- HP3/HP4 - HARD PLASTER REPAIR
- HP5 - PIN HARD PLASTER
- HP6 - CAST AND INSTALL DECORATIVE PLASTER ITEM
- S1 - REPOINT STONEWORK
- S2 - RESET STONEWORK
- S3 - CARVE AND INSTALL NEW STONE
- S1 - TERRA-COTTA CRACK REPAIR
- S1 - REPOINT TERRA-COTTA
- S2 - PATCH REPAIR TERRA-COTTA
- S5 - CARVE AND INSTALL NEW ARCHITECTURAL TERRA-COTTA
- ASSOCIATED WORKS WITH FIRE/ELECTRICAL ENGINEER'S DOCUMENTATION

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SCALE 1:100 @ A1

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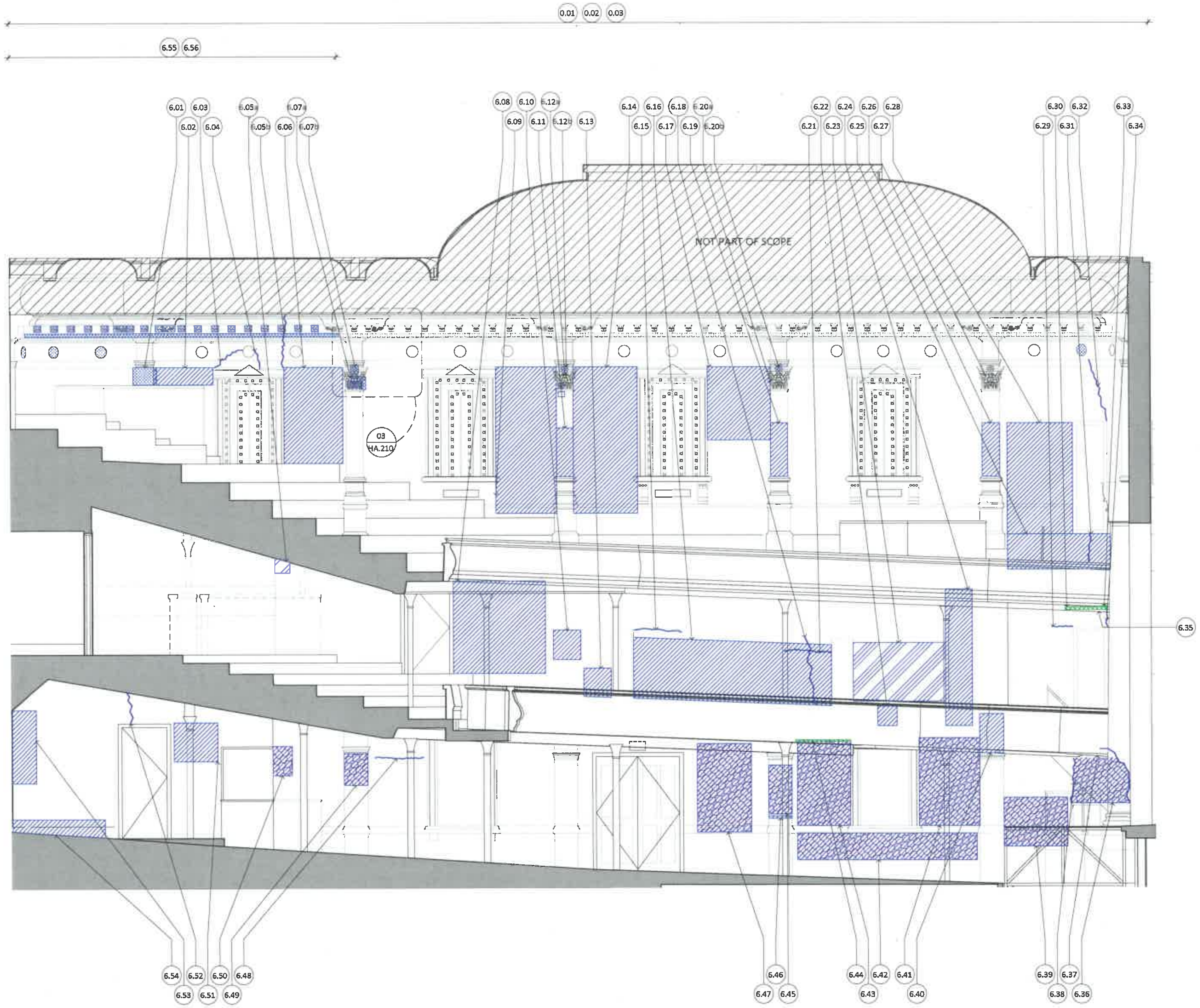
PROJECT
HER MAJESTY'S THEATRE
CONSERVATION WORK

DRAWN	CHECKED	PROJECT NO.	DATE
AO	CHL	7637	DECEMBER 2017

DRAWING TITLE
GENERAL SECTION - EAST-WEST

ISSUE	SCALE	DRAWING NO.	REVISION
TENDER	1:100@A1	HA.206	T1



01 NORTH INTERNAL ELEVATION
- 1:50

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CONSERVATION WORKS LEGEND

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- G3 - INTERNAL PAINT REMOVAL
- G4 - SALT REMOVAL
- G5 - PIGMENTED MORTAR MIX REPAIR
- G6 - REPAIR LINING PAPER
- R1/R2- RENDER REPAIR
- R3- CRACK REPAIR
- R4- RENDER COPING/PARGING
- B1 - REPOINT BRICKWORK
- B1 - REPOINT BRICKWORK
- B2 - REPLACE BRICKWORK
- C1 - REPAIR TIMBER WORK
- C2 - REPLACE TIMBER WORK
- RG2 - REPLACE INTERNAL GUTTER
- HP1- CRACK REPAIR
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- S2 - PATCH REPAIR TERRA-COTTA
- S5 - CARVE AND INSTALL NEW ARCHITECTURAL TERRA-COTTA
- ASSOCIATED WORKS WITH FIRE/ELECTRICAL ENGINEER'S DOCUMENTATION

NOT FOR CONSTRUCTION

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SCALE 1:50 @ A1

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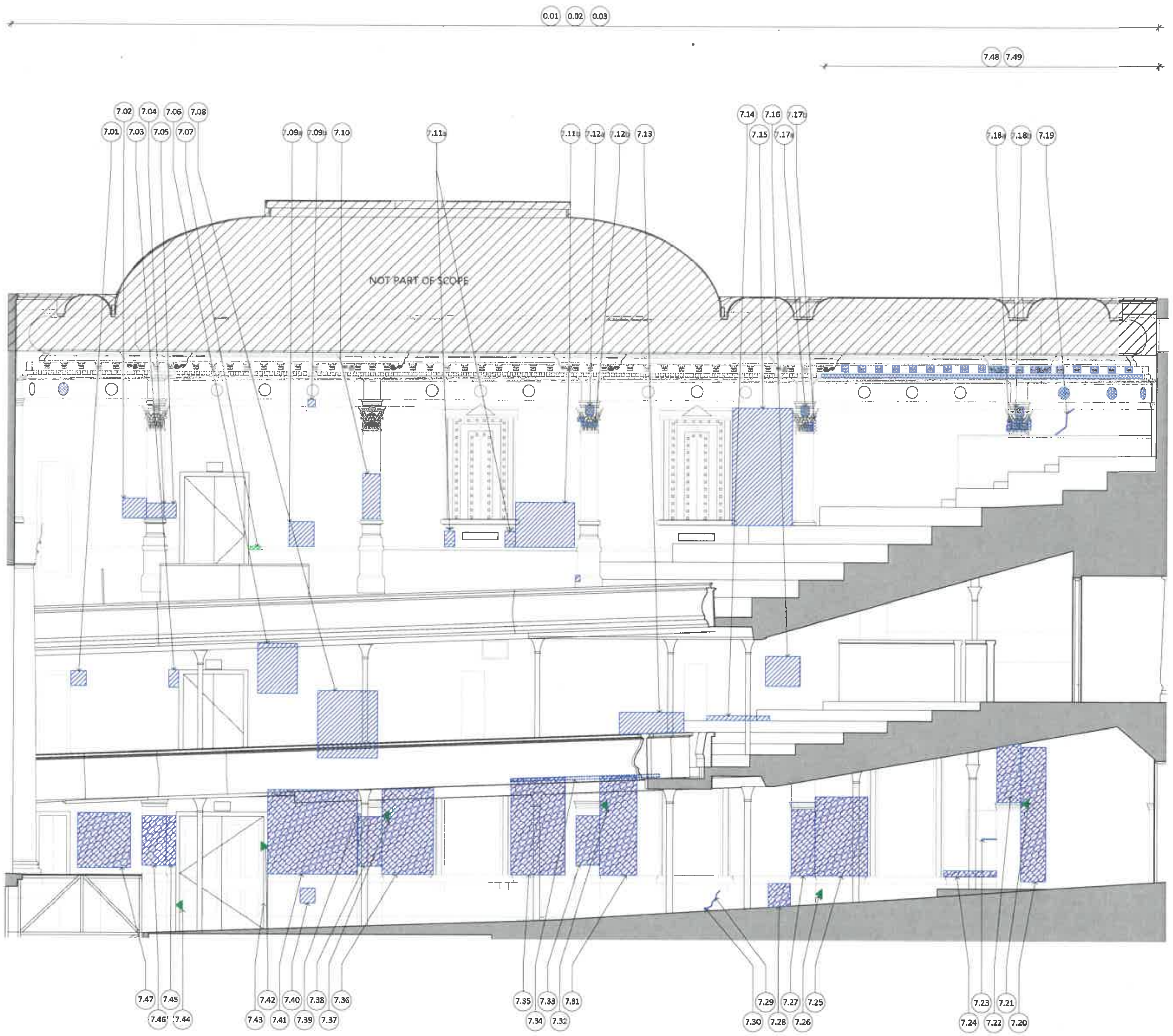
PROJECT
HER MAJESTY'S THEATRE
CONSERVATION WORKS

DRAWING TITLE
AUDITORIUM - NORTH ELEVATION

DRAWN	CHECKED	PROJECT NO.	DATE	ISSUE	SCALE	DRAWING NO.	REVISION
AO	CHL	7637	DECEMBER 2017	TENDER	1:100@A1	HA.207	T1



01 SOUTH INTERNAL ELEVATION
1:50

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CONSERVATION WORKS LEGEND

- G2 - REMOVE EMBEDDED ITEMS
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- G5 - PIGMENTED MORTAR MIX REPAIR
- G6 - REPAIR LINING PAPER
- R1/R2- RENDER REPAIR
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- B1 - REPOINT BRICKWORK
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- C2 - REPLACE TIMBER WORK
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- ASSOCIATED WORKS WITH FIRE/ELECTRICAL ENGINEER'S DOCUMENTATION

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SCALE 1:50 @ A1

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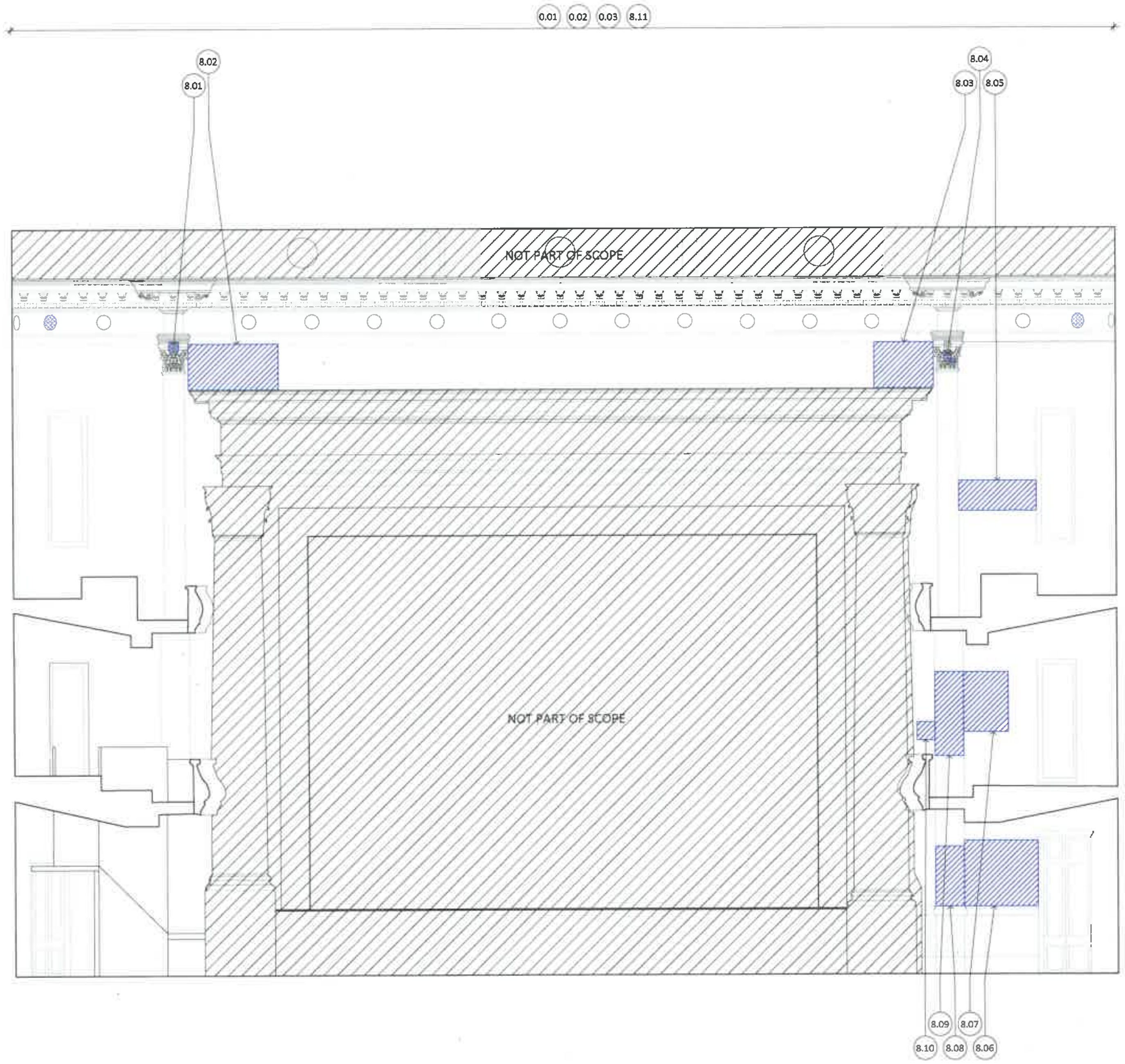
PROJECT
HER MAJESTY'S THEATRE
CONSERVATION WORKS

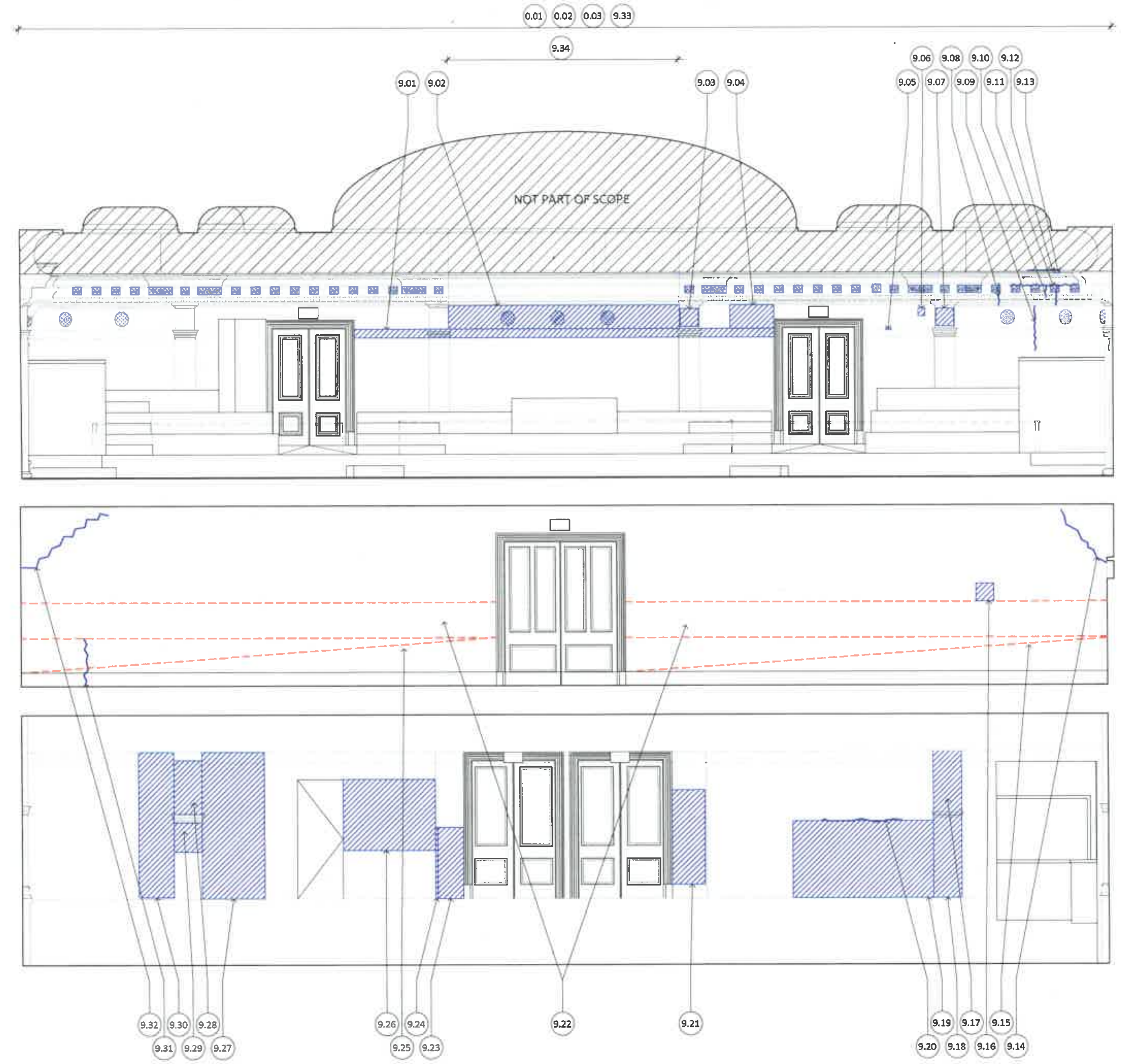
DRAWN	CHECKED	PROJECT NO.	DATE
AO	CHL	7637	DECEMBER 2017

DRAWING TITLE
AUDITORIUM - SOUTH ELEVATION

ISSUE	SCALE	DRAWING NO.	REVISION
TENDER	1:50@A1	HA.208	T1



01 AUDITORIUM - EAST INTERNAL ELEVATION
1:50



02 AUDITORIUM - WEST INTERNAL ELEVATION
1:50

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- S1 - TERRA-COTTA CRACK REPAIR
- S1 - REPOINT TERRA-COTTA
- S2 - PATCH REPAIR TERRA-COTTA
- S5 - CARVE AND INSTALL NEW ARCHITECTURAL TERRA-COTTA
- ASSOCIATED WORKS WITH FIRE/ELECTRICAL ENGINEER'S DOCUMENTATION

NOT FOR CONSTRUCTION

0 0.5 1 1.5 2 2.5 M
SCALE 1:50 @ A1

NO.	DATE	REVISION
T1	04/06/2018	ISSUE TO CLIENT FOR INFORMATION

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624 RATHDOWNE STREET, NORTH CARLTON, 3054

SERVICES ENGINEER
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LVL 1, 1 SOUTHBANK BVD, SOUTHBANK, VIC 3006

FIRE SAFETY ENGINEER
GINCAT FIRE ENGINEERING
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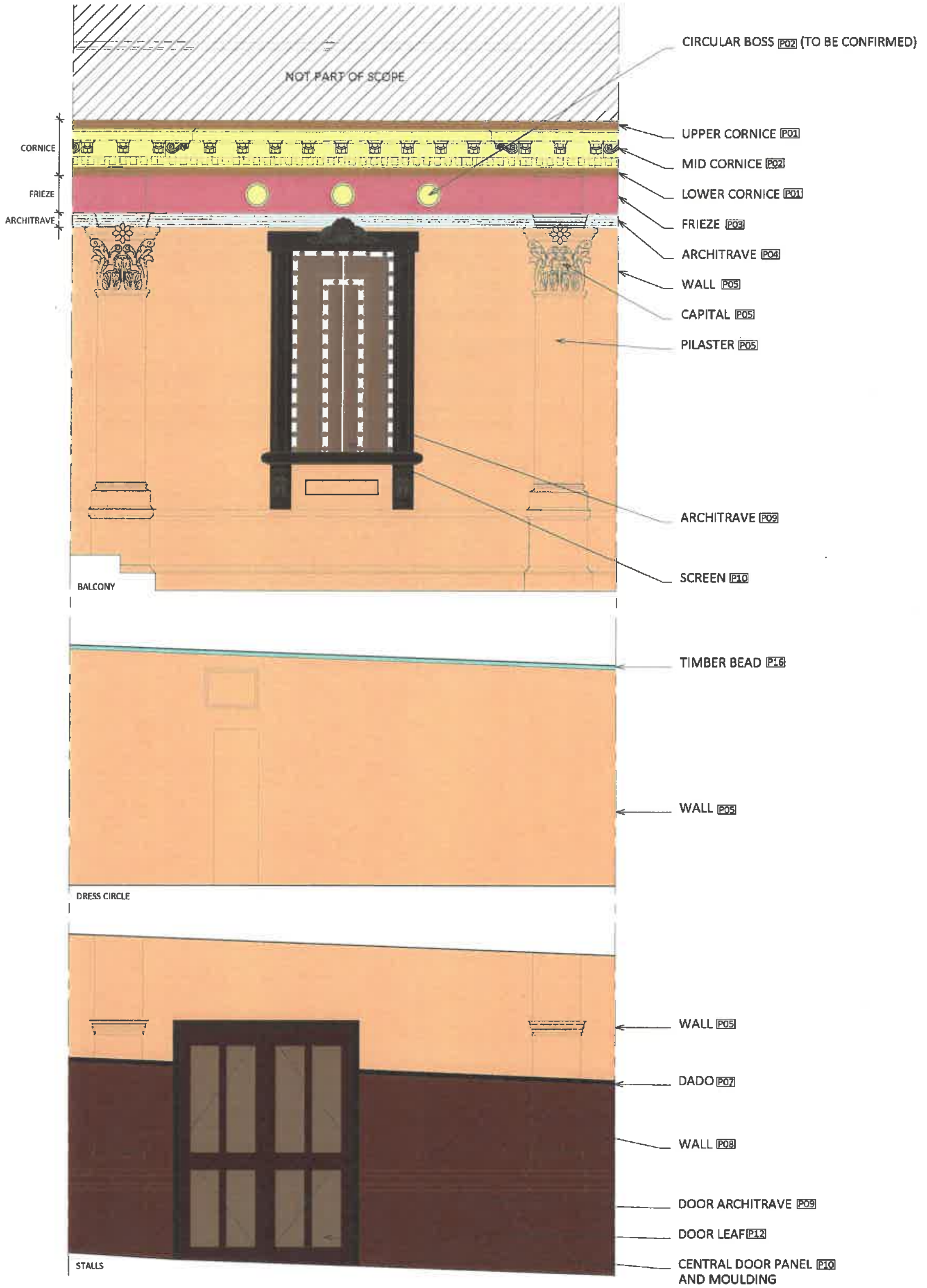
PROJECT
HER MAJESTY'S THEATRE
CONSERVATION WORKS

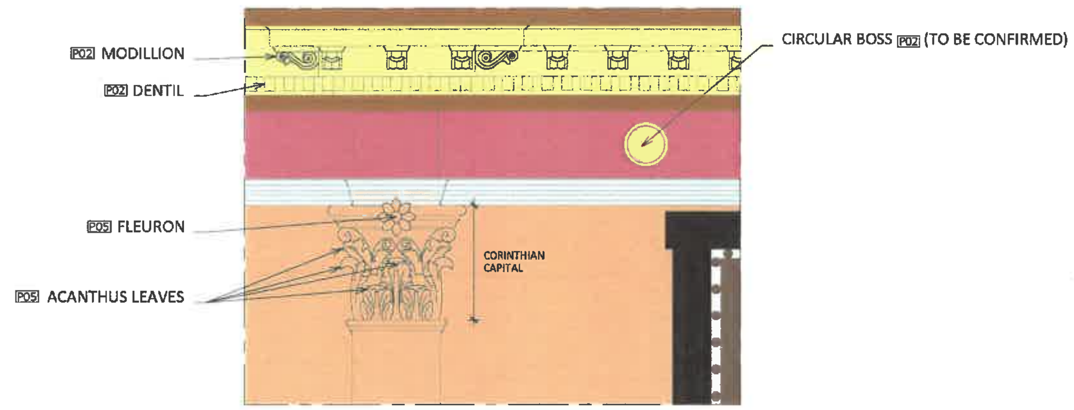
DRAWING TITLE
AUDITORIUM EAST AND WEST ELEVATIONS

DRAWN	CHECKED	PROJECT NO.	DATE	ISSUE	SCALE	DRAWING NO.	REVISION
AO	CHL	7637	DECEMBER 2017	TENDER	1:100@A1	HA.209	T1



01 AUDITORIUM NORTH ELEVATION
1:30

02 AUDITORIUM WEST DOORS
1:30



03 AUDITORIUM ORNAMENTATION
1:20

GENERAL NOTES:

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- ALL WORK IS TO COMPLY WITH THE RELEVANT AUSTRALIAN STANDARDS.
- ANY GLAZING MUST COMPLY WITH AS 1288-2006.
- ALL STAINLESS STEEL PRODUCTS MUST BE GRADE 316.

CONSERVATION NOTES:

- ALL QUANTITIES RELATED TO THE CONSERVATION WORKS PROVIDED IN THE SCHEDULES ARE NOMINAL ONLY AND THE CONTRACTOR SHALL VERIFY ON SITE AND NOTIFY THE CONSERVATION ARCHITECT AS SOON AS ANY DISCREPANCIES ARE FOUND.
- PROVIDE ALL SAMPLES FOR APPROVAL BY CONSERVATION ARCHITECT PRIOR COMMENCEMENT OF WORKS.

JOINERY NOTES:

- ALL MEASURMENTS MUST BE CONFIRMED ON SITE PRIOR TO COMMENCEMENT OF ANY WORKS.
- SHOP DRAWINGS FOR ALL JOINERY WORKS AND ASSOCIATED HARDWARE TO BE PRESENTED AND APPROVED BY CONSERVATION ARCHITECT PRIOR TO MANUFACTURING. ALL DETAILS TO MATCH ORIGINAL DETAILS.

PAINTING NOTES:

- CONTRACTOR IS TO ASSUME THAT ALL PAINT CONTAINS GREATER THAN 0.1% LEAD CONTENT AND IS TO UNDERTAKE PREPARATION OF EXISTING PAINTED SURFACES IN ACCORDANCE WITH AS 4361.2 2017 - GUIDE TO HAZARDOUS PAINT MANAGEMENT-LEAD PAINT IN RESIDENTIAL, PUBLIC AND COMMERCIAL BUILDINGS AND AS 4361.1 2017 - GUIDE TO HAZARDOUS PAINT MANAGEMENT - LEAD AND OTHER HAZARDOUS METALLIC PIGMENTS IN INDUSTRIAL APPLICATIONS.
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- ENSURE WINDOWS ARE OPERABLE. DO NOT PAINT SHUT.
- PREPARE, PRIME, UNDERCOAT AND PAINT ALL NEW TIMBER AND STEEL WORKS (EXCEPT COPPER AND LEAD WORKS)

COLOUR SCHEME

- P01 - HAYMES LOW SHEEN ACRYLIC "SOVEREIGN GOLD"
- P02 - HAYMES LOW SHEEN ACRYLIC "BEIGE"
- P03 - UPPER WALL: HAYMES LOW SHEEN ACRYLIC "IRONSTONE"
- P04 - TAUBMAN'S LOW SHEEN ACRYLIC "BLUE WHISPER"
- P05 - HAYMES LOW SHEEN ACRYLIC "BERBERTONE"
- P06 - HAYMES HIGH GLOSS ACRYLIC "BERBERTONE"
- P07 - DADO: HAYMES HIGH GLOSS ENAMEL "RUSSET"
- P08 - WALL: LOW SHEEN ENAMEL TINT "LSEWT4"
- P09 - ARCHITRAVE: DULUX LOW SHEEN ACRYLIC "DOVER REEF BROWN"
- P10 - TAUBMAN'S SEMI GLOSS ENAMEL "HAZEL"
- P11 - TAUBMAN'S SEMI GLOSS ENAMEL "WILUNA BROWN"
- P12 - TAUBMAN'S SEMI GLOSS ENAMEL "PINE HILL BROWN"
- P13 - DULUX SEMI-GLOSS ENAMEL "PATINA"
- P14 - DULUX SEMI-GLOSS ENAMEL "HIGH SEA"
- P15 - DULUX SEMI-GLOSS ENAMEL "KOALA"
- P16 - HAYMES LOW SHEEN ACRYLIC "SEAFOAM"

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0 200 400 600 800 1000 MM
SCALE 1:20 @ A1

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PROJECT
HER MAJESTY'S THEATRE
CONSERVATION WORKS

DRAWN	CHECKED	PROJECT NO.	DATE
AO	CHL	7637	MAY 2018

DRAWING TITLE
AUDITORIUM
COLOUR SCHEME

ISSUE	SCALE	DRAWING NO.	REVISION
TENDER	1:20 1:2	HA.210	T1

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LIGHT PAVEMENT WORKS NOTES:

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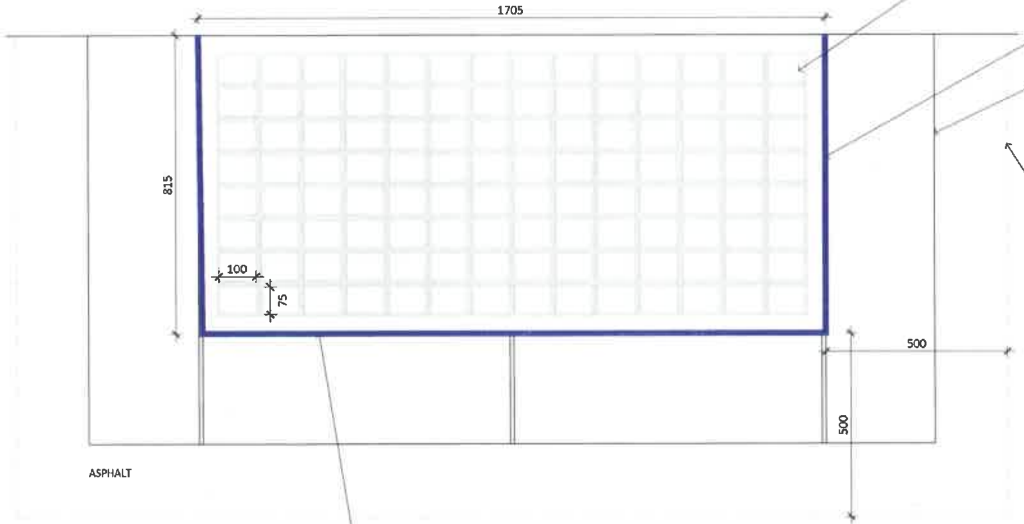


REMOVE ALL GLASS BLOCK PAVERS AND SALVAGE GLASS BLOCKS IN GOOD CONDITION FOR REUSE. ORIGINAL STORED ON SITE IN BATTERY ROOM B1.08 TO REINSTATE (LIGHT PINK COLOUR). REINSTATE SALVAGED GLASS BLOCK PAVERS AND COMPLETE WITH NEW GLASS BLOCKS TO MATCH ORIGINAL DETAIL (CLEAR GLASS).

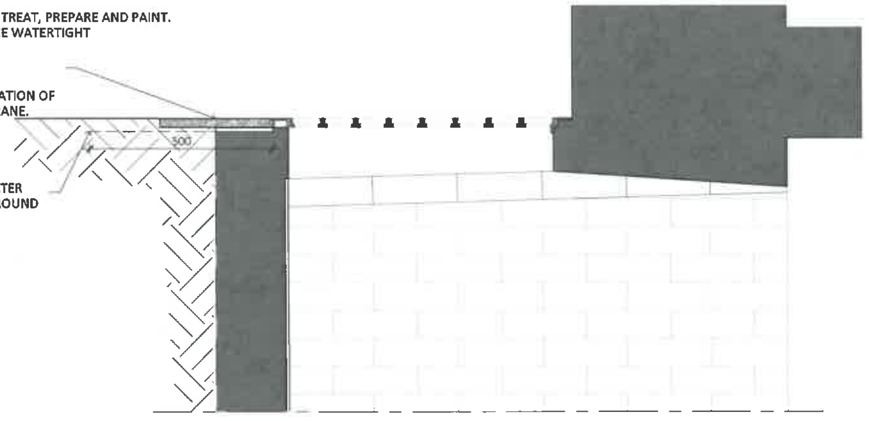
REMOVE CAST IRON GRID. TREAT, PREPARE AND PAINT. REINSTATE GRID AND MAKE WATERTIGHT

REMOVE BLUESTONE PAVEMENT/ASPHALT AND REINSTATE AFTER INSTALLATION OF WATERPROOFING MEMBRANE.

INSTALL 500MM WIDE WATER PROOFING MEMBRANE AROUND GLASS BLOCK PAVEMENT.

NEW WEATHERPROOFING SEALANT AS SPECIFIED

01 GLASS BLOCK PAVEMENT PLAN
1:10



02 GLASS BLOCK PAVEMENT SECTION
1:10

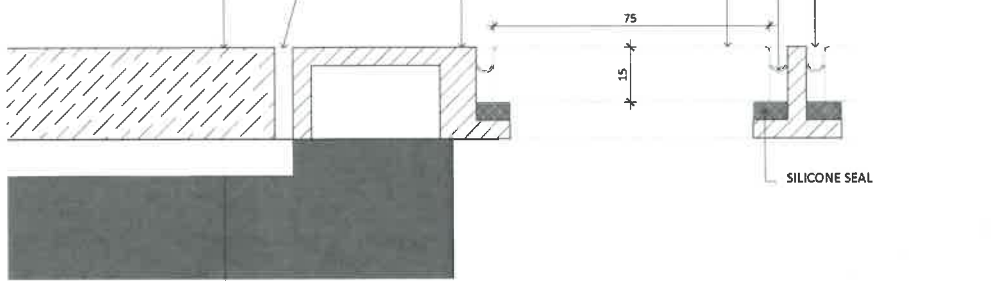
REMOVE BLUESTONE PAVEMENT/ASPHALT AND REINSTATE AFTER INSTALLATION OF WATERPROOFING MEMBRANE.

REMOVE AND REINSTATE CAST IRON GRID. TREAT PREPARE AND PAINT.

100 X 75 X 15 GLASS BLOCK PAVERS

WATERPROOFING MEMBRANE BY GLASS BLOCK PAVEMENT CONSERVATOR

FINISHING GROUT



SILICONE SEAL

INSTALL 500MM WIDE WATER PROOFING MEMBRANE AROUND GLASS BLOCK PAVEMENT/ASPHALT.

03 GLASS BLOCK PAVEMENT DETAIL
1:1

NEW CLEAR GLASS BLOCK PAVER TO MATCH ORIGINAL DETAIL, PROFILE AND PATTERN. COLOUR: TRANSLUCENT

04 ORIGINAL GLASS BLOCK PAVER
1:1

NOT FOR CONSTRUCTION

0 100 200 300 400 500MM
SCALE 1:10 @ A1

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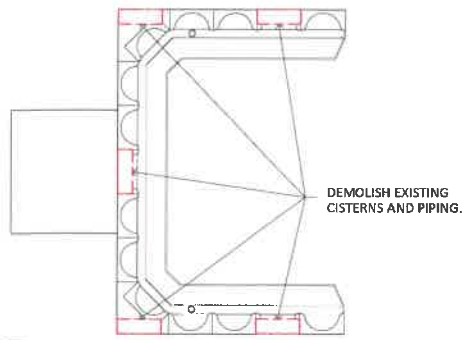
PROJECT
HER MAJESTY'S THEATRE
CONSERVATION WORKS

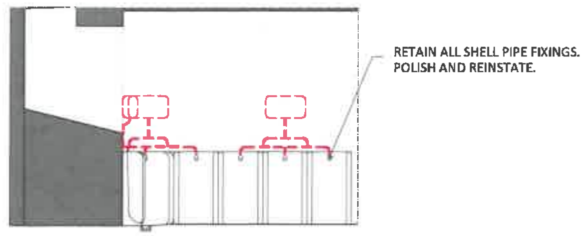
DRAWN	CHECKED	PROJECT NO.	DATE
AO	CHL	7637	DECEMBER 2017

DRAWING TITLE
TRAFFICABLE LIGHT PAVEMENT

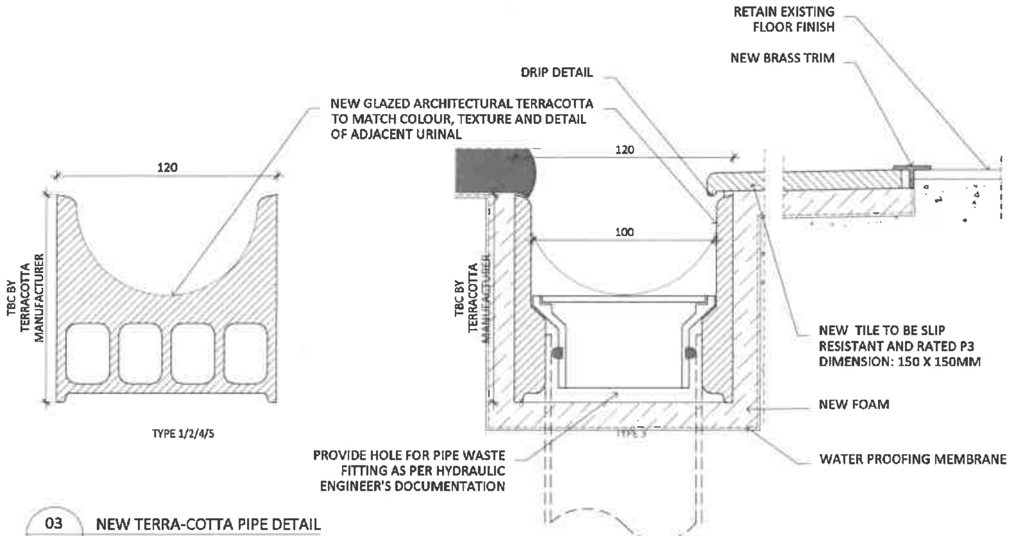
ISSUE	SCALE	DRAWING NO.	REVISION
TENDER	SCALE@A1 SCALE@A1	HA.301	T1



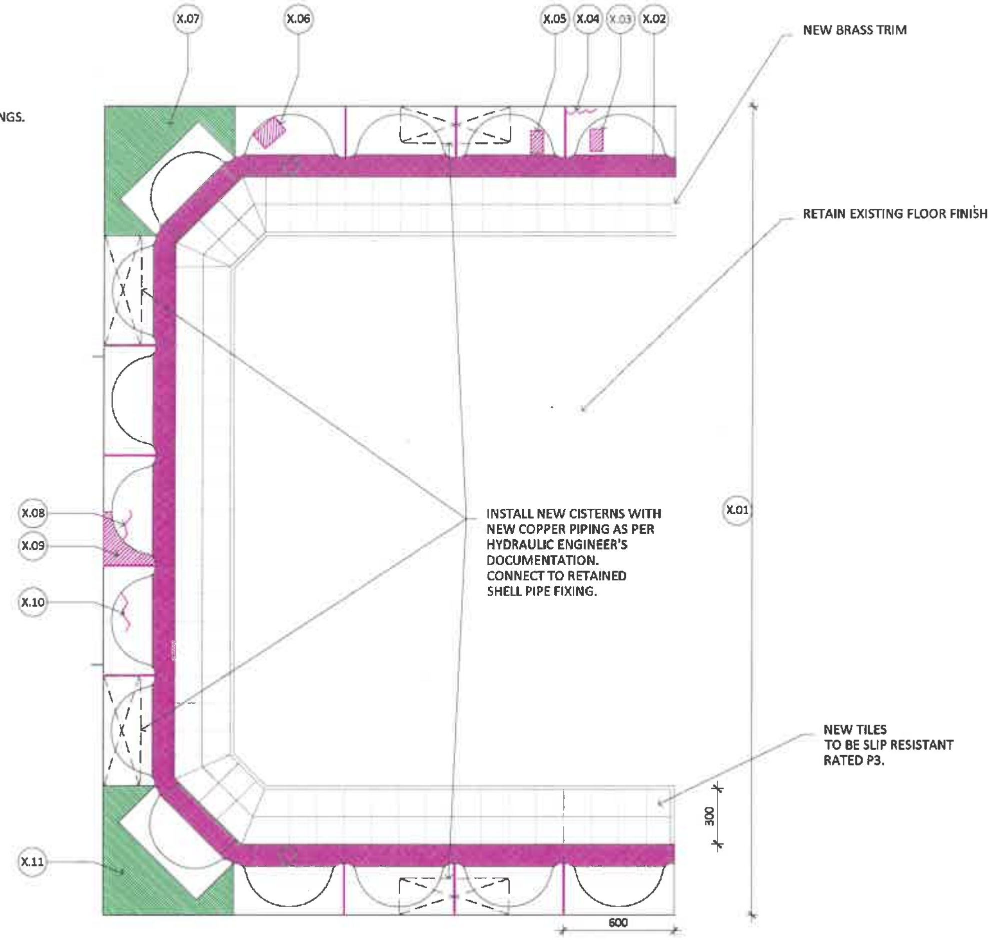
01 DEMOLITION PLAN
1:50



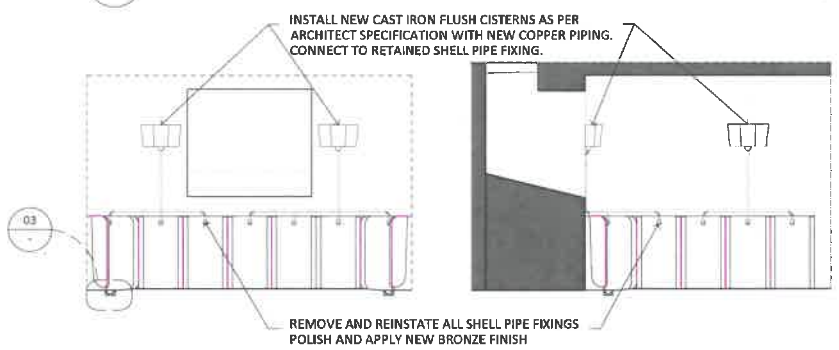
02 DEMOLITION ELEVATION
1:50



03 NEW TERRA-COTTA PIPE DETAIL
1:2



05 HERITAGE URINALS PLAN
1:20



06 HERITAGE UINALS NORTH ELEVATION
1:20

07 HERITAGE UINALS EAST ELEVATION
1:20

08 CISTERN MODEL
NTS

05 NEW TERRA-COTTA PIPE TYPES
1:5

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TERRACOTTA WORKS NOTES:

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CONSERVATION WORKS LEGEND

- S1 - REPOINT STONEWORK
- G3/S4 - PAINT REMOVAL / APPLY LIME WASH
- G3/P5 - PAINT REMOVAL / PREPARE AND PAINT RENDERWORK - MINERAL PAINT
- G5 - SALT REMOVAL
- G6 - GROUTING INJECTION
- G9- NEW RENDER TO PLAIN/FLAT SURFACES
- REPLACE TILE
- ASSOCIATED WORKS WITH FIRE/ELECTRICAL ENGINEER'S DOCUMENTATION

CONSERVATION WORKS LEGEND

- G2 - REMOVE EMBEDDED ITEMS
- G3 - INTERNAL PAINT REMOVAL
- G4 - SALT REMOVAL
- G5 - PIGMENTED MORTAR MIX REPAIR
- G6 - REPAIR LINING PAPER
- R1/R2- RENDER REPAIR
- R3- CRACK REPAIR
- R4- RENDER COPING/PARGING
- B1 - REPOINT BRICKWORK
- B1 - REPOINT BRICKWORK
- B2 - REPLACE BRICKWORK
- C1 - REPAIR TIMBER WORK
- C2 - REPLACE TIMBER WORK
- RG2 - REPLACE INTERNAL GUTTER
- HP1- CRACK REPAIR
- HP2 - STRUCTURAL CRACK REPAIR
- HP3/HP4 - HARD PLASTER REPAIR
- HP5 - PIN HARD PLASTER
- HP6 - CAST AND INSTALL DECORATIVE PLASTER ITEM
- S1 - REPOINT STONEWORK
- S2 - RESET STONEWORK
- S5 - CARVE AND INSTALL NEW STONE
- S1 - TERRA-COTTA CRACK REPAIR
- S1 - REPOINT TERRA-COTTA
- S2 - PATCH REPAIR TERRA-COTTA
- S5 - CARVE AND INSTALL NEW ARCHITECTURAL TERRA-COTTA
- ASSOCIATED WORKS WITH FIRE/ELECTRICAL ENGINEER'S DOCUMENTATION

NOT FOR CONSTRUCTION

0 0.5 1 1.5 2 2.5 M
SCALE 1:50 @ A1

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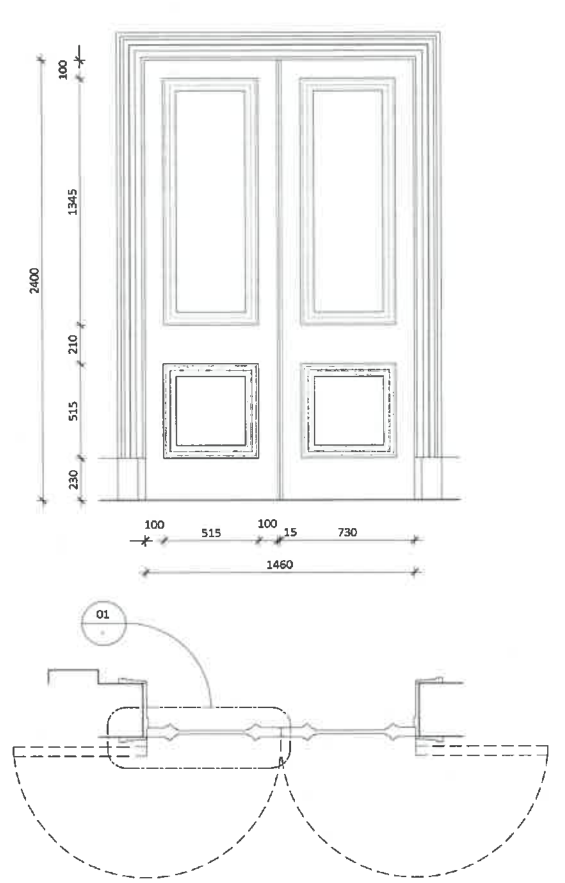
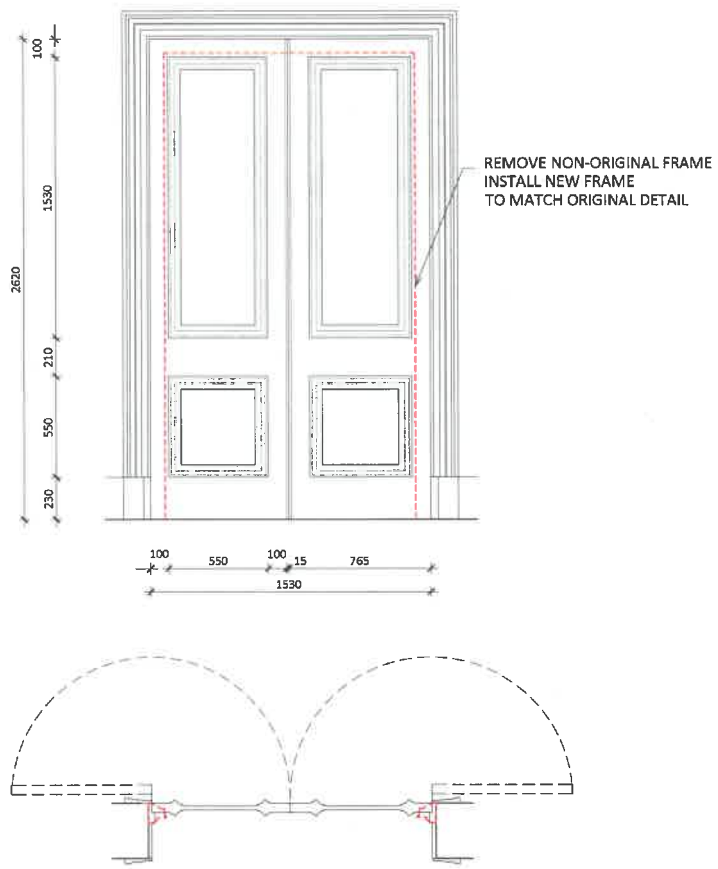
PROJECT
HER MAJESTY'S THEATRE
CONSERVATION WORKS

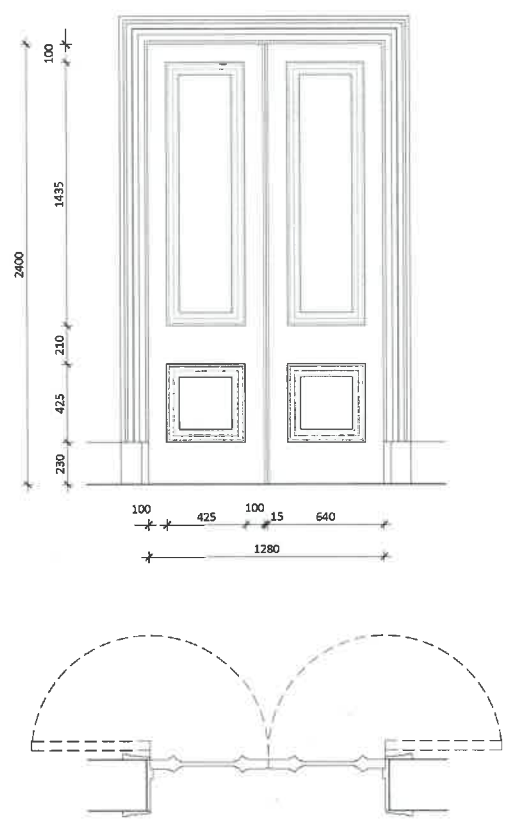
DRAWN	CHECKED	PROJECT NO.	DATE
AO	CHL	7637	DECEMBER 2017

DRAWING TITLE
PROPOSED CONSERVATION WORKS
HERITAGE URINALS

ISSUE	SCALE	DRAWING NO.	REVISION
TENDER	1:50@A1 1:20@A1	HA.401	T1



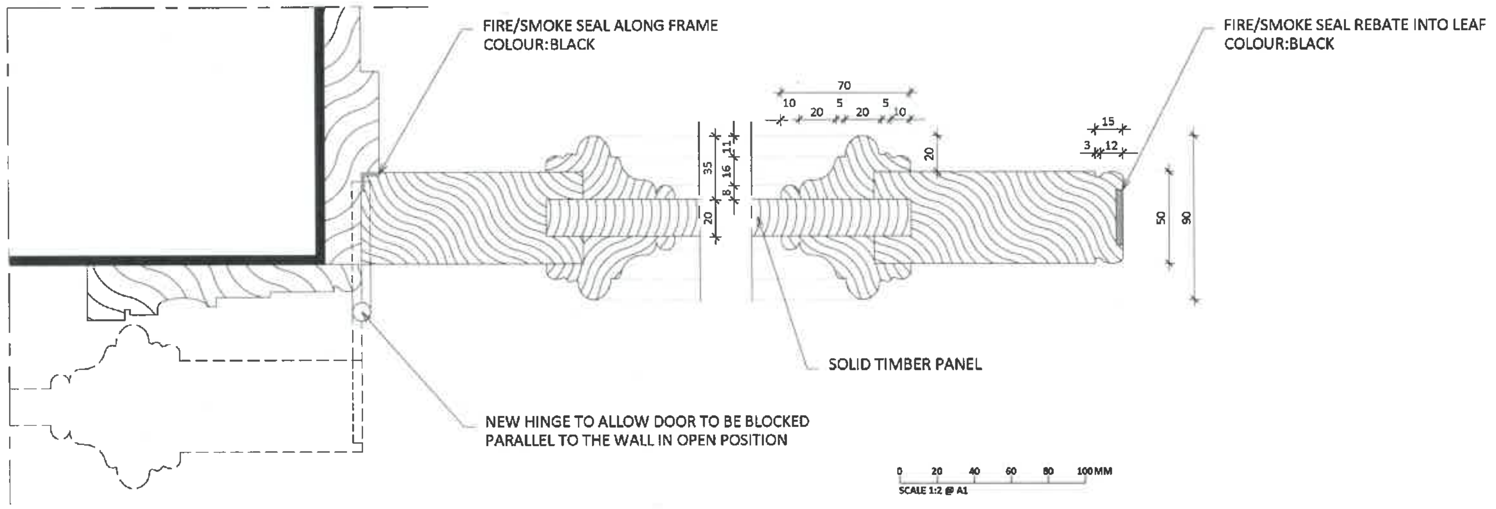




TYPE	TIMBER FIRE/SMOKE PANELLED DOOR
ROOM/NO.	ND-01
FRAME	RETAIN TIMBER FRAME
LEAF	NEW HARDWOOD TIMBER PANELLED LEAF
GLAZING	N/A
ARCHITRAVE	RETAIN TIMBER ARCHITRAVE
HARDWARE	REFER TO DOOR AND WINDOW HARDWARE SCHEDULE
WORKS	PREPARE AND PAINT CONNECT TO FIP AS PER SERVICES ENGINEER DOCUMENTATION

TYPE	TIMBER FIRE/SMOKE PANELLED DOOR
ROOM/NO.	ND-02
FRAME	NEW HARDWOOD TIMBER FRAME
LEAF	NEW HARDWOOD TIMBER PANELLED LEAF
GLAZING	N/A
ARCHITRAVE	RETAIN TIMBER ARCHITRAVE
HARDWARE	REFER TO DOOR AND WINDOW HARDWARE SCHEDULE
WORKS	REMOVE NON ORIGINAL TIMBER FRAME PREPARE AND PAINT CONNECT TO FIP AS PER SERVICES ENGINEER DOCUMENTATION

TYPE	TIMBER FIRE/SMOKE PANELLED DOOR
ROOM/NO.	ND-03, ND-04
FRAME	RETAIN TIMBER FRAME
LEAF	NEW HARDWOOD TIMBER PANELLED LEAF
GLAZING	N/A
ARCHITRAVE	RETAIN TIMBER ARCHITRAVE
HARDWARE	REFER TO DOOR AND WINDOW HARDWARE SCHEDULE
WORKS	PREPARE AND PAINT CONNECT TO FIP AS PER SERVICES ENGINEER DOCUMENTATION



01 DETAIL TIMBER PANELLED DOOR
1:2

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- PROVIDE ALL SAMPLES FOR APPROVAL BY CONSERVATION ARCHITECT PRIOR COMMENCEMENT OF WORKS.

JOINERY NOTES:

- ALL MEASURMENTS MUST BE CONFIRMED ON SITE PRIOR TO COMMENCEMENT OF ANY WORKS.
- SHOP DRAWINGS FOR ALL JOINERY WORKS AND ASSOCIATED HARDWARE TO BE PRESENTED AND APPROVED BY CONSERVATION ARCHITECT PRIOR TO MANUFACTURING. ALL DETAILS TO MATCH ORIGINAL DETAILS.

PAINTING NOTES:

- CONTRACTOR IS TO ASSUME THAT ALL PAINT CONTAINS GREATER THAN 0.1% LEAD CONTENT AND IS TO UNDERTAKE PREPARATION OF EXISTING PAINTED SURFACES IN ACCORDANCE WITH AS 4361.2 2017 - GUIDE TO HAZARDOUS PAINT MANAGEMENT-LEAD PAINT IN RESIDENTIAL, PUBLIC AND COMMERCIAL BUILDINGS AND AS 4361.1 2017 - GUIDE TO HAZARDOUS PAINT MANAGEMENT - LEAD AND OTHER HAZARDOUS METALLIC PIGMENTS IN INDUSTRIAL APPLICATIONS.
- ALL PAINT WORK IS TO COMPLY WITH AS/NZS 2311 SECTION 6, PREPARATION TO METAL SURFACES WITH AS/NZS SECTION 3 AND PROTECTION OF STEELWORK WITH AS/NZS 2312 SECTIONS 4 AND 8.
- ENSURE WINDOWS ARE OPERABLE. DO NOT PAINT SHUT.
- PREPARE, PRIME, UNDERCOAT AND PAINT ALL NEW TIMBER AND STEEL WORKS (EXCEPT COPPER AND LEAD WORKS)

NOT FOR CONSTRUCTION

0 200 400 600 800 1000 MM
SCALE 1:20 @ A1

NO.	DATE	REVISION
T1	04/06/2018	ISSUE TO CLIENT FOR INFORMATION

NOTE: ALL DIMENSIONS ARE TO BE VERIFIED ON SITE BEFORE COMMENCING ANY WORK OR PREPARING ANY SHOP DRAWINGS. SCALE INDICATED FOR REFERENCE ONLY. DO NOT SCALE OFF DRAWINGS. DO NOT SCALE DRAWINGS. OMISSIONS OR DISCREPANCIES ARE TO BE NOTIFIED TO THE ARCHITECT.

HERITAGE STRUCTURAL ENGINEER
MARK HODKINSON PTY LTD
624 RATHDOWNE STREET, NORTH CARLTON, 3054

LAND SURVEYOR
TGM GROUP PTY LTD
1315 STURT STREET, BALLARAT, VIC 3350

SERVICES ENGINEER
SIMPSON KOTZMAN PTY LTD
LVL 1, 1 SOUTHBANK BVD, SOUTHBANK, VIC 3006

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12 WEBSTER ST, BALLARAT, VIC 3350

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PROJECT
HER MAJESTY'S THEATRE
CONSERVATION WORKS

DRAWN	CHECKED	PROJECT NO.	DATE
AO/MB	CHL	7637	MAY 2018

DRAWING TITLE
DOOR & WINDOW SCHEDULE

ISSUE	SCALE	DRAWING NO.	REVISION
TENDER	1:20 1:2	HA.501	T1

gincat FIRE SAFETY ENGINEERS

Document:

Addendum to Fire Engineering Report

Project:

Her Majesty's Theatre

(17 Lydiard St South, Ballarat Central Vic., 3350)

Client:

City of Ballarat

Project Ref: P17247

FER Revision: FER 1.4 - Addendum 1.0

Date: 2/9/19

Office: 03 9395 8318 Mobile: 0414 406 214
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GinCat Fire Engineering Pty Ltd ACN 147 236 155 ABN 59 147 236 155

P17279

Report Issue/Authorisation

FEB/FER Rev.	Date	Issue Status/Description	Prepared/ Authorised By
FER 1.0	14/6/18	FER - Draft for comment review by relevant stakeholders.	G.G. Catania EF 44651
FER 1.1	11/7/18	FER Draft for comment/ review by relevant stakeholders. Deleted one-way fire rating performance solution. New Figure 12 to illustrate setback of sprinklers from doors. Updated construction requirements and Table 9. Updated §1.3 design additions.	G.G. Catania EF 44651
FER 1.2	30/7/18	FER Draft for comment/ review by relevant stakeholders. Includes comment/clarification required Architect dated 18/7/18.	G.G. Catania EF 44651
FER 1.3	10/10/18	FER – Client Issue. Includes EVACNET 4 Calculations for egress from auditorium – Refer Appendix C1.1.5A and C2. Updated factors of safety to 1.5 in event of failure of 1 of 2 subsystems and 1.0 for failure of 2 sub-subsystems. Updated occupant numbers to include additional occupants from 1058 up to 1128 occupants in total with 120 in long room.	**G.G. Catania EF 44651**
FER 1.4	29/1/19	FER – Client Issue. Post Independent Review. Updated Appendix headers. Updated §6.2.9.1 for inherent FRL's (no impact on outcome of solution). Bio-box solution added within New §6.5 (as DtS Clauses vary from Doors in §6.1). Acceptance criteria for convective exposure of 100°C re-confirmed for sprinkler failure and 60°C for sprinkler operating (as per IFEG 1996). Original Tables included 60°C in error for non sprinkler cases.	**G.G. Catania EF 44651**
FER 1.4 Addendum 1.0	2/9/19	Addendum to FER 1.4 – Includes Basement B2 revised layout. Includes lift and stair in the same shaft, Inward door swing at the Long Room, hose Reel crossing smoke wall at the Long Room.	G.G. Catania EF 44651

Conditions of Use

Executive Summary

This report presents an Addendum 1.0 to the Performance Solution and the Fire Engineering Report P17247 FER 1.4 (dated 29/1/19), for Her Majesty's Theatre located at 17 Lydiard St S, Ballarat Central

This Addendum shall be read in conjunction with the Original Fire Engineering Report (P17247 FER 1.4 (dated 29/1/19), with all the details, conditions and limitation within the Original Fire Engineering Report being applicable, unless otherwise identified within this Addendum.

The building development is understood to comprise an existing 4-storey theatre (public assembly – Class 9b with an administration area (Class 5) in the basement). The building is heritage listed with sprinkler protection throughout except for the auditorium and organ areas below. A proscenium curtain separates the stage/backstage areas. The existing building is to be fire separated into 3 fire compartments.

Table 1: Key BCA Parameters/Characteristics

BCA Clause		Description		
A1.1	Effective Height	< 25m		
A3.2	Occupancy Classification	Class 9b		
C1.1	Minimum Type of Construction	Type A		
C1.2	Rise in Storeys	3 (4-storeys contained)		
C2.2	Fire Compartment	West (m^2)	Mid (m^2)	East (m^2)
	(excludes south fire stairs 160m^2)	957	1765	873

The following variations from the Deemed-to-Satisfy (DtS) provisions of the BCA have been identified by the Relevant Building Surveyor (RBS), and are Additional to those addressed in Original Fire Engineering Report (P17247 FER 1.4, dated 2/9/19), and will be considered in this Addendum in a fire engineering performance assessment against the relevant performance requirements of the BCA, as part of the proposed Performance Solution-

Table 2: Additional Variations from BCA DtS Provisions to those Prescribed in Original Fire Engineering Report P17247 FER 1.4 (dated 29/1/19)

DtS Clause	Description of Variation from DtS Provisions	Performance Requirements
C2.11	Lift and stair in the same shaft in lieu of fire separated from each other. [Subject to dry type sprinklers to be retained at top of lift shaft, as prescribed by BCA Specification E1.5, Clause 12, where water will discharge after 60 seconds. Louvres to be provided at lift over-run].	CP2, DP5, EP2.2
D2.20	The provision of an inward swinging door at the Long Room	DP2(b), EP2.2
E1.4(f)	Omission of hose reel installation in the Long Room [2A:20BE fire extinguishers to be provided within the Long Room adjacent to each exit]	EP1.1

Note

The scope of this report is limited to the assessment of the relevant variations from the deemed-to-satisfy provisions of the BCA as outlined above. The building is otherwise assumed to comply with all other deemed-to-satisfy provisions of the BCA and the Building Regulations in matters of fire safety. The scope of this report does not extend to any other variations from the deemed to satisfy provisions of the BCA and does not address non-fire related issues.

Any Performance Solution proposed associated with the provision of fire hydrant and fire hose reel protection for the site will under Regulation 129 require the report and consent of the Chief Officer of the Relevant Fire Brigade - Note building fire services shall comply with the BCA DtS, and Building Regulation 129 consent shall not be required for the project.

As part of the Performance Solution, the following design measures are prescribed, and do not preclude those required by the DtS provisions or those previously prescribed by the Original Fire Engineering Report P17247 FER 1.4, dated 29/1/19, (unless explicitly considered in the Table above), and would be required to form part of the schedule of essential safety measures for the building:

- **Fire-Isolated Stairs and Lift Shaft -**
  - At Basement Level 2 - provide a BCA Specification C3.4 sliding fire door
  - The walls that separate the required fire-isolated stair from the lift shaft are to be of FRL 120/120/120 or FRL -/120/120 construction, as appropriate (for loadbearing and non-loadbearing shaft walls, respectively); and
  - Door openings to the lift lobby to be protected by FRL -/120/30 fire doors fitted with AS 1530.4 intumescent fire and AS 1530.7 medium temperature smoke seals and vision panels. These doors are to be self-closing or interfaced to the building wide alarm system to close in accordance with BCA Specification C3.4
  - Option 1 -
    - Provide a fire rated lift landing door of FRL -/60/- to protect openings in the fire rated lift shaft of FRL 120/120/120 or FRL -/120/120, as appropriate (for loadbearing and non-loadbearing shaft walls, respectively); or
  - Option 2 -
    - Provide a non fire-rated lift in a fire rated shaft of FRL 120/120/120 and doors as prescribed above.
- **Portable Fire Extinguishers**
  - Within Long Room - Provide a 2A:20BE fire extinguisher immediately adjacent to the exit

Based on the analysis and discussion presented, it is considered that with regard to the variations from the DtS provisions identified above, the relevant performance requirements CP2, DP2(b), DP5, EP1.1 and EP2.2 are satisfied, *to the degree necessary*.

It is also considered that this Additional Variation assessed in this Addendum does not adversely impact on the assessment and conclusions of Original Fire Engineering Report P17247 FER 1.4, dated 29/1/19.

Table of Contents

gincat FIRE SAFETY ENGINEERS

1 Introduction

1.1 Background/Description

This report presents an Addendum 1.0 to the Performance Solution and the Fire Engineering Report P17247 FER 1.4 (dated 29/1/19), for Her Majesty's Theatre located at 17 Lydiard St S, Ballarat Central

This Addendum shall be read in conjunction with the Original Fire Engineering Report (P17247 FER 1.4 (dated 29/1/19), with all the details, conditions and limitation within the Original Fire Engineering Report being applicable, unless otherwise identified within this Addendum.

The building development is understood to comprise an existing 4-storey theatre (public assembly – Class 9b with an administration area (Class 5) in the basement). The building is heritage listed with sprinkler protection throughout except for the auditorium and organ areas below. A proscenium curtain separates the stage/backstage areas. The existing building is to be fire separated into 3 fire compartments.

Table 3: Key BCA Parameters/Characteristics

BCA Clause		Description		
A1.1	Effective Height	< 25m		
A3.2	Occupancy Classification	Class 9b		
C1.1	Minimum Type of Construction	Type A		
C1.2	Rise in Storeys	3 (4-storeys contained)		
C2.2	Fire Compartment (excludes south fire stairs 160m²)	West (m²)	Mid (m²)	East (m²)
		957	1765	873

The proposed analysis will include a combination of qualitative and quantitative techniques as applicable, consistent with the methodology outlined within the International Fire Engineering Guidelines [IFEG 2005].

1.2 Variations from Deemed-to-Satisfy Provisions of the BCA

The following variations from the Deemed-to-Satisfy (DtS) provisions of the BCA have been identified by the Relevant Building Surveyor (RBS), and are Additional to those addressed in Original Fire Engineering Report (P17247 FER 1.4, dated 2/9/19), and will be considered in this Addendum in a fire engineering performance assessment against the relevant performance requirements of the BCA, as part of the proposed Performance Solution-

Table 4: Additional Variations from BCA DtS Provisions to those Prescribed in Original Fire Engineering Report P17247 FER 1.4 (dated 29/1/19)

DtS Clause	Description of Variation from DtS Provisions	Performance Requirements
C2.11	Lift and stair in the same shaft in lieu of fire separated from each other. [Subject to dry type sprinklers to be retained at top of lift shaft, as prescribed by BCA Specification E1.5, Clause 12, where water will discharge after 60 seconds. Louvres to be provided at lift over-run].	CP2, DP5, EP2.2
D2.20	The provision of an inward swinging door at the Long Room	DP2(b), EP2.2
E1.4(f)	Omission of hose reel installation in the Long Room [2A:20BE fire extinguishers to be provided within the Long Room adjacent to each exit]	EP1.1
Note The scope of this report is limited to the assessment of the relevant variations from the deemed-to-satisfy provisions of the BCA as outlined above. The building is otherwise assumed to comply with all other deemed-to-satisfy provisions of the BCA		

DtS Clause	Description of Variation from DtS Provisions	Performance Requirements
and the Building Regulations in matters of fire safety. The scope of this report does not extend to any other variations from the deemed to satisfy provisions of the BCA and does not address non-fire related issues. Any Performance Solution proposed associated with the provision of fire hydrant and fire hose reel protection for the site will under Regulation 129 require the report and consent of the Chief Officer of the Relevant Fire Brigade - Note building fire services shall comply with the BCA DtS, and Building Regulation 129 consent shall not be required for the project.		

1.3 Design Additions

As part of the Performance Solution, the following design measures are prescribed, and do not preclude those required by the DtS provisions or those previously prescribed by the Original Fire Engineering Report P17247 FER 1.4, dated 29/1/19, (unless explicitly considered in the Table above), and would be required to form part of the schedule of essential safety measures for the building:

- **Fire-Isolated Stairs and Lift Shaft -**
    - At Basement Level 2 - provide a BCA Specification C3.4 sliding fire door
    - The walls that separate the required fire-isolated stair from the lift shaft are to be of FRL 120/120/120 or FRL -/120/120 construction, as appropriate (for loadbearing and non-loadbearing shaft walls, respectively); and
    - Door openings to the lift lobby to be protected by FRL -/120/30 fire doors fitted with AS 1530.4 intumescent fire and AS 1530.7 medium temperature smoke seals and vision panels. These doors are to be self-closing or interfaced to the building wide alarm system to close in accordance with BCA Specification C3.4
    - Option 1 -
        - Provide a fire rated lift landing door of FRL -/60/- to protect openings in the fire rated lift shaft of FRL 120/120/120 or FRL -/120/120, as appropriate (for loadbearing and non-loadbearing shaft walls, respectively); or
    - Option 2 -
        - Provide a non fire-rated lift in a fire rated shaft of FRL 120/120/120 and doors as prescribed above.
- **Portable Fire Extinguishers**
    - Within Long Room - Provide a 2A:20BE fire extinguisher immediately adjacent to the exit

1.4 Regulatory Framework and Authorities Having Jurisdiction

1.4.1 Legislation

The primary legislation applicable to the development is the Victorian Building Act and the Victorian Building Regulations 2018 which references BCA 2016: Building Code of Australia (BCA) – Amendment 1.

The BCA is a performance-based document, where compliance is can be demonstrated by either of the two following approaches:

(i) Meeting the relevant Performance Requirements; or
(ii) Meeting the prescriptive requirements of the Deemed-to-Satisfy Provisions

The Deemed-to-Satisfy (DtS) Provisions, provides an acceptable level of safety. Variations from the DtS Provisions may be addressed as an Alternative Solution, to determine if it complies with the relevant BCA Performance Requirements; as determined in accordance with BCA Clause A0.7.

BCA Clause A0.3 requires an Alternative Solution (Performance Solution), to either comply with the Performance Requirements or be at least equivalent to the Deemed-to-Satisfy Provisions.

The assessment of an Alternative Solution can be undertaken using a variety of methods. These are defined in BCA Clause A0.5. One or more, or a combination of these methods may be adopted to determine whether the proposed Alternative Solution complies with the BCA Performance Requirements.

1.4.2 Regulatory Framework

The following Victoria Legislation is applicable:

- VIC Building Act, 1993 and subsequent amendments
- VIC Building Regulations 2018 and subsequent amendments

1.4.3 Building Regulation 121

A Relevant Building Surveyor (RBS) can determine that a Performance Solution complies with a fire performance requirement of the BCA, when they have the prerequisite qualifications under Building Regulation 121 or if they rely on certificate under Section 238 of the Building Act, by a fire safety engineer/registered building surveyor, who did not design the building work, which states that the alternative solution complies with that performance requirement.

Note in the instance of a Building Regulation 129 report and consent/notification item, the Fire Brigade are a Reporting Authority/Authority Having Jurisdiction. In this instance, in accordance with Building Regulation 121, for that alternative solution, the RBS may rely on report by the Chief officer of the Relevant Fire Brigade under Building Regulation 129, which states that the chief officer is satisfied that a satisfactory degree of fire safety is achieved by that alternative solution.

1.4.4 Fire Engineering Process and MFB CFA Guideline 33

In accordance with the International Fire Engineering Guidelines (IFEG), the fire engineer typically undertakes a Fire Engineering Brief (FEB) process for every project.

The Fire Engineering Brief (FEB), is a briefing document that defines the Performance Solution(s), the scope of work for the fire engineering analysis, the method of analysis and acceptance criteria, for each variation from the DtS provisions, for agreement by the relevant stakeholders.

In the case where the variations from the DtS provisions are minor and the building development is not likely to be the subject of the Building Regulation 129 consent and report/notification items, an FEB is not typically required to be prepared, unless requested and agreed to, by the relevant stakeholders.

When the building is likely to be the subject of Building Regulation 129 report and consent/notification items, the Fire Brigade are a Reporting Authority and also a stakeholder in the FEB process. An FEB is required to be prepared and forwarded to the Chief Officer of the Relevant Fire Brigade, for review/comment, prior to proceeding with the FER, in accordance with MFB CFA Guideline 33.

Subsequent to FEB review/comment by the relevant stakeholders, the revised/confirmed fire safety strategy will form the basis of the proposed Performance Solution to be considered within the FER.

The Fire Engineering Report (FER) contains all the relevant design calculations and justifications to demonstrate that the proposed Performance Solution complies with the relevant BCA Performance Requirements. Stakeholder approval of the FER is to be gained before submission to the RBS for their assessment of compliance to the BCA Performance Requirements.

The approved FER is also required to be included as part of the supporting documentation in an Application for a Building Regulation 129 report and consent/notification item.

1.4.5 Hazardous/Dangerous Goods

It is required that all hazardous/dangerous goods will be stored in accordance with the relevant state legislative and occupational health and safety requirements.

1.4.6 Objectives, Scope and Limitations

1.4.6.1 Objectives

The objective of the Fire Engineering Report is to demonstrate compliance of the building solution with relevant performance requirements of the BCA, the relevant building regulations and the Building Act 1993 as interpreted by the Relevant Building Surveyor.

The analysis will incorporate a combination of quantitative and qualitative assessment methods, consistent with the methodology outlined within the Fire Engineering Guidelines. Note all design solutions are subject to formal approval by the relevant regulatory authorities.

1.4.6.2 Scope

The scope of this report is limited to the assessment of the relevant variations from the deemed-to-satisfy provisions of the BCA as outlined within Section 1.2. The building is otherwise assumed to comply with all other deemed-to-satisfy provisions of the BCA and the Building Regulations.

The scope of this report does not extend to any other variations from the deemed to satisfy provisions of the BCA and does not address non-fire related issues.

1.4.6.3 Limitations

This report has been prepared on the basis of the documentation provided as detailed above, in §1.3.

The report assumes that fire safety systems will be installed as detailed within this report or are otherwise compliant with the deemed-to-satisfy provisions of the BCA. The report assumed they will be maintained as required by the relevant Australian Standards, and Essential Services Legislation.

Any modifications or changes to the building, fire safety management system, or building usage from that described in this report, may adversely impact the fire safety strategy and thereby invalidate the findings of this report.

As is consistent with a building designed in accordance with the deemed-to-satisfy provisions of the BCA, the safety of all occupants from fire cannot be guaranteed. It is not possible to totally eradicate the risk of injury or death from fire. The report will not assess the risk of an individual involved intimately with the fire ignition.

The fire safety strategy outlined in this report and protection of occupants assume a completed/commissioned building, and do not address protection of the building during construction, renovation or demolition, when systems are likely to be incomplete or isolated.

The report will not address fire development associated with criminal acts including terrorism, arson, vandalism, explosives and/or multiple ignition sources or malicious acts, which deliberately result in fire ignition or interference with the fire safety systems for the building.

The report will assume all hazardous substances/dangerous goods are stored as prescribed by the relevant legislative requirements.

This report does not consider issues associated with health and amenity, disability access issues or other non-fire related matters.

The report will not consider the protection of contents of in the considered building from damage in fire.

1.5 Relevant Stakeholders

The relevant stakeholders in the design of this development are listed in Table 5.

Table 5: Relevant Stakeholders

Name	Organisation	Role
Christophe Loustau	Lovell Chen	Client
Martin Ryan	Hendry Building Surveying	Relevant Building Surveyor
-	Mark Hodkinson Pty. Ltd.	Heritage Structural Engineer
-	Simpson Kotzman Pty. Ltd.	Services Engineer
-	TGM Group Pty. Ltd.	Land Surveyor
Gino Catania	GinCat Fire Engineering	Fire Safety Engineer

1.6 Relevant Documentation

This report has been prepared based on the following documentation provided:

(a) This proposal has been prepared based on a briefing by Lovell Chen (dated 30/06/19) and the following documents (Refer Appendix):

Drawing Name	Job No.	Drawing No.	Revision	Date
Basement 1 Plan	7925	A.01	P4	11/7/19
Basement 2 Plan	7925	A.02	P4	11/7/19
Ground Floor Plan	7925	A.03	P4	11/7/19
First Floor Plan	7925	A.04	P4	11/7/19
Second Floor Plan	7925	A.05	P4	11/7/19

(b) Building Regulatory Review by Hendry Group dated Hendry Group (dated June 2019).

1.7 References

The following documents, where referenced in the report will utilise the following abbreviations.

1.7.1.1 Legislation and Regulatory Documents

[VIC Act]	VIC Building Act, 1993 and subsequent amendments
[VIC Reg]	VIC Building Regulations, 2018 and subsequent amendments
[BCA]	National Construction Code Series Volume 1: Class 2 to 9 buildings – Building Code of Australia 2016, Australian Building Codes Board.

1.7.1.2 Australian Standards

[AS1851	AS 1851, Maintenance of fire protection systems and equipment s
[AS 2293.2]	AS 2293.2-1995, Emergency evacuation lighting for buildings - Inspection and maintenance.
[AS2419.1]]	AS 2419.1, Fire hydrant installations - System design, installation and commissioning.
[AS2441]	AS 2441, 2005, Installation of hose reels.
[AS2444]	AS 2444, 2001, Portable fire extinguishers and fire blankets – Selection and location.
[AS2118.1]	AS 2118.1, 1999. Automatic fire sprinkler systems - General requirements
[AS3959]	AS3959 -2009 ; Construction of Building in Bushfire Prone Area

1.7.1.3 Guidelines

[BCA Guide]	Australian Building Codes Board, 2016, Guide to the Building Code of Australia, Australia.
[IFEG 2005]	International Fire Engineering Guidelines, 2005.
[FEG 1996]	Fire Engineering Guidelines 1996, Fire Code Reform Centre Project 5A
[MFB GL16]	MFB Guideline No 16, 2009. Selection, installation and Maintenance of portable fire extinguishers. Version No. 8, MFESB Community Safety Policy Group, Australia
[MFB GL-17]	MFB Guideline No 17, 2010, Fire Brigade Intervention Model (FBIM) General Provisions, Version No. 3, MFESB Community Safety Policy Group, Australia
[MFB GL 33]	MFB Guideline No. 33 Performance Based Design within the Built Environment, Version 2, November 2010, Community Safety Advisory Group (MFB), Community Infrastructure Department (CFA)
[FBIM]	Fire Brigade Intervention Model Version 2.1", Australasian Fire Authorities Council
[QFRE GL]	Guide to the Referral of Performance Solutions, Department of Community Safety, Queensland Government, Issue 2, 2010
[DFES GL-15]	FIRE SAFETY ENGINEERED ALTERNATIVE SOLUTIONS, DFES BEB GUIDELINE No: GL – 15 Department Of Fire And Emergency Services, Built Environment, March 2015

1.7.1.4 Reference Text Books / Journal Articles /International Standards

[Drysdale]	Drysdale, D., Introduction to Fire Dynamics, John Wiley & Sons, Sydney, 1985
[Bryan]	Bryan, J.L., "Behavioural Response to Fire and Smoke", SFPE Handbook of Fire Protection Engineering 2nd Edition, 1995, pp. 3-241 – 3-262
[Grubits]	Grubits, S.J. and Moulen A.W., " Technical Record 422 – Water-Curtains to Shield Glass from Radiant Heat from Building Fires", July 1975 Experimental Building Station, Chatswood N.S.W
[PD 7974-3]	PD 7974-3 : 2003, "Application of fire safety engineering principles to the design of buildings – Part 3: Structural response and fire spread beyond the enclosure of origin (Sub-System 3), British Standards Institution, Jan 2003
[Law]	Law, Margaret, " Heat Radiation from Fires and Building Separation", Fire Research Technical Paper No. 5, London, 1963
[SFPE 3rd]	Tien, C.L., Lee, K.Y. and Stretton, A.J., "Radiation Heat Transfer", 2002, Section 1,Chapter 4 *SFPE Handbook of Fire Protection Engineering 3rd Edition*, pp. 1-73 – 1-89
[Madrzykowski]	SFPE Handbook of Fire Protection Engineering, 4th Edition, 2008, National Fire Madrzykowski, Daniel, "Review of Residential Sprinkler Systems", NISTIR 6941, Jan 2002.
[England]	England et al., 2000. *Fire Resistant Barriers and Structures.* Building Control Commission, Melbourne.
[CIBSE TM19]	Relationships for Smoke Control Calculations – Technical Memoranda TM19:1995",1995, Chartered Institution of Building Services Engineers
[Bennetts]	Bennetts, I.D., Thomas, I.R., Proe, D.J. & Lewins, R.R., "Fire Safety in Car Parks", 1990, BHP Research, Melbourne Laboratories
[Recherches]	Recherches, A., "Development of Design Rules for Steel Structures Subjected to Natural Fires in Closed Car Parks", 1997
[Milke]	Milke, J.A. & Klote, J.H., "Smoke Management in Large Spaces in Buildings", 1999, Building Control Commission, Melbourne
[Chow 94]	Chow, W.K., "A Short Note on the Simulation of Atrium Smoke Filling Process Using Fire Zone Models", Journal of Fire Sciences, Vol. 12, 1994, pp. 516-528
[Duong]	Duong, D.Q., "The Accuracy of Computer Fire Models: Some Comparisons with Experimental Data from Australia", Fire Safety Journal, Vol. 16, 1990, pp. 415-431
[Chow 96]	Chow, W.K., "Multi-cell Concept for Simulating Fires in Big Enclosures Using a Zone Model", Journal of Fire Science", 1996, Vol. 14, pp. 186-198
[Bryan]	Bryan, J.L., "Behavioural Response to Fire and Smoke", SFPE Handbook of Fire Protection Engineering 2nd Edition, 1995, pp. 3-241 – 3-262
[Mowrer]	Harold E. "Bud" Nelson and Frederick W. Mowrer, "Emergency Movement" *SFPE Handbook of Fire Protection Engineering 3rd Edition* Chapter 14, Sect 3
[Kim 1997	*Fire Protection of Windows Using Sprinklers*, National Research Council Canada, 1997.
[Kim 1993]	Sprinkler Protection of Exterior Glazing, National Research Council Canada, 1993.
[Choi]	Choi, C.I., Radiation Blockage Effects By Water Curtain, International Journal On Engineering Performance-Based Fire Codes, Volume 6, Number 4, P.248-254, 2004.

[Doolan] Doolan, C., The effects if Water Mist and Spray on Radiative Heat Transfer for Stored Ordnance, Weapons System Division, Defence Science and Technology Organisation, South Australia, 2003.

[BRE] Sprinkler protected car stacker fire test , BRE Global11/12/09

[BRANZ] Car parks – Fire Involving Modern Cars and Stacking Systems SR 255 2011

[CLG] Fire spread in carparks, Department for Community and Local Government BRE BD255, Dec 2010

[Kholshevnikov] Kholshevnikov et al., "Pre -School Evacuation and School Building Evacuation, State Moscow University of Civil Engineering".

[Gross] Gross, D., and Haberman, W., "Analysis and Prediction of Air-Leakage Through Door Assemblies], Fire Safety Science Proceedings, Second International Symposium, 169-178.

1.7.1.5 Computer Models

[Firecalc] Firecalc Version 2.3, CSIRO Division of Building, Construction & Engineering, 1993

[CFAST] Jones, W.W., Forney, G.P., Reneke, P.A. & Peacock, R.D, "CFAST, the Consolidated Model of Fire Growth and Smoke Transport Technical Reference Guide : NIST Special Publication 1026", 2005, National Institute of Standards & Technology, US Department of Commerce, 126pp.

2 Review of Available Statistics

2.1 Office/Retail Areas

2.1.1 Introduction

Reference has been made to fire incident statistics which have been published by the New South Wales Fire Brigades [NSWFB 05/06], [NSWFB 06/07], which are the most recent body of statistics available in Australia.

