UNSW Australia

Electrical Engineering Building Capital Renewal and Modernisation

Concept Fire Engineering Report

Rev B28 January 2016Rev A | 12 January 2016

Job number 246128-00

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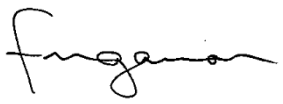
		Signature			
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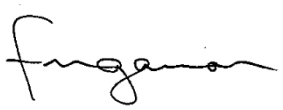
		Signature			
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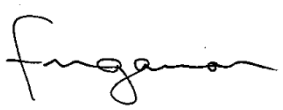
		Signature			
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Contents

1 Introduction

The EEB_CRM aims to revitalise the existing building at the Kensington Campus of UNSW Australia. (The University of New South Wales). The building is in 2 major blocks – North and South with footprint areas of roughly 1500m² for the South block and 1200m² for the North block.

The building was originally built in 1963 and consists of Lower Ground (across western half of S block only), Ground plus 4 above ground levels.

Figure 1: EEB

The building houses the School of Electrical Engineering & Telecommunications, part of the Faculty of Engineering, at UNSW. It contains computer laboratories, testing laboratories, tutorial and lecture teaching spaces, and office areas. The existing building is sprinkler protected but has a series of open stairs that connect all floors currently used as the exit stairs in the event of a fire. The existing hydrant booster located to the West of the South block and this location will be retained although the booster assembly will be upgraded as required).

The BCA would classify the building into the following areas

The EEB_CRM includes multiple classifications, including:

- Class 5 (office);
- Class 8 (laboratory);
- Class 9b (assembly area – teaching spaces).

The proposed project will largely refurbish the whole building and the Rex Vowels (RV) theatre (on an area by area basis). Arup understand the program to be along the lines of the following;

- SSD (State Significant Development) application finalisation – February 2015
- Design Development completed by January 2016
- Project Completion 2018

The following table outlines the key team members:

Table 1: Team members

Role	Company	Representative
Client	UNSW	Janine Deshon Joe Santangelo
Architect	HASSELL	Matthew Todd Kathy Roberts Nathan Humphries
Structural Engineer	TTW	Martin Rogers
Mechanical/ Electrical Engineers	Jacobs	Jeff Ryan (mech) Mihaela Serban (elc)
Hydraulics	LHO	Michael Armitage
Fire Engineer	Arup	Felix Gamon Neil McPhail

This report highlights the key fire safety aspects of the design that are considered important to enabling the architectural vision for the building.

2 Concept Fire Safety Strategy

The fire safety strategy aims to provide an appropriate level of fire life safety for all building occupants and attending Fire & Rescue NSW personnel, by satisfying the Performance Requirements of the Building Code of Australia 2015 (BCA).

In general, the fire safety design will be in accordance with the requirements of the prescriptive Deemed-to-Satisfy (DTS) Provisions of the BCA.

However, the DTS Provisions can prove overly onerous and/or restrictive, especially for existing building upgrades. Therefore, the design will include non-compliances from the DTS Provisions, so as to minimise adverse impacts on the architectural intent and the building's functional requirements, to provide greater flexibility for future changes to layout and usage, to limit ongoing maintenance requirements and to contribute to a cost effective design. Any such non-compliances will be addressed as Alternative Solutions in order to demonstrate that the Performance Requirements of the BCA are achieved.

Unless noted otherwise in this report, all aspects of the fire safety design must comply with the DTS Provisions of the BCA.

2.1 Building Separation

The EEB RV building is stand-alone, as shown below.

