Royal Australian Historical Society

History House, 133 Macquarie Street

Fire Engineering upgrade concept for DA

Issue | 6 June 2016

Job number 247851

Arup
Arup Pty Ltd ABN 18 000 966 165

Arup
Level 10 201 Kent Street
PO Box 76 Millers Point
Sydney 2000
Australia
www.arup.com

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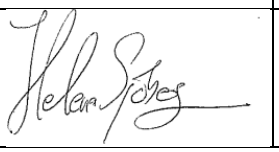
		Signature			
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Contents

1 Introduction

1.1 General

This report has been prepared for Royal Australian Historical Society care of Mr Robert Gasparini at Design 5, as part of the submission for a Development Application (DA) for an upgrade of and extension to the rear end of History House, 133 Macquarie Street, Sydney.

The purpose of this report is to describe the proposed fire safety strategy for the extension to History House and to seek Council conditions that only require the new works to comply with the Building Code of Australia. The report outlines the fire strategy for the existing parts, describing how they will meet an acceptable level of safety, and describes how the new works do not adversely impact the current level of safety.

History House is an existing building owed by the Royal Australia Historical Society (RAHS). The building currently consists of three above ground storeys and one underground basement and is used as an office building. The part of the building facing Macquarie Street is heritage listed whilst the rear of the building was built in the 1970's and does not form a part of the heritage listing.

The works are proposed to incorporate two additional levels. The intended use of the new parts is for office tenancies. The effective height of the building will not exceed 25 m.

The strategy is not to upgrade the entire building to full compliance with the current BCA (2015), rather this report describes an appropriate upgrade strategy for the existing areas, with the new works to achieve full compliance with the BCA Performance Requirements and not have an adverse effect on the existing parts.

The intention is that this fire safety strategy can be used by City of Sydney Council, in granting DA conditions to only require the new works to comply with the BCA, with the existing to adopt the fire upgrade approach described in this report.

1.2 Existing building

The new works are to have no adverse effect on the fire safety of the existing parts. The fire safety of the existing areas has been assessed and practical improvement measures developed that both increase the fire safety and do not adversely affect the heritage of the building.

The following table describes the existing conditions in the building:

Table 1: Existing fire safety measures

Fire Safety Measure	Description	Part of heritage listing	Arup recommendation
Separation			
Type of Construction	Building has a rise in storeys of 5. BCA would require type A construction with concrete floors. The floors in the original section of the building are timber, whilst the 1970s work has concrete floors. The new works are to be on the concrete section; compliance for fire ratings is assumed for the 1970s area.	Yes	The existing floors should be able to remain as is as the new works are to be fire separated from the existing, thereby not adversely affecting the existing compartmentation.
Internal open timber stair	Connects 4 floors where only 2 floors are permitted in an un-sprinklered building. The stair has non-compliant handrails and balustrades.	Yes	The new works proposed improve the egress provisions for all occupants with extension of the fire-isolated stair, see below. It is not feasible to enclose the existing heritage listed internal stair and this is to remain as is.

Fire-isolated stair	The fire-isolated stair does not currently serve the attic, leaving the attic only served by the open stair. The fire isolated stair has non-compliant handrails and balustrades.	No	With the additional floors being added, the fire-stair shall extend to these new floors, thereby serving all areas and improving the egress. Balustrades and handrails shall be upgraded to the fire isolated stair, as this is not heritage listed. The egress is to be designed such that all occupants can access the fire-isolated stair without passing through the open central stair. The egress provisions for all areas will therefore be improved by the proposed works in the building. The existing travel distance from the attic via the open stair to the fire stair is up to approximately 25 m. This will be improved with the new works since all levels will have access to the fire stair from that level.

Unprotected openings	Openings within 6 m of other buildings with no wall wetting sprinklers or other protection.	Openings facing Macquarie Street to remain unprotected Openings facing Philip Ln to be protected	Openings facing Macquarie Street will not need protection based on adjacent solid wall and heritage nature of the windows. Openings at the rear end of the building may need protection pending fire engineering analysis. The distance to the boundary and adjacent buildings needs to be confirmed. Pending confirmation, options for protection to be developed taking into account natural ventilation requirements.
Verandas	The verandas have 990 mm balustrades, but these are climbable.	Not a fire safety issue, and no upgrade proposed	The balustrades are existing and part of the heritage fabric. No works are proposed in these areas, but to minimise risk of falling, planter boxes or similar obstruction can be placed in front of the balustrades to hinder people from reaching and climb up on the balustrades.
Installations			
Smoke Detection	There is a smoke detection throughout, but not in every room, which does not match the Annual Fire Safety Statement that certifies compliance with AS 1670. The attic has detection but unclear if this is connected to the general building alarm.	Yes	As part of the new works, AS 1670 shall be provided throughout the building, both existing and new parts. Improved detection will improve the overall safety through early detection and evacuation from the building.