The statistical classification of "Shop, Store, Office and Storage" was considered the most appropriate for the use of this building although it must be noted that the characteristics of a shop differ considerably from an Office, Store and Storage building. Eg Shops can include restaurants, with cooking an introduced for of ignition that can skew the results, as shown below where cooking kitchen areas accounted for approximately 9.7% of the area of fire origin

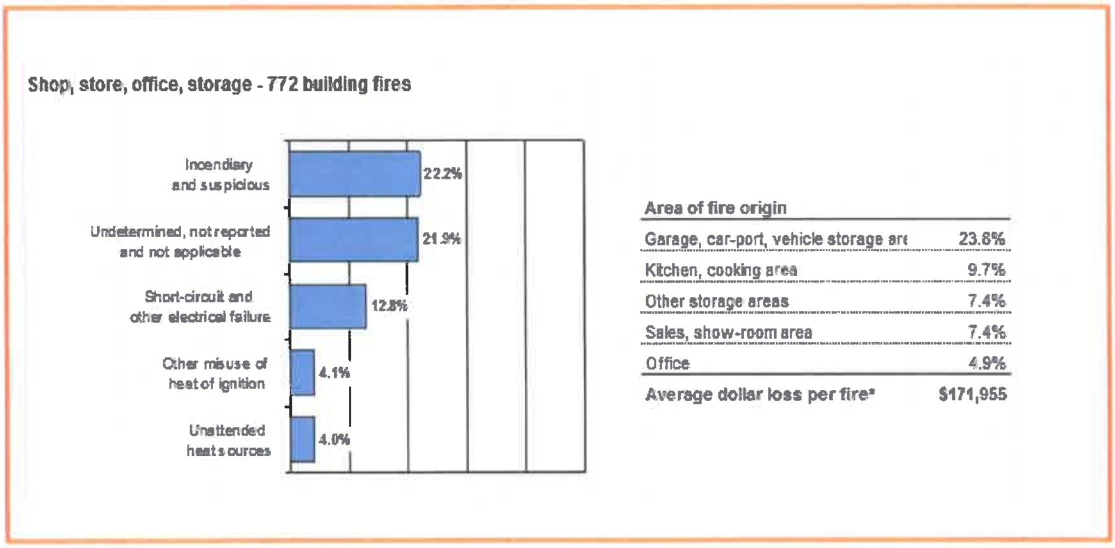

Figure 1: NSWFB Annual Statistics – ignition factor and area of origin (2005/06 Figure 8)

2.1.2 Form of Heat of Ignition

For the purpose of identifying the relative increase in risks of ignition within the Subject building, reference is drawn to the form of heat of ignition. It is expected that fires will ignite within the areas with electrical equipment eg office areas

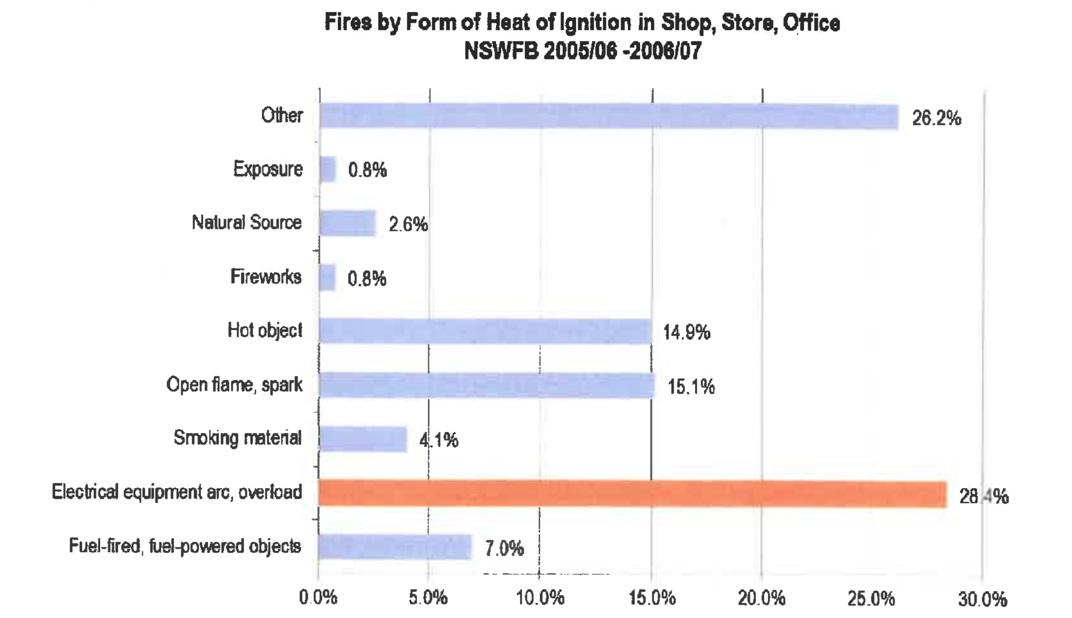

Figure 2: NSWFB Annual Statistics 2005/06 and 2006/07 – Form of heat of Ignition

2.1.3 Area of Fire Origin

In terms of a likely location of fire originating within the Subject building, reference is drawn to the proportion of fires starting by location.

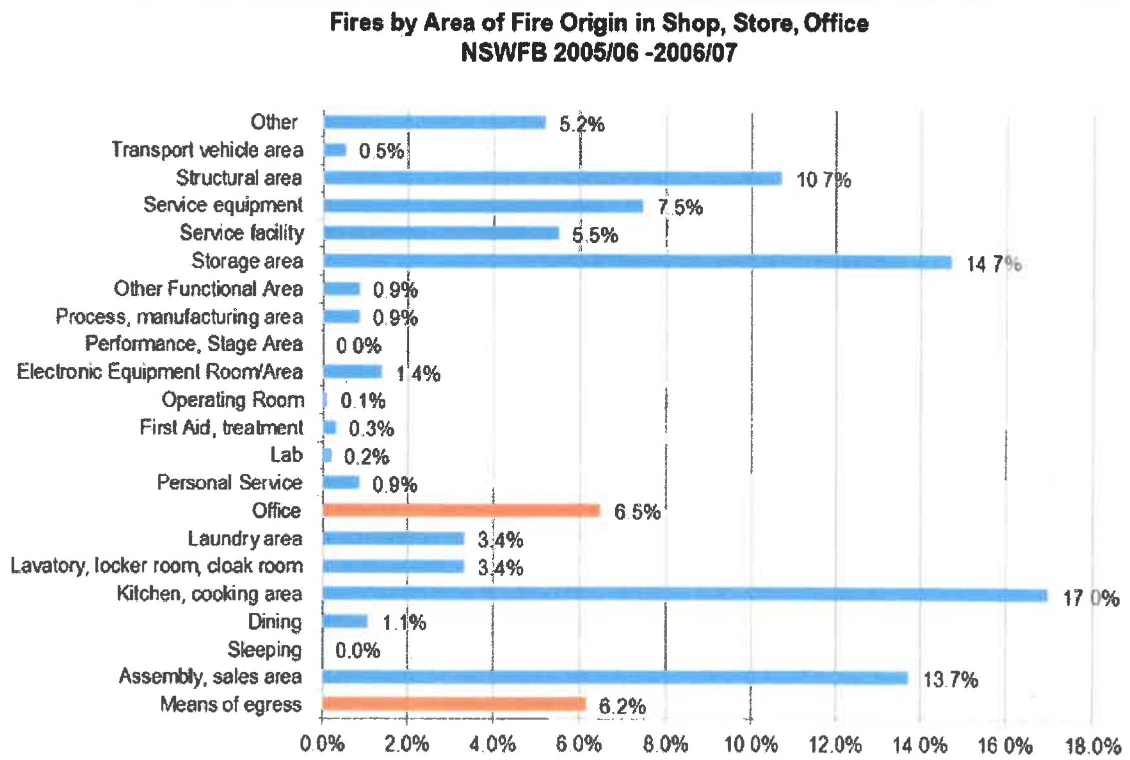

Figure 3: NSWFB Annual Statistics 2005/06 and 2006/07 – Fire by Area of Ignition

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2.2 Referenced Statistics Manual Suppression by Occupants

2.2.1 Likelihood that Occupants Commence Intervention

2.2.1.1 Reported fire incidents and Manual Suppression by Occupants

Reference to data published within the SFPE Handbook [Bryan] examining the percentage of occupants who would fight fires within residential apartments revealed that approximately 28 percent of occupants within apartments would fight fires within. It is assumed to be less so, in a common areas with no direct interest to the property/linings under threat.

Being a place of work, occupants are likely to be alert/awake and respond to cues of fire. Data from general Class 5 to 9b building will be adopted with similar occupant characteristics.

According Australian Incident Reporting System (AIRS) data of the office premises (a common area) [NSW FB 89-99], that with Fire Hose Reels installed, they were only used in 3% of cases whereas Fire Extinguishers were used in 20.3% of cases, indicating that people are more than twice as likely to make use of an extinguisher than a hose reel. These are for reported fires (where the fire brigade have attended and are reported).

In the reported incidents, for a small fire the likelihood of use of an extinguisher = 7 x that of a hose reel in a shop (=20.3/3).

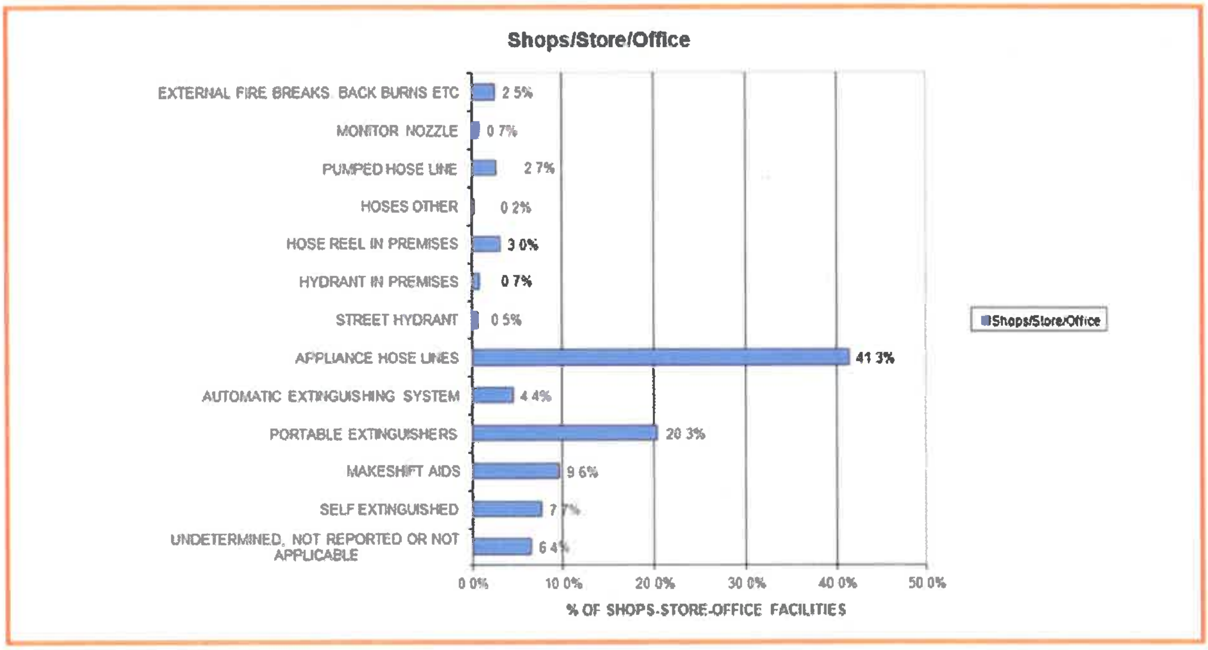

Figure 4: NSWFB Annual Statistics 89-990 [NSW FB 89-99] – Shops

In the reported incidents, for all occupancies this changes to the likelihood of use of an extinguisher = 11 x that of a hose reel (=12/1.1), which would include low rise residential Dwellings/homes, where no hose reels are present.

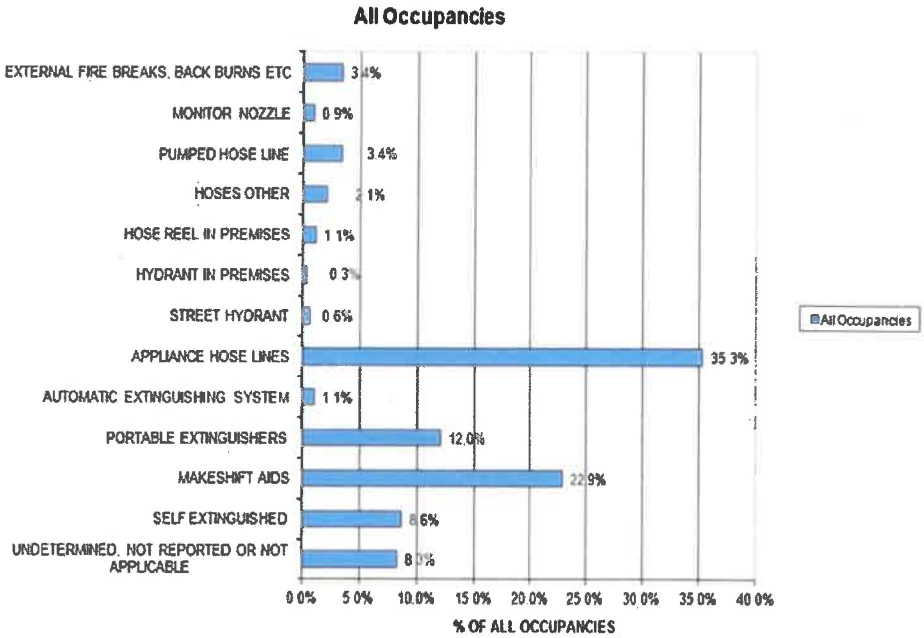

Figure 5: NSWFB Annual Statistics 89-990 [NSW FB 89-99] All occupancies

2.2.1.2 Unreported Fires Incidents by Occupants

A significant number of fires remain unreported with some studies attempting to quantify the number. The unreported cases may go some way to accounting for the discrepancy between use of suppression equipment by occupants.

Based on the following it is assumed that approximately 70% to 80% of fires go unreported-

- Within the SFPE Handbook [SFPE 3], by Crossman et al, a total of 180 individual involves in 208 fire incidents fought the fire, of which for 167 incidents were not reported. Approximately 80% unreported.
- The FETA [FETA] study found similar orders of unreported fires in 6 European Countries 75%-80%.
- Further Australian studies [Barnett] found that of 498 people surveyed that approximately 20.3% have had a fire incident that 75.2% of fires were unattended and hence unreported
- Studies by Tannous [Tanmous NSW] found that of while 10% of the surveyed a population of 14,732 occupants had experienced fires, 3.1% of the population called the brigade, which 6.9% of the surveyed population did not call the brigade. Accordingly 69% of fires went unreported (refer below).
- Within PD 747 -7 2003 it was found that the probability of a fire occurring and nor being reported to an authority is 0.5 for industrial, 0.8 for commercial, 0.8 for Dwellings and 0.8 on average.

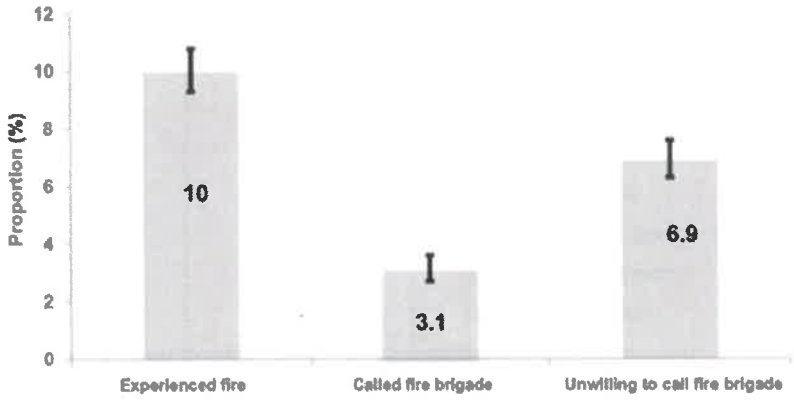

Fig. 2. Proportion of NSW population who experienced residential fires, willing to call fire service and unwilling to call fire service.

Figure 6: Unreported Fires

The above goes some way to explaining why the UK statistics claim that approximately 79.9% of fires are extinguished by portable fire extinguisher. i.e. an approximate 79.9% success rate for portable fire extinguishers in 75% to 80% of fires (noting that the bulk of the fires, 75% to 80% are unreported).

2.2.2 Impact of Location of Suppression Equipment on Likelihood of Occupant Intervention

In addition, in the event that an occupant has decided to fight the fire, the time required to reach a fire hose reel is expected to be longer statistically than that to reach a portable fire extinguisher if provision and location of portable extinguishers complies with AS 2444. This is because the maximum coverage of a hose reel according to AS 2441 is 40m (36m hose length plus 4m hose stream); whereas the maximum travel distance to a portable fire extinguisher for Class A fire risks is 15m.

It is assumed that distance to the fire suppression tool (i.e. its availability/proximity to the fire) also impacts on the likelihood of it being used.

The distance to a second hose reel could be potentially 2 x greater than that for an extinguisher (an likely to further compound use of a fire extinguisher).

2.2.3 Likelihood of Occupant Success

2.2.3.1 Occupant Success Rate in Intervention for Small Fires Using Portable Fire Extinguishers Versus Hose Reels

Whether an occupant decides to fight a fire is dependent on various factors including environmental factors, physical factors and also available means of manual intervention.

Fire brigade reports indicate that there is a more frequent use of extinguishers for first attack; however they do not distinguish between who was using them (VUT, 2005). Statistical data provided by the NSW Fire Brigade (2006/2007) indicates that approximately 10 % of fires are extinguished by fire extinguishers. Note these are for reported fire where the fire brigade have attended.

This percentage is inclusive of fires extinguished by a fire fighter using an extinguisher. The statistics do not show how many fires were extinguished using fire hose reels. It is assumed that the likelihood that an occupant undertakes manual fire fighting is estimated to be 10 % for both fire extinguishers and fire hose reels.

The success rate given an occupant has intervened with an extinguisher, is likely to be in the order of 80%.

A study conducted by the Fire Extinguishing Trades Association and the Independent Fire Engineering and Distributors association [ABCB 2007][FETA] which found that of 2,131 fire incidents that were surveyed in the United Kingdom (UK) and 5 other European Nations Countries -

- Approximately 79.9% of surveyed incidents (fire starts) were extinguished by fire extinguishers; and
- 24.1% of surveyed incidents resulted in the fire brigade being called. Conversely 75.9% went unreported.

i.e. For a small fire the likelihood of success with a portable fire extinguisher = 79.9%.

The same success rate is assumed for a hose reel, for a small fire.

2.2.3.2 Occupant Success Rate in Intervention for Developing Fires Using Portable Fire Extinguishers Versus Hose Reels

For large fires which cannot feasibly be extinguished by occupants (21.1% of fires = 100% - 79.9%), the fire hose reel will have a safer distance of operation.

The safe distance of operation however is 4m for a hose reel versus 2m for an extinguisher [ABCB 2005].

i.e. For a large fire the likelihood of use of an extinguisher = 0.5 x that of a hose reel (based on the distance of operation).

Given fire brigade attendance, the success rate will adopt that when the fire brigade reported statistics where –

- For large fire where hose reels were reportedly used as the means of suppression in 3% of cases

2.2.4 Summary Of Occupant Intervention

The above shows that occupants are likely to attempt the extinguishment of a fire in its developing phase and -

- For a small fire (includes reported an unreported), occupants extinguish a fire with a portable fire extinguisher for 79.9% of incidents. The fire brigade do not attend for approximately 80% of fire incidents and loosely correlates to the success rate for extinguishers.
- For a small fire (includes reported an unreported), occupants extinguish a fire with a hose reel for 7% of incidents (a factor of 11 less to that of extinguishers)
- For a larger developing fire (21.1% of fires), the hose reel is 2 x more likely to be adopted and has a success rate of 3%. Based on distance of operation the portable fire extinguisher success rate is assumed to be half that of hose reel, for a large fire.

3 Performance Solution

3.1 Lift and Stair in the Same Shaft in lieu of fire separated from each other

3.1.1 Introduction

The following variations from the deemed-to-satisfy provisions of the BCA will be considered within this section of the report:

Table 6: Variations from BCA DtS Provisions

DtS Clause	Description of Variation from BCA DtS Provisions	Performance Requirements
C2.11	Lift and stair in the same shaft in lieu of fire separated from each other. [Subject to dry type sprinklers to be retained at top of lift shaft, as prescribed by BCA Specification E1.5, Clause 12, where water will discharge after 60 seconds. Louvres to be provided at lift over-run].	CP2, DP5, EP2.2

3.1.2 Identification of Areas under Consideration

Figure 7 and Figure 8 show the location of the areas (highlighted in orange) that vary from the relevant BCA DtS Provision.

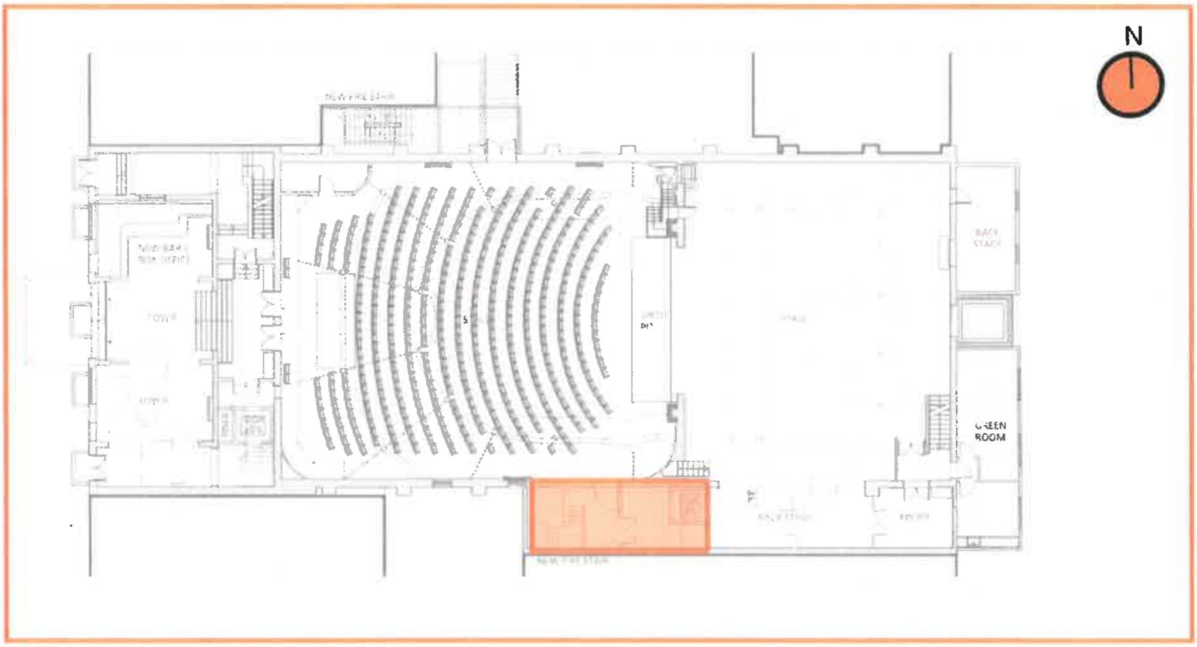

Figure 7: Lift and Stair in the Same Shaft at Ground Level

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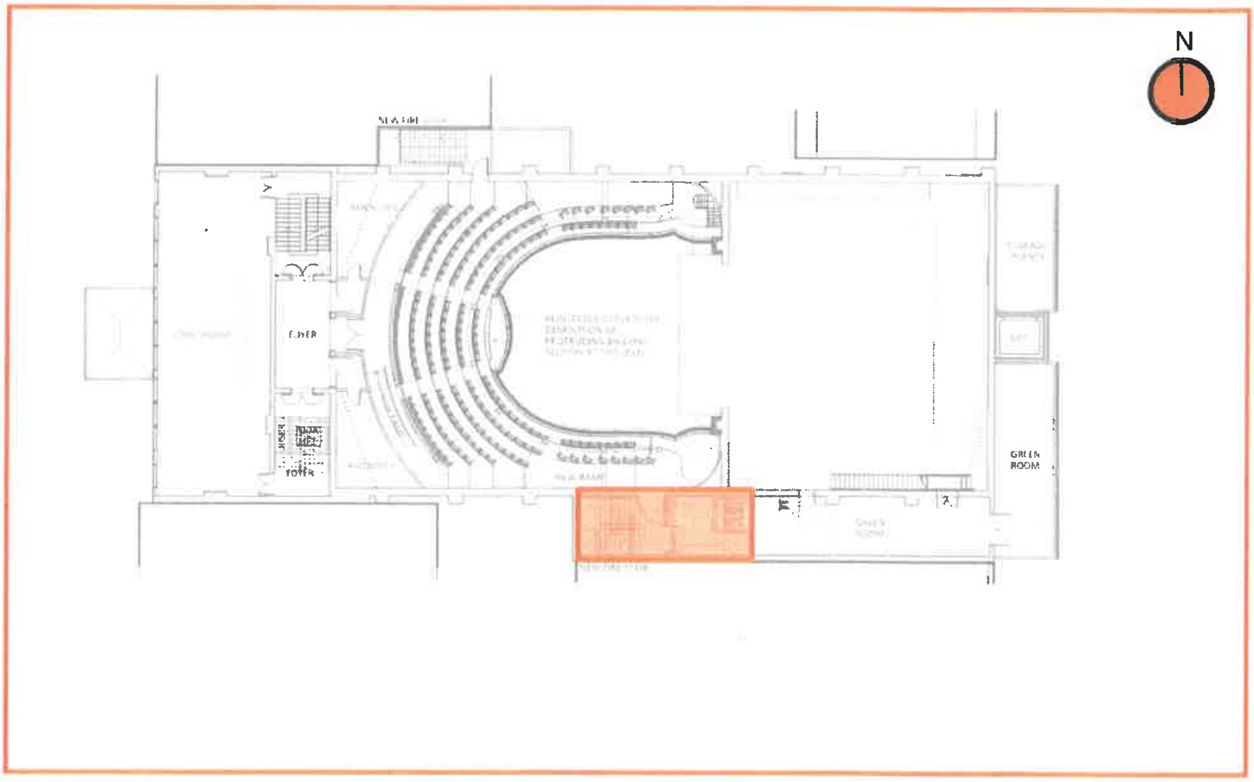

Figure 8: Lift and Stair in the Same Shaft – First Floor

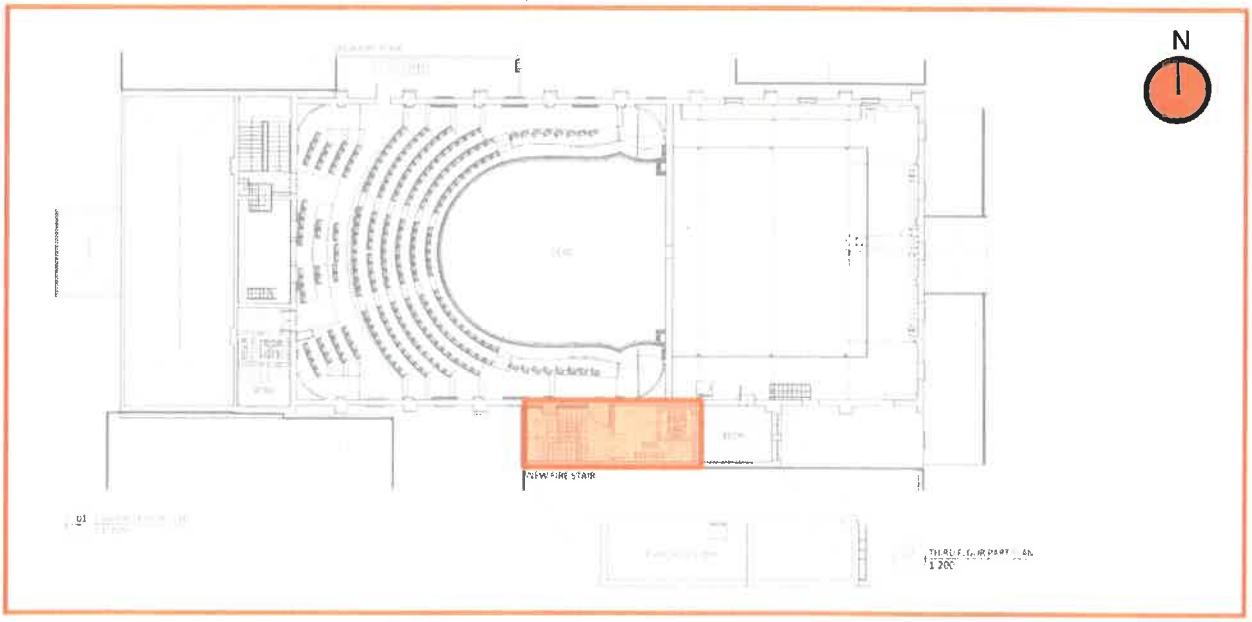

Figure 9: Lift and Stair in the Same Shaft – Second Floor

3.1.3 Identification of Upgrades

The following upgraded are proposed at -

- Fire-Isolated Stairs and Lift Shaft -
    - At Basement Level 2 - provide a BCA Specification C3.4 sliding fire door

- The walls that separate the required fire-isolated stair from the lift shaft are to be of FRL 120/120/120 or FRL -/120/120 construction, as appropriate (for loadbearing and non-loadbearing shaft walls, respectively); and
- Door openings to the lift lobby to be protected by FRL -/120/30 fire doors fitted with AS 1530.4 intumescent fire and AS 1530.7 medium temperature smoke seals and vision panels. These doors are to be self-closing or interfaced to the building wide alarm system to close in accordance with BCA Specification C3.4

- Option 1 -
  - Provide a fire rated lift landing door of FRL -/60/- to protect openings in the fire rated lift shaft of FRL 120/120/120 or FRL -/120/120, as appropriate (for loadbearing and non-loadbearing shaft walls, respectively); or

- Option 2 -
  - Provide a non fire-rated lift in a fire rated shaft of FRL 120/120/120 and doors as prescribed above.

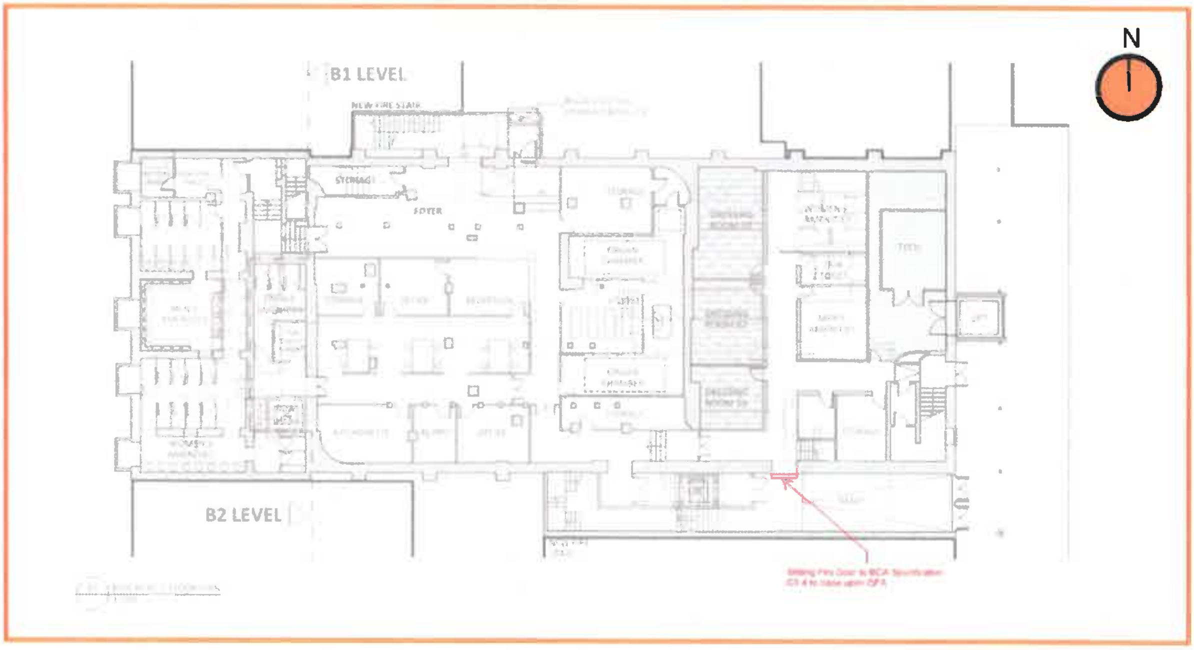

Figure 10: Basement 1 Upgrades

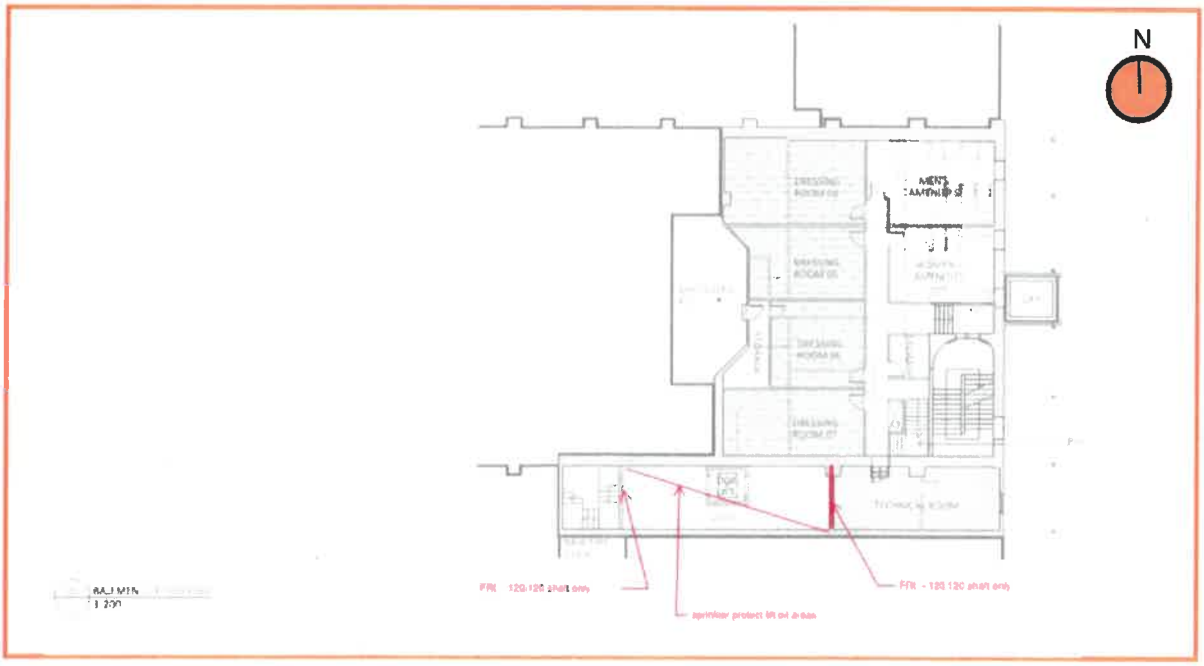

Figure 11: Basement 1 Upgrades

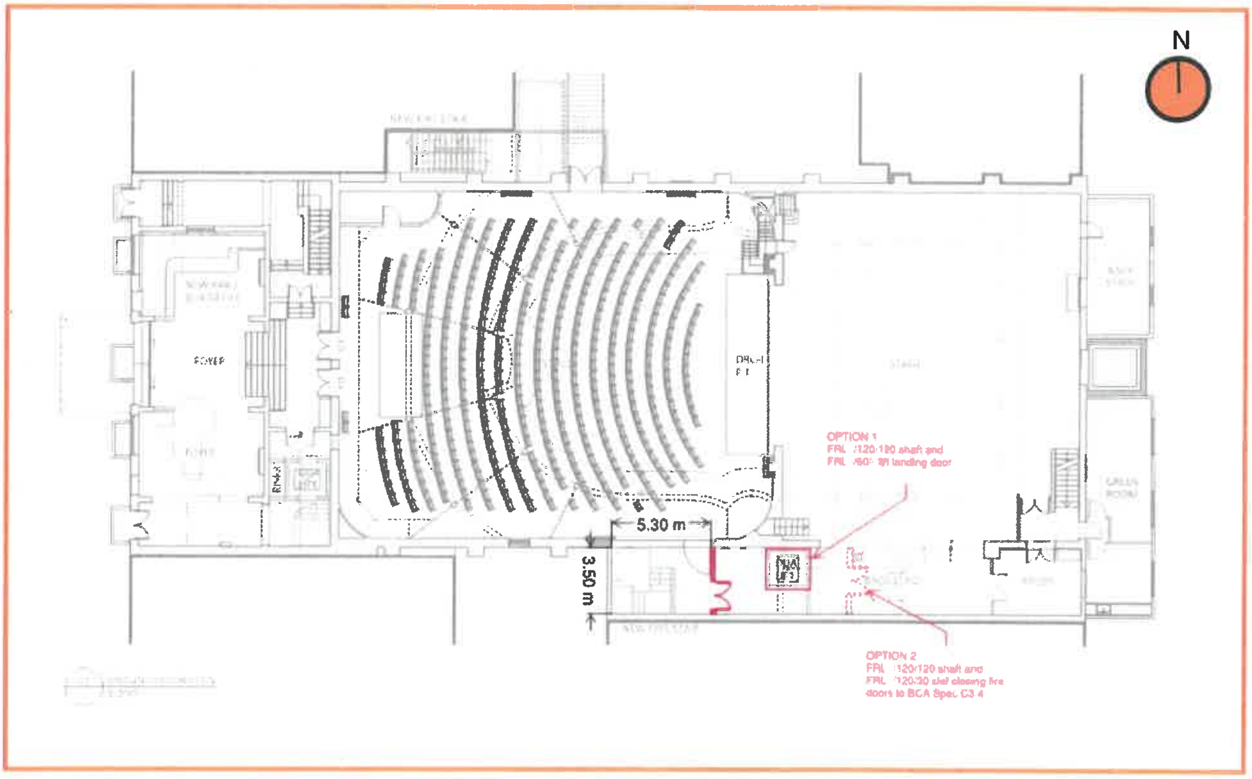

Figure 12: Ground Floor Upgrades

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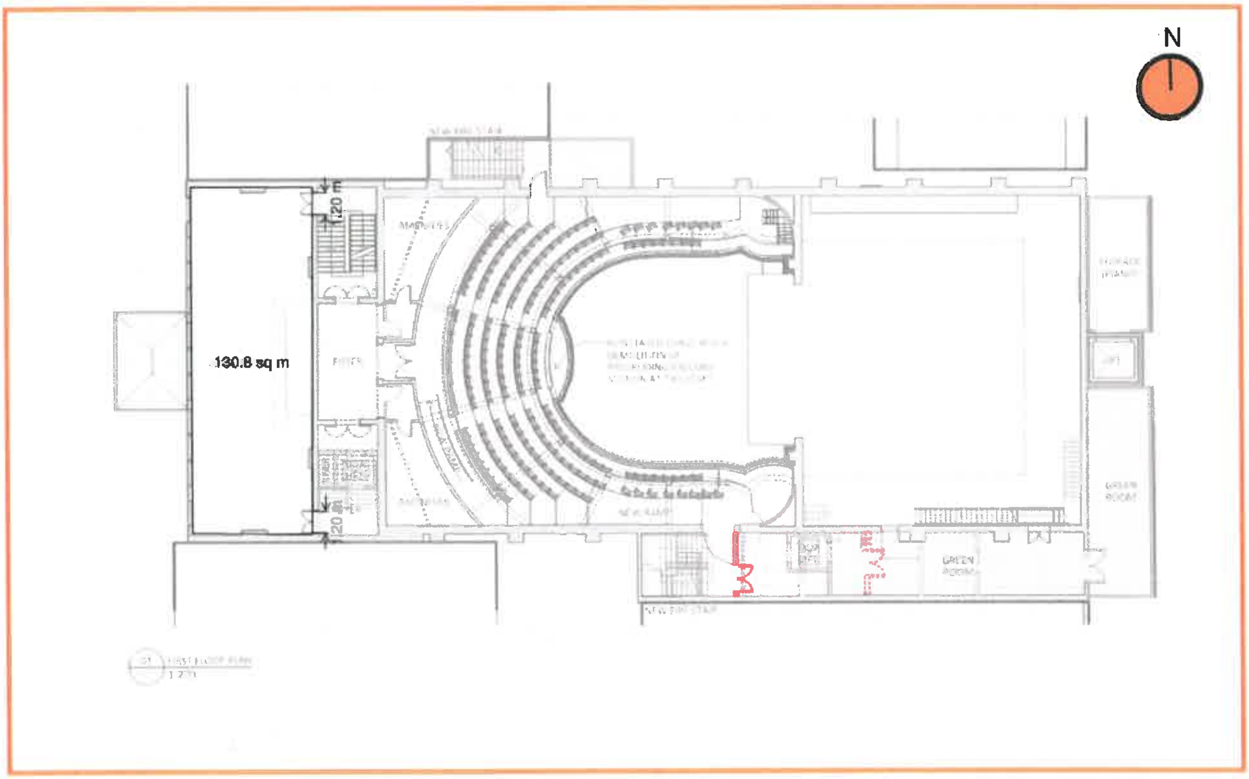

Figure 13: First Floor Upgrades

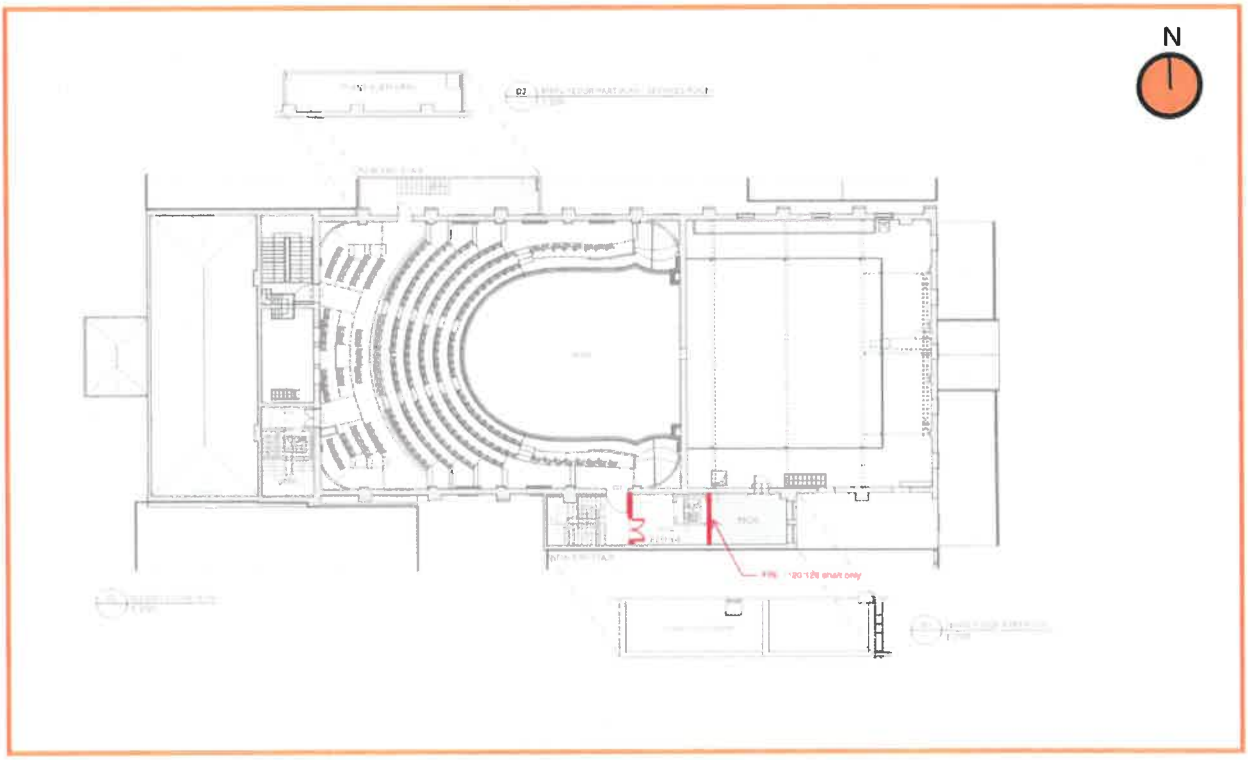

Figure 14: Second Floor Upgrades

3.1.4 BCA Requirements and Intent

3.1.4.1 Relevant Deemed-to-Satisfy Provisions

The relevant BCA deemed-to-satisfy requirements for stairways and lift shafts is BCA Clause C2.11 as depicted below.

C2.11 Stairways and lifts in one shaft-
A stairway and lift must not be in the same shaft if either the stairway or the lift is required to be in a fire-resisting shaft.

3.1.4.2 Relevant BCA Performance Requirement

The relevant BCA performance requirements associated with the fire separation of the lift shaft and stairs that are required to be fire isolated, are CP2 and DP5, stated as follows:

CP2

(a) A building must have elements which will, to the degree necessary, avoid the spread of fire —

- (i) to *exits*; and
- (ii) to *sole-occupancy units* and *public corridors*; and
- (iii) between buildings; and
- (iv) in a building.

(b) Avoidance of the spread of fire referred to in **(a)** must be appropriate to—

- (i) the function or use of the building; and
- (ii) the *fire load*; and
- (iii) the potential *fire intensity*; and
- (iv) the *fire hazard*; and
- (v) the number of *storeys* in the building; and
- (vi) its proximity to *other property*; and
- (vii) any active *fire safety systems* installed in the building; and
- (viii) the size of any *fire compartment*; and
- (ix) *fire brigade* intervention; and
- (x) other elements they support; and
- (xi) the *evacuation time*.

DP5 To protect evacuating occupants from a fire in the building exits must be fire isolated, to the degree necessary, appropriate to-
(a) the number of storeys connected by the exits; and
(b) the fire safety system installed in the building; and
(c) the function or use of the building; and
(d) the number of storeys passed through by the exits; and
(e) fire brigade intervention.

It is also considered that the performance requirement EP2.2 is also interrelated with the protection of the route from hot smoke, this requirement is stated as follows:

EP2.2
(a) In the event of a fire in a building the conditions in any evacuation route must be maintained for the period of time occupants take to evacuate the part of the building so that-
(i) the temperature will not endanger human life; and
(ii) the level of visibility will enable the evacuation route to be determined; and
(iii) the level of toxicity will not endanger human life.
(b) The period of time occupants take to evacuate referred to in (a) must be appropriate to-
(i) the number, mobility and other characteristics of the occupants; and
(ii) the function or use of the building; and
(iii) the travel distance and other characteristics of the building; and
(iv) the fire load; and
(v) the potential fire intensity; and
(vi) the fire hazard; and

3.1.4.3 Intent of the BCA DtS Requirements

BCA DtS Clause C2.11 prescribes that a stairway and a shaft must not be in the same shaft if either the stairway of the lift is required to be in a fire-resisting shaft.

As per the BCA Guide, the intent with C2.11 is to make a fire-isolated passageway safe from fire outside the stair shaft.

3.1.5 Hazard Identification

3.1.5.1 Key Hazards

3.1.5.1.1 Lift Shafts

A fire in a lift shaft can generate smoke that could potentially migrate between levels through gaps in the lift landing doors.

The components of a lift within the lift shaft present a fire load that may become ignited. If the lift shaft is within the stair shaft, the smoke may spill into the fire-isolated stair shaft and expose occupants to hazardous conditions. BCA Deemed-to-Satisfy Provisions would allow only the stair in its own fire isolated shaft. In the current proposed situation, the stairs share a fire-isolated shaft with a lift.

The top of the lift car includes electrical equipment, which can be a source of ignition. Combustibles located on top of the lift car can therefore be involved in fire. It is noted however that the provision of water type sprinklers directly above the lift car can also present an electrical hazard, which may cause the lift to cease functioning, presenting a potential entrapment hazard to occupants.

The BCA DtS requirement recognises this hazard (BCA Specification E1.5, Clause 13) and specifically prescribes dry system type sprinkler heads in the incidence of spaces housing lift electrical and control equipment as reproduced below:.

13. Sprinkler systems in lift installations

Where sprinklers are installed in a space housing lift electrical and control equipment, including machine rooms, secondary floors and sheave rooms, they must be of the dry system type in accordance with AS 2118.1

Note a dry type system is filled with an inert gas above the alarm valve (dry) and with water below the alarm valve. The dry-pipe valve prevents water from entering the pipe until a fire causes one or more sprinklers to operate. Once this happens, the air escapes and the dry pipe valve releases. Water then enters the pipe, flowing through open sprinklers onto the fire. These are typically prescribed in cold storage/freezers.

Dry pipe sprinklers provide marginal protection advantages for protection of collections and other water sensitive areas. This perceived benefit is due to a fear that a physically damaged wet pipe system will leak while dry pipe systems will not. In these situations, however, dry pipe systems will generally not offer any advantage over wet pipe systems. Should impact damage happen, there will only be a mild discharge delay, i.e. 1 minute, while air in the piping is released before water flow.

The dry system type sprinklers will discharge water after an approximate 60 second delay, potentially allowing occupants to continue their elevator trip, prior to water discharge onto the electrical control equipment. The lift may not function after the application of water, though the risk of entrapment is reduced.

3.1.5.1.2 Having Additional Doors Opening Into the Stair/Passageway

The key hazard in providing a fire door is that it can enable the passage of fire/smoke despite being fire rated and smoke sealed.

Doors have a higher failure rate that walls. With PD 7974-7:200, doors are given a failure rate of 0.2 to 0.3 with regard to closure. i.e. they are 70% reliable though have an inherent leakage.

Masonry walls have a reliability of 75% in achieving 75% reliability. They are assumed to have no leakage under BCA Clause D1.3(b)(iii).

3.1.5.2 Referenced Statistics

With the referenced statistics the proportion of fire that have electrical overload as the form of heat of was 28.6% (Refer Figure **2**).

The proportion of fire originating within service area equipment however is only 7.5% and service facility 5.5%, indicating that despite the provision of electrical equipment, the risk of fire starts in the lift area is comparatively low (refer Figure **3**).

3.1.6 Fire Safety Measures for the Performance Solution

The fire safety measures form the holistic fire safety design for the Performance Solution and incorporate the additional design measures prescribed within §1.3.

3.1.7 BCA Clause A0.5 Assessment Method

The approach adopted will utilise a quantitative, comparative analysis for the purposes of utilising a combination of the Verification Method and a comparison with other building solutions, which comply with the BCA as described by A0.5 (b)(ii) and A0.5(d), as shown below.

Table 7: Assessment Methods in accordance with BCA Clause A0.5

BCA Clause A0.5
The following Assessment Methods, or any combination of them, can be used to determine that a Performance Solution or a Deemed-to-Satisfy Solution complies with the Performance Requirements, as appropriate: (a) Evidence to support that the use of a material or product, form of construction or design meets a Performance Requirement or a Deemed-to-Satisfy Provision as described in A2.2. (b) Verification Methods such as — (i) the Verification Methods in the NCC; or (ii) **such other Verification Methods as the appropriate authority accepts for determining compliance with the Performance Requirements.** (c) Expert Judgement. (d) **Comparison with the Deemed-to-Satisfy Provisions.**

3.1.8 Methodology of Fire Engineering Analysis

3.1.8.1 Introduction

It is proposed to carry out a qualitative and comparative analysis of the Performance Solution containing a fire-isolated stair and lift within the same fire-isolated shaft (due to fire doors). In the event of a fire in the lift shaft the occupants may be exposed to smoke from a likely sprinkler protected fire.

3.1.8.2 Fire Scenario and Fire Size

3.1.8.2.1 Fire Scenarios

This analysis will considered a sprinkler protected fire in the following areas due to the location of the openings:

(i) Fire in the lift shaft
(ii) A fire in one of levels

3.1.8.2.2 Discounted Fire Scenarios

A fully developed fire is not considered within the egress route, having regard for the likely fuel loads and lining limitations and ignition sources as per BCA Clause D2.7(a).

In addition the increase in risk to occupants is from the lift shaft (as opposed from the stair to the lift shaft). For a fire within the stair, occupants are not likely to enter a smoke filled environment however is not adverse when compared with a DtS building <25m high, single stair and fire originating within eth stair.

3.1.8.2.3 Fire Size

The fire size will be implicitly the same for the Subject building and the comparative building, for the comparative assessment.

3.1.8.3 DtS Comparative Solutions

3.1.8.3.1 Lift fire versus a Fire in a SOU occupying entire level

The risk of fire spread to the Fire-Isolated Stair will be compared with a DtS solution permitted an SOU which occupies the entire storey that opens directly into the fire isolated stair, which can have -

(i) a higher fire load
(ii) no smoke seals to the entry door

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(iii) no sprinkler protection
(iv) no active smoke hazard management measures/venting

3.1.9 Acceptance criteria

The acceptance criterion for this performance assessment is that the building solution shall provide equivalent levels of protection to the egress, when compared with a building solution that meets the deemed-to-satisfy provisions of the BCA.

3.1.10 Analysis

3.1.10.1 Fire in Lift Shaft

3.1.10.1.1 Sprinklers

The smoke production is directly proportional to the fire size. The BCA DtS provisions inherently recognise the benefits of sprinkler protection and reduce the size of fire to be catered for within the smoke hazard management provisions of the BCA.

i.e. Under BCA specification E2.2b, the fire size in a sprinkler protected Class 5/9b building is 1.5MW versus 5MW in a non sprinkler protected building, notwithstanding that this is for habitable areas of significantly higher fuel loads than for a lift shaft/car.

3.1.10.1.2 Fire Loads in Lift Pits

There are limited fire loads within the lift shaft and are protected by a sprinkler heads.

The lift pit is to be provided with a sprinkler to ensure that the potential risk of fire from combustibles accumulated at the bottom of the lift shaft is appropriately mitigated. The top of the shaft is also prescribed to be provided with a sprinkler head.

3.1.10.1.3 Requirement for Dry System Type Sprinklers as prescribed by BCA Specification E1.5 Clause 13 in a building that requires sprinklers

The suppression of fire by sprinklers in the top of a lift shaft, may cause electric shorts which can stop the lift having the lift users trapped in the cabin until they are rescued. The 60 second delay is likely to limit the likelihood if this occurrence in a DtS building.

There are specific exclusions under BCA Specification E1.5 Clause 13 for lift installations, where dry system type sprinklers are prescribed as per below:

> **13. Sprinkler systems in lift installations**
>
> Where sprinklers are installed in a space housing lift electrical and control equipment, including machine rooms, secondary floors and sheave rooms, they must be of the dry system type in accordance with AS 2118.1.

Consistent with Clause A1.4, the BCA overrules any differences between it and any Standard. Accordingly it is considered that a dry system type sprinkler head is the DtS requirement.

3.1.10.1.4 Radiant Heat Flux Limits

For a sprinkler protected fire, temperatures in the order of 100°- 200°C are expected.

The reduction in hot-layer temperatures by both sprinkler suppressed and sprinkler shielded fires is supported in the literature [CIBSE TM19:1995] for smoke control states a reasonable assumption for the maximum smoke layer temperature in a sprinkler controlled fire is 100°C.

The above is consistent with findings by England et al (2000) which states that "temperatures outside the immediate area of operation of the sprinkler system are below 100°C, and temperatures within the area of operation are generally below 200°C except in the immediate vicinity of the flames."

For a compartment temperature of 200°C, the radiant heat flux from the openings at the lift landing doors would be likely to be less than 2.5kW/m².

The limiting radiant heat fluxes occupants is likely to be less than 4kW/² less than those described within AS1530.4 Table A3, reproduced below:

TABLE A3

TYPICAL RADIANT HEAT INTENSITIES FOR VARIOUS PHENOMENA

Phenomena	kW/m²
Maximum for indefinite exposure for humans	
Pain after 10 s to 20 s	4
Pain after 3 s	10
Piloted ignition of cotton fabric after a long time	13
Piloted ignition of timber after a long time	13
Non-piloted ignition of cotton fabric after a long time	25
Non-piloted ignition of timber after a long time	25
Non-piloted ignition of gaberdine fabric after a long time	27
Non-piloted ignition of black drill fabric after a long time	38
Non-piloted ignition of cotton fabric after 5 s	42
Non-piloted ignition of timber in 20 s	45
Non-piloted ignition of timber in 10 s	55

Therefore the radiant heat flux to occupants is likely to be less than that for a DtS building solution noting an lift landing door need only be of FRL -/60/-, which has no insulation protection and therefore the potential for high radiant heat fluxes and no fire rating for an internal exposure; lift landing doors are intended to limit fire spread from level to level and are tested from the landing side only and not the shaft side).

3.1.10.1.5 Comparison with Other DtS buildings with Limited/No Sprinkler Protection – Fire Spread

For the Subject building, the lift shaft is fire separated from the balance of the building and includes limited fire loads. The likely fire size and intensity is considered to be low when compared with other areas.

The Subject building is less than 25m high and is provided with sprinkler protection to offset other risks that are not directly to the lift shaft.

A fire originating in the lift shaft is rare (approximately 2.8% of fire occurs in service equipment area), with a low likely fire intensity and duration.

The following DtS solutions could also present an equivalent or greater risk to the egress routes -

(i) A Class 9b building with a rise in storeys of 4 (4-storeys contained) with a lift opening directly into a habitable area (and no sprinkler protection).

(ii) A sprinkler protected 4-storey Class 9b building with two hour shafts and FRL -/120/30 protection to openings to the shaft to a habitable area, permitted an exemption from sprinkler protection to the shaft under AS2118.1: 1999 Clause 3.1.3(c). In this instance sprinkler are to be provided to the shaft.

3.1.10.1.6 Smoke Spread

An elevator door specimen tested to AS1530.4 and AS1735.11 is permitted a gap space of up 6 mm between leaves (and up to 9.5 mm to allow for facings) for an overlap 13 mm overlap (and up to 19mm).

2.1.4 Clearances.

2.1.4.1 *Horizontally sliding doors.* For doors of the horizontally sliding type, the clearances between the finished faces of adjacent door panels and between the finished faces of door panels and jambs shall be not more than 6.5 mm; however, in order to allow for not more than 3.2 mm thickness of facing to be adhered to the panels, a doorset may be tested with the clearance being not more than 9.5 mm.

2.1.4.2 *Vertically sliding doors.* The maximum running clearance between panels of vertically sliding doors and jambs shall be not more than the following:

(a) For openings not more than 2400 mm in height or width . . . . 9.5 mm.

(b) For openings more than 2400 mm in height or width . . . . 13 mm.

2.1.5 Overlaps. The minimum overlaps for door heads, panels, and jambs shall be as follows:

Clearance, as in Clause 2.1.3	Minimum overlap
6.5 mm	13 mm
9.5 mm	19 mm
13 mm	26 mm

Door panels shall not enter striker jambs more than 20 mm, with a tolerance of ±3 mm.

Figure 15: Maximum Clearances under AS 1735.11

It is implicit that some smoke leakage is permitted between building sections. For example –

(a) Lift landing doors do not require smoke separation and are permitted to open directly into habitable areas.

(b) AS 1668.1 allows some smoke leakage Clause 2.3.8 at smoke dampers of not more than 100L/s/m^2 (=0.1 m^3/s/m^2) at 200°C.

Therefore smoke is likely to spread from the lift shaft. Upgrades are proposed.

3.1.10.1.7 Smoke Seals < 200°C

For a fire in the lift shaft the fire-stairs are however to be protected by a second tier of fire-doors fitted with AS 1530.7 smoke and AS1530.4 intumescent fire seals to the door heads and sides.

Research by NIST on the air leakage through standard sized single doors [Gross] indicates that smoke at 200 °C (consistent with sprinkler protected fire scenarios), typically flows at a rate of 0.06 m^3/s [= 216 m^3/h] at a 25 Pa pressure differential. This flow is measured through the door head and two sides.

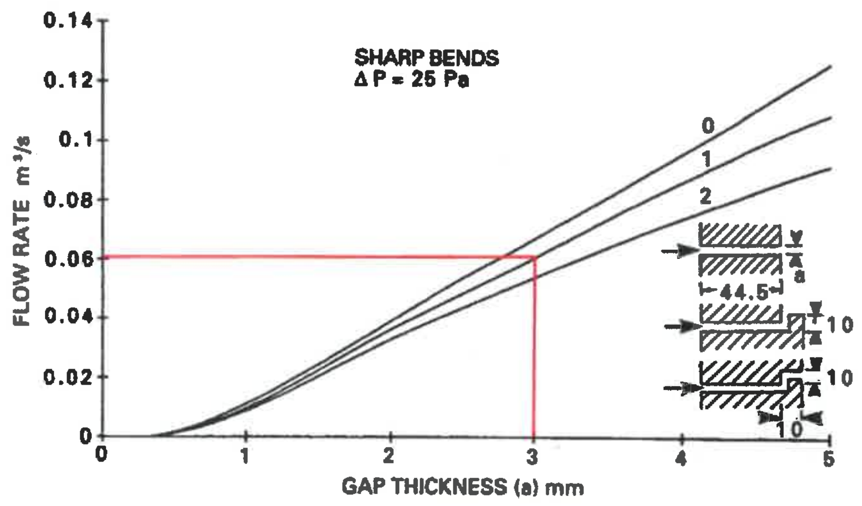

Figure 2. Gaps with 0, 1, and 2 sharp (90°) bends.

Figure 16: Flow Rates through Typical Doors – Door Head and Sides

3.1.10.1.7.1 BCC Data No Seals and Threshold Seals

The results above coincide with results presented within the "Guide for the Design of Fire Resistant Barriers and Structures", for a typical solid core timber doorset.

Table 8.6: Air Leakage test results for a typical solid-core doorset
(Courtesy of Lorient Fire Seals (Aust) Pty Ltd)

Test Pressure (Pa)	Total Leakage (m^3/hour)					
	Ambient seal fitted at sill in swing	Ambient no seals in swing	Medium Elevated Temp no seals in swing*	Medium Elevated Temp no seals in swing**	Ambient no seals out swing	Ambient seal fitted at sill out swing
12.5	89.8	144.7	107.0	172.7	236.7	166.7
25	132.4	213.6	133.5	215.5	-	246.1
50	191.5	-	158.0	255.0	-	-
75	-	-	191.1	308.4	-	-

* Calculated at standard temperature and pressure
** Calculated at 200°C and standard pressure

Figure 17: Flow Rates – No seals versus threshold seals

Note that in the tests above, the threshold seal reduce the leakage rate from 216m³/hr to 132m³/hr. It can be surmised that the threshold seals have a capacity to inhibit a leakage of 84m³/hr (=216m³/hr - 132m³/hr).

Further testing [Lorient], showed that when fitted with a threshold seal and seals to door head and sides, the leakage rate reduced from 213m³/hr to 11m³/hr.

It is noted for doors tested to AS1530.7 the entire door is subjected to positive pressure which renders the provision of a threshold seals of greater consequence than for an AS1530.4 Standard Fire or real fire where negative pressures are typically at the threshold, limiting smoke ingress to the corridor from this location.

3.1.10.1.7.2 AS 6905 Performance versus Door Seals to Door Head and Sides Only (Sprinkler Protected Fire)

The AS 6905 requires the smoke leakage at medium temperature conditions to be limited to 40m³/hr (when tested to AS1530.7). This leakage includes door seals to door head, sides and threshold.

This reduction to 40m³/hr from 216m³/hr (for the same door and gaps), includes a threshold seal which is attributed to excluding 82m³/hr leakage. When not provided with a threshold seal, it is assumed that the leakage into the corridor is 40m³/hr + 82m³/hr = 112m³/hr, approximately 50% of that when no seals are present (216m³/hr).

3.1.10.1.7.3 Smoke Ingress into Fire Stairs

The relative performance of doors protecting a corridor enclosure with and without hot smoke seals fitted to the doors, which have been subjected to standard AS1530.4 and hydrocarbon fire resistance heating regimes has been presented by Young *et al [BCC]*. Within these tests a standard corridor 6m long x 1.8m wide x 2.4m high was utilised, to observe smoke spread for a variety of temperature exposures (non sprinkler protected fires).

This standard corridor door size [BCC] was utilised for the purposes of inter-comparisons though for sprinkler protected fires (with no hot layer development due to mixing/turbulence caused by the sprinklers).

For a sprinkler protected fire within an Adjoining Room, the time to theoretically fill an adjoining corridor (6m long x 1.8m wide x 2.4m high as per BCC tests) was compared with and without seals -

Table 8: Smoke Seal Performance Inter-Comparison First Floor

Scenario	Length	Width	Height	Volume, V1 m³	Leakage Rate m³/hr	Volume Increase Factor* T2/T1 (°K/°K)	Filling Time (hr)	Filling Time (mins)
BCC test corridor – No Seals	6	1.8	2.4	25.9	216	1.6	0.07	4.5
BCC test corridor – With Seals Door Head and Side	6	1.8	2.4	25.9	112	1.6	0.14	8.6

*Note the above does not take into account the entrainment of the cool air, as the ceiling height is relatively low, however does take into account the increase in smoke volume with temperature [Milke], thereby increasing the rate of filling (T1/T2 factor).

As expected when provided with smoke seals, the smoke leakage rate is approximately half that when no seals are provided (and hence the time to fill the same volume is also approximately double).

3.1.10.1.7.4 Comparative Improvement in Available Safe Egress Time –(Sprinkler Protected Fire in Adjoining Area)

The Subject fire stair approximate in volume (per level) to that of a DtS corridor (sprinkler protected fire).

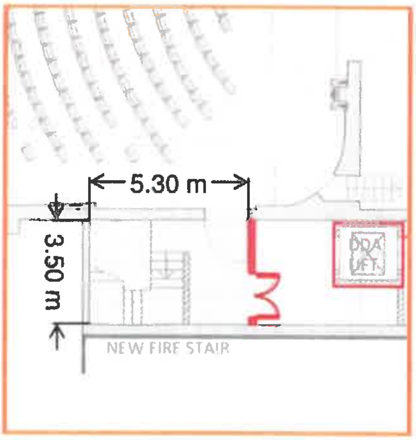

Figure 18: Subject Stair

A comparison in smoke filling of a DtS corridor and the Performance Solution are compared below for a sprinkler protected corridor -

Table 9: Smoke Seal Performance Inter-Comparison

Scenario	Length	Width	Height	Volume, V1 m³	Leakage Rate m³/hr	Volume Increase Factor* T2/T1 (°K/°K)	Filling Time (hr)	Filling Time (mins)
DtS – No Seals	6	1.8	2.4	25.9	216	1.6	0.07	4.5
Proposed Solution With Seals Door Head and Side	5.3	3.5	3.0	55.7	112	1.6	0.30	18.5

The considered Proposed Building Solution with an adjoining corridor/stair of greater volume and lower leakage rate at the door, would be expected to take longer to fill theoretically when compared with a DtS case (approximately 4 times longer).

The above serves to provide a measure in the relative improvement in conditions for the Subject Building when compared with a DtS building (and is not the actual Available Safe Egress Time)

3.1.10.1.8 Summary

Based on the above, the provision of fire doors (fitted with AS 1530.4 intumescent fire and AS 1530.7 sool/medium smoke seals) are likely to protect the egress route from a fire in the lift shaft at least consistent with A DtS building permitted -

(a) a door opening directly into the fire stairs from an SOU that occupies the entire storey in a Type A building
(b) a door opening form a sanitary compartment and no fire protection.

3.1.10.2 Fire in From a level with lift landing Doors opening directly into level

A fire from an adjoining area has the potential to ingress into the lift shaft and consequently at each lift landing. Smoke spread from the lift shaft has already been considered in the previous section, with the fire doors likely to protect the egress route from a fire in the lift shaft at least consistent with A DtS building permitted -

(a) a door opening directly into the fire stairs from an SOU that occupies the entire storey in a Type A building
(b) a door opening form a sanitary compartment and no fire protection.

3.1.10.3 Fire Brigade

The following is a summary of the key results from the FBIM Estimation (in FER report No P19247 REV 1.4):

- First fire brigade appliance arrives on scene at 701 seconds (= 11.7 minutes) after alarm.
- Fire brigade setup completed, intervention underway on uppermost level 1762 seconds (=29.4 minutes) after alarm.

The fire brigade utilise fire-isolated stairs as a point of entry to a storey that is on fire.

This operation is consistent with a DtS Class 5-9b building provided, however in this instance the building is sprinkler protected (except for below ceiling sprinklers in the auditorium), facilitating fire brigade operations by reducing the likely fire size.

3.1.11 Assessment against the Relevant Performance Requirement of CP2, DP5 and EP2.2

The analysis has considered whether sufficient protection has been afforded to occupant discharging form the fire-isolated stair with regard to –

(a) the number of storeys connected by the exits – The number of storeys connected by the exit is not adverse when compared to a DtS Class 5-9b building with similar occupant characteristics. i.e. the 4 storeys are provided.

(b) The fire safety systems installed – Active systems were considered within the analyses. The building is provided with a automatic fire sprinkler system connected to the fire brigade (and a smoke detection system).

(c) Function or use of the building – The stairs are located within a theatre, though are within a staffing/wardens when operating during performances.

The time to intervention by the fire brigade will however dictate the period of fire exposure, which in this instance is expected to be consistent (or less) with that of a deemed-to-satisfy building solution.

(d) The number of storeys through passed by the exit – There are no storeys that are by-passed by the fire-isolated.

It was considered to not be adverse when compared with other DtS solutions permitted a fire-stair and sprinkler protection), which can have openings directly the fire floor and no protection by fire/smoke seals at the door openings.

(e) Fire brigade Intervention - Fire brigade intervention is not likely to be adversely affected.

It is therefore considered that the performance requirement CP2, DP5 and EP2.2 are satisfied to the degree necessary.

3.1.12 Conclusion

Based on the above, with regard to the provision of a stair and lift in the same shaft, it is considered that the performance requirements CP2, DP5 and EP2.2, are satisfied to the degree necessary.

3.2 Inward Door Swing at Long Room

3.2.1 Introduction

The following variations from the deemed-to-satisfy provisions of the BCA will be considered within this section of the report:

Table 10: Variations from BCA DtS Provisions

DtS Clause	Description of Variation from BCA DtS Provisions	Performance Requirements
D2.20	The provision of an inward swinging door at the Long Room	DP4, EP2.2

3.2.2 Identification of Egress Provisions under Consideration

Figure 19 shows the egress provisions under consideration that vary from the relevant BCA DtS Provision.

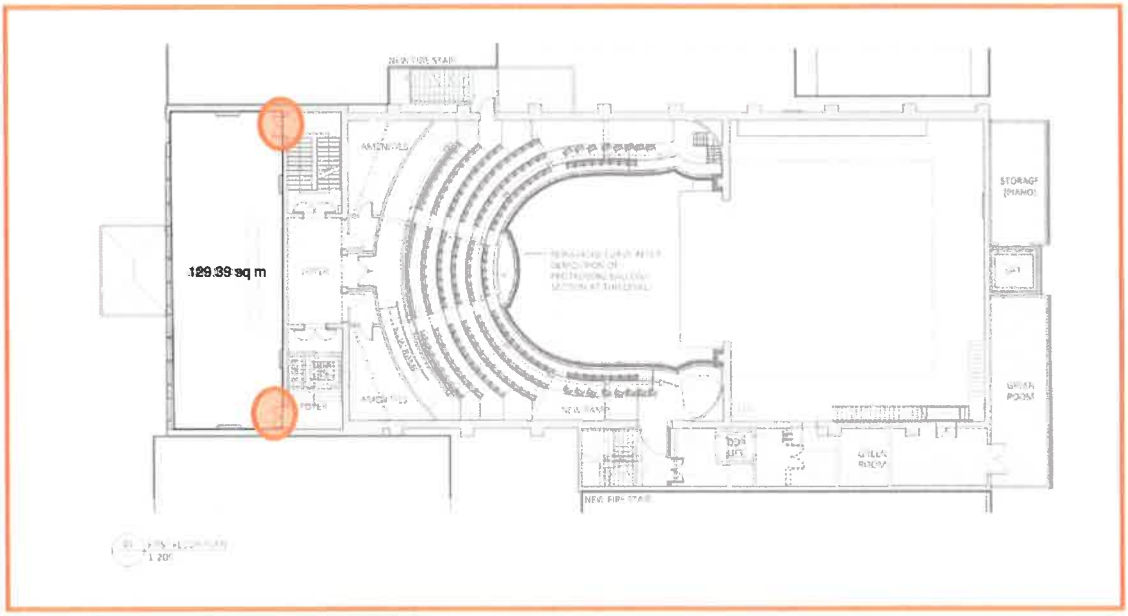

Figure 19: Egress from Long Room

Note the area operates as a bar and will be compared with a retail building for the purpose of risk of fire starts.

3.2.3 BCA Requirements and Intent

3.2.3.1 Relevant Deemed-to-Satisfy Provisions

3.2.3.1.1 Door Swing

The Relevant Deemed-to-Satisfy Provisions associated with direction of door swing is D2.20(b), reproduced below:

D2.20 Swinging Doors
A swinging door in a required exit or forming part of a required exit—
(a) must not encroach—
(i) at any part of its swing by more than 500 mm on the required width (including any landings) of a required—
(A) stairway; or
(B) ramp; or
(C) passageway,
if it is likely to impede the path of travel of the people already using the exit; and

(ii) when fully open, by more than 100 mm on the required width of the required exit,
and the measurement of encroachment in each case is to include door handles or other furniture or attachments to the door

3.2.3.2 Relevant BCA Performance Requirements

3.2.3.2.1 Door Swing

The relevant BCA performance requirements associated with door swing is DP2(b), reproduced below.

DP2
So that people can move safely to and within a building, it must have—
(a) walking surfaces with safe gradients; and
(b) any doors installed to avoid the risk of occupants—
(i) having their egress impeded; or
(ii) being trapped in the building; and
(c) any stairways and ramps with—
(i) slip-resistant walking surfaces on—
(A) ramps; and
(B) stairway treads or near the edge of the nosing; and
(ii) suitable handrails where necessary to assist and provide stability to people using the stairway or ramp; and
(iii) suitable landings to avoid undue fatigue; and
(iv) landings where a door opens from or onto the stairway or ramp so that the door does not create an obstruction; and
(v) in the case of a stairway, suitable safe passage in relation to the nature, volume and frequency of likely usage

BCA performance requirement EP2.2 is considered inter-related as the evacuation route must be maintained for the period of time occupants take to evacuate. This has been reproduced previously within the report.

3.2.3.3 Intent of the BCA

3.2.3.3.1 Door Swing

The BCA Guide states that the intent of D2.20 is to minimize the risk that a door may obstruct a person evacuating. If a door swings against the direction of egress, the first person to it may not be able to open it because of the pressure of people behind them. This could delay evacuation.

DtS Clause D2.20(b) provides concessions (under specified criteria) for a small building or part with floor area not more than 200 m². The reason for allowing a door to swing against the direction of travel in such buildings is because the number of people likely to use the door is low. This in turn minimizes the risk caused by delays induced by opening a door towards the person attempting to gain egress.

DtS Clause D2.20(b)(i) requires doors that swing against the direction of egress to be fitted with a device for holding the door in the open position. The BCA Guide states although it may be desirable to have the door locked open when the building is occupied, because of climatic conditions or the weather conditions on a particular day, or for security reasons it may not be possible or desirable for the occupants.

3.2.4 Hazard Identification

3.2.4.1 Key Hazards

3.2.4.1.1 Door Swing

The swinging of the door against the direction of egress from the exit may delay a person evacuating and could result in the first person to reach the door not being able to open it due to crowding behind them which could delay evacuation. This is generally due to the density and population of the crowd attempting to use the exit, and may also be influenced by the state of the occupants. Eg under the influence of drugs, alcohol or disorientated/adversely affected by smoke inhalation.

The Kings Cross Fire, 1942 Cocoanut Grove nightclub fire in Boston and 1903 Iroquois Theatre fire in Chicago are two major fires where doors swinging against the direction of egress were thought to be one of many contributing factors leading to large number of fatalities.

In cases where the number of occupants served by the door is low **(or the door is locked open),** the exit door swing direction has little or no effect on the ability of occupants to evacuate as crushing is usually the result of high population density rushing towards the exits and "jamming" the exits.

3.2.4.2 Referenced Statistics

In terms of a likely location of fire originating within the Subject building, reference is drawn to the proportion of fires starting by location (Refer Figure **3**). Approximately 17% of fires start in kitchens, 13.7% of fires start in the sales area. The form of heat of ignition within a building is by electrical overload at 28.4% (Refer Figure **2**).

3.2.5 BCA Clause A0.5 Assessment Method

The approach adopted will utilise a quantitative and qualitative inter-comparison as described by A0.5(d), to demonstrate compliance with the Performance Requirements, as shown below.

Table 11: Assessment Methods in accordance with BCA Clause A0.5

BCA Clause A0.5
The following Assessment Methods, or any combination of them, can be used to determine that a Performance Solution or a Deemed-to-Satisfy Solution complies with the Performance Requirements, as appropriate: (a) Evidence to support that the use of a material or product, form of construction or design meets a Performance Requirement or a Deemed-to-Satisfy Provision as described in A2.2. (b) Verification Methods such as — (i) the Verification Methods in the NCC; or (ii) such other Verification Methods as the appropriate authority accepts for determining compliance with the Performance Requirements. (c) Expert Judgement. **(d) Comparison with the Deemed-to-Satisfy Provisions.**

3.2.6 Fire Safety Measures for the Performance Solution

The fire safety measures form the holistic fire safety design for the Performance Solution and incorporate the additional design measures prescribed within §1.3.

3.2.7 Methodology of Fire Engineering Analysis

3.2.7.1 Fire Engineering Assessment Methods in accordance with IFEG 2005

The risk of fire spread to evacuating occupants will be qualitatively compared having regard for inherent protection afforded and comparison with other solutions that meet the BCA prescriptive requirements having regard for –

(a) The likelihood of occupant arriving at the same time and jamming the exit doors (and proposed measures)
(b) The likely occupant numbers
(c) The likely conditions in the egress route

3.2.7.2 Comparative Solution

The Subject building solution will be compared with a DtS building (non sprinkler protected), where a higher occupants may be located within the fire compartment of origin and permitted an inward swinging door (in a 200m² part).

3.2.7.3 Fire Scenarios, Fire Size and Models

3.2.7.3.1 Fire Scenarios

The analysis will consider -

(a) the development of a fire in the Long Room during trading hours

3.2.7.3.2 Discounted Fire Scenarios

A fully developed fire in the egress route is not considered (as the threat to occupants is diminished in the upper levels) and not adverse when compared with a 200m² mezzanine.

3.2.7.3.3 Fire Size

The fire size will be implicitly the same for the Subject building and the comparative building, for the comparative assessment.

3.2.8 Acceptance criteria

The acceptance criterion for this performance assessment is that the building solution shall provide equivalent or higher levels of safety with regard to egress, when compared with a building solution that meets the deemed-to-satisfy provisions of the BCA.

3.2.9 Analysis

3.2.9.1 Inward Swinging Doors and Door Locked Open – Business Hours

3.2.9.1.1 Likely Occupant Numbers Served by the Exits – Business Hours

The occupant numbers are assumed to be 230.

Table 12: Occupant Numbers Served by the Exit

Building Level	Description	Class	Approx. Area (m²)	Aggregate Width	Approx. Occupant No.	Approx. Occupant per exit
First Floor	DTS Class 6 Building	Class 6	200	2m	200	100
First Floor	Theatre Bar	Class 9b	130	2.4m	120	60

3.2.9.1.2 Effective Width of Exits and Boundary Layers

In determining the occupant flow time through an exit, the effective width of the exit is to be determined having regard for boundary layer effects from walls, obstructions, handrails etc. where occupants need a clearance to accommodate the lateral body sway and assure balance" [Nelson].

The boundary layer widths are adopted from the SFPE Handbook of Fire Protection Engineering [Nelson] as shown in Figure 20 and Figure 21. Assuming the stairs have handrails on both sides, the effective widths are taken from the clear stair width less the width of the boundary layers.

Table 13 compares the Alternative Solution with the BCA compliant design. The total flow rate of the occupants is calculated by multiplying the effective width and the specific flow rate. The specific flow rate of 1.0 people/m/s is the prescribed value from SFPE Table 3-14.5 for the flow of occupants through an exit and is the same for both the proposed and DtS compliant scenarios for the purpose of this comparison.

The queuing time of the occupants has then been calculated by dividing the total flow rate by the number of occupants.

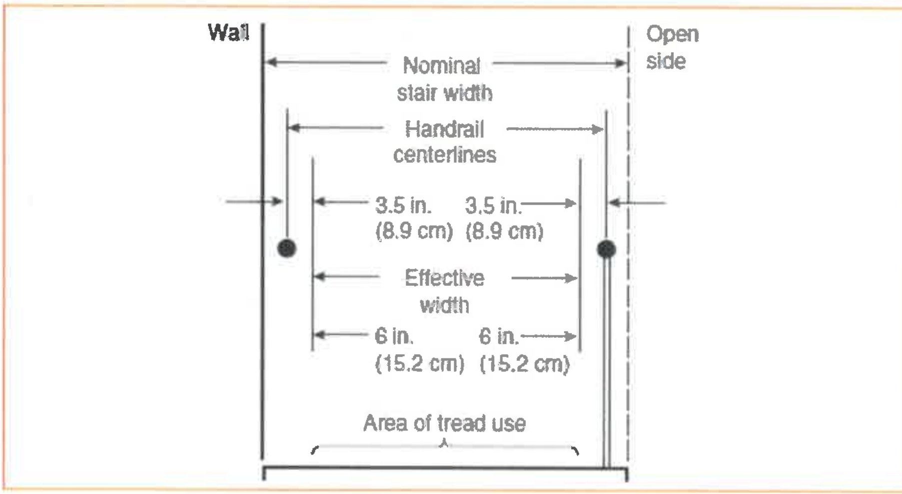

Figure 20: Measurement of effective width in stairs [Nelson]

	Boundary Layer	
Exit Route Element	(in.)	(cm)
Stairways—wall or side of tread	6	15
Railings, handrails[a]	3.5	9
Theater chairs, stadium benches	0	0
Corridor, ramp walls	8	20
Obstacles	4	10
Wide concourses, passageways	<18	46
Door, archways	6	15

[a]Where handrails are present, use the value if it results in a lesser effective width.

Figure 21: Boundary layer widths [Nelson]

3.2.9.1.3 Queuing Times

The following table compares the queuing time for the Subject building solution and a comparative DtS compliant design.

Table 13: Queuing Time between the Subject building and comparative DtS building

	Subject building	DtS Building
Occupants	120	200
Aggregate Width	2400mm	2000mm
Door Width (mm)	1200mm	1000mm
Effective Width per Exit (mm)	900 (=1200 – 2 x 150mm for doors boundary layer)	750
Specific Flow Rate (ppl/m/s)	1.0	1.0
Flow Rate (ppl/s)	1.80	1.4
Queuing Time (s)	66	143

As shown in Table 13 above, the queuing time for the Subject building exit of 66 seconds is lower than that for a comparable DtS solution (143s) with a 1000mm wide door.

Accordingly egress from Subject building is expected to be faster than for a DtS solution (permitted an inward door swing).

Note the above inter-comparison of flow times has compared the flow time and queuing time for occupants with no mobility impairments, though has compared ""like for like".

3.2.9.1.4 Consideration of Occupants Arriving Simultaneously at the Door

The time to delay evacuation and hence occupants' response is an important factor in determining the time occupants reach the subject exit. The occupants' pre-movement behaviour was studied by Proulx and Fahy [Proulx].

Studies in conducting fire drills for buildings with a "good" alarm system, that approximately 50% would commence evacuation two minutes after the alarm occurred, 85% after five minutes and 95% after ten minutes [Proulx].

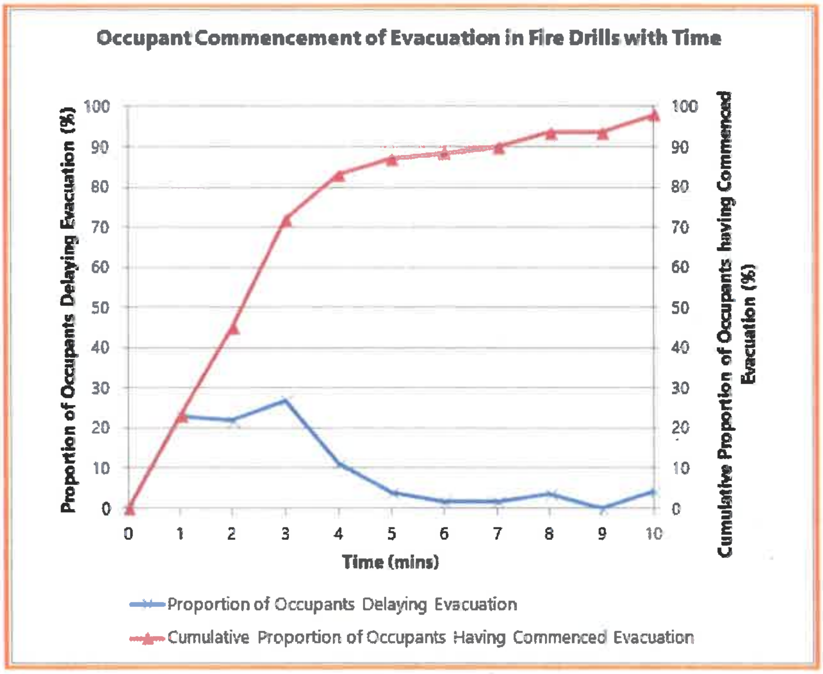

Figure 22: Occupant Commencement of Evacuation in Fire Drills With Time

In the unlikely event that occupants queue at the exit, it was demonstrated in the previous section (§3.2.9.1.3) that the clearing times would be less than for a DtS building (66 versus 143 seconds).

Given lower likelihood of queuing and higher flow rate due to greater clear width, it is considered that the level of safety would be equivalent or safer, than for a DtS building solution.

3.2.9.2 Negotiation of Inward Door Swing – Redundancies

3.2.9.2.1 Inward Door Swing

Observations by Proulx, show that there is a marginal increase in time taken to negotiate an inward swinging door versus a door swinging in the direction of egress from the same force. For a 70N force the mean time to negotiate an inward singing door is 4.6 seconds (with a standard deviation of 2.2), yielding a 90th percentile of 6.8 seconds (as shown in the extract below).

Table 3-13.4 *Time in Seconds to Negotiate Doors*

Closing Force (*N*)	No Aid (*n* = 63)			Crutch Users (*n* = 5)		Walking Stick (*n* = 28)			Walking Frame/ Rollator (*n* =8)	
	Mean (s)	Standard Deviation	Range (s)	Mean (s)	Range (s)	Mean (s)	Standard Deviation	Range (s)	Mean (s)	Range (s)
Push										
21	3.0	0.8	1.7–4.5	3.7	3.6–3.8	3.7	1.5	2.3–7.4	7.9	2.0–12.8
30	3.5	2.2	1.9–15.0	3.0	2.5–3.2	3.8	1.5	2.5–7.3	6.3	2.2–10.5
42	3.7	1.5	1.6–10.2	3.8	2.9–5.2	4.0	1.6	2.3–7.5	5.2	2.1–10.3
51	4.1	2.4	1.0–14.3	3.6	3.1–3.9	4.3	2.4	1.5–10.7	7.9	2.0–14.3
60	4.0	1.9	1.3–13.0	3.8	3.6–4.1	3.7	1.5	1.7–7.9	5.2	2.0–10.3
70	4.3	2.0	1.7–11.2	3.9	3.3–4.6	4.6	2.1	2.5–11.1	6.2	1.7–11.2
Pull										
21	3.3	1.5	1.5–7.6	2.8	2.2–4.0	3.6	1.4	1.8–7.6	5.7	2.0–8.2
30	3.2	1.0	1.5–5.2	—	—	3.2	0.9	1.8–4.9	5.2	4.3–6.0
42	3.7	1.8	1.4–12.6	4.0	2.9–6.3	3.9	1.4	1.9–6.8	4.7	2.6–6.9
51	3.8	1.6	1.5–10.2	3.6	2.5–4.6	4.6	2.2	1.5–9.5	6.3	2.5–11.2
60	4.1	1.9	1.5–11.4	3.6	2.7–4.7	4.1	1.7	1.4–7.4	8.9	1.9–17.0
70	4.6	2.2	1.5–12.6	4.6	2.6–4.7	4.9	2.3	2.1–9.7	3.2	1.9–6.7

Figure 23: Excerpt from SFPE handbook for time to negotiate doors

In comparison for a 70N force the mean time to negotiate a door swinging in the direction of egress is 4.3 seconds (with a standard deviation of 2.0), yielding a 90th percentile of 6.3 seconds.

The 0.5 second difference is likely to have limited impact on egress time when conditions within the egress route are tenable and the occupancy load is low.

However door operation is likely to have a more significant impact if occupants have their affect motor skills/decision making impaired by smoke (narcosis).

Within SFPE Handbook studies by Tadahis [Jin], observed the impact of smoke and radiant heat on the emotional state of occupants. Test were conducted in dimly lit rooms filled with smoke (extinction rate C_s 0.1 1/m visibility of 20m) to determine the influence on motors skills.

The tests included researchers and general public, where given their prior knowledge of toxicity and harm the researchers coped with far higher levels of smoke irritation for the same task (0.5 1/m = 4m visibility) versus 0.1 1/m. It was correlated that the emotional state influenced an occupant's ability to cope with smoke.

A second test in a 10m long corridor filled with smoke and electric radiators at the far end, to ascertain the emotional instability of occupants as they neared more threatening conditions by gauging the change in accuracy of responses to arithmetic questions. Psychological effects cause a 10 % reduction in accuracy as they neared threatening condition while physiological effects cause a 10% reduction in accuracy.

It was recognised within the tests above that occupants that are familiar with the layout (or can see road/open space), will have a higher coping factor to smoke than for unfamiliar occupants. Similarly for occupants when the exit or outside is easily visible, as is the case for the considered solution. Knowledge that an exit is close increases the coping factor.

Table 2-4.2 ***Allowable Smoke Densities and Visibility That Permits Safe Escape***

Degree of Familiarity with Inside Building	Smoke Density (extinction coefficient)	Visibility
Unfamiliar	0.15 1/m	13 m
Familiar	0.5 1/m	4 m

Figure 24: Excerpt from SFPE handbook for visibility limits versus occupant familiarity

The above is impacted is more likely to be of consequence in a non sprinkler protected building.

3.2.9.2.2 Correct Operation of Sprinkler

Sprinklers are in the order of 95% reliable.

The reduction in hot-layer temperatures by both sprinkler suppressed and sprinkler shielded fires is supported in the literature - reference to the CIBSE TM19:1995 for smoke control states a reasonable assumption for the maximum smoke layer temperature in a sprinkler controlled fire is 100°C [CIBSE TM19:1995]. Mawhinney *et al* reported maximum temperatures of approximately 200°C from tests performed in enclosures up to 3.6m high [Mawhinney].

Accordingly for a fire remote in the Subject area, tenability is expected to be maintained.

3.2.9.2.3 Conditions in the Egress Route – Fire at the Exit

It is therefore important that tenable conditions within the egress route are maintained, not only to facilitate travel to the exit but also, to facilitate occupant negotiation of exit doors and hardware and minimise the likelihood of jamming at exits.

In a comparable DtS building (200m² floor area served by an inward swinging door), it is expected that the occupants in the initial stage of a fire would be at greater risk from fire in a habitable area.

A DtS building could have the only one exit door in the compartment of origin with occupant exposed to temperatures >60°C. This temperature is sufficient to threaten occupants.

In this instance there are at least two exits, providing a level of redundancy in the incidence that one exit is blocked. Accordingly for the same fire, the proposed solution would be expected to be inherently safer due to having multiple exits.

3.2.9.2.4 Inward Swinging Doors and Door Locked from Inside - Outside Business Hours

Members of the public are not expected to be inside the building outside business hours and the egress route within the retail sections is effectively an extension of the residence.

The likely occupant numbers, was be determined in accordance with the occupant density recommended within Table D1.13 of the BCA. Outside business hours it is conservatively assumed that 8 occupants could be within the building outside business hours.

* staff numbers based on an occupant density as per a factory for set-up by staff outside business hours 30m²/person.

From the data it can be deduced that occupants within the building are likely to commence evacuation within 10 minutes of an alarm, for 95% of instances.

Due to the low number of occupants and the Building being provided with two exits at the ground floor, it is not expected that all occupants would reach the subject exits at the same time such that inward door or locking will adversely delay egress.

3.2.10 Assessment against the Relevant Performance Requirements DP2

As part of the comparative assessment regarding the provided egress strategy, the assessment considered the function of building area, number and mobility of occupants, the height of the building.

The subject building was compared with a deemed-to-satisfy Class 6 building solution, with regard to the likely potential for congestion of exit routes and the time for evacuation, and potential for occupants becoming trapped/egress routes jammed.

Utilising the principle of equivalence as prescribed in the BCA, it was demonstrated that the considered building, would provide a consistent level of safety when compared with a building solution compliant with the deemed-to-satisfy provisions of the BCA.

Consequently, with regard to the variations from the deemed-to-satisfy provisions of the BCA specified within this report, the performance requirements DP2 are considered satisfied.

3.2.11 Conclusion

Based on the analysis and discussion above, it is considered that the relevant performance requirement associated with the provision with of an inward swinging door, DP2(b) is satisfied and as far as is reasonably practicable within an existing building.

3.3 Deletion of Hose Reel from Long Room

3.3.1 Introduction

The following variations from the deemed-to-satisfy provisions of the BCA will be considered within this section of the report:

Table 14: Variations from BCA DtS Provisions

DtS Clause	Description of Variation from BCA DtS Provisions	Performance Requirements
E1.4(f)	Omission of hose reel installation in the Long Room [2A:20BE fire extinguishers to be provided within the Long Room adjacent to each exit]	EP1.1

3.3.2 Identification of Areas Under Consideration

Figure 25 shows the location of the areas that vary from the relevant BCA DtS Provision.

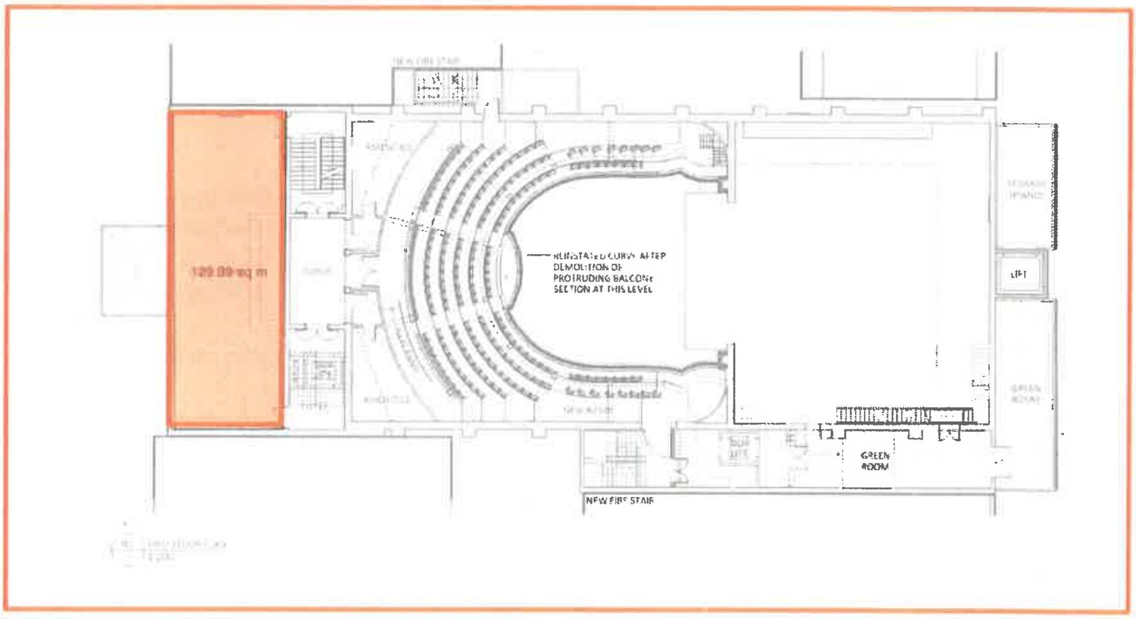

Figure 25: No Hose Reels in Long Room

3.3.3 BCA Requirements and Intent

3.3.3.1 Relevant Deemed-to-Satisfy Provisions

3.3.3.1.1 Fire Hose Reels

The relevant deemed-to-satisfy requirement associated with provision of fire hose reels is BCA Clause E1.4.

E.14 Hose Reels

(a) E1.4 does not apply to—

(i) a Class 2 or 3 building or Class 4 part of a building; or

(ii) a Class 8 electricity network substation; or

(iii) a Class 9c building; or

(iv) classrooms and associated corridors in a primary or secondary school.

(b) A fire hose reel system must be provided—

(i) to serve the whole building where one or more internal fire hydrants are installed; or

(ii) where internal fire hydrants are not installed, to serve any fire compartment with a floor area greater than 500 m2.

(c) The fire hose reel system must—

(i) have fire hose reels installed in accordance with AS 2441; and

(ii) provide fire hose reels to serve only the storey at which they are located, except a sole-occupancy unit of not more than 2 storeys in a Class 5, 6, 7, 8 or 9 building may be served by a single fire hose reel located at the level of egress from that sole-occupancy unit provided the fire hose reel can provide coverage to the whole of the sole-occupancy unit.

(d) Fire hose reels must be located internally, externally or in combination, to achieve the system coverage specified in AS 2441.

(e) In achieving system coverage, one or a combination of the following criteria for individual internally located fire hose reels must be met in determining the layout of any fire hose reel system:

(i) Fire hose reels must be located adjacent to an internal fire hydrant (other than one within a fire-isolated exit), except that a fire hose reel need not be located adjacent to every fire hydrant, provided system coverage can be achieved.

(ii) Fire hose reels must be located within 4 m of an exit, except that a fire hose reel need not be located adjacent to every exit, provided system coverage can be achieved.

(iii) Where system coverage is not achieved by compliance with (i) and (ii), additional fire hose reels may be located in paths of travel to an exit to achieve the required coverage.

(f) Fire hose reels must be located so that the fire hose will not need to pass through doorways fitted with fire or smoke doors, except—

(i) doorways in walls referred to in C2.5(a)(v) in a Class 9a building and C2.5(b)(iv) in a Class 9c building, separating ancillary use areas of high potential fire hazard; and

(ii) doorways in walls referred to in C2.12 or C2.13 separating equipment or electrical supply systems; and

(iii) doorway openings to shafts referred to in C3.13.

(g) Where the normal water supply cannot achieve the flow and pressures required by AS 2441, or is unreliable—

(i) a pump; or

(ii) water storage facility; or

(iii) both a pump and water storage facility, must be installed to provide the minimum flow and pressures required by clause 6.1 of AS 2441.

3.3.3.2 Relevant Section of AS 2441 in relation to coverage

The following extract from AS2441 prescribes the system coverage requirements (which will be used as a point of reference):

10.2 System coverage
Where a fire hose reel system is required in a building it shall be suitable to allow the occupants to undertake initial fire suppression without being placed in any immediate danger.

The maximum coverage for a fire hose reel shall comply with the following requirements:

(a) All points on a floor shall be within reach of a 4 m hose stream issuing from a nozzle at the end of the hose laid on floor. The hose length shall not exceed 36 m.
(b) The distance from a hose reel to the nominated point shall be taken as the most direct laid-on-ground or floor route.
(c) The location of internal walls, partitions, doorways, storage racking, and any other fixed obstructions, which would restrict normal hose coverage throughout the building or area to be protected, shall be considered when determining the number and location of fire hose reels.

NOTE: In the case of car parks, the coverage is based on the arc of hose length +4 m.

(d) The coverage shall be in compliance with the requirements stipulated in the BCA.

Note that the 40m coverage requirement (4m hose stream + 36m fire hose length) aligns with the 40m for an internal fire hydrant (10m stream + 30m hydrant hose length) and the maximum allowable distance when 2 exits are provided.

3.3.3.3 Relevant BCA Performance Requirement

The relevant BCA performance requirements associated with the provision of fire hose reels is EP1.1. This performance requirement is stated as follows:

EP1.1
A fire hose reel system must be installed to the degree necessary to allow occupants to safely undertake initial attack on a fire appropriate to—
(a) the size of the fire compartment; and
(b) the function or use of the building; and
(c) any other fire safety systems installed in the building; and
(d) the fire hazard.

3.3.3.4 Intent of the BCA

The Guide to the BCA states the intent of Clause E1.4 is to require the installation of suitable fire hose reel systems to enable, where appropriate, a building's occupants to undertake initial attack on a fire.

The Guide to the BCA defines the following objective of EP1.1:

Fire hose reels in buildings allow occupants to fight a fire. The fire may be in its infancy, and early control or extinguishment may reduce the hazard, allow more time for evacuation and prevent structural damage.

The Guide to the BCA details the following regarding the provision of portable fire extinguishers to meet the performance requirement EP1.2:

Fire extinguishers in buildings allow occupants to fight fires. Extinguishment may complete all the functions listed in EP1.1 above.

Therefore, the Guide to the BCA recognises that portable fire extinguishers can provide the functions of fire hose reels. Thus deletion of portable fire hose reels and providing portable fire extinguishers can meet the objectives of the performance requirement EP1.1.

3.3.4 Hazard Identification

3.3.4.1 Key Hazards

3.3.4.1.1 Deletion of Hose Reel from fire/smoke compartment

The hazard in not providing a hose reel installation within a fire/smoke compartment is that occupants lose touch with the fire, in having to leave the area of fire origin, obtain the hose reel and re-enter the area, where fire conditions may have changed markedly.

There is likely to be a slower response in an occupant using a hose reel compared with a portable fire extinguisher due to the increased difficulty in accessing/using the hose, compared with a portable extinguisher. i.e. the fire size at the time intervention commences may be larger.

These are consistent with the arguments used for the deletion of hose reels in Class 2/3 buildings where untrained occupants may need to leave an SOU to obtain a hose reel for initial fire attack. A hose reel can be up to 40m away from the seat of a fire (when 2 exits are provided).

3.3.4.1.2 Extinguishers with Finite Supply of Suppression Agent

The amount of extinguishing agent in a portable fire extinguisher is limited and there may be fires that are too large to extinguish with a portable fire extinguisher based on the amount of extinguishing agent. Conversely fire hose reels are connected to the water main and therefore supplies an indefinite amount of water.

A water extinguisher or a fire hose is only appropriate for Class A fires while a portable multipurpose extinguisher can be used for Class A, B, C, D and E fires. From this viewpoint, portable extinguishers are more versatile than fire hose reels (for an AE Type).

Fire extinguishers complying with Australian Standards are marked with a classification and rating, determined in accordance with AS 1850 as shown in Table 15.

Table 15: Fire Extinguisher Categories

Fire extinguisher type	Description
Class A	Fires in ordinary combustible materials, such as wood, cloth, paper, rubber and many plastics.
Class B	Fires in flammable and combustible liquids, greases, and oils.
Class C	Fires in combustible gases.
Class D	Fires in combustible metals.
Class E	Fires which involve energised electrical equipment.
Class F	Fires for cooking oils and fats.

There are many types of fire that could occur in a residential building where a fire hose reel not is appropriate for undertaking the initial attack.

3.3.4.1.3 Fuel Loads ad Linings

There are limited fuel loads within the smoke lobby ($4m^2$) with linings to be of non combustible construction to BCA Clause C1.0/C12, with the risk more like a fire-isolated passageway.

This is recognised within the BCA, where areas of low fire load are permitted to have active fire safety measures deleted; eg. Sprinkler protection in fire-isolated stairs to AS 2118.1, bathrooms/WC to AS 2118.4.

3.3.4.2 Referenced Statistics

3.3.4.2.1 Fire in Lobbies

For the purpose of identifying the relative increase to occupants by the deletion of a hose reel to a lobby, reference is drawn to the area of fire origin the lobbies, which account for 4.4% of fire (Refer Figure **3**).

Note for the subject building the area is very small an unlikely to promote a large fire.

3.3.4.2.2 Fire Outside Lobbies

For the purpose of identifying the relative in risk of initiating within the buildings, reference was made to the area of ignition (Refer Figure **3** for Office/Shop). The statistics reveal that approximately 17% fires originated within cooking areas with Sales areas the next highest at 17%.

It is however noted that the greatest risk of ignition was from electrical overload in a Shop/Office (Refer Figure **2**).

3.3.4.2.3 Likelihood of Occupant Intervention

Reference to data published within the SFPE Handbook [Bryan] examining the percentage of occupants who would fight fires within residential apartments revealed that approximately 28 percent of occupants within apartments would fight fires within. It is assumed to be less so, in a common areas with no direct interest to the property/linings under threat.

The lobby is within the carpark, occupants are likely to be alert/awake and respond to cues of fire. Data from general Class 5 to 9b building will be adopted with similar occupant characteristics.

According to national incidents data of the office premises with Fire Hose Reels installed, they were only used in 5% of cases whereas Fire Extinguishers were used in 11% of cases, indicating that people are more than twice as likely to make use of an extinguisher than a hose reel.

In the event that an occupant has decided to fight the fire, the time required to reach a fire hose reel is expected to be longer statistically than that to reach a portable fire extinguisher if provision and location of portable extinguishers complies with AS 2444. This is because the maximum coverage of a hose reel according to AS 2441 is 40m (36m hose length plus 4m hose stream); whereas the maximum travel distance to a portable fire extinguisher for Class A fire risks is 15m.

It is assumed that distance to a fire suppression measure impacts on the likelihood of use.

3.3.4.2.4 Occupant Intervention and Success

Whether an occupant decides to fight a fire is dependent on various factors including environmental factors, physical factors and also available means of manual intervention.

Fire brigade reports indicate that there is a more frequent use of extinguishers for first attack; however they do not distinguish between who was using them (VUT, 2005). Statistical data provided by the NSW Fire Brigade (2006/2007) indicates that approximately 10 % of fires are extinguished by fire extinguishers.

This percentage is inclusive of fires extinguished by a fire fighter using an extinguisher. The statistics do not show how many fires were extinguished using fire hose reels. It is assumed that the likelihood that an occupant undertakes manual fire fighting is estimated to be 10 % for both fire extinguishers and fire hose reels.

i.e. equivalent levels of success assumed between extinguishers and hose reel at 10%.

3.3.5 BCA Clause A0.5 Assessment Method

The approach adopted will utilise a quantitative, comparative analysis for the purposes of utilising a combination of the Verification Method and a comparison with other building solutions, which comply with the BCA as described by A0.5 (b)(ii) and A0.5(d), as shown below.

Table 16: Assessment Methods in accordance with BCA Clause A0.5

BCA Clause A0.5
The following Assessment Methods, or any combination of them, can be used to determine that a Performance Solution or a Deemed-to-Satisfy Solution complies with the Performance Requirements, as appropriate: (a) Evidence to support that the use of a material or product, form of construction or design meets a Performance Requirement or a Deemed-to-Satisfy Provision as described in A2.2. (b) Verification Methods such as — (i) the Verification Methods in the NCC; or (ii) **such other Verification Methods as the appropriate authority accepts for determining compliance with the Performance Requirements.** (c) Expert Judgement. (d) **Comparison with the Deemed-to-Satisfy Provisions.**

3.3.6 Fire Safety Measures for the Performance Solution

The fire safety measures form the holistic fire safety design for the Performance Solution and incorporate the additional design measures prescribed within §1.3.

3.3.7 Methodology of Fire Engineering Analysis

3.3.7.1 Fire Engineering Assessment Methods in accordance with IFEG 2005

A combination of quantitative and qualitative discussion will be presented to support this proposed variation from the deemed-to-satisfy provisions of the BCA.

A risk assessment approach shall be performed consistent with the methods presented within AS 4360.

The qualitative comparative assessment will be undertaken to assess the risk to the life safety of occupants associated with the proposal to delete the hose reel from the smoke lobby, having regard for the following (as per EP1.1) -

- the size of the fire compartment which is a measure of the size of any potential fire;
- the function of the building will affect the fire load in the building;
- the fire-safety systems which can affect the rate of fire spread (eg if a sprinkler system is installed in a building, it should extinguish the fire or reduce its growth rate); and
- the fire hazard which means the danger in terms of potential harm and degree of exposure arising from the start and spread of fire, and the smoke and gases generated by a fire.

Comparison will be made with other DtS solutions which recognise that subject to adequate separation/precautions fire hose reels need not be provided or may pass through doors.

3.3.7.2 Risk inter-Comparison

The following shall outline the method of risk assessment approach generally consistent with the methodology outlined in AS4360. Broadly, the basis of establishing the risk posed is defined by the following equation.

Risk = probability x consequence

The following diagrams outline the mechanism of assessing the risk (reproduced from AS 4360) in relating the likelihood (probability of an event) and the consequence.

Table E1 Qualitative measures of consequence or impact

Level	Descriptor	Example detail description
1	Insignificant	No injuries, low financial loss
2	Minor	First aid treatment, on-site release immediately contained, medium financial loss
3	Moderate	Medical treatment required, on-site release contained with outside assistance, high financial loss
4	Major	Extensive injuries, loss of production capability, off-site release with no detrimental effects, major financial loss
5	Catastrophic	Death, toxic release off-site with detrimental effect, huge financial loss

NOTE: Measures used should reflect the needs and nature of the organization and activity under study.

Table E2 Qualitative measures of likelihood

Level	Descriptor	Description
A	Almost certain	Is expected to occur in most circumstances
B	Likely	Will probably occur in most circumstances
C	Possible	Might occur at some time
D	Unlikely	Could occur at some time
E	Rare	May occur only in exceptional circumstances

NOTE: These tables need to be tailored to meet the needs of an individual organization.

Figure 26: Excerpt from AS 4360

Risk Assessment Matrix		Consequences				
		Negligible No injuries or not requiring first aid	Minor First aid needed	Moderate Medical treatment	Major Extensive injury	Severe Death or permanent disability
Likelihood	Almost Certain Expected to occur in most circumstances	Medium	High	High	Extreme	Extreme
	Likely Will probably occur in most circumstances	Medium	Medium	High	Extreme	Extreme
	Possible May occur occasionally	Low	Medium	Medium	Extreme	Extreme
	Unlikely Could happen at some time	Low	Low	Medium	High	High
	Rare May happen only in exceptional circumstances	Low	Low	Medium	Medium	Medium

Risk Level	Recommended Actions
Extreme	Immediate action required – Activity must not proceed until steps are taken to reduce risk to as low as reasonably practicable using the hierarchy of controls
High	Risk control measures required to reduce risks to as low as reasonably practicable using the hierarchy of controls
Medium	Review risk assessment and ensure control measures to reduce risk to as low as reasonably practicable using the hierarchy of controls
Low	Manage risks by routine procedures and monitor

Figure 27: Risk Matrix

The process of risk assessment requires an identification of potential hazards (i.e. potential causes of fire or fire scenarios), establishment of a likelihood of such scenarios, and establishing the consequence of each event.

The scenarios to be considered will involve consideration of a fire on the affected levels, and compare the risk between the proposed building solution, where a portable fire extinguisher is provided, and a building solution, which complies with the deemed-to-satisfy provisions of the BCA where hose reel protection is provided.

3.3.7.3 Fire Scenario and Fire Size

3.3.7.3.1 Fire Scenarios

This analysis will considered a fire in the following areas -

(i) A fire in the habitable room – Sprinkler protected
(ii) A fire in the habitable room – Sprinkler failure

3.3.7.3.2 Discounted Fire Scenarios

Fire Isolated stairs - A fully developed fire is not considered likely within the fire isolated stairs, having regard for the likely fuel loads and lining limitations and ignition sources as per BCA Clause D2.7(a). Hose reels are not permitted in fire isolated stairs

Carpark - For a fire in the carpark is likely to be smoke isolated from the lobby. Hose reels are installed in the carpark.

3.3.7.3.3 Fire Size

The fire size will be implicitly the same for the Subject building and the comparative building, for the comparative assessment.

(a) Sprinkler protected fire - 200°C unlikely to spread and breach smoke compartmentation to the egress route (note solid core door provided of inherent FRL of 15 minutes)
(b) Sprinkler failure - 600°C likely to spread and breach smoke compartmentation to the egress route (note solid core door provided of inherent FRL of 15 minutes)

3.3.7.4 Inter-comparative Solution(s)

3.3.7.4.1 Class 6 Building Part > 500m² with Smoke Lobby

The following DtS building will be adopted for the purpose of the inter-comparison -

- Retail (Class 6) with glazed walls between SOU's sprinkler protected
- Internal Hydrant not provided but >500m² fire compartment/building
- Distance of travel <40m to nearest of 2 exits
- Hose reel coverage provided by a single hose reel <4m from an exit (as per BCA Clause E1.4(e)(ii))

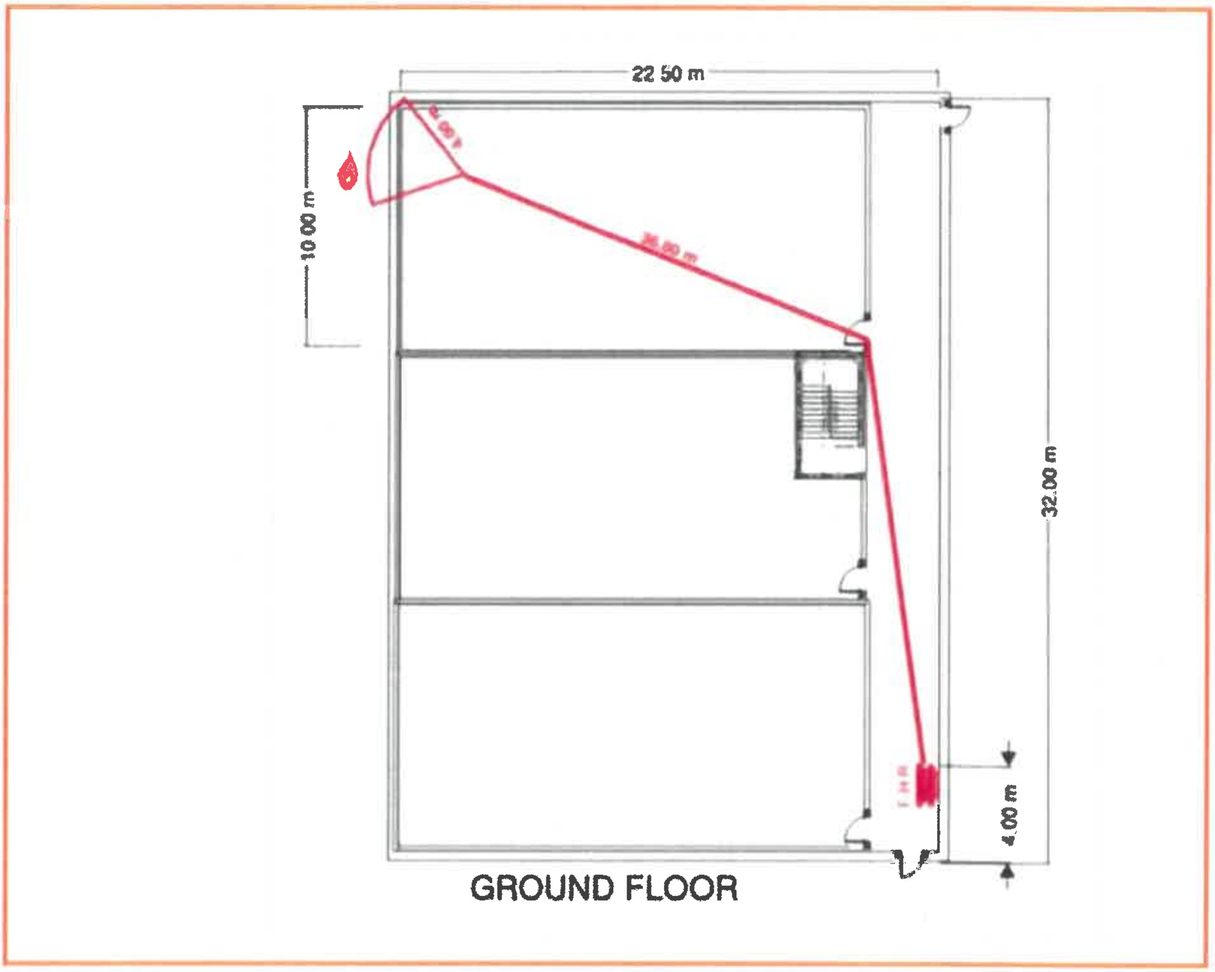

Figure 28: Inter-comparative DtS Building

Given the SOU tenancy doors are not smoke/fire doors a hose reel is permitted to cross the SOU entry doors, in the single fire compartment (as per BCA Clause E1.4(f)).

3.3.7.5 Acceptance criteria

The risk of fire/smoke spread to adjoining areas by the omission of a hose reel installation within the habitable room (given sprinklers) shall be shown to be less than for a DtS Building.

3.3.8 Analysis

3.3.8.1 General Discussion

3.3.8.1.1 Sprinkler Protection and Smoke Separation of Smoke Compartment not installed with Hose Reels

The intention of the provision of a hose reel within a fire compartment is for direct fire attack within the room/compartment of origin. The Subject building is provided with fire sprinkler protection throughout in accordance with AS 2118.1, thus if the fire exceeds a size which can be controlled by an occupant with a portable fire extinguisher, the fire sprinkler system will be likely to control the fire from developing to a large fire, which threatens the balance of the building.

For the Subject building, from a redundancy viewpoint, the bounding construction comprises fire resistant walls of FRL 90/90/90 and self-closing solid core doors in a sprinkler protected building.

In the event of sprinkler failure, the likely fire load and fire intensity in the 140m² fire compartment is likely to be less than for –

i. a DtS non sprinkler protected Class 6 building/fire compartment > 500m² with SOU's separated by glazed walls BCA (and provided with hose reels).
ii. a DtS non sprinkler protected Class 6 building at 500m² separated by BCA Clause C2.7 fire walls that need not be provided with hose reels.

3.3.8.1.2 Fire Type

AS 2441 states that hose reels are designed for Class A fires (carbonaceous fires). In this instance the fire is likely to be a cooking fat fire. A dedicated extinguishing agent (Wet Chemical Class F extinguisher or fire blanket is to be provided in the immediate area of risk.

A hose reel in his instance, may not be suitable in the event of limited training.

3.3.8.1.3 Class 6/9b Occupants

When provided with an internal hydrant or fire compartment/building >500m², the provision of fire hose reels is intended to provide a "limitless" supply of water for occupants to fight a fire and provide capacity for cooling heated surfaces, which may continue to continue to re-ignite a fire.

It is not necessarily considered to be a safe or appropriate mechanism for fire fighting within the Subject retail section due to the following:

i. Occupants are likely to be untrained in the hose reel use – it is a retail section/place of work, with staff or visitors, where controls on occupant training cannot be implemented, nor can reliance be placed on staff to be trained to use the hose reels (OH and S requirements to limit risk to staff).
ii. There is no implicit or explicit requirement in the BCA for occupants to fight fires within their own tenancies as a component of life safety within the building.
iii. There is likely to be a slower response in an occupant using a hose reel compared with a portable fire extinguisher due to the increased difficulty in accessing/using the hose, compared with a portable extinguisher. i.e. the fire size at the time intervention commences may be larger.

3.3.8.2 Inter-comparison of Risk with a DtS Building for Fire within Lobby – Sprinkler Activates

3.3.8.2.1 Qualitative Risk Analysis

Fires in sprinkler protected retail tenancies are not likely to increase in size such that an unlimited water supply is required for occupants to undertake primary attack.

For fires where the use of water as an appropriate extinguishment medium i.e. excluding electrical type sources of fat/fuels, the likelihood of a fire event requiring extinguishment is considered unlikely. A relatively small volume of extinguishment media is likely to be required to control a fire.

On this basis the consequence of such a fire, whether the extinguishment medium is via a portable fire extinguisher or fire hose reel, is considered to be Minor, with the Risk considered to Low.

Risk Assessment Matrix		Consequences				
		Negligible No injuries or not requiring first aid	Minor First aid needed	Moderate Medical treatment	Major Extensive injury	Severe Death or permanent disability
Likelihood	Almost Certain Expected to occur in most circumstances	Medium	High	High	Extreme	Extreme
	Likely Will probably occur in most circumstances	Medium	Medium	High	Extreme	Extreme
	Possible May occur occasionally	Low	Medium	Medium	Extreme	Extreme
	Unlikely Could happen at some time	Low	Low	Medium	High	High
	Rare May happen only in exceptional circumstances	Low	Low	Medium	Medium	Medium

Risk Level	Recommended Actions
Extreme	Immediate action required – Activity must not proceed until steps are taken to reduce risk to as low as reasonably practicable using the hierarchy of controls
High	Risk control measures required to reduce risks to as low as reasonably practicable using the hierarchy of controls
Medium	Review risk assessment and ensure control measures to reduce risk to as low as reasonably practicable using the hierarchy of controls
Low	Manage risks by routine procedures and monitor

Figure 29: Risk Matrix for Both Hose Reel and Portable Fire Extinguisher

3.3.8.2.2 Quantitative Inter-comparison – Small Fire/Smouldering Fire/Sprinkler Protected < 200°C

The scenario of a small smouldering fire/sprinkler protected fire is presented below, where the size of the fire is insufficient to threaten the inherent separation and occupants remote from the fire.

The above is consistent with findings by England et al (2000) which states that "temperatures outside the immediate area of operation of the sprinkler system are below 100°C, and temperatures within the area of operation are generally below 200°C except in the immediate vicinity of the flames."

The scenario of a small smouldering fire/sprinkler protected fire is presented below, where the size of the fire is insufficient to fracture/threaten the bounding walls.

Table 17: Comparison of Risk to Adjoining Areas from Smouldering/Sprinkler Protected Fire to Adjoining Egress Route

Condition	Portable Fire Extinguisher in RFO (PS)	Fire Hose Reel in Adjoining Corridor (DtS)
Room of Fire Origin (RFO)	In habitable Room 140m²	In habitable Room 200m²
Occupant Location	In Room of Fire Origin (RFO)	In Room of Fire Origin (RFO)
Likelihood sprinkler Operates and Controls fire	0.95	0.95
Temperature in Room of Fire Origin (RFO)	<200°C	<200°C
Occupant Likely to use	0.799	0.07 (=0.79/11)
Occupant Likely to succeed	0.799	0.799
Occupant Likely to use and succeed	0.61 (= 0.95 x 0.799 x 0.799)	0.055 (= 0.95 x 0.07 x 0.799)
Likelihood of incomplete fire extinguishment by occupant	**0.39**	**0.94**
Short Term Conditions in Adjoining Areas during fire attack	Limited impact – Retail tenancy smoke separated from balance of building with solid core doors. Extinguisher in room used. No door opened.	Medium impact – occupant uses hose reel from lobby, door may remain ajar for short period, allowing smoke into egress route. Closed once extinguished.
Failure of Bounding Construction 20%	**0.20**	**0.20**
Consequence – Exposure to Conditions Beyond RFO (<200°C = 0.5, >600° =1.0)	**0.50**	**0.50**
Risk of Fire/Smoke Extending Beyond RFO to main egress route	**0.39 x 0.20 x 0.5 = 0.04**	**0.94 x 0.20 x 0.50= 0.09**

For a sprinkler protected fire, it is considered, the balance of the building/egress routes are at less risk from fire/smoke spread, when provided with an extinguisher inside the RFO (which is more likely to be utilised), than when provided with a hose reel in the lobby (as per DtS requirements).

3.3.8.3 Inter-comparison of Risk with a DtS Building for Fire within Lobby – Sprinkler Fails

3.3.8.3.1 Qualitative Risk Analysis

The area under consideration is smoke separated from the adjoining areas with inherent fire separation of the masonry walls (and solid core doors). In the event of sprinkler failure, the egress route may be threatened.

Risk Assessment Matrix		Consequences				
		Negligible No injuries or not requiring first aid	Minor First aid needed	Moderate Medical treatment	Major Extensive injury	Severe Death or permanent disability
Likelihood	Almost Certain Expected to occur in most circumstances	Medium	High	High	Extreme	Extreme
	Likely Will probably occur in most circumstances	Medium	Medium	High	Extreme	Extreme
	Possible May occur occasionally	Low	Medium	Medium	Extreme	Extreme
	Unlikely Could happen at some time	Low	Low	Medium	High	High
	Rare May happen only in exceptional circumstances	Low	Low	Medium	Medium	Medium

Risk Level	Recommended Actions
Extreme	Immediate action required – Activity must not proceed until steps are taken to reduce risk to as low as reasonably practicable using the hierarchy of controls
High	Risk control measures required to reduce risks to as low as reasonably practicable using the hierarchy of controls
Medium	Review risk assessment and ensure control measures to reduce risk to as low as reasonably practicable using the hierarchy of controls
Low	Manage risks by routine procedures and monitor

Figure 30: Risk Matrix for Both Hose Reel and Portable Fire Extinguisher

It is not expected that occupant would intervene for a fully flaming fire. For the Subject building, occupants are still likely to be able move away from the area of fire origin to limit radiant exposures (with 2 exits available).

i.e. Occupants in a retail area are likely to be alert, awake and able to response to cues of fire. They also are provided with two exits from each tenancy, facilitating movement away from the immediate risk.

The consequence is not considered likely to be closer to Moderate (as opposed to Major or Severe for a typical sprinkler failure case) based on the size of the area under consideration (approximately 140m²). The risk is considered to be Medium.

3.3.8.3.2 Quantitative Inter-comparison – Small Fire/Smouldering Fire/Sprinkler Protected > 600°C

The scenario of a large fire is presented below, where the size of the fire is sufficient to fracture the glazed smoke separation.

The scenario of a small smouldering fire/sprinkler protected fire is presented below, where the size of the fire is insufficient to fracture/threaten the bounding walls.

Table 18: Comparison of Risk to Adjoining Areas from a Fully Developed Fire/Sprinkler Failure to Adjoining Egress Route

Condition	Portable Fire Extinguisher in RFO (PS)	Fire Hose Reel in Adjoining Corridor (DtS)
Room of Fire Origin (RFO)	In habitable Room 140m²	In habitable Room 200m²
Occupant Location	In Room of Fire Origin (RFO)	In Room of Fire Origin (RFO)
Likelihood sprinkler failure	0.05	0.05
Temperature in Room of Fire Origin (RFO)	>600°C	>600°C
Temperatures in Adjoining Areas	>600°C	>600°C
Occupant Likely to use	0.12 (24.1% of fires reported to fire brigade x 0.5 less likely to use for large fire)	0.24 (24.1% of fires reported to fire brigade)
Occupant Likely to succeed	0.015 (= 3% / 2)	0.03 (=3%)
Occupant Likely to use and succeed	0.00009 (= 0.05 x 0.12 x 0.015)	0.00036 (= 0.05 x 0.24 x 0.03)
Likelihood of incomplete fire extinguishment by occupant	0.999**91**	0.999**64**
Short Term Conditions in Adjoining Areas during initial fire attack	Medium impact – Retail tenancy smoke separated from balance of building with self closing solid core doors. Insufficient medium for extinguishment. Extinguisher discarded in RFO. Solid Core doors in remain closed.	Major impact - Occupant uses hose reel from lobby, door may remain ajar for short period, allowing smoke into egress route. Door may remain ajar by fire hose if discarded and left in RFO.
Failure of Bounding Construction (20% for fire rated construction and 100% of glass at 600°C)	**0.20**	**1.0**
Consequence – Exposure to Conditions Beyond RFO (<200°C = 0.5, >600° =1.0)	**1.0**	**1.0**
Risk of Fire/Smoke Extending Beyond RFO to main egress route	**0.99991 x 0.2 x 1.0 = 0.199982**	**0.99964 x 1.0 x 1.0 = 0.99964**

For a sprinkler failure, it is considered, the balance of the building is at marginally less risk from fire/smoke spread (due to inherently fire rated construction), than when provided with a hose reel and glazed construction as for a DtS building permitted glazed walls to the corridors.

3.3.8.4 Summary

For the scenarios presented, in considering the life safety of occupants, and potential for fire spread beyond the smoke resistant enclosure of origin, which are the fundamental objectives of the BCA, the provision of portable fire extinguishers within this sprinkler protected building solution is considered to provide a lower risk of both occupant safety and fire/smoke spread beyond the enclosure of origin.

3.3.9 Assessment against the Relevant Performance Requirements

A qualitative comparative assessment will be undertaken to assess the risk to the life safety of occupants associated with the proposal to omit the hose reel from the lobby (EP1.1)

(a) *the size of the fire compartment which is a measure of the size of any potential fire* – The lobby is fire separated from the fire–isolated stair and smoke separated from the balance of the carpark. The compartment area is approximately $4m^2$ significantly less than the $500m^2$ typically required with a hose reel

(b) *the function or use of the building will affect the fire load in the building* – The building area function as a carpark to an apartment building. The fire load is less than that for a typical lobby, smoke separated from a non sprinkler protected Class 5 to 9 building section.

(c) The fire safety systems – Sprinkler protection provided to inhibit fire growth. The provision of fire extinguishers in lieu of hose reels in the sprinkler protected area is likely to be sufficient to enable occupants to commence initial fire attack.

(d) *the fire hazard which means the danger in terms of potential harm and degree of exposure arising from the start and spread of fire, and the smoke and gases generated by a fire* – The area under consideration is small ($4m^2$) and is smoke separated. In the event of correct operation of the sprinklers, fire/smoke spread is not considered likely from the area of origin.

3.3.10 Conclusion

Based on the discussion above, with regard to the provision of a portable fire extinguishers in the sprinkler protected area, the relevant BCA Performance Requirement EP1.1 is satisfied.

4 Conclusions

This report has presented an Addendum 1.0 to the Performance Solution and the Fire Engineering Report P17247 FER 1.4 (dated 29/1/19), for Her Majesty's Theatre located at 17 Lydiard St S, Ballarat Central.

This Addendum shall be read in conjunction with the Original Fire Engineering Report (P17247 FER 1.4 (dated 29/1/19), with all the details, conditions and limitation within the Original Fire Engineering Report being applicable, unless otherwise identified within this Addendum.

The following variations from the Deemed-to-Satisfy (DtS) provisions of the BCA have been identified by the Relevant Building Surveyor (RBS), and are Additional to those addressed in Original Fire Engineering Report (P17247 FER 1.4, dated 2/9/19), and will be considered in this Addendum in a fire engineering performance assessment against the relevant performance requirements of the BCA, as part of the proposed Performance Solution-

Table 19: Additional Variations from BCA DtS Provisions to those Prescribed in Original Fire Engineering Report P17247 FER 1.4 (dated 29/1/19)

DtS Clause	Description of Variation from DtS Provisions	Performance Requirements
C2.11	Lift and stair in the same shaft in lieu of fire separated from each other. [Subject to dry type sprinklers to be retained at top of lift shaft, as prescribed by BCA Specification E1.5, Clause 12, where water will discharge after 60 seconds. Louvres to be provided at lift over-run].	CP2, DP5, EP2.2
D2.20	The provision of an inward swinging door at the Long Room	DP2(b), EP2.2
E1.4(f)	Omission of hose reel installation in the Long Room [2A:20BE fire extinguishers to be provided within the Long Room adjacent to each exit]	EP1.1
Note The scope of this report is limited to the assessment of the relevant variations from the deemed-to-satisfy provisions of the BCA as outlined above. The building is otherwise assumed to comply with all other deemed-to-satisfy provisions of the BCA and the Building Regulations in matters of fire safety. The scope of this report does not extend to any other variations from the deemed to satisfy provisions of the BCA and does not address non-fire related issues. Any Performance Solution proposed associated with the provision of fire hydrant and fire hose reel protection for the site will under Regulation 129 require the report and consent of the Chief Officer of the Relevant Fire Brigade - Note building fire services shall comply with the BCA DtS, and Building Regulation 129 consent shall not be required for the project.		

As part of the Performance Solution, the following design measures are prescribed, and do not preclude those required by the DtS provisions or those previously prescribed by the Original Fire Engineering Report P17247 FER 1.4, dated 29/1/19, (unless explicitly considered in the Table above), and would be required to form part of the schedule of essential safety measures for the building:

- **Fire-Isolated Stairs and Lift Shaft -**
    - At Basement Level 2 - provide a BCA Specification C3.4 sliding fire door
    - The walls that separate the required fire-isolated stair from the lift shaft are to be of FRL 120/120/120 or FRL -/120/120 construction, as appropriate (for loadbearing and non-loadbearing shaft walls, respectively); and
    - Door openings to the lift lobby to be protected by FRL -/120/30 fire doors fitted with AS 1530.4 intumescent fire and AS 1530.7 medium temperature smoke seals and vision panels. These doors are to be self-closing or interfaced to the building wide alarm system to close in accordance with BCA Specification C3.4

Gincat FIRE SAFETY ENGINEERS

- Option 1 -
  - Provide a fire rated lift landing door of FRL -/60/- to protect openings in the fire rated lift shaft of FRL 120/120/120 or FRL -/120/120, as appropriate (for loadbearing and non-loadbearing shaft walls, respectively); or
- Option 2 -
  - Provide a non fire-rated lift in a fire rated shaft of FRL 120/120/120 and doors as prescribed above.

- **Portable Fire Extinguishers**
  - Within Long Room - Provide a 2A:20BE fire extinguisher immediately adjacent to the exit

Based on the analysis and discussion presented, it is considered that with regard to the variations from the DtS provisions identified above, the relevant performance requirements CP2, DP2(b), DP5, EP1.1 and EP2.2 are satisfied, *to the degree necessary*.

It is also considered that this Additional Variation assessed in this Addendum does not adversely impact on the assessment and conclusions of Original Fire Engineering Report P17247 FER 1.4, dated 29/1/19.

This report has been prepared subject to several conditions detailed within Section 8.

5 Conditions

This report has been prepared based on the following conditions:

- The report addressee may only reproduce this report in full for use with respect to the project specified in the report. No other party/organisations/ individuals are permitted to reproduce this report or any part thereof without the prior written consent of the Principals of GinCat Fire Engineering Pty Ltd.

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- The preparation of this report has been based on the information and drawings provided as detailed within this report. The use and occupancy should not change to the degree that assumptions made about the building fabric, function, occupant characteristics no longer valid. Any alterations to the proposed development and fire safety systems as provided and stated may invalidate the results of this report.

- This assessment does not include design aspects that are not explicitly specified in the Assessment Brief of this report. All non-specified design aspects are assumed to be fully BCA compliant or otherwise meet the Building Regulations. Consideration of all other issues associated with fire safety within the proposed development has not been made, nor has consideration been made for property protection, insurance and related risks and potential losses.

- The conclusions of this report assume that all essential services, including equipment, systems and procedures / occupant and staff training, are maintained to achieve their design intention, as required under essential services legislation, relevant Australian Standards or designer/manufacturer requirements.

- This report applies to this site only and shall not be applied to other buildings.

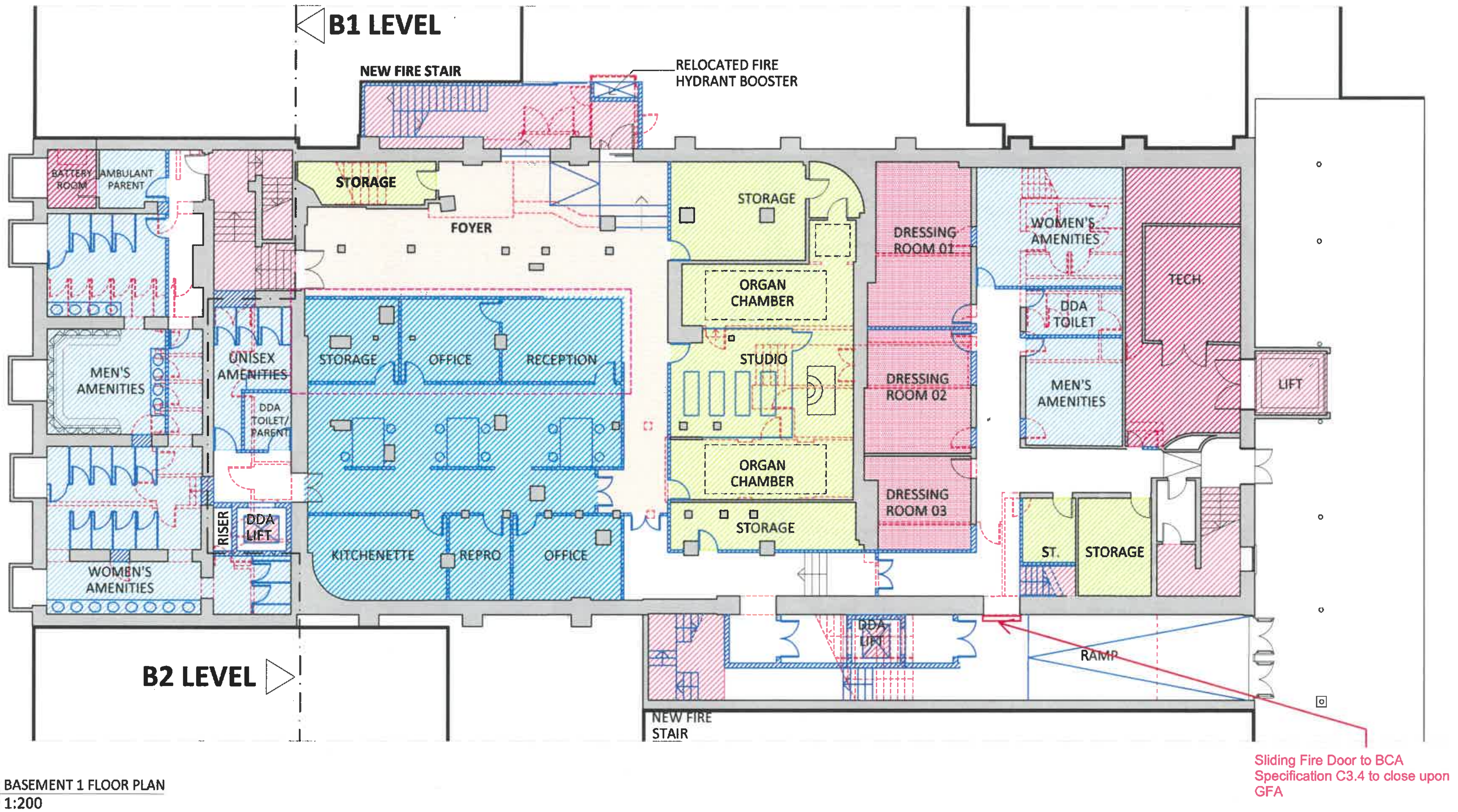
- Fire development associated with criminal acts including terrorism, arson, vandalism, explosives and/or multiple ignition sources or malicious acts, which deliberately result in fire ignition or interference with the fire safety systems for the building is outside the scope of this report

- It should be noted that it is not possible to totally eradicate the risk from fire, particularly those intimately involved with fire ignition.

- The reduction in the fire resistance levels of building construction elements compared with the deemed-to-satisfy provisions of the BCA may result in increased property damage, interruption of service and reconstruction costs in the event of a severe fire.

- Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety

Appendix A – DRAWINGS



01 BASEMENT 1 FLOOR PLAN
-- 1:200

LEGEND:

- ADMIN
- AMENITIES
- FOYER
- GREEN ROOMS
- TECHNICAL ROOMS
- STORAGE
- VERTICAL ACCESS
- DRESSING ROOMS
- TO DEMOLISH/DISMANTLE
- PROPOSED
- LONG ROOM
- DECK
- ROYAL SOUTH STREET SOCIETY

NOT FOR CONSTRUCTION

0 2 4 6 8 10 M
SCALE 1:200 @ A3

NO.	DATE	REVISION
P3	13/06/19	PRELIMINARY
P4	11/07/19	PRELIMINARY

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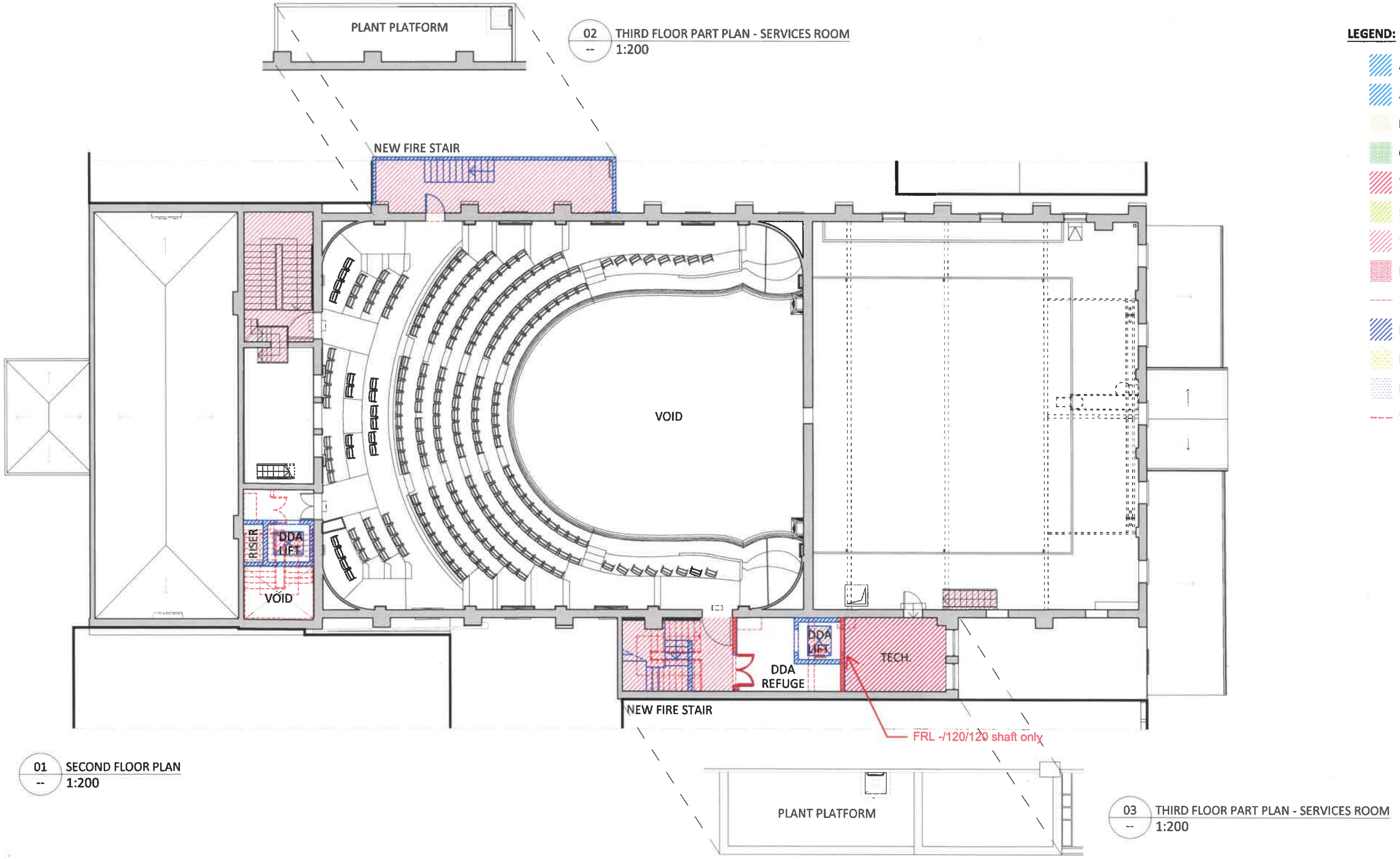
www.lovellchen.com.au

PROJECT
HER MAJESTY'S THEATRE
BALLARAT
FEASIBILITY STUDY

DRAWING TITLE
PROPOSED BASEMENT 1
FLOOR PLAN

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB/DT/	CB	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.01	P4



LEGEND:

- ADMIN
- AMENITIES
- FOYER
- GREEN ROOMS
- TECHNICAL ROOMS
- STORAGE
- VERTICAL ACCESS
- DRESSING ROOMS
- TO DEMOLISH/DISMANTLE
- PROPOSED
- LONG ROOM
- DECK
- ROYAL SOUTH STREET SOCIETY

NOT FOR CONSTRUCTION

0 2 4 6 8 10M
SCALE 1:200 @ A3

NO.	DATE	REVISION
P1	31/10/18	PRELIMINARY
P1	xx/11/18	PRELIMINARY
P3	13/06/19	PRELIMINARY
P4	11/07/19	PRELIMINARY

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PROJECT
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BALLARAT
FEASIBILITY STUDY

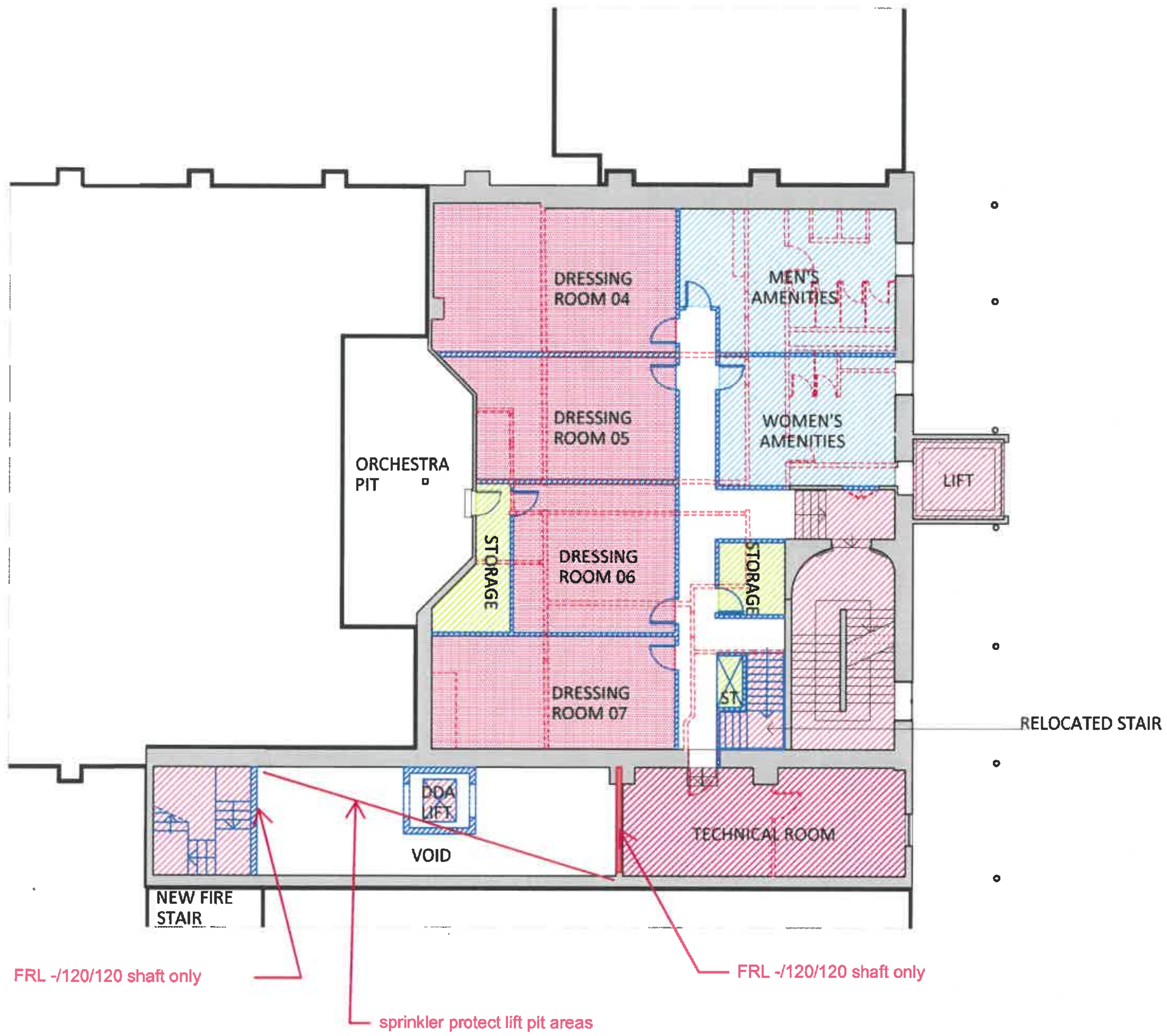
DRAWING TITLE
PROPOSED SECOND FLOOR PLAN

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB/DT/KB		7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.05	P4

LEGEND:

- ADMIN
- AMENITIES
- FOYER
- GREEN ROOMS
- TECHNICAL ROOMS
- STORAGE
- VERTICAL ACCESS
- DRESSING ROOMS
- TO DEMOLISH/DISMANTLE
- PROPOSED
- LONG ROOM
- DECK
- ROYAL SOUTH STREET SOCIETY



01 -- BASEMENT 2 FLOOR PLAN 1:200

NOT FOR CONSTRUCTION

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NO.	DATE	REVISION
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P1	xx/11/18	PRELIMINARY
P3	13/06/19	PRELIMINARY
P4	11/07/19	PRELIMINARY

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PROJECT
HER MAJESTY'S THEATRE BALLARAT FEASIBILITY STUDY

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PROPOSED BASEMENT 2 FLOOR PLAN

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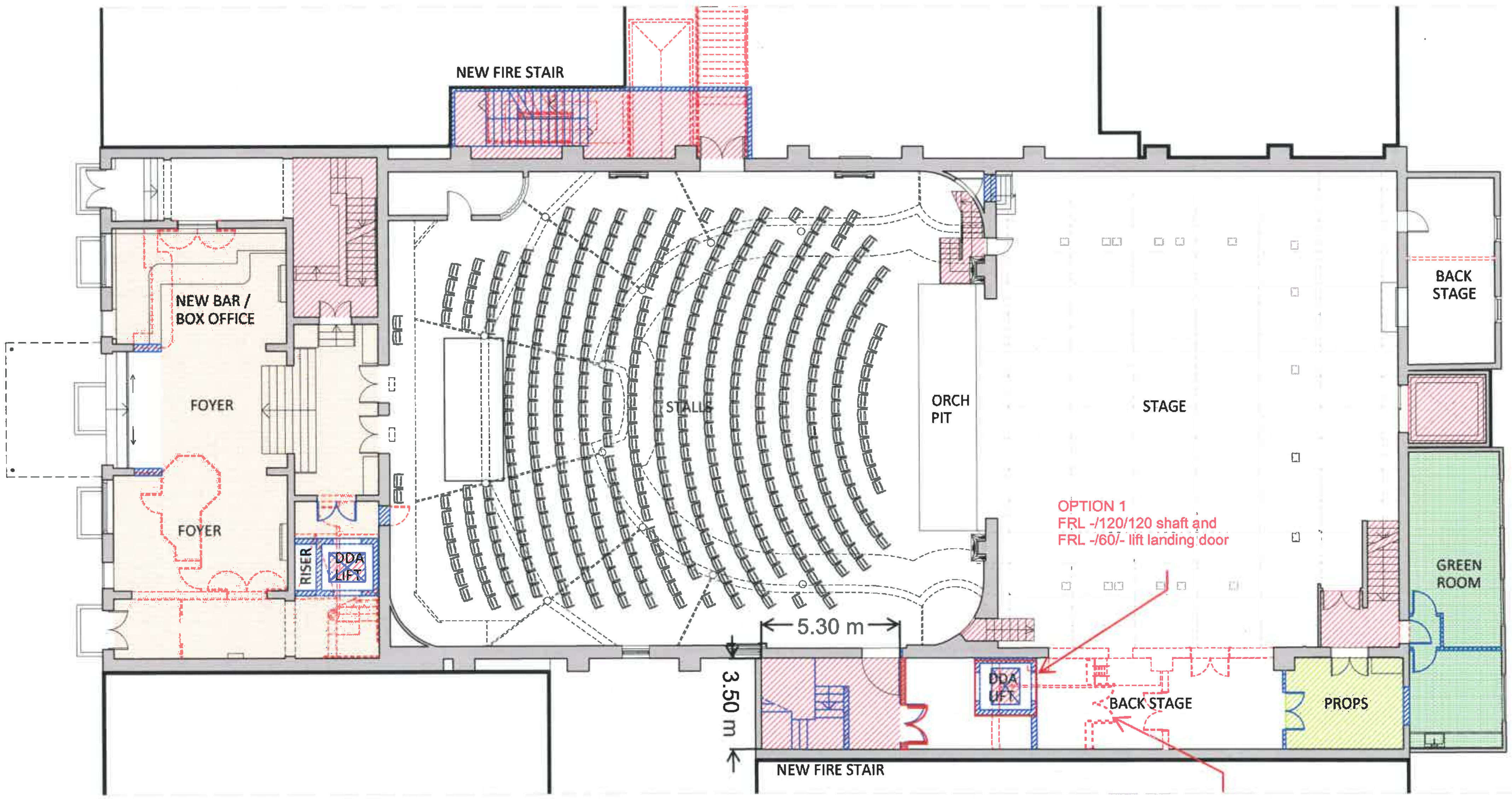

01 GROUND FLOOR PLAN
-- 1:200

LEGEND:

- ADMIN
- AMENITIES
- FOYER
- GREEN ROOMS
- TECHNICAL ROOMS
- STORAGE
- VERTICAL ACCESS
- DRESSING ROOMS
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- LONG ROOM
- DECK
- ROYAL SOUTH STREET SOCIETY

NOT FOR CONSTRUCTION

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SCALE 1:200 @ A3

NO.	DATE	REVISION
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P3	13/06/19	PRELIMINARY
P4	11/07/19	PRELIMINARY

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BALLARAT
FEASIBILITY STUDY

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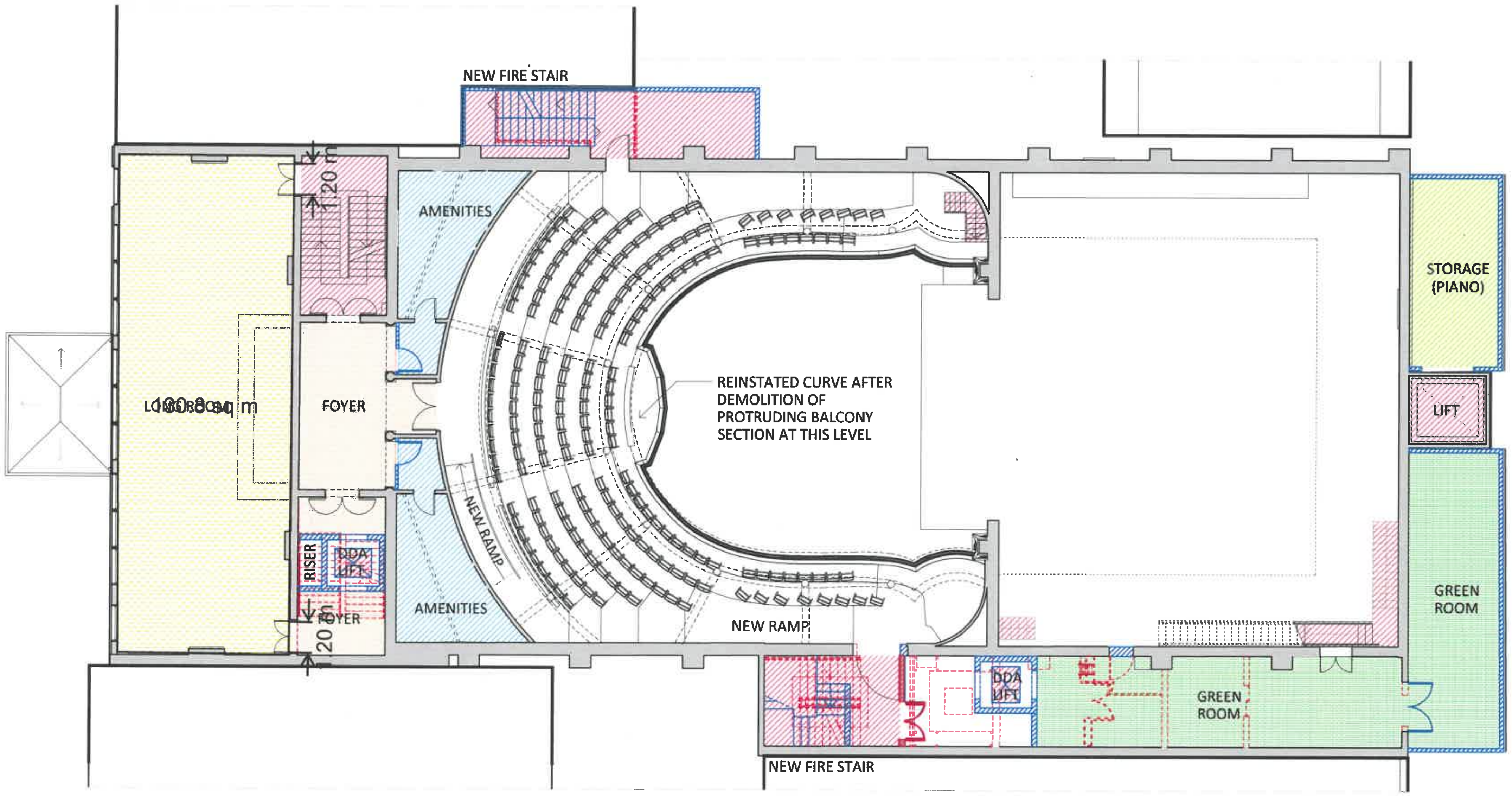
DRAWING TITLE
PROPOSED GROUND FLOOR PLAN

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.03	P3



01 FIRST FLOOR PLAN
-- 1:200

LEGEND:

- ADMIN
- AMENITIES
- FOYER
- GREEN ROOMS
- TECHNICAL ROOMS
- STORAGE
- VERTICAL ACCESS
- DRESSING ROOMS
- TO DEMOLISH/DISMANTLE
- PROPOSED
- LONG ROOM
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NOT FOR CONSTRUCTION

0 2 4 6 8 10M
SCALE 1:200 @ A3

NO.	DATE	REVISION
P1	31/10/18	PRELIMINARY
P1	xx/11/18	PRELIMINARY
P3	13/06/19	PRELIMINARY
P4	11/07/19	PRELIMINARY

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PROJECT
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DRAWING TITLE
PROPOSED FIRST FLOOR PLAN

DRAWN	CHECKED	PROJECT NO.	DATE
CHL/MB/DT/	DB	7925	OCTOBER 2018

ISSUE	SCALE	DRAWING NO.	REVISION
PRELIMINARY	1:200@A3	A.04	P4

APPENDIX G BUILDING SERVICES REPORT RPEPARED BY SIMPSON KOTZMAN

Her Majesty's Theatre
7 Lydiard Street South, Ballarat

Building Services Report
Feasibility Report Stage 2

Prepared by
Simpson Kotzman Pty Ltd
Consulting Engineers
Project No 21895
30 June 2019

Her Majesty's Theatre
7 Lydiard Street South, Ballarat

Building Services Report
Feasibility report Stage 2

Prepared by
Simpson Kotzman
Consulting Engineers

Table of Contents

VERSION	DATE	DESCRIPTION	AUTHOR
A	30/06/2019	Initial Issue	JK/MA

1 BACKGROUND

This Feasibility Report Stage 2 provides Building Services assessment and recommendations on the Her Majesty's Theatre Compliance, Facilities & Operational Upgrade Feasibility Report prepared by Lovell Chen in November 2018, to assist in the preparation of Her Majesty Theatre - Feasibility Report Stage 2.

Proposed future Stage 3 works at Her Majesty's primarily consist of compliance works required to bring the theatre up to current compliance standards, including improved disability access to the building. The works will include amenities upgrades and to bring the building into line with current building codes and compliance requirements.

The existing conditions of each of the relevant building services will be described below. The constraints and recommendations for each service are also described.

2 ELECTRICAL SERVICES

Existing Conditions

- **General**
  - Electrical services included within the building are as follows:
    - Existing Indoor substation supply to the building
    - Main Switchboard (MSB)
    - Distribution boards for the Theatre building
    - Separately metered Distribution board for the Organ Society
    - Lighting and general power reticulation

- **Electrical supply**
  - The electrical supply to the building is fed from an existing substation located on sub-basement level 1. Access to the substation is from the Lewis Street at the rear of the building.
  - The mains cable from the substation to the MSB was installed as part of major works in 1989.

- **Main switchboard**
  - The MSB was installed as part of previous major works and is in good condition.
  - The rating of the existing MSB will accommodate additional loads, however if the existing MSB is retained the board will require extending which would likely trigger egress compliance issues for the switchroom
  - Essential services in the existing MSB are not segregated and not compliant to current AS3000:2018 requirements.

- **Distribution boards**
  - Distribution boards are located on Sub-basement level 1 and Stalls level 3, some in dedicated cupboards and some wall mounted.
  - All distribution boards are nearing end of service life with limited spare capacity for additional circuits.
  - The majority of circuits on each distribution board are not RCD protected which is not AS3000:2018 compliant
  - Submains cabling in the building appears to be recently upgraded and is in good condition from a visual inspection

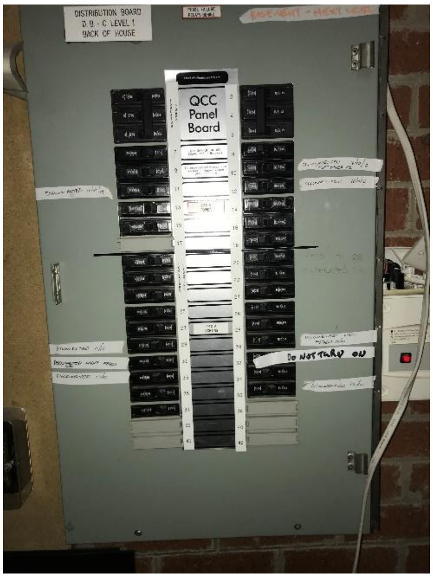
- **Lighting and general power circuits**
  - Light fittings are generally dated and recommend be replaced with efficient LED lighting.
  - Power outlets are generally in good visual condition throughout
  - Lighting and power subcircuit wiring condition appears in good condition from a visual inspection of accessible visible areas.

- Emergency lighting and exit lighting upgrade has recently been undertaken to bring the system up to current standards. The system is a central DC system with new charging equipment and batteries included.

The photographs below show various components of the existing electrical services.

Main Switchboard – Basement Level 1

Stage Switchboard – Stalls Level 3



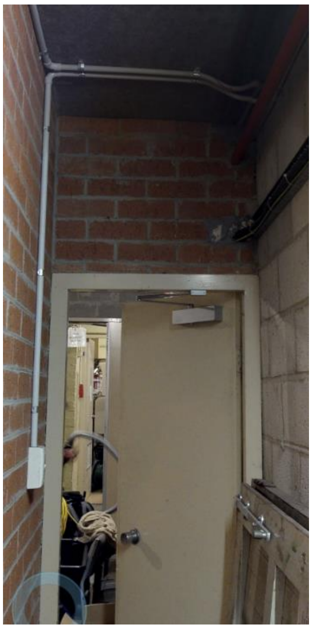
BOH Switchboard –Basement Level 1

FOH Switchboard –Stalls Level 3

FOH Switchboard –Basement Level 1

Electrical Services Constraints:

- Metering data for the theatre is yet to be confirmed by the electricity retailer. At this stage we are unable to confirm if the existing Powercor 500kVA substation is nearing supply capacity and therefore trigger the need to upgrade to accommodate additional electrical loads from proposed Stage 3 works. Note the existing substation supplies power to other loads external to the theatre building which need to be considered when calculating spare load capacity of the substation.
- CitiPower have been contacted for historical substation load information however records are only available for the previous 12 months. Therefore, loading information is only available during the Stage 1 construction works and is not an accurate indication of the buildings load during peak operational/performance times.
- Should the substation require an upgrade, the spatial requirements for a higher rated substation are larger than that provided by the existing substation room. A rearrangement of the Level 1 areas likely be required to accommodate a higher rated substation.
- The MSB rating will accommodate additional loads, however if the existing MSB is used an additional tier will be need to be provided alongside the existing. This will increase the length of the switchboard to over 3 meters, which would likely trigger a requirement for an additional point of egress from the switchroom as per AS3000:2018
- Essential services on the MSB are not segregated and there is no means to isolate the incoming supply via a main switch. Therefore, the MSB is non-compliant. Further investigation would be needed to determine if the existing MSB can be modified to achieve compliance.
- Existing switchroom egress doorway is smaller in width and height than that required by AS3000:2018. Risk the doorway is required to be larger to achieve compliance.



Switchroom Egress Door – Basement Level 1

Recommendations for Feasibility Study - Electrical

- Further investigate the requirement for a power supply (substation) upgrade to the site
- Replace main switchboard with new compliant main switchboard
- Investigate the need to upgrade incoming mains cabling based on proposed loads, including the addition of new lifts
- Replace distribution switchboards with new compliant boards throughout
- Investigate the need to upgrade subcircuit wiring to whole of building to current codes and compliance.

- Provide new efficient LED general and house lighting with upgraded lighting control systems throughout.
- Provide new performance (theatre) lighting with upgraded lighting control system.
- Include electrical services provisions to suit the revised theatre layout and extensions.
- Upgrade audio loop to wireless system.
- Include special purpose power throughout, including for additional lifts and mechanical plant
- Upgrade communications and data infrastructure.
- Include additional emergency and exit luminaires if required due to the proposed building works.

3 FIRE PROTECTION SERVICES

Existing Conditions

- Fire Protection Services included within the building are as follows:
  - Automatic Fire Sprinklers installed throughout with some agreed areas not protected as required by sprinkler code current at the time of installation in 1987/88.
  - Fire alarm system comprising a new Wormald installed Vigilant MX1 fire panel connected to new smoke detectors and other equipment.
  - Occupant warning system comprising wall mounted sounders and strobe lights are interlocked with the fire alarm system.
  - Fire services comprising external hydrants points within town mains in Lewis Street and Lydiard street plus internal hydrants.
  - A mechanical services fire brigade control panel is also provided within the theatre entry foyer.
  - Hand fire extinguisher are provided in selected areas.

Fire Protection Services Constraints:

- Automatic Fire Sprinklers installed do not have complete coverage in accordance with the current Australian Standard AS2118.1 with the main area of non-compliance being the absence of sprinklers below the main theatre ceiling. Due the height of the space, it is considered unlikely that these sprinklers would operate in the early stage of a fire in any event (Fire Engineering Review Required). It is considered that there are some other minor areas of non-compliance which should be rectified in any upgrade.

  The existing automatic fire sprinkler control valves are located against the North side of the building adjacent to Unicorn Lane.

  A sample of fire sprinkler heads were tested in 2018 and found to be suitable for retention without replacement due to age.

- The fire alarm system coverage is incomplete with no smoke detectors installed at Basement 1 and Basement 2 levels. In any upgrade these work should be undertaken.

- The existing occupant warning system could be extended if required.

- In regard to the fire service, the City of Ballarat commissioned hydrant flow in February 2018 which showed available pressure at feed hydrants in Lewis Street and Lydiard Street to provide 20 litres /second at two outlets flowing simultaneously at 310kPa residual pressure. AS2419.1 would require a minimum of 200kPa for feed hydrants so this showed compliance. The tested internal hydrants residual pressure of 320kPa (2 operating) against the Code minimum of 350kPa This showed a non-compliance with the deemed to satisfy requirements.

- The mechanical services fire brigade control panel would be upgraded in the event of any mechanical services works being undertaken.

Recommendations for Feasibility Study – Fire Protection Services

- Automatic Fire Sprinklers to be extended to provided complete coverage in accordance with the current Australian Standard AS2118.1 subject to Fire Engineering review of the main theatre auditorium ceiling. Include alterations and additions arising from implementation of the new works.

  As a result of the proposed enclosure of the fire escape stair, the sprinkler control valves will need to be considered in the design of the new enclosure. Likely requirement is that a new control valve installation will be required in a position approved by the local fire brigade and the Relevant Building Surveyor.

- Undertake extension of the existing fire alarm system coverage to include smoke detectors installed at Basement 1 and Basement 2 levels.
- Carry out alterations and additions to the existing occupant warning system to take into account the proposed building works.
- In regard to fire service, obtain formal sign off of the water pressure non-compliance noted earlier. Consult with Local Fire brigade and Relevant Building Surveyor. Ensure booster connections and suction heads are incorporated into the fire sprinkler and fire hydrant system.
- Install new mechanical services fire brigade control panel to suit revised mechanical plant.
- Review extent of hand fire extinguishers required and amend as required.

4 MECHANICAL SERVICES

Existing Conditions

Mechanical Services included within the building are as follows:

Air Conditioning and Ventilation

This area is air conditioned via the following:

The Auditorium and Stage Air handling unit is located at roof plant room level supplying air conditioned 100% outside air to the front of the auditorium via wall mounted outlets on each side of the stage (3,190 litres/second) and to the Stage (600 litres/second). No return air provision is included and all supply air is spilled to outside via ceiling openings into the roof space and via roof cowls.

Auditorium Air Handling Unit

A ceiling mounted local ducted fan coil unit is provided to air condition the Dress Circle. No outside air is provided to this system. The fan coil supply air quantity is 700 litres/second.