Building Occupant Warning System, BOWS	There is no Building Occupant Warning System, but there are bells throughout that the tenants say are loud	Yes	A sound pressure test is recommended and if adequate, this system could be retained. There is no capacity for an alert tone and a phased evacuation with this system, but as it is a timber building all floors should evacuate simultaneously. Considering the low expected population, a simultaneously evacuation will not lead to congestion in the evacuation routes. The warning system (bells) shall be included throughout the building, including the new parts and supplemented in existing parts if needed.
Fire hydrants	There are no fire hydrants in the building.	No	Fire hydrants shall be provided within the fire-isolated stair, thereby improving the fire safety of the whole building.
Fire hose reels	Fire hose reels are not provided in the building.	Yes	Fire hose reels can be replaced by portable extinguishers as part of a fire engineering alternative solution.

Portable fire extinguishers	Extinguishers are provided throughout the existing parts of the building.	Yes	Extinguishers shall be retained. All new parts shall be provided with extinguishers throughout.
Egress			
Travel distance	Travel distances from the level 2 mezzanine currently exceeds 20m dead end distance as the fire stair is accessed at the half landing below L2.	Yes	Landings are proposed to be altered such that all levels have access to the fire stair on that level, improving egress for all levels. Occupants will no longer have to pass through the open 4 storey stair to reach the fire stair, reducing potential exposure to smoke on their egress route.
Egress width in fire stair	The fire isolated stair reduces in width at points down to approximately 690 mm in lieu of 1000 mm. It also contains some services at the discharge level.	Yes/No	Services not related to fire safety will be removed. Any pinch-point reduction in widths in the existing parts can be justified via a Performance Based solution based on the low occupant numbers. New parts of the fire star shall have compliant width.

1.3 Documentation

This report is based on the documentation listed below:

- Architectural drawing set by Design 5. History House 133 Macquarie Street. 7 June 2016, DA Submission.
- Technical Note by Arup. History House: 133 Macquarie Street, Sydney. Job number 233976-00. Dated 21 January 2014.

Note that the figures and diagrams used within the report are indicative and serve the purpose of supporting the fire engineering strategy.

2 Project description

This section describes Arup's understanding of History House and its proposed extension, based on the drawings referenced in this report, and other information provided by the project team.

2.1 Building characterisation

History House on 133 Macquarie Street was built ca 1871, with further extensions at the rear in the 1970's. The building comprises a small car park facing Philip Ln on Level 1 (Basement) and office tenancies on the other floors.

The additional proposed levels increase the effective height of the building and rise in storeys to 5. The effective height will be remained under 25 m. The fire-isolated stair shall be extended to the new top-most floor as parts of the new works and also be modified to be accessed from each level as opposed to the mid-landings as in the existing layout. This avoids occupants having to travel via the open 4 storey stair to reach the fire stair.

133 Macquarie Street is located in Sydney and accessed by Macquarie Street in the east or Philip Lane in the west. Refer to Figure 1 below.