Two ducted fan coil units located at Stalls sub floor plan supply air (1,470 litres/sec) to the rear of the stalls seating area. Again no outside air included.

The Gallery is not specifically air conditioned but includes a relief air system which would partially air condition the space by movement of air conditioned air from the auditorium system to this area. The relief air system directly exhausts air through the north facade at this level.

Air conditioning is provided to the sub-basement Level 1 Dressing Rooms via a local 100% outside air fan coil unit (790 l/s).

Air conditioning is provided to the Basement Level 2 Dressing Rooms via a local 100% outside air system comprising an axial fan with duct mounted heating and cooling coils The air quantity is 995 litres/second. No return air is provided.

A local air conditioning unit is provided at ground floor level to server the ticket office.

Air conditioning to the sub-auditorium area which includes offices and the Kittson Room is provided by local fan exposed coil units. No specific outside air is provided to these areas and ventilation relies on an exhaust system which draws air from other areas. Heating is provided by hot water radiators.

The Green Room is provided with a local fan coil unit fitted with a cooling coil.

The Long Room is air conditioned via an air cooled externally mounted packaged reverse cycle air conditioning unit connected to externally run ductwork with roof penetrations through to ceiling supply outlets and return air grilles.

Existing Long Room air conditioning system

Thermal Plant

Heating to the building is provided by a roof mounted gas fired boiler installed in 2015 which reticulates heating water to hot water radiators located through the building. The boiler also provided heating water to heating coils located in air handling units serving the front of the Auditorium and Stage, plus the fan coil units serving the dressing room at Basement Levels 1 & 2. Foot warmers are also provided in selected areas of the auditorium.

Gas fired boiler

Air cooled Chiller

Cooling is provided by a roof mounted Carrier central air cooled chiller set installed in 2015 which delivers chilled water to cooling coils located within air handling units and fan coil units located through the theatre.

Miscellaneous Mechanical Services

Toilet exhaust is provided from the Male and Female toilets located at the sub- basement lavatory level. The exhaust risers run up to a fan chamber at Gallery floor level and then discharge directly to outside.

A toilet exhaust to the toilets at Basement Level 2

Roof mounted smoke exhaust fans are provided to the stage area. The exhaust rates are unlikely to comply with current codes.

An exhaust system is also provided to the electricity sub-station.

<u>Mechanical Services Constraints:</u>

The existing air conditioning systems installed throughout the building have considerable deficiency as noted in previous studies and the deficiencies relate to the following:-

Insufficient outside air is provided throughout the building to comply with current codes (AS1668.2) with a maximum population within the auditorium of up to 1000 people. The theatre auditorium is provided with 3,190 litres per second of outside air which is sufficient for 319 people (based on the standard 10 litres per second) or 425 litres second (based on modification to include improved air filters to allow 7.5 litres/second per person). Parts of the sub-auditorium level (Kittson Room and adjacent offices) appear to have no direct outside air.

No return air is included in the main auditorium and the air supplied is directly spilled to outside via the roof space and the roof cowls installed. No heat recovery is included. This arrangement is contrary to the energy efficiency requirements of the current Nations Construction Code (NCC).

The chilled water plant and heating water plant at roof plant are nearing their serviceable life and should be replaced in any upgrade.

Recommendations for Feasibility Study – Mechanical Services

The following mechanical services works are required:-

Auditorium Air Conditioning

Upgrade air handling plant serving the Auditorium and Stage to provide sufficient outside air to serve the maximum population of up to 1,000 people. This will require more than double the amount of supply air presently delivered to the auditorium. The supply air for the auditorium would increase from 3,190 litres/second to 7,500 litres per second. A new variable volume air handler delivering 100% outside air would be required with new ductwork and an increased area of supply air openings into the auditorium. A system of CO_2 sensors would be included to reduce the supply air rate in periods of partial occupancy.

The new air handling plant would include a ducted spill air arrangement whereby heat recovery from the spill air could be undertaken for compliance with energy efficiency requirements of the NCC.

Investigations were undertaken into use of air purification systems to allow reduced outside air rates and these systems are not considered feasible for the Her Majesty's Theatre. Such systems have been applied in the United States whereby the gas cleaning technology (gas phase or chemical cleaning option) are used with high efficiency filters to reduce outside air to as low as 2.5 litres/second per person.

As a result of the increased heating and cooling load arising from the increased outside air requirement, additional chilled water and heating water plant will need to be increase in capacity. New Chiller and boiler plant are proposed at roof level. By the adoption of heat recovery from the theatre to precool or preheat the outside air, the increase in load will be minimised. Further studies are required to establish the increase capacity actually required.

Other Mechanical Services Works

A new building automation system is proposed to control and monitor the mechanical services plant. A new mechanical services switchboard would be required. A new mechanical services control panel would be required at the ground floor entry to replace the existing.

Outside air provisions to the sub-auditorium level should be improved. The current arrangement is not a reliable system of ventilation.

Toilet exhaust alterations and additions are required to meet the proposed scope of works.

An option included in the study was to convert the roof over the Long Room to an outdoor deck. This conversion would require the removal of the existing air conditioning plan t serving the Long Room and the installation of new plant. One solution would be to include ducted ceiling mounted fan coil units connected to the new heating water and chilled water plant.

Review smoke exhaust system to Stage area and allow to upgrade.

5 HYDRAULIC SERVICES

Existing Conditions

- Hydraulic Services included within the building are as follows:
  - Cold water connection to Lydiard Street towns main for domestic water, fire service and fire sprinkler services.
  - Local domestic hot water plant.
  - Sanitary plumbing including connection to authority sewer.
  - Storm water drainage from roof to site infrastructure.

Hydraulic Services Constraints:

Major constraint on the site is the invert level of the connection to the authority sewer main. The installation of facilities below this level will require a sewer pumping station.

Stormwater has been on issue on site previously and any new works will require alterations and additions the existing system.

Recommendations for Feasibility Study – Hydraulic Services

Extend water services to new or relocated positions.
Install local domestic hot water systems to provide for new facilities.
Undertake sanitary plumbing works to connect to new or relocated facilities.

6 LIFT SERVICES

Lift Services Constraints:

Two new DDA lifts are proposed. Preferred type for commercial use are MRL type which require lift pits and top over runs. Use of systems which use domestic standard lifts is non-preferred as they are not designed for the frequency of operation likely in this installation.

An option considered in the feasibility study is to include a new lift to connect between the long room and the proposed Terrace over the Long Room.

Recommendations for Feasibility Study – Lift Services

Incorporate where possible, commercial MRL type lifts which are suitable for the duty likely to be encountered in this installation.

Where this is not possible due to spatial constraints and the inability to incorporate lift pits and to over runs, utilise lifts suitable for limited DDA use only.

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APPENDIX H COST PLAN REPORT RPEPARED BY PLANCOST AUSTRALIA

4 February 2020

Her Majesty's Theatre Ballarat

Cost Plan 6
Revision D
Future Works

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Her Majesty's Theatre Ballarat

Cost Plan 6
Revision D
Future Works

EXECUTIVE SUMMARY

4 February 2020

Introduction

The Cost Plan is based on Future Works documents from Lovell Chen Architects.

Cost Estimates

The current anticipated Total End Cost are:

Building Works	$14,137,500
External Works and Services	$500
Contingencies and Allowances	$2,828,000
Fees, FFE, ITC and Other Client items	$2,036,000
Escalation	$1,598,000
GST	excluded
Total End Cost	**$20,600,000**

Refer to the attached Cost Plan 6 for details.

Note

The Cost Plan is based on preliminary information and therefore should be regarded as indicative only of the possible order of cost.

The cost of various components of the Cost Plan could vary significantly depending on the final design, materials selection and quality of the proposed building works.

We recommend that a detailed Cost Plan be prepared at Schematic Design stage to verify the anticipated total cost.

Her Majesty's Theatre Ballarat

Cost Plan 6
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Future Works

EXECUTIVE SUMMARY

4 February 2020

Inclusions

The Cost Plan includes allowances for the following:

- Building works
- External works
- External Services
- Site and services infrastructure upgrades
- Demolition
- Asbestos removal
- Design contingencies
- Construction contingencies
- Consultants' fees
- Furniture, furnishings and equipment
- IT, AV and communications equipment
- Cost escalation up to completion of construction February, 2023

Exclusions

The Cost Plan excludes the following:

- Rock excavation
- Site decontamination (in ground only)
- Rainwater harvesting
- Landscaping
- Locality allowance
- Staging costs
- Procurement method costs
- Environmentally sustainable design initiatives
- Disbursements
- Management support costs
- Supply authority charges
- Prolongation and delay risk
- Client contingency
- Cost escalation after February, 2023
- GST
- Land purchase
- Seismic upgrades to the building structure

Her Majesty's Theatre Ballarat

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4 February 2020

COST PLAN SUMMARY

	Quantity	Rate	Total
COST COMPONENT			
Basement	996 m²		
Basement 02	352 m²		
Ground Floor	1093 m²		
First Floor	489 m²		
Second Floor	346 m²		
TOTAL BUILDING COST (TBC)	3276 m²	4,315	**14,137,500**
External works and services			excluded
NET CONSTRUCTION COST (NCC) (Feb, 2020)		4,316	**14,138,000**
Locality allowance			excluded
Additional costs for staging of the works			excluded
Design contingency	10.00%		1,414,000
Construction contingency	10.00%		1,414,000
TOTAL CONSTRUCTION COST (TCC) (Feb, 2020)		5,179	**16,966,000**
Consultants' fees	10.00%		1,697,000
Project Management Fees (Provisional)	2.00%		339,000
Disbursements			excluded
Management support costs			excluded
Furniture, furnishings and equipment			incl above
IT, AV and communications equipment			0
Supply authority and headworks charges			excluded
TOTAL PROJECT COST (TPC) (Feb, 2020)		5,800	**19,002,000**

Cost escalation

Escalation rate	3.50%	Market conditions		0.00%		
Up To	Date	Months	%/Year	Weighting	Total %	Total
Tender	Feb, 21	12	3.50%	100%	3.50%	666,000
Completion	Feb, 23	24	3.50%	70%	4.90%	932,000

	Quantity	Rate	Total
Goods and services tax	10.00%		excluded
Client contingency	0.00%		excluded
TOTAL END COST (TEC) (Feb, 2023)	3276 m²	6,288	**20,600,000**

COST OPTIONS			
Construct new two storey green room to the foot print of the rear skillion structure incorporating a new stair and unisex sanitary facilities.	Additional		646,900
Construction of new prop store	Additional		78,700

The options indicated above include builder's margin and all % mark-ups included in the Cost Plan.

Her Majesty's Theatre Ballarat

Cost Plan 6
Revision D
Future Works

4 February 2020

COST PLAN SUMMARY

	Quantity	Rate	Total
COST COMPONENT			
PROPOSED STAGE 3A WORKS (PRIORITY 0 & 1) (refer to attached breakdown)			
Priority 0 (refer to attached breakdown)			612,028
Priority 1 (refer to attached breakdown)			12,395,323
PROPOSED STAGE 3A WORKS - TOTAL END COST (TEC)			13,007,351

The priorities indicated above include builder's margin and all % mark-ups included in the Cost Plan.

POTENTIAL SCOPE OMISSIONS IN STAGE 3A (PRIORITY 0 & 1) TO ACHIEVE BUDGET		
Delete - Reconfiguration of dressing rooms and upgrade of sanitary facilities to Basement Level 1 & 2	Reduction in TEC	-461,644
Delete - All new fixtures, finishes and fittings including furniture to the dressing rooms Basement Level 1	Reduction in TEC	-61,203
Delete - New lift to back of house	Reduction in TEC	-306,014
Delete - Remove the adjudicator's box from the front of the dress circle and reinstate balustrade to match existing	Reduction in TEC	-69,946
Delete - Reconfigure the sanitary facilities to the Basement Level 1 & 2 and the green rooms, including shower facilities	Reduction in TEC	-1,661,220
Delete - Rewire whole of building to current codes and compliance	Reduction in TEC	-1,432,146
Delete - Upgrade whole of mechanical plant system	Reduction in TEC	-2,490,081
Delete - New computerized monitoring system	Reduction in TEC	-87,433
Delete - New artist room within existing green room at stage level	Reduction in TEC	-87,433
TOTAL POTENTIAL SCOPE OMISSIONS		-6,657,120
PRIORITY 0 & 1 TOTAL END COST BEFORE ABOVE OMISSIONS		13,007,351
PRIORITY 0 & 1 TOTAL END COST AFTER ABOVE OMISSIONS		6,350,231
PRIORITY 0 & 1 TARGET BUDGET		10,000,000

The omissions indicated above include builder's margin and all % mark-ups included in the Cost Plan.

Her Majesty's Theatre Ballarat

Cost Plan 6
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Future Works

COST PLAN

plancost

4 February 2020

Fully **E**nclosed **C**overed **A**rea	3276 m²
Unclosed **C**overed **A**rea	m²
GFA (FECA + UCA)	3276 m²

ITEM	Quantity	Rate	Total
4.1 Hazardous Materials			
4.1 Hazardous Materials			
A suitably qualified contractor should be engaged for the management, removal and disposal of all hazardous materials. • Refer to the Part 6 Audit for details on hazardous materials and their location. • Include a contingency to address latent conditions with respect to hazardous material management and removal.	Provisional		50,000
4.2 Compliance Upgrade			
4.2.1 Balustrades			
Upgrade all stairs to include tactile indicators, colour contrasting nosing strips and complaint handrails.	Item		244,000
Upgrade all ramps to include tactile indicators, colour contrasting nosing strips and complaint handrails. (assumed 100m2)	Item		50,000
Increase the height of balustrades only to the end of isles within the dress circle and balcony to minimise fall risk, but without obstruction of sight lines. Structural upgrade to entire balustrade within dress circle and balcony	Item		126,000
Provide handrails to stairs within the dress circle and balcony.	Item		112,000
Provide new lift to front of house with access to basement level 1, ground floor, auditorium stalls, dress circle and long room.	Item		205,000
Provide new lift to back of house with access to basement level 1, auditorium stalls, stage, green rooms and dress circle.	Item		175,000
Upgrade door hardware throughout to comply with AS 1428.1	Item		136,000
Remove the adjudicator’s box from the front of the dress circle and reinstate balustrade to match existing profiles.	Item		40,000
4.2.2 Seating			
Provide a minimum of 5 new disability compliant seats to the dress circle level.	Item		10,000
Maintain a minimum of 14 disability compliant seats to the stalls and reinstate to standard fixed seats within the stalls and the 4 transfer arm seats. (assumed 100 seat replacement)	Item		75,000
4.2.3 Ticket and Refreshment Sales			
Upgrade bar and ticket sales counters to include zones for common reach of disables and ambulant persons.	Item		175,000
Relocate the bar and ticket sales counter to increase the foyer space including reducing the ticket office.	Item		incl above
Upgrade long room bar to include zones for common reach of disabled and ambulant persons.	Item		135,000
4.2.4 Sanitary Facilities			
Generally upgrade all sanitary facilities to front of house areas and include ambulant closet facilities.	Item		450,000
Retain the male facilities in the basement, identified as being of primary significance. Minor upgrade to these facilities should be accepted to include ambulant closet facilities.	Item		incl below
Provide new disability accessible toilet facilities including fold away baby change tables.	Item		incl below

Fully **E**nclosed **C**overed **A**rea	3276 m²
Unclosed **C**overed **A**rea	m²
GFA (FECA + UCA)	3276 m²

	Quantity	Rate	Total
Reconfigure the sanitary facilities to the basement level 1 and 2 and the green rooms, including shower facilities.	Item		950,000
Upgrade all associated statutory signage to comply with the provisions of AS 1428.1 – 2009 Section 8.	Item		35,000
Provide a total of 7 shower facilities to the back of house areas.	Provisional		25,000
4.3 Services Upgrades			
4.3.1 Electrical Upgrades			
Replace switchboards containing hazardous materials.	Item		50,000
Investigate loads and potential for electrical upgrades.	Item		10,000
Rewire whole of building to current codes and compliance.	Item		819,000
Upgrade DC battery system with upgrade of fire safety systems.	Item		50,000
4.3.2 Lighting and Sound			
Install a new wireless audio induction loop to the auditorium, cry room and long room.	Provisional		100,000
Upgrade the existing front of house and back of house PA systems to be integrated with the emergency warning and intercommunication system (EWIS).	Provisional		50,000
Upgrade auditorium lighting. Replace existing chandeliers with Victorian Era lighting.	Provisional		350,000
Upgrade all lighting generally.	Provisional		50,000
Sound equipment upgrade (including stage lighting)	Excluded		0
Upgrade backstage and bio-box lighting controls and dimmer systems.	Excluded		0
Upgrade performance lighting, rigging bars and other associated mountings	Excluded		0
4.3.3 Mechanical and Plant Platforms			
Remove the split system to the ticket box when redeveloping the foyer	Item		1,000
Ensure redevelopment of the south and north stair provisions of new plant platforms including access and maintenance	Item		500,000
Upgrade whole of mechanical plant system	Item		1,424,000
Confirm the capacity of the existing plant and upgrade all plant equipment.	Item		incl. above
4.3.4 Stormwater System			
Replace existing stormwater systems on the south and east elevations, including that belonging to the neighbouring property	Item		51,000
4.3.5 Fire Safety			
Construction and FRL's			

Her Majesty's Theatre Ballarat

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COST PLAN

4 February 2020

Fully **E**nclosed **C**overed **A**rea	3276 m²
Unclosed **C**overed **A**rea	m²
GFA (FECA + UCA)	3276 m²

	Quantity	Rate	Total
Bio-box glazed (and operable) openings between the bio-box and auditorium to be provided with AS 2118.12 fast response pendant sprinkler to the auditorium side.	Item		15,000
Long room north stair to be separated by 35mm thick solid core timber doors and protected by AS 2118.12 fast response pendant sprinkler to the long room side.	Item		8,000
Auditorium stair to be fire separated by 35mm thick solid core timber doors and protected by AS 2118.12 fast response pendant sprinkler to the auditorium side.	Item		8,000
Basement level substation and switch board construction to FRL 120/120/120 with FRL -/120/30 self-closing fire doors.	Provisional		15,000
Basement level battery room construction to FRL 120/120/120 with FRL -/120/30 self-closing fire doors.	Provisional		15,000
Basement backstage to be separated from administration and organ with fire rated door FRL -/120/30 with vision panel.	Item		25,000
Fire wall to be made good with penetrations to FRL -/120/120 and penetrations protected to NCC C3.15	Provisional		5,000
Louvers in external wall of auditorium to bio-box to be covered in metal sheet and sprinkler protection above	Item		10,000
Smoke walls are to be made good to NCC specification C2.5 Clause 2.	Provisional		5,000
Existing doors adopted as fire/smoke doors for the purpose of Performance Solution are to be provided with AS 1530.7 smoke seals. (assumed 10No.)	Item		25,000
Sprinkler Protection			
Re-working of existing sprinkler protection only to areas of refurbishment with exception of the auditorium and organ areas.	Provisional		100,000
Within Long Room - Provide a 2A:20BE fire extinguisher adjacent to exist	Item		500
Bio-box glazed (and operable) openings between the bio-box and auditorium to be provided with AS 2118.12 fast response pendant sprinkler to the auditorium side.	Item		15,000
Long room north stair to be separated by 35mm thick solid core timber doors and protected by AS 2118.12 fast response pendant sprinkler to the long room side.	Item		5,000
Auditorium stair to be fire separated by 35mm thick solid core timber doors and protected by AS 2118.12 fast response pendant sprinkler to the auditorium side.	Item		18,000
Fire Detection and Alarm			
Provide a manual call point at the sub-panel and FIP and at proscenium control.	Item		10,000
Provide a public address (PA) system is to be provided at the bio-box and at the sub-panel.	Provisional		30,000
Ensure building occupants warning speaker and strobe is provided within the orchestra pit and organ areas.	Item		5,000
Ensure building occupant warning speaker and strobe is provided at far end of fly platform.	Item		5,000
Management			
Implement hot works permits for contractors.	By client		0
Induct contractors into fire evacuation procedures.	By client		0
A designated fire warder to be present on site at all times.	By client		0

Fully **E**nclosed **C**overed **A**rea	3276 m²
Unclosed **C**overed **A**rea	m²
GFA (FECA + UCA)	3276 m²

	Quantity	Rate	Total
Manual call point to be available at each required exist.	Item		13,000
The stairs are to be adopted as a safe haven for occupants in wheelchairs. The stair is to be separated from the auditorium by inherently fire resistant walls (masonry). Wall openings are to be protected by existing doors with sprinkler protection or self-closing minimum FRL -/120/30 door leaves with AS 1530.7 cool/medium temperature smoke seals and AS 1530.4 intumescent fire seals to the door heads, side and stiles.	Item		222,000
4.4 Facilities and Operations Upgrades			
4.4.1 Offices and Facilities Upgrades			
Upgrade the administration areas into the area allocations identified above.	Item		528,000
Continue to use the sanitary facilities throughout the basement level 1.	Nil		0
Provide compliant disability access from Unicorn Lane to basement level by ramp including new sprinkler control valves	Item		35,000
Provide all new furniture associated with the fit out works, consisting of workstations, shelving, partitions, chairs, tables and the like.	Provisional		210,000
4.4.2 Back of House Upgrades			
Increase capacity of the stage by extending the southern wing through removal of the existing southern stores and opening up the southern wall of the stage.	Item		220,000
Incorporate new trap doors into the stage along with required fire rating needed for compartmentation.	Excluded		0
Construct a new lift, fire lobby and egress stair to replace the existing stairs. This lift will service the stage, basement level 1, stalls and dress circle. Including new fire door	Item		35,000
New artist room within existing green room at stage level	Item		50,000
Construct new two storey green room to the foot print of the rear skillion structure incorporating a new stair and unisex sanitary facilities.	Option		0
Construct a new props store.	Option		0
Generally reconfigure the dressing rooms to basement level 1 including full upgrade of sanitary facilities to Basement level 1 and 2 as outlined in Section 4.2.4.	Item		264,000
Provide all new fixtures, finishes and fittings including furniture to the dressing rooms.	Provisional		35,000
4.4.3 Orchestra Pit Upgrades			
Implement the works outlined in the specification for: Orchestra Pit Modules, Stalls Removable Wall, Drapery and Track dated June 2010.	Provisional		450,000
4.4.4 Fly Tower and Bio Box			
Install automated winches to the fly system.	Provisional		100,000
4.4.5 Roof Access System			
Design and install a complaint roof access system to provide access to all roof areas for maintenance or roofs, gutters and access to plant and plant platforms.	Item		115,000

Fully **E**nclosed **C**overed **A**rea	3276 m²
Unclosed **C**overed **A**rea	m²
GFA (FECA + UCA)	3276 m²

	Quantity	Rate	Total
Initiate a maintenance regime for annual testing of all access systems from date of initial certification.	By client		0
Design an access system so that access can be gained to the rear wall of the fly tower (east wall) to install banners and other forms of temporary signage.	Provisional		50,000
4.4.6 Organ and Organ Chamber			
Relocate the organ to the south of the stage.	Provisional		30,000
Upgrade the organ hoisting equipment to facilitate the proposed modular stage extension and orchestra pit cover system.	Item		90,000
4.4.7 Front of House			
Demolish the existing bar, ticket box and office.	Item		15,000
Construct a new bar with integrated fridges and point of sale.	Provisional		100,000
Close off the existing opening between the Foyer and the north vestibule with a fire rated infill.	Item		4,000
Widen the existing opening between the south vestibule and foyer.	Item		2,000
Reconfigure the existing ramping in the south vestibule.	Item		10,000
Install digital signage.	Provisional		10,000
4.5 Conservation Works			
Undertake paint sample analysis to interior spaces to inform repainting.	Excluded		0
Undertake conservation works associated with the works and repainting generally. This including stripping of existing paint where required, removal of efflorescence and other damage due to damp, patching, preparation, stencilling and repainting. It also includes multi-coloured paint schemes to match existing finishes and heritage requirements. Refer to Section 4.5 of the Feasibility Report.	Provisional		1,500,000
Reinstate the mural inside the plaster dome of the auditorium including scaffolding	Provisional		250,000
Install damp treatment to the external walls to address rising damp.	Provisional		150,000
At the completion of all works the CMP should be updated to reflect the alterations and to ensure that the building caretakers have guiding policies that are consistent with the buildings current form.	Excluded		0
4.6 Sundry Works			
Install new computerised monitoring system.	Provisional		50,000
Replace existing Fire Indicator Panel with a new addressable Fire Indicator Panel complete with new addressable smoke detectors, thermal detectors and beam detectors. The existing occupant warning sounders and strobes would be retained. The existing wiring would be reused to avoid requirement for damaging chases and ceiling access for new cable runs. A new external alarm bell would replace the existing.	Provisional		300,000
Rectification of the box gutter on the roof of the long room.	Provisional		25,000
The sprinkler control valves will need to be relocated due to the construction of the new northern fire stair since they currently sit in that footprint.	Provisional		150,000

Her Majesty's Theatre Ballarat

Cost Plan 6
Revision D
Future Works

4 February 2020

COST PLAN

Fully **E**nclosed **C**overed **A**rea	3276 m²
Unclosed **C**overed **A**rea	m²
GFA (FECA + UCA)	3276 m²

	Quantity	Rate	Total
Section 5.3 - consideration should potentially be given to a seismic solution that is formulated to AS 3826-1998: Strengthening existing buildings for earthquake via a Performance Solution approach since compliance with AS 1170.4 for a building like this is expected to be extremely onerous, if not impossible.	Excluded		0
Option for construction of a roof deck above the Long Room for extended function space.	Excluded		0
Sub-total BUILDING WORKS	\$3596.00/m²FECA \$3596.00/m²GFA		**11,780,500**
Preliminaries, overheads and profit	20.00%		2,357,000
TOTAL COST			**14,137,500**

	Accessibility
	Safety and compliance
	Amenity
	Conservation

COB HMT 3 Feasibility scope priority options sheet - Draft

PRIORITY	Notes	Item Cost	LOVELL CHEN FEASIBILITY REPORT	HENDRY REPORT	MORRIS CONSULTING	MARK HODKINSON - Structural	GINCAT	SIMPSON KOTZMAN	PLANCOST GROSS	PLANCOST EST	PRIORITY
			Conservation Works								
2	Reduce to priority 2, $20k FOR REPORT		Undertake paint sample analysis to interior spaces to inform repainting.						excluded	excluded	2
1 and 2	Disperse to separable portions		Undertake conservation works associated with the works and repainting generally. Includes localised paint removal, painting the proscenium, ceilings of balconies and auditorium and as associated with other works throughout.						2,622,979	1,500,000	2
2			Reinstate the mural inside the plaster dome of the auditorium.						437,163	250,000	2
2	Reduce to priority 2 but consider as next item to move into priority 1 if budget $10 million allows - while integral to reducing moisture ingress its not a safety issue and interim measures to waterproof applied from internal with stage 1 works already complete.		Install damp treatment to the external walls along Lydiard St to address rising damp.						262,298	150,000	2
2	Allow $50k for CMP		At the completion of all works the CMP should be updated to reflect the alterations and to ensure that the building caretakers have guiding policies that are consistent with the buildings current form.						excluded	excluded	2
			Hazardous Materials								
	Contingency $50,000 for latent conditions		A suitably qualified contractor should be engaged for the management, removal and disposal of all hazardous materials.						87,433	50,000	1
1	Priority 1 -Council policy to remove asbestos when the opportunity presents so look to include this aspect of hazardous mtl component - disperse across the separable portions	Separate cost unknown	Refer to the Part 6 Audit for details on hazardous materials and their location.						Included above	Included above	1
	refer above		Include a contingency to address latent conditions with respect to hazardous material management and removal.						Included above	Included above	1
			Facilities Upgrade								
2 and 1	Reduce to priority 2, however maintain all abilities access through this area. Fit out of new offices in stage 2	Cost to maintain access not iyet identified	Upgrade the administration areas into the area allocations identified above.		The offices & facilities are located on basement level 1 & 2 are proposed to be upgraded into the following configuration, 1 x individual office, open plan office layout, staff kitchenette & storage areas. Ensure compliant continuous accessible path of travel/circulation space is provided to corridors, doorways (Hinged & sliding) open office layout, kitchenette & storage rooms,				923,288	528,000	2
1	Tie in with safety egress	61,328	Provide compliant disability access from Unicorn Lane to basement level by ramp.	The sprinkler control valves will need to be relocated due to the construction of the new northern fire stair since they currently sit in that footprint.		The Unicorn Lane stair structure does not comply with Section 3.6 of AS1170.1 - Structural Design Actions Part 1 : Permanent, imposed and other actions for the required C3 loading.		As a result of the proposed enclosure of the fire escape stair, the sprinkler control valves will need to be considered in the design of the new enclosure. Likely requirement is that a new control valve installation will be required in a position approved by the local fire brigade and the Relevant Building Surveyor.	61,203	35,000	1
2			Provide all new furniture associated with the fit out works, consisting of workstations, shelving, partitions, chairs, tables and the like.		kitchenettes with a universal bench height of 900 mm above floor level & appliances ((Taps/GPOs/Microwave/Vending machines) within reach range zones.				367,217	210,000	2
2	Reduce to priority 2		Increase capacity of the stage by extending the southern wing through removal of the existing southern stores and opening up the southern wall of the stage.		The back of house areas are proposed to be upgraded to provide an increased capacity of the stage, dressing rooms, green room, storage areas & sanitary facilities.				384,704	220,000	2
1	Need to include allocation for this to tie in with safety egress	78,850	Construct a new stair and fire lobby to replace the existing stairs. This egress stair will services the stage, basement level 1, stalls and dress circle. Retain existing south fire stair.	The sprinkler control valves will need to be relocated due to the construction of the new northern fire stair since they currently sit in that footprint. SEEK DISPENSATION FROM CFA			At Basement Level 2 - Provide a BCA specification C3.4 sliding fire door. The walls that separate the required fire isolated stair from the lift shaft are to be of FRL 120/120/120 or FRL -/120/120 construction as appropriate for loadbearing and non-loadbearing shaft walls, respectively. Door openings to the lift lobby to be protected by FRL -/120/30 fire doors fitted to AS1530.4 intumescent fire and AS1530.7 medium temperature smoke seals and vision panels. These doors are to be self-closing or interfaced to the building wide alarm system to close in accordance with BCA specification C3.4	Incorporate where possible, commercial MRL type lifts which are suitable for the duty likely to be encountered in this installation. Where this is not possible due to spatial constraints and the inability to incorporate lift pits and to over runs, utilise lifts suitable for limited DDA use only.	61,203	35,000	1
	DELETE FROM CURRENT SCOPE - COST BELOW THE LINE FOR FUTURE STAGE		Construct new two storey green room to the foot print of the rear skillion structure incorporating a new stair and unisex sanitary facilities.		The back of house areas are proposed to be upgraded to provide an increased capacity of the stage, dressing rooms, green room, storage areas & sanitary facilities.			Extend water services to new or relocated positions. Install local domestic hot water systems to provide for new facilities. Undertake sanitary plumbing works to connect to new or relocated facilities.	Option	Option	2

	DELETE FROM CURRENT SCOPE - COST BELOW THE LINE FOR FUTURE STAGE		Construct a new props store.				Option	Option	2
1	Basement Level 2 - toilets only Basement Level 1 - refurbishment of dressing rooms and toilets.		Generally reconfigure the dressing rooms to basement levels 1 including full upgrade of sanitary facilities to Basement level 1 and 2 as outlined in Section 4.2.4.	Section 4.1.4 – the BCA does not prescribe toilet numbers for participants in single auditorium theatres. It would be logical to apply for participant numbers for other Class 9b performance venues. However, this results in required toilet numbers that greatly exceed what is proposed in the table for the Back-of-House / Staff areas. A Performance Solution could be considered here as part of the Stage 2 works.	The back of house areas are proposed to be upgraded to provide an increased capacity of the stage, dressing rooms, green room, storage areas & sanitary facilities.	Extend water services to new or relocated positions. Install local domestic hot water systems to provide for new facilities. Undertake sanitary plumbing works to connect to new or relocated facilities.	461,644	264,000	1
				Recommend that this be clarified to account for the fact that accessible toilets can be counted once for each sex and that ambulant facilities are included in the overall numbers.			0		
1	Include as it forms part of fire safety works.	Separate cost unidentified		The proposed alterations to Basement 1 will compromise the fire wall strategy implemented in Stage 1 i.e. the removal of part of the fire wall separating the back-of-house and auditorium fire compartments. This will need to be reassessed by the fire engineer as part of the Stage 2 works package.			0		
1	include DDA and ambulant toilets in upgrade			Section 4.1.4 – the table seems to indicate that accessible and ambulant facilities are required in addition to standard male and female toilets.			0		
				The approved building permit drawings associated with the Stage 1 works do not appear to include HA.214. Drawing HA.214 shows a 2.2m ceiling height in the B2.11 corridor serving the dressing rooms.			0		
1	Include as it forms part of fire safety works	Separate cost unidentified		The sliding door in Basement 1 leading to the new southern fire stair will need to be replaced with a swinging door or be assessed by the fire engineer.			0		
				The access consultant will need to rationalise the width of the B2.11 corridor since it is not wide enough to accommodate the circulation spaces required by AS 1428.1-2009.			0		
2				The stairs in the Basement 1 technical room mean that the dressing rooms will still not be accessible, despite the new lift being extended to serve Basement 1. Consider ramping this change in level with compliant 1:14 ramp.			0		
1			Provide all new fixtures, finishes and fittings including furniture to the dressing rooms Basement Level 1				61,203	35,000	1
2			Implement the works outlined in the specification for: Orchestra Pit Modules, Stalls Removable Wall, Drapery and Track dated June 2010.				786,894	450,000	2
2	Reduce to priority 2		Install automated winches to the fly system for lighting bars (Curtain to be French opening).				174,865	100,000	2
1			Design and install a complaint roof access system to provide access to all roof areas for maintenance or roofs, gutters and access to plant and plant platforms.	Section 4.3.5 – consideration should be given to the installation of AS 1657 system for roof access, as appropriate and required.			201,095	115,000	1
	Maintenance cost by client		Initiate a maintenance regime for annual testing of all access systems from date of initial certification.				by client	by client	
2			Design an access system so that access can be gained to the rear wall of the fly tower (east wall) to install banners and other forms of temporary signage.	Section 4.3.5 – consideration should be given to the installation of AS 1657 system for roof access, as appropriate and required.			87,433	50,000	2
2			Relocate the organ within orchestra pit.				52,460	30,000	2
2			Upgrade the organ hoisting equipment.				157,379	90,000	2
1			Close off the existing opening between the Foyer and the north vestibule with a fire rated infill.				6,995	4,000	1
1			Widen the existing opening between the south vestibule and foyer.				3,497	2,000	1
1	Consider this in relation to damp proofing on Lydiard st (to be moved into priority 1 if affordable)	17,487	Reconfigure the existing ramping in the south vestibule.		Access is not provided into the theatre via the main principal pedestrian entry due to the location of the steps, it is noted that there is a compliant wheelchair accessible entry point located adjacent to the main entry. Performance solution to be detailed. The accessible entry point is provided with door leaf's which are non-compliant in width and will need to be operated via a staff management plan. Performance solution to be detailed.		17,487	10,000	1
2			Install digital signage.		Consider the use of digital media screens for front of house areas/lobby areas.		17,487	10,000	2

			Compliance Upgrade								
2	Lower priority look to complete later. Include all balustrade works but complete stair and TI's works later.		Upgrade all stairs to include tactile indicators, colour contrasting nosing strips and complaint handrails.	Section 5.3 – the requirement for the balustrades to meet crowd loading requirements would need to be considered in more detail.	•The existing stairs leading to the theatre will be upgraded to provide compliant handrails, stair nosing's & TGSIs. •All existing stairs throughout the theatre are proposed to be upgraded with compliant handrails/handrail extensions, stair nosing's with 30% luminance contrast & Tactile Ground Surface Indicators (TGSIs).	Section 3.6 of AS1170.1 - Structural Design Actions Part 1 : Permanent, imposed and other actions specifies that balconies in "areas susceptible to over-crowding" such as theatres be capable of withstanding 'crush' loadings which includes a horizontal loading of 3.0 kN/m (C5 loading). The existing balustrades would need to be analysed in order to determine their compliance with AS1170.1.			426,671	244,000	2
1		87,433			All existing ramps throughout the theatre are proposed to be upgraded with compliant handrails/handrail extensions, & Tactile Ground Surface Indicators (TGSIs). New ramps to comply with AS 1428.1,2009				87,433	50,000	1
1	structural upgarde of the balustrade - additional height only to the ends of aisles	220,330	Increase the height of balustrades within the dress circle and balcony front rail to minimise fall risk at the end of aisles, but without obstruction of sight lines.	Section 5.3 – the requirement for the balustrades to meet crowd loading requirements would need to be considered in more detail.	New handrails are to be provided to stairs within the dress circle & balcony levels.	Section 3.6 of AS1170.1 - Structural Design Actions Part 1 : Permanent, imposed and other actions specifies that balconies in "areas susceptible to over-crowding" such as theatres be capable of withstanding 'crush' loadings which includes a horizontal loading of 3.0 kN/m (C5 loading). The existing balustrades would need to be analysed in order to determine their compliance with AS1170.1, and unless the existing balustrades have sufficient capacity as 'arches' then it is extremely unlikely that they would comply with AS1170.1			220,330	126,000	1
1	structural upgarde of the balustrade - height only to the ends of aisles	195,849	Provide handrails to stairs within the dress circle and balcony.	Section 5.3 – the requirement for the balustrades to meet crowd loading requirements would need to be considered in more detail.	New handrails are to be provided to stairs within the dress circle & balcony levels.	Section 3.6 of AS1170.1 - Structural Design Actions Part 1 : Permanent, imposed and other actions specifies that balconies in "areas susceptible to over-crowding" such as theatres be capable of withstanding 'crush' loadings which includes a horizontal loading of 3.0 kN/m (C5 loading). The existing balustrades would need to be analysed in order to determine their compliance with AS1170.1, and unless the existing balustrades have sufficient capacity as 'arches' then it is extremely unlikely that they would comply with AS1170.1			195,849	112,000	1
1		358,474	Provide new lift to front of house with access to basement level 1, ground floor, auditorium stalls, dress circle and long room.	The access consultant will need to rationalise via Performance Solution not having an accessible unisex sanitary facility on each level containing toilets i.e. Basement 1.	the FOH lift which will provide compliant access to the following levels, basement level 1, ground floor, dress circle & long room levels. Consider provision of a DDA refuge space within lobbies.	Possible underpinning of adjacent bluestone walls subject to geotech investigation.		Incorporate where possible, commercial MRL type lifts which are suitable for the duty likely to be encountered in this installation. Where this is not possible due to spatial constraints and the inability to incorporate lift pits and to over runs, utilise lifts suitable for limited DDA use only.	358,474	205,000	1
1		306,014	Provide new lift to back of house with access to basement level 1, auditorium stalls, stage, green rooms and dress circle.	Section 4.3.2 – incorporation of a new lift into the southern fire-isolated stair will require fire engineering verification since the BCA does not permit the sharing of shafts that are required to be fire-rated. The access consultant will need to rationalise via Performance Solution not having an accessible to Basement 2.	The second lift will provide access to the following levels, basement level 1, ground floor, dress circle both FOH & BOH. Consider provision of a DDA refuge space within lobbies.	Possible underpinning of adjacent bluestone walls subject to geotech investigation.	At Basement Level 2 - Provide a BCA specification C3.4 sliding fire door. The walls that separate the required fire isolated stair from the lift shaft are to be of FRL 120/120/120 or FRL -/120/120 construction as appropriate for loadbearing and non-loadbearing shaft walls, respectively. Door openings to the lift lobby to be protected by FRL -/120/30 fire doors fitted to AS1530.4 intumescent fire and AS1530.7 medium temperature smoke seals and vision panels. These doors are to be self-closing or interfaced to the building wide alarm system to close in accordance with BCA specification C3.4	Incorporate where possible, commercial MRL type lifts which are suitable for the duty likely to be encountered in this installation. Where this is not possible due to spatial constraints and the inability to incorporate lift pits and to over runs, utilise lifts suitable for limited DDA use only.	306,014	175,000	1
1		237,817	Upgrade door hardware throughout to comply with AS 1428.1		The door hardware throughout the theatre is proposed to be upgraded to a compliant standard. As a minimum, all doorways in the public areas to have D shaped door lever handles, located between 900-1100 mm AFL, enhanced clear opening widths, circulation spaces and latch side clearances. Doors to have an operating force not exceeding 20n. Double doors, active leaf min 850 mm clear opening width, where this is not achieved on existing doors a performance solution is to be detailed.				237,817	136,000	1
1		69,946	Remove the adjudicator's box from the front of the dress circle and reinstate balustrade to match existing profiles.			The 'new' steelwork that supports the adjudicator's box has been welded to the balcony steelwork and therefore will be able to removed.	LINK TOP BALAustrade		69,946	40,000	1
1		17,487	Provide a minimum of 5 enhanced accessability seats to the dress circle level.	Section 4.1.2 - the required number of accessible seats in the auditorium is listed as 17 whereas the actual required number when calculated in accordance with BCA Clause D3.9 is 16. The BCA has specific requirements on how the accessible seats are distributed that will need to be factored into future works packages.					17,487	10,000	1
1		131,149	Maintain a minimum of 14 disability compliant seats to the stalls and reinstate to standard fixed seats within the stalls and the 4 transfer arm seats.	Section 4.1.2 - the required number of accessible seats in the auditorium is listed as 17 whereas the actual required number when calculated in accordance with BCA Clause D3.9 is 16. The BCA has specific requirements on how the accessible seats are distributed that will need to be factored into future works packages.	The auditorium seating is proposed to be provided with alternative accessible seating to the ground floor stalls and the level 1 dress circle that will provide visitors with a range of experiences over these two levels. Ensure companion seating and a number of transfer seats are provided over the two levels. Accessible seating numbers to be provided as per NCC.				131,149	75,000	1

1			Upgrade bar and ticket sales counters to include zones for common reach of disabled and ambulant persons.		A new FOH bar & ticket box office is proposed which will be provided with compliant access for a person in a wheelchair or with an ambulant disability in regard to reach ranges & point of sale transactions.				507,109	290,000		1
1		incl above	Relocate the bar and ticket sales counter to increase the foyer space including reducing the ticket office.					Extend water services to new or relocated positions. Install local domestic hot water systems to provide for new facilities. Undertake sanitary plumbing works to connect to new or relocated facilities.	incl above	incl above		1
2	Link to other ticket candy bar height needs bar rejustified		Upgrade long room bar to include zones for common reach of disables and ambulant persons.		The existing long room is proposed to have minor upgrade/replacement works undertaken to the bar to provide compliant access for a person in a wheelchair or with an ambulant disability in regard to reach ranges & point of sale transactions. Existing bar height is 1200 mm AFL. Currently the long room does not provide compliant access as there is a 40 mm high step at both entry door points, additionally the door leaf's are non-compliant in width and will need to be operated via a staff management plan, it was noted that the two sets of doors are provided with a hold open device, it is assumed these will be retained. Performance solution to be detailed for non-compliant door widths. Provide step free threshold entry into the long room.			Extend water services to new or relocated positions. Install local domestic hot water systems to provide for new facilities. Undertake sanitary plumbing works to connect to new or relocated facilities.	236,068	135,000		2
1		786,894	Generally upgrade all sanitary facilities to front of house areas and include ambulant closet facilities.	The access consultant will need to rationalise via Performance Solution not having the new accessible unisex sanitary facilities at the existing banks of toilets.	Ambulant male & female sanitary facilities are proposed to be provided at each bank of sanitary facilities to the following levels: Basement level 2 (BOH) Basement level 1 (FOH/BOH) & first floor level (FOH). Provide compliant braille & tactile signage as per NCC D3.6			Extend water services to new or relocated positions. Install local domestic hot water systems to provide for new facilities. Undertake sanitary plumbing works to connect to new or relocated facilities.	786,894	450,000		1
1		incl above	Retain the male facilities in the basement, identified as being of primary significance. Minor upgrade to these facilities should be accepted to include ambulant closet facilities.	Once the accessible unisex sanitary compartment is installed in Basement 1, the male and female toilets will need to be altered to include at least 1 compartment for use by people with ambulant disabilities.				Extend water services to new or relocated positions. Install local domestic hot water systems to provide for new facilities. Undertake sanitary plumbing works to connect to new or relocated facilities.	incl above	incl above		1
1		incl above	Provide new disability accessible toilet facilities including fold away baby change tables.		There is a total of 3 new proposed compliant unisex accessible sanitary facilities which will be located on the following levels: Two x DDA toilets located on basement level 1 and one x DDA toilet located on the ground floor level (DDA toilet to first floor TBC) the new UATs will be provided with a baby change station for enhanced use.				incl above	incl above		1
1		1,661,220	Reconfigure the sanitary facilities to the basement level 1 and 2 and the green rooms, including shower facilities.	Section 4.1.4 - a Performance Solution / dispensation approach would be required to rationalise the proposed reduction in the number of showers provided to the building.	Ambulant male & female sanitary facilities are proposed to be provided at each bank of sanitary facilities to the following levels: Basement level 2 (BOH) Basement level 1 (FOH/BOH) & first floor level (FOH). Provide compliant braille & tactile signage as per NCC D3.6			Extend water services to new or relocated positions. Install local domestic hot water systems to provide for new facilities. Undertake sanitary plumbing works to connect to new or relocated facilities.	1,661,220	950,000		1
1		61,203	Upgrade all associated statutory signage to comply with the provisions of AS 1428.1 – 2009 Section 8.		Provide compliant braille & tactile signage as per NCC D3.6 - Wayfinding Existing statutory signage will be upgraded to compliant standard. Consideration should be given to "iBeacon" or QR code technology that is used by "Blind Square" as a method of wayfinding. Signage utilising plain English and pictograms ensure direct wayfinding and allow use by technology such as AI See, which uses PR Codes to read a sign. Provide compliant braille & tactile signage as per NCC D3.6			Install new emergency & exit luminaires of a modern type meeting current standards. Generally luminaires will be installed in the position of existing and reconnected to the existing wiring. Include additional emergency and exit luminaires if required due to the proposed building works.	61,203	35,000		1
2			Provide a total of 7 shower facilities to the back of house areas.	Section 4.1.4 - a Performance Solution / dispensation approach would be required to rationalise the proposed reduction in the number of showers provided to the building.	Ensure BOH areas are accessible for performers in regard to dressing rooms, green room sanitary facilities & showers, consider provision of a unisex accessible toilet with shower/change facilities. Provide a continuous accessible path of travel/circulation space to corridors & doorways (Hinged & sliding).	Query inclusion as per DDA requirement Include adult change .place			43,716	25,000		2
1	Is this included in Hazardous material itemabove? (line 12)	87,433	Replace switchboards contain hazardous materials.	recommend specifying that new switchboards are required to be in non-combustible enclosures and be provided with smoke seals.				Replace distribution switchboards with new compliant boards throughout	87,433	50,000		1
	ASSUME THERE IS SUFFIICENT CAPACITY	17,487	Investigate loads and potential for electrical upgrades.					Investigate the need to upgrade incoming mains cabling based on proposed loads, including the addition of new lifts	17,487	10,000		1
1	ASSUME THIS GENERALLY COMPLIES - ALLOWANCE FOR WHERE THIS HAS BEEN MISSED	1,435,073	Rewire whole of building to current codes and compliance.					Investigate the need to upgrade sub circuit wiring to whole of building to current codes and compliance. Include electrical services provisions to suit the revised theatre layout and extensions. Include special purpose power throughout, including for additional lifts and mechanical plant. Upgrade communications and data infrastructure.	1,432,146	819,000		1

1	Link in with line 60 for areas being updated		Upgrade DC battery system with upgrade of fire safety systems.					Install new battery bank. Install new centralised DC power supply unit and charger.	87,433	50,000	1
	DELETE		Upgrade theatre sound system.						excluded	excluded	
1		174,865	Install a new wireless audio induction loop to the auditorium, cry room and long room.	Section 4.2 - the number of receivers in the proposed induction (hearing) loop will need to meet BCA Clause D3.7 when compared to occupancy levels unless a Performance Solution approach is adopted.	Hearing augmentation will be provided via a new wireless audio induction loop to the auditorium, cry room & the long room. Ensure that the sales box office is also provided with compliant hearing augmentation if screened from the service provider & sufficient receivers provided for the number of persons accommodated as per NCC D1.13.			Upgrade audio loop to wireless system.	174,865	100,000	1
1		87,433	Upgrade the existing front of house and back of house PA systems to be integrated with the emergency warning and intercommunication system (EWIS).					Carry out alterations and additions to the existing occupant warning system to take into account the proposed building works.	87,433	50,000	1
2			Upgrade the house lighting within the auditorium. Consideration should be given to the removal of the chandeliers dating from the 1950s and reinstatement of gasolier style reproduction fittings based on historical images and consistent of nineteenth century aesthetics or a contemporary fitting of similar size and scale.					Provide new efficient LED general and house lighting with upgraded lighting control systems throughout.	612,028	350,000	2
1	IN AREAS AFFECTED BY WORKS ONLY		Upgrade all lighting generally.					Provide new efficient LED general and house lighting with upgraded lighting control systems throughout.	87,433	50,000	1
	DELETE		Upgrade performance lighting, rigging bars and other associated mountings					Provide new performance (theatre) lighting with upgraded lighting control system.	excluded	excluded	
	DELETE		Upgrade backstage and bio-box lighting controls and dimmer systems.						excluded	excluded	
	ASSUME THERE IS SUFIFICENT CAPACITY		There is a great opportunity to do early work to rationalise this to ensure we can get this right					Further investigate the requirement for a power supply (substation) upgrade to the site Replace main switchboard with new compliant main switchboard Install new mechanical services fire brigade control panel to suit revised mechanical plant.		included below	1
1								Upgrade air handling plant serving the Auditorium and Stage to provide sufficient outside air to serve the maximum population of up to 1,000 people. This will require more than double the amount of supply air presently delivered to the auditorium. The supply air for the auditorium would increase from 3,190 litres/second to 7,500 litres per second. A new variable volume air handler delivering 100% outside air would be required with new ductwork and an increased area of supply air openings into the auditorium. A system of CO2 sensors would be included to reduce the supply air rate in periods of partial occupancy. The new air handling plant would include a ducted spill air arrangement whereby heat recovery from the spill air could be undertaken for compliance with energy efficiency requirements of the NCC. As a result of the increased heating and cooling load arising from the increased	0		1
								Outside air provisions to the sub-auditorium level should be improved. The current arrangement is not a reliable system of ventilation.	0		1
1								Toilet exhaust alterations and additions are required to meet the proposed scope of works	0		1
1			Remove the split system to the ticket box when redeveloping the ground floor foyer						1,749	1,000	1
1	Refer to previous note referencing plant equipment - note this does not need replacing if plant remains as is (line 60)	874,326	Ensure redevelopment of the south and north stair provisions of new plant platforms including access for maintenance. Refer to previous note referencing plant equipment - note this does not need replacing if plant remains as is	A loading assessment of the plant equipment on the structure will need to be factored into the structural design and fire-ratings assessment. The new fire-isolated stair is required to have a 2-hour fire-rated lid, meaning that any proposed access hatch to access the roof plant platform must be a tested, fire-rated system. Any ladders and the like to access the new roof plant platform on top of the stair must not impede use of the fire-isolated stair. The plant platform will require a full, BCA D2.16 compliant balustrade with no climbable elements. Consider the installation of a fall arrest system to the plant platform					874,326	500,000	1

1	This should be included but refer to informationregarding existing plant not being that old. Upgrade could be triggered by need to comply with BCA	2,978,783	Upgrade whole of mechanical plant system.					A new building automation system is proposed to control and monitor the mechanical services plant. A new mechanical services switchboard would be required. A new mechanical services control panel would be required at the ground floor entry to replace the existing.	2,490,081	1,424,000	1
		89,181	Replace or remediate existing stormwater systems on the south and east elevations, including that belonging to the neighbouring property.	Section 4.2.4 – replacing the stormwater system to the neighbouring property may require a separate building permit to be issued for that property. May also require an easement to be established.				Rectification of stormwater drainage components throughout the site noting that some of the works fall under a civil engineer category (not hydraulics). A detailed study has been undertaken on the scope of the various components. South Elevation: New drain and New Pit13 including new Drain to connect to Pit12 & Pit 11. (Suggest Civil Engineer would be responsible for replacing the three pits and drain.) New cast iron downpipe with access trap (Max, 2Mtr to DP14)	89,181	51,000	1
1		26,230	Bio-box glazed (and operable) openings between the bio-box and auditorium to be provided with AS 2118.12 fast response pendant sprinkler to the auditorium side.	The approved services documentation for Stage 1 does not appear to capture FER requirements sprinklers on the auditorium side of the non-fire-rated doors or the sprinklers to protect the Bio-Box openings. There may be documents missing from the package provided to us that could explain the discrepancy. That said, the sprinklers did not appear to have been installed during our audit, though works were clearly ongoing at that time. PREVIOUS STAGE DID NOT INCLUDED THE FER RECOMMENDATIONS					26,230	15,000	1
1		13,989	Long room north stair to be separated by 35mm thick solid core timber doors and protected by AS 2118.12 fast response pendant sprinkler to the long room side.						13,989	8,000	1
1		13,989	Auditorium stair to be fire separated by 35mm thick solid core timber doors and protected by AS 2118.12 fast response pendant sprinkler to the auditorium side.						13,989	8,000	1
1		26,230	Basement level substation and switch board construction to FRL 120/120/120 with FRL -/120/30 self-closing fire doors.						26,230	15,000	1
1		26,230	Basement level battery room construction to FRL 120/120/120 with FRL -/120/30 self-closing fire doors.						26,230	15,000	1
1		43,716	Basement backstage to be separated from administration and organ with fire rated door FRL -/120/30 with vision panel.						43,716	25,000	1
1		8,743	Fire wall to be made good with penetrations to FRL -/120/120 and penetrations protected to NCC C3.15.						8,743	5,000	1
1		17,487	Louvers in external wall of auditorium to bio-box to be covered in metal sheet and sprinkler protection above.						17,487	10,000	1
		8,743	Smoke walls are to be made good to NCC specification C2.5 Clause 2.	Package this together					8,743	5,000	1
1		43,716	Existing doors adopted as fire/smoke doors for the purpose of Performance Solution are to be provided with AS 1530.7 smoke seals.						43,716	25,000	1
	DELETE - ALLOW FOR REWORKING ONLY IN AREAS TO BE REFURBISHED	174,865	Sprinkler protection through out the building to AS 2118 – 1982 with exception of the auditorium and organ areas.	The approved services documentation for Stage 1 does not appear to capture FER requirements sprinklers on the auditorium side of the non-fire-rated doors or the sprinklers to protect the Bio-Box openings. There may be documents missing from the package provided to us that could explain the discrepancy. That said, the sprinklers did not appear to have been installed during our audit, though works were clearly ongoing at that time.				Automatic Fire Sprinklers to be extended to provided complete coverage in accordance with the current Australian Standard AS2118.1 subject to Fire Engineering review of the main theatre auditorium ceiling. Include alterations and additions arising from implementation of the new works.	174,865	100,000	1
2		Include with plant review	Review smoke exhaust system to Stage area and allow to upgrade					Review smoke exhaust system to Stage area and allow to upgrade.	0	0	2
1	minor cost		Review extent of hand fire extinguishers required and amend as required.				Within Long Room - Provide a 2A:20BE fire extinguisher adjacent to exist	Review extent of hand fire extinguishers required and amend as required.	874	500	1
			In regard to fire service, obtain formal sign off of the water pressure non-compliance noted earlier. Consult with Local Fire brigade and Relevant Building Surveyor. Ensure booster connections and suction heads are incorporated into the fire sprinkler and fire hydrant system.					In regard to fire service, obtain formal sign off of the water pressure non-compliance noted earlier. Consult with Local Fire brigade and Relevant Building Surveyor. Ensure booster connections and suction heads are incorporated into the fire sprinkler and fire hydrant system.	0	0	1
1		17,487	Provide a manual call point at the sub-panel and FIP and at proscenium control.						17,487	10,000	1
1		52,460	Provide a public address (PA) system is to be provided at the bio-box and at the sub-panel.						52,460	30,000	1
1		8,743	Ensure building occupants warning speaker and strobe is provided within the orchestra pit and organ areas.	The approved services documentation for Stage 1 does not appear to capture FER requirements for occupant warning speakers and visual alarm devices (VADs) i.e. strobes in the orchestra pit, organ chambers and fly platform, along with manual call points at all exits. There may be documents missing from the package provided to us that could explain the discrepancy			Include this with fire services package - this needs to be tied with wormwald - TJ Coutts	Undertake extension of the existing fire alarm system coverage to include smoke detectors installed at Basement 1 and Basement 2 levels.	8,743	5,000	1
1		8,743	Ensure building occupant warning speaker and strobe is provided at far end of fly platform.						8,743	5,000	1
		by client	Implement hot works permits for contractors.						by client	by client	0
		by client	Induct contractors into fire evacuation procedures.						by client	by client	0

		by client	A designated fire warden to be present on site at all times.	The FER states that a designated fire warden is to be present at all times. Clarification required as to whether this means 24/7, whilst the building is occupied for performances or purely whilst construction works are ongoing.					by client	by client	0
1		22,732	Manual call point to be available at each required exit.						22,732	13,000	1
1	This needs to be included	388,994	The stairs are to be adapted as a safe haven for occupants in wheelchairs. The stair is to be separated from the auditorium by inherently fire resistant walls (masonry). Wall openings are to be protected by existing doors with sprinkler protection or self-closing minimum FRL -/120/30 door leaves with AS 1530.7 cool/medium temperature smoke seals and AS 1530.4 intumescent fire seals to the door heads, side and stiles.	The FER has rationalised the inclusion of smoke doors to BCA Specification C3.4 where fire doors are required in certain areas. However, the Specification C3.4 requirement for such doors to swing in the egress direction was not included in the analysis for the Long Room. The implementation of the fire compartmentation noted in the FER has resulted in fire hose reel shortfalls to the auditorium and the Long Room, since fire hose reels are not permitted to pass through fire doors or smoke doors to achieve coverage. The FER addresses the enclosure of the space beneath one non-fire-isolated stair per BCA Clause D2.8, whereas multiple stairs within the building actually display non-compliance with this Clause but are not addressed. The FER enacted by the building issued on 10/10/2018 has now obviously been superseded. It is unclear if FER version 1.4 has been enacted by a building permit. The FER has required smoke walls in the Basement 1 as shown in Appendix F, including the replacement of several doors with solid core doors provided with smoke seals but this requirement does not appear to have been picked up in the approved building permit					388,201	222,000	1
			Compliance Upgrade - Structural Concerns								
	DELETE		Option for construction of a roof deck above the Long Room for extended function space.	Section 4.2.5 of the Feasibility Report nominates a rise in stories of 3. Our assessment of the building has determined that the building has a rise in stories of 4.				An option included in the study was to convert the roof over the Long Room to an outdoor deck. This conversion would require the removal of the existing air conditioning plan t serving the Long Room and the installation of new plant. One solution would be to include ducted ceiling mounted fan coil units connected to the new heating water and chilled water plant.	excluded	excluded	2
	DELETE			Section 5.3 - consideration should potentially be given to a seismic solution that is formulated to AS 3826-1998: Strengthening existing buildings for earthquake via a Performance Solution approach since compliance with AS 1170.4 for a building like this is expected to be extremely onerous, if not impossible.		Section 2.2 of AS1170.4 - Structural Design Actions Part 4 : Earthquake actions in Australia specifies Earthquake Design Categories (EDC) for buildings which are partly a function of the site geology, and for HMT the EDC is likely to be either II or III. Section 2.2 of AS3826 - Strengthening existing buildings for earthquake states that the threshold loadings for EDCs of II and III are respectively one-third and two-thirds of the loads specified by AS1170.4. Given that the building is constructed from unreinforced brickwork, steel frames would need to be installed to stiffen the walls and ceilings, or the walls would need to be post-tensioned to new concrete footings, or a combination of both would be required. Clearly these options would be extremely onerous and have a significant impact on the fabric of the building.		$ 14,114,000.00	excluded	excluded	
	DELETE			Section 5.3 – recommend clarifying reference in this specifically to Regulation 233 of the Building Regulations 2018 in respect of the 50% volume trigger and deleting the change of use reference, since it is not applicable.				$ 24,730,550.80	excluded	excluded	
				Section 5.3 – recommend also clarifying that full compliance would not be expected for a building like this and that the relevant building surveyor has significant powers of discretion in applying Regulation 233 in its entirety, when considering the individual characteristics of a particular building.					0	0	
								Install new computerised monitoring system.	87,433	50,000	0
							Possible fire source	Replace existing Fire Indicator Panel with a new addressable Fire Indicator Panel complete with new addressable smoke detectors, thermal detectors and beam detectors. The existing occupant warning sounders and strobes would be retained. The existing wiring would be reused to avoid requirement for damaging chases and ceiling access for new cable runs. A new external alarm bell would replace the existing.	524,596	300,000	0
							possible fire source	The existing mechanical control panel would be retained.	N/A	N/A	0

	The fire sprinkler heads have been arrange to undergo the test required by AS1851. The outcome depends on whether the test fail or not.	N/A	N/A	0
Sundry Works				
Bio-box glazed (and operable) openings between the bio-box and auditorium to be provided with AS 2118.12 fast response pendant sprinkler to the auditorium side.		26,230	15,000	1
Long room north stair to be separated by 35mm thick solid core timber doors and protected by AS 2118.12 fast response pendant sprinkler to the long room side.		8,743	5,000	1
Auditorium stair to be fire separated by 35mm thick solid core timber doors and protected by AS 2118.12 fast response pendant sprinkler to the auditorium side.		31,476	18,000	1
Rectification of the box gutter on the roof of the long room.		43,716	25,000	1
The sprinkler control valves will need to be relocated due to the construction of the new northern fire stair since they currently sit in that footprint.		262,298	150,000	1
New artist room within existing green room at stage level		87,433	50,000	1
	SUB-TOTAL - PRIORITY 0	**612,028**	**350,000**	0
	SUB-TOTAL - PRIORITY 1	**12,395,323**	**7,088,500**	1
	SUB-TOTAL - PRIORITY 2	**7,592,649**	**4,342,000**	2
	TOTAL	**20,600,000**	**11,780,500**	

APPENDIX I ORCHESTRA PIT UPGARDE WORKS PREPARED BY L'RTMI

THEATRE DESIGN & TECHNOLOGY

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HER MAJESTYS THEATRE

Lydiard Street. Ballarat
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CITY OF BALLARAT

SPECIFICATION:

Orchestra Pit Modules
Stalls Removable Wall
Drapery & Track

Ref: HMT-RTM 300610-TEC 1
June 2010 / Issue for Coordination

Document Verification

Page 1 of 1

Job Title	Orchestra Pit Modules/Stalls Wall/Track & Drapery HER MAJESTY'S THEATRE BALLARAT	Job Number	HMT-001
Document Title	SPECIFICATION – Orchestra Pit Modules Rear Stalls Removable Wall Track & Drapery	File Reference	HMT-RTM 300610 TEC 1

Revision	Date	Filename			
Issue 1	30/06/10	Description	For Coordination		
			Prepared by	Checked by	Approved by
		Name	RM, MK, AK	EB	RM
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
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		Name	Prepared by	Checked by	Approved by
		Signature			
		Filename			
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		Name	Prepared by	Checked by	Approved by
		Signature			

CONTENTS

Drawings.

RTM-P-001 ORCHESTRA PIT INFILL / THRUST STAGE SPECIFICATION
RTM-C-001 REAR STALLS REMOVABLE PANELS
RTM-D-001 DRAPERY & TRACKS

EXECUTIVE SUMMARY

Her Majesty's has been a central part of the cultural life of Ballarat since it first opened its doors in 1875. Australia's best preserved theatre building, it has been continuously used as Ballarat's home of live performance ever since. It has been owned and operated by the City of Ballarat since 1987 and functions as Ballarat's performing arts centre.

Her Majesty's is a professionally equipped and staffed performing arts centre. The Theatre presents an annual Theatre Season of touring professional and local productions. It is also hired for professional tours, local productions, school concerts, dance recitals, and conferences.

This document outlines the design concept and operational intent of the following:

- **Orchestra Pit Modules**

It is the intention to redesign the current orchestra pit modules to a system that satisfies the requirements of a pit cover and thrust stage combined into a single adjustable system.

- **Removable Rear Stalls Wall**

It is the intention to design a removable barrier to the rear of the stalls for protection of production operations.

- **Drapery & Track**

It is the intention that further to the Stalls Wall above adjustable masking is to be installed to further protect production operations and to assist to eliminate interference into the auditorium during a performance from main entry.

The project time line estimates completion in early 2011.

1. GENERAL REQUIREMENTS

1.01 Introduction.

The works covered by this specification comprise the detailed design, manufacture, delivery, installation, erection, testing, commissioning, documentation and demonstration to the client - City of Ballarat, of the Orchestra Pit Modules/Stalls Wall/Track & Drapery

1.02 Interpretation

For the purpose of interpretation of this specification the following definitions apply.

Project	Her Majesty's Theatre. Ballarat. Victoria. Australia.
Tenderer	Company replying to this invitation to Tender
Equipment Contractor (EC)	The contractor to whom this contract has been awarded.
The Client / Employer	City of Ballarat
The Project Manager	City of Ballarat –Arts & Culture Unit
The Electrical Engineer	TBA
The Structural Engineer	TBA
Theatre Consultant (TC)	RTM International Theatre Design & Technology
'Shall'	Means that the associated action is the responsibility of the specialist contractor
'Install'	Means supply, deliver, fix, terminate, test, commission, and demonstrate as specified
Practical Completion	When the client can take beneficial ownership of the completed systems, including all testing, documentation, and training
Completion Date	Early 2011

1.03 Tender Basis

Tenders shall be submitted in accordance with the instructions outlined in this document

The cost of preparing the tender shall be borne solely by the tenderer. No cost of the preparation of the tender shall be incorporated into the tender itself.

The tenderer warrants upon submission of the tender that it has reviewed all drawings, specifications and related contract documents for the project and that the tender submitted is inclusive of all labour, materials and supplies required to deliver the seating as specified.

All equipment proposed shall be new and shall meet or exceed the performance requirements outlined in this specification.

RTM International have conducted design work for the Theatre. It is on the basis of this design that the systems indicated have been identified. These designs are indicative only and final design and layouts will be required by the EC.

Manufacturers and installers of such equipment shall have a recognised history in theatre design, manufacture and installations.

Tenders shall be valid for acceptance for a period of twelve months from date of tender and shall include all costs associated with the work.

1.04 Technical & Pricing Information

The tender return shall include:

Itemised lists of all equipment proposed to be supplied. These must include all equipment necessary to develop the complete functioning systems, whether or not the equipment is specifically indentified in this specification. Each piece of equipment shall be individually priced. Sub-totals shall be provided for each unique system and sub-system

Technical data sheets or other documentation for each major equipment item selected by the tenderer to show how each item meets the requirements of the specification.

A fixed sum for all other services that shall comprise the total systems cost broken down into the following categories:

- Project Management
- System engineering
- Field installation of all systems equipment
- Supervision
- Testing & commissioning
- Documentation
- Training

1.05 Pricing Methodology

The tenderer shall estimate the contract based on the costs of the equipment available currently.

1.06 Warranty Statement

Provide warranty for materials, workmanship, installation and operation for a period of 3 years.

Clear identification of any exclusions or conditions affecting warranty of the systems shall be provided with the tender.

1.07 Spares

The tenderer shall include a list of recommended spares in the costing.

1.08 Tender Documentation

This specification shall be read in conjunction with the following information:

- As built Architectural, Electrical, and Structural Drawings & Specifications.
- RTM International Drawings & Specifications as attached.

1.09 Additional Information to be provided with Tenders

In addition to any particular requirements detailed specified, tenders shall also include the following:

- Letter of acceptance of contract conditions and specified requirements.
- Advice of lead times for shop drawings; delivery of equipment to site, and expected installation periods required
- Initial proposals for any nominated sub-sub-contract or separate purchase items
- Nomination of Senior personnel resident in Victoria to be assigned to the Project during the detailed design and installation process
- Advice of any hoisting, scaffolding, making good or other works which will be required to be provided by the Builder or other sub-contractors
- Statement of Australian content; Victorian support base for installation and service of equipment during life cycles and other relevant non-financial factors which may assist in Tender assessment.

2. SCOPE OF WORK

2.01 Generally

The responsibilities and approach of the equipment contractor (EC) shall have design responsibility. These include interpreting the project drawings and specification and preparing detailed designs and shop drawings of the equipment and installations which will accomplish the functions described in the specification documents.

Any errors, omissions or ambiguities in the project drawings or specifications shall be brought to the attention of the project manager immediately for clarification of the possible effect on the intent of the specification.

The EC shall have a fully collaborative approach to the project working closely with the client, design team to ensure that highly successful and integrated systems are achieved.

The EC shall have a presence on site and be responsible for overseeing the complete installation and coordination of seating.

The EC shall coordinate all items of Architectural, Structural, Electrical integration so required with the respective disciplines through the Project Manager.

The EC shall liaise closely with the Project Manager and client with regard to final design, layout and programming

2.02 Equipment

This document outlines the general requirements of theatre seating and associated equipment and as such does not go into detail on every item to complete the systems. The tender shall include for all items to produce fully working systems, whether or not specifically specified in this document. This includes, but not limited to, pit module tops, gates, valances, fixings, removable rear stall wall sections, drapes and tracks, storage trolleys etc, installed and non-installed items necessary to allow the systems to function correctly.

Tenders shall ensure that their equipment fully conforms to current standards and industry practices and shall allow for attendance on site to assist theatre staff during the period prior to the first production.

2.03 Work by Others

The following will be provided by other Sub-Contractors:

- Repairs to timber floor
- Power and cabling to Aisle light positions
- Graphics or signs required by Authorities, unless part of, or attached to specified equipment

2.04 Standards

The equipment and installation shall comply fully with all requirements of The Building Certifier; Victorian Occupational Health & Safety Act; and other relevant Local Authorities.

The relevant materials or design shall comply with Australian standards

2.05 Power Supply and Earthing

It should be noted that the power distribution and wiring will be the MEN system. Any power requirements to be coordinated with the electrical contractor

2.06 Noise & Vibration

All equipment shall operate freely without undue noise or vibration. Motions shall be smooth, silent and free of shock or sway transmitted by misalignment, excessive clearance or imperfection in any part of the installation.

The EC shall be responsible for the achievement of levels of noise and transmitted vibration acceptable to the Project Manager.

2.07 Painting & Finishing

The EC shall be responsible for the finishing of all works provided under this contract, to the complete satisfaction of the Project Manager.

The EC shall coordinate with the Project Manager to ensure that the proposed finishes of any installed item such as visible panels, plates, paint finishes and labels are approved. Exact positions of equipment shall also be confirmed before commencement of work.

2.08 Shop drawings

Equipment specified shall require submission by the EC of Shop Drawings for approval by the Project Manager and the Consultant prior to commencement of manufacture. Standard products can be submitted as manufacturers' drawings.

Shop drawings shall show all details and final locations of all systems, including storage footprint for coordination and approval by the Project Manager prior to manufacture or installation.

2.09 Testing

On completion of the installation the equipment shall be proof tested in accordance with the relevant regulations, all expenses so incurred being the responsibility of the EC including associated Authority charges or fees.

Testing and commissioning documentation to be provided by EC and approved by the Project Manager.

Tests shall include operation of the equipment to ensure compliance with safety regulations and include any required proof load testing, witnessed by Authority inspectors.

All rectification work and re-testing required as a result of these tests shall be at the EC expense.

2.10 Training

Tenders shall allow 1 (one) day on installations and equipment, dates to be nominated by the Project Manager.

The training shall include correct and safe operation of the equipment, including full instruction on the operating and maintenance manuals specified in below.

The EC shall provide costing for each half day additional training that may be requested.

2.11 Risk Analysis

It shall be noted that the EC forms a key element in the duty of care process with respect to safety of the complete systems during change-over, rehearsals or performances and in static conditions.

Not later than completion of the shop drawing period, the EC shall produce a formal risk analysis of each system in accordance with OH&S and WorkCover VIC requirements for acceptance by the Project Manager prior to commencement of installation.

Any additional safeguards, warning devices or the like found to be necessary as a result of the risk analysis shall be included in the tender price, unless otherwise agreed as a variation by the Project Manager, eg: as a result of changes of Statutory Requirements or Standards subsequent to acceptance of Tender.

2.12 Maintenance & Breakdown

The servicing and maintenance work shall incorporate all the requirements of standard manufactured items of fixtures or subassemblies to ensure that the warranty provided with them is not prejudiced by the EC.

Progress and final payments will be certified in accordance with the contract only when the Project Manager is satisfied that inspection and maintenance has been properly carried out and reports submitted during the maintenance period.

The EC shall without charge and in timely fashion, repair or replace any component of the equipment proving defective due to faulty design, bad workmanship or normal wear and tear.

Tenders shall include an optional additional rate per annum for provision of a future maintenance and breakdown service, with a statement of associated material costs

The EC shall provide the Project Manager with the names, addresses and telephone numbers at which maintenance staff resident in Victoria can be contacted during and outside normal office hours in the event of a breakdown.

2.13 Operating & Maintenance Manuals

Manuals shall be provided, at hand-over, in A4 4-ring binders and shall include schedules and copies of all warranties and guarantees.

Three (3) copies of the manual in bound folders and two (2) CD copies of the manual shall be provided which shall include at least the following:

- Index of Contents
- General description of the contract & all equipment including description of the function and location of each item.
- System Diagrams
- A detailed description of the method of operating and maintaining the equipment
- Systems Risk Analysis
- Timeframe of life cycle of replacements including detailed maintenance schedules
- Schedule of Melbourne-based suppliers of relevant spare parts and service on a 24hour basis
- A3 and copies of 'As Built' installation drawings
- One separate set of A1 drawings shall be provided, together with a digital format copy compatible with AutoCAD 2009 or higher.

2.14 Spare Parts

Tenders shall include a list of any spare parts considered necessary for the equipment, together with any special tools required for servicing or maintenance.

Prices and availability of spares are to be indicated. It is a requirement that all main component replacement parts or sub-assemblies be available from Melbourne stock, for twenty-four (24) months from practical completion.

Storage locations to be advised

2.15 Subcontractors

The TEC shall not, unless as advised in the tender submission, engage others to carry out any aspect of the specified work without the prior permission of the Project Manager. In any case sub-contracted work in excess of 40% of the contract sum will not be permitted.

3. ORCHESTRA PIT INFILL & THRUST STAGE EXTENSION SPECIFICATION

3.1 General

This section of the specification includes the design supply, installation and commissioning of the following:

- Orchestra Pit Infill & Thrust Stage Extension.
- Modular Decks
- Fast Fold Frames
- Fascias
- Storage Trolleys

The performance systems shall comprise:

Design, supply and install modular orchestra pit infill & thrust stage extension as shown on drawings. Stage extension shall be rated to withstand 4.5KPa and be fully demountable.

The surface of the modules shall be finished to existing stage finish, metal parts finished in satin black powder coat or similar.

There shall be allowance made for simple adjustment of sections to level of stage platform

Fascia's to attach easily to open faces of pit and stage extension.

Design and supply adequate storage trolleys to be accommodated in the backstage area.

Preference will be given to systems that are lightweight and easily assembled

3.2 Modular Decks

Stage decks shall be constructed of aluminum outer frame, mechanically assembled to achieve an overall dimension of approx 2480mm x 9425mm.

Extrusion must feature a recessed groove for Velcro hook running the outer perimeter of deck. Frame is to have mechanically riveted inside of frame either one or two support beams (based on rating of 4.5Kpa).

Deck surface is constructed of structural plywood painted stage black.

Deck must feature "dual function" corner, which allows deck to be received on locator plates of Fast-fold frames of the orchestra pit infill and stage level infill.

3.3 Fast-fold Frame

Support structures are to be aluminum alloy with a "scissor action" fold up feature.

Frame must have a device which sets opening position correctly.

All diagonal bracing is to be integral, with no additional parts or braces. There are to be no loose bolts, or pins on lanyards.

3.4 Transport Cart

Stage transport carts shall be structured to support and contain the product to be carried on it.

Wheels must be rated for 4 times the actual load to be implemented. Six wheels for most carts is recommended.

Carts must also have proper bars for hands to push, and carts must roll on hard floor, and carpeted floor with ease.

Where decks are to be loaded in vertical position, a holding device must exist to contain any number of decks already in cart from falling over during loading.

Carts must be galvanized, or painted with a baked on powdercoat finish.

3.5 Fascias

Design, supply and install fascia's to attach easily to open faces of orchestra pit infill & thrust stage extension.

Two (2) fascias are required:

- Stage fascia when pit infill in place.(hard)

Stage fascia approx 9425mm x 2260mm. EC to consider use of existing fascia

- Stage thrust fascia when stage extended.(soft - skirt)

Stage skirt shall be pre-pleated with a 50% gather.

Top of skirt must align with top of thrust stage extension surface, and remain stiff and vertical with backing material.

Skirt must also have a built in velcro loop strip to adhere to stage edge.

Skirting must contain flameproof agent.

Skirting must be manufactured using a fabric which will maintain wrinkle free performance, and non-shrinking or fading after washing.

Final colour will be at the discretion of the client.

Skirt length and depth shall be continuous fixed at stage height exactly within 5mm tolerance. Approx overall dimensions 14400mm x 1140mm.

4. WALL PANELS, DRAPERY & TRACK SPECIFICATION

4.1 General

This section of the specification includes the design supply, installation and commissioning of the following:

- **Removable Wall Panels (rear stalls)**

The removable wall panels are designed to mask and protect the sound and lighting operations equipment at the rear stalls operating position when assembled.

There shall be 5 removable panels approx 1400mm H x 1200mm W x 200mm D that mirror the finish of the rear short wall fixed in the Dress Circle.

The Panels shall when assembled fix rigidly together by means of Roto locks or similar.

Panels shall have vertically insertion stabilisation and be easily removable by 1 person without the use of tools.

- **Drapery & Track (rear stalls)**

There shall be to the foyer side of the panels as above masking in the form of stage drapes in fitting with Heritage colour requirements.

There shall be 5 individual drapes floor to ceiling with allowance for overlap and aligned to removable panels

There shall be a 2 individual drapes each to the left and right of the entry doors floor to ceiling where indicated

Drapes should be easily removable.

Tracks or batten will be required to be fitted to the ceiling within the designated area and able to support weight of drapery.

4.2 Removable Wall Panels

Design, construct and supply modular wall system, non-loadbearing, completely demountable, non-progressive, as indicated on the Drawings, including all installation attachments.

Panels shall be architecturally flat with no bowing, oil canning, warping, waviness or any other surface deformation and discontinuity.

All of the panel edges shall be angled to follow seat and drapery curve.

All of the panels shall be nominally of the same size, unless requested otherwise by the architect.

Joints between panel vertically shall be 0mm when locked into position.

The individual wall panels shall not weigh more 34.2 Kg per square meters

Panels to be non-combustible.

Panel color shall be at the clients discretion based on Heritage advice

Final installation of partition components shall assemble into a rigid structure with tight straight-line joints.

Completed installation shall be free of exposed bolts, nuts, rivets, and fasteners when the operable wall is in position within the enclosure area

Verify dimensions of floor supporting structure by field measurements so that the modular wall will be accurately designed, fabricated, and fitted to the structure.

Coordinate modular wall work with the work of related sections and provide items to be placed during installation of other work at the proper time to avoid delays in the work.

4.3 Drapery

Design, construct and supply Drapery as generally indicated on the drawings, including all installation attachments.

Drapes shall be of wool serge or velour not less than 600 gsm made up of 50% fullness

Drapes shall have bottom hem treatment of min 100mm

Drapes shall have top hem treatment with 50mm cotton webbing attached with eyelets and ties at top of 150mm centres.

Eyelets and ties shall be black finish.

A sample of approx 300mm square shall be included

The EC shall ensure that all materials are approved by the relevant Authorities as being flame proofed and acceptable for theatre use.

Final dimensions shall be determined on site after installation of track/batten, height to be measured from floor.

Initial installation of drapes shall ensure that all drapes hang true. Not less than 3 months after installation, carry out any adjustments necessary due to stretch or other movement.

4.4 Tracks/Batten

Provide heavy duty roller track or Batten as shown on the drawings.

Track / batten shall be supported on brackets provided by the EC at not more than 1200mm centres with min M10 threaded dropper allowing stepless height adjustment due to racked floor from nominated height.

Provide for each track one standard wheel runner or tie per 150mm of track run, plus 10% spares

Drapes are to be hand pulled only.

APPENDIX J CONSERVATION MANAGEMENT PLAN PREPARED BY MCDOUGAL & VINES

McDOUGALL & VINES

CONSERVATION & HERITAGE CONSULTANTS

HER MAJESTY'S THEATRE BALLARAT

CONSERVATION MANAGEMENT PLAN

October 2006

in association with

swanbury penglase architects of human space

CONTENTS

CONTENTS (cont)

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Janice Haynes – Director, Her Majesty's Theatre

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Tony Diamond – General Manager, City Wellbeing, City of Ballarat

Cr Peter Innes – Councillor, City of Ballarat

Val Sarah – Chairman, Her Majesty's Theatre Board of Management

Stephen O'Neil – Technical Operations Manager, Her Majesty's Theatre

Wendy Hall – Deputy Director, Her Majesty's Theatre

Peter Freud – Publicist, Her Majesty's Theatre

Andrew Miller - Manager Program Delivery, City Infrastructure & Development, City of Ballarat

David Bagshaw - Swanbury Penglase

Robert Mitchell - RTMi Theatre Design Theatre Design

Wendy Jacobs - Conservation Architect for adjacent Mechanical Institutes Building

Note that all current photos were taken by McDougall & Vines. Use has also been made of the excellent photographs taken by Jeremy Bannister, and these are individually acknowledged throughout the document. Sources of early photographs are also included where required throughout the document.

ABBREVIATIONS

Development Feasibility Study	*Development Feasibility Study for Her Majesty's Theatre,* Ballarat, Swanbury Penglase,2006[1]
HMT	Her Majesty's Theatre
HMTFR	Her Majesty's Theatre Feasibility Report
RSSS	Royal South Street Society
VAPAC	Victorian Association of Performing Arts Centres

[1] The *Development Feasibility Study* has been prepared concurrently with this Conservation Management Plan.

SUMMARY OF RECOMMENDATIONS

Heritage Significance and Conservation Objectives

Her Majesty's Theatre is included within the Lydiard Street Heritage Precinct under the Heritage Overlay of the City of Ballarat Planning Scheme. The theatre is also included on the Register of the National Estate as item number 15722 and on the Victorian Heritage Register as item number H0648 and file number 604232 (see Appendix 3 for details).

The following statement of significance updates the current statement in the Victorian Heritage Register to reflect the additional significant values identified in this Conservation Management Plan. It is recommended that this revised statement of significance be used for future planning and reference (Refer Section 3 for a detailed assessment of significance in relation to the criteria under the *Heritage Act 1995* :

> Originally known as the Academy of Music, Her Majesty's Theatre is of considerable importance to Victoria's theatrical history. As one of the few Ballarat and Bendigo theatres which, in the nineteenth century, rivalled those in Australia's capital cities, the theatre has been in use since 1875. Used in its early days to provide entertainment for miners working on the central gold fields, the theatre's name was changed to Her Majesty's Theatre in 1898 with a period between 1966 and 1988 where it was known as the South Street Memorial Theatre.
>
> The theatre incorporates the designs of two distinguished nineteenth century architects, George Browne and William Pitt, both of whom specialised in the design of theatres. Browne, who was responsible for the original 1874 design, also designed Melbourne's rebuilt Theatre Royal in 1872 (now demolished). Pitt, who designed the 1898 alterations and additions was responsible for the new Princess Theatre in 1886, the Bijou (rebuilt after the fire of 1889) and the 1891 design and 1901 rebuilding of the Melbourne Opera House. Pitt was also responsible for alterations to the interior of the Melbourne and Hobart Theatre Royal in 1904 and 1911 respectively and Her Majesty's Theatre in Melbourne at the turn of the century.
>
> Her Majesty's Theatre is a good example of typical nineteenth century theatre planning and exhibits the principal 'Boom' style characteristic of the 1880's and the evolution of theatre design through the unique integration of old and new design features. Whilst there have been extensive renovations to the theatre over time, the theatre has landmark value and retains significant sections dating back to the original building and the 1898 period. The original 1874 Lydiard Street facade, which survives partially intact is of a Victorian Italianate style, providing a contributory element to the Lydiard Street precinct and the rear façade is a strong visual element that closes the vista along Lewis Street.
>
> The theatre is a resource for the study of the development of theatre design from Victorian times to the present. As the most intact of only four surviving nineteenth century public theatres in Australia, the theatre contains the only complete (and partially operable) late Victorian stage remaining in Australia. The fly gallery and the flying system, is also understood to be the only manual (non-counterweight) hand-line system in existence in Australia. While the double horse-shoe shaped balconies, added from the designs of William Pitt in 1898, are the last example of this type of theatre design in the State.
>
> The theatre has had associations with Ballarat's social and cultural life for more than a century, including links with notable theatrical figures, William Cyster, Dame Nellie Melba, Gladys Moncrieff and Amy Castles as well as the Sun Aria competitions, which resulted in the discovery of many important Australian singers. Since 1896, the theatre has been associated with the Royal South Street Society, a Ballarat organisation (who owned the building from 1965 to 1987) dedicated to the promotion of excellence in the performing arts. The theatre also has associations with Sir William J. Clarke (1831-1897), the landowner, stud breeder and philanthropist for whom it was built in 1874-75, and with a number of Ballarat's leading citizens, most notably William Collard Smith (1830-1894), agent, investor and politician.

The objective for any work or adaptations both externally and internally, should allow for the continued use of the theatre as a performing arts facility and to continue the representation of theatrical development within the region. All original building materials and fittings should be handled in a conservative manner, and all elements of high cultural significance (as outlined in Section 3) should be retained.

Requirements for Ongoing Use of Building

Section 4.4 sets out the requirements for the ongoing use of the theatre by the community, performers, the Director and staff. The present theatre building is considered by the director and users to be lacking in space and amenity in a number of areas.

Areas of the building complex identified by the building users as requiring adaptation and upgrading are assessed in this section in relation to possible impacts on the heritage character of the building. It is essential that any changes and upgrades to Her Majesty's Theatre ensure the continued use of the theatre by the community. These matters are addressed in greater detail in the *Development Feasibility Study*.

Heritage Listing Implications

As the Ballarat Her Majesty's Theatre is included on the Victorian Heritage Register, there are statutory obligations to refer works to Heritage Victoria for heritage permits. It should be noted that Her Majesty's Theatre has a Permit Exemption Declaration which allows certain classes of works or activities to be carried out without the need to obtain a permit from Heritage Victoria (refer Section 4.2).

Furthermore, as the Ballarat Her Majesty's Theatre is included within the Lydiard Street Heritage Precinct under the Heritage Overlay of the City of Ballarat Planning Scheme, there are statutory obligations to refer works to the City of Ballarat for planning and building permits.

Conservation Policies

Section 5.3 details the Adaptation and Change Policy which can be summarised as follows:

- Ensure the ongoing use of the theatre is achieved through appropriate adaptation and change. Adaptations and changes should balance current performance and user requirements with the significant heritage qualities of the theatre.

Sections 5.4 to 5.6 of this report cover in detail external, internal and site conservation policies as well as specific recommendations for their implementation.

Maintenance Program

It is recommended that a maintenance program be adopted for Her Majesty's Theatre as outlined in Section 7.3. Maintenance should not be undertaken in response to crisis situations, but should be a methodical and continuous process to prevent deterioration of elements of this significant building complex.

Interpretation and Tourism

It is recommended that an interpretation program be established (as outlined in Section 7.4) such that users and visitors have a means of understanding the cultural value of the place. A display or information leaflets could be provided which give details to the history of the theatre, its architecture, early theatre equipment and its changing use. Future tourism programs should look at the promotion of the theatre as a 'unique' theatre experience.

National Heritage Listing

It is possible that Her Majesty's Theatre may qualify for listing in the National Heritage List. A preliminary assessment of the theatre indicates that the theatre satisfies five of the nine criteria used by the Australian Heritage Council to assess whether a place should be listed on the National Heritage List (refer Section 7.6). It is recommended that further assessment be undertaken to investigate this opportunity.

Inclusion on the National Heritage List would elevate the theatre's heritage status as well as open up possibilities for National funding.

Funding Sources

Funding sources currently available are identified in Section 7.7 and include grants or loans offered by Heritage Victoria and the Department of the Environment and Heritage.

1.0 INTRODUCTION

1.1 Background and Previous Studies

Her Majesty's Theatre is a central part of the cultural life of Ballarat since it first opened its doors in 1875. It has been the home of the Royal South Street Society (RSSS) and their famous Grand National Eisteddfod of Australia since 1896. Other major hirers include Ballarat Light Opera Company, Ballarat Lyric Theatre and the Arts Academy of the University of Ballarat as well as local schools and ballet, dance and callisthenics schools.

In 1898, the theatre was sold to a consortium of local businessman and renamed Her Majesty's Theatre. Under this ownership, more than £20,000 was spent on remodelling and refurbishment over the period 1898 and 1907. The ownership then changed several times until the theatre was purchased by the RSSS in 1965 and renamed the Memorial Theatre.

In 1987 the RSSS, gifted the building to the, then, City of Ballaarat[2]. During much of 1987, substantial investigations were undertaken of the building and its market context, including the preparation of a comprehensive Conservation Analysis and Conservation Policy[3] by Clive Lucas and Partners). This resulted in the expenditure of some $6.0 million on the restoration and modernisation of the theatre over the period 1988 to 1990 and the theatre was renamed Her Majesty's in 1990. The conservation approach adopted by Clive Lucas and Partners was highly appropriate, taking into consideration the heritage qualities of the building.

In 1996, Arts Victoria in conjunction with the Victorian Association of Performing Arts Centres (VAPAC) commissioned a 'Survey of Rural and Metropolitan Performing Arts Centres'. The survey identified Her Majesty's Theatre, Ballarat, as one of three theatres whose heritage characteristics were considered to be important, but which would always be restricted in their staging capacity by aspects of their historic qualities. The most significant technical shortcomings were identified as the limited size of the loading dock and stage storage. Since the survey, many of the facilities at the theatre have been upgraded. A list of Capital Works projects completed at the theatre between 1999 and 2005 is attached (refer to Appendix 2). Studies undertaken since 1996 include:

- *Thomas Gibcus McGrath Pty Ltd & Wendy Jacobs, Building Condition Report, Her Majesty's Theatre, Melbourne, June 1997.* This report provides an appraisal of the condition of the theatre from both a structural and architectural perspective, and advises on maintenance requirements, both urgent and routine.
- SKM (Sinclair Knight Mertz), *Performing Arts Precinct Feasibility Study, Feasibility Outcomes, Melbourne, November 2003.* – this report iinvestigates the economic, architectural and social feasibility of making physical and organisational links between Her Majesty's Theatre and the Ballaarat Mechanics' Institute.[4]
- *Ballarat City Council, Best Value Report, Her Majesty's Theatre, Ballarat, July 2004*

The various investigations and reports undertaken over the past two decades have identified a number of emerging issues concerning the operation, efficiency and viability of the theatre. In order to address these issues, an understanding of the architectural and heritage limitations of the theatre is necessary.

This Conservation Management Plan has been commissioned by the City of Ballarat and the objectives of this plan are outlined in Section 1.2 below. The authors acknowledge the comprehensive research and investigation undertaken in the 1987 Conservation Analysis and Conservation Policy report which has been used as a starting point for this current report. The

[2] The City of Ballarat was known as the City of Ballaarat prior to the name change in 1994.

[3] Clive Lucas and Partners in association with Civil and Civic Pty Ltd, *Royal South Street Memorial Theatre, Lydiard Street South, Ballarat, Victoria: Conservation Analysis and Conservation Policy*, Sydney, 1987

[4] Following receipt of that Study, Her Majesty's Theatre Board of Management prepared a statement for the Ballarat City Council recommending that the options proposed in the report not proceed for the reason that they did not adequately address the current and future needs of the Theatre.

scope of the 1987 report was to inform the design decisions of the 1988-90 building works (undertaken to the direction of Conservation Architects Clive Lucas and Partners) which included reinstatement of the dome and the rear skillion addition). The following report updates this previous document and should be used to guide future planning, maintenance and modifications.

Concurrently with the preparation of this report, a *Development Feasibility Study for Her Majesty's Theatre, Ballarat*[5] has been prepared providing different options and scenarios for the ongoing use and upgrading of the theatre.

1.2 Objectives of Conservation Management Plan

The objective of the Conservation Management Plan for Her Majesty's Theatre at Ballarat is to provide a guide to the most effective way for caring for and managing the theatre in the future. The significance of the building in architectural, social and historical terms is well established, and its future will be determined by the degree of care and conservation input, balancing the conservation objectives against the need for the building to function as a viable and contemporary theatre complex.

The Conservation Plan considers the needs of the users of the building and provides an overall assessment of the theatre's condition. The need for urgent works is identified, providing the opportunity for overall planning for the theatre, rather than an ad-hoc response to planning where maintenance is undertaken when required. The Plan will be critical to the informing and guiding of potential development options, and the ability of the Heritage Victoria to assess the impact of a proposal when considering a permit application.

The Conservation Plan will also assist in providing the theatre with long term financial planning objectives for the conservation of the building and with obtaining financial assistance in the way of grants from relevant grant agencies.

It should be noted that during the preparation of this CMP, close consultation has been held with Mandy Jeans, the City of Ballarat's Heritage Advisor and delegate from Heritage Victoria. Feedback from Ms Jeans has been incorporated into the final document and the final report "signed off" in relation to Heritage Victoria requirements for the preparation of a CMP. This will now enable the report, following adoption by the City of Ballarat, to form the basis for future management of the building.

1.3 Existing Heritage Listings

Her Majesty's Theatre at Ballarat is included on the Register of the National Estate as item number 15722. The theatre is also included on the Victorian Heritage Register as item number H648 and file number 604232 and thus protected under the *Heritage Act 1995*. See Appendix 3 for details of these listings.

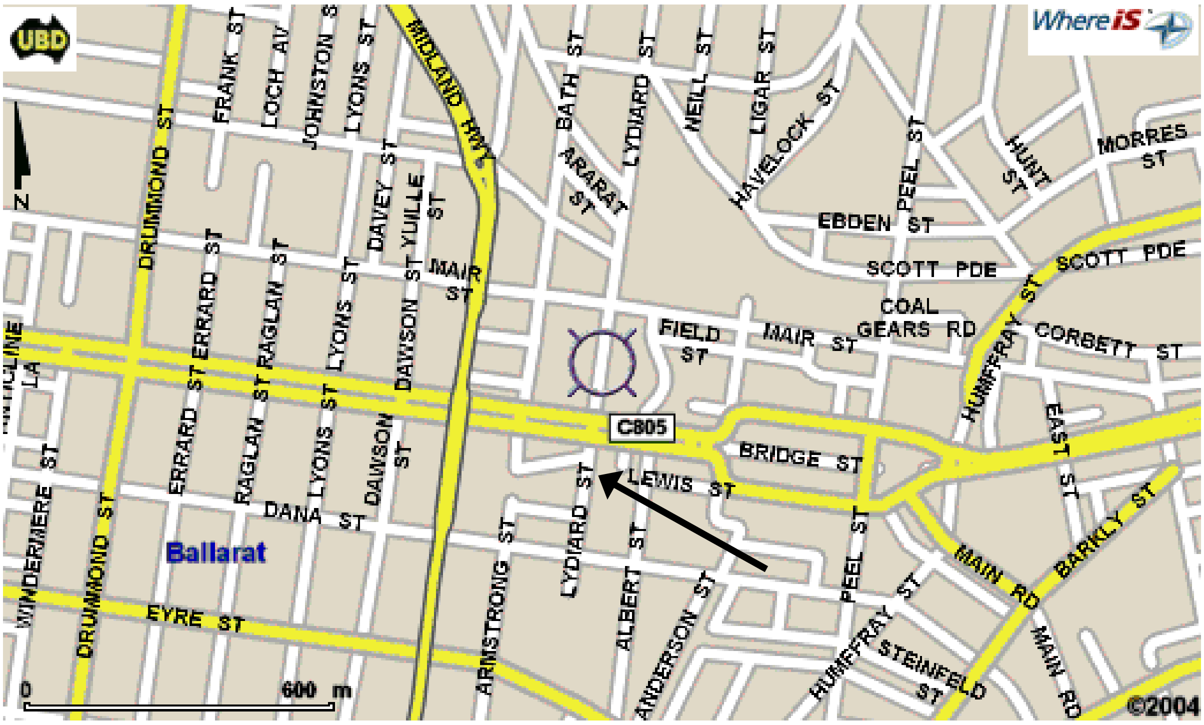
Under the Planning and Environment Act (1987), heritage places of 'local significance' are also identified within the local municipal planning scheme and are afforded protection via a Heritage Overlay control. Under the Heritage Overlay of the City of Ballarat Planning Scheme, Her Majesty's Theatre, 17 Lydiard Street is included within the Lydiard Street Heritage Precinct.

1.4 Location of Site

Her Majesty's Theatre at Ballarat is situated at 17 Lydiard Street South Ballarat. Ballarat is Victoria's second largest regional centre and is located approximately 110 km west of Melbourne, in Victoria.

[5] *Development Feasibility Study for Her Majesty's Theatre, Ballarat,* Swanbury Penglase, 2006

The property description is Crown Allotment 3 and part of Crown Allotment 4, Section 13 of the Township and Parish of Ballarat County of Grenville and the land contained in Certificate of Title/Crown Grant Volume 4306 Folio 123.



LOCATION OF HER MAJESTY'S THEATRE IN BALLARAT (shown arrowed) **N**

1.5 Ownership Details and Management

In November 1987, an agreement was made whereby the Royal South Street Society's freehold title in the Memorial Theatre (as it was known at the time) was transferred to the City of Ballaarat subject to certain conditions and the retention of certain rights.

An Advisory Board of Management was formed as a Section 86 'Special Committee' of the Ballarat City Council, as described in the Local Government Act 1989.

Today, in May 2006, as a Business Unit of the City Attractions & Tourism section of the Organisation Development & Marketing Division of the City of Ballarat, Her Majesty's Theatre is operated and managed by a team of professional staff employed by the City, with responsibility for:

- establishing and implementing business plans and strategies
- programming
- presenting an entrepreneurial program of professional touring productions
- budget setting and management, including fees for use and services
- receipt, disbursal & acquittal of all monies received by the Theatre (including grants)
- building maintenance and capital works
- promotion of the Theatre and the program of performances
- entering into Agreements for hire and use of the Theatre and MajesTix ticketing services
- maximizing use of Her Majesty's Theatre and its services
- grant application and seeking sponsorship
- advocacy of Her Majesty's Theatre and the performing arts in Ballarat.

The Board's role is:

- to formulate broad policy for the future of Her Majesty's Theatre

- to assist the Business Unit implement it's programs and operations;
- to overview the ongoing management and staffing structures of the Her Majesty's Theatre Business Unit
- to develop and promote interest within the community in Her Majesty's Theatre and the performing arts
- to maximize funding opportunities (including any grants made available through State or Federal government sources) for the development of activities of the Her Majesty's Theatre Business Unit.
- to encourage sponsorship and donations for activities of the Her Majesty's Theatre Business Unit.
- to encourage greater community participation in the activities of the Her Majesty's Theatre Business Unit.
- to develop and promote the Her Majesty's Theatre Business Unit entrepreneurial activities.
- to monitor the annual recurrent and Capital budgets for the Her Majesty's Theatre Business Unit as adopted by the Ballarat City Council.

1.6 Methodology of Conservation Management Plan

This Conservation Management Plan has been developed in accordance with the principles of the *Burra Charter* and comprises two sections:

- The historical and physical analysis of the place and determination of its cultural significance; and
- The preparation of guiding conservation policies which form the basis for recommendations for physical works and management of the place.

The format of this Conservation Plan is one which has been developed by McDougall & Vines over twenty years of preparation of such reports. The terminology used in the Conservation Plan accords with the definitions of such terms within the *Burra Charter*, the Australian ICOMOS Charter for the Conservation of Places of Cultural Significance (Refer Appendix 5).

2.0 HISTORICAL OUTLINE

2.1 Historical Development of the Theatre[6]

2.1.1 Historical Background

Theatre has been a part of Ballarat life since the early years of the gold rushes. The earliest theatres were associated with the hotels along Main Road, the commercial hub of the Ballarat Flat, in the midst of the diggings. The best known were the Victoria, the Charlie Napier and the Montezuma. These goldfields theatres were wooden structures, very susceptible to fire, and were regularly destroyed in major conflagrations along Main Road and rebuilt.

Ballarat's first permanent theatre, the Theatre Royal, was built in 1858 away from the crowded conditions on the Flat. Situated in Sturt Street, the Royal was a part of the shift in the centre of business activity away from Main Road to the township. It was a brick structure and opened with a declaration by its first manager, Shakespearian actor William Hoskins, that it would, “lift the standard of Ballarat's cultural life”.

As the centre of town life shifted to Sturt St, the Main Road theatres began to disappear. Ballarat East was left with one theatre, the Charlie Napier, which, following a fire in 1861, was rebuilt as the New Adelphi, along similar lines to the Royal. It closed after a short life, opening again in the mid-1860's as the Bijou Theatre, and finally closing its doors about 1868. The Royal was left as Ballarat's only fully equipped theatre. By that time, most performances presented there were limited seasons of touring productions originating from Melbourne or overseas.

By the 1870's the Theatre Royal was felt to be inadequate for the needs of an important provincial city like Ballarat. The stage facilities were too cramped for the productions that Melbourne theatrical managers were now producing. It needed refurbishment, and ways were examined to provide Ballarat with a new theatre. A group of Ballarat citizens approached the family of William J.T. Clarke, a wealthy pastoralist with vast land holdings across Victoria and interest in the Ballarat area. At the time, the Clarke family were interested in developing some of their property holdings and thus the family agreed to build a new theatre in Ballarat, a project that Clarke Jnr undertook.

Construction of Her Majesty’s Theatre, Ballarat began in 1874 at a cost of £12,000. Initially known as the Academy of Music (a name chosen to overcome religious and temperance scruples against patronising a 'theatre') the building was opened for its first performance on 7 June 1875. The Foundation Stone of the Academy of Music was laid on Thursday 24th September 1874 by Madame Arabella Goddard, a famous British pianist of the time. Madame Goddard laid the stone with an engraved silver trowel, which is currently on display in the Long Room.

The group of Ballarat citizens agreed to lease the theatre for ten years at a guaranteed ten per cent of Clarke's investment. This yearly rental was to prove unsustainable and the Academy of Music was handed back to Clarke within two years.

For the next twenty three years, the Academy of Music was unchallenged as Ballarat's main theatrical venue, although it was never as popular as the old Theatre Royal. Soon after the Academy opened, the large Supper Room (known today as the Long Room) was leased to William Bridges, a former miner, who ran it as an art gallery. After Bridges moved his operations to Melbourne in 1883, the Ballarat Fine Art Gallery was formed. The Gallery Society ran the Gallery from the Academy from 1884 until 1890, when the present Art Gallery in Lydiard Street North was opened.

In 1898, after William Clarke’s death, the theatre was sold to a consortium of local businessman, James Coghlan, Harry Davies and Johann Heinz. The consortium renamed the Academy as Her

6 Expanded from: Her Majesty’s Theatre, Ballarat website: *http://www.hermaj/history/index.htm* (accessed March 2006) and the *Royal South Street Memorial Theatre, Lydiard Street South, Ballarat, Victoria: Conservation Analysis and Conservation Policy*, Sydney, 1987 prepared by Clive Lucas and Partners in association with Civil and Civic Pty Ltd.

Majesty's Theatre and over the period 1898 and 1907, more than £20,000 was spent on remodelling and refurbishment.
Moving pictures came to Her Majesty's in the 1890's and by April, 1910 the theatre became a full-time cinema. From this time until the early 1960's, cinema was the predominant, but not the exclusive use of the building, as it remained the chief live theatre venue for local and touring performances.

In 1965, the theatre was saved from demolition and bought by the Royal South Street Society for £32,000. The theatre was renamed the Memorial Theatre and became the home of the Society's Annual Competitions, which are still held annually in the theatre between August and November. However, the Society was unable to adequately maintain the upkeep of the building and the building was gifted to the then, City of Ballaarat in 1987.

The City undertook a major renovation of the theatre in 1988-90, seeking funding from a wide range of businesses, individuals and organisations. Financial assistance was received from Heritage Victoria in April 1989 and comprised a grant of $35,000 allocated towards the restoration of the façade. The theatre re-opened as Her Majesty's Theatre on 1st November, 1990 and presents an annual theatre Season of touring professional and local productions. It is also hired for professional tours, local productions, school concerts, dance recitals, and conferences.

2.1.2 Previous Owners

The building's founder was Sir William Clarke, Baronet, one of Victoria's most prominent landowners and businessmen. As a well-known patron of the arts, the theatre in Ballarat was just a small part of his extensive business empire, and was managed by his local business agent. The theatre at this time was known as the Academy of Music.

In 1898, after Clarke's death, the theatre was sold to a consortium of local businessmen, James Coghlan JP, Harry Davies and Johannes (John) Heinz. Davies was a draper, Coghlan a brewer, and Heinz a butcher - together they were known as 'Rags, Bottles and Bones'. The purchase of the theatre was both a commercial opportunity and a public service. With the assistance of their agent, John Blight, the consortium undertook an extensive remodelling of the theatre which was renamed Her Majesty's Theatre.

James Coghlan died in 1902 and in 1904, his share of the theatre was bought by Heinz's brother, Christoph. In 1906, the owners undertook further work on the theatre to meet the requirements of the Central Board of Health. Between 1898 and 1907, the consortium spent over £20,000 on remodelling and refurbishing the theatre. By 1920, Davies and the Heinz brothers had all died and the building was sold again. The new owners were William Crowley, a solicitor and businessman from Bendigo, and his brother Cornelius, a Melbourne doctor. The theatre business was already well known to Crowley, as he and his two brothers had inherited Bendigo's Royal Princess Theatre from their father, John Crowley.

In 1928, Ballarat Theatres Pty Ltd, a Hoyts subsidiary, opened the Ballarat Regent Theatre, a purpose-built movie house in Lydiard Street North. At the same time, Ballarat Theatres bought Her Majesty's from the Crowleys for £22,500. However, the purchase price for Her Majesty's was never paid; instead, the Crowleys received 6½% annual interest payment on the amount owing.

In 1936, Ballarat Amusements leased Her Majesty's from Ballarat Theatres. When Crowley died in 1937, his interest in Her Majesty's passed to his nieces in England, the estate being administered by Sandhurst Trustees. They were the theatre proprietors in name only, Hoyts (previously Ballarat Theatres) continued to control the building and the lease to Ballarat Amusements. The curious question of ownership was resolved in 1942, when Ballarat Theatres finally purchased Her Majesty's from the Crowley estate.

Ballarat Amusements continued to lease Her Majesty's until the end of its life as a cinema. This came after local television station BTV-6 commenced commercial broadcasting in Ballarat in April 1962. The effect on local cinema audiences was immediate, and the decision was made to close

down the theatre. The last movie screened by Ballarat Amusements at Her Majesty's was Mutiny On The Bounty on 27 April 1963.
In June 1965, Ballarat Theatres sold Her Majesty's to the Royal South Street Society for £32,000. The Society was able to purchase the theatre through a mix of government subsidy and private donations. £10,000 came from local businessman Alf Reid (of Reid's Coffee Palace in Lydiard Street North) and a contribution was made by Royal South Street Society Board member James Kittson. However, the major part of the purchase price was covered by a grant of £20,000 from the Bolte Government.

The Royal South Street Society then changed the name of the theatre to the Memorial Theatre to ensure that donations to its renovation appeal were tax deductible (since they were made to an official war memorial). However, the Society was unable to adequately maintain the upkeep of the building and the building was gifted to the then, City of Ballaarat in 1987.

2.1.3 Summary of Key Historical Dates

24 Sept 1874	The Foundation Stone is laid by eminent British pianist, Madame Arabella Goddard.
7 June 1875	The Academy of Music opens with La Fille de Madame Angot, presented by W. S. Lyster's Royal Opera Bouffe Company.
1884 - 1890	The Academy's Supper Room is the first home of the Ballarat Fine Art Gallery.
1896	The Academy is used by the Royal South Street Society for the first time.
1898	The first owner, Sir William Clarke, Bt. dies. The Academy of Music is sold to James Coghlan, Harry Davies & Johann Heinz. Building modified (to design of William Pitt Architect) with inclusion of sloping auditorium floor, domed roof and second balcony level.
1910	Royal Pictures commences screenings. The theatre continues to be used for live theatre as well.
1920	Her Majesty's is sold to Bendigo theatre owners William and Cornelius Crowley.
1942	Ballarat Theatres buys Her Majesty's from William Crowley's executors.
1963	The last movie is shown at Her Majesty's, and the theatre closes down as a cinema.
1965	The Royal South Street Society buys the theatre. It is renovated and renamed The Memorial Theatre.
12 June 1982	The Compton Theatre Organ is launched.
1987	The Royal South Street Society gives the theatre to the then, City of Ballaarat.
1 Nov 1990	The theatre reopens after a major renovation funded by state and local governments, local donations and the Hugh Williamson Foundation. It is renamed Her Majesty's Theatre.

2.2 Architectural Development of the Theatre

2.2.1 Architectural Background

The architect responsible for the original design of Her Majesty’s Theatre in 1874-75 was George Browne. The successful tenderer for construction was Messrs James Sumner and Co., contractors of Melbourne and Ballarat. Commissioned by William Clarke, Browne was the Surveyor for the City of Melbourne and was also responsible for the design of the New Theatre Royal in Bourke Street, Melbourne, in 1872.

The initial design for the theatre was a three-storey building very similar to the Melbourne Theatre Royal, in an ornate ’Byzantine’ style. However this design was reduced to two stories for reasons of economy. Browne was not completely happy with the reduced scale of the building because the roof and ventilation tower of the auditorium, which was supposed to be concealed behind the facade was clearly visible from the street (*The Courier*, p.3, May 24 1875). The reduced height also had the effect of placing the façade out of proper scale and balance with the main structure. In order to maximise the commercial return, the street-frontage of the theatre was planned as shop-fronts or offices, a common practice when building theatres at that time. Two passages on either side were to give access to the different levels of the auditorium. The passageways were plastered and tiled while the business offices had wooden ceilings and fireplaces. It should be noted that before the Academy opened, Browne redesigned the front to create a grand entrance in place of a central office.

The original 1875 theatre was built with a flat floor, suitable for dances and dinners, and had a single balcony carried on wrought iron wall brackets fitted to the rear and side walls. The curves of the balcony formed a lyre shape and hence the theatre is known as a 'lyric' theatre to describe this style of auditorium. The balcony featured a decorative cast iron balustrade topped by a polished cedar handrail eight inches wide with golden lyres and silver strings worked into the design. The significance of the single balcony was that the upper balcony, or gallery, of Victorian theatres was the roughest part of the house, with the cheapest seats. It seems the management of the Academy of Music, in wishing to establish a respectable place of amusement, dispensed with a gallery.

The separate areas in the theatre were known as the *Parquette* (front stalls), with the *Pit* (rear stalls) behind it, and the *Paradis* (balcony or gallery) tier. The original seating capacity was 1,700, with 500 in the *Paradis* on upholstered seats, 400 in the *Parquette* on cane chairs, and the remaining 800 on plain wooden forms in the *Pit* (*The Courier*, p.3, May 24 1875). Access to the *Parquette* was via a separate door and a passage down the northern side of the auditorium.

The original lighting in the building was produced by gas burners. The auditorium was lit by a combination of 'sunburners, coronation fringes, brackets and floats', with light coming from the central burners as well as from lamps around the walls (Her Majesty's Theatre, March 2006). The burning of the gas created fumes and carbon residues and as such, keeping theatres clean was a constant problem. Two ventilation towers were built into the roof to carry off used air and fumes from the gas lighting.

In 1898, the new owners (Davies, Coghlan and Heinz) commissioned noted theatre architect William Pitt (who had worked on the original building as an apprentice under Browne and designed Melbourne's Princess Theatre) to modify the auditorium and improve the stage facilities. The present layout of the auditorium with the sloping floor and double balconies is Pitt's creation. It is much more 'theatrical' than the 1875 auditorium, which was more of a concert hall. The level stage floor was overlaid with a raked (sloping) floor, to improve sight-lines and the *Paradis* was removed and audience capacity increased by building two balconies - the Dress Circle and the Family Circle (known now as the Balcony) which are supported by pillars. It was claimed that 1,600 could easily be seated, with more standing in the promenades at the back of each Circle.

During the modifications undertaken by Pitt, the original roof was removed and a domed roof that could open to the sky was installed. Hugh Paterson, one of Melbourne's leading designers at that time undertook the interior decoration of the theatre and decorated the dome and proscenium arch with murals. The mural in the dome depicted a carnival scene, with dancers in fanciful costumes; Comedy and Tragedy were featured on either side of the proscenium arch, with Shakespeare over the top. Unfortunately most of the murals were destroyed in 1907 as part of the 1904-12 overhaul when Government regulations required the dome be removed for structural reasons (although it was later restored in the 1988-90 restoration works). However, it is understood that some of the painted paper lining of the dome still exists in the Sydney office of Clive Lucas and Partners (the Architects who undertook the 1988-90 works) and who took this off site during these works.

At about this time, the dome was covered by an octagonal shaped false ceiling and the proscenium wall was replaced with a solid firewall as it was constructed of timber and plaster, and did not provide a fire barrier between the stage and the auditorium. Original drawings show the proscenium as a delicate arch, with an inner proscenium arch built into it. The inner arch acted as a funnel for the sound, ensuring the sound produced on stage did not get lost in the fly tower above the stage. It also provided a small apron or forestage, where 'entr'actes' could be performed during scene changes behind.

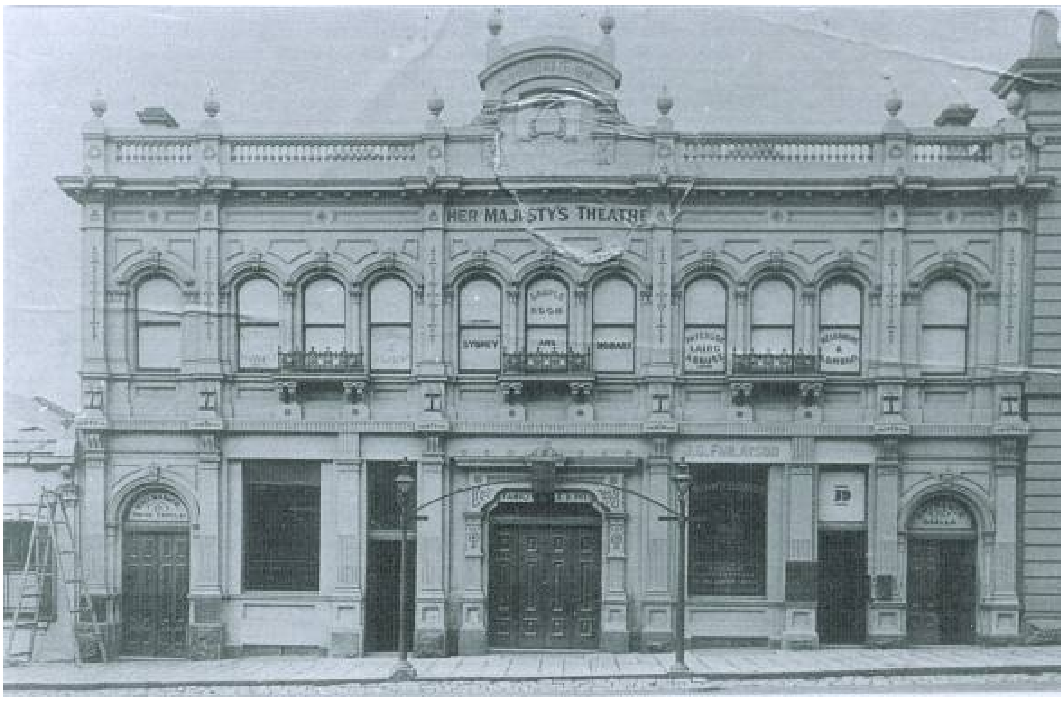
More significant modifications were undertaken throughout the mid 20th century and these are summarised in Section 2.2.1. Whilst the theatre has continued to be altered over time, most of the more recent restoration works has been concentrated on bringing equipment up to modern standards and dressing rooms up to present requirements to make the theatre efficient, comfortable and safe.

In December 1984, architect Ewan Jones prepared a development proposal to 'rejuvenate and revitalize the theatre' at an estimated cost of $ 2.3 million. This proposal did not come to fruition and Civil & Civic were appointed to implement a 'restoration and rejuvenation' proposal based on a Conservation Analysis and Conservation Policy report developed for the theatre by architects Clive Lucas and Partners in association with Civil & Civic. The renovations were undertaken in three stages over the period 1988-1990. The total cost of the conservations works was $ 6.5 million (Stage 1: $ 3.4 M, Stage 2: $ 2.5 M and Stage 3: $ 0.6 M).

During the 1988-90 conservation works, a collection of documents and other historical items were found. These items are currently stored in a trunk situated in the roof space. The theatre also has other items donated or purchased relating to the history of the performing arts in Ballarat and the region.

View of theatre c1884-1890 when the Ballarat Art Gallery was located there

(Source: City of Ballarat)

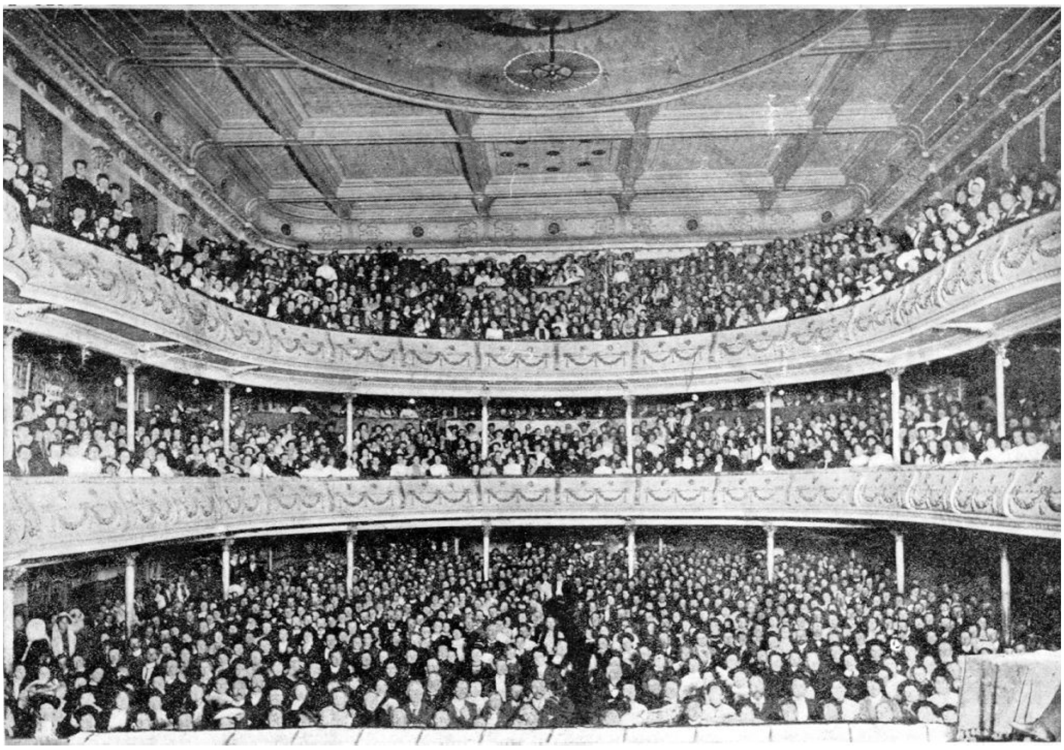


View of façade c1890-1898
(Source: City of Ballarat)

View of façade c1890-1898
(*Source: City of Ballarat)*

View of theatre interior with flat floor and single balcony level c1896

(Source: State Library of Victoria, mp011916)



View of theatre in 1904 after 1898 alterations – note newly inserted dome to the design of architect William Pitt

(Source: Her Majesty's Theatre)

View of theatre in 1930

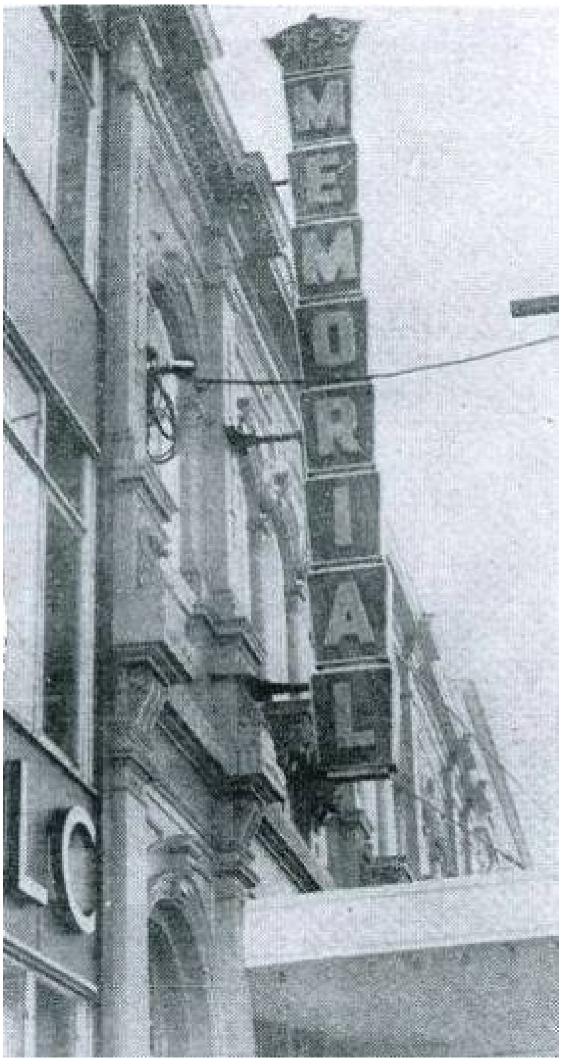
(Source: Her Majesty's Theatre Archives, photo by Alec Hannah)

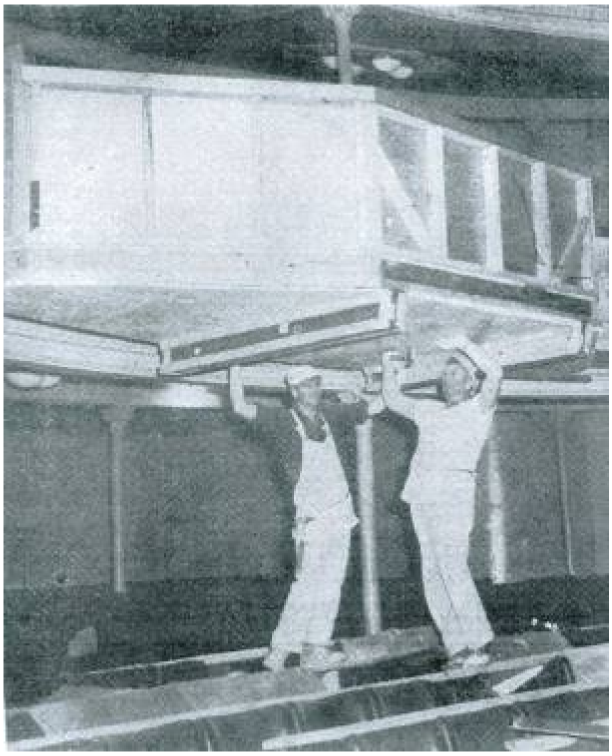
View of central entrance foyer in 1930

(Source: Her Majesty's Theatre Archives, photo by Alec Hannah)

View of theatre interior in 1930

(Source: Her Majesty's Theatre Archives, photo by Alec Hannah)





ABOVE: View of construction of Royal South Street Society adjudicators box in 1967

(Source: The Courier, 17 June 1966)

LEFT: View of Memorial Theatre sign in 1967

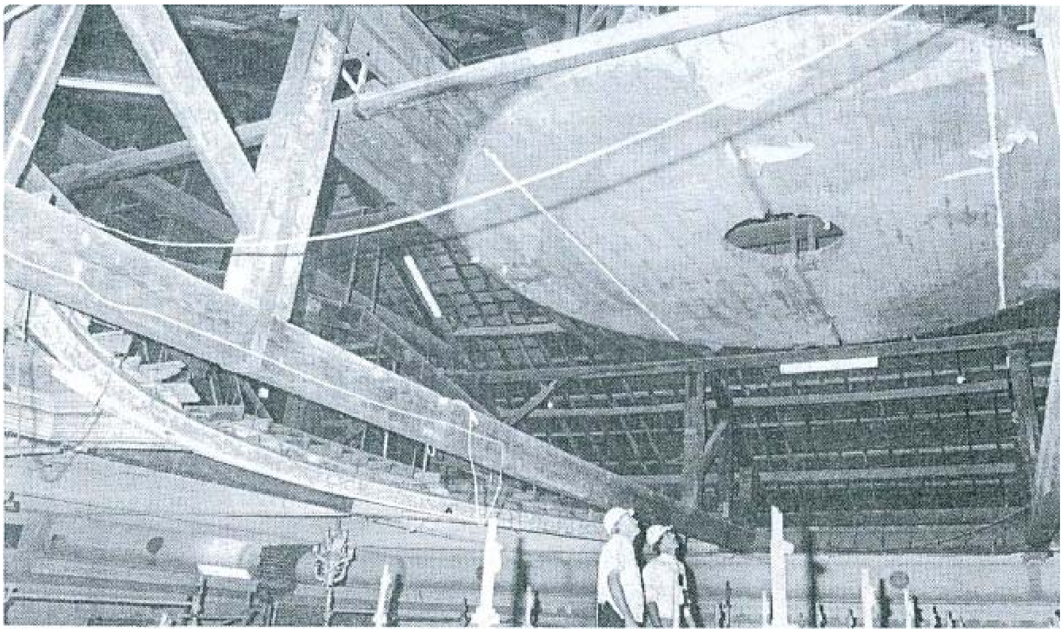
(Source: The Courier, 1 June 1967)

View of rear of theatre in c1970 - note that there is no "lean-to"

(Source: City of Ballarat)

View of theatre in 1974

(Source: Picture Australia JC000978)



View of roof during reconstruction of dome in 1989

(Source: The Courier, 21 December 1989)

View of theatre during re-opening in 1990

(Source: Her Majesty's Theatre)

2.2.2 Summary of Physical History[7]

Period of Construction	Name of Theatre	Owner	Architect	Work Carried Out	Types of performances
1874-75	Academy of Music	W J T Clarke	George Browne	Construction of original theatre building, including auditorium, 2 shops, and offices.	Victorian melodramas, Shakespeare, Operas, Musicals, Religious musical concerts, Temperance dramas, Pantomimes, Concerts, Royal South Street Competitions
1898-99	Her Majesty's Theatre	Coghlan, Davies, Heinz	William Pitt	Single gallery replaced with two galleries; dome introduced in ceiling; shopfronts replaced; dressing rooms replaced with new facilities built over Lewis Street footpath; extension to south of building comprising fire escape with egress to Lewis Street and dressing rooms above.	
1904-12	Her Majesty's Theatre	Coghlan, Davies, Heinz	Clegg & Morrow	Stair constructed up to dress circle lobby in central entrance hall, new stair down to stalls lobby and separate stair to warehouse space (long room foyer); fire wall constructed, fire curtain installed & proscenium replaced; roof trusses reconstructed and dome covered by octagonal shaped false ceiling; new escape passage introduced through north east corner of auditorium; portico constructed; main entrance altered.	
1916	Her Majesty's Theatre	Coghlan, Davies, Heinz	Clegg & Morrow	Bio Box constructed.	Films, interspersed with singers, comedians, instrumental concerts, etc.
1920-36	Her Majesty's Theatre	W Crowley, C G Crowley	Clegg & Morrow	Lavatories installed in basement with new stair down. First neon sign installed.	More films shown, 'talkies' introduced in 1930; concerts
1936-41	Her Majesty's Theatre	W Crowley, C G Crowley	Taylor, Soilleux & Overend	Parapet and window balustrades removed; south shop taken into foyer; new double flight of stairs down to stalls lobby from entrance; ticket box relocated & kiosk installed; general redecoration; new heating and mechanical ventilation systems installed; portico replaced by cantilevered awning over central doors.	
1942-52	Her Majesty's Theatre	Ballarat Theatres Ltd (later Ballarat Amusements Ltd).	Cowper, Murphy & Associates	Cantilevered awning extended across entire frontage; shopfronts altered; north shop taken into foyer and confectionery counter installed; stair up to dress circle lobby altered; stair in north corridor up to long room foyer removed and new stair constructed to link dress circle lobby with long room; new stair constructed down to basement from stalls lobby; stalls lobby enlarged; escape passage through auditorium abandoned; external fire stair constructed; Bio Box raised; general redecoration; additional heating & ventilation system installed.	Films

[7] Expanded from: Clive Lucas and Partners in association with Civil and Civic Pty Ltd, *Royal South Street Memorial Theatre, Lydiard Street South, Ballarat, Victoria: Conservation Analysis and Conservation Policy*, Sydney, 1987

Period of Construction	Name of Theatre	Owner	Architect	Work Carried Out	Types of performances
1966-67	Memorial Theatre	Royal South Street Society	G S Richards	Office for Royal South Street Society constructed in location of former north shop; Chairman's and adjudicator's dais constructed in auditorium, altering dress circle balustrade.	RSSS Competitions, Concerts, Plays, Operas, Ballet, Musicals, etc, by local and travelling companies.
1966	Memorial Theatre	Royal South Street Society	M F Murray	Dressing rooms constructed below stage - 1898 dressing rooms removed from over Lewis Street footpath.	
1978-87	Memorial Theatre	Royal South Street Society	Thomas C Sayer	Compton organ installed.	
1988-90	Her Majesty's Theatre	City of Ballaarat	Clive Lucas and Partners	Stage One: Upgrading of the façade, foyer, public spaces; redecoration of the auditorium; provision of new seating; upgrading of dressing rooms and installation of new fire grid and theatre equipment. Stage Two: Reconstruction of the front façade; general exterior work; restoration and reconstruction works in foyers and staircase areas; reconstruction of auditorium ceiling to Pitt configuration; construction of theatre offices; reconstruct rear skillion and external fire escape; refurbishment of ablution facilities; upgrade of various mechanical and fire services. Stage Three: Fit out of green room, bar, candy room and offices; painting; installation of fire curtain; new laundry; installation of fly system; carpets installed in sub-floor; renovations to orchestra pit; store for RSSS; new cloak room; refurbishments of seating and foot warmers.	Heritage Victoria Records and drawings held at the Theatre in Ballarat
1992	Her Majesty's Theatre	City of Ballaarat	Wendy Jacobs Architect	New entry under fire escape stairs and construction of entrance portico on north elevation (to match Lydiard Street).	Heritage Victoria File Records
1998-2001	Her Majesty's Theatre	City of Ballarat	Wendy Jacobs Architect	Rationalisation of Bio box window operation; Replacement of Baltic pine flooring at the stalls level with stained messmate timber; Replacement of intermediate sub-floor structure (floor structure between raked floor and flat floor); External illumination of Lydiard street façade.	Heritage Victoria File Records
2003	Her Majesty's Theatre	City of Ballarat	Wendy Jacobs Architect and Invertech PL	Installation of air-conditioning and roof ventilation to back stage dressing rooms, office area and auditorium.	Heritage Victoria File Records

2.3 Architectural Description and Analysis

Her Majesty's Theatre was originally completed in 1875 to a design by architect George Browne. The theatre is of solid masonry construction with a timber framed roof structure. The main body is brick with piers both inside and out. The façade is an early example of the 'Boom' style characteristic of the 1880's and is two storeyed in height with stucco ornamentation in a somewhat florid Classical style. The main features of the external elevation are the three triple arcade bays with less than semicircular arches with archivolts supported by slender columns as are the two ground floor subsidiary entrances.

The theatre originally comprised a rectangular auditorium with a steep lyre-shaped gallery, with a flat auditorium floor and a sloped stage. Three entries led to separate parts of the auditorium and two shops faced Lydiard Street (a common practice when building theatres at that time). Major modifications were carried out by William Pitt in 1898-99 and the present layout of the auditorium is essentially of Pitt's design. A sloping auditorium floor and a dress circle and gallery level were installed. The dress circle and gallery levels are carried on cast iron supporting posts typical for auditoria design in the late nineteenth/early twentieth century. The balcony balustrading is swag bellied and decorated.

The theatre interior is somewhat ornate with decorative motifs surviving from 1898 and subsequent alterations. The ground floor and entrance/foyer have been considerably altered at various times while much of the auditorium ceiling and pilastered walls are original.

The current colour appearance of the building is the result of the work of Clive Lucas and Partners, architects who were responsible for the conservation works undertaken in 1987- 1990. The colour and decorative schemes were prepared by this firm and are recreations of (or simplified versions of) the interior decoration undertaken in 1898-99 by Hugh Paterson, one of Melbourne's leading designers. The positive contribution that Clive Lucas and Partners made to the conservation of this building cannot be underestimated, as there had been other proposals prepared for inappropriate works (such as a "fake heritage" verandah) which would have had a disastrous and negative impact on the building.

2.4 Comparative Analysis with other Early Theatres

In order to ascertain the relative significance of Her Majesty's Theatre, Ballarat, a comparative analysis of Her Majesty's Theatre with other similar theatres throughout Australia and Victoria has been undertaken.

The analysis considers theatres that are:

- From a similar period (mid to late nineteenth century);
- Considered to be associated with the Victorian goldrushes; and
- Of a similar design.

The analysis considers five theatres as follows.

2.4.1 Theatre Royal, Hobart, TAS

Currently listed on the Register of the National Estate and the Tasmanian Heritage Register, the Theatre Royal, Hobart was constructed in 1834 and is Australia's oldest working theatre. Designed by Peter Degraves, (founder of Australia's oldest brewery, Cascade), the theatre is the only example of the Victorian bijou style remaining in Australia. Opened by a consortium of business leaders in 1837, the aim was to establish a permanent theatre for the rapidly expanding colony. The theatre was originally used for a number of purposes including a music hall and to provide entertainment such as cock fighting.

Constructed of convict-carved stone, the theatre has undergone a number of restoration and refurbishment works including the addition of a gallery in the 1850s, new decoration to the auditorium in the 1890s and extension of the fly tower in the 1980s. Following a fire in June 1984 which destroyed much of the stage area and the front of the auditorium, the theatre underwent major reconstruction and refurbishment, reopening in March 1986.

Although Her Majesty's Theatre is a younger building than the Theatre Royal in Hobart it is more intact with a higher proportion of original fabric. Whilst both theatres have undergone significant reconstruction and refurbishment overtime, Her Majesty's Theatre still retains significant sections dating back to the original 1875 building and the 1898 period.

2.4.2 Theatre Royal, Castlemaine, VIC

Currently listed on the Register of the National Estate, the Theatre Royal, Castlemaine was constructed in 1858 and replaced an earlier (1855) building which had burnt down. Originally constructed to provide live entertainment for goldminers in the area, the site is significant as it has continuously been used as a theatre, in substantially the same building, with no ostensible break in service. The theatre hosted many travelling companies, exhibiting drama, melodrama, circuses, tragedies and comedies as well as concerts and recitals.

Adjacent to the theatre was the Royal Hotel, and the two buildings were joined by a lobby before another fire in 1887, which resulted in the theatre being rebuilt utilising the whole block (replacing the area once used by the Royal Hotel).

With the coming of moving pictures the venue became a popular picture cinema and was extensively remodelled in 1938 having already lost its high Victorian verandah, dress circle, fixtures and fittings in the early 1920s. By the early 1970s the theatre had fallen on hard times until the 1980s when a variety of new films, matinees, live theatre, discos, bands and live music for various age groups were shown on a regular basis. Since then, the theatre has undergone extensive restoration to the 1938 period.

Similar to Her Majesty's Theatre, the Theatre Royal was built in a goldfields town and continues to be used as a theatre. However its original appearance has been significantly altered and is currently of an Art Deco architectural style.

2.4.3 Capital Theatre, Bendigo, VIC

The Capital Theatre, Bendigo is part of the former Masonic Hall, now The Capital - Bendigo's Performing Arts Centre, in the City of Greater Bendigo. The Masonic Hall is currently listed on the Register of the National Estate and the Victorian Heritage Register.

Constructed in 1873-74, the Masonic Hall originally consisted of lodge rooms and a public tavern on the ground floor with a large concert hall above. Designed by architects W.C. Vahland and R. Getzchmann (both freemasons), the two storey brick structure has a rendered facade composed of a giant Corinthian portico with flanking single bay wings. In 1890, the concert hall was converted to a theatre with a proscenium arch by one of the original architects, W.C.Vahland. To achieve this, land adjacent to the theatre was acquired and a two storey brick extension was added. The plasterwork in the theatre is diverse with panels of strapwork and superb pedestals decorated with acanthus.

As the last of the Bendigo theatres, the theatre was closed in the 1970s amongst constant attempts by the community to have the theatre reinstated. In 1987, three of the five Bendigo municipalities purchased the building with the financial support of State and Local Government, and private and public subscriptions and renovations (costing around $6 million) began in 1989. Reopened in 1991, further upgrades were undertaken in 2003-2004, including improvements to backstage facilities, structural upgrades and enlarging of the Box Office to improve the venue for local and commercial hirers and to accommodate the growing number of patrons.

Similar to Her Majesty's Theatre, the Capital Theatre was built in a goldfields town and continues to be used as a theatre. Constructed during the same period, the theatres adopt different architectural styles and interiors with Masonic symbols evident throughout the Capital Theatre.

2.4.4 Royal Theatre, Maldon, VIC

Dating from the 1860s, the Royal Theatre is typical of the extensive range of facilities provided by prosperous hotel keepers during the gold rush when hotels could have an entertainment venue attached. The theatre is believed to have survived dances, church services, a music hall, a Masonic Lodge and pictures until the 1960s.

The building which comprises a small hall, has been fully restored, including a beautiful ceiling and small stage. The projection room can be seen from the opposite side of the street, built out over the front verandah.

Unlike Her Majesty's the Royal Theatre is of a much smaller scale is no longer being used as a theatre. It is currently known as the Royal Theatre Cafe and Gallery.

2.4.5 Star Theatre, Chiltern, VIC

Currently listed on the Register of the National Estate and the Victorian Heritage Register, the Star Theatre was constructed in 1866 and replaced an earlier (1859) building constructed by J.A. Wallace which had burnt down. The entire complex, including the neighbouring Star Hotel (known today as the Grapevine Hotel) was rebuilt (with a common wall between the two facilities) by the coaching firm Crawford and Connelly and survives as a rare and complete example of the extensive range of facilities provided by prosperous hotel keepers during the gold rush.

The theatre has provided a variety of entertainment over its life including: live productions, balls, card nights, political rallies, cinema and boxing and roller skating. The theatre is a simple rectangular hall with a stage at the northern end and in its cinema form, films were projected from a bio box built on the outside wall of the stage to a screen mounted on the rear wall of the auditorium. In the courtyard is a grapevine which was planted in 1867 and is currently recorded as the largest in the Southern Hemisphere.

After a number of renovations, the theatre was restored in 1996 to its original theatre form and the former hotel and theatre are used today as an extensive art gallery and antique shop. There is also cinema memorabilia, old movie posters and footage which can be viewed at the theatre, which is of a much smaller scale than Her Majesty's Theatre.

2.4.6 Princess Theatre, Melbourne, VIC

Currently listed on the Register of the National Estate and the Victorian Heritage Register, the Princess Theatre is Melbourne's oldest theatre and occupies a site associated with theatre since 1854.

Erected in 1886 for Williamson, Garner and Musgrove by Cockram and Company, the architect was William Pitt. Constructed of brick with a French Second Empire facade and Malmsbury bluestone shop front piers, the lavish facade and interiors reflect the enormous wealth that had flooded into Melbourne as a result of the gold rushes. The first floor balcony was enclosed c1900 and the theatre was extensively renovated in 1922 and 1989. While these renovations have led to extensive internal change, most of the interior dates from 1922 and the basic structure of the building and its facade remain largely intact. As part of the 1989 works, extensions were made to the fly tower and gallery and modern equipment was installed to cater for a larger range of performances.

The Princess Theatre and Her Majesty's Theatre are similar in many ways. Both theatres had the notable architect William Pitt work on them and have a similar sliding roof opening to the sky in the auditorium. Both theatres have staged a number of notable artists and are also of a similar two storey height at the street front, although the Princess is a larger theatre complex. Her Majesty's Theatre is of added significance given its location within a regional setting which is different from the capital city setting of the Princess.

View of Theatre Royal, Hobart, 1985
(Source: National Archives of Australia A6135-1)

View of Capital Theatre, Bendigo, 2006
(Source: http://bendigolive.com/tourism/default.htm)

View of Theatre Royal, Castlemaine, 1989
(Source: Dep. for Env. and Heritage rt47182)

View of Royal Theatre, Maldon, 1965
(Source: State Library of Victoria jc011556)

View of Star Theatre, Chiltern, 1973
(Source: State Library of Victoria jc003700)

Alternate View of Star Theatre, Chiltern, 1995
(Source: Dep. for Env. and Heritage rt44804-23845)

View of Princess Theatre, Melbourne, 1985
(Source: Dep. for Env. and Heritage rt15127-6250)

View of Princess Theatre after renovations, c1989
(Source: Trevor Huggard and Associates)

3.0 STATEMENT OF CULTURAL SIGNIFICANCE

3.1 Assessment of Significance

3.1.1 Existing Statement of Significance

Her Majesty's Theatre at Ballarat is included on the Register of the National Estate as item number 15722 and on the Victorian Heritage Register as item number H0648 and file number 604232 (see Appendix 3 for details).

The statement of significance for the building from the Victorian Heritage Register is as follows:

> ‘This building, which was known in 1874 as the Academy of Music, in 1898 as Her Majesty's Theatre, and, from 1966 to 1988 as the South Street Memorial Theatre, has both historical and architectural significance. It is a rare survivor of a number of Ballarat and Bendigo theatres which, in the 19th century, rivalled those in Australia's capital cities. The Ballarat theatre is arguably the oldest operating theatre in Australia. According to Ross Thorne, a major exponent of our theatrical history, the memorial theatre is 'probably the most significant theatre in Australia today'. Thorne claims that it is the most substantially intact of our remaining 19th century theatres, which include the theatre Royal in Hobart, the Princess in Melbourne and Her Majesty's in Brisbane.
>
> On a Victoria-wide basis, the Ballarat theatre has special importance for its unique interior. Its double horse-shoe shaped balconies supported on columns, added from the designs of the notable architect William Pitt in 1898, are the last example of this type of theatre design in the State. The theatre has significance because of its associations with two distinguished 19th century architects, George Browne and William Pitt, both of whom specialised in the design of theatres. Browne, who was responsible for the original 1874 design of the Academy of Music, also designed Melbourne's rebuilt Theatre Royal in 1872. He was the designing architect in 1874 of Rupertswood, the Sunbury mansion of Sir William J Clarke, Patron of the Academy of Music. Pitt, who designed the 1898 alterations and additions, included among his theatrical works the new Princess Theatre in 1886, the Bijou (rebuilt after the fire of 1889), the 1891 design of the Melbourne Opera House and its rebuilding in 1901 (later known as the Tivoli), alterations to the interior of the Theatre Royal in Bourke Street in 1904 and alterations to the interior of the Hobart Theatre Royal in 1911. Also, at the turn of the century, Pitt was responsible for extensive alterations to Her Majesty's Theatre in Melbourne. Other major buildings designed by Pitt include the Rialto and the Olderfleet in Collins Street and the St Kilda Town Hall.
>
> The Theatre is a building which illustrates important aspects of the social and cultural life of Ballarat over a period of more than 100 years. It has importance for its links with Sir William J. Clarke (1831-1897), the landowner, stud breeder and philanthropist for whom it was built in 1874, and with a number of Ballarat's leading citizens, most notably William Collard Smith (1830-1894), agent, investor and politician. It is important for its associations from 1896 with the prestigious Royal South Street Society, a Ballarat organisation dedicated to the promotion of excellence in the performing arts. This society owned the building from 1965. The theatre is associated also with the Sun Aria competitions, which resulted in the discovery of many important Australian singers. Notable theatrical figures who performed at the theatre included the company of William Cyster, who is remembered for his part in establishing opera as a permanent institution in Victoria; Any Castles, dramatic soprano; Dame Nellie Melba and Gladys Moncrieff.
>
> The building has landmark value. The original 1874 Lydiard Street facade, which survives partially intact, provides a contributory element to the Lydiard Street precinct. The rear three-storey brick section has a strong visual element and closes the vista along Lewis Street.’

3.1.2 Assessment against *Heritage Act, 1995*

The theatre is considered to satisfy the following criteria under Sections 8(c) and 8(2) of the *Heritage Act, 1995:*

Criterion (a) *The historical importance, association with or relationship to Victoria's history of the place or object.*

Originally known as the Academy of Music, Her Majesty's Theatre is of considerable importance to Victoria's theatrical history. It is the one of the few Ballarat and Bendigo theatres which, in the nineteenth century, rivalled those in Australia's capital cities.

Having been in use since 1875, its name was changed to Her Majesty's Theatre in 1898 with a period between 1966 and 1988 where it was known as the South Street Memorial Theatre. The theatre was used in its early days to provide entertainment for the miners working on the central gold fields. Since then, the theatre has been used continuously by the local community and visitors for social/recreational purposes.

Criterion (b) *The importance of a place or object in demonstrating rarity or uniqueness.*

Built in 1874-75 to a design by George Browne, Her Majesty's Theatre is unique as it is the most intact of only four surviving nineteenth century public theatres in Australia. The theatre contains the only complete late Victorian stage remaining in Australia and the double horse-shoe shaped balconies, added from the designs of William Pitt in 1898, are the last example of this type of theatre design in the State. Of added significance is the fly gallery and the flying system, which is understood to be the only manual (non-counterweight) hand-line system in existence in Australia.

Criterion (d) *The importance of a place or object in exhibiting the principal characteristic or the representative nature of a place or object as part of a class or type of places or objects.*

Her Majesty's Theatre is a good example of typical nineteenth century theatre planning and exhibits the principal 'Boom' style characteristic of the 1880's. The façade still shows the three separate entrances to the theatre, separated by two shops and is two storeyed in height with stucco ornamentation in a florid Classical style.

Criterion (e) *The importance of the place or object in exhibiting good design or aesthetic characteristic and/or in exhibiting a richness, diversity or unusual integration of features.*

Her Majesty's Theatre exhibits good design and aesthetic characteristics and has a significant Victorian Italianate rendered facade. The theatre incorporates the designs of two distinguished nineteenth century architects, George Browne and William Pitt, both of whom specialised in the design of theatres. Browne, who was responsible for the original 1874 design, also designed Melbourne's rebuilt Theatre Royal in 1872 (now demolished). Pitt, who designed the 1898 alterations and additions was responsible for the new Princess Theatre in 1886, the Bijou (rebuilt after the fire of 1889) and the 1891 design and 1901 rebuilding of the Melbourne Opera House. Pitt was also responsible for alterations to the interior of the Melbourne and Hobart Theatre Royal in 1904 and 1911 respectively and Her Majesty's Theatre in Melbourne at the turn of the century.

Whilst there have been extensive renovations to the theatre over time, the theatre still retains significant sections dating back to the original building and the 1898 period. The original 1874 Lydiard Street facade survives substantially intact and is a contributory element to the 19^{th} century streetscape of Lydiard Street and the rear section is a strong visual element that closes the vista along Lewis Street.

The theatre is of added significance as it exhibits the evolution of theatre design through the unique integration of old and new design features.

Criterion (f) *The importance of the place or object in demonstrating or being associated with scientific or technical innovations or achievements.*

The building demonstrates significant technical innovation and achievement and is a resource for the study of the development of theatre design from Victorian times to the present. The stage equipment is the only known complete (and partially operable) equipment from the nineteenth century in Australia. Significant technical achievement and innovation is demonstrated through the equipment in the fly gallery and the opening mechanism and sliding table at the top of the 1898 dome constructed by Pitt.

Criterion (g) *The importance of the place or object in demonstrating social or cultural associations.*

The theatre has had associations with Ballarat's social and cultural life for more than a century, including links with notable theatrical figures, William Cyster, Dame Nellie Melba, Gladys Moncrieff and Amy Castles as well as the Sun Aria competitions, which resulted in the discovery of many important Australian singers.

The theatre also has associations with Sir William J. Clarke (1831-1897), the landowner, stud breeder and philanthropist for whom it was built in 1874-75, and with a number of Ballarat's leading citizens, most notably William Collard Smith (1830-1894), agent, investor and politician.

Since 1896, the theatre has also been associated with the Royal South Street Society, a Ballarat organisation dedicated to the promotion of excellence in the performing arts. This society owned the building from 1965 to 1987.

Theatre Royal, Bourke Street Melbourne (1885 view) also designed by George Browne Architect
Constructed in 1872- now demolished (*Source: State Library of Victoria, a14355*)

3.1.3 Revised Statement of Significance

The existing statement of significance for the building from the Victorian Heritage Register requires a number of amendments and updates with the additional significant values identified in this Conservation Management Plan. It is recommended that this revised statement of significance be used for future planning:

> Originally known as the Academy of Music, Her Majesty's Theatre is of considerable importance to Victoria's theatrical history. As one of the few Ballarat and Bendigo theatres which, in the nineteenth century, rivalled those in Australia's capital cities, the theatre has been in use since 1875. Used in its early days to provide entertainment for miners working on the central gold fields, the theatre's name was changed to Her Majesty's Theatre in 1898 with a period between 1966 and 1988 where it was known as the South Street Memorial Theatre.

The theatre incorporates the designs of two distinguished nineteenth century architects, George Browne and William Pitt, both of whom specialised in the design of theatres. Browne, who was responsible for the original 1874 design, also designed Melbourne's rebuilt Theatre Royal in 1872 (now demolished). Pitt, who designed the 1898 alterations and additions was responsible for the new Princess Theatre in 1886, the Bijou (rebuilt after the fire of 1889) and the 1891 design and 1901 rebuilding of the Melbourne Opera House. Pitt was also responsible for alterations to the interior of the Melbourne and Hobart Theatre Royal in 1904 and 1911 respectively and Her Majesty's Theatre in Melbourne at the turn of the century.

Her Majesty's Theatre is a good example of typical nineteenth century theatre planning and exhibits the principal 'Boom' style characteristic of the 1880's and the evolution of theatre design through the unique integration of old and new design features. Whilst there have been extensive renovations to the theatre over time, the theatre has landmark value and retains significant sections dating back to the original building and the 1898 period. The original 1874 Lydiard Street facade, which survives partially intact is of a Victorian Italianate style, providing a contributory element to the Lydiard Street precinct and the rear façade is a strong visual element that closes the vista along Lewis Street.

The theatre is a resource for the study of the development of theatre design from Victorian times to the present. As the most intact of only four surviving nineteenth century public theatres in Australia, the theatre contains the only complete (and partially operable) late Victorian stage remaining in Australia. The fly gallery and the flying system, is also understood to be the only manual (non-counterweight) hand-line system in existence in Australia. While the double horse-shoe shaped balconies, added from the designs of William Pitt in 1898, are the last example of this type of theatre design in the State.

The theatre has had associations with Ballarat's social and cultural life for more than a century, including links with notable theatrical figures, William Cyster, Dame Nellie Melba, Gladys Moncrieff and Amy Castles as well as the Sun Aria competitions, which resulted in the discovery of many important Australian singers. Since 1896, the theatre has been associated with the Royal South Street Society, a Ballarat organisation (who owned the building from 1965 to 1987) dedicated to the promotion of excellence in the performing arts. The theatre also has associations with Sir William J. Clarke (1831-1897), the landowner, stud breeder and philanthropist for whom it was built in 1874-75, and with a number of Ballarat's leading citizens, most notably William Collard Smith (1830-1894), agent, investor and politician.

3.2 Delineation of Significant Fabric and Components

3.2.1 Site Elements

The following elements are considered to be of **high significance**:

- The contribution of the Lydiard Street facade to the streetscape.
- The rear elevation of the building which closes the vista along Lewis Street – in particular the outline of the red brick building shape/ silhouette
- The contribution of the building as a landmark in the area.

3.2.2 External Elements

Refer to Section 3.2.4 for plans showing areas of the theatre rated as low, medium or high significance.

The front façade is considered to be of **high significance.** Conservation works in 1988-90 reconstructed the c1904 entrance portico, the entry doors (which are similar to the original configuration) and reinstated the parapet detailing and other ground floor openings to the original configuration. All the exterior fabric of the building comprising of stone, brick and timber are also considered to be of **high significance** excluding the following which are considered to be of **low significance**:

- The later external hoist and skillion addition on the eastern elevation (note that the skillion addition is a 1989 reconstruction of the 1895 Pitt extension).
- The later glazed porch under stairs and fire exits on the northern elevation.
- Corrugated roofing and quad guttering (which replaced original slate tiles and ogee guttering).
- PVC down pipes.
- Infill of windows.

3.2.3 Internal Elements

Refer to Section 3.2.4 for plans showing areas of the theatre rated as low, medium or high significance.

The following elements are considered to be of **high significance**:

- The internal spaces comprising: the proscenium arch, the fly tower gallery, the fly tower timber trusses, original equipment in the fly gallery, dress circle (416-417), gallery (503) and dress circle foyer (404-406),.
- The wall and ceiling surfaces and detailing in the auditorium (including the 1988-90 reconstruction of the 1898 dome).

The following elements are considered to be of **medium significance**:

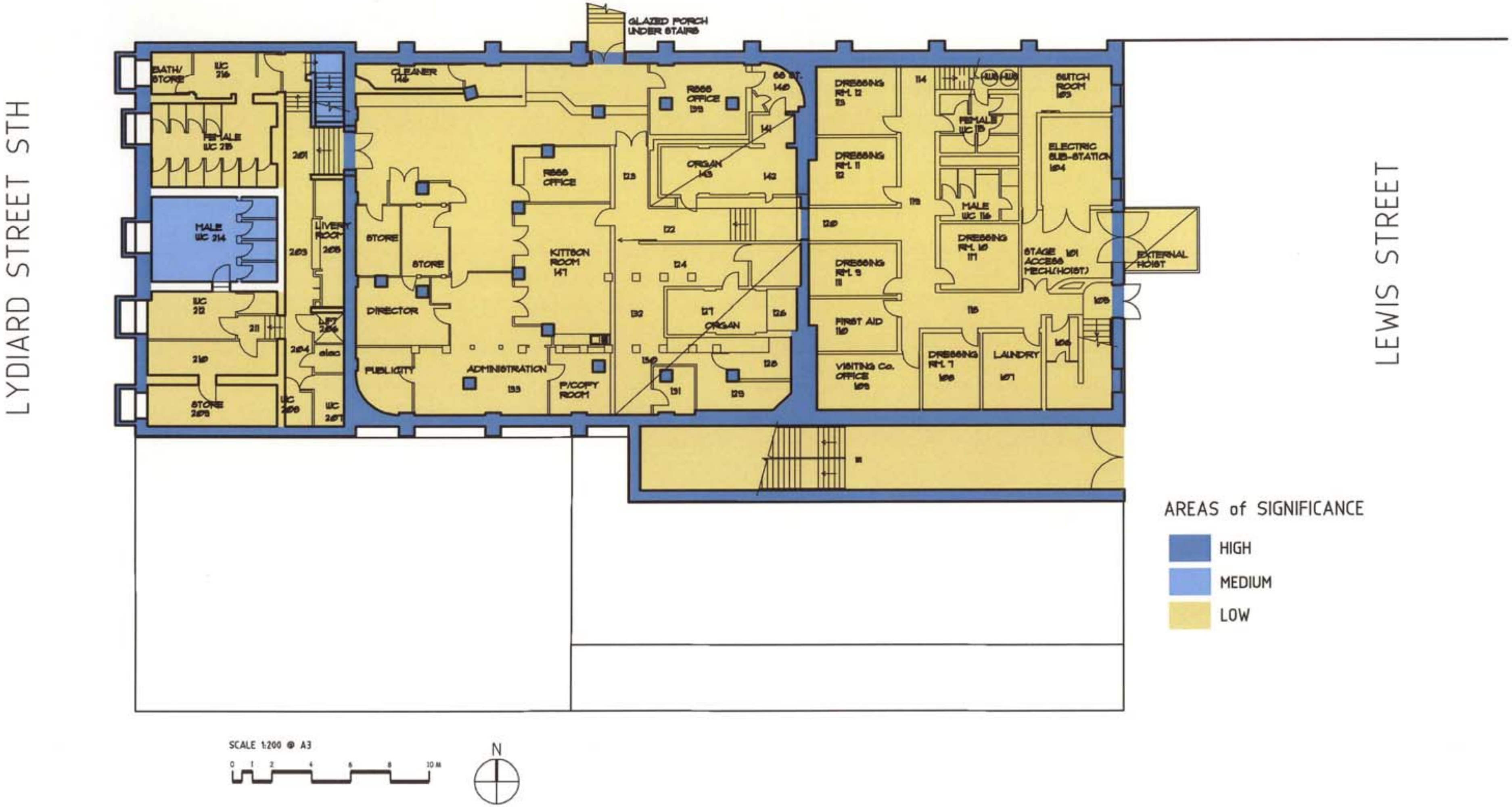
- The internal spaces comprising: the northern staircase (309, 403, 415, 502 and at sub-basement level), southern staircase (401, 413, 501), the tiled area at the foyer entrance (part 301), stalls (317, 318, 327), long room (414), stage, (319-325), men's urinals (214), north entry passage (301, 308) and south entry passage (314, 315).
- The Compton Organ (this was installed in 1982 and did not replace an earlier organ).
- The seating in the stalls, gallery and dress circle levels.
- The timber floors in the auditorium.
- The c1950 chandeliers installed during the period when the theatre was under the ownership of Hoyts.

All other internal spaces are considered to be of **low significance**.

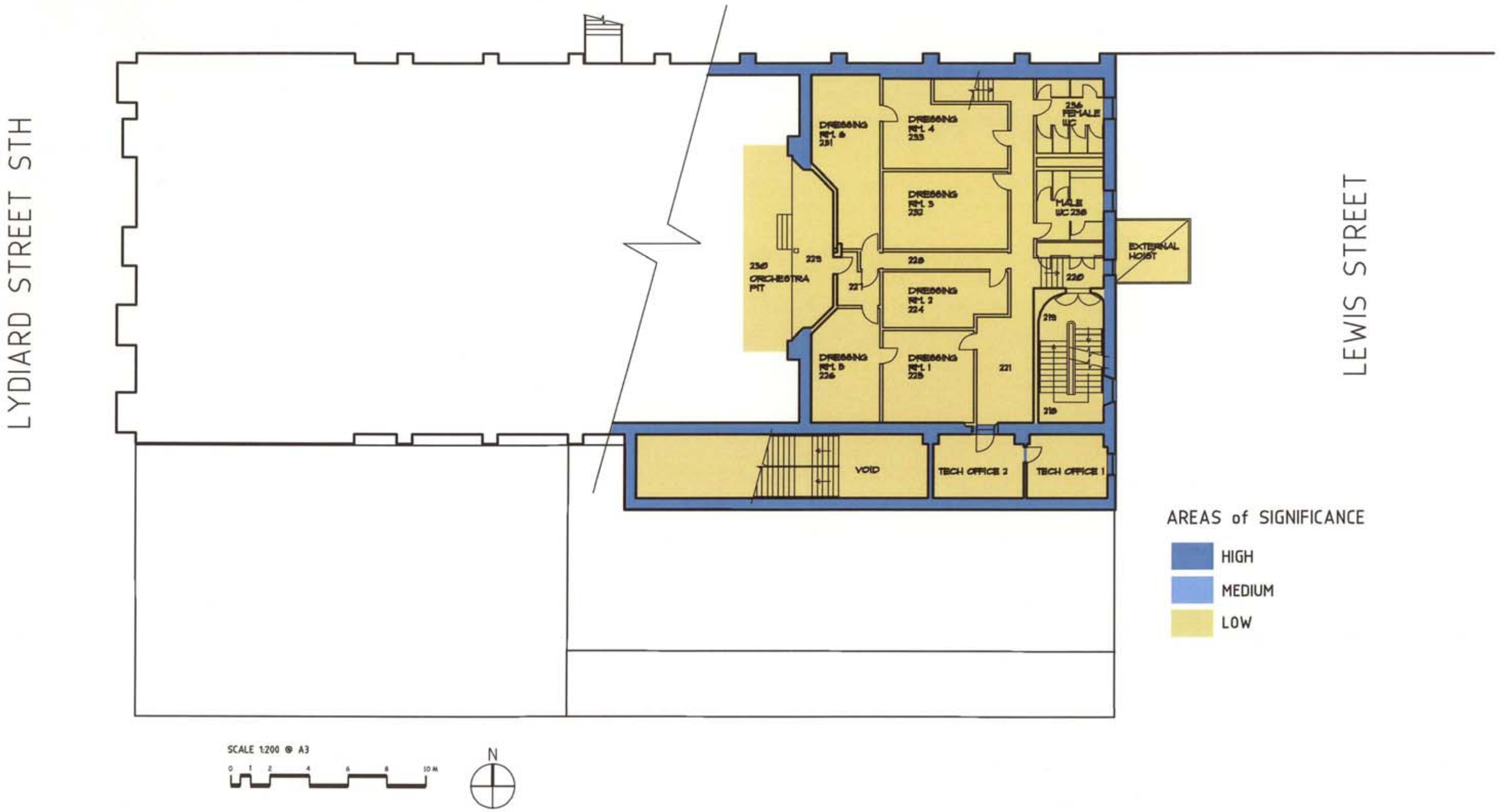
It should be noted that as part of the Permit Exemption Declaration held by Her Majesty's Theatre, a number of exemption areas have been set by Heritage Victoria (refer to Section 4.2). Internal minor works which do not require a permit are: the back stage, side stage and sub-basement rooms on Level 1, Level 2 and Level 3 in the areas as delineated on plans numbered Drawing 03/01, 03/02 and 03/03 (refer Appendix 4) .

3.2.4 Plans showing significant areas of Her Majesty's Theatre

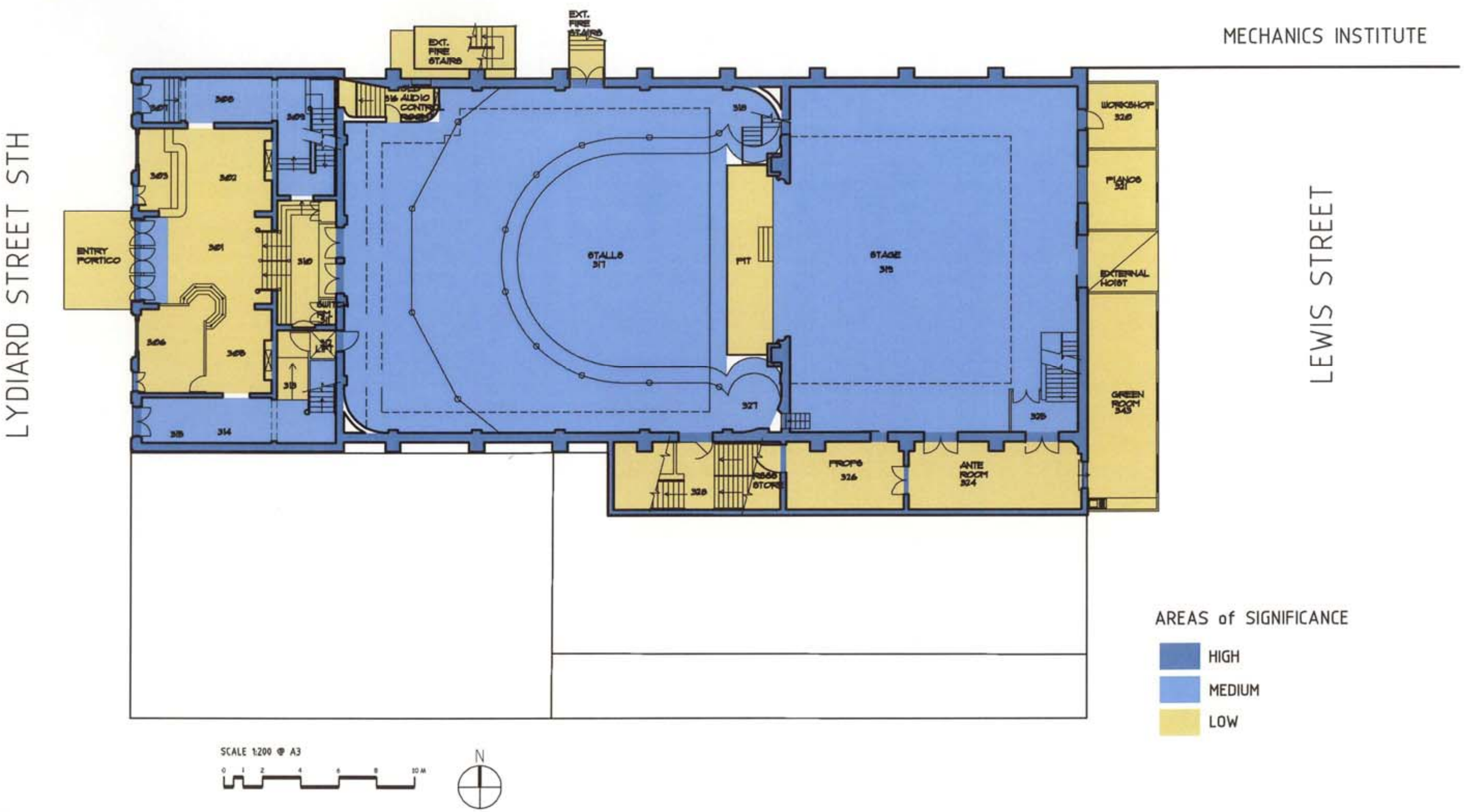
The following plans show the rating of each level of Her Majesty's Theatre assessed under three levels of significance, high, medium and low. The plans correlate with the assessments undertaken as part of the *Development Feasibility Study.*



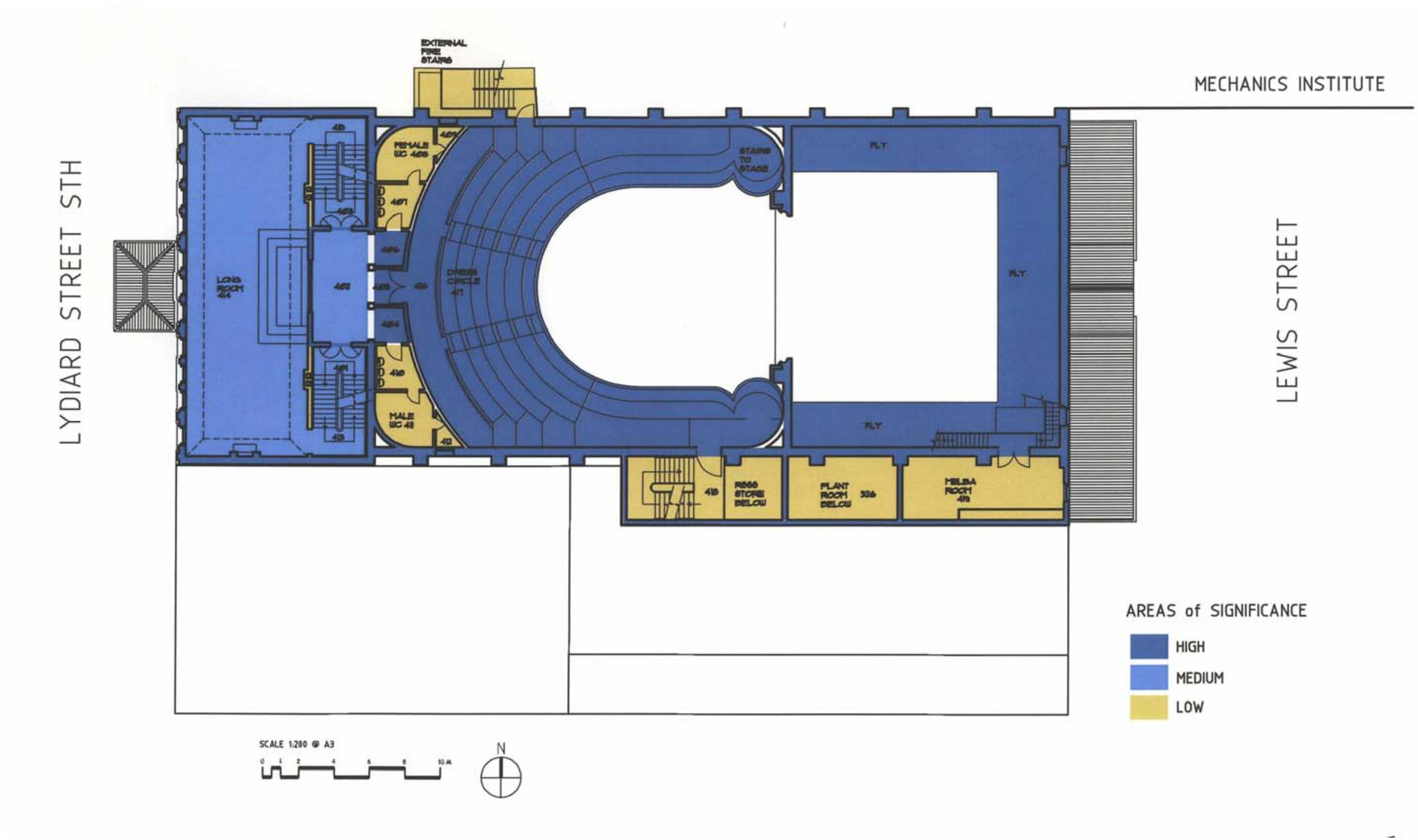
AREAS OF SIGNIFICANCE - SUB-BASEMENT - LEVEL 1



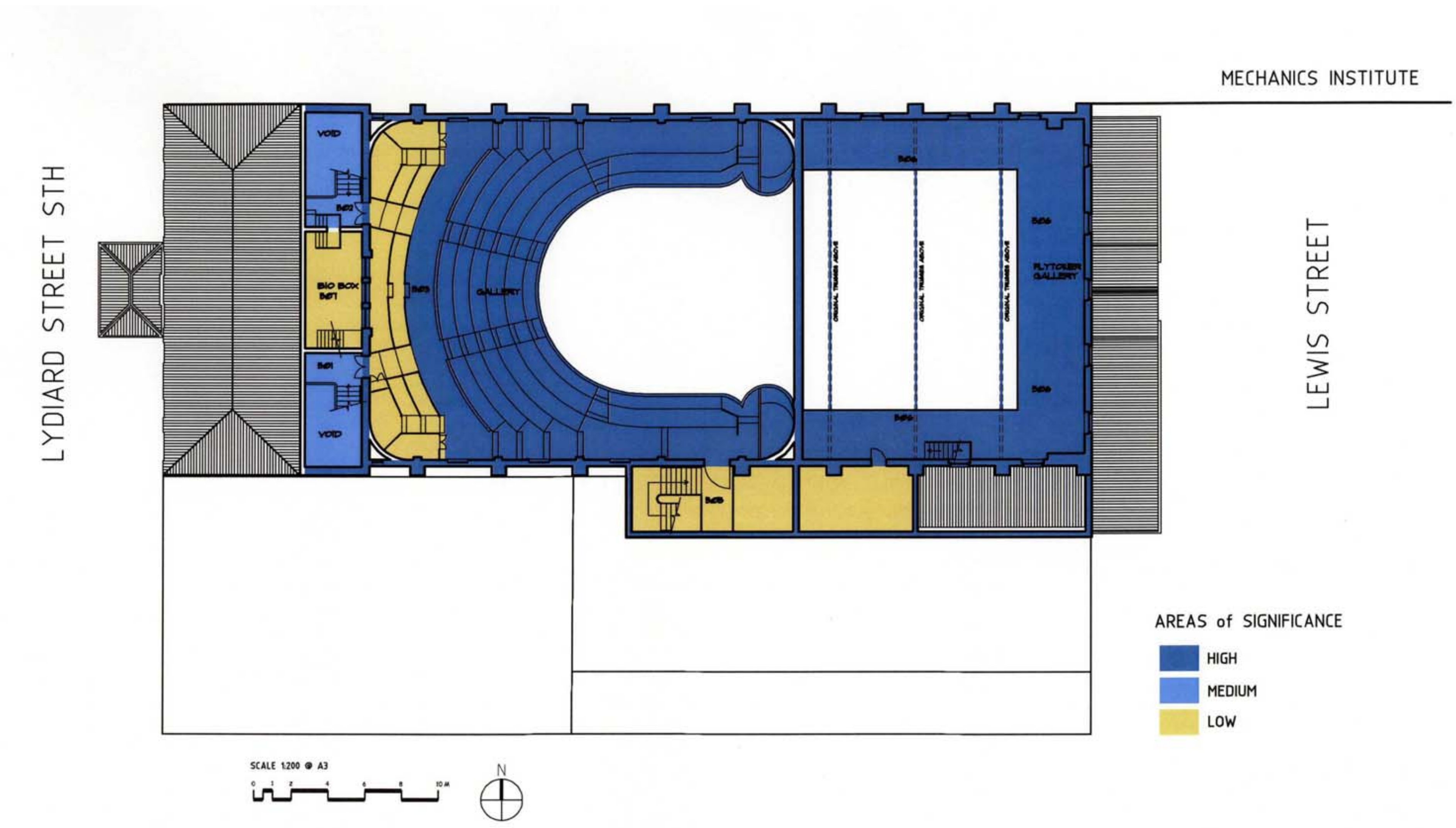
AREAS OF SIGNIFICANCE - BASEMENT - LEVEL 2



AREAS OF SIGNIFICANCE - STALLS - LEVEL 3



AREAS OF SIGNIFICANCE - DRESS CIRCLE - LEVEL 4



AREAS OF SIGNIFICANCE - GALLERY - LEVEL 5

4.0 CONSTRAINTS AND OWNER/USER REQUIREMENTS

4.1 Constraints Arising from Statement of Cultural Significance

Reference should be made to this report when undertaking any maintenance or adaptation, to ensure that any proposed works accord to the general recommendations and spirit of this report.