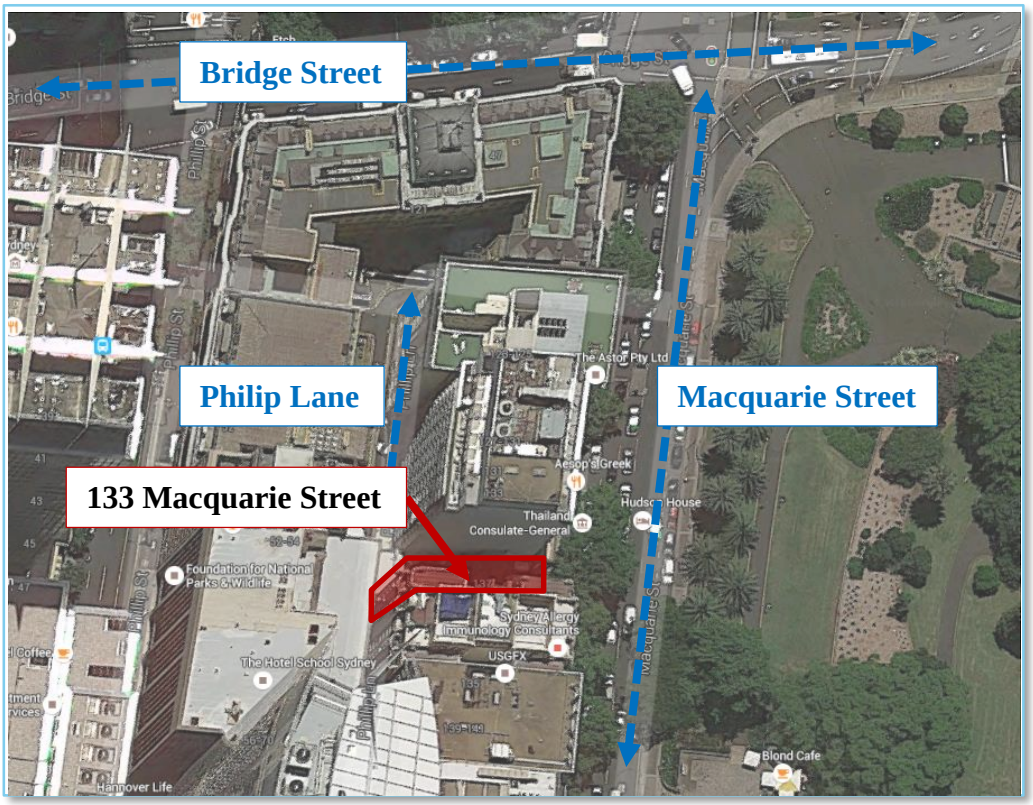

Figure 1: Proximity of p to road

The following figures indicate the existing building levels and the proposed extension and change.

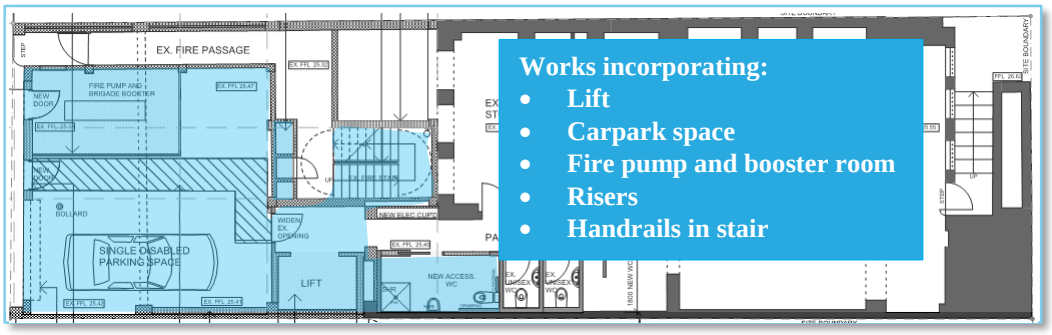

Figure 2: Level 1 (Basement)

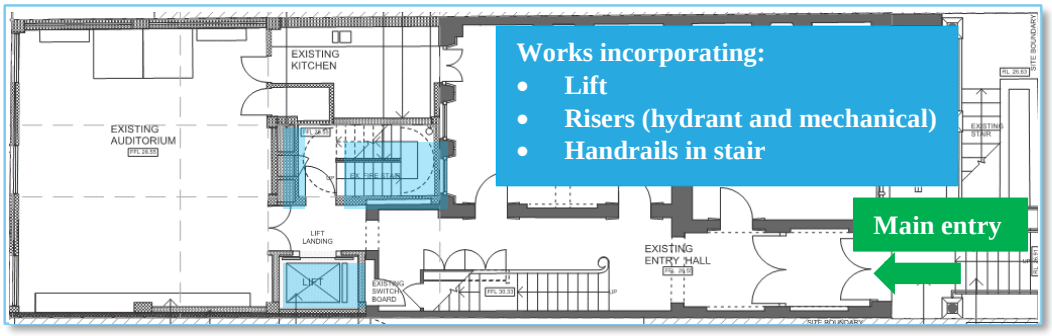

Figure 3: Level 2 (Ground)

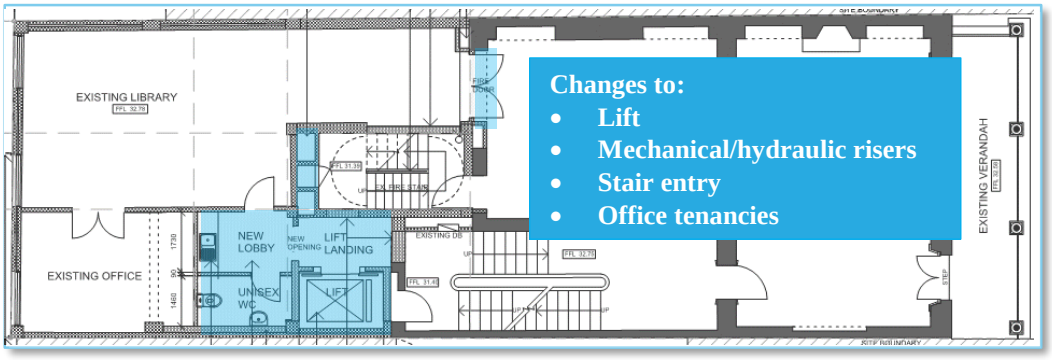

Figure 4: Level 3

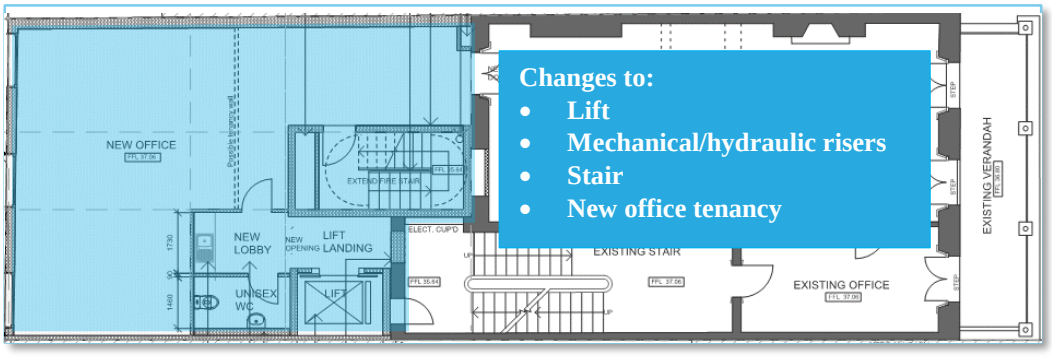

Figure 5: Level 4

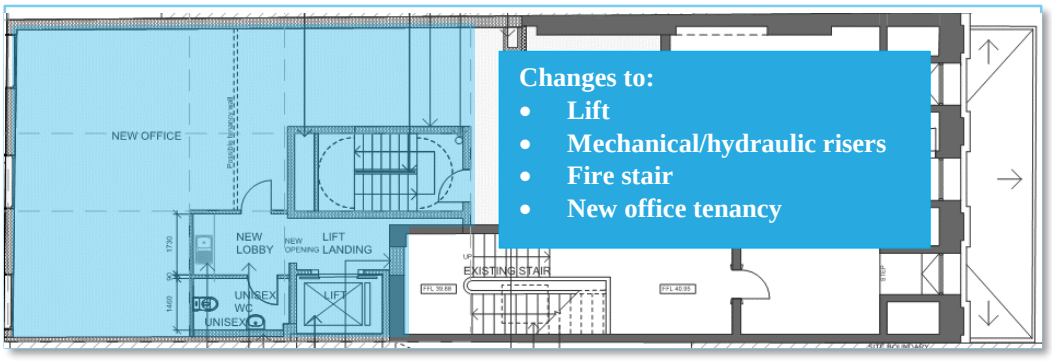

Figure 6: Level 5

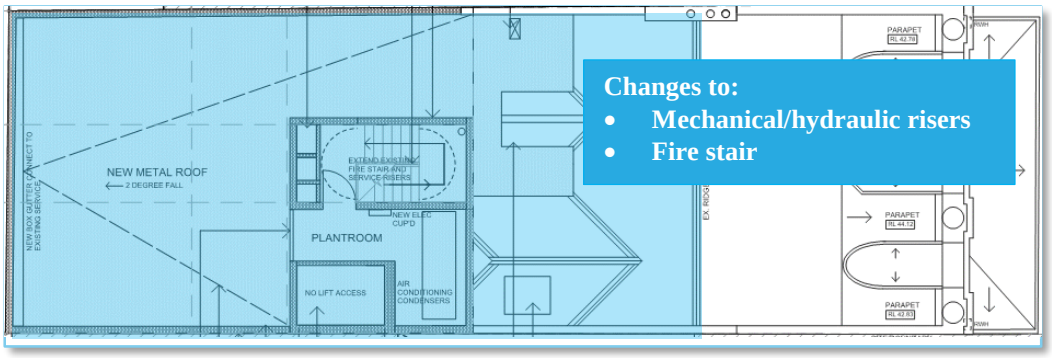

Figure 7: Level 6

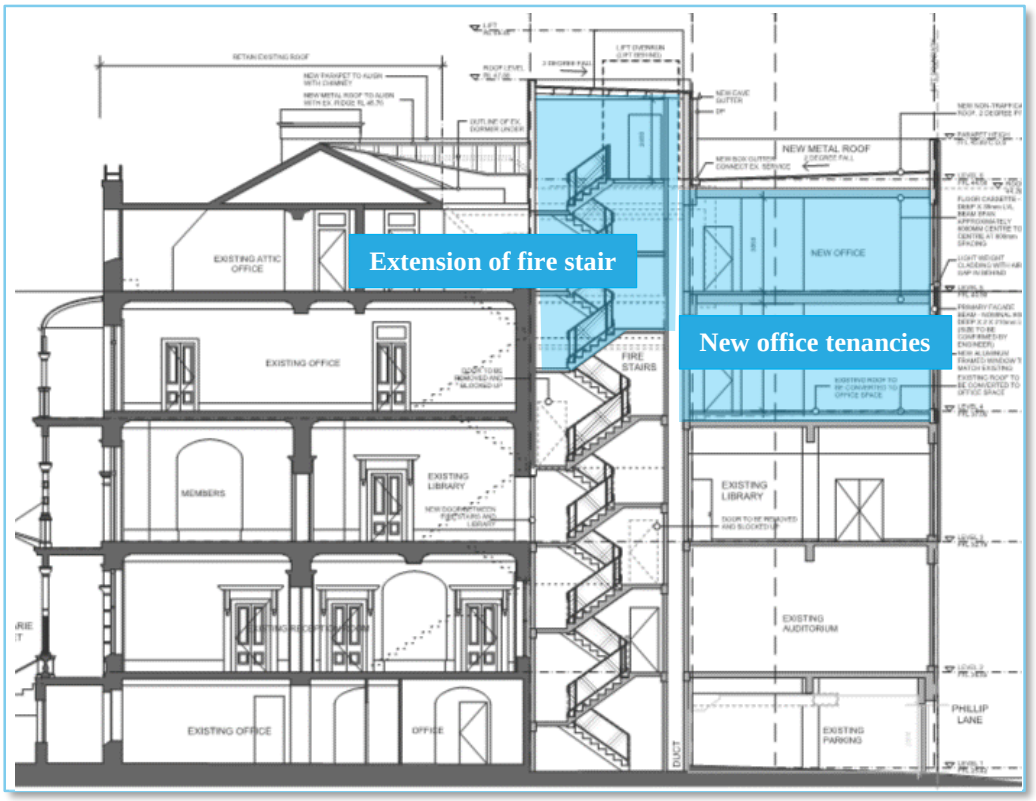

Figure 8: Section

2.2 BCA building characteristics

A summary of the key BCA building characteristics are provided in Table 2. The characteristics below should be confirmed by the BCA consultant.

Table 2: BCA building characteristics

Characteristics	Description	
	Existing	Proposed
Rise in storeys	4	5
Effective height	14.3 m	18.0 m
BCA classes of use	BCA Class 5 – Office	BCA Class 5 – Office
Type of construction (DtS)	Type A required. Existing heritage parts are timber.	Type A. New parts shall be fire rated as perType A.
Boundary distance	> 3 m TBC	> 3 m TBC
Number of stairs / exits	- Internal timber stair - Fire-isolated stair Level 1-4	- Internal timber stair - Fire-isolated stair Level 1-6
Fire brigade access and facilities	No fire hydrants	Fire hydrants shall be installed in the fire-isolated stair

2.3 Occupant characteristics

The occupants within the building will predominantly be office tenants and their visitors.

Based on 1 person per 10 m² floor space as set out as guideline in BCA Table D1.13 for office use, the indicative increase of occupants in the building is expected to be approximately 17 occupants. A typical office level (Level 4 and 5) is expected to have space for 16 – 17 occupants in total per floor.

The occupant load on Level 3 where both library and office is located, Level 2 with reception and auditorium and Level 1 with office and car park space will not change due to the proposed works.

Occupants within the building are generally expected to be alert, awake and familiar with the building layout and the locations of exits. Visitors may not be familiar with the building layout but are expected to be accompanied whilst visiting the building.

2.4 Heritage requirements

Within existing heritage areas of the building which are being retained, the objective of this concept fire strategy is to achieve an acceptable level of fire safety, as per the EP&A Regulations Clause 94. This requires consent authorities to consider whether or not the measures contained in the building:

Are inadequate –

(i) To protect persons using the building, and to facilitate their egress from the building, in the event of a fire, or

(ii) To restrict the spread of fire from the building to other buildings nearby.

(2) In determining a development application to which this clause applies, a consent authority is to take into consideration whether it would be appropriate to require the existing building to be brought into total or partial conformity with the Building Code of Australia.

It is not anticipated that the fire safety measures within the existing heritage parts of the building will achieve full compliance with the Performance Requirements of BCA. However, the upgrade measures shall provide a reasonable level of fire safety and the new works shall achieve the Performance Requirements of the BCA.