Section 3.0 outlines the Statement of Significance and those elements which are considered significant to the building and any future upgrading and extension of the building should be undertaken in a manner which does not compromise or remove any of the significant elements identified in Section 3.0. Reference should also be made to the *Development Feasibility Study*.

Any major works undertaken at the building should be undertaken to the direction of a qualified Conservation Architect. This is important to ensure that the significant fabric of the building, both (the exterior and the interior) is appropriately handled, and no future works diminish the significance of the building. In addition any new development on the site should not detract from the significance of the building.

4.2 Heritage Listing Implications

As the Ballarat Her Majesty's Theatre is included on the Victorian Heritage Register, it is protected under the *Heritage Act 1995* and there are statutory obligations to refer works to Heritage Victoria for heritage permits. It should be noted that Her Majesty's Theatre has a Permit Exemption Declaration which allows certain classes of works or activities to be carried out without the need to obtain a permit from Heritage Victoria. These include:

- Internal minor works to the back stage, side stage and sub-basement rooms on Level 1, Level 2 and Level 3 in the areas as shown on the plans numbered Drawing 03/01, 03/02 and 03/03 (refer Appendix 4) which are endorsed by the Executive Director and form part of a permit exemption.
- The internal minor works include but are not limited to the installation of lighting, screens, storage systems, mezzanine structures and fittings and fixtures provided the work has been agreed with by the appropriately qualified heritage consultant.

Full details and conditions of the Permit Exemption Declaration including drawings are attached as Appendix 4.

Irrespective of this Conservation Management Plan, works not exempt on the Heritage Victoria Permit Exemption Declaration will require a permit application to Heritage Victoria. When determining an application, *Section 73* under the *Heritage Act 1995* applies and the Executive Director considers the following:

- The extent to which the application, if approved, would affect the cultural heritage significance of the registered place or registered object.
- The extent to which the application, if refused, would affect the reasonable or economic use of the registered place or registered object, or cause undue financial hardship to the owner in relation to that place or object.
- If the applicant is a public authority, the extent to which the application, if refused, would unreasonably detrimentally affect the ability of the public authority to carry out a statutory duty specified in the application.
- Any matters relating to the protection and conservation of the place or object that the Executive Director considers relevant.
- The extent to which the application, if approved, would affect the cultural heritage significance of any adjacent or neighbouring property that is:
  - subject to a heritage requirement or control in the relevant planning scheme; or
  - included in the Heritage Register; and
  - any other relevant matter.

As the Ballarat Her Majesty's Theatre is included within the Lydiard Street Heritage Precinct under the Heritage Overlay of the City of Ballarat Planning Scheme, there are also statutory obligations to refer works to the Council for planning and building permits.

4.3 Compliance with Codes and Regulations

Any planned development of the theatre will be assessed for compliance with the Statutory Codes and regulations, including the Building Code of Australia and the Disability Discrimination Act (DDA). It may be possible that some flexibility is permitted in relation to meeting the provisions of the above frameworks, given the heritage status of the building.

4.3.1 Disabled Facilities

Currently there is not easy access by disabled patrons through the Lydiard Street entrance. In addition, there is no disabled access to the Dress Circle, Balcony and Long Room and this is seen as a limitation.

All proposals must comply with OH&S regulations - currently the steepness of the ramp to the lift, the heavy entry doors, the lack of airlock and the foyer steps have all been identified by the users as being of concern.

The current allocation for disabled seating would not meet the "Access Code for Buildings" under Class 9B – Assembly Building. This is currently a draft document awaiting ratification. It is recommended that the draft code is adopted in any upgrades to this area[8].

4.3.2 Fire Engineering

The Country Fire Authority undertook an inspection of the theatre in March 2006 and prepared an Inspection Report – Maintenance, Building Act 1993 (Pursuant to Section 227E). The following summarises the issues raised in the report:

- Exit lights not illuminated correctly and not operational in some areas.
- Non compliant or no exit or directional exit signage in many areas.
- Visibility of exit signage is not achieved from all areas within the dress circle.
- The sprinkler control assembly had some valves not locked & chained in the correct positions.
- A number of doors within the building are held open with electro magnetic devices connected to the building's detection system, none of these doors have any seals or signage (fire or smoke doors – do not obstruct).
- Non compliant or no dry chemical fire extinguishers in a number of areas.
- No instructions to not use the lift in the event of a fire.
- Some exit doors had multiple & non-compliant hardware.
- Disability Egress needs to be addressed.

[8] Extracted from Her Majesty's Theatre – *Redevelopment Theatre Consultants Report*, RTMI Theatre Design &Technology, April 2006

4.3.3 General

The *Building Services Report for Her Majesty's Theatre (2006)*[9] indicates that there is a significant shortcoming in terms of fresh air supply to the theatre auditorium and stage area which will need to be addressed in an appropriate and non-intrusive way. In addition the following issues need to be addressed:

- Battery store and internal condenser units are non-compliant and there are OH&S issues.
- Dress Circle Toilets exhausts are non-compliant.
- Fire curtain operation to be reviewed.

4.4 Community Use of the Theatre

Her Majesty's Theatre is a central part of the cultural life of Ballarat since it first opened its doors in 1875. It has been the home of the Royal South Street Society (RSSS) and their famous Grand National Eisteddfod of Australia since 1896. Other major hirers include Ballarat Light Opera Company, Ballarat Lyric Theatre and the Arts Academy of the University of Ballarat as well as local schools and ballet, dance and callisthenics schools.

The 2004-2005 Annual Report for the theatre indicates that 60% of the performances held at the theatre were for Royal South Street Competition sessions followed by 21% which were presented by Local & Not-for-Profit hirers. The remaining performances comprised of Commercial hirers (5%), professional productions run by Her Majesty's Theatre (7%) and rehearsals or workshop hires (7%).

It is essential that any changes and upgrades to the theatre ensure the continued use of the theatre by the community.

[9] *Building Services Report for Her Majesty's Theatre at Lydiard Street South Ballarat,* Simpson Kotzman Pty. Ltd., March 2006

4.5 Use of the Theatre by Performers, Director and Staff

This present theatre building is considered by the director and users to be lacking in space and amenity in a number of areas. The *Development Feasibility Study* explores the issues related to space and amenity of the building in detail, and outlines options for extending theatre activities either by extending the building at the rear, or into adjoining sites or both. It should be noted, however, that the adjoining properties are not presently in the ownership of Her Majesty's Theatre, or of the City of Ballarat.

The following areas of the building complex have been identified by the building users as requiring assessment, adaptation and upgrading - these matters are addressed in the *Development Feasibility Study*. Some have impact on the heritage character of the building, and are summarised in the table below:

Analysis	**Issues & Opportunities**
4.5.1 Foyer and Box Office Area	
Foyer Space - this area is currently cramped and overcrowded on busy nights, in particular full houses. From a user's point of view, physically enlarging the foyer space and creating larger public gathering spaces is required. Levelling of the multiple levels could also be considered.	• As the foyer has evolved over time with ongoing changes in various stages of the building's history, further change could be anticipated in this area.
Commercial Outlets - these are currently considered too small for the operations of the theatre at full house capacity. Opportunities to expand into adjoining buildings and side passages to ease spatial pressures on the foyer and provide more adequate space for commercial outlets should be investigated.	• Extension into the adjacent southern building would provide easier access compared to the adjacent northern building which is at a lower level.
Late Room/Crying Room – a late room/ crying room with a capacity for at least 10 people accessible from the foyer into the auditorium should be considered as this facility is now often provided in theatres. This room could also be used as a sound-proofed interpreter booth.	• There is insufficient space in the foyer area to install an additional room for this purpose. However opportunities exist to use the Long Room for this purpose.
Disabled Entry and Lift – disabled entry to the theatre is gained through the southern passage. A sloped concrete floor leads to the disabled lifts, which provides access to the toilets and the stalls level.	• The sloped concrete floor appears to be too steep and does not meet OH&S regulations. The lift and ramp are intrusive to the character of the building.
Foyer Signage - This was upgraded in 1999 under the direction of Wendy Jacobs Architect & Peter Lambert Graphic Designer.	• The foyer signage is considered by the current director to require revisions with a signage display system that is more clearly visible to all patrons.
4.5.2 Stage	
The following stage elements require review and upgrading:	
• *Stage Trap and Stage Floor* - constructed with a rake of 1:25, the size of the stage is an issue as it is too small for some stage performances. The stage once had 'traps' for stage effects, however these traps were removed when the RSSS laid a new hardwood stage. While stronger, it is not as 'live' as the more reverberant old pine stage.	• Current benchmarks require that the full stage floor be sacrificial to allow traps to be cut into any area of the performer's footprint. • Opportunities to expand the stage area as well as the feasibility of having a sacrificial stage and/or providing traps in the stage should be investigated.

Analysis	**Issues & Opportunities**
• *Thrust Stage* - creation of a thrust stage over the orchestra pit, which can be raised or lowered for audience seating depending on the requirements of the performance.	• The construction of a thrust stage should form part of any upgrades to expand or alter the stage area.
• *Organ Location and use* - With the organ in its current location, the orchestra pit and adjunct musician rooms are not viable and the stage traps are not functional or safe.	• Raising the organ to Stage level or the removal of the organ could be considered. Although it was installed in 1982, the organ was built by the English firm John Compton & Co in 1937 and is one of very few theatre organs outside a capital city.
• *Increase Wing Space* – current wing space available is insufficient.	• The following opportunities to expand the stage area should be explored: - *The Mechanics Institute or the adjacent apartment building* - additional openings could be incorporated. - *The skillion addition* - by adding an additional level or extending the skillion addition above Lewis Street or across to the Mechanics Institute. • In considering expansion options, the vista west along Lewis should be maintained.

4.5.3 Long Room

The Long Room is currently underutilised, and there are other options for use such as: performance space, display area and increased retail/hospitality.	• Retention of the bar (installed in 1989) is not needed and its removal or replacement with a smaller bar would allow for more flexible use of the room.

4.5.4 Auditorium

Seating - There are currently 959 seat frames in the theatre auditorium, and it is considered that these are uncomfortable. A seating configuration that accommodates more seats with better sight lines and larger seats is a suggestion of the current director. *Disabled Seating* – Seating available to disabled persons is inadequate and does not meet current regulations.	• Any upgrading of seating should retain some of the original seating (preferably in the side areas of the balcony and dress circle where sight lines are poor) and provide for adequate disabled seating.

4.5.5 Roof and Grid Area

Structure Evaluation - The need for a structural assessment and engineering study of the design of the roof has been identified by the users.	• This has been undertaken separately in the *Development Feasibility Report*.
Grid Height - Options to raise the height of the fly grid need to be explored. An increase in the grid height for hanging stage cloths by 4.6 metres to achieve an 18 metre drop is a preferred option as the theatre is currently limited to certain performances due to the low height of the fly gallery.	• Investigations have been undertaken in the *Development Feasibility Report* to raise the height of the fly tower to meet current benchmark standards. Whilst the fly tower is a significant part of the theatre, it is currently limiting the theatre to certain performances. A balance needs to be met to ensure the livelihood of the theatre and the associated heritage impacts.
Automated Flying - In 1988-90 the handlines were replaced with counterweight fly lines. Current benchmarks call for automated power flying in new and refurbished theatres.	• Retain the original handlines and counterweight fly lines and install an automated flying system as part of any upgrades to the fly tower.

Analysis	**Issues & Opportunities**
Bio Box Access - Covered access from the fly gallery to the Bio box is currently a preferred user option.	• Provide covered access from the fly gallery to the Bio box by investigating opportunities to connect the roof cavity area with the fly gallery.
4.5.6 Backstage and Loading Area	
Theatre Vehicle Parking - Secure, permanent parking at Lewis Street for at least the theatre's van and one other vehicle is required.	• There is not sufficient space to the rear of the theatre for permanent, secure parking. Locations near to the theatre should be explored and Ballarat City Council should be consulted.
Rear Stage Extension – The stage is currently too small and the extension of the rear of stage area out over Lewis Street is a preferred user option.	• The extension is a significant opportunity to increase the current size of the stage. The current rear skillion addition was erected in 1988-90 and is therefore not significant fabric. Extensions would need to meet current planning regulations set by Ballarat City Council. In considering any extension, the vista west along Lewis should be maintained and stormwater configuration, electrical and sewerage implications considered.
Stage Goods and Stage Passengers Lift – The provision of an enclosed stage access goods lift (with dimensions of approx 6 m long x 4 m wide and a load capacity of 2 tonne) to be used for people is a user requirement.	• A goods lift could be installed (replacing existing hoist system) to bring goods from Lewis Street to the stage level. However the size of the lift required is larger than that currently occupied by the hoist. The installation of a lift should be considered concurrently with any plans to extend the rear stage.
4.5.7 Other items for adaptation and upgrading	
Administration & Box Office: - the Administration and Box Office are currently separate. Efficiencies may be gained from having staff located together and this is a preference of the current users. *Storage Areas:* - storage areas at Her Majesty's Theatre are inadequate for technical equipment, archives and other items. One storage area requires climate control for historical material, and another needs to have humidity control for the storage of the theatre's pianos. *Lighting:* - lighting improvements at the Lydiard Street frontage and Emergency Evacuation lighting systems throughout the building require upgrading and improvement. *Dressing Room Mirrors:* - these require replacement with upgraded lighting for the application of stage make-up.	• Opportunities to provide additional administration, storage and box office areas. All these issues have been investigated in the *Development Feasibility Study.*

Analysis

4.5.8 Additional Backstage Areas

The following additional backstage space is required:

- Rehearsal Room: a sound proofed room of similar dimensions to the stage and in close proximity to the stage.
- One large dressing room capable of accommodating 40 people – this room could have alternative uses, such as conference room use.

Issues & Opportunities

- Opportunities to expand the theatre into neighbouring properties include:

  - Ballarat Mechanics' Institute - potential physical linkages might add to the storage space available at Her Majesty's; and sharing of spaces such as dressing rooms between the complexes.

  - Floor space in the residential apartment adjacent to the theatre on Lewis Street (two of these apartments have been vacant for some time).

  - Extension of the rear skillion addition above Lewis Street.
- Other neighbouring buildings linked to Her Majesty's Theatre have been investigated in the *Development Feasibility Study*.

View of Mechanical Institute

View of buildings adjacent to theatre on Lydiard Street

View of adjacent apartment

NEARBY BUILDINGS REPRESENTING POSSIBLE EXPANSION OPPORTUNITIES FOR THE THEATRE

5.0 CONSERVATION POLICIES, SURVEY OF FABRIC AND RECOMMENDATIONS

5.1 General Approach

The Statement of Cultural Significance for the Her Majesty's Theatre outlines that the primary value of the place derives from its architectural significance as well as its long history and ongoing use as a theatre. The general approach to be adopted in all conservation works is as follows:

- The statement of cultural heritage significance (refer to Section 3.1.3) for the place should be accepted as the basis for future planning.
- All future conservation and adaptation works which affect elements of significance should be carried out having regard for the principles of the Australia ICOMOS (Burra Charter) 1999.
- Those elements identified as being of significance should be conserved in accordance with the conservation policy identified in this study.
- Any major additions and alterations works to the buildings that impact on elements of significance should be undertaken in consultation with a conservation practitioner.
- A systematic program of maintenance be prepared (refer to Section 7.3).

The objective for any work or adaptations both externally and internally, should be to continue the representation of this building telling the story of the theatre activities within the district.

5.2 Site Policy

Background: Her Majesty's Theatre is part of a large group of nineteenth and early twentieth century buildings. The front façade of the building is a dominant feature of the Lydiard Street streetscape, while the rear façade presents an imposing façade that is directly visible along Lewis Street and also widely visible from a broad view catchment.

Policy: Her Majesty's Theatre should be maintained as a dominant landmark feature in the townscape and the manner in which the rear section closes the vista along Lewis Street should be retained.

Implementation: Ensure that any future development, works and activities do not obscure or lessen the contribution of the building to the current setting.

5.3 Adaptation and Change Policy

Background: Of the remaining 19th century theatres in Australia, Her Majesty's Theatre is substantially intact. However it is currently restricted in its staging capacity. Aspects of its significant historic qualities including the size of the stage, the height of the fly tower, original roof truss configuration, backstage facilities and disability requirements do not meet current user requirements and benchmark standards. This constrains the current range of possible performances which can be staged at the theatre.

Policy: Ensure the ongoing use of the theatre is achieved through appropriate adaptation and change. Adaptations and changes should balance current performance and user requirements with the significant heritage qualities of the theatre.

Implementation: Assess each potential adaptation and change against the requirements for continued use of the theatre and its conservation. Allow for original elements to be evident and respect the form, detailing and significant fabric of the building.

5.4 External Conservation Policies

5.4.1 Roof and Stormwater

Background: The roof is clad in corrugated iron and is in sound condition. Quad guttering (originally ogee profile guttering) discharges to round galvanised downpipes which are set on off-set stirruped brackets. Some of the downpipes are rusting and have been replaced with PVC pipes in some areas.

Policy: The external elevations and roof form should be retained. Original material and elements which have been altered over time should be reinstated in a manner which matches the original architecture of the building.

Implementation: Roof stormwater discharge needs to be checked as it is unclear as to whether the downpipes (together with gutters) are of sufficient capacity and are connected to the underground stormwater system. Rusted and PVC downpipes need to be replaced with round galvanised downpipes on round PVC stand-off brackets, to match original. Regular monitoring of roof and gutters should be undertaken. Gutters should be replaced with ogee profile guttering with traditional profiled rainheads or with half-round gutters for greater capacity.

5.4.2 External Joinery

Background: The joinery is generally in good condition, but paint finishes have failed. The front entrance doors are not original and are considered to be of low significance.

Policy: The original joinery should be maintained and current colour and finish is to be retained.

Implementation: Continue to maintain timber and regularly repaint and re-stain as required to prevent deterioration.

5.4.3 Brickwork

Background: All external walls (except for the front elevation) are constructed in red brick to the upper levels. Brickwork is generally in good condition, however there are large sections of mortar missing in areas, particularly above the roof line. Render is missing on the coping of the buttresses and brick cappings and this is causing the brickwork to deteriorate steadily. There is some black soiling adjacent to some of the brick pilasters.

Policy: All brickwork should be retained, cleaned and conserved, and reinstated where missing, using brick and mortar which matches in colour and finish.

Implementation: Continue to maintain and clean brickwork. Re-point with lime mortar and repair render to match existing where required. An accurate assessment of works by an experienced brickmason will provide an indication of the scope of works required and costings for these works.

5.4.4 Stonework

Background: All external walls (except for the front elevation) are constructed in bluestone to the lower levels. The stonework is generally in good condition, and is supported by brick and stone buttresses on the northern and southern elevations. There are some areas of stonework where sections of mortar are missing and there is some soiling of the stone face where water run-off from render and brick cappings have collected and discharged.

Policy: All stonework should be retained, cleaned and conserved, and reinstated where missing, using stone and mortar which matches in colour and finish.

Implementation: Continue to maintain and clean stonework. Re-point with lime mortar to match existing where required. An accurate assessment of works by an experienced stonemason will provide an indication of the scope of works required and costings for these works.

5.4.5 Front Facade

Background: The front façade is rendered and is in excellent condition. Most of the façade comprises 1874 and 1898 detailing (either original or reconstructed). Conservation works in 1988-90 have successfully reinstated the c1912 portico (which was removed c1940), the parapet details and associated stucco ornamentation and the ground floor opening configurations. The entry doors to Lydiard Street are from the 1988-90 conservation works and are similar to the original configuration. The only elements not reinstated were the cast iron balconettes to the windows.

Policy: The architectural qualities of the front facade should be retained.

Implementation: Continue to maintain the front façade with regularly cleaning of cement render and painting as required. Monitor and maintain the condition of the parapet, portico and balconettes and other detailing. Reinstate cast iron balconettes to the windows.

5.4.6 Rear Facade

Background: The rear façade (east elevation) is constructed in face red brick with bluestone to the lower levels and is generally in good condition except for some sections of missing mortar. There have been a number of changes to this elevation over time and the current skillion addition (a reconstruction of the 1898-99 skillion) formed part of the 1988-90 restoration program. Opportunities to expand the theatre complex at this elevation are being considered. There are a number of surface mounted conduits and pipes to this elevation including the natural gas supply pipe, plastic stormwater pipes and PVC plumbing drainage pipes.

Policy: Maintain the stonework and brickwork of the rear façade in good condition. Necessary changes to expand the theatre at this elevation must maintain the building's silhouette such that it continues to be a strong visual element that closes the vista along Lewis Street.

Implementation: Continue to maintain the rear façade with regularly cleaning of brickwork and re-pointing of missing mortar in stonework and brickwork. Relocate current surface mounted plumbing pipes internally.

5.5 Internal Conservation Policies

The interior of the building has been modified over the years but retains significant elements from the 1874 and 1898 periods. The following policies should guide conservation and adaptation work to the interior of the building.

5.5.1 Foyer

Background: The foyer has evolved over time with a number of changes in various stages of the theatre's history. The area is currently cramped and overcrowded on busy nights and this is impacting upon the continued use of the theatre.

Policy: Ensure that the foyer is capable of meeting the requirements of users. Changes should allow for original elements to be evident and respect the form and detailing of the foyer and significant fabric.

Implementation: Investigate opportunities to expand into adjoining buildings and side passages to ease spatial pressures on the foyer and provide more adequate space for commercial outlets.

5.5.2 Auditorium

Balconies

Background: The original auditorium had a single balcony until 1898, when Pitt upgraded the auditorium, adding an additional balcony. The curve of the balconies form a lyre shape and are still intact, however the balcony on the dress circle level has been altered with the installation of later timber balustrading and the insertion of an adjudicator's dais in c1965 for the Ballarat Eisteddfods (this was undertaken carefully, repeating original detailing).

Policy: Retain the detailing, colour and form of the balconies to the 1898 Pitt alterations. Original material and elements which have been altered over time should be reinstated in a manner which matches the original form.

Implementation: Continue to maintain the balconies, consider removing the adjudicator's dais and reconstructing the dress circle balustrade.

Seating

Background: There are currently 959 seats in the theatre, which were installed in 1930-40. While of historical interest, they are considered to be uncomfortable by some and too small and do not provide the best sight lines for the audience. In 2000, seating was reconfigured to continental seating (no centre aisle) and seats were placed slightly further apart to increase patron comfort. Extensive testing of new seating was undertaken during this upgrade and it was determined that the older style seating was satisfactory.

Policy: Any upgrades to seating should respect the existing seating design and retain a section of the current seating in the upper balcony area. Seating capacity should be maintained or increased if possible and shall also meet disabled seating requirements.

Implementation: Upgrade seating designs and configurations to improve sight lines and provide for more comfortable seating.

Dome

Background: Originally installed in 1898, the dome was removed in 1904 before it was reconstructed in 1988. The current plain appearance of the dome is in stark contrast with original dome which was covered with paper lining which had a mural painted directly onto them. Some of the painted paper lining of the dome exists in the Sydney office of Clive Lucas and Partners (the Architects who undertook the 1988-90 works).

Policy: The dome should be retained and future conservation works should continue to be undertaken to match the dome to its original 1898 form.

Implementation: Reinstatement of a painted mural either accurately reconstructing or deriving from the remnant paper lining mural is recommended for the dome.

Stage Floor

Background: constructed with a rake of 1:25, the size of the stage is a growing issue as it is too small for some stage performances. The stage once had 'traps' for stage effects, however these traps were removed when the RSSS laid a new hardwood stage. While stronger, it is not as 'live' as the more reverberant old pine stage. Current benchmarks require that the full stage floor be sacrificial to allow traps to be cut into any area of the performer's footprint.

Policy: Upgrades to the stage should only be undertaken to promote the theatre's use. Upgrades shall ensure that original elements are evident and respect the form, detailing and all significant fabric of the building. Maintain the rake of the stage if this is vital to the establishment of sight lines in the theatre.

Implementation: Explore opportunities to expand the stage area as well as the feasibility of having a sacrificial stage and/or providing traps in the stage.

5.5.3 Roof and Grid Area

Fly Gallery and Tower

Background: Dating from the construction of the theatre in 1875, the fly gallery is constructed with three original timber trusses and some steel framing and is in sound condition. The fly grid is the area at the top of the trusses and the fly tower is the part of the theatre building above the gallery. The fly tower is currently limiting the range of theatre performances as the drift (calculated as 2.5 times the proscenium height) of the fly tower falls short of the theatre industry standard. Ongoing use of the theatre for contemporary (large scale) performances will require changes and upgrades to the fly gallery and increase in height to the fly tower.

Policy: In order to meet current community expectations and theatre industry standards, changes could be undertaken to the fly gallery and tower. These necessary changes should allow for original elements to be retained or interpreted appropriately. Any change should respect the form, detailing and significant fabric of the building and should not be detrimental to the theatre's structural stability.

Implementation: Investigate options to raise the height of the fly tower to meet current benchmark standards.

Original Equipment

Background: The fly gallery contains a number of early equipment and fittings of heritage value including original handlines, fire curtain winch and wind and thunder machine. Most of the original equipment is obsolete and does not meet current safety standards. In 1988-90 the handlines were replaced with counterweight fly lines. Current benchmarks call for automated power flying in new and refurbished theatres.

Policy: Early equipment and fittings that are now obsolete should be retained on-site for interpretation purposes.

Implementation: Continue to maintain original equipment as part of an active interpretation program. Install an automated flying system to meet current safety requirements.

Bio Box

Background: Constructed in 1916, the Bio box is accessed from the gallery level. It has undergone a number of renovations and is also the access point to the roof cavity above the auditorium. Current user requirement requires covered access from the fly gallery to the bio box.

Policy: Any adaptations and changes should respect the form, detailing and all significant fabric of the building.

Implementation: Provide covered access from the fly gallery to the Bio box by investigating opportunities to connect the roof cavity area with the fly gallery.

5.5.4 Long Room

Background: Originally subdivided as offices and rented out by the theatre, the north end of the long room retains a section of the original plaster ceiling. A number of changes have occurred in this room over time and the room was reconstructed to its original 1875 form during the 1988-90 conservation works. The room is currently considered to be underutilised and does not have disabled access.

Policy: Continue to retain this room in its original 1875 form. Retention of the bar (installed in 1989) is not a requirement.

Implementation: Consider removing or replacing the bar with a smaller bar to allow for more flexible use of the room. Investigate opportunities for disability access and extended uses for the room such as a function room, offices or rehearsal room.

5.5.5 Internal Materials

Floor Surfaces

Background: The floor surfaces of the theatre are generally in good condition and comprise carpet, timber floors, tiles, slate and concrete. Of particular significance are the original timber floors to the galleries and fly gallery, the patterned tiles in the central foyer and the 1920s carpet design in the dress circle. The auditorium timber floor was replaced in 2000.

Policy: All floor surfaces should be retained and conserved to match original.

Implementation: continue to maintain slate, original timber floors, tiles and carpet. If replacement of carpet is necessary, maintain the same 1920s design used in the dress circle.

Joinery

Background: Joinery is generally in good condition, but requires regular re-painting/staining as part of overall internal maintenance. The timber floors in the auditorium are significant and considered to be original joinery.

Policy: Retain original joinery within the theatre. A clear stain finish is recommended for the balustrades and seating. Elsewhere on architraves, cornices, skirtings, panelling and doors a paint finish in the same colour scheme is appropriate.

Implementation: Continue to maintain timber and regularly re-paint or re-finish as required to prevent deterioration.

Plaster

Background: The internal walls are smooth plastered and in good condition, with only some hairline cracks appearing mostly at the junction of dissimilar materials. The ceilings in the auditorium and dress circle foyer are of particular significance.

Policy: The plaster surfaces which exist in the rooms currently should be retained and any new work required should also be completed in this smooth plaster finish.

Implementation: continue to maintain walls, ceilings and decorative moulding. Repair cracks in the wall and re-plaster if necessary using a compatible plaster mix. If repainting is required, use the same colour scheme as existing.

5.5.6 Services

Electrical

Background: Various types of lighting are used throughout the theatre. Pendant 'period' lights are used to light all public areas in the theatre except in the auditorium where c1950 chandeliers are used (installed during the period when the theatre was under the ownership of Hoyts). The auditorium is heated by a system of hot water pipes connected to foot warmers at the base of seats at the stalls level. Air-conditioning was installed in most areas in 2003.

Policy: Continue to maintain current lighting levels. Any new heating or cooling requirements and other electrical services should be undertaken in the most unobtrusive manner for the building.

Implementation: Consideration could be given to the replacement of the c1950s chandeliers with the pendant period lights elsewhere in the theatre. Future upgrading and installation of electrical services should adhere to the following:

- consolidation of conduits into a single cable and careful consideration of the location of supply conduits.
- recessing/chasing of cable into masonry walls or wainscotting.
- the least obtrusive and less damaging method should be determined in all cases.

Any computer fibre optic cable should be combined with electrical supply and recessed into wall cavity. Any signal cable should be installed to ASTA Standard.

Amenities

Background: The main theatre toilets located on Sub-basement Level 1 were initially installed c1920 with additional upgrades and facilities (including a disabled person's toilet and lift) taking place in 1988-90. Current disabled access does not comply and upgrading of the lift access zone is required. The male WC (room 214) on Level 1 is of particular interest, however maintenance of these is currently problematic with plumbers sometimes not willing to undertake work on these.

Toilets are also provided on Dress Circle Level 4. The original toilets were installed c1904 and upgraded c1942 prior to refurbishments which took place in 1988-90.

Policy: Ensure that appropriate amenities are provided for all staff and patrons including disabled persons. Retain the male WC (room 214) within a framework of current plumbing standards..

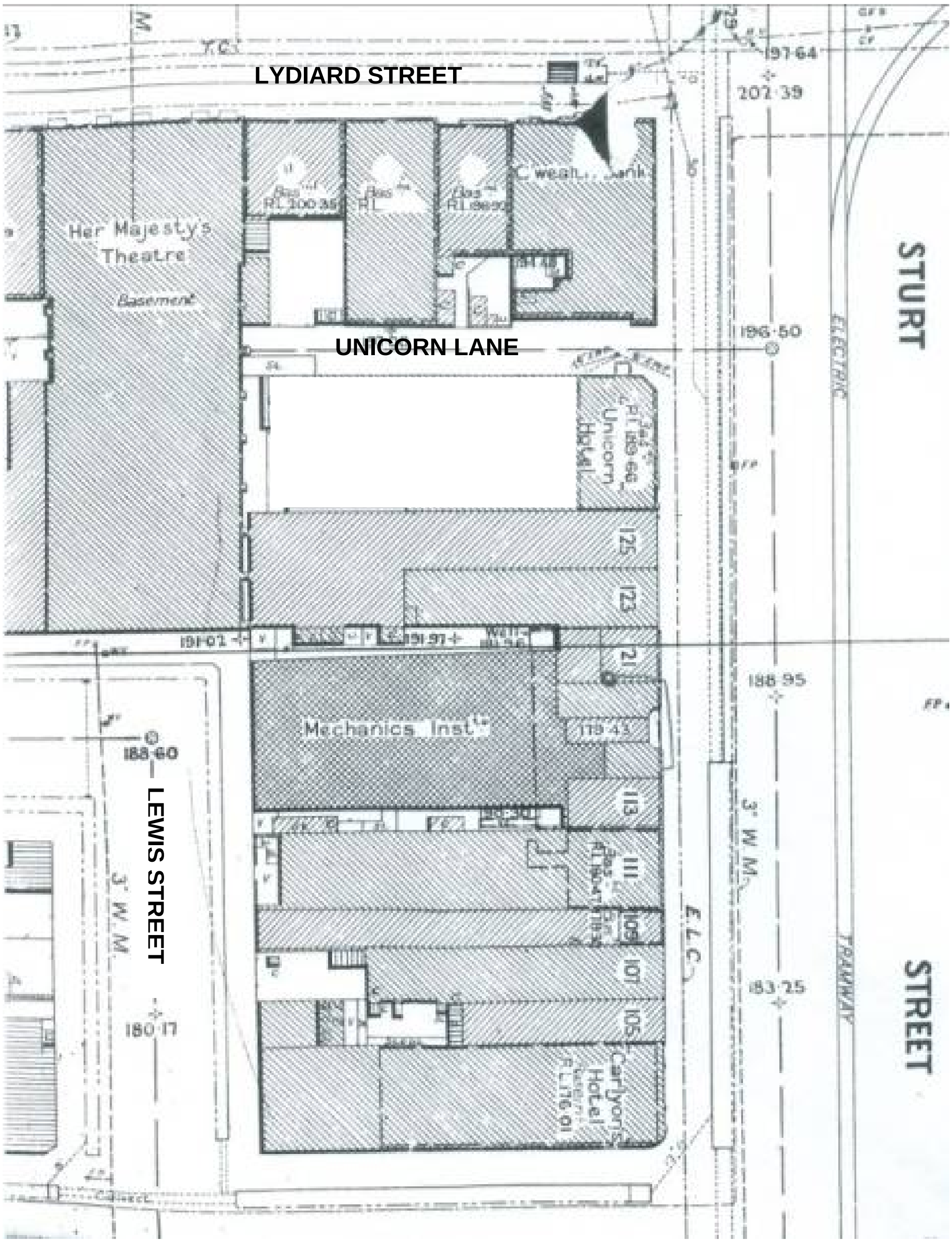
Implementation: Continue to maintain current amenities, consider upgrading wet areas (including access for disabled persons) as required.

6.0 BUILDING AND SITE ANALYSIS AND RECOMMENDATIONS

6.1 Site Analysis and Recommendations

6.1.1 Site Analysis

Her Majesty's Theatre is one of a large group of nineteenth and early twentieth century buildings located in the central business district of Ballarat, which give the city its Victorian period character. Located on the east side of Lydiard Street South, the site is located directly on the steeply sloped edge of a basalt plain.



SITE LOCATION

View looking towards south down Lydiard Street (Her Majesty's Theatre is on the left)

Above: View looking towards northern elevation of theatre from vacant block to rear of Unicorn Hotel

Right: View looking down Lewis Street towards eastern elevation of theatre (rear entrance)

The front façade of the building presents essentially as a two storey building in the Lydiard Street streetscape, while the rear façade presents an imposing façade (over five storeys in height) that is directly visible along Lewis Street and also widely visible from a broad view catchment. The building forms an integral part of the 'rearscape' of the varied buildings which face Lydiard Street South and Sturt Street.

The theatre is located on land sloping slightly down to the west with adjacent buildings to most of the north and south elevations. There are three entrances to the theatre, the main entrance is off Lydiard Street and the remaining entrances are off Unicorn Lane and Lewis Street (this is the rear entrance). Delivery of equipment and supplies currently takes place through this rear entrance. The back of the stage is 6.3 m above Lewis Street and all stage equipment and scenery is brought up to stage level by a hydraulic scissor lift.

There is currently a vacant block used for car parking adjacent to the northern elevation (to the rear of the Unicorn Hotel). At the time of writing this report there was Council approval for a new development at this site. Architectural plans for the proposed development (provided by the Council) showed a five storey apartment building located 1,600 mm from the northern wall of the theatre.

6.1.2 Site Recommendations

- Ensure that future development directly adjacent to and/or surrounding the site does not visually dominate the theatre and is complementary in building form, materials, colours, proportions and overall bulk and form.
- No works or activities should be carried out that will obscure or lessen the contribution of the building to the streetscape and as a landmark in the area.

6.2 External Assessment of Condition and Recommendations

The external assessments made in this section include a summary of the external changes made to the theatre over time. The summary of changes has been expanded from the *Royal South Street Memorial Theatre: Conservation Analysis and Conservation Policy Volume I* report prepared by Clive Lucas and Partners in association with Civil and Civic Pty Ltd in 1987. Detailed information on the development of the theatre can be found in the 1987 report.

6.2.1 Roof and Stormwater

Analysis

The original roof of the theatre was of slate and has since been replaced with corrugated iron and is currently in good condition. Box gutters have been well lined and are clean of debris.

The guttering is in quad with circular galvanised downpipes leading from the gutters to join at the base to original cast iron downpipes.

The downpipes are generally rusted and in some cases broken.

There are no rain heads to cope with large water volumes.

On the southern elevation, the lower section of one downpipe has been replaced with PVC.

Recommendations

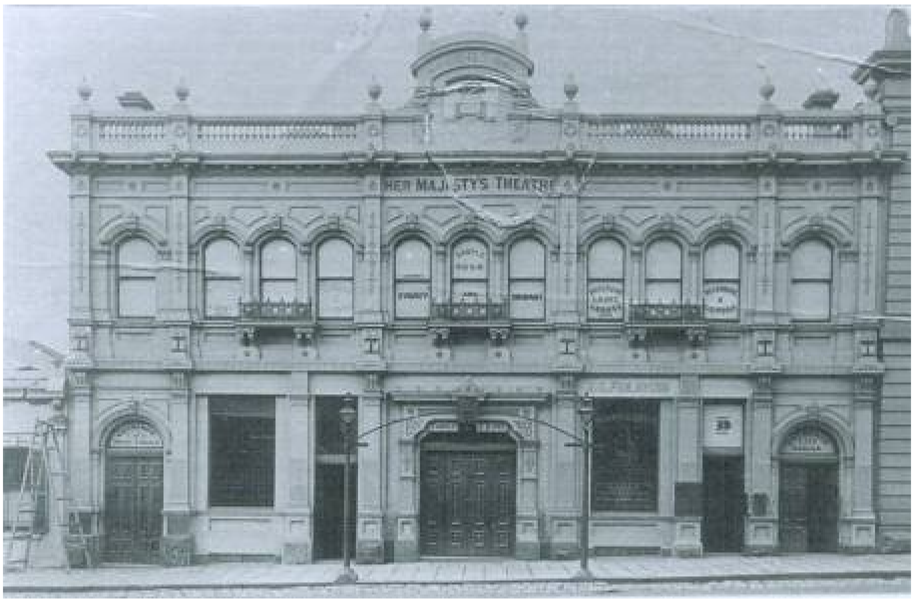
- Continue to maintain roof.
- Check the condition and cleanliness of all guttering and continue to check that downpipes are clear and not blocked.
- Gutters when replaced, should be in ogee profile with traditional profiled rainheads or with half-round gutters for greater capacity.
- Downpipes (together with gutters) require assessment to ensure they are sufficient in capacity.
- Rusted and PVC downpipes need to be replaced.
- The discharge from the downpipes needs to be checked (is it discharging onto the surface of the adjacent ground, or is it led away in the lane stormwater?)

6.2.2 West (Front - Lydiard Street) Elevation

A summary of the changes to the west elevation is tabled below:

Date	Description	Reference
1875	• Three separate entrances to theatre: - North to *Paradis* (balcony) and *Parquette* (front stalls). - Centre to body of hall (stalls). - South to offices (now upper foyer) also escape exit. • Two shops, glazed shopfronts, recessed doors. • All windows at first floor glazed (no false windows). • Street lamps either side of entry.	Original plans by Geo Brown WD THE 1-3, 4, 8. Premier Album of Ballarat Views, n.d. National Library.
1898	• Three separate entrances to theatre: - North to dress circle and offices (upper foyer). - Centre to pit (stalls) and Family Circle (gallery). - South to front stalls and offices (upper foyer). • Two shops altered including addition of 1 extra masonry pilaster to each.	Plans by W Pitt WD THE 1-14. Photographs of facade circa 1900-1906; 1905. Photograph of entrance, 1904.
1904-9	• Three windows at first floor blocked up.	Photograph c1917-36.
1912	• Cast iron and timber portico built in front of main entrance. • Main entrance widened, new doors installed. • Street lamps relocated.	Council register of plans submitted. Photos c1915, c1917-36. Site evidence.
1934	• Neon sign installed	Council Register of plans submitted.
1936-41	• Parapet balustrade taken down. • Three decorative window balustrades removed. • The 1912 portico is replaced with a cantilevered (postless) verandah over the central doors.	Site evidence.
1942-54	• New terrazzo steps to centre entrance. • Front of south shop remodelled including doors. • Doors to northern corridor remodelled. • Cantilevered awning extended across entire street frontage. • Northern shop window reduced and doors altered.	HCV File 507/1-2. Site evidence.
1965-87	• New illuminated signage to Lydiard Street.	HCV File 507/3. Site evidence.
1988-90	• Removal of cantilevered verandah and construction of new cast iron portico as a replica of one placed there in 1912. • Parapet reconstruction and reinstatement of original details (including installation of urns, pediment, console brackets, etc. to the Lydiard Street façade). • Masonry repair and painting and removal of surface mounted piping. • Open up and reconstruct three windows and cast iron balconettes to the first floor. • Reconstruct openings to the ground floor to the 1912 configuration including shopfront (including installation of basalt entry door treads). • Repair and restore all pavement grilles to basement preserving existing 1890s (northern) window frame and all earlier decoration.	Civil & Civic correspondence to City of Ballarat, 15 March 1989. Site evidence.

Date	Description	Reference
	• Reconstruct correct floor level to entrance doors to 1890 configuration by lowering one step. • Reconstruct sympathetic advertising boxes to front of pilasters. • Repair plaster work and joinery to front façade and repaint in circa 1912 decoration. • Installation of two gas lamps to footpath.	
c1999	• External illumination of the Lydiard Street façade	Heritage Victoria Permit File Information.
2001-02	• The front façade was repainted to 'Haymes Buff tone' to approximate the original stucco (approval from Heritage Victoria was obtained). • New entrance canopy sign.	Heritage Victoria File Information. Heritage Victoria Permit File Information.



View of façade c1890-1898 (Source: City of Ballarat)

View of theatre in 1930 showing changes to central entrance including the 1912 portico (Source: Her Majesty's Archives, photo by Alec Hannah)

View of theatre in 1974 with cantilevered awning and further changes to main entrance
(Source: Picture Australia JC000978)

Current view of theatre in 2006

Analysis

The front façade is rendered and is in excellent condition. Most of the façade comprises 1874 and 1898 detailing (either original or reconstructed). Numerous changes have been made to the front façade over time. The recent 1988-90 conservation works have successfully reinstated the c1912 portico (which was removed c1940), the parapet details and associated stucco ornamentation and the ground floor opening configurations.

The entry doors to Lydiard Street are also from the 1988-90 conservation works and are similar to the original configuration. The only elements not reinstated were the cast iron balconettes to the windows.

Concerns have been expressed about heaviness of front entrance doors, trip hazards of central and left hand entrance doors (white painted line to assist with definition) and width of crossover bluestone gutter.

Recommendations

- The front façade needs to be regularly maintained with regular repainting of the colour schedule as devised by Wendy Jacobs in the 2001 façade conservation works.
- Reinstate cast iron balconettes to the windows.
- Current concerns could be addressed by exploring alternative door mechanisms and possible grading of external footpath (although this would impact on the glass bricks positioned at the entrance threshold).

6.2.3 North Elevation (Unicorn Lane)

Analysis

Constructed in bluestone to the lower levels and red brick to the upper levels, the north elevation has been temporarily revealed due to the demolition of the building to the rear of the Unicorn Hotel.

There is an easement adjacent to the bluestone base to a width of 1600 mm and windows at the upper level (belonging to the auditorium) have been infilled.

This elevation includes brick and stone buttresses with rendered coping and sloping tops (note that render is missing to top of buttresses) and there are iron wall ties connecting sections of the pilasters. There is also black soiling adjacent to one of the brick pilasters.

This elevation also provides a view of the proscenium arch wall which is projecting above the roof line in red brick. This area of brickwork has large sections of mortar missing. This wall projects through the roof and has brick cappings without any rendered coping, causing the brickwork to deteriorate steadily.

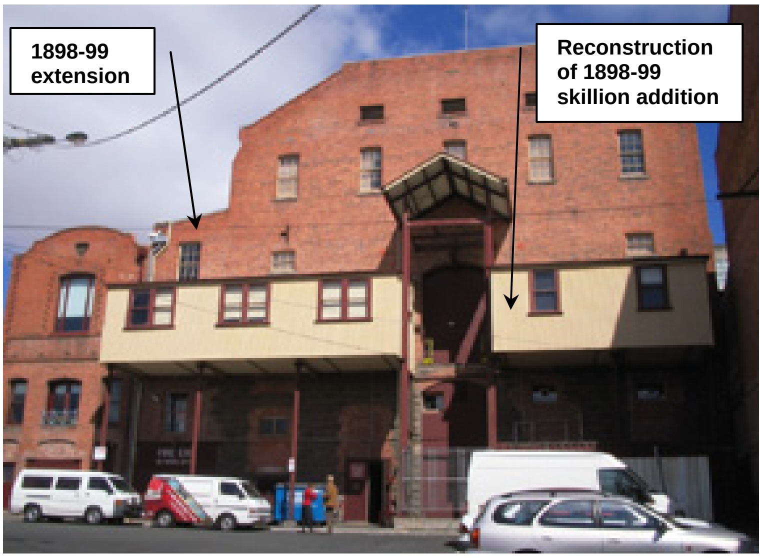
Fire escape and entrance – The c1898 fire escape provides egress to timber stairs leading to Unicorn Lane. While repairs and reconstruction was undertaken to the escape stairs during the 1988-90 works, the timber stair treads are deteriorating and splitting.

A new entrance with a glass enclosure was constructed c1992 beneath the fire exit stairs. At the same time, an entrance portico was constructed (echoing the portico on the Lydiard Street frontage) to provide sheltered access to the entrance. The roof to the entrance is in corrugated iron, which is accumulating debris and brick fragments.

Recommendations

- Continue to maintain this elevation, if left as it is the fabric of the building will deteriorate to this elevation.
- Window joinery requires re-painting.
- Window sills require re-rendering and general repairs.
- The tops of the brick buttresses also require re-rendering to ensure that water does not penetrate down through the brickwork causing deterioration below.
- This elevation requires some urgent maintenance work including the re-pointing and repairs to the brick chimneys and the projecting brick proscenium arch wall.
- Check that the fire escape meets relevant building codes and repair or replace defective timber treads.
- Clean the roof to the entrance of debris and continue to monitor.

6.2.4 East (Rear - Lewis Street) Elevation



Analysis

The east elevation is constructed in face red brick with bluestone to the lower levels. There have been a number of changes to this elevation. Generally it is in good condition, although there are areas of brickwork where mortar is missing, in particular below the upper southern window which corresponds to a crack which appears to travel down the building. This has resulted in missing mortar to the brickwork and bluestone at the lower levels.

The fire escape at this elevation is part of the 1898-99 extensions made to the building by Pitt.

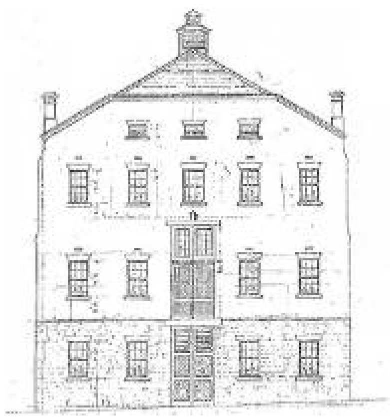
The skillion addition is a reconstruction of the 1898-99 skillion (which was removed in 1967) and formed part of the 1988-90 restoration program. It is likely that the roofing over the loading door was also installed during these works.

There are a number of surface mounted conduits and pipes to this elevation including the natural gas supply pipe, plastic stormwater pipes and PVC plumbing drainage pipes.

The current method for transporting goods to the stage level from Lewis Street is located via a scissor lift at the centre of this elevation.

Recommendations

- Continue to maintain this elevation.
- Re-point missing mortar to sections of brickwork and stonework.
- Opportunities to expand the theatre complex into the adjacent apartments, the Mechanics Institute or through the extension of the skillion addition should be investigated as part of the overall feasibility study.
- Surface mounted pipes are not considered appropriate and no further external piping or fittings should be permitted. In the long term, internal relocation of current surface mounted plumbing pipes is recommended.



Drawing of original Browne 1875 rear elevation
(Source: State Library of Victoria)

Drawing of Pitt 1898 rear elevation
(Source: State Library of Victoria)

6.2.5 South Elevation

Analysis

The south elevation is largely built against, but can be viewed above the roof of the adjacent southern building.

This elevation includes the roof of the southern section of the building, supporting the air-conditioning plant, partially screened by horizontal slatting.

Two original window openings remain at the lower level with deteriorating timber infill.

The visible sections of this elevation display similar problems to the north elevation, namely deteriorated fascia and deterioration to the coping at the top of the pilasters.

Recommendations

- Fascias require painting (or renewal) where rotten.
- Infilling of window openings in a more robust manner is recommended.
- This elevation requires some urgent maintenance work including re-rendering of the coping of the pilasters.

View of deterioration to pilaster

6.3 Internal Assessment of Condition and Recommendations

The internal assessments made in this section include a summary of the internal changes made to the theatre over time. The summary of changes has been expanded from the *Royal South Street Memorial Theatre: Conservation Analysis and Conservation Policy Volume I* report prepared by Clive Lucas and Partners in association with Civil and Civic Pty Ltd in 1987. Detailed information on the development of the theatre can be found in the 1987 report.

Reference should be made to current drawings of the theatre attached in Section 10. Note that room numbers in this section refer to numbers shown in the current drawings.

6.3.1 Sub-basement – Level One and Basement – Level Two

A summary of the changes to the sub-basement (Level One) and the basement (Level Two) is tabled below:

Date	Description	Reference
1875	• North and south stairs down to basement. • Three lavatories, two urinals.	Original plans by Geo Brown WD THE 1-4. Site evidence.
1898-99	• South stair access to basement blocked.	Plans by W Pitt, WD THE 1-12, 14. Site evidence.
1904-09	• Floor of stalls lobby lowered, making basement hallway a sub-floor space. • New stair down to basement from north passage.	Site evidence.
1920-36	• Women's and men's lavatories installed in basement. • New stair down to women's lavatories from stalls lobby.	HCV File 507/1. Plan, HCV, 25/2/27. Site evidence.
1942-54	• New stair down from stalls foyer adjacent to switch room. • New partition between anteroom to Men's lavatory and engine room for lighting plant.	HCV File 507/1-2. Site evidence.
1967	• 1967 - $30,000 worth of works comprising: new underground concrete subway from Lydiard Street extending to two tiers of 13 dressing rooms with toilets and wash rooms built under the stage (Level One and Level Two).	Her Majesty's Theatre, Record of Changes since 1990.
1978-87	• Ballarat Theatre Organ Society installed a Compton Theatre Organ under the floor of the theatre.	Her Majesty's Theatre, Record of Changes since 1990.
1988-90	• Construction of office and reception area in Level One, including new concrete floor with carpet and new ceilings. • Construction of lift plant room for disabled persons lift. • Provision of access between basement toilets and offices. • Renovation and repair of male lavatories. • Construction of new female and disabled lavatories. • Construction of new cloaks area and laundry. • Upgrade of dressing rooms.	Civil & Civic correspondence to City of Ballarat, 15 March 1989.
2003	• Installation of air-conditioning and roof ventilation to offices and back stage dressing rooms.	Heritage Victoria File Information.

- ***Sub-basement Level One - Theatre Offices Rooms (133, 139, 146,147 and other offices)***




Analysis

The offices of both Her Majesty's Theatre and the Royal South Street Society were constructed during the 1988-90 restoration works. Formerly a basement storage area, the area also houses the Kittson Room (the RSSS's meeting/board room named in honour of J.F. Kittson, who played an important part in organising the acquisition of the theatre in 1965).

Current users of the area talk of the lack of light, lack of outlook and low ceiling heights which do make the area an ideal working environment.

Beneath the Theatre Director's office is the (capped) shaft of the Unicorn Mine. The shaft was dug in 1857 to exploit the rich Gravel Pits Lead on the edge of the plateau. Soon forgotten, the mine had a wooden hall built over it, the first home of Ballarat's Stock Exchange.

These rooms form part of the Permit Exemption Declaration which allows certain classes of works or activities to be carried out without the need to obtain a permit from Heritage Victoria (refer to attached plan numbered Drawing 03/01 in Appendix 4).

Recommendations

- Consider relocation of offices elsewhere or renovating offices to provide more comfortable work spaces.
- Removal of structure (eg. walls and posts) need to be assessed on a case by case basis as adaptation is anticipated.
- Consider installing a plaque or similar to convey the significance of the area beneath the Theatre Director's office.
- This area is already subject to a Permit Exemption Declaration and changes to this area are anticipated.

- **Basement Level Two - *Amenities and Store Rooms (201-216)***

Analysis

The main theatre toilets are housed in an area that was the storage basements of the original shops/offices in the front of the building. They were converted into toilets in 1927. The area is not an ideal location for amenities due to its distance from patrons.

A lift provides disabled access between the front foyer, the stalls area and the toilets in the basement. The disabled person's toilet does not comply with current standards.

The men's urinals (214) are of interest and current grouping is now not common. However maintenance of these is currently problematic with plumbers sometimes not willing to undertake work on these.

Recommendations

- Continue to maintain this area.
- Upgrading of wet areas (including access for disabled) could be considered. Current disabled access does not comply and upgrading of the lift access zone is required.
- The men's urinal (214) is of interest and retention of early fittings is encouraged within a framework of current plumbing standards.

- **Basement Level Two - *Sub-Stage Area (Rooms 101-132, Organ chamber, 218-238)***

View of Compton Organ (Source: Jeremy Bannister)

Analysis

The space beneath the stage was formerly a workshop area, housing the stage machinery necessary to operate the traps in the stage.

There are now thirteen dressing rooms there, together with a laundry, toilets, lift room, electricity supply room and organ chamber. One of the dressing rooms was converted to a first aid room in 2003.

These rooms and the organ chamber form part of the Permit Exemption Declaration which allows certain classes of works or activities to be carried out without the need to obtain a permit from Heritage Victoria (refer to attached plans numbered Drawing 03/01 and 03/02 in Appendix 4).

Recommendations

- Continue to maintain the rooms.
- Upgrade dressing room lights with enclosed units that provide more appropriate lighting (A minimum of 3,500 degree Kelvin fluorescent is recommended. Also consider making the lights dimmable to allow artists to view in low stage light).
- In the long-term, adapt areas to provide more usable space.
- Removal of structure (eg. walls and posts) need to be assessed on a case by case basis as adaptation is anticipated.
- This area is already subject to a Permit Exemption Declaration and changes to this area are anticipated.

Organ Chamber - The organ chamber houses the Ballarat Theatre Organ Society's Compton Organ. Installed in 1982, the organ was built by the English firm John Compton & Co in 1937 and is one of very few theatre organs outside a capital city. With nearly 800 pipes, it was necessary to install the organ console directly under the floor of the orchestra pit as the side stage area, where the pipes would normally be housed, was needed as wing space for stage shows. The organ is brought (through the orchestra pit) to stage height or pit height for performances by a hydraulic scissor lift.

- In its current location, the use of the organ affects the use of the orchestra pit. Investigate the feasibility of relocating the organ chamber to address this issue.
- The late date of its installation makes it not of high heritage significance in relation to its association with the building.

6.3.2 Stalls - Level Three

A summary of the changes to the entry foyer, side passages and staircases (on Level Three) is tabled below. Plans showing the development of this area are included in Section 8.

Date	Description	Reference
1875	• Two passages/entries to north and south stairs that provide access to the basement, dress circle and offices (long room). • Three large rooms comprising shops to the north and south and a central entrance. The central entrance was a last minute redesign by Browne which replaced a central office. The shops have their own front entry but can also be accessed from the central entrance hall. • Entrance to front stalls via north passage while entrance to back stalls is via south corridor or central entrance. • Ticket office located between north stair and central entrance.	Plans by Geo Brown WD THE 1-4, 8. Site evidence.
1898-99	• South stair access to basement blocked up and entrance to dress circle from south stair closed off. • Entrance to front stalls (via north passage) closed off and a new entrance installed below south stair. • North and south stairs raised to allow entrance to new balcony level. South stair is also reversed. • New ticket box for dress circle located in north passage.	Plans by W Pitt, WD THE 1-12, 14. Plan, HCV File 507/1, n.d. Site evidence.
1904-9	• Access from north and south passages to original stairs blocked off. • New stair up to dress circle lobby in central entrance hall. • Connection created through auditorium from north stair to new exit. • South stair moved to passageway and the former south stair area is used to create the stalls lobby. The floor of the stalls lobby is lowered and there are two entrances from the lobby to the stalls. • New stairs from the central entrance provide access to the new stalls lobby. • New stair in north passage up to long room and down to basement. • Access between north and south shops and central entrance closed off.	Plan HCV 25/2/27. Site evidence.
1920-36	• Access between stalls lobby area and south passage reopened and new stair constructed down to women's lavatories in basement. • New ticket box on landing of south stair.	Plan, HCV, 25/2/27. Site evidence.
1936-41	• South shop taken into foyer space (section of wall removed). • Floor to ground floor foyer raised slightly. • c1904-09 stair to dress circle altered and located further from entrance doors and new double flight of stairs down to stalls lobby • Central ticket box and kiosk in street foyer (ground floor foyer). • Original ticket boxes replaced by manager's office/ticket box.	HCV File 507/1-2. Plan, HCV, c18/4/41. Site evidence.

Date	Description	Reference
1942-54	• Manager's office in foyer removed and foyer enlarged, north shop taken into foyer and confectionary counter installed. • c1904-09 stair from north passage up to long room removed and section down to basement covered with concrete. • North passage used as exit again with diversion through auditorium blocked off. • New stair down to basement from stalls lobby, new switch room installed adjacent to new stairs.	HCV File 507/2. Plans, Cowper Murphy & Associates 27/8/48; 22/11/51, HCV. Site evidence.
1965-87	• North confectionary shop converted to office for RSSS. • Glazed screen between ground floor foyer and RSSS office, new strong room formed. • Kiosk fitment replaced.	HCV File 507/3. Plan, G S Richards, 1966, HCV. Site evidence.
c1992	• Installation of merchandise cabinet in candy bar. • Installation of display boards in box office and candy bar.	Her Majesty's Theatre, Record of Changes since 1990.
1997	• Alteration of front box office to allow third workstation.	Her Majesty's Theatre, Record of Changes since 1990.
1988-90	• Installation of ticket box office, bar area and program booth. • Installation of disabled person's lift to basement lavatory. • Reconstruction of two fireplaces including mantelpieces and fire grates reinstated to the chimney breasts and the pendant 'period' lighting. • Dismantling of existing stone staircases and reassemble in original keying holes to Pitt configuration of 1898 with new balustrades matching existing. • Ceiling and walls of southern staircase restored and reconstructed to Pitt configuration. • At northern staircase, relocate entrance to gallery to former location at landing, reconstruct ceiling to original level and restore entrance to dress circle lobby. • New front of house signs - to establish consistent directional and other signage in the theatre.	Civil & Civic correspondence to City of Ballarat, 15 March 1989. Her Majesty's Theatre, Record of Changes since 1990. Heritage Victoria Permit File Information.
2000	• Removal of merchandise cabinet in candy bar.	Her Majesty's Theatre, Record of Changes since 1990.
2003-04	• Provision of brass handrails on foyer steps. • Installation of flashing lights on foyer steps.	Her Majesty's Theatre, Record of Changes since 1990.

- ***Entry Foyer (301-306, 310)***

(Source of photograph above: Jeremy Bannister)

Analysis

The entry foyer has undergone a number of changes. The 1875 configuration by Browne allowed for a central grand entrance and two shopfronts/offices with two flanking passages. These different sections of the foyer are still visible - the central entrance hall with plastered ceiling, the wooden ceilings and fireplaces (reconstructed in 1988-90) of the flanking shopfronts/offices, and the side passageways with tiled floors.

Currently, the entry foyer area accommodates a Candy Bar and the MajesTix Box Office.

Current concerns for the foyer area include: multiple levels, cramped size of foyer, poor signage and trip hazards of stairs and flashing light points on entrance stairs. Although the 1988-90 conservation works were carefully undertaken to recreate a suitable foyer interior, the upgrade did not address problems of cramped foyer space, and did not solve the problems of trip hazards and level changes.

Recommendations

- As the foyer has evolved over time with ongoing changes in various stages of the building's history, further change could be anticipated in this area.
- Ongoing assessment of the space configuration could include the possible incorporation of the side passage floor space into the foyer space to increase the area.
- Levelling of the multiple levels should be considered, ensuring that the tiles to the front central entrance and the staircases are retained.
- Opportunities to expand into adjoining buildings to ease spatial pressures on the foyer should be investigated. Extension into the adjacent southern building would provide easier access compared to the adjacent northern building which is at a lower level.
- Install a foyer signage system that is visible to all patrons.
- In the short-term, continue to maintain finishes and fittings whilst devising more suitable and workable foyer space.

- ***Side Passages and Staircases (307-309, 313-315)***

Left: Existing view of central entrance foyer

Above: View of central entrance foyer in 1930 *(Source: Her Majesty's Theatre Archives, photo by Alec Hannah)*

Above and Left: Views of northern passage

Below: Views of southern passage

Analysis

The side passages originally gave access to the different levels of the auditorium without connections through to the central foyer area (the adjoining spaces were given over for commercial purposes).

The northern passage (307-309) has been tiled with later red tiling. The southern passage (313-315) provides disability access and retains a section of the original levels (as evidenced by patterned tiling). Level changes have been introduced to this area with three steps and later red tiling (as part of the 1988-90 works).

The sloped concrete floor leading to the disabled lifts in the southern passage appears to be too steep and does not meet OH&S regulations. The lift and concrete ramp are intrusive to the character of the building.

The access stairs to the dress circle and down stairs to the service areas are in basalt with cast iron balustrading. The staircases have also undergone a number of changes, but were reconstructed to the 1898 Pitt configuration in the 1988-90 conservation works.

Recommendations

- Continue to maintain staircases and passages.
- Consider incorporation of the side passage floor space into the foyer space to increase the size of the foyer.
- Consider carpeting or placing a carpet runner and installing a 'protective rail' to protect wall and skirtings of southern passageway leading to disabled lifts (concrete floor area).
- Removal of the lift from the building (and associated ramping) is recommended and could be explored.

- ***Auditorium (317)***

A summary of the changes to the auditorium is tabled below:

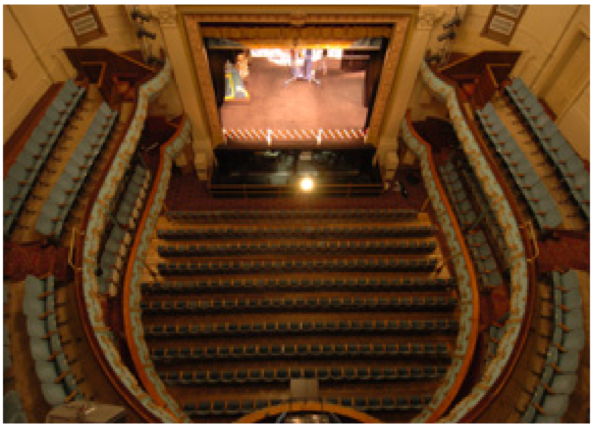
Date	Description	Reference
1875	• Rectangular with curved corners, four windows down each side at both stalls and gallery levels, pilasters to walls. • One steep lyre shaped gallery, supported on three columns at rear of auditorium, iron brackets off wall and suspended from ceiling at front edge, with timber capped cast iron bellied balustrade. • Flat floor to body of hall, physical separation of *Parquette* and body of hall. • Proscenium with one door in each splayed side. • Orchestra located at front of auditorium, stairs in front of stage to stair down. • Colour scheme of red, green and gold.	Plans by Geo Brown WD THE 1-3, 4. Aust Sketcher 10/7/1875. Site evidence. *Ballarat Courier* 24/5/1875.
1898-99	• Original gallery removed. • Two galleries constructed, copying original lyre shape and cedar handrail with bellied plaster balustrade supported on 14 iron columns. • Sloping floor built over original floor to auditorium. The sloping floor was constructed over timber joists with Baltic tongue and groove flooring 150 mm wide. • Redecoration in blue, gold and amber colour scheme. • Additional escape stairs built from exits in north and south walls.	Plans by W Pitt WD THE 1-12, 14. Plan HCV File 507/1 n.d. *The Leader*, 12/8/1899. *The Australasian* 15/10/1904. Ballarat in Pictures Scrapbook. Site evidence. *Ballarat Courier*, 27/3/1899 and 29/3/1899.
1904-9	• Construction of fire exit diversion through NW corner of auditorium. • Fire wall built between auditorium and stage; proscenium replaced.	Site evidence. Photographs c1914 & later.
1916	• Access stair from north stair.	Council Register of Plans submitted. Site evidence.
1920-30	• Raised platform at back of gallery. • Redecoration.	HCV File 507/1. Site evidence
1930	• Theatre was wired for sound.	Site evidence.
1930-40	• Seats installed (relocated from another venue) during the period when the theatre was used as a cinema.	Heritage Victoria File Notes.
c1941	• Foot warmers (from original Rivoli Theatre in Burke Road, Camberwell) installed under the seats.	Site evidence.
1942-54	• New raised stepped platforms at back of gallery to replace earlier platform. • Fire diversion passage in NW corner abandoned. • Redecoration and new lighting. • New external fire stair on north side of auditorium from new exit door at dress circle. • New ventilation and heating system in SE wing. • Rewind room and additional stair built; c1920's stair altered.	HCV File 507/1. Council Register of Plans Submitted. Site evidence.

Date	Description	Reference
1965-87	• 1969: Latest computer lighting and a new switchboard installed. • New chairman's dais built adjacent to northern corner of stage. • Theatre organ installed; organ chambers under auditorium constructed.	Plans, Building Permit Nos 12433, 13057. HCV File 507/3. Site evidence. The Courier, Exact date unknown, 1971.
1988-90	• Carpet laid down throughout theatre using a 1920s design. • Redecoration and painting of auditorium to original colour schemes determined by paint scrapes. • Refurbishment of seating, including reupholster of seating in stalls area in pale blue to match original blue colour scheme.	Her Majesty's Theatre, Record of Changes since 1990.
1996	• Restoration and framing of dome mural panel.	Her Majesty's Theatre, Record of Changes since 1990.
1997	• Balcony seats reupholstered.	Discussions with Her Majesty's Theatre at meeting held 15 May 2006
2000	• The 1899 baltic pine floor was replaced with stained messmate timber for the stabilization of seating. The intermediate sub-floor structure (floor structure between raked floor and flat floor) was also replaced as it was found to be in poor condition. • Seating was reconfigured to continental seating (no centre aisle) and seats were placed slightly further apart to increase patron comfort.	Her Majesty's Theatre, Record of Changes since 1990. Heritage Victoria Permit File Information.
2001-02	• West wall of auditorium was repainted 'Haymes brick colour 405' to resemble the original brick colour. • All the carpet was replaced, although the 1990 carpet is retained in the long room. • Usher seats constructed in stalls.	Her Majesty's Theatre, Record of Changes since 1990.
2003	• Installation of air-conditioning and roof ventilation, fan coil units installed in the space between the original flat floor of the auditorium and the introduced raked floor for seating. Supply air provided via floor vents located along the side walls.	Heritage Victoria File Information. Heritage Victoria Permit File Information.

Top Left: View of columns holding up gallery

Top: View of air conditioning vents in floor

Left: View of foot warmers (photo by Jeremy Bannister)



(Source of above photographs: Jeremy Bannister)

Analysis

The original auditorium was built with a flat floor suitable for dancing and dinners, and had a single balcony. The curve of the balcony forms a lyre shape (hence the name 'lyric' theatre to describe this style of auditorium). In 1898 Pitt upgraded the stage facilities and modified the auditorium, changing the original concert hall character into a more theatrical auditorium and introducing a raked floor and additional balcony.

The current colour scheme of the auditorium recreates the Paterson Brothers' decoration of the theatre in 1898. A sole surviving painted tin panel (a fragment of one of Paterson Brothers' murals) belonging to the ventilator is located at the northwest corner of the auditorium.

The theatre currently contains 959 seats and access to the auditorium is via steps from the foyer and through paired double doors. The theatre has received complaints in the past that the seats are uncomfortable and RTMi Theatre Design & Technology have indicated that refurbishment of existing seating would far outweigh the price of new seating.

Reference to the "Access Code for Buildings" (currently a draft document awaiting ratification which is ensured) indicates that the current allocation for disabled seating is insufficient.

The auditorium is heated by a system of hot water pipes connected to footwarmers at the back of seats. These footwarmers came from the original Rivoli Theatre in Burke Road, Camberwell (at the time of construction of the new Rivoli in 1941) and the footwarmers were installed at Her Majesty's at about that time.

In 2000, the auditorium was re-floored in Tasmanian Oak replacing the original Baltic Pine flooring. At this time the seating layout was also reconfigured with the removal of the central aisle and re-upholstering of the seats.

Air-conditioning was installed in the auditorium in 2003 via a system of grilles in the aisles (with return air in the northwest corner).

Recommendations

- Maintain and repaint as required in Paterson Brothers' colour scheme.
- An interpretation plaque should be installed adjacent to the framed fragment of the mural panel in the northwest corner of the auditorium to provide visitors with an appreciation of the significance of this fragment.

Right: View of Surviving dome panel

- The seating and footwarmers are of interest. If replacement of seating in the stalls level is considered, ensure that some original seating at the gallery levels is retained (ie. those seats to the sides of the gallery which currently have poor sight lines).
- If new seating is installed it is recommended that aisle ends and arms similar to existing be installed to retain current visual impact.
- New seating should be comfortable, low maintenance and be located to maximise the best sight lines. Revised draft seating layouts undertaken by RTMi Theatre Design & Technology using Hadley Lyric seats indicate that it should be possible to achieve near the same number of seats that currently exist.
- It is recommended that the draft code is adopted in any upgrades to disabled seating.
- Modern technological improvements or alterations should not diminish the significance of the place, nor destroy any of the early fabric.
- New flooring is specified by Heritage Victoria to be fine sanded without finish applied and the aisles carpeted, but the floor under the seating is to remain as natural timber to retain acoustics and to match current flooring.

- ***The Dome and Ceiling***

A summary of the changes to the dome and ceiling (on Level Three) is tabled below:

Date	Description	Reference
1875	• Flat ceiling coffered; 2 roof vent structures.	*Ballarat Courier* 24/5/1875.
1898-99	• Large dome built in ceiling, cutting through original coffering and removing the bottom chords of two of the roof trusses; opening panels in roof also installed.	*Ballarat Courier*, 27/3/1899 and 29/3/1899.
1904-9	• 1898 dome removed and shallow octagonal dome constructed with small cylindrical vent.	Site evidence Photographs c1914 & later.
1988-90	• Remove existing octagonal structure and reconstruct dome to Pitt configuration. The 1898 pattern restored in the ceiling coffers directly around the dome. • Remove air conditioning duct in northwest corner. • Steel inserts to be added to existing trusses over area to be affected by dome reconstruction. Dome reconstructed with bottom and top ring beams. Dome refinished and redecorated. • Reconstruct cornices at rear of the auditorium and construct lighting ports to accommodate spotlights from dome.	Civil & Civic correspondence to City of Ballarat, 15 March 1989.
1999	• Alteration of cinema ports for follow spots. Six holes for the two cinema projectors and one slide projector were replaced with three large windows.	Her Majesty's Theatre, Record of Changes since 1990.
2002	• Refurbishment of c1950 Hoyts chandeliers and painting to match colour scheme in auditorium.	Her Majesty's Theatre, Record of Changes since 1990.

(Source of photographs above: Jeremy Bannister)

Analysis

Dome and Ceiling - The dome was originally installed in 1898, but removed in 1904. The design was similar to Pitt's 1886 design for the Princess Theatre in Melbourne. Like the dome at the Princess, the central panel of the dome was designed to open to allow hot fumes and waste by-products from the gas lamps to escape.

The original dome was a timber structure covered with paper lining which had a mural painted directly onto them. Some of the painted paper lining of the dome still exists in the Sydney office of Clive Lucas and Partners (the Architects who undertook the 1988-90 works).

The dome was reconstructed in 1988. The current plain appearance of the dome is in stark contrast with the decorative colour scheme of the ring perimeter of the dome and the adjacent ceiling.

When the reconstruction work was undertaken, original paintwork was revealed and the current colour scheme reinstates the Paterson Brothers' original decoration of the theatre in 1898, but without the mural panels.

The horizontal shutters and tube structure to a former sliding ventilated roof of the 1898 dome are still in existence.

Lighting - The existing chandeliers were installed c1950 when the theatre was under ownership by Hoyts (previously known as Ballarat Theatres).

Recommendations

- Reinstatement of a painted mural (either accurately reconstructing or deriving from the remnant painted paper lining) is recommended for the dome.
- Maintain and repaint ceiling as required in Paterson Brothers' colour scheme.
- c1950 chandeliers are of interest. Consideration could be given to upgrading lighting to a modern design reminiscent of the original gas sun burners, (similar to the fittings produced by Clive Lucas in the foyer and long room).

- ***The Stage (319), Orchestra Pit (230) and Proscenium Arch***

A summary of the changes to the stage, orchestra pit and proscenium arch (on Level Three) is tabled below:

Date	Description	Reference
1875	• Sloping stage with a rake of 1:25. • Dressing rooms at rear of fly gallery. • Two windows in side walls at each level, plus windows in rear wall at each level; two doors to Lewis Street. • Side flies, paint frame. • A delicate proscenium arch with doors allowing actors to take their bows after the fall of the curtain.	Plans by Geo Brown WD THE 1-3, 4. Site evidence.
1898-99	• Original dressing rooms removed at rear to increase depth of stage. • New dressing rooms built in wing along south side of stage and in rear verandah addition over street. • New stairs to fly gallery and basement at south east corner of stage. • Paint frame relocated to rear wall. • Redecoration of inner proscenium by Paterson Brothers to represent comedy and tragedy; a bust of Shakespeare was located at the centre of the top.	Plans by W Pitt WD THE 1-13, 14. Plan, HCV file 507/1 n.d. Site evidence.
1904-9	• Fire wall built between auditorium and stage. • Fire curtain installed and proscenium replaced.	Photographs c1914 & later. Site evidence.
1965-87	• Pine stage re-floored with hardwood. • Stage lighting replaced.	Plan M F Murray, c6/67 HCV. HCV file 507/3. The Courier 1st July, 1967. Site evidence.
1988-90	• Renovations to orchestra pit.	Civil & Civic correspondence to City of Ballarat.
1994	• Installation of trap door and lift in stage.	Her Majesty's Theatre, Record of Changes since 1990.
1996	• Installation of painted act drop, a gift from Scenic Studios in Melbourne, the only company of traditional scene painters in Australia.	Her Majesty's Theatre, Record of Changes since 1990.
2000	• Seating configuration in 1990???	
2001-02	• Trap door and lift closed off due to safety concerns. • Carpet in foyer and stairs only replaced.	Her Majesty's Theatre, Record of Changes since 1990.
2004	• Trap door and lift closed over pending installation of an approved lift and safety procedures. • Safety features installed to rear loading door and access lift.	Her Majesty's Theatre, Record of Changes since 1990.

View of stage showing 1996 painted act drop (Source of photo: Jeremy Bannister)

Analysis

Stage – The stage area is 18.25 m wide by 15.3 m deep and is constructed on a slope with a rake of 1:25 to assist the sightlines from the auditorium. The size of the stage is a growing issue as it is too small for a number of stage performances.

The stage once had 'traps' for stage effects, however these traps were removed when the RSSS laid a new hardwood stage. While stronger, it is not as 'live' as the more reverberant old pine stage. The trapdoor and lift installed in 1994 was closed off in 2004 due to safety concerns. Current benchmarks require that the full stage floor be sacrificial to allow traps to be cut into any area of the performer's footprint.

The current red curtain on the stage came from the Dendy Brighton. This replaced a blue curtain which formed part of the 1899 design of the theatre. Behind the curtain hangs a painted act drop installed in 1996 that depicts a scene of Sturt Street, Ballarat in 1880 from an original watercolour by A H Fullwood.

The current method for transporting goods to the stage level from Lewis Street is through a hoist/pulley system located on the eastern elevation.

Recommendations

- It is recommended that the rake of the stage be retained as this is original to the building and establishes the sight lines in the building.
- The opportunities to expand the stage area need to be examined:

  - sharing backstage space with the Mechanics Institute.

  - to the south into the apartment building(additional openings could be incorporated).

  - to the east into the skillion addition (by adding an additional level or extending the skillion addition above Lewis Street or across to the Mechanics Institute.

  - internally, consider more strategic positioning of on-stage stairs, removal of walls on prompt to access off-stage space and replacement of counterweight lined and associated equipment.
- The vista west along Lewis Street is significant, and opportunities to expand the stage at this elevation should maintain this vista as much as possible.
- Make the trapdoor and lift functional again by resolving the associated safety issues. Investigate the feasibility of having a sacrificial stage.
- Continue to maintain the act drop.
- Install a goods lift (replacing existing hoist system) to bring goods from Lewis Street to the stage level.

Orchestra Pit - The orchestra pit, which used to be level with the floor of the auditorium, was dropped one metre during the renovation of 1988 - 1990, and can seat between 25 and 35 musicians. Access is from a door on the upper dressing room level. There have been instances in the past where performers have fallen off the stage into the pit.

- Investigate options to address the safety issues relating to performers falling into the orchestra pit. Consider options to install a rated pit net.

Analysis

Proscenium Arch – The original proscenium wall was constructed of timber and plaster and did not provide a fire barrier between the stage and the auditorium.

The current proscenium arch is 8.46 m wide and 6.15 m high and was installed in 1907 in response to the Board of Health who required the theatre to construct a masonry proscenium wall with an asbestos fire curtain to separate the auditorium from the stage.

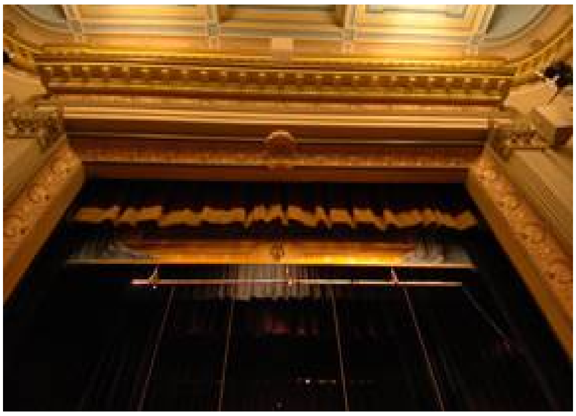
The plasterwork and decoration of the proscenium is contemporary with the decoration of the dress circle lobby.

A fire pipe penetrates through the proscenium arch wall with space around it, resulting in a penetration of the fire compartmentalisation.

Recommendations

- Continue to maintain the proscenium arch and plasterwork.
- Repaint as required in the same colour scheme.