In addition, the level of fire safety in the building will not be decreased, but rather increased, allowing the certifying authority to issue a construction certificate at the appropriate time, as per Clause 143 (3) of the EP&A Regulations.

The proposed design will be supported by fire safety engineering analysis to demonstrate that the building provides an adequate level of fire safety in the event of credible fire scenarios. The in-depth details of this will be included in the report for construction certificate.

3 Fire Safety Strategy

3.1 General building philosophy

The History House on 133 Macquarie Street is an office building proposed to be extended with two additional office levels facing Philip Lane. As described in Section 1.2, the existing building does not fully achieve the DtS Performance Requirements. Considering the heritage nature of the building, it would be cost prohibitive and impracticable to bring all the existing heritage parts of the building up to full compliance with the current BCA (2016).

The new proposed works are not considered to adversely impact the fire life safety for the existing parts and the new works will satisfy the Performance Requirements of the BCA. The proposed works are also to improve the fire life safety of the existing parts by improving means of egress, detection, and fire fighting. This is further described in Section 3.4.

3.2 Fire resistance and compartmentation

The Fire Resistance Level (FRL) and fire compartmentation for the new works re anticipated to be in accordance with the DtS Provisions of the BCA (2015) for a building of Type A construction.

The existing heritage parts are constructed with timber floor and the parts from the 1970's have concrete floors; the 1970's parts are assumed to achieve the required FRLs. The new works will sit on top of the 1970's concrete floors and shall be fire separated off from the heritage parts of the building. The new works should therefore not adversely impact the fire resistance and compartmentation of the existing parts.

The existing open internal timber stair connects four floors. The building is not provided with sprinklers and would therefore only be permitted to have an open stair connecting two floors, if designed in accordance with the current deemed to satisfy provisions. The new works are to be fire separated from the heritage areas such that there is no adverse effect on fire spread in the existing building. The addition of improved detection, fire-fighting provisions and egress further reduces the overall fire spread risk in the existing areas, such that retention of the four storey connection is considered reasonable.

3.3 External openings

There are openings which are located within 6 m of buildings on the adjoining allotment both facing Macquarie Street and Philip Lane.

Openings facing Macquarie Street are part of the heritage listing and the existing building facades adjacent to the openings are solid walls. These openings should not need protection to prevent fire spread based on adjacent solid wall and heritage nature of the windows.

Openings in the new extension will be at the rear end of the building facing Philip Lane. These openings may require protection pending detailed fire engineering analysis. If protection is required, the protection would include existing openings in the 1970's parts of the building also facing Philip Lane.

Pending analysis, options for protection to be developed taken into account requirements for natural ventilation. Potential options include fixed or automated windows provided with external window wetting sprinklers.

3.4 Egress

The egress provisions from the new parts of the building are anticipated to be in accordance with the DtS Provisions of the BCA (2016). The new works are also to improve the egress provisions from the existing parts.

Currently, the fire-isolated stair (part of the 1970's era) connects from Level 1 (Basement) to Level 4 but does not extend all the way up to current top level, Level 5. The fire stair is currently accessed on the half landings such that occupants need to travel a half-landing in the internal open stair to access the tenancies. This currently exposes them to smoke from a fire on the lower levels as this smoke spreads up the void created by the open stair.

As part of the new works, the fire isolated stair shall be extended to the top most level of the building and the entry points shall be adjusted such that the stair is accessed from each level.. The new works shall be constructed such that all occupants, both in existing and new parts, can access the fire-isolated stair without passing through the internal open stair. This is illustrated in Figure 5 below. As such, the egress for all areas of the building is improved.

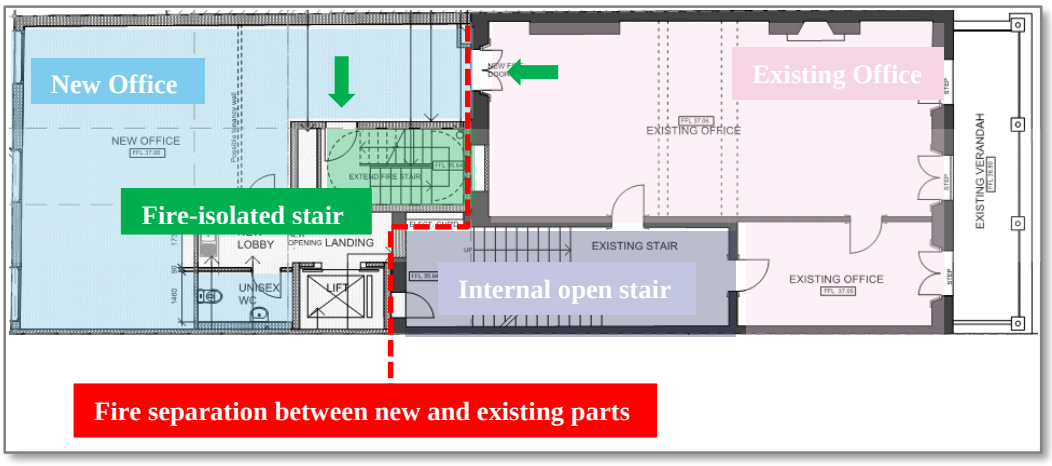

Figure 9: Evacuation strategy – Level 4 shown

A 2 storey building is permitted to be constructed in timber with an internal stair, accommodating more people than are present in this small building The time it takes for occupants to move to a safe place in the fire-isolated stair for History House is no longer than it would take for occupants to travel to outside (the safe place) in a 2 storey building with a single open stair.

In a DtS Compliant design, the travel distance from any point to a point of egress by way of a required non-fire isolated stairway can be up to 80 m.

In the proposed design, the travel distance to the fire-isolated stair is no more than 20 m from any of the office tenancies on the upper levels where additional works are proposed.

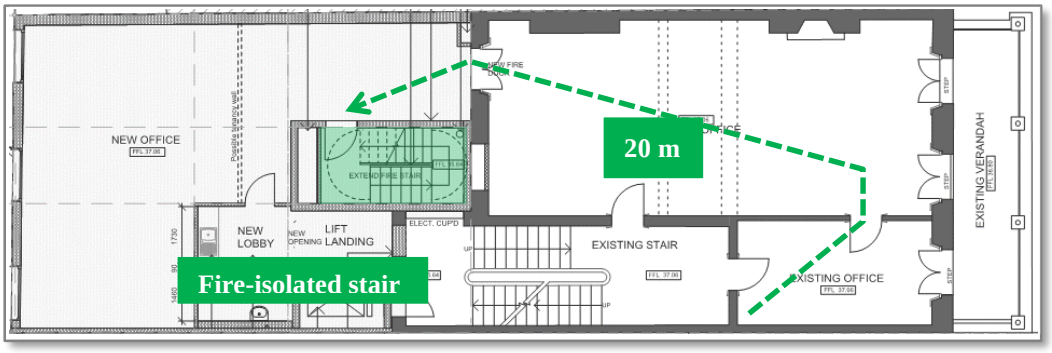

Figure 10: Travel distance to fire-isolated stair – Level 4 shown

By assuming a travel speed of 0.8 m/s to account for mobility impaired, yet abled, occupants[1], the time to reach a point of egress for the proposed design and a comparable DtS design is summarised in the table below. Note that the travel time does not take into account decrease in vertical travel speed for the DtS design case.

Table 3: Movement times Proposed Design vs. DtS Design

Design	Travel distance	Movement time
Proposed design with fire-isolated stair	20 m	25 s
DtS design, 2 storey timber building with open stair.	80 m	100 s

As shown in the table above, the time for occupants in the proposed design to reach safety in the fire-isolated stair is significant shorter than for a DtS design with an open internal stair.

As such, the presence of both the void and the timber construction are not considered to present an unacceptable fire risk in the building, once the detection and fire-fighting are improved.

For security, doors into the tenancies will most likely be locked/closed from the open stair, if the tenants are not related. Occupants located in the internal stair might therefore not have access to the fire-isolated stair in the event of a fire; they are however already in the open stair and are expected to be able to evacuate quickly. This is no different from the existing egress provisions in the building.

[1] Proulx G., Movement of People: The Evacuation Timing. SFPE Handbook of Fire Protection Engineering, 3rd edition, National Fire Protection Association/Society of Fire Protection Engineers, 2002.

The internal stair has non-compliant balustrades and handrails. The stair is existing, part of the heritage listing, and it is not realistic nor achievable to adjust handrails and balustrades considering the heritage nature of the building. The new works will not have any impact on the existing stair. The new works is however expected to result in improved overall evacuation as stated above with the fire-isolated stair being extended throughout.

3.5 Detection and alarm

There is an existing smoke detection system throughout all levels of the building which according to the Annual Fire Safety Statement is in accordance with AS 1670.1. Detection is however not provided to all individual rooms, hence the Annual Fire Safety Statement is considered to be inaccurate.

As part of the extension to the building, AS 1670.1 detection shall be provided throughout the whole building. Improved detection will improve the overall fire safety and evacuation provisions by providing occupants with early warning.