Views of the Orchestra Pit

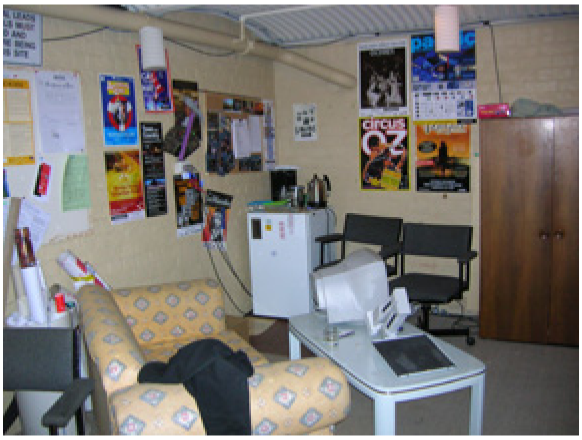



Views of the Proscenium Arch and Stage
(top photos taken by Jeremy Bannister)

- ***The 1898-99 Extension and Skillion Addition (121, 222, 223, 320-324, 326, 328)***

A summary of the changes to the extension and skillion addition backstage (on Level One, Two and Three) is tabled below:

Date	Description	Reference
1875	• Two 'stars' dressing rooms to the south of the stage.	Plans by Geo Brown WD THE 1-3, 4. Site evidence.
1898-99	• Extension of building to the southern elevation, including a fire escape with egress to Lewis Street. • Skillion addition built with three dressing rooms and backstage toilets. The addition abutted a similar set of dressing rooms built behind the rear wall of the Mechanics Institute hall.	Plans by W Pitt WD THE 1-13, 14.
1969	• Skillion addition demolished.	HCV file 507/3.
1990	• Skillion addition replaced and green room fitted out.	Civil & Civic correspondence to City of Ballarat, 15 March 1989. Site evidence.
c1998	• Rebuilding of exterior doors of Lewis Street fire escape.	Site evidence.
2003	• Partitioning of old Props Room for sound equipment store. • Installation of air-conditioning and roof ventilation, fan coil units installed in Green Room.	Her Majesty's Theatre, Record of Changes since 1990. Heritage Victoria Permit File Information.



Views of Tech Rooms (222, 223)


Views of Melba Room and Props Room (324, 326)

Analysis

The Southern Extension - The 1898-99 extension to the southern elevation provided for a fire escape, dressing rooms, store and props room (where the theatre's stock of theatrical properties was housed for the use of visiting companies). The rooms are situated directly above the fire escape. There were originally dressing rooms in this area next to the original scene dock.

The ground level of the southern extension (Room 121) is the corridor that leads to the Lewis Street fire escape, the floor above this is currently used as Tech Rooms (222, 223).

Above the Tech Rooms are the Melba Room (324) and the Props Room (326). The Melba Room was named in honour of Dame Nellie Melba, who performed at the theatre in 1885, 1902 and 1908. It is however, unlikely that she used the room as a dressing room.

The Tech Room and Melba Room form part of the Permit Exemption Declaration which allows certain classes of works or activities to be carried out without the need to obtain a permit from Heritage Victoria (refer to attached plan numbered Drawing 03/03 in Appendix 4).

The Skillion Addition – This addition is a reconstruction of the original 1898-99 skillion undertaken by Pitt. Reconstructed in 1990, the addition is attached to the rear wall of the theatre and is built directly over the Lewis Street footpath. The skillion section is interrupted by the loading bay, with a large rear door at the rear of the stage through which scenery, props, etc. are brought up to the stage. On the northern side of the loading bay are piano and lighting stores (320, 321), on the southern side is the Green Room (323) which is the backstage common room.

These rooms form part of the Permit Exemption Declaration which allows certain classes of works or activities to be carried out without the need to obtain a permit from Heritage Victoria (refer to attached plan numbered Drawing 03/03 in Appendix 4).

Recommendations

- Continue to maintain.
- This area is already subject to a Permit Exemption Declaration and changes to this area are anticipated.

View of fire escape (121)

- The skillion is not original. It could therefore be expanded in size to provide more floor space adjacent to the stage.
- This area is already subject to a Permit Exemption Declaration and changes to this area are anticipated.

Views of Green Room (323)

6.3.3 Dress Circle - Level Four

A summary of the changes to the dress circle, dress circle foyer and long room (on Level Four) is tabled below:

Date	Description	Reference
1875	• Office space in long room, fireplace at each end, all windows glazed. • Access to dress circle and long room via south and north stairs. • Ladies cloak room and crush room between stairs.	Plans by Geo Brown WD THE 1-3, 4.
1898-99	• North stair raised, south stair reversed and raised. • Entrance to long room from north stair altered. • Entrance to dress circle from south stair blocked off. • Access to cloak and crush rooms from long room and dress circle closed off.	Plans by W Pitt, THE 1-12, 14 Plan, HCV File 507/1, n.d. Site evidence.
1904-9	• New Art Nouveau style foyer formed to dress circle with coved ceiling and skylight; original cloak rooms and crush rooms removed. • New stair in long room down to north passage. • All entries to dress circle and long room from north and south stairs closed off. • New men's and women's lavatories off dress circle lobby. • Direct egress from dress circle to entrance foyer created.	Site evidence.
1942-54	• New ladies lavatory at north end of long room and old lavatory at dress circle converted to manager's office. • New opening and fire door between south stair and long room. • c1904-09 stair to dress circle foyer altered and located further from entrance doors. • c1904-09 stair from long room to north passage removed and new connection and stair constructed from dress circle lobby up to long room.	HCV File 507/1 2. Plan, Cowper, Murphy & Associates 27/8/48; 22/11/51. Site evidence.
c1965	• New adjudicator's dais cantilevered from front of dress circle, removing original plaster balustrade; later altered with balustrade panels to match original.	Site evidence.
1988-90	• Installation of air conditioning and sound system in long room and installation of a bar. • Restoration of plaster ceiling and refurbishment of male/female toilets including the removal of the ladies toilets in the long room. • Reconstruction of fireplaces (including mantelpieces) to long room and revival of staircase and wall openings. • Repairs and redecoration of joinery. • Open balcony created at dress circle foyer affording view of the main entrance foyer.	Her Majesty's Theatre, Record of Changes since 1990. Heritage Victoria Permit File Information. Civil & Civic correspondence to City of Ballarat, 15 March 1989.
1998	• Air conditioning installed in Long Room	Discussions with Her Majesty's Theatre at meeting held 15 May 2006
c2000	• Enclosure of south stair as long room store.	Her Majesty's Theatre, Record of Changes since 1990.
2003	• Installation of air-conditioning and roof ventilation, ducts introduced in the corner of the female and male toilets, and new air vents introduced into the ceiling above the rear walkway vent in the dress circle.	Heritage Victoria Permit File Information.

- ***Dress Circle Foyer, 402-406***

(Source of photographs above: Jeremy Bannister)

Analysis

The decoration of the dress circle foyer is an eclectic blend of art nouveau and Egyptian decoration, executed by the local building firm of R. Ludbrook in 1904-09. The blue tessellated tiled floor and elaborate plasterwork throughout this foyer dates back to the 1904-09 alterations.

The cedar staircase with brass handrails constructed in 1907 once ran straight up from the main entrance of the theatre, along the wall which divided the northern shop to the dress circle foyer. This staircase was removed in sometime between 1942 and 1954.

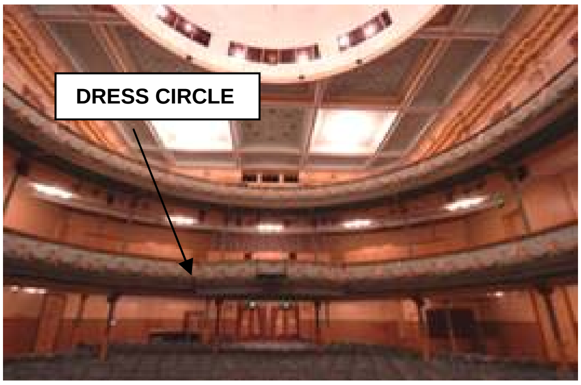
From the dress circle foyer access is provided through to the women's and men's toilets through doors on either side of the dress circle entrance. These toilets were upgraded in the 1988-90 works.

Recommendations

- Continue to maintain foyer, repaint as required in the same colour scheme.
- Continue to maintain wet areas.

Views of Dress Circle Foyer

- ***Dress Circle (416-417)***



(Source of photographs above: Jeremy Bannister)

Analysis

The old *Paradis* tier of the Academy was divided into the traditional arrangement of a central dress circle and side boxes with partitions made up of ornamental uprights, brass rods and green damask curtains, creating private boxes for family use. During the time when the theatre was fitted out as a cinema, the dress circle was known as the Lounge.

Today the dress circle retains its original configuration, although the balcony has been altered with the installation of later timber balustrading and the insertion of an adjudicator's dais in c1965 for the Ballarat Eisteddfods (this was undertaken carefully, repeating original detailing). Access to the dress circle is via the dress circle foyer (between 1899 and 1907, patrons would enter the dress circle directly from the northern staircase). There is currently no disability access to this area.

The curves of the balcony of the dress circle form a lyre shape (hence the name 'lyric' theatre to describe this style of auditorium). The balustrade of the balcony appears to be low and there are no hand rails or safety bars installed at the end of the aisles.

The floor in this section is the original Baltic Pine flooring with red linoleum sheeting. Carpeting throughout this area incorporates the Lyre carpet pattern. Seats are fixed to the ground without the use of blocks.

Lights to this section incorporate four light fixtures mounted on pressed plaster bases. The ceiling lining is pressed tin.

Recommendations

- In the long term, investigate methods of providing disability access to this seating area.
- Continue to maintain balustrading, repaint as required in same colour scheme.
- Maintain carpet and if replacement is required, replaced with identical pattern.
- It is recommended that an upgraded and better designed safety bar be installed at the end of the aisles (in a similar manner to the balcony level). The bar should have simple detailing sympathetic to the theatre.
- If replacement of seating in the stalls level is considered, ensure that some original seating at this level is retained (ie. those seats to the sides of the gallery which currently have poor sight lines).
- Consideration in the long term could be given to the removal of the adjudicator's dais and reconstruction of the dress circle balustrade.

- ***Long Room (414)***

(Source of photographs above: Jeremy Bannister)

Analysis

Originally subdivided as offices and rented out by the theatre, the north end of the long room retains a section of the original plaster ceiling (there is a line of the ceiling that indicates this). The room dimensions are 19.5 metres by 6.6 metres wide with a ceiling height of 4.7 metres. Pitt's changes in 1898 meant that the level of this room did not match that of either of the new balconies. The room was given its own access via a staircase in the northern entrance passage in c1904-09 which was later removed in c1942-54 and replaced with a ladies lavatory. This lavatory was removed in the 1988-90 conservation works.

Occupying the full width of the building at the first floor level, the room was upgraded during the 1988-90 works.

It currently does not have disabled access. It has a coffered ceiling, cornices, picture rails, traditional skirtings and architraves. The marble fireplaces at each end of the room were reconstructed in the 1988-90 works.

Today the room houses an historical display and is the home of the Melba Piano, a Bechstein Concert Grand once owned by Dame Nellie Melba.

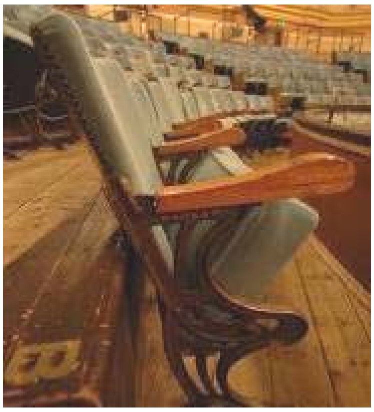
Air-conditioning was installed in 1998 and in 2003, three plaster ceiling roses were installed at the light points and suspended 100 mm below the ceiling level to provide sufficient area for the air supply and return air for the system to function. The associated air-conditioning plant is located on the roof behind the parapet.

Recommendations

- Continue to conserve and maintain.
- Investigate opportunities for extended uses for the room such as a function room, offices or rehearsal room.
- Retention of the bar (installed in 1989) is not a requirement and its replacement with a smaller bar would allow for more flexible use of the room.
- In the long term, investigate methods of providing disability access to this room.

6.3.4 Gallery - Level Five

- ***Balcony (503-504)***



(Source of photographs above: Jeremy Bannister)

Analysis

The balcony level retains the original timber flooring, the earliest seats in the theatre and an encircling balcony which forms a lyre shape (hence the name 'lyric' theatre). The balustrade of the balcony appears to be low (height of 700 mm). Attempts have been made to address the safety issue of the balcony height by the installation of hand rails. The current hand rails were installed in 1988-90 and replaced flimsy handrails previously installed. An additional raised safety bar has been installed at the end of the aisles.

During the 1988-90 works, the standing room area at the rear was rebuilt and additional handrails were installed. As part of installation of air conditioning in 2003, the central bank of standing room was raised to allow for the installation of air conditioning equipment.

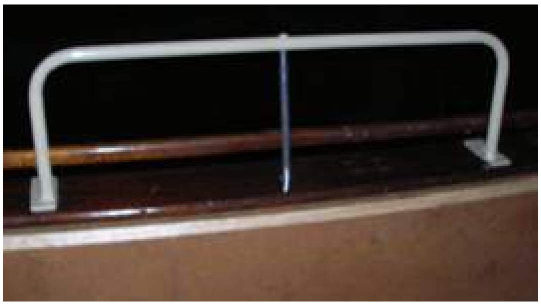
Access to the balcony is via original stairs with cast iron balustrading, cedar hand rails and basalt treads. There is currently no disabled access to this area.

Lighting stands are located in the front 'Juliet' balcony section, and side wall mounted lighting is being phased out (associated with the six double power points on each side wall).

In some rows the seats have been individually mounted on blocks and are similar to the seats elsewhere in the auditorium. The A Reserve balcony seating was reupholstered in 1992, the remainder in 1996.

Recommendations

- Maintain and repaint as required in Paterson Brothers' colour scheme.
- Safety bar at the end of the aisles should be replaced with a bar with simple detailing more sympathetic to the theatre.



View of existing hand rail

- Consider placing additional seating in the standing room area (if required).
- In the long term, investigate methods of providing disability access to this area.
- If replacement of seating is considered, ensure that some original seating at balcony level and in side galleries is retained.
- Modern technological improvements or alterations should not diminish the significance of the place, nor destroy any of the early fabric.

- ***Fly Gallery (506)***

A summary of the changes to the fly gallery is tabled below:

Date	Description	Reference
1875	• Seven small dressing rooms to the eastern side of the gallery.	Original plans by Geo Brown WD THE 1-4.
1898-99	• Dressing rooms removed from the gallery. • New stairs to fly gallery at south east corner of stage. • Possible alterations to roof beams to allow large cloths to be flown. • Paint frame moved against the rear wall of the gallery.	Plans by W Pitt, WD THE 1-12, 14. Plan, HCV File 507/1, n.d. Site evidence.
1988-90	• New counter-weighted fly system installed to replace some of the old hand-lines. • Installation of new fire grid and theatre equipment.	Civil & Civic correspondence to City of Ballarat, 15 March 1989.
2003	• Construction of walkways to allow safe access to area above and in front of dome. • Installation of additional fly lines. • Installation of lighting store next to fly gallery stair. • Safety grills installed over fly lines.	Her Majesty's Theatre, Record of Changes since 1990.

Item 2 (Block & Tackle)
Item 5 (early wind machine)

Item 3 (Behind ladder)

VIEWS OF FLY GALLERY

(Item numbers refer to items discussed on following page)

Analysis

The fly gallery (from which the flying lines are operated) runs around three sides of the stage, between 6-7 metres above stage level. Constructed mostly from timber with some steel framing, the structure is in sound condition. The flooring is original Baltic timber, and the original roof structure (1877 Oregon timber trusses) designed to take roofing slate can be seen from this level. Subsequent re-roofing in corrugated iron included the installation of canite between the original slate battens and the roof sheeting in an attempt to dampen rain noise.

Recommendations

- Retain all original equipment dating from the Browne and Pitt periods.

Analysis

The fly grid is the area at the top of the trusses and there have been some repairs undertaken to the trusses over time. The fly tower (the part of the theatre building above the gallery) is currently limiting the theatre to certain performances as the drift of the fly tower, calculated at 2.5 times the proscenium height as an industry standard falls short of this calculation.

The fly grid and tower was not designed nor constructed for current performing standards as is obvious by the additional structural support installed up around the head blocks. The addition of counterweight fly lines has not only put strain on the fly-tower structure but infringes on much needed wing space. Current benchmarks call for automated power flying in new and refurbished theatres.

A fire pipe penetrates through the proscenium arch wall with space around it, resulting in a penetration of the fire compartmentalisation.

The fly system is operated from the fly gallery and comprises 31 double purchase 4-line counterweight sets, with provision for an additional 16 sets. Each line can take a total of 140 kg in weight.

The area contains early equipment and fittings of heritage value as follows (refer to photos marked with item number):

1. Fire curtain winch - this is an early winch but does not comply with current standards and is not connected to the fire panel. A capital works application has been made to motorise this winch.
2. Block and tackle - in south east corner balustrade - this is indicative of early block and tackle systems and should be retained.
3. Scene painting frame - this is a rare piece of early theatre scenery equipment showing marks of many years of use. Originally there was a gap in the adjacent wall allowing this frame to be used for theme painting and raised and lowered as required for painters. In the 1988 renovation, the metal catwalk was fixed to the rear wall which stopped the frame from moving. The corresponding floor slot has been infilled.

4&5. Wind and thunder machine - used for theatre noise effects.

6. Lift blocks and pulleys - there are some early timber lift blocks sitting on the floor in the north east corner.
7. Original hand line - this is the last surviving original hand line and is the only one left in the rig although it is not used. This is shown on tours of the building.
8. Hand forged metal strut - this is used to secure the timber (Oregon) heavy balustrade which is subject to numerous heavy loads.

Recommendations

- Retain and reinstate to working condition (as far as possible within working fly tower constraints) equipment and fittings identified as having heritage value.
- Investigate options to raise the height of the fly tower.
- Ensure structural engineering advice is sought before any loading to the fly grid, gallery and tower. Structural investigation should also be undertaken of the fly tower.
- It is recommended that the fly tower be brought up to current bench mark standards. It is recommended in the long term that an automated flying system be installed.
- Infill hole around fire pipe with fire rated material ('white frost') foam which will reinstate the fire rating of this wall.

Item 1

Item 6

Item 7

- ***The Bio Box***

A summary of the changes to the bio box is tabled below:

Date	Description	Reference
1916	• Bio box constructed.	Site evidence.
c1948	• Bio box raised.	Site evidence.
c1998	• Rationalisation of bio box window operation.	Site evidence.

Analysis

By the First World War, moving pictures had established a dominant position in the entertainment industry, and theatres were being adapted to accommodate them. The Biograph Box was installed in Her Majesty's in 1916, above the Dress Circle lobby. When Ballarat Theatres sold Her Majesty's in 1965, the original carbon arc projectors were disabled and left in the building. All three projectors are missing the sound heads and motors.

The Bio box is accessed from the balcony and the roof cavity above the auditorium is accessible from the Bio box.

Recommendations

- Current user requirement requires covered access from the fly gallery to the bio box.

6.3.5 Roof Space

Analysis

The original trussed, gable roof was altered by Pitt in 1898-99 when the dome was inserted. This resulted in the cutting of the original trusses.

The roof space is accessible from the Bio box. Theatre technicians come up here to adjust the stage lights installed in the dome. In 2003, walkways were constructed to allow safe access to area above and in front of dome.

The new dome, of steel construction was inserted during the 1988-90 restoration. The opening mechanism associated with Pitt's 1898 dome is still visible.

Also of historical interest in the roof is the large wooden ventilation shaft, which sits directly over a ring of decorative grills in one of the ceiling coffers. The shaft indicates the site of one of the two large gas sunburners that were used to light the auditorium. The shaft took the heat and carbon residue created by the sunburner out to turrets in the roof of the theatre. A second shaft was removed when the dome was installed in 1899.

Recommendations

- Continue to maintain the roof space area.
- The opening mechanism for the old dome and associated equipment should be retained and conserved.
- Continue to maintain and conserve the ventilation shaft and other elements which date back to the original Browne and Pitt designs.

View of ventilation shaft
(Source of photo: Jeremy Bannister)

- Modern technological improvements or alterations should not diminish the significance of the place, nor destroy any of the early fabric.


Views of mechanisms used to open Pitt's 1898 dome





General views of the Roof Space

6.4 Engineering Condition Report

A structural assessment of Her Majesty's Theatre was undertaken by Trevor Huggard and Associates in February 2006. The *Structural Report – Her Majesty's Theatre Lydiard Street South, Ballarat,* Trevor Huggard and Associates, prepared in May 2006 states that:

> *'The theatre has performed very well and is generally in very good condition despite obvious areas of past maintenance neglect which have allowed water entry to the brick construction and roof to occur.*
>
> *Apart from the obvious deflection and sagging of the roof in the vicinity of the dome the building is relatively free of distortion and movement.'*

The *Structural Report* provides a number of recommendations that need to be implemented within certain time frames in order to ensure a long and satisfactory structural performance for the building.

7.0 CONSERVATION ACTIONS AND ONGOING MANAGEMENT

7.1 Objectives

Management of Her Majesty's Theatre must provide for the long term care and maintenance of this significant building. The theatre must be maintained in a safe and usable condition for all users.

7.2 Proposed Works

Following from the analysis and recommendations provided in Section Six, the following priorities are recommended:

7.2.1 Urgent Works

- **Downpipes** – check that downpipes are connected to the underground stormwater system. Replace defective pipes.
- **Stone and brick conservation** – repair render to all coping and cappings and re-point brickwork.
- **Proscenium wall** – reinstate fire rating of wall.

7.2.2 Medium Term Works

- **Gutters and downpipes** – replace rusted and PVC downpipes. Check that gutters and downpipes are of sufficient capacity.
- **Stone conservation** – clean brick and stone, re-point brickwork and stonework where required.
- **Cracks** - structural rectification of cracks.
- **Auditorium** – provide interpretative plaque for the painted paper ventilator panel and address safety issues associated with the orchestra pit and height of hand rails at balcony level.
- **Entrance foyer** – Install a signage system visible to all patrons.
- **Disabled Access** – Address disabled access, parking and seating issues.

7.2.3 Long Term Works

- **General** – continue to maintain and monitor the condition of the interior and exterior including walls, mouldings, joinery, carpet, timber floors and tiles.
- **Roof, gutters and downpipes** - continue to maintain roof, dormers, downpipes and gutters. When gutters require replacement, replace quad guttering with ogee profile guttering with traditional profiled rainheads or with half-round gutters for greater capacity.
- **Front Façade** - Reinstate cast iron balconettes to the windows.
- **Electrical and Lighting** – develop more appropriate methods for lighting and cabling.
- **Dressing Rooms** – replace dressing room lights and consider options for renovating to provide more usable space.
- **Offices** – consider options for renovating offices to provide more comfortable work spaces. Interpret the Unicorn mines area beneath the Director's office.
- **Auditorium** – consider options for increasing seating capacity, comfort and sightlines. Reinstate painted mural of dome. Make the stage trapdoor(s) and associated lift functional. Remove adjudicator's dais and reconstruct dress circle balustrade.

- **Entrance foyer and passages** – consider options for increasing foyer space. Undertake restoration and reconstruction works to northern and southern passages.
- **Bio Box** – consider options for access from the fly gallery to the bio box.

7.3 Maintenance and Ongoing Management

A systematic program of maintenance is required for the theatre to ensure no elements further deteriorate. It is recommended that a record of maintenance be undertaken and an example of an external maintenance schedule is included as Appendix 6 of this report.

Following the City of Ballarat's adoption of the final Conservation Management Plan, the Plan should be submitted to Heritage Victoria for adoption and to form the basis for future management of the building. It should be understood that it is not possible for the Conservation Management Plan to include detailed matters that may arise in the future management of the place. These matters are usually addressed at permit application stage as part of the preparation of a Heritage Impact Statement.

7.4 Interpretation and Tourism

It is recommended that an interpretation program be established such that users and visitors have a means of understanding the cultural value of the place. A display or information leaflets could be provided which give details to the history of the theatre, its architecture, early theatre equipment and its changing use.

Significant potential exists to interpret the theatre in relation to its context within Ballarat and amongst theatres in Victoria. The theatre's association with the Royal South Street Society and notable theatre and society figures such as Dame Nellie Melba, Sir William J. Clarke and William Collard Smith should be promoted.

The way forward is to also maximise the theatre's use by providing greater access for touring companies and performers. This in turn will provide the people of Ballarat with the opportunity to use the theatre more often and in many cases remove the need to travel to Melbourne for entertainment.

Future tourism programs should look at the promotion of the theatre as a 'unique' theatre experience. Visitors from Melbourne and regional Victoria should be encouraged to come to Ballarat as a complete package. Promotion of the theatre should be carried out jointly with other organisations in Ballarat and opportunities for direct transport, accommodation, dinner and theatre tickets etc. should be explored.

7.5 Security, Services and Building Protection

Security cameras and an alarm system were installed in 2003. Her Majesty's Theatre Board of Management should consider if existing security and other protective arrangements are satisfactory. If not, develop an appropriate building protection strategy.

7.6 Assessment for National Heritage Listing

The National Heritage List is a record of places that have outstanding natural, Indigenous or historic heritage values for the nation. Places on the list are protected under federal law by the *Environment Protection and Biodiversity Conservation Act 1999.* This requires that approval is obtained before any action takes place which has, will have, or is likely to have, a significant impact on the national heritage values of a listed place.

It is possible that Her Majesty's Theatre may qualify for listing in the National Heritage List. A preliminary assessment of the theatre indicates that the theatre satisfies five of the nine criteria used by the Australian Heritage Council to assess whether a place should be listed on the National Heritage List. These include:

> b) the place has outstanding heritage value to the nation because of the places' possession of uncommon, rare or endangered aspects of Australia's natural or cultural history
>
> d) the place has outstanding heritage value to the nation because of the place's importance in demonstrating the particular characteristics of a class of Australia's natural or cultural places
>
> e) the place has outstanding value to the nation because of the place's importance in exhibiting particular aesthetic characteristics valued by a community or cultural group
>
> f) the place has outstanding heritage value to the nation because of the place's importance in demonstrating a high degree of creative or technical achievement at a particular period
>
> h) the place has outstanding heritage value to the nation because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history

It is recommended that further assessment be undertaken to investigate this opportunity. Inclusion on the National Heritage List would elevate the theatre’s heritage status as well as open up possibilities for National funding.

7.7 Funding Sources

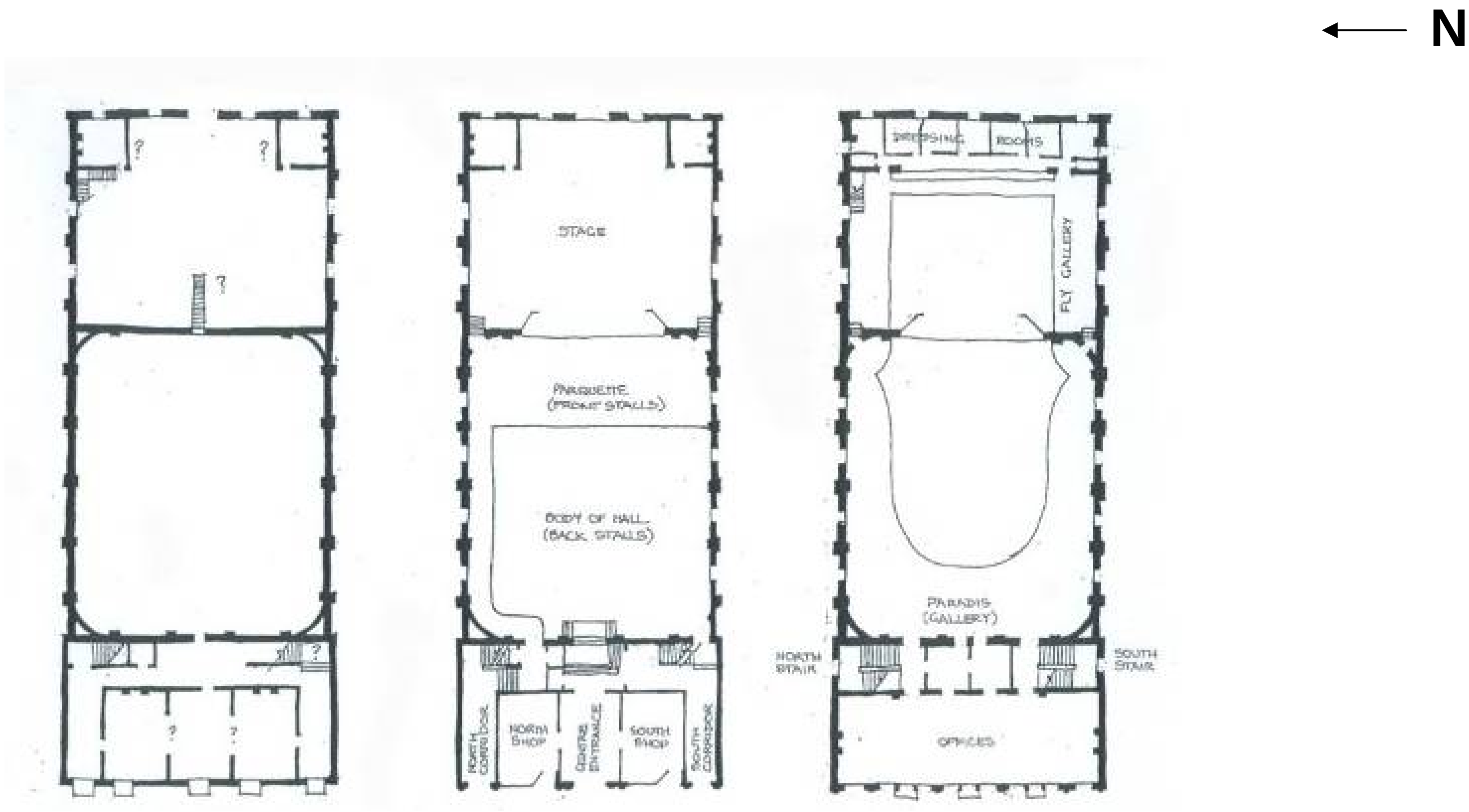
The funding for conservation works can be assisted by grants or loans from Government agencies. These include:

- **Creating Better Places Program *Melbourne 2030*** – this Heritage Victoria program funds initiatives that will result in physical improvements to recognised heritage places. Grants are provided on the basis of comparative merit, for the restoration and conservation of heritage places in and around metropolitan Activity Centres and in the cities and towns along the Networked Cities Corridors. The program operates on a July to June financial year basis and applications for grants are called annually. Notice for the 2006-07 round will take place by the end of April 2006, letters will be sent directly to the CEO and the Development Officer at all Councils.
- **Creating Better Places Program *Public Land*** - this Heritage Victoria program funds conservation initiatives in its broader sense, directed at increasing the use or viability of the place. Grants are provided on the basis of comparative merit, for the restoration and conservation of heritage places on public land, including land owned by local councils, throughout Victoria. The program operates on a July to June financial year basis and applications for grants are called annually. Notice for the 2006-07 round will take place by the end of April 2006, letters will be sent directly to the CEO and the Development Officer at all Councils.
- **National Heritage Investment Initiative** – this Australian Government funding program provides assistance to restore and conserve Australia’s most important historic heritage places. The National Heritage Investment Initiative is administered by the Department of the Environment and Heritage on behalf of the Australian Government Minister for the Environment and Heritage. Grants may be provided to assist in funding works to restore important historic heritage places listed on the Australian Government’s National Heritage List, or entered in a state or territory government statutory heritage register. Priority is given to places entered on the Australian Government’s National Heritage List. The National Heritage Investment Initiative invests in projects identified through a competitive application process. Grants will generally be for 12 months and will range from $10,000 to $500,000. The Minister may offer part-funding for projects to meet urgent or strategic conservation works. It is recommended that an application be made for funding from this source - the second round of funding is due for mid 2006 and an application should be made at that time.

8.0 SCHEMATIC PLANS SHOWING DEVELOPMENT OF BUILDING COMPLEX

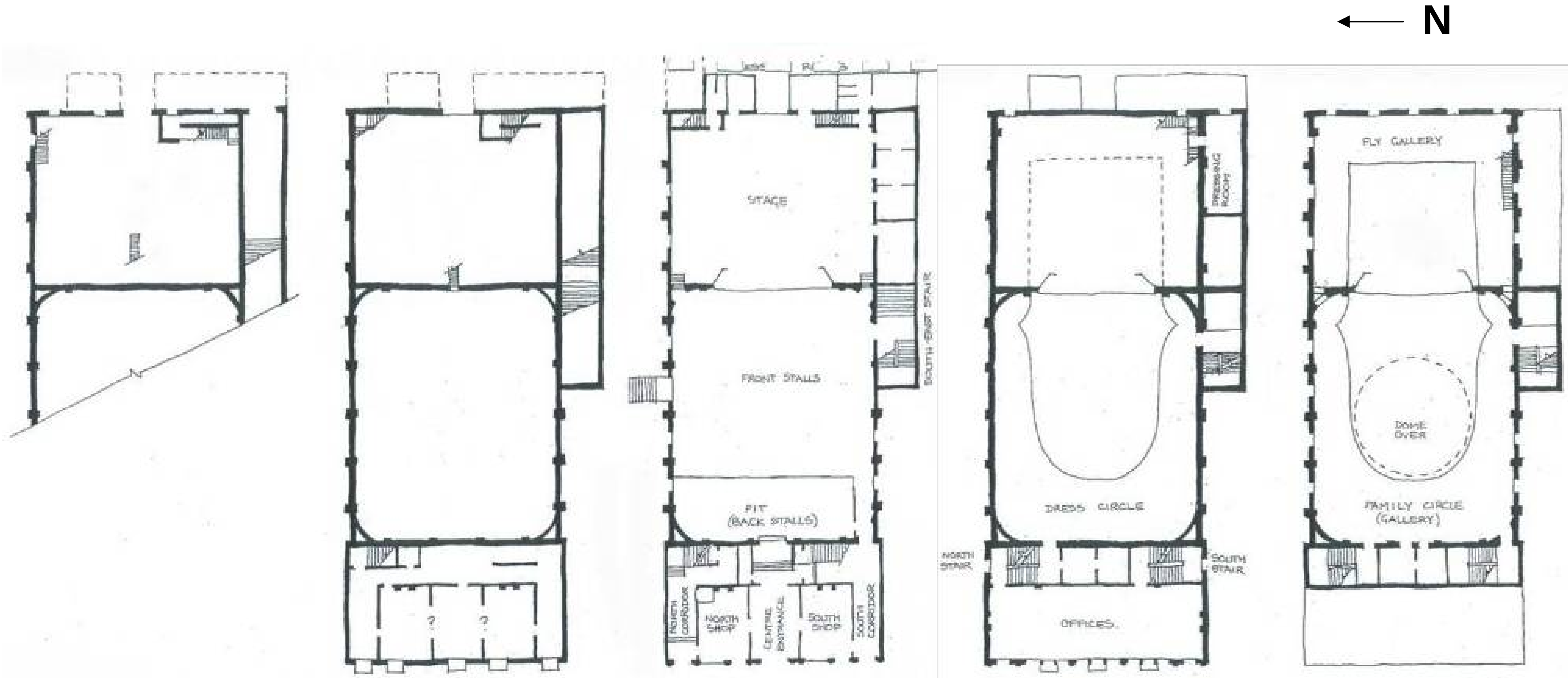
The following plans have been extracted from the *Royal South Street Memorial Theatre: Conservation Analysis and Conservation Policy Volume I* report prepared by Clive Lucas and Partners in association with Civil and Civic Pty Ltd in 1987. The plans show the major physical changes that have taken place over the life of the theatre.

BROWNE, 1875



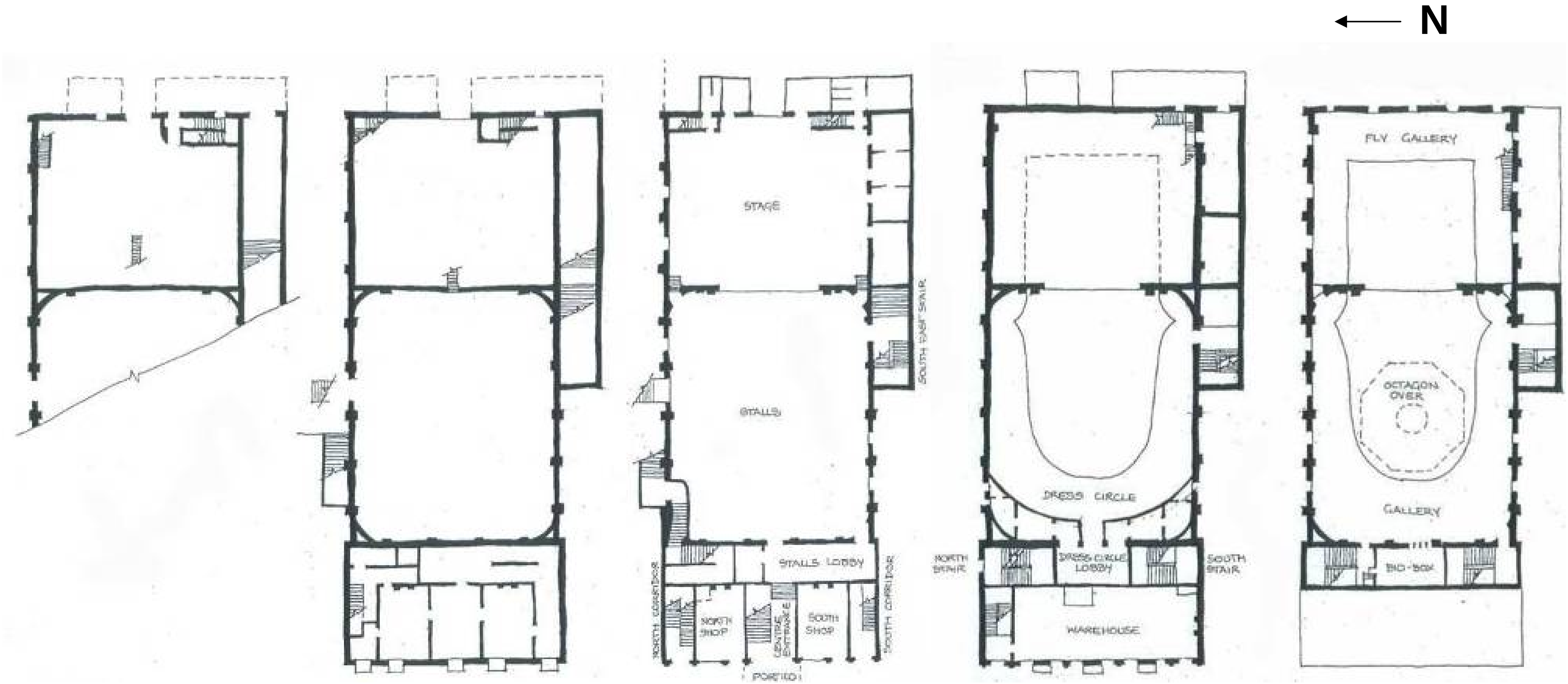
BASEMENT **STALLS LEVEL** **DRESS CIRCLE/ GALLERY**

PITT, 1898-99



SUB-BASEMENT **BASEMENT** **STALLS LEVEL** **DRESS CIRCLE/ GALLERY** **FAMILY CIRCLE/ BALCONY**

CLEGG & MILLER, c1904-17

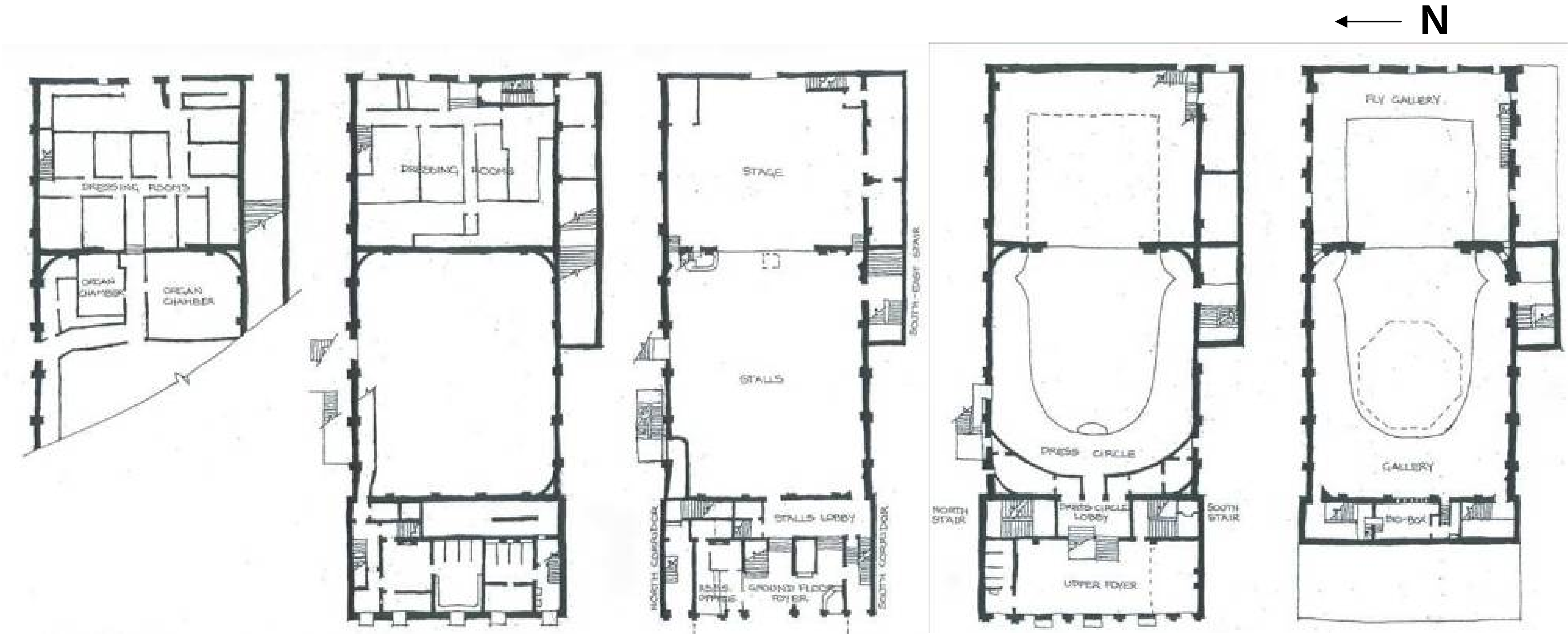


SUB-BASEMENT **BASEMENT** **STALLS LEVEL** **DRESS CIRCLE/ GALLERY** **FAMILY CIRCLE/ BALCONY**

CINEMA PERIOD, 1920-64

SUB-BASEMENT **BASEMENT** **STALLS LEVEL** **DRESS CIRCLE/ GALLERY** **FAMILY CIRCLE/ BALCONY**

ROYAL SOUTH STREET SOCIETY, 1965-87

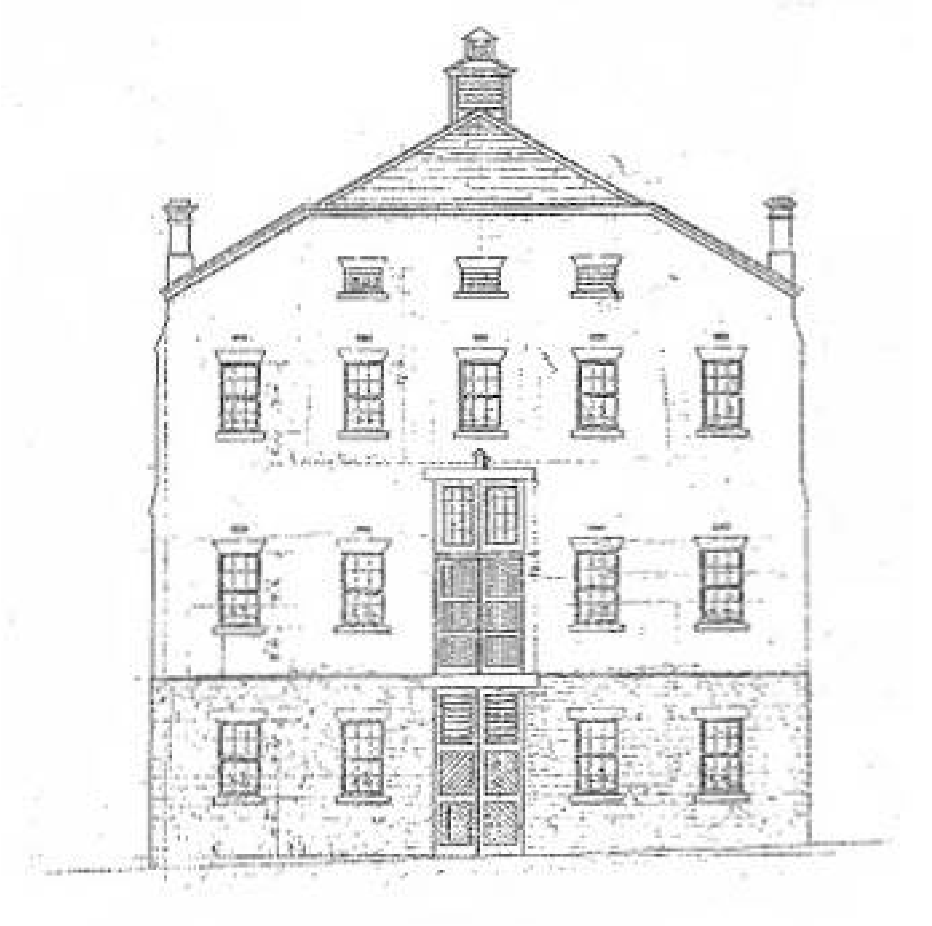


SUB-BASEMENT **BASEMENT** **STALLS LEVEL** **DRESS CIRCLE/ GALLERY** **FAMILY CIRCLE/ BALCONY**

9.0 EARLY DRAWINGS OF BUILDING COMPLEX

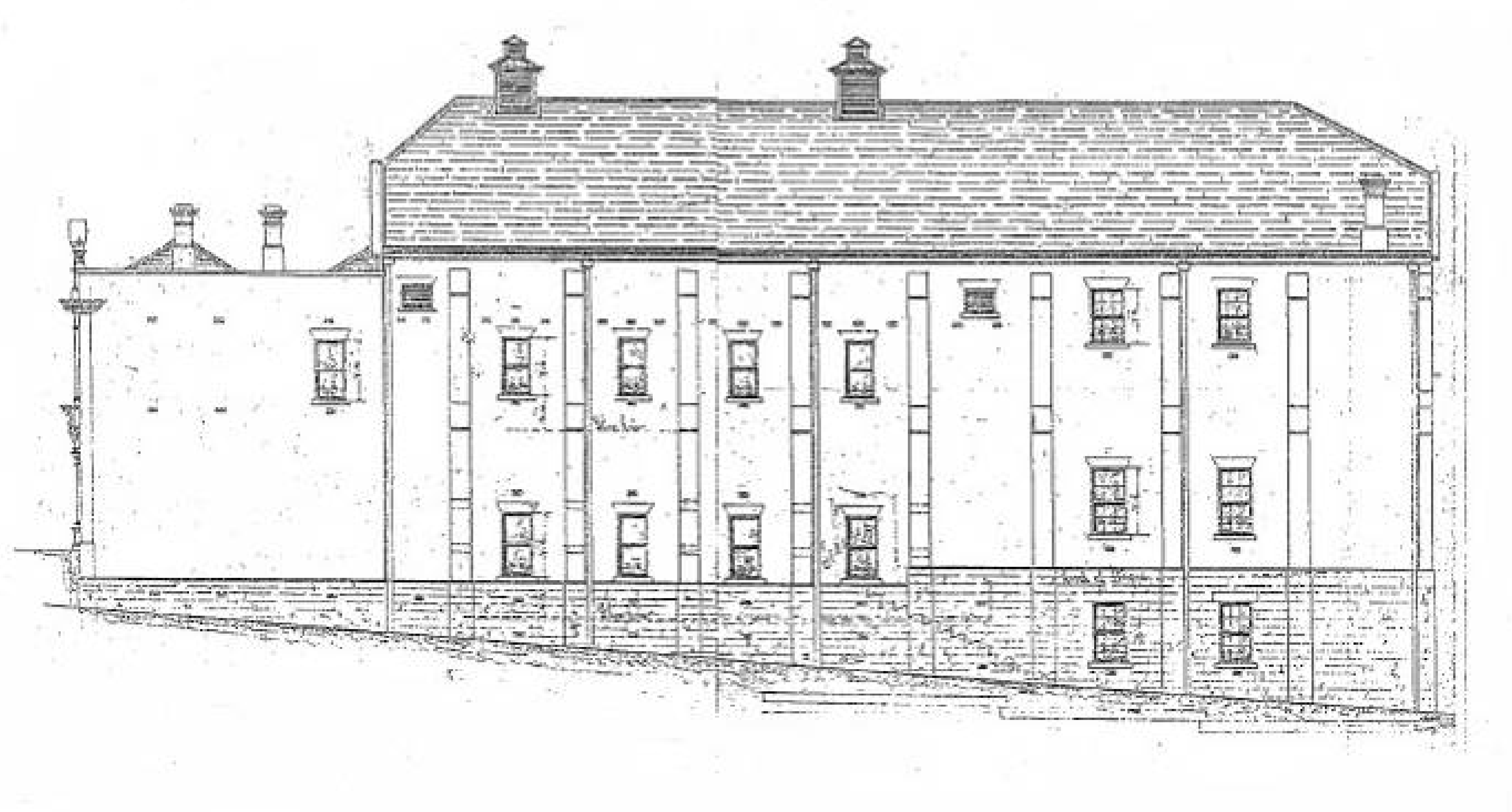
BROWNE, 1875

FRONT ELEVATION



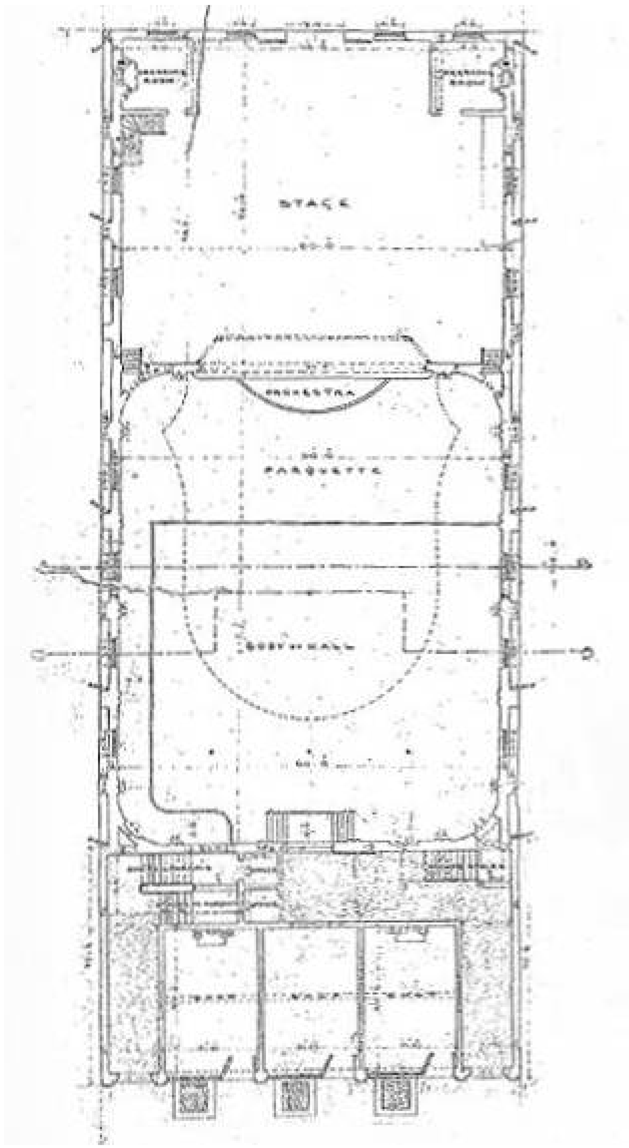
REAR ELEVATION

BROWNE, 1875

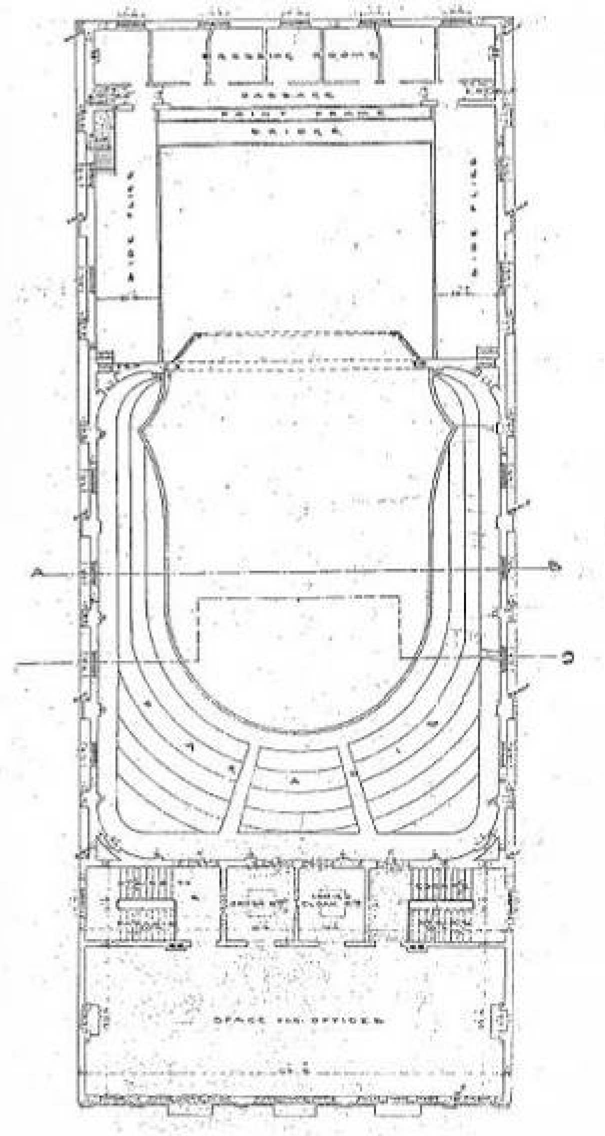


SIDE ELEVATION

BROWNE, 1875

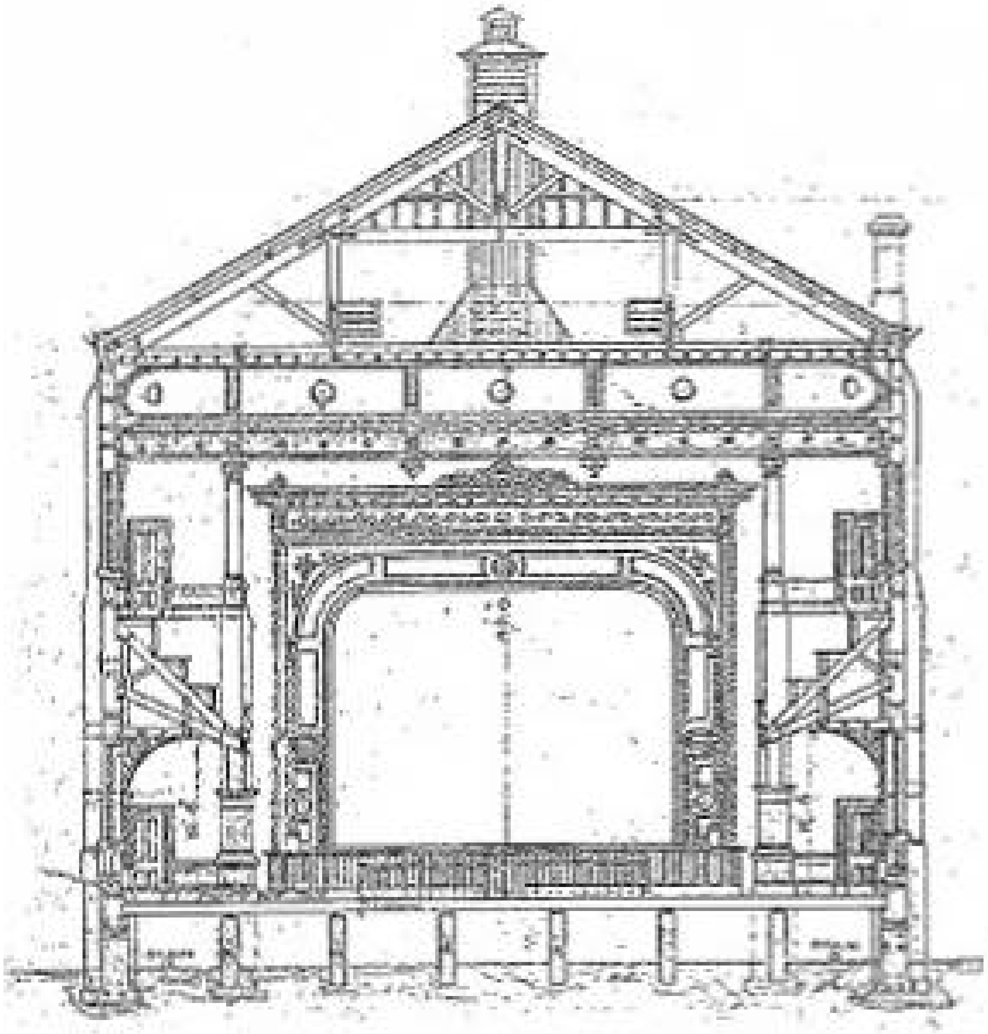


GROUND PLAN (LEVEL 3)

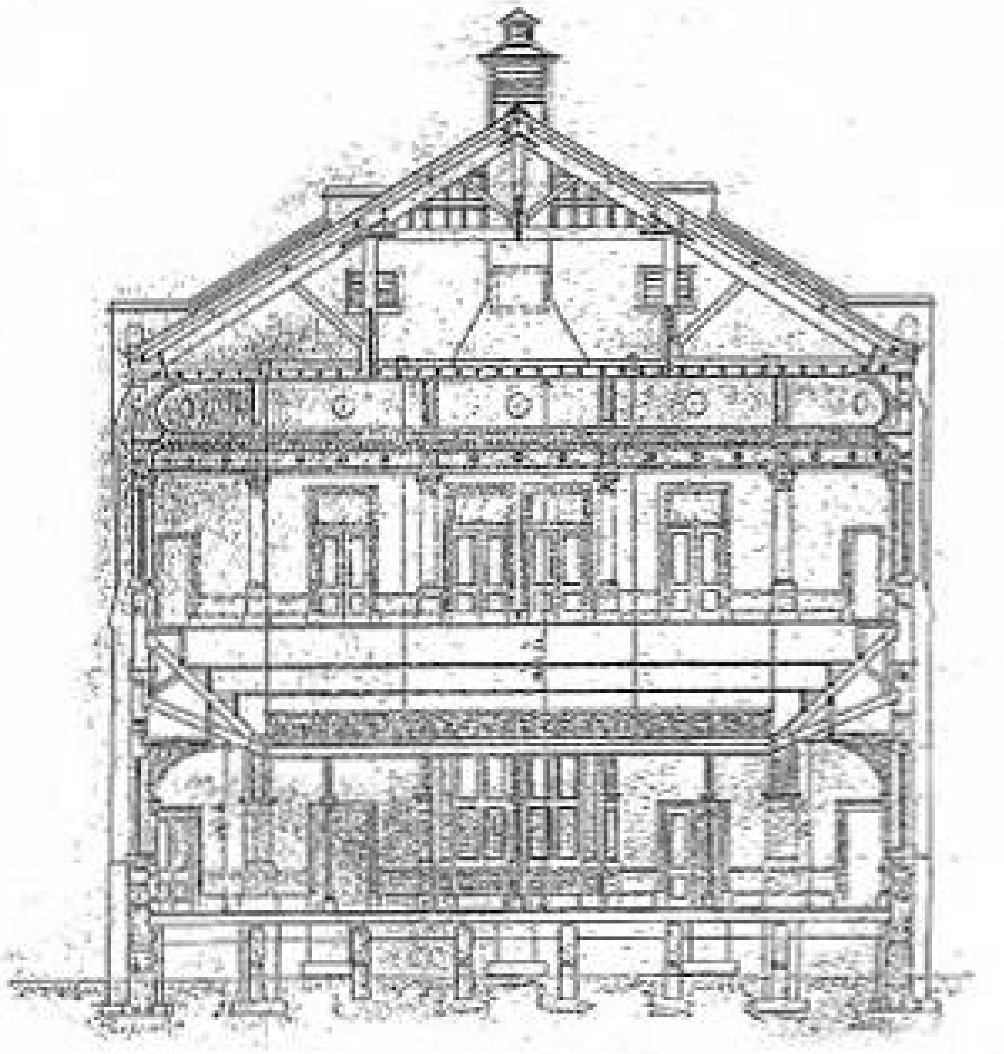


FIRST FLOOR PLAN (LEVEL 4)

BROWNE, 1875



TRAVERSE SECTION A-B

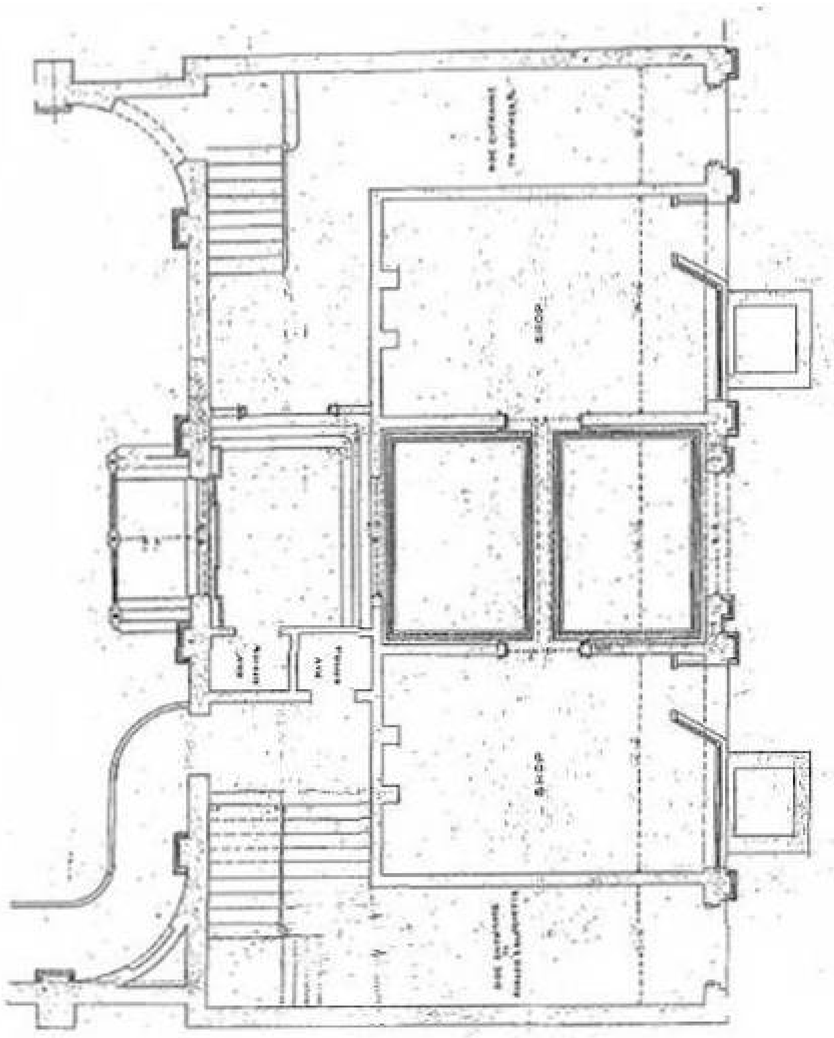


TRAVERSE SECTION C-D

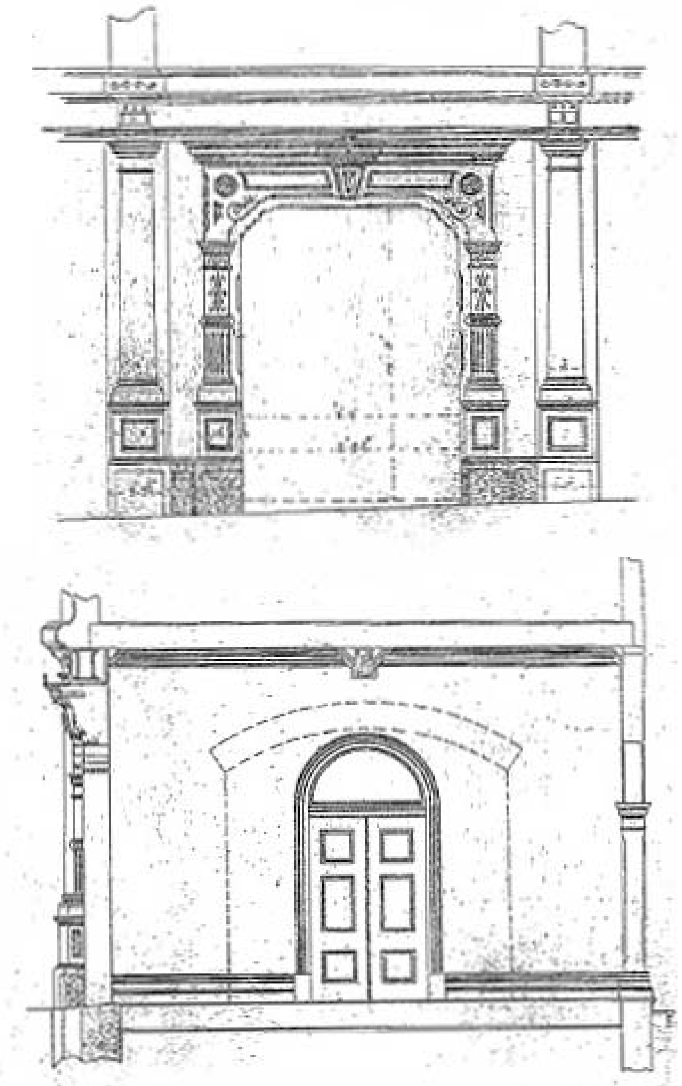
BROWNE, 1875

LONGITUDINAL SECTION

BROWNE, 1875

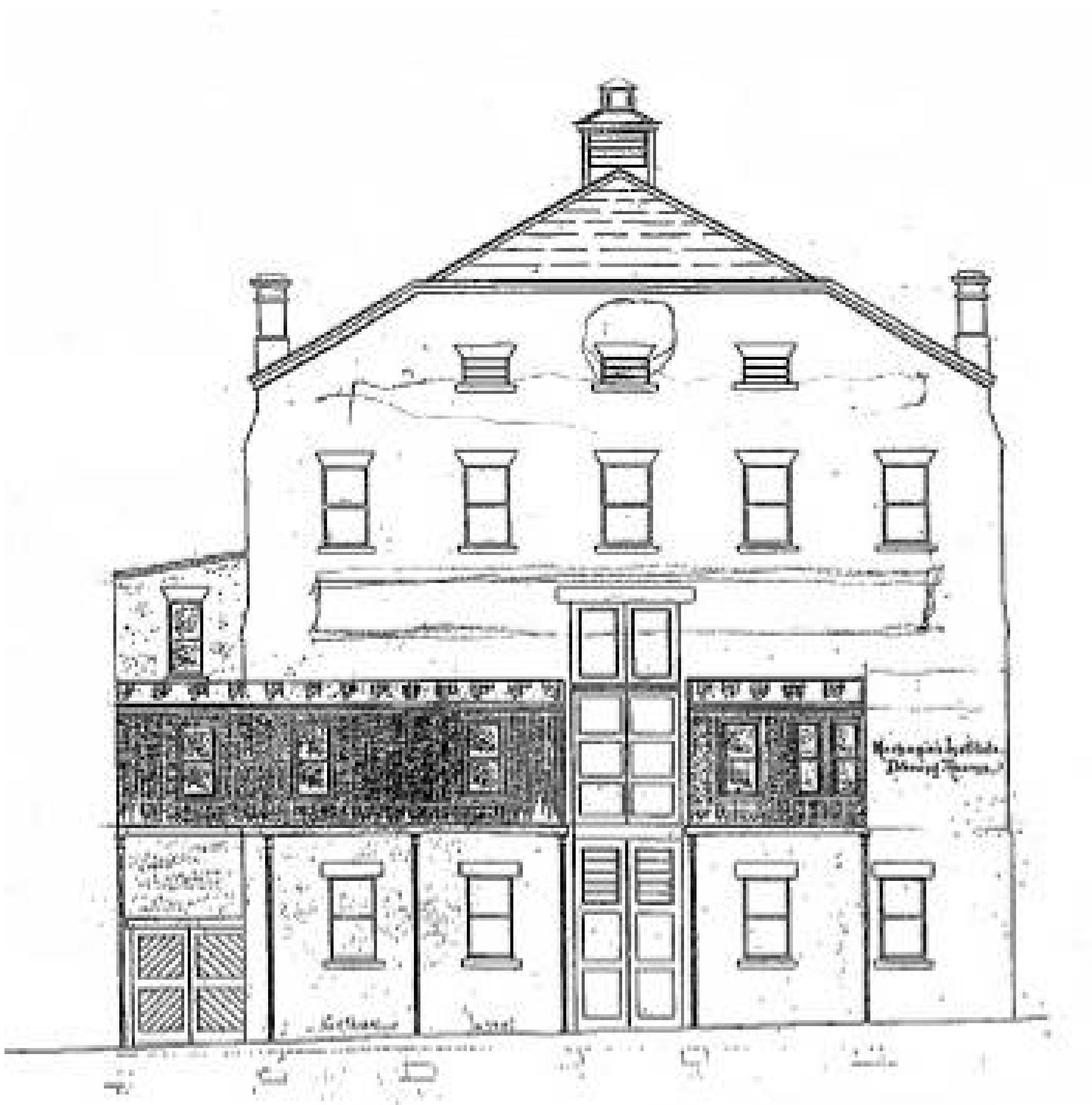


PLAN OF ENTRANCE FOYER

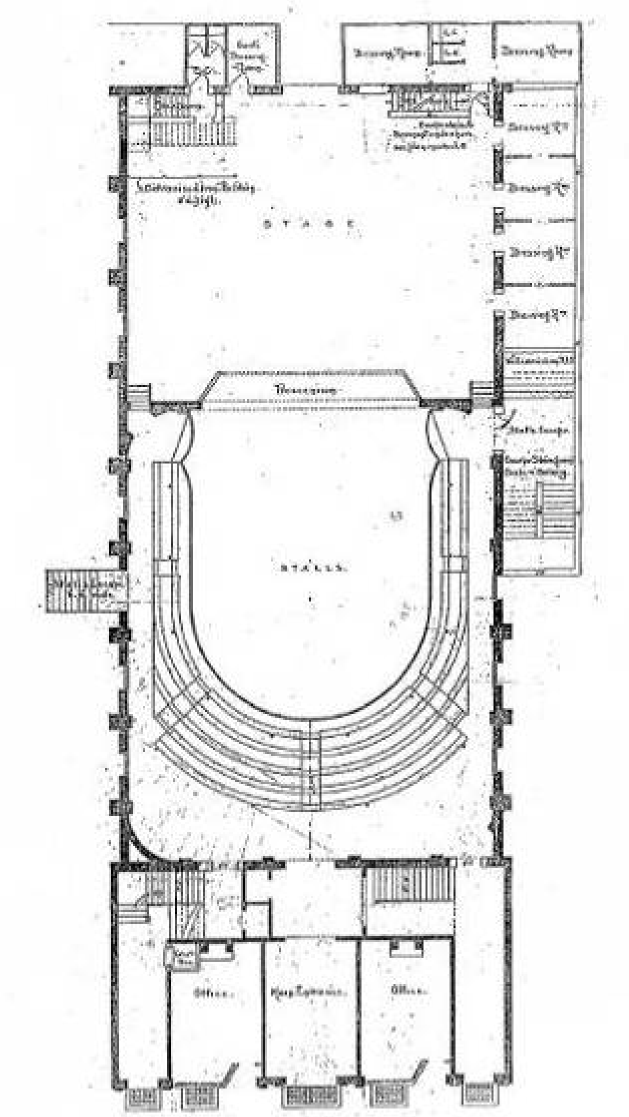


ENTRANCE FOYER DETAIL

PITT, 1898

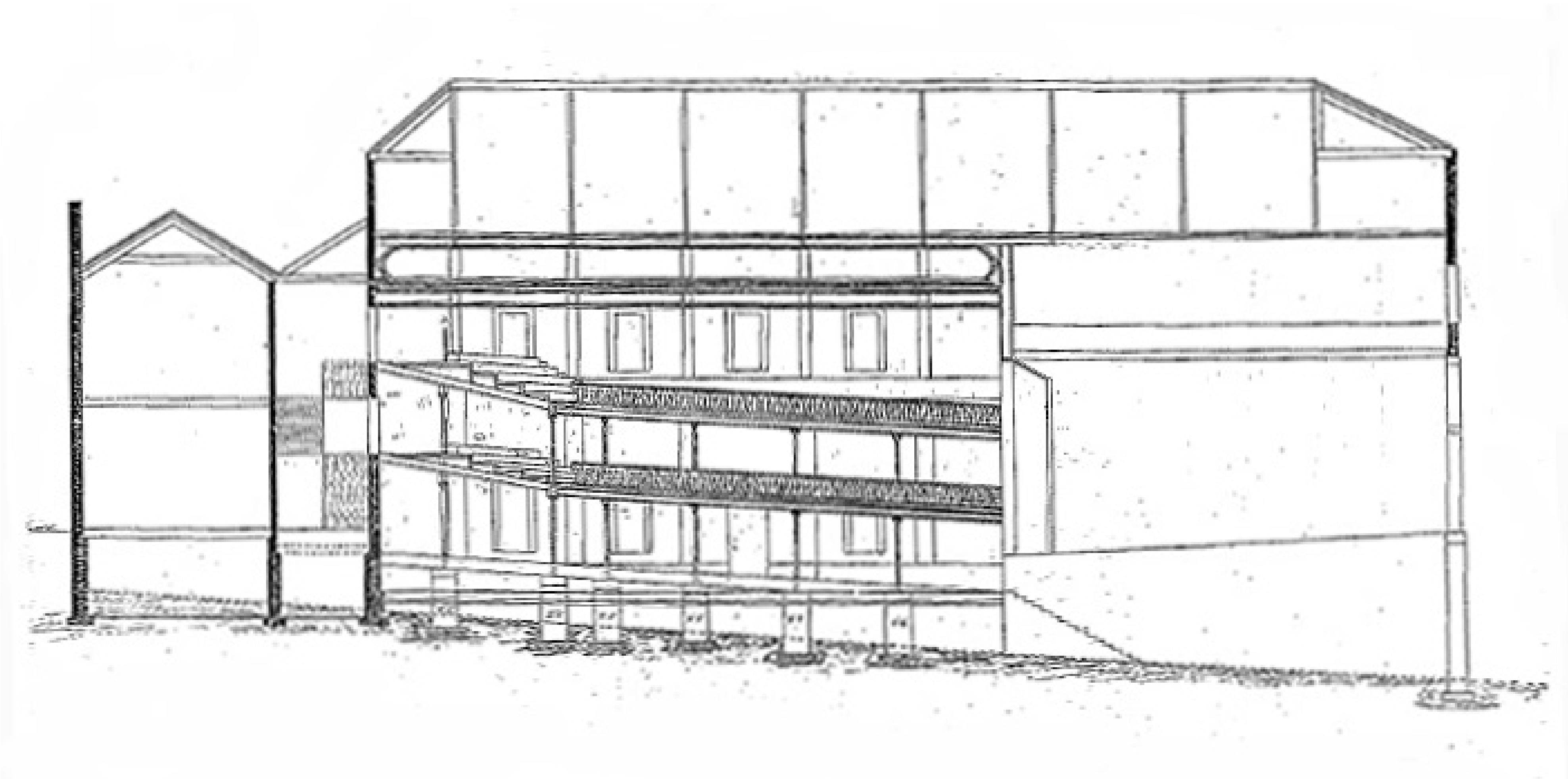


SKILLION ADDITION TO REAR ELEVATION



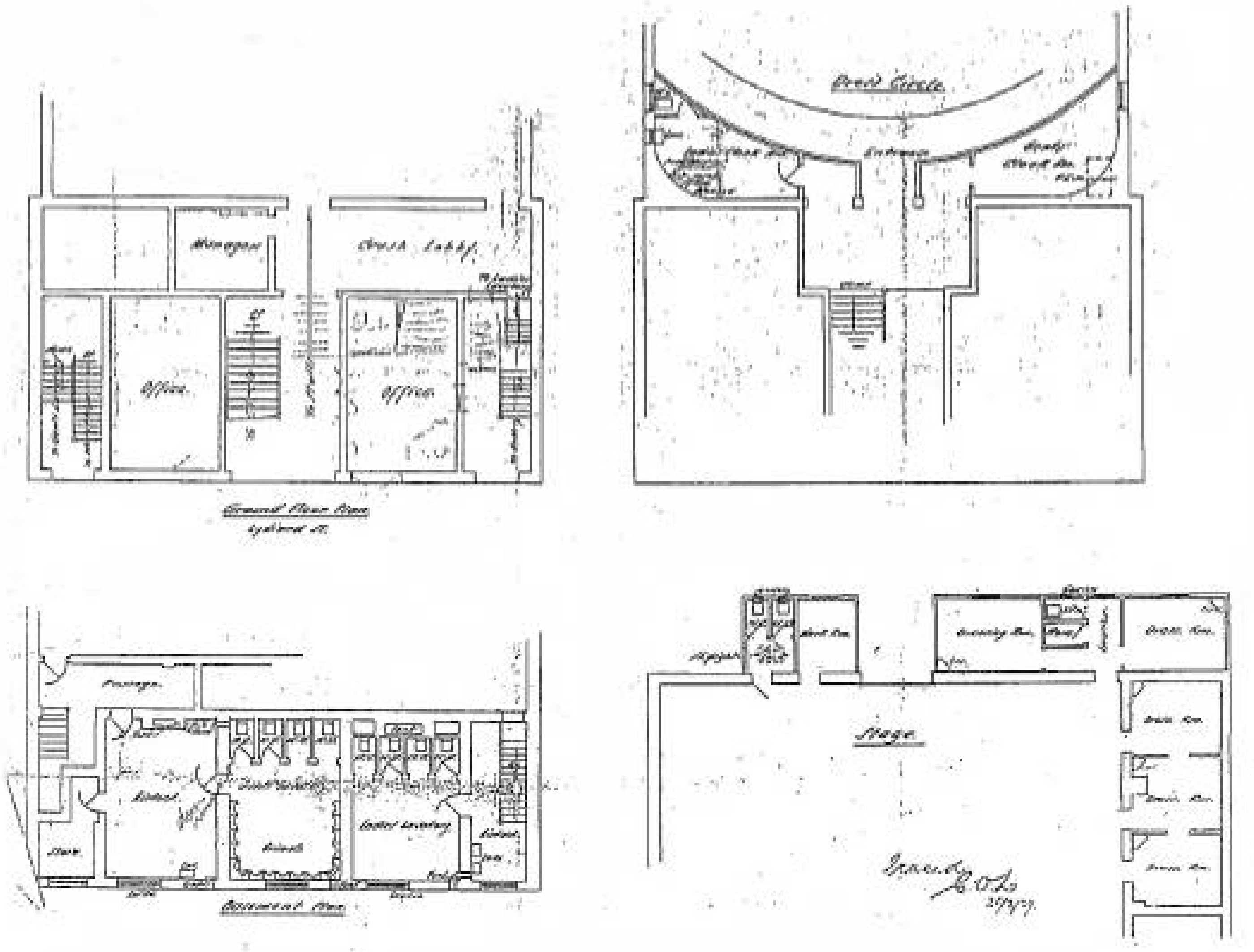
ADDITIONS AND ALTERATIONS TO GROUND PLAN (LEVEL 3)