There is no Building Occupant Warning System currently installed in the building, but there are existing bells connected to the smoke detection system. The bells are, according to tenants, very loud. As part of the new works, a pressure test is recommended and if the existing bells provide adequate sound pressure, this system can be retained. There is no capacity for an alert tone or phased evacuation in the currently installed system, but as it is partially a timber building all floors should evacuate simultaneously. The population in the building is also expected to be low as the building is small, and a simultaneously evacuation will not lead to congestion in the exit system.

The warning system (existing bells if proven adequate) shall be extended throughout the building, including new parts, and supplemented in existing parts if needed.

3.6 Suppression

Any automatic fire sprinkler system is not proposed to be installed in the building since this would result in unreasonable costs and impact on the heritage attributes of the building due to installation difficulty.

Pending Fire Engineering analysis, window wetting sprinklers might be required for windows facing Philip Lane that are located within 3 m of the boundary.

3.7 Exit signage and emergency lighting

Exit signage and emergency lighting shall retained in the existing parts and provided to the new parts.

Clear exit signage is of significant importance where existing office tenancies will evacuate via new office tenancies. This evacuation route will not be part of the occupant's daily circulation routes and must be clearly indicated.

3.8 Fire-fighting provisions

3.8.1 Portable fire-extinguishers

Portable fire extinguishers are currently provided to the building and shall be retained. All new parts of the building shall be provided with portable fire extinguishers throughout.

3.8.2 Fire hose reels

There are no fire hose reels provided to the existing building and it is not proposed to provide fire hose reels to the new parts. Fire hose reels in an office building can be replaced by portable fire extinguishers as part of the fire engineering design.

It is considered that portable fire extinguishers are a more suitable tool for initial fire-fighting by occupants in the building. A portable fire extinguisher is easy to use and also has a limited amount of extinguishing agent, which encourages occupants to leave if they are being unsuccessful in first aid fire-fighting Generally it is not appropriate for occupants to attempt extinguish a large fire beyond the initial stages of the fire and they should evacuate the building when the fire grows beyond the initial stages fightable with a portable extinguisher.

3.8.3 Fire hydrants

There are currently no fire hydrants in the building for fire brigade intervention. As part of the new works, fire hydrants shall be provided to the fire-isolated stair with outlets on each landing. This will provide fire-fighting coverage for the whole building.

4 New works BCA compliance summary

The new works shall comply with the BCA Performance Requirement either by complying with the Deemed-to-Satisfy provisions or by means of a Fire Engineering Performance Solution.

Proposed Performance Solutions for History House and approach for each are summarised in the table below. In the table, Performance Solutions related to the existing parts of the building are also included.

Table 4: Potential items subject to Performance Solution

Non-conformance	BCA Clause	Proposed Performance Solution
Existing timber parts of the building does not achieve Type A construction.	Spec C1.1	Parts of existing heritage listing. The existing floors can remain based on being existing and new works will not affect the timber structure in any way. Addition of detection, improved egress and fire hydrants reduces the overall fire risk See Section 3.2.
Existing timber stair connects four floors of the building where only two interconnected floors are permitted. The stair also have handrails and balustrades which does not comply with the BCA.	D1.12	The stair is existing, part of the heritage listing and it would not be possible to enclose the stair or alter balustrades and handrails. The new works proposed will provide occupants with access to the fire-isolated stair without passing through the internal open stair. See Section 3.2.
Fire hose reels are not proposed to be provided to the new parts of the building.	E1.4	Portable fire extinguishers will replace fire hose reels. Portable extinguishers are considered being a more appropriate equipment for initial fire-fighting by occupants, and do not adversely affect the heritage. See section 3.8.2.

Non-conformance	BCA Clause	Proposed Performance Solution
Openings are location within 6 m of buildings on adjoining allotment.	C3.2	Openings facing Macquarie Street should not need protection based on adjacent solid wall and heritage nature of the windows. Openings at rear of the building may need protection pending fire engineering analysis. The distance to the boundary and adjacent buildings needs to be confirmed. Pending confirmation, options for protection to be developed taking into account natural ventilation. Protection may be wall-wetting sprinklers.

5 Conclusion

Based on the Fire Safety Strategy presented in Section 3, we support that the proposed new works to the History House can meet the Performance Requirement of the BCA 2016 either through comply with the Deemed-to-Satisfy provisions or by Fire Engineering Performance Solution.

It is anticipated that other non-conformances with the DtS Provisions if the BCA may be identified as the design develops further. However, it is considered that, as the design stands, an approvable solution can be achieved through the use of performance based fire engineering or minor design modifications without significantly affecting the building.

The new works will not have any negative impact on the existing heritage listed parts of the building, and the new works will improve fire safety of the existing areas of the building. As such, it is considered that the existing areas do not have to be brought up to full compliance with the Performance Requirements of BCA 2016.