PITT, 1898



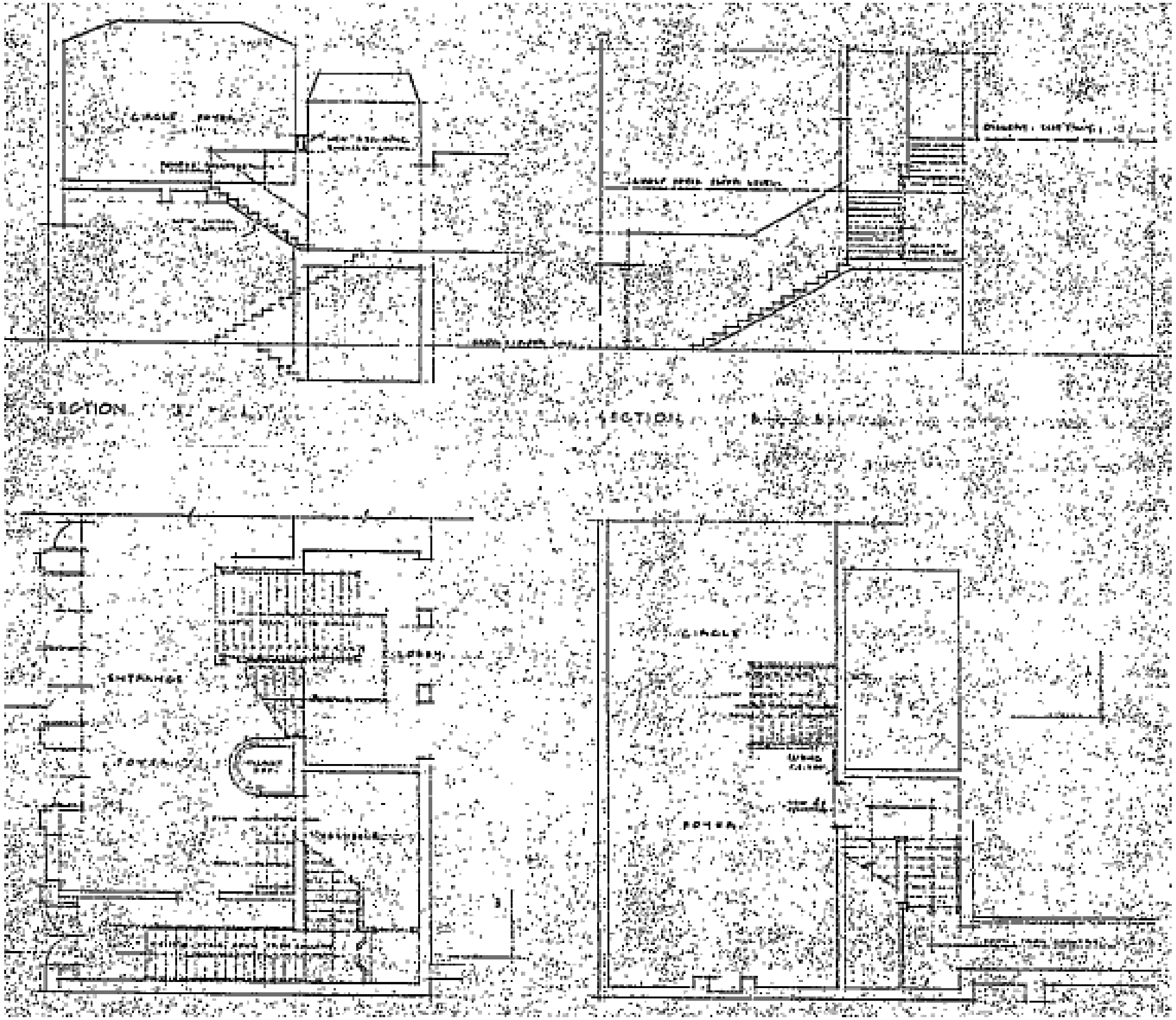
LONGITUDINAL SECTION OF ALTERATIONS AND ADDITIONS

CLEGG & MORROW, 1927



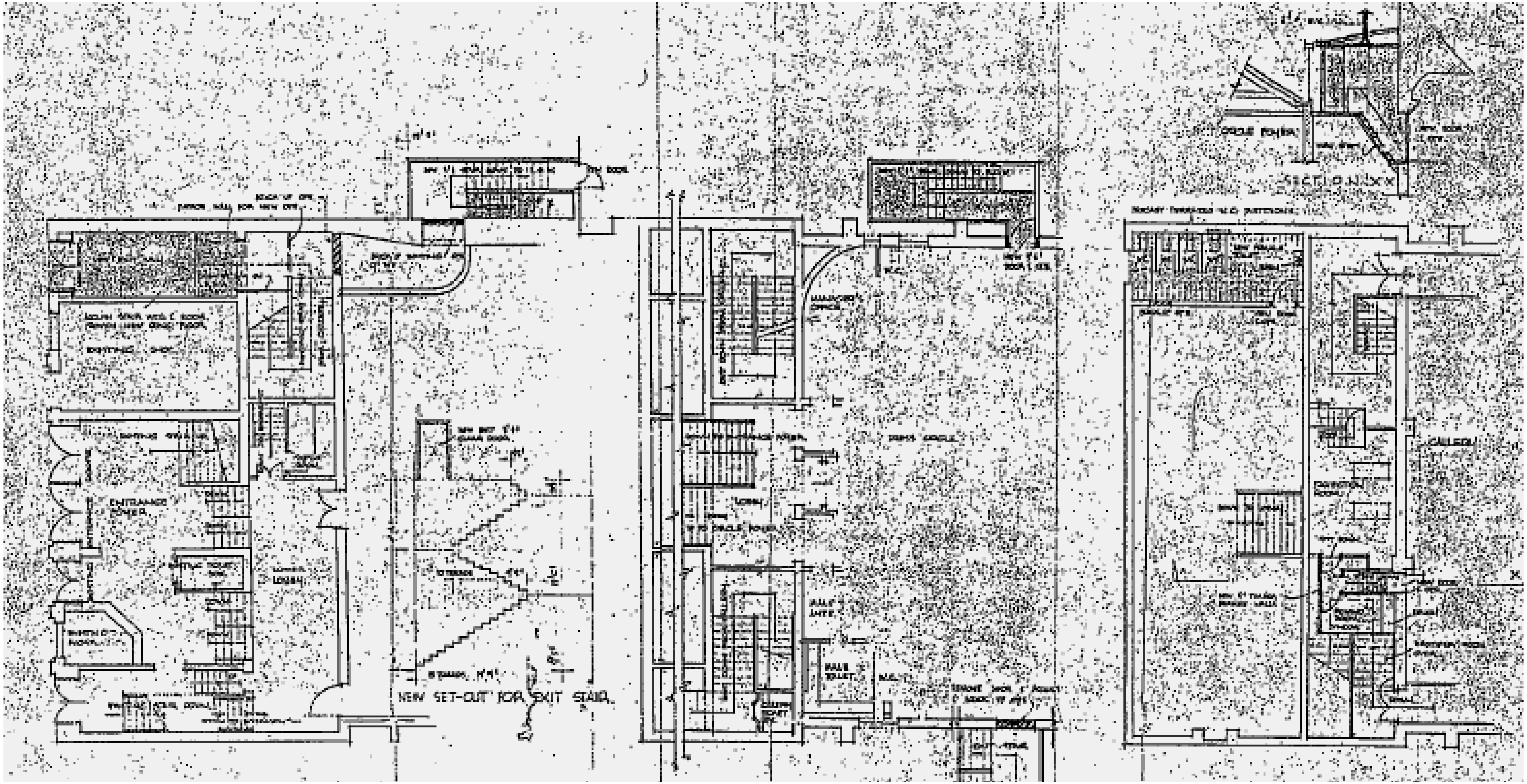
ADDITION OF SEWERAGE TO BACKSTAGE AREAS, AND DRESS CIRCLE FOYER

COWPER MURPHY & ASSOCIATES, 1948



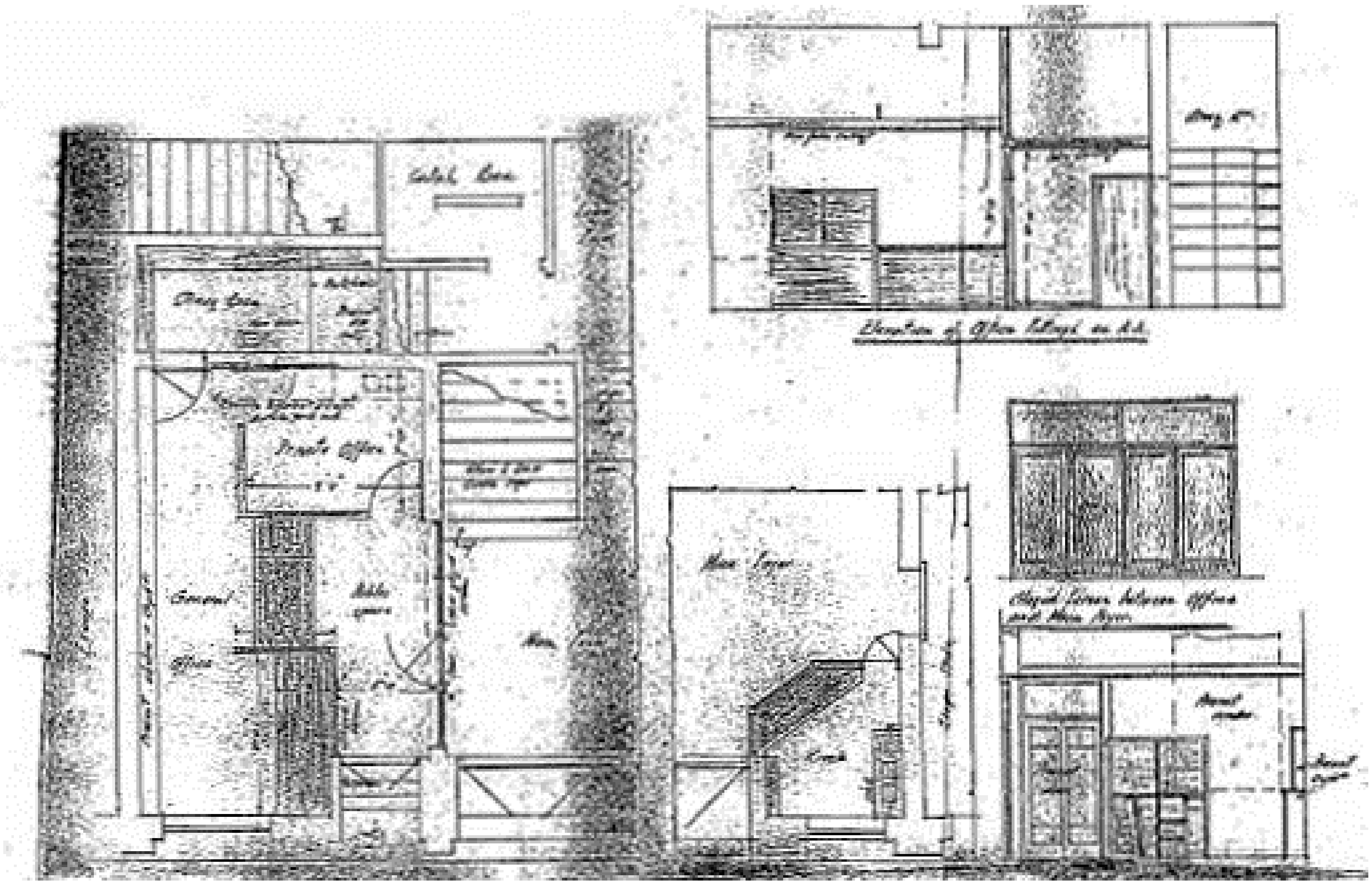
ALTERATIONS TO THE FRONT ENTRANCE AND STAIRCASES

COWPER MURPHY & ASSOCIATES, 1951



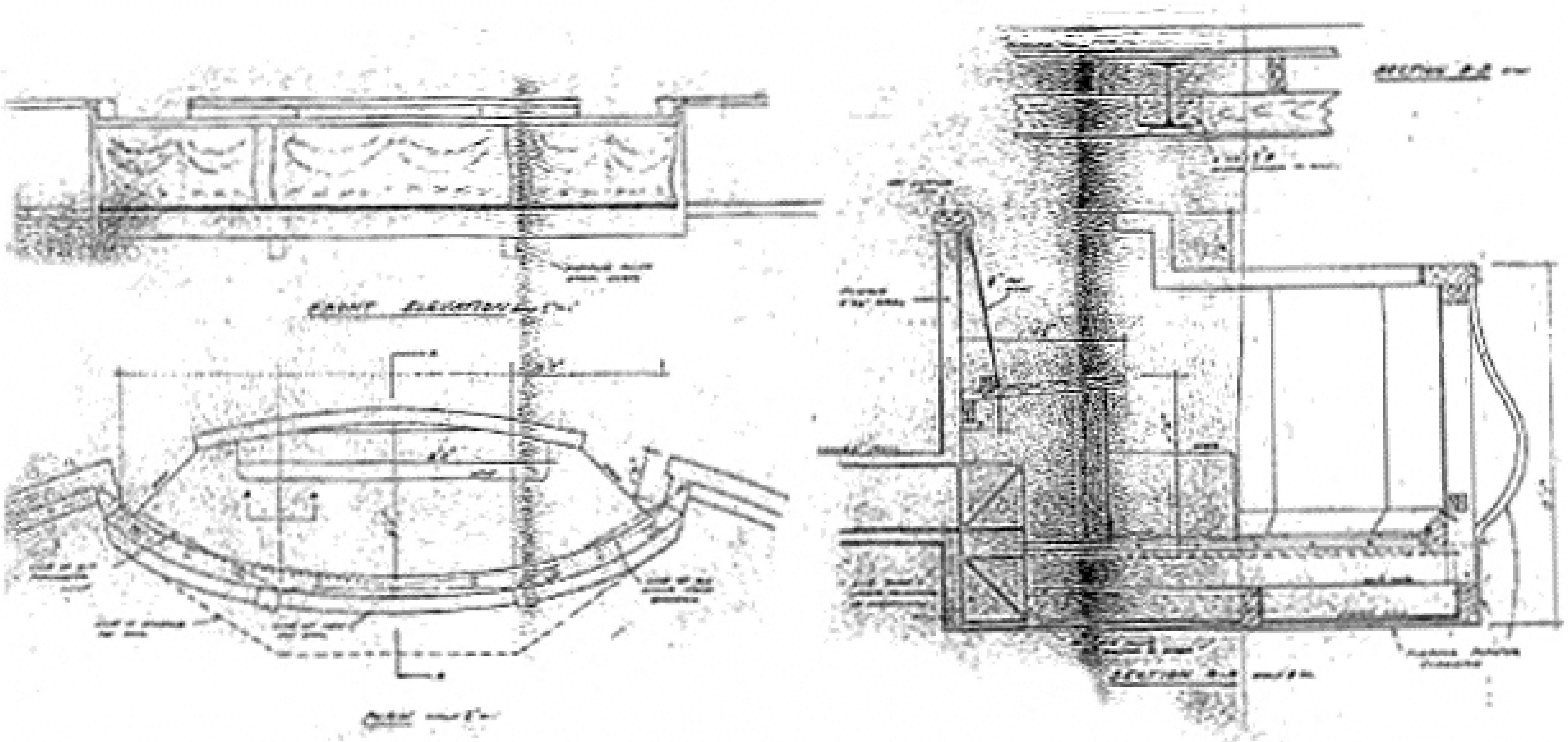
ALTERATIONS TO THE FRONT ENTRANCE **ALTERATIONS TO DRESS CIRCLE** **ALTERATIONS TO LONG ROOM**

G.S. RICHARDS, 1966



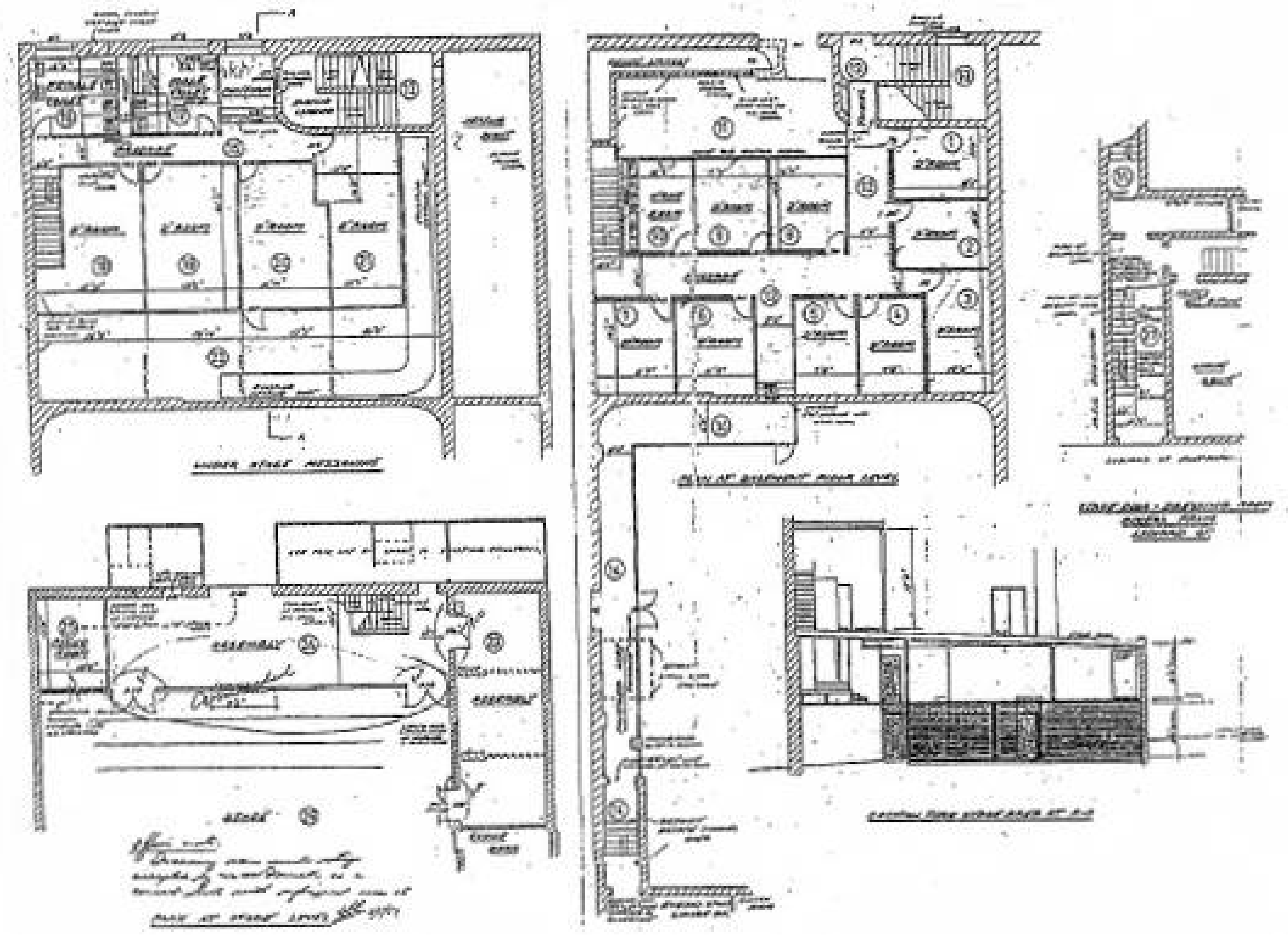
NEW ROYAL SOUTH STREET SOCIETY OFFICES

G.S. RICHARDS, 1966



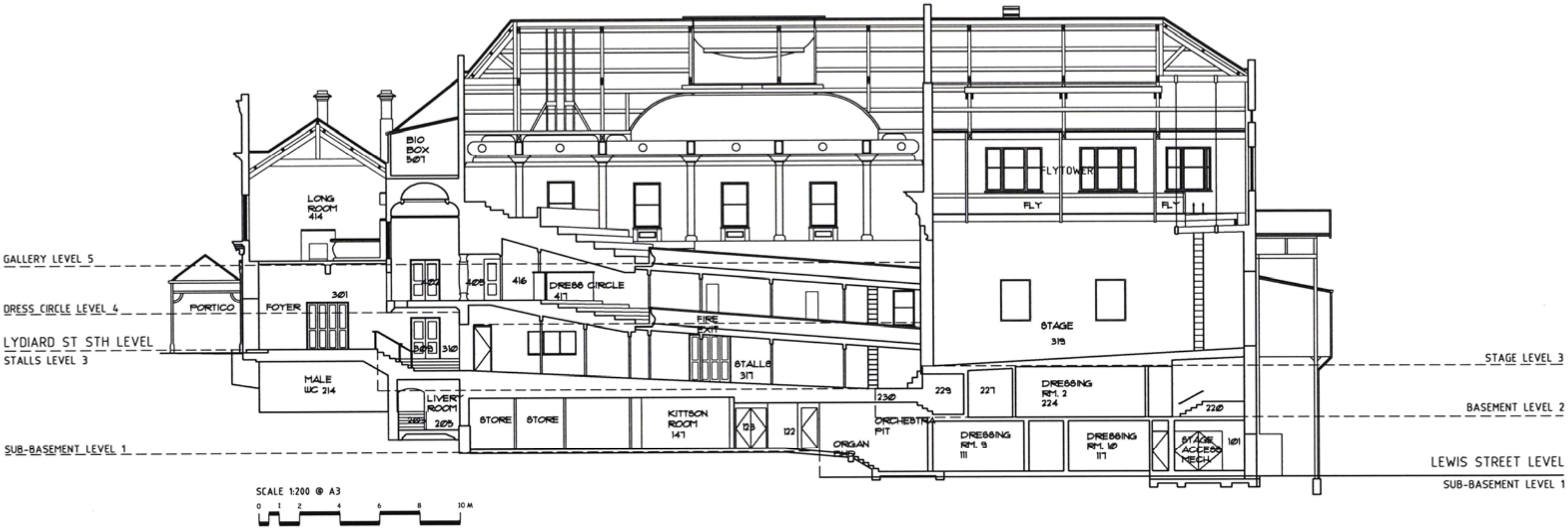
NEW ADJUDICATOR'S BOX AT DRESS CIRCLE LEVEL

M. F. MURRAY, 1966

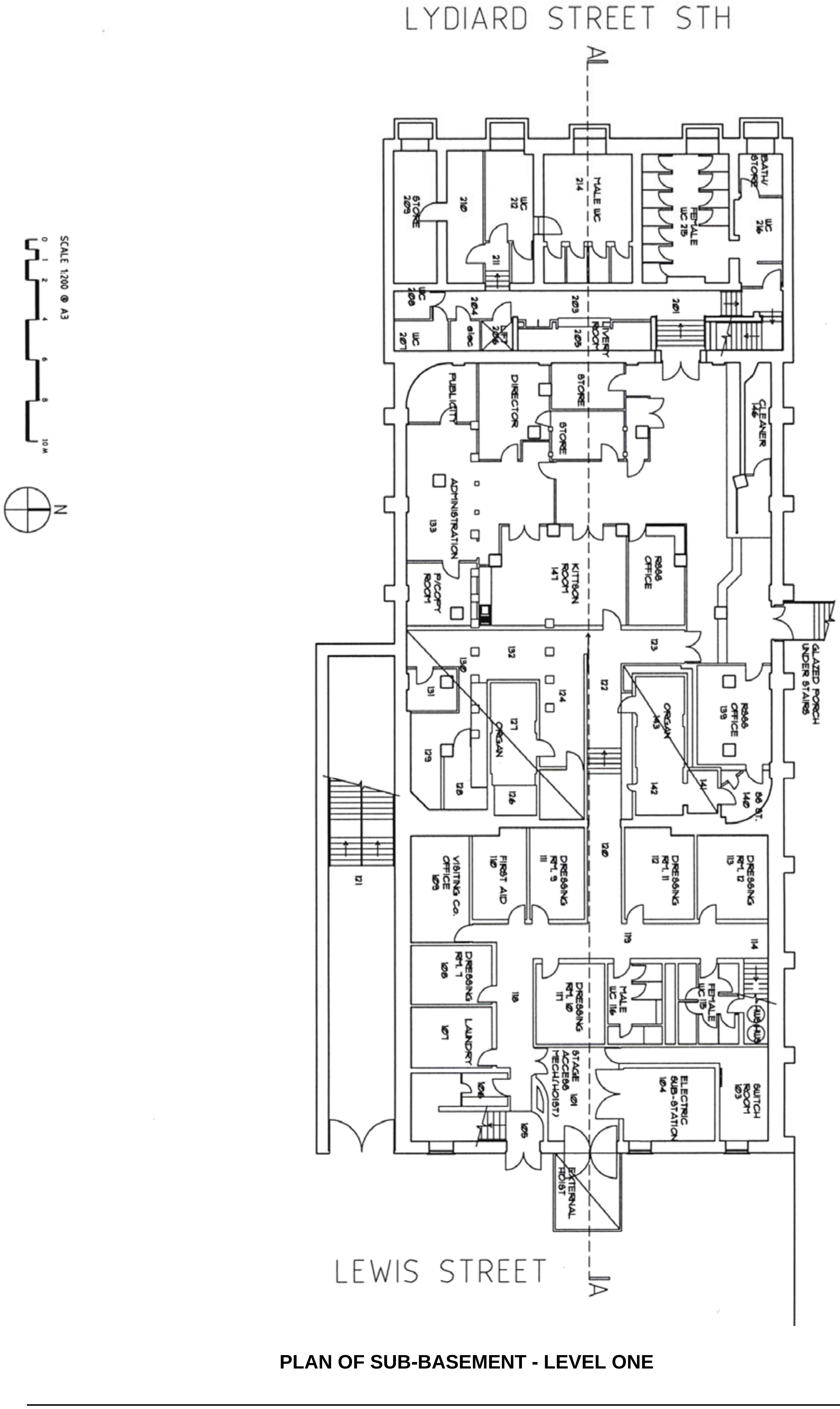


NEW DRESSING ROOM ACCOMMODATION AT SUB-BASEMENT AND BASEMENT LEVEL

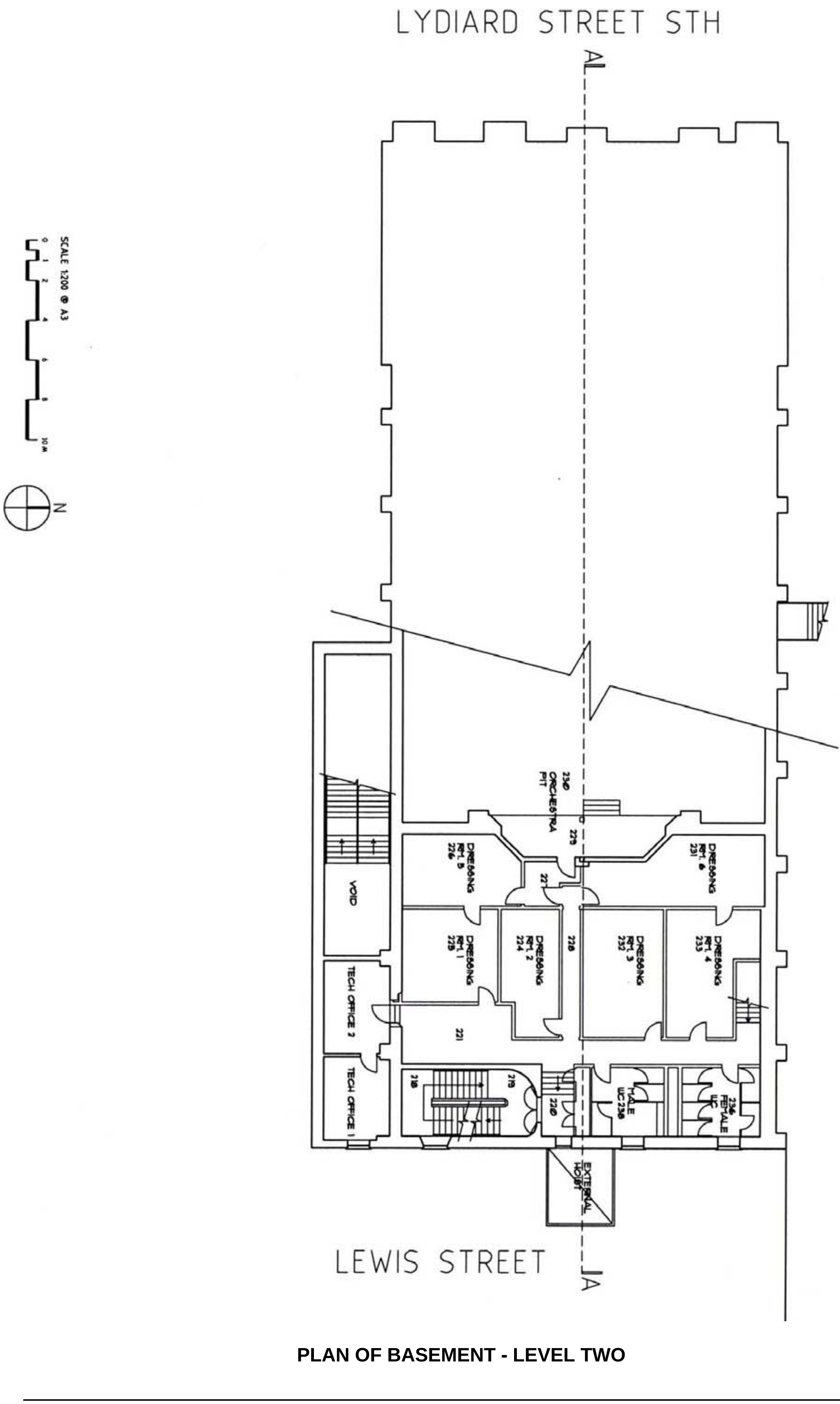
10.0 CURRENT DRAWINGS OF BUILDING COMPLEX



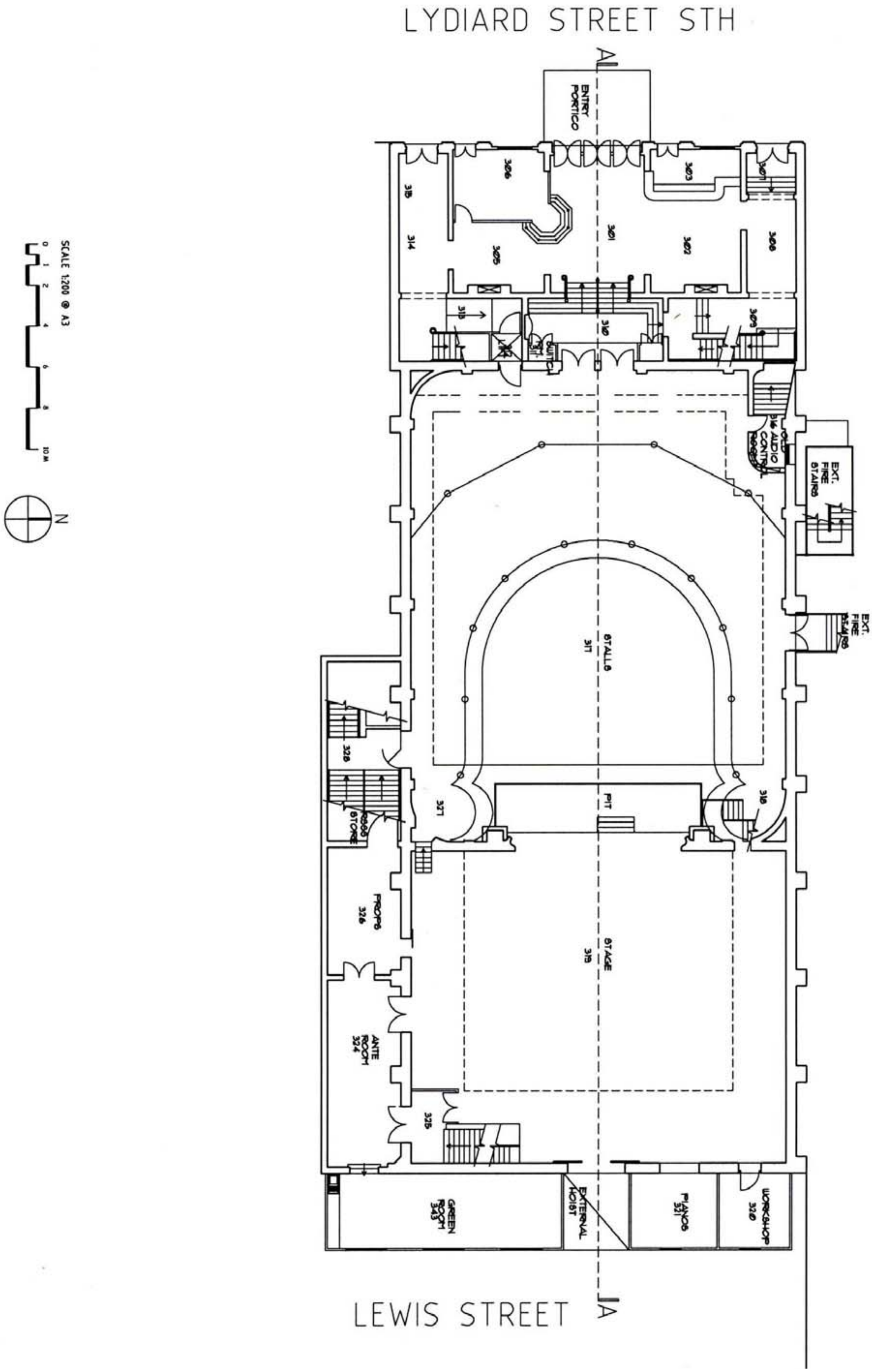
SECTION OF HER MAJESTY'S THEATRE



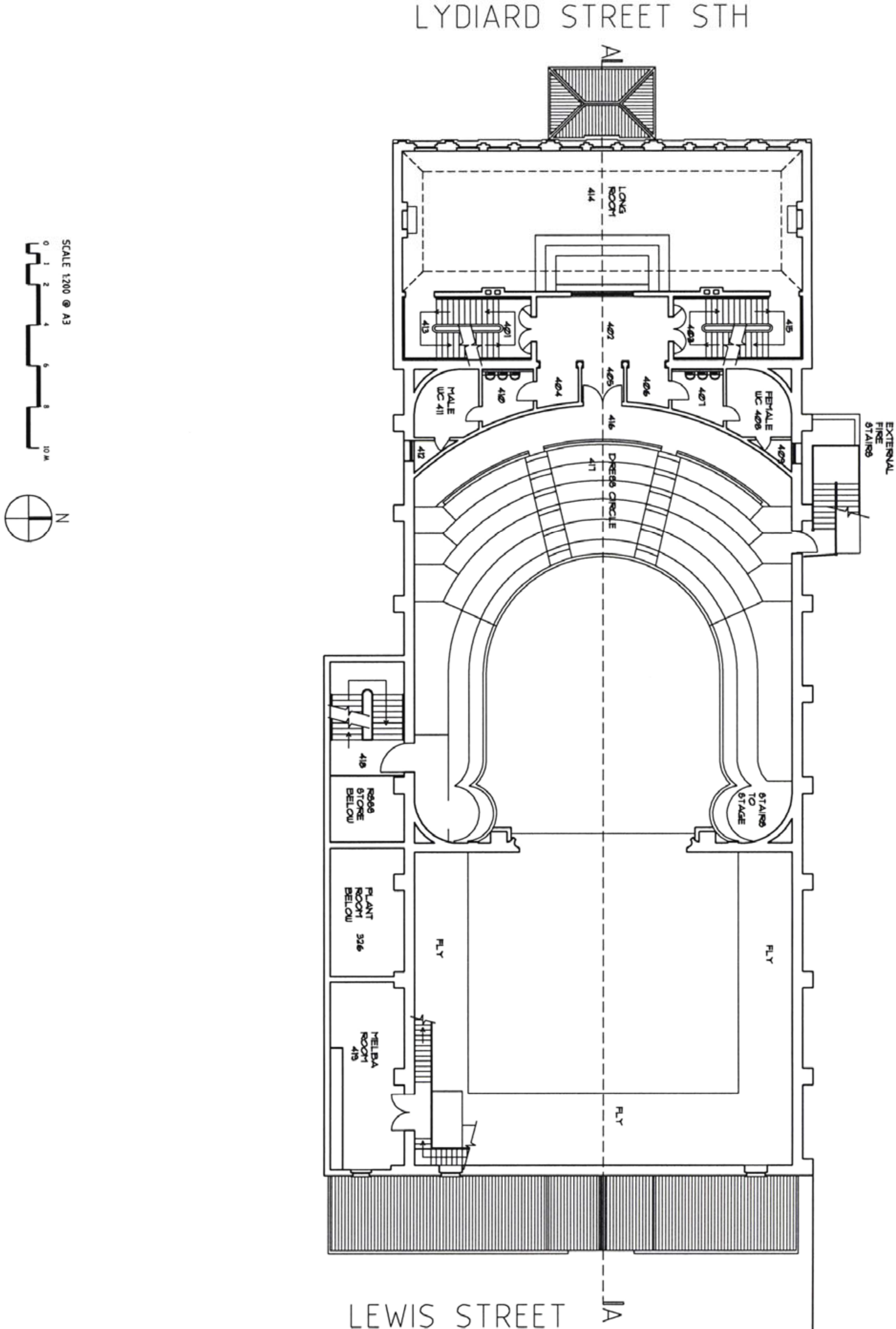
PLAN OF SUB-BASEMENT - LEVEL ONE



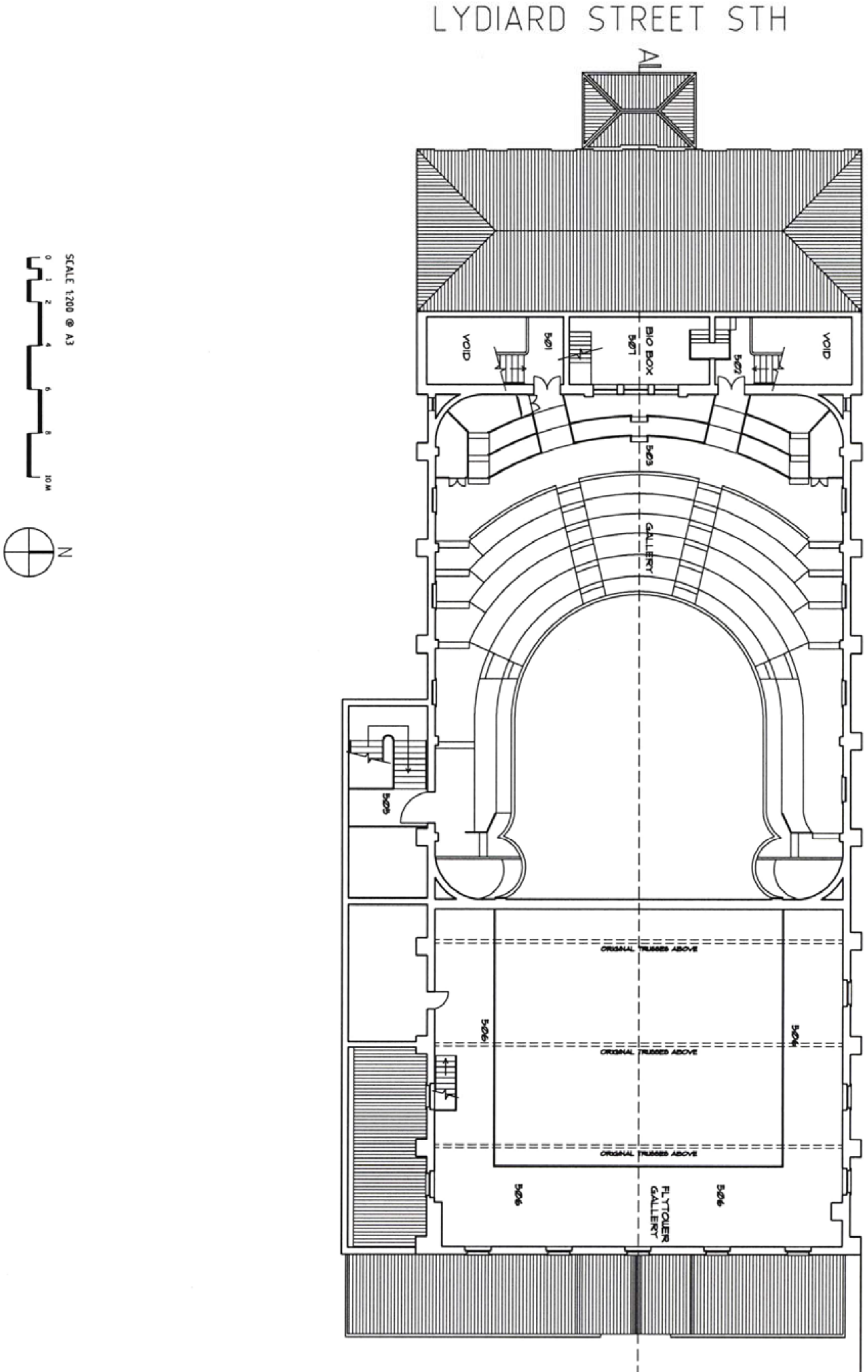
PLAN OF BASEMENT - LEVEL TWO



PLAN OF STALLS - LEVEL THREE



PLAN OF DRESS CIRCLE - LEVEL FOUR



PLAN OF GALLERY - LEVEL FIVE

APPENDIX ONE: SOURCES OF INFORMATION

- Ballarat City Council, *Best Value Report, Her Majesty's Theatre*, Ballarat, July 2004
- Ballarat City Council Files 5/60/1 (held in boxes in Theatre Director's Office) note these files contain details from the 1897-1990 restoration project including letter files, a copy of the project brief, copy of contracts and drawings, etc.
- Ballarat City Council, photographs scanned from folders held by the Council which contain the results of a project called 'Ballarat's City Buildings – Bi-Centennial Photographic Archival Project 1988, co-ordinated by Mr J. A. Chisholm MBE, as chair of the Ballarat Restoration Advisory Committee.
- Ballarat in Pictures Scrapbook.
- Ballarat Visitor Information Centre, 2006 *Walking Ballarat's Heritage booklet*. *http://www.ballarat.com/walkheritage.htm*
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- Carlotta Kellaway, *Royal South Street Memorial Theatre, Lydiard Street South, Ballarat*, Historic Buildings Council Victoria, September 1986
- City of Greater Bendigo, 2006 *A Guided Tour,* http://www.bendigo.vic.gov.au/Page/page.asp?Page_Id=390&h=0
- Clive Lucas and Partners in association with Civil and Civic Pty Ltd, *Royal South Street Memorial Theatre, Lydiard Street South, Ballarat, Victoria: Conservation Analysis and Conservation Policy*, Sydney, 1987
- Country Fire Authority, *Inspection Report – Maintenance, Building Act 1993,* 2006
- Her Majesty's Theatre Board of Management meeting held 10th February 2004, Agenda Item 12.2.3: Performing Arts Precinct - Her Majesty's Theatre/Mechanics' Institute link Feasibility Study (Extract of Minutes)
- Her Majesty's Theatre, *Her Majesty's, Celebrating 130 years,* Ballarat, June 2005
- Her Majesty's Theatre, *Her Majesty's Theatre, Ballarat Conservation Management Plan Review and Update and Re-development Feasibility Study,* Ballarat, December 2005
- Her Majesty's Theatre, Ballarat, Web site: *http://www.hermaj.com/history/index.htm* (Accessed, March 2006)
- Heritage Victoria, Files as follows: early newspaper articles and drawings, information on the architects and information on the musicians, correspondence file, permit file history and Heritage Listing information (see Appendix 3).
- Jacobs Lewis Vines Architects, *Ballarat Conservation Study*, commissioned by the City of Ballarat, the Historic Buildings Preservation Council and the Australian Heritage Commission, September 1978
- *Martin, Robert,* Ballarat History Central, *http://www.ballarathistory.org/artshmaj.html* (Accessed March 2006)
- RTMI Theatre Design &Technology, *Automated Power Flying,* April 2006
- RTMI Theatre Design &Technology, *Her Majesty's Theatre – Redevelopment Theatre Consultants Report,* April 2006
- SKM (Sinclair Knight Menz), *Performing Arts Precinct Feasibility Study, Feasibility Outcomes*, Melbourne, November 2003
- *The Courier*: p.3, 24/5/1875; 27/3/1899; 29/3/1899; 17/6/1966; 1/6/1967; 21/12/1989
- *The Leader*, 12 August 1899 (supplement p. 3)
- *The Australasian,* 15/10/1904.

- Thomas Gibeus McGrath Pty Ltd Engineers in association with Wendy Jacobs Architect, *Building Condition Report, Her Majesty's Theatre, Lydiard Street South, Ballarat for Her Majesty's Theatre,* Melbourne, June 1997
- Thorne, Ross, *Theatre Buildings in Australia until 1905*, University of Sydney, 1971
- Trevor Huggard and Associates, *Structural Report – Her Majesty's Theatre Lydiard Street South, Ballarat*, Melbourne, 2006

Records held at Her Majesty's Theatre

- General correspondence folders relating to 1988 building conservation project and the re-opening in 1990.
- Heritage Victoria Permit Exemption Declaration - this declaration allows for works to be carried out without the need to obtain a permit from the Executive Director of Heritage Victoria. This Permit Exemption was granted on 26 March 2003 and provides exemptions for:
- Memorial Theatre Restoration Project - Claims (provides information on costings for project).
- Specification for Ballarat Memorial Theatre at Lydiard Street, Ballarat for the City of Ballarat, Architects: Clive Lucas & Partners, Project Managers: Civil & Civic Pty Ltd, Melbourne, dated 8 August 1988
- Specification of Electrical Services at Ballarat Memorial Theatre, W L Meinehardt & Partners, Melbourne, dated 8 August 1988
- Specification for Mechanical Services, W L Meinhardt & Partners, Civil & Civic Pty Ltd, Melbourne, dated 8 August 1985
- Schedule of works on materials and workmanship for Stage One of the Conservation and Restoration of the Memorial Theatre, Clive Lucas & Partners Architects, Civil & Civic Pty Ltd, Melbourne, 8 August 1988

APPENDIX TWO: CAPITAL WORKS SINCE 1999

HER MAJESTY'S THEATRE, Ballarat

Capital Works project lists 1999 - 2006

1999 – 2000 Capital Works & Infrastructure Sustainability

Project	Cost
Heating system Boiler	$24,283
Lighting Desk	$42,963
Renovations to Piano Store	$5,766
Snorkel	$12,726
Box Office, Candy Bar & Front Windows	$6,228
Emergency Paging System	$1,913
Emergency Lighting	$2,240
Uninterrupted Power supply	$3,003
New Hot Water Services	$6,550
Lightning Rod	$5,500
Stage Access Mechanism Repairs	$7,580
Total	**$118,752**

2000 – 2001 Capital Works & Infrastructure Sustainability

Project	Cost
Colour Printer	$6,077
Computer Equipment	$6,627
Twin Multi Disk Player	$2,520
Twin Cassette Deck	$1,170
Twin CD Player	$2,520
Closed Circuit TV Monitors	$6,949
Pit Cover	$5,892
Box Office blinds, counters & air-conditioner	$5,265
Major building upgrade project (BMI)	$2,720
Civic Hall Computer	$3,323
Radio Microphones & Speakers	$30,727
Pass Box Office ticketing system	$15,724
Repairs to Glass skylights	$27,202
Monitor Colour Camera	$2,998
Stage Trap	$13,248
Admin Server NT	$3,136
Box Office Server	$2,045
TV Monitor system cable	$7,870
Cyclorama	$2,018
Chandeliers rewiring	$5,421
Flying system repairs	$3,614
Box Office report printer	$773
Fax machine	$325
Total	**$154,841**

2001-2002 Capital Works

Project	Cost
Painting exterior of HMT	$31,017
Administration computers	$2,907
Fire Door	$1,450
Web site design	$6,280
Tag & Test equipment	$1,630
Sound Desk	$29,012
Monitor Wedge	$15,104
Construct new store room	$4,512
Lighting equipment	$44,883
Talkback headsets	$7,417
Flylines x 5	$15,577
Usher livery	$6,906
Office carpet	$3,182
Usher seats Auditorium	$2,582
Total	**$172,459**

2002 – 2003 Capital Works

Project	Cost
Administration Server	$1,817
Construct Mezzanine Storage Room	$11,492
Fire Panel replacement	$7,840
Building Alarm system	$26,494
Chandelier winches	$7,511
Stalls Aisle Lights	$2,029
Roof insulation batts	$3,074
New carpet Foyer / Stairs	$15,300
Air-conditioning design – part payment	$10,677
Box Office flat screens	$1,895
Funktion One Sound System	$153,211
300 series lighting console	$62,488
5 x Dimmer racks	$15,852
25 x SL Profile Lights	$21,610
Replace Pit Net	$1,010
Piano Mover ½ share	$1,085
Safety point hook Dress Circle	$650
Dome Walkway	$13,842
Backup Power supply for Lighting Desk	$8,633
Total	**$366,510**

2003- 2004 Capital Works

Project	Cost
Air-conditioning design	$35,297
Air-conditioning installation	$375,675
Total	**$410,972**

2004- 2005 Capital Works

Project	Cost
Stage Access Mechanism – skirt repair	$9,822
90 degree Lens barrels x 2	$ 897
Microphones - Radio x 8/ Floor x 4/ Choir x 2	$22,308
Bar stock storage Fridges x 2	$6,481
Front of House Lift components	$6,695
Box Office hardware & software	$14,240
Total	**$60,443**

2005- 2006 Capital Works - Projected cost

Project	Cost
Conservation Feasibility Study	$95,000
Unicorn Lane Lighting – 2 x floodlights	$ 415
Motorise Central Auditorium Chandelier	$3,600
Dress Circle Lighting Bar Reinforcement	$2,000
Internal Signage	$2,500
Stair Carpet replacement – FOH & Backstage	$8,000
Total	**$111,515**

Year	Income	Expenditure	Net
1999-2000		$118,752	$118,752
2000-2001		$154,841	$154,841
2001-2002	-$80,000	$172,459	$92,459
2002-2003	-$423,900	$366,510	$-57,390
2003-2004		$410,972	$410,972
2004-2005		$60,443	$60,443
2005-2006 Projected		$111,515	$111,515
Average Net per year			**$127,370**

2001 - 2002
Capital Works projects at Her Majesty's Theatre upgraded the Auditorium mixing desk and Sound system, and included the installation of 5 additional fly lines on stage and the purchase of additional stage lights.

2002 - 2003
Capital Works projects completed at Her Majesty's Theatre in 2002-2003 include the replacement of the Fire Panel ($7,840) and installation of a Security system ($26,494), the replacement of carpet in the foyer and stairs ($15,300), the purchase of a Funktion One Sound system for the Auditorium ($153,211) and a Strand 530 Lighting Console and backup power supply ($71,121). 5 Additional Bytecraft dimmer racks were purchased (15,852) along with 25 Strand SL Profile lights ($21,610). A mezzanine storage area was built backstage ($11,492) and a walkway was built in the Dome ($13,842). Electric winches were installed on the Auditorium Chandeliers ($7,511). Flat computer screens were installed in the Box office and the design work for the Air-conditioning system was commenced.

APPENDIX THREE: HERITAGE LISTING INFORMATION

VICTORIAN HERITAGE REGISTER INFORMATION

HER MAJESTY'S THEATRE

17 LYDIARD STREET SOUTH BALLARAT

VHR Number	H0648
File Number	604232
Other Names	ACADEMY OF MUSIC|ROYAL SOUTH STREET MEMORIAL THEATRE
Year Construction Started	1874
Municipality	Ballarat City
Extent of Registration	To the extent of the whole of the theatre building; and the land as defined by the Heritage Council.
Other Listings 1	Ballarat City Planning Scheme
Architect/Designer	Browne, George L
Architectural Style	Victorian Period (1851-1901) Free Classical
Heritage Act Categories	Heritage place

Item Categories

Item Group	Item Category
Recreation and Entertainment	Theatre

Statement of Significance

This building, which was known in 1874 as the Academy of Music, in 1898 as Her Majesty's Theatre, and, from 1966 to 1988 as the South Street Memorial Theatre, has both historical and architectural significance. It is a rare survivor of a number of Ballarat and Bendigo theatres which, in the 19th century, rivalled those in Australia's capital cities. The Ballarat theatre is arguably the oldest operating theatre in Australia. According to Ross Thorne, a major exponent of our theatrical history, the memorial theatre is 'probably the most significant theatre in Australia today'. Thorne claims that it is the most substantially intact of our remaining 19th century theatres, which include the theatre Royal in Hobart, the Princess in Melbourne and Her Majesty's in Brisbane.

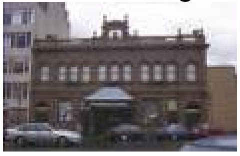
On a Victoria-wide basis, the Ballarat theatre has special importance for its unique interior. Its double horse-shoe shaped balconies supported on columns, added from the designs of the notable architect William Pitt in 1898, are the last example of this type of theatre design in the State. The theatre has significance because of its associations with two distinguished 19th century architects, George Browne and William Pitt, both of whom specialised in the design of theatres. Browne, who was responsible for the original 1874 design of the Academy of Music, also designed Melbourne's rebuilt Theatre Royal in 1872. He was the designing architect in 1874 of Rupertswood, the Sunbury mansion of Sir William J Clarke, Patron of the Academy of Music. Pitt, who designed the 1898 alterations and additions, included among his theatrical works the new Princess Theatre in 1886, the Bijou (rebuilt after the fire of 1889), the 1891 design of the Melbourne Opera House and its rebuilding in 1901 (later known as the Tivoli), alterations to the interior of the Theatre Royal in Bourke Street in 1904 and alterations to the interior of the Hobart Theatre Royal in 1911. Also, at the turn of the century, Pitt was responsible for extensive alterations to Her Majesty's Theatre in Melbourne. Other major buildings designed by Pitt include the Rialto and the Olderfleet in Collins Street and the St Kilda Town Hall.

The Theatre is a building which illustrates important aspects of the social and cultural life of Ballarat over a period of more than 100 years. It has importance for its links with Sir William J. Clarke (1831-1897), the landowner, stud breeder and philanthropist for whom it was built in 1874, and with a number of Ballarat's leading citizens, most notably William Collard Smith (1830-1894), agent, investor and politician. It is important for its associations from 1896 with the prestigious Royal South Street Society, a Ballarat organisation dedicated to the promotion of excellence in the performing arts. This society owned the building from 1965. The theatre is associated also with the Sun Aria competitions, which resulted in the discovery of many important Australian singers. Notable theatrical figures who performed at the theatre included the company of William Cyster, who is remembered for his part in establishing opera as a permanent institution in Victoria; Any Castles, dramatic soprano; Dame Nellie Melba and Gladys Moncrieff.

The building has landmark value. The original 1874 Lydiard Street facade, which survives partially intact, provides a contributory element to the Lydiard Street precinct. The rear three-storey brick section has a strong visual element and closes the vista along Lewis Street.

Click on the arrow below to view the Images. Note: Some records may not yet have images.

Images



Click to view image at full-size.

AUSTRALIAN REGISTER OF THE NATIONAL ESTATE DATA SHEET

Royal South Street Memorial Theatre, 17 Lydiard St South, Ballarat, VIC

Photographs: 

List: Register of the National Estate
Class: Historic
Legal Status: Registered (21/10/1980)
Place ID: 15722
Place File No: 2/03/122/0051

Statement of Significance:
The Royal South Street Memorial Theatre, built in 1874-75 to a design by George Browne, is significant as one of the most intact, commercial nineteenth century theatres in Australia (criteria A.4 and B.2). It is also the oldest operating theatre having been in use from 1875 up until the present and provides a record of theatrical development and technology throughout this period (criterion D.2). Included in this record is a rare, possibly unique in Australia, manually operated fly tower (criterion B.2). The theatre interior is of major interest with its decorative motifs , such as the ornate wall pilasters, panelled ceiling and stage which date from 1875, the uncommon double balcony and art nouveau motifs in the lounge (criterion F.1). The Theatre is also significant as an example of the work of both George Browne, theatre architect and William Pitt, who made a number of alterations to the theatre in 1898 and was a very influential figure in the design of public buildings in Victoria, Tasmania and New Zealand (H.1). The Theatre has considerable social significance, this dates from its very early days when it provided entertainment for the miners working on the central gold fields, through its continuous use for local community debating and social/recreational activities and is reflected in the public support for the restoration of the building to enable its ongoing use as a theatre (criterion G.1). The restoration of the theatre to its c 1912 configuration places extra emphasis on the Theatre's earlier phase of use without compromising the remaining original fabric or integrity of the building.

Official Values: Not Available

Description:
The Memorial Theatre was originally completed in 1875 to a design by architect George Browne. It initially comprised a theatre with rectangular auditorium, a steep lyre-shaped gallery, three entries leading to separate parts of the auditorium and two shops facing Lydiard Street. The theatre is constructed in brick with timber roof construction sheeted with iron. The main body is brick with piers both inside and out. The hipped trussed roof covers both the three-level auditorium and the stage with dressing rooms below. The ground floor and entrance/foyer have been considerably altered at various times but the auditorium and stage structure are original as is much of the auditorium ceiling and pilastered walls. The roof over the stage also dates from 1875 and the later inclusion of a fly tower stage in 1898 is fitted around the original trusses. The flying system is the only manual (non counterweight) system in existence in Australia. In the auditorium roof there appears to have been two domes, a small one dating from before 1898 for which the horizontal shutters and tube structure to a former sliding ventilated roof are still in existence. In 1898 the dome was enlarged and then eventually removed and a false octagonal ceiling fitted. Internally the circle and gallery levels are horseshoe shaped in plan and are carried on cast iron columns. The balcony balustrading is swag bellied and decorated. It is believed that the wall pilasters, panelled ceilings and proscenium are original decorations and some traces of art nouveau decorative motifs are to be seen where later alterations have been made. The two balconies were constructed in 1898, but one balcony front is the reused 1874 front while the second was made to match. The balconies and cast-iron supporting posts are typical for auditoria design in the late nineteenth/early twentieth century. The double balcony, supported on columns, is now the last of this form of theatre in Victoria. The facade of this building is two storeyed in height with stucco ornamentation in a somewhat florid Classical style. The upper storey windows are round headed with archivolts supported by slender columns as are the two ground floor subsidiary entrances. The highly decorated curved entrance has now been lost. The ground floor facade has been much altered and a street awning has been added. The first floor facade is intact but the parapet balustrading and ornamentation has been destroyed.

History: Not Available

Condition and Integrity:

The theatre is being restored to its c 1912 configuration. This will include the reinstatement of the ceiling dome and parts of the coffered ceiling. The existing proscenium (1904-09) will be retained and the stage will retain its original equipment and fly galleries. Basement and sub-basement levels will be conserved and modernised and a stage level timber and iron sheeted annexe at the rear of the building will be reinstated. (April 1995)

Location:

17 Lydiard Street South, Ballarat.

Bibliography:

THORNE,R (1976) THEATRES IN AUSTRALIA: AN HISTORICAL PERSPECTIVE OF SIGNIFICANT BUILDINGS. UNIVERSITY OF SYDNEY.

Report Produced: Wed Jan 25 10:25:26 2006

APPENDIX FOUR: PERMIT EXEMPTIONS DECLARATION

1.APR.2003 14:44 HERITAGE VICTORIA 613 96559720 NO.010 P.2/6

Heritage
VICTORIA

Nauru House
Level 22
80 Collins Street
Melbourne 3000

Telephone (03) 9655 6519
Facsimile (03) 9655 9720

www.heritage.vic.gov.au
www.doi.vic.gov.au/heritage/

File No. 604232

26 March 2003

Ms J Haynes
Director
Her Majesty's Theatre
PO Box 249
Ballarat VIC 3353

Dear Ms Haynes,

HER MAJESTY'S THEATRE VICTORIAN HERITAGE REGISTER NO. H 648

Attached is a Permit Exemption Declaration which allows you to carry out certain works without the need to obtain a permit from the Executive Director.

Note that some conditions do apply.

If, prior to undertaking out any works, you are unsure as to whether or not the exemptions apply, please contact Heritage Victoria to ensure that your works are will not be carried out illegally.

If you have any queries please contact Janet Sullivan, Permits Coordinator, on (03) 9655 9753.

Yours sincerely

RAY TONKIN
EXECUTIVE DIRECTOR

C.C. Statutory Planner, City of Ballarat.

1.APR.2003 14:44 HERITAGE VICTORIA 613 96559720 NO.010 P.3/5

PERMIT EXEMPTIONS

DECLARATION

HERITAGE ACT 1995

Heritage VICTORIA

DECLARATION NO: X 312

OWNER/S: City of Ballarat
ADDRESS: c/- Ms J Haynes
Director,
Her Majesty's Theatre 17 Lydiard Street South

HERITAGE REGISTER NO: H 648 FILE NO: 604232
REGISTRATION CATEGORY: Historic Place
NAME OF PLACE /OBJECT (IF ANY): Her Majesty's Theatre
LOCATION: 17 Lydiard Street South
Ballarat

Pursuant to Section 66(1) of the Heritage Act (1995) and in respect to the above-registered place / object, the Executive Director hereby DECLARES EXEMPT THE OWNERS NEED TO OBTAIN A PERMIT TO CARRY OUT ANY OF THE FOLLOWING CLASSES OF WORKS OR ACTIVITIES, SUBJECT TO ANY CONDITIONS PRESCRIBED HEREUNDER:

- Internal minor works to the back stage, side stage and sub-basement rooms on Level 1, Level 2 and Level 3 in the areas as shown on the attached plans numbered Drawing 03/01, 03/02 and 03/03 which are endorsed by the Executive Director and form part of this permit exemption

- The internal minor works include but are not limited to the installation of lighting, screens, storage systems, mezzanine structures and fittings and fixtures provided the work has been agreed with by appropriately qualified heritage consultant.

CONDITIONS:

1. Exempt classes of works or activities are to be planned and carried out in a manner which prevents damage to the registered place / object. However, if other previously hidden original or inaccessible details of the object or place are uncovered, any works that may affect such items shall immediately cease. The Executive Director shall be notified of the details immediately to enable Heritage Victoria representatives to inspect and record the items, and for discussion to take place on the possible retention of the items, or the issue of a modified approval.

2. If there is a Conservation Policy and Plan approved by the Heritage Council or Executive Director, all works and activities shall be carried out in accordance with that Policy and Plan.

3. Nothing in this Declaration prevents the Executive Director from amending or rescinding all or any of the permit exempt alterations provided work has not commenced on the alteration.

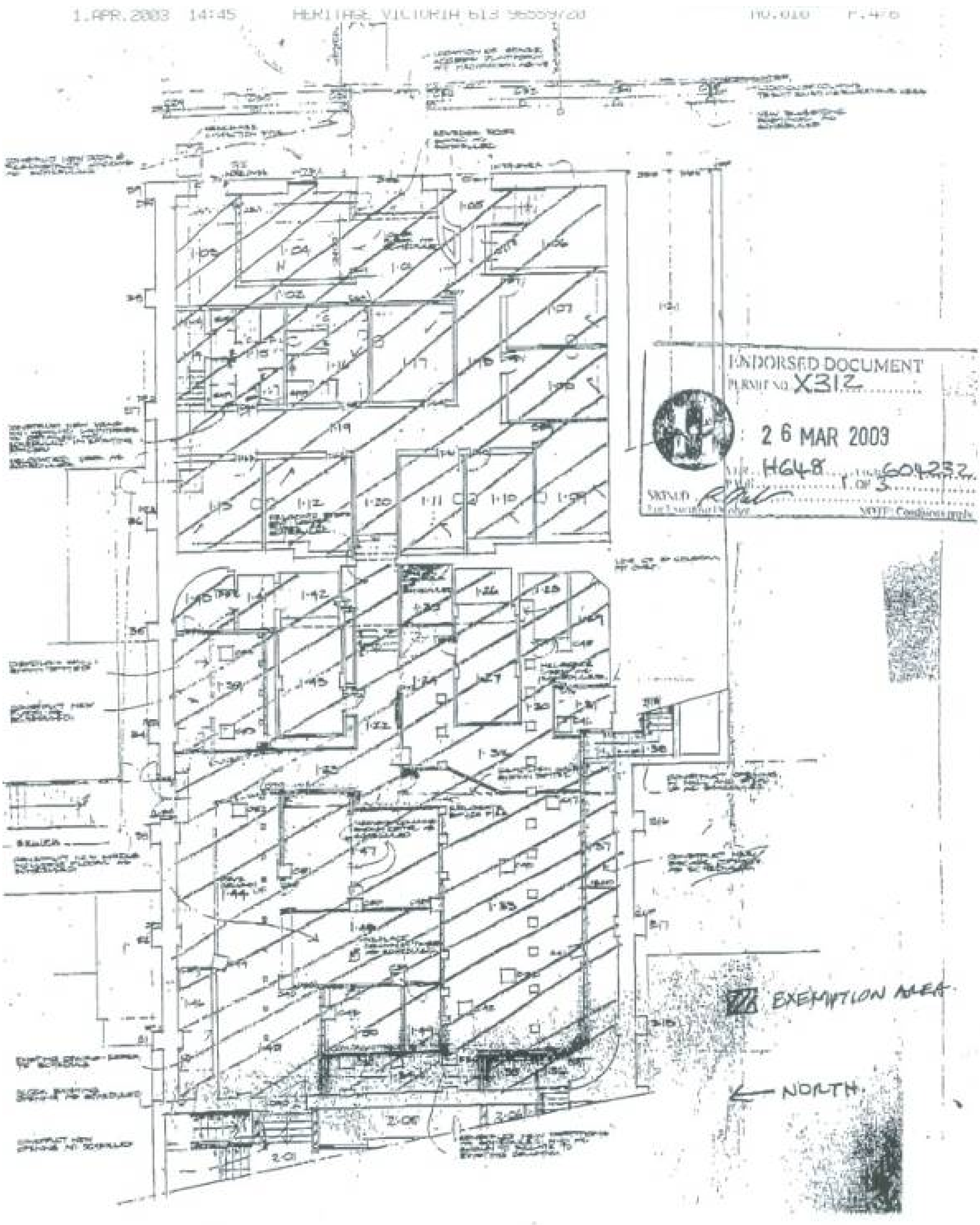
THE ATTENTION OF THE OWNER AND/OR APPLICANT IS DRAWN TO THE NEED TO OBTAIN ALL OTHER RELEVANT PERMITS PRIOR TO THE COMMENCEMENT OF WORKS.

Copies to:
- *Statutory Planner, City of Ballarat*

HERITAGE COUNCIL OF VICTORIA
GPO BOX 2240T MELBOURNE 3001

Signed .... for Executive Director
Date 28. 2. 2003
(as delegate of the Heritage Council)

Page 1 of 1



LEVEL 1
HER MAJESTY'S THEATRE

DRAWING 03/01
7-2-03

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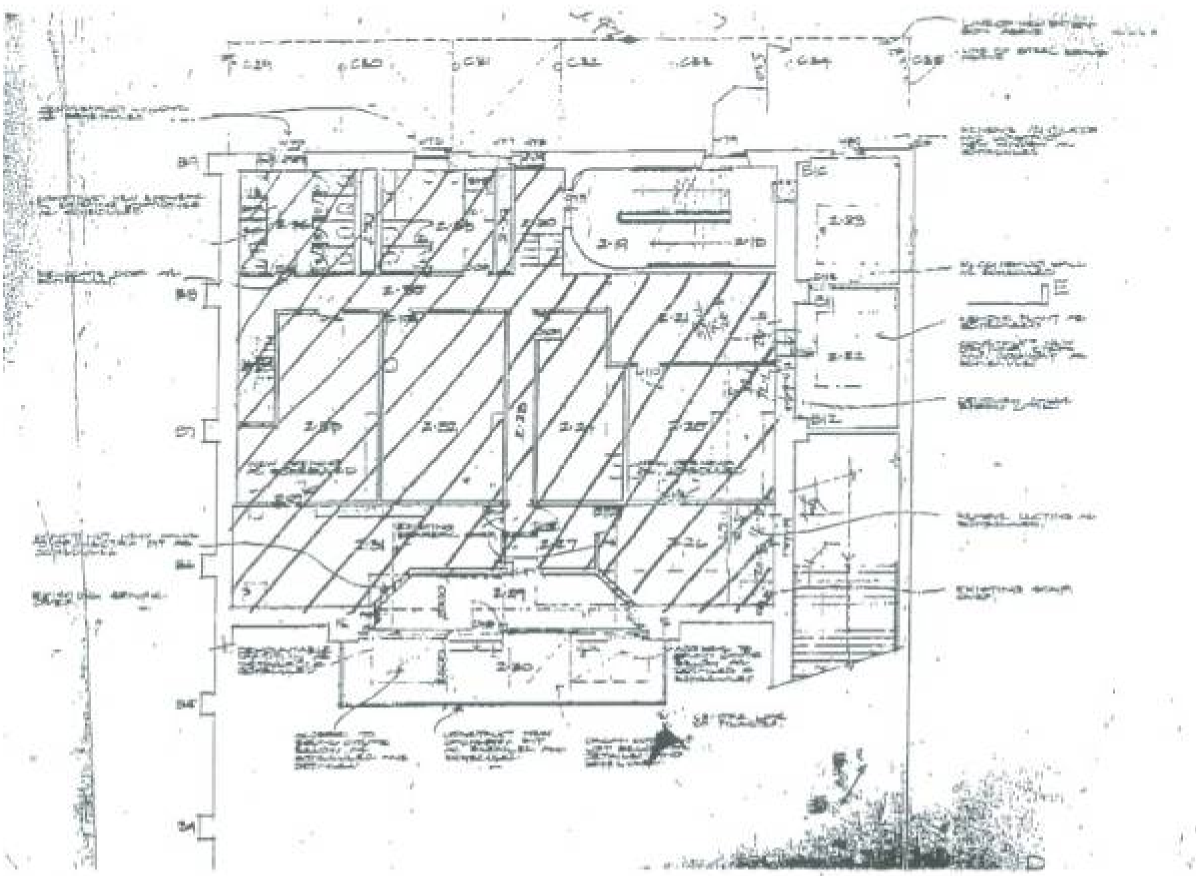
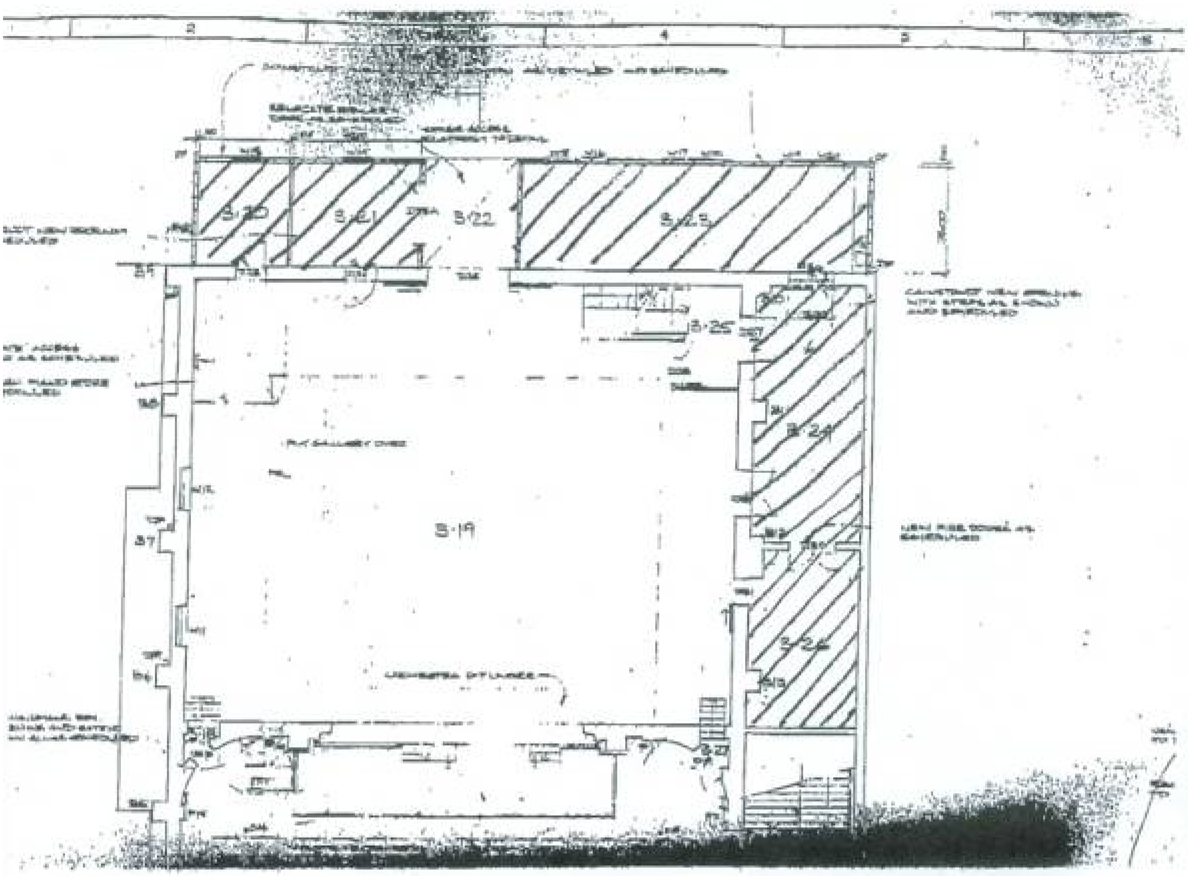


ENDORSED DOCUMENT
PERMIT NO. X312
26 MAR 2003
H648 FILE 604232
PAGE 2 of 3
SIGNED
NOTE: Conditions apply

← NORTH.

LEVEL 2
HER MAJESTY'S THEATRE

DRAWING 03/02
7-2-03.



ENDORSED DOCUMENT
PERMIT NO. X312
26 MAR 2003
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3 ... OF 3
SIGNED

← NORTH

LEVEL 3.
HER MAJESTY'S THEATRE

DRAWING 03/03
7-2-03.

APPENDIX FIVE: *THE BURRA CHARTER*

AUSTRALIA ICOMOS, THE ILLUSTRATED BURRA CHARTER
Good Practice for Heritage Places
by Meredith Walker and Peter Marquis-Kyle

This revised Charter was adopted on 26 November 1999

Preamble

Considering the International Charter for the Conservation and Restoration of Monuments and Sites (Venice 1964), and the Resolutions of 5th General Assembly of ICOMOS (Moscow 1978), the Burra Charter was adopted by Australia ICOMOS (the Australian National Committee of ICOMOS) on 19 August 1979 at Burra, South Australia. Revisions were adopted on 23 February 1981, 23 April 1988 and 26 November 1999.

The Burra Charter provides guidance for the conservation and management of places of cultural significance (cultural heritage places), and is based on the knowledge and experience of Australia ICOMOS members.

Conservation is an integral part of the management of places of cultural significance and is an ongoing responsibility.

Articles

Article 1. Definitions

For the purpose of this Charter:

1.1 *Place* means site, area, land, landscape, building or other work, group of buildings or other works, and may include components, contents, spaces and views.

1.2 *Cultural significance* means aesthetic, historic, scientific, social or spiritual value for past, present or future generations.

Cultural significance is embodied in the *place* itself, its *setting*, *use*, *associations*, *meanings*, records, *related places* and *related objects*.

Places may have a range of values for individuals or groups.

1.3 *Fabric* means all the physical material of the *place* including components, fixtures, contents and objects.

1.4 *Conservation* means all the processes of looking after a *place* so as to retain its *cultural significance*.

1.5 *Maintenance* means the continuous protective care of the *fabric* and *setting* of a *place,* and is to be distinguished from repair. Repair involves *restoration* or *reconstruction.*

1.6 *Preservation* means maintaining the *fabric* of a *place* in its existing state and retarding deterioration.

1.7 *Restoration* means returning the existing *fabric* of a *place* to a known earlier state by removing accretions or by reassembling existing components without the introduction of new material.

1.8 *Reconstruction* means returning a *place* to a known early state and is distinguished from *restoration* by the introduction of new material into the *fabric.*

1.9 *Adaptation* means modifying a place to suit the existing *use* or a proposed use.

1.10 *Use* means the functions of a place, as well as the activities and practices that may occur at the place.

1.11 *Compatible use* means a *use* which respects the *cultural significance* of a *place*. Such a use involves no, or minimal, impact on cultural significance.

1.12 *Setting* means the area around a *place,* which may include the visual catchment.

1.13 *Related place* means a *place* that contributes to the *cultural significance* of another place*.*

1.14 *Related object* means an object that contributes to the *cultural significance* of a *place* but is not at the place.

1.15 *Associations* mean the special connections that exist between people and a *place.*

1.16 *Meanings* denote what a *place* signifies, indicates, evokes or expresses.

1.17 *Interpretation* means all the ways of presenting the *cultural significance* of a *place*

Conservation Principles

Article 2. Conservation and management

2.1 *Places* of *cultural significance* should be conserved.

2.2 The aim of *conservation* is to retain the *cultural significance* of a *place*.

2.3 *Conservation* is an integral part of good management of *places* of *cultural significance*.

2.4 *Places* of *cultural significance* should be safeguarded and not put at risk or left in a vulnerable state.

Article 3. Cautious approach

3.1 *Conservation* is based on a respect for the existing *fabric, use associations* and *meanings.* It requires a cautious approach of changing as much as necessary but as little as possible.

3.2 Changes to a *place* should not distort the physical or other evidence it provides, nor be based on conjecture.

Article 4. Knowledge, skills and techniques

4.1 *Conservation* should make use of all the knowledge, sills and disciplines which can contribute to the study and care of the *place*.

4.2 Traditional techniques and materials are preferred for the *conservation* of significant *fabric*. In some circumstances modern techniques and materials which offer substantial conservation benefits may be appropriate.

Article 5. Values

5.1 *Conservation* of a *place* should identify and take into consideration all aspects of cultural and natural significance without unwarranted emphasis on any one value at the expense of others.

5.2 Relative degrees of *cultural significance* may lead to different *conservation* actions at a place.

Article 6. Burra Charter Process

6.1 The *cultural significance* of a *place* and other issues affecting its future are best understood by a sequence of collecting and analysing information before making decisions. Understanding cultural significance comes first, then development of policy and finally management of the place in accordance with the policy.

6.2 The policy for managing a *place* must be based on an understanding of its *cultural significance*.

6.3 Policy development should also include consideration of other factors affecting the future of a *place* such as the owner's needs, resources, external constraints and its physical condition.

Article 7. Use

7.1 Where the *use* of a *place* is of *cultural significance* it should be retained

7.2 A *place* should have a *compatible use*.

Article 8. Setting

Conservation requires the appropriate visual *setting* and other relationships that contribute to the *cultural significance* of the *place*.

New construction, demolition, intrusions or other changes which would adversely affect the setting or relationships are not appropriate.

Article 9. Location

9.1 The physical location of a *place* is part of its *cultural significance*. A building, work or other component of a place should remain in its historical location. Relocation is generally unacceptable unless this is the sole practical means of ensuring its survival.

9.2 Some buildings, works or other components of *places* were designed to be readily removable or already have a history of relocation. Provided such buildings, works or other components do not have significant links with their present location, removal may be appropriate.

9.3 If any building, work or other component is moved, it should be moved to an appropriate location and given an appropriate use. Such action should not be to the detriment of any *place* of *cultural significance*.

Article 10. Contents

Contents, fixtures and objects which contribute to the *cultural significance* of a *place* should be retained at that place. Their removal is unacceptable unless it is: the sole means of ensuring their security and *preservation;* on a temporary basis for treatment or exhibition; for cultural reasons; for health and safety; or to protect the place. Such contents, fixtures and objects should be returned where circumstances permit and it is culturally appropriate.

Article 11. Related places and objects

The contribution which *related places* and *related objects* make to the *cultural significance* of the *place* should be retained.

Article 12. Participation

Conservation, interpretation and management of a *place* should provide for the participation of people for whom the place has special *associations* and *meanings*, or who have social, spiritual or other cultural responsibilities for the place.

Article 13. Co-existence of cultural values

Co-existence of cultural values should be recognised, respected and encouraged, especially in cases where they conflict.

Conservation Processes

Article 14. Conservation processes

Conservation may, according to circumstance, include the processes of: retention or reintroduction of a *use*; retention of *associations* and *meanings; maintenance, preservation, restoration, reconstruction, adaptation* and *interpretation*; and will commonly include a combination of more than one of these.

Article 15. Change

15.1 Change may be necessary to retain *cultural significance*, but is undesirable where it reduces cultural significance. The amount of change to a *place* should be guided by the cultural significance of the place and its appropriate *interpretation*.

15.2 Changes which reduce *cultural significance* should be reversible, and be reversed when circumstances permit.

15.3 Demolition of significant *fabric* of a *place* is generally not acceptable. However, in some cases minor demolition may be appropriate as part of *conservation*. Removed significant fabric should be reinstated when circumstances permit.

15.4 The contributions of all aspects of *cultural significance* of a *place* should be respected. If a place includes *fabric*, *uses*, *associations* or *meanings* of different periods, or different aspects of cultural significance, emphasising or interpreting one period or aspect at the expense of another can only be justified when what is left out, removed or diminished is of slight cultural significance and that which is emphasised or interpreted is of much greater cultural significance.

Article 16. Maintenance

Maintenance is fundamental to *conservation* and should be undertaken where *fabric* is of *cultural significance* and its maintenance is necessary to retain that *cultural significance*.

Article 17. Preservation

Preservation is appropriate where the existing *fabric* or its condition constitutes evidence of *cultural significance*, or where insufficient evidence is available to allow other *conservation* processes to be carried out.

Article 18. Restoration and reconstruction

Restoration and *reconstruction* should reveal culturally significant aspects of the *place*.

Article 19. Restoration

Restoration is appropriate only if there is sufficient evidence of an earlier state of the *fabric*.

Article 20. Reconstruction

20.1 *Reconstruction* is appropriate only where a *place* is incomplete through damage or alteration, and only where there is sufficient evidence to reproduce an earlier state of the *fabric*. In rare cases, reconstruction may also be appropriate as part of a *use* or practice that retains the *cultural significance* of the place.

20.2 *Reconstruction* should be identifiable on close inspection or through additional interpretation.

Article 21. Adaptation

21.1 *Adaptation* is acceptable only where the adaptation has minimal impact on the *cultural significance* of the place.

21.2 *Adaptation* should involve minimal change to significant fabric, achieved only after considering alternatives.

Article 22. New work

22.1 New work such as additions to the *place* may be acceptable where it does not distort or obscure the *cultural significance* of the place, or detract from its *interpretation* and appreciation.

22.2 New work should be readily identifiable as such.

Article 23. Conserving use

Continuing, modifying or reinstating a significant *use* may be appropriate and preferred forms of *conservation*.

Article 24. Retaining associations and meanings

24.1 Significant *associations* between people and a *place* should be respected, retained and not obscured. Opportunities for the *interpretation*, commemoration and celebration of these associations should be investigated and implemented.

24.2 Significant *meanings*, including spiritual values, of a *place* to people should be respected. Opportunities for the continuation or revival of these meanings should be investigated and implemented.

Article 25. Interpretation

The *cultural significance* of many *places* is not readily apparent, and should be explained by *interpretation*. Interpretation should enhance understanding and enjoyment, and be culturally appropriate.

Conservation Practice

Article 26. Applying the Burra Charter process

26.1 Work on a *place* should be preceded by studies to understand the place which should include analysis of physical, documentary, oral and other evidence, drawing on appropriate knowledge, skills and disciplines.

26.2 Written statements of *cultural significance* and policy for the *place* should be prepared, justified, and accompanied by supporting evidence. The statements of significance and policy should be incorporated into a management plan for the place.

26.3 Groups and individuals with *associations* with a *place* as well as those involved in its management should be provided with opportunities to contribute to and participate in understanding the *cultural significance* of the place. Where appropriate they should also have opportunities to participate in its *conservation* and management.

Article 27. Managing change

27.1 The impact of proposed changes on the *cultural significance* of the *place* should be analysed with reference to the policy for managing the place. It may be necessary to modify proposed changes following analysis to better retain cultural significance.

27.2 Existing *fabric* and *use* should be recorded before any changes are made to the *place*.

Article 28. Disturbance of fabric

28.1 Disturbance of significant *fabric* for study, or to obtain evidence, should be minimised. Study of a *place* by any disturbance of the fabric, including archaeological excavation, should be undertaken only to provide data essential for decisions on the *conservation* of the place; or to obtain important evidence about to be lost or made inaccessible.

28.2 Investigation of a *place* which requires disturbance of the *fabric*, apart from that necessary to make decisions, may be appropriate provided that it is consistent with the policy for the place. Such investigation should be based on important research questions which have potential to substantially add to knowledge, which cannot be answered in other ways and which minimises disturbance of significant fabric.

Article 29. Responsibility for decisions

The organisations and individuals responsible for management decisions should be named and specific responsibility taken for each decision.

Article 30. Direction, supervision & implementation

Competent direction and supervision should be maintained at all stages, and any changes should be implemented by people with appropriate knowledge and skills.

Article 31. Documenting evidence and decisions

A log of new evidence and additional decisions should be kept.

Article 32. Records

32.1 The records associated with the *conservation* of a *place* should be placed in a permanent archive and made publicly available, subject to requirements of security and privacy, and where this is culturally appropriate.

32.2 Records about the history of a *place* should be protected and made publicly available, subject to requirements of security and privacy, and where culturally appropriate.

Article 33. Removed fabric

Significant *fabric* which has been removed from a *place* including contents, fixtures and objects, should be catalogued, and protected in accordance with its *cultural significance*.

Where possible and culturally appropriate, removed significant fabric including contents, fixtures and objects, should be kept at the place.

Article 34. Resources

Adequate resources should be provided for *conservation*.

APPENDIX SIX: EXTERNAL MAINTENANCE SCHEDULE

Area of Building – house and stables	Recommended Assessment	Date of Works and Extent	Contractor for Works	Cost of Works	Source of Funding
Drainage Stormwater pipes Groundwater drainage sump	Every 6 months				
Roof Cladding (corrugated iron) Flashings Fixing and cappings Gutters and brackets Rainwater heads Downpipes Eaves Chimneys *Are stormwater pipes blocked?* *Do gutters need cleaning?*	Every 12 months - clean gutters				
External walls Brick walls Brick re-pointing Rendered elements Stone wall sections Slate verandah finishes Windows – check glazing Doors *Is there any dampness?*	Check every 5 years				

APPENDIX SEVEN: HERITAGE VICTORIA FILE INFORMATION

Permit Number	Date of Permit	Description of Works/Architect
666	18 May 1988	Changes to the proposed scope of works including relocation of plant room, brickwork extended to match existing with new skilion roof, reinstatement of skylight above art nouveau foyer, modifications to door openings, toilet cubicles, service arrangements. (Civil & Civic, and Clive Lucas & Partners Architects)
	2 May 1989	Stage Two conservation works - excluded canopy to Lydiard Street South. Condition required resolution of removal of basement column. (Civil & Civic, and Clive Lucas & Partners Architects)
	May 1992	Proposal for new entry under fire escape stairs and construction of entrance portico (to match Lydiard Street (similar to Lydiard Street portico). (Wendy Jacobs Architect)
3826	18 June 1998	Bio box window operation - rationalisation of openings. (Wendy Jacobs Architect) Cost of works $5,000
3969	16 October 1998	Replacement of Baltic pine flooring at the stalls level of the theatres auditorium with stained messmate timber (135 x 22) for the stabilization of seating. . (Wendy Jacobs Architect)
4124	31 December 1998	Replacement of intermediate sub-floor structure (floor structure between raked floor and flat floor) - when the works were undertaken this was found to be in poor condition once Baltic pine flooring was taken up. . (Wendy Jacobs Architect)
4172	5 February 1999	Attachment of Heritage Victoria plaque.
4233	23 March 1999	External illumination of the Lydiard Street façade. . (Wendy Jacobs Architect)
4361	June 1999	Air-conditioning of Long Room - installation of 3 plaster ceiling roses suspended 100 below the ceiling level. (Wendy Jacobs Architect)
4362	11 August 1999	New front of house signs - to establish consistent directional and other signage in the theatre. . (Wendy Jacobs Architect & Peter Lambert Graphic Designer)
	September 2001	External painting and new entrance canopy sign. (Wendy Jacobs Architect)
		Review of seating in the balcony - installation of 49 seats on tiered seating at the back of the balcony - uncertain if undertaken. . (Wendy Jacobs Architect)
Declaration X312	28 March 2003	A permit exemption for internal minor works to the back stage, side stage and sub-basement levels - include minor works include, but are not limited to the installation of lighting, screens, storage systems, mezzanine structures, and fittings and fixtures provided the work has been agreed with an appropriate qualified heritage consultant. (Allows theatre to carry out certain works without the need to obtain a permit from the Executive Director).

Permit Number	Date of Permit	Description of Works/Architect
7783	5 September 2003	Installation of air-conditioning and roof ventilation to back stage dressing rooms, office area and auditorium. At stalls level works included: • Introduction of fan coil units in the space between the original flat floor of the auditorium and the introduced raked floor for seating. Supply air provided via floor vents located along the side walls. • Introduction of fan coil unit into the existing Green room. At dress circle level works included: • Ducts introduced in the corner of the female and male toilets, and new air vents introduced into the ceiling above the rear walkway vent in the dress circle. At gallery level works included: • Extraction fan area into boxed areas (part of 1988 refurbishment). External works included: • Construction of chillers located directly west of existing plant room on the south side of the building with the introduction of a safety wall of louvred aluminium. • Introduction of 4 new exhaust vents to the western end of the main room in conical shape, constructed in galvanised steel and mesh. (Wendy Jacobs Architect and Invertech PL)

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