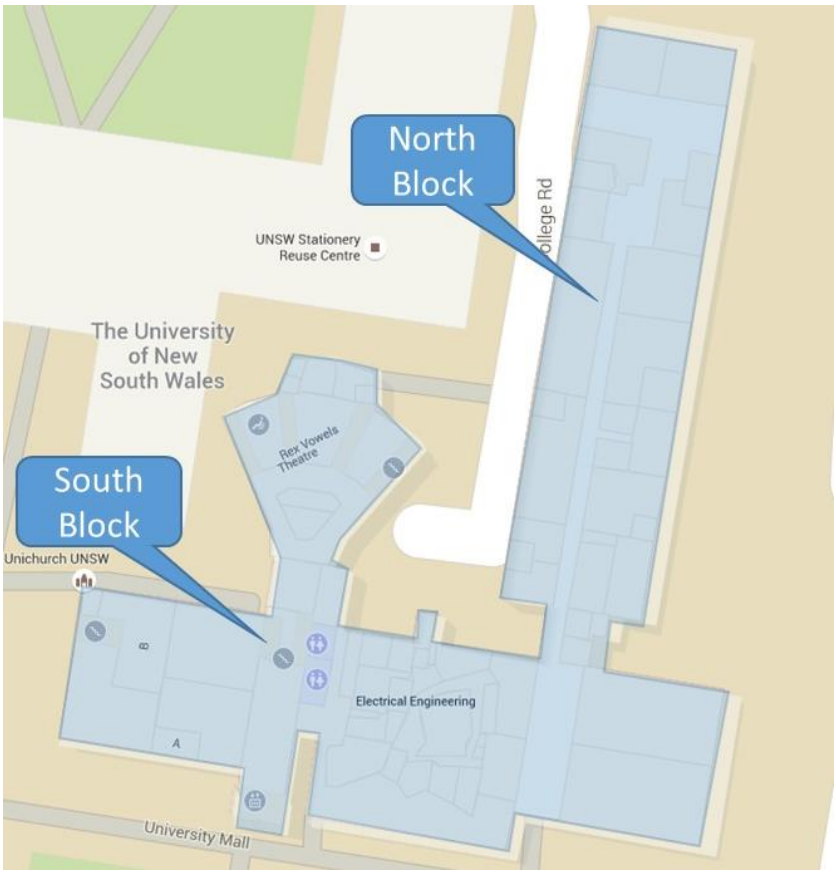

Figure 2 – EEB and RV site plan

The Rex Vowels Theatre appears to be within 6m of the Quadrangle. Even though this is an existing condition, it is possible that additional fire safety provisions may be required. The existing structure of the theatre will need to be assessed to ascertain the current level of fire separation provided. If additional measures are needed, these could include any combination of the following:

- Solid construction achieving 2 hours fire rating;
- Fire rated doors on hold open devices that release on fire trip;
- Wall wetting sprinkler system applied (externally) to glazed openings;
- Fire shutters.

2.2 Structural Fire Resistance Levels

The EEB has a rise in storeys of 6 and hence Type A construction is required.

It is proposed that the structural fire resistance level (FRL) for the building is 2hrs throughout.

This requires a fire engineered approach to justify rationalising the requirement for Class 8 (laboratory) from 4hrs to 2hrs FRL. This rationalisation of FRL will be based on fuel load density comparisons and/or fire severity calculations and is a common Alternative Solution for this type of building.

This proposed design means that there is no fire separation required as a result of having different classifications on the same storey.

Based on the structural engineer's review of the building, it appears as though there may be some limited areas that require additional material to achieve this FRL throughout. This is typical for buildings of this age.

2.3 Compartmentation

The building is split into north and south blocks on each floor (except Lower Ground, which only covers part of the south block footprint), with fire walls and doors separating the two blocks. Refer Figure 3 below.

The footprint of the two blocks on a typical floor has been calculated as roughly 1500 m² for the south block and 1200 m² for the north block.

It is proposed that the DTS fire compartment area and volume limits provided in the BCA are adhered to. This removes the potential for the building to be classified as a large isolated building, which has more onerous DTS fire safety requirements including full perimeter access for fire service vehicles, which is not possible for this site.

The building is approximately 50% laboratory (Class 8) and 50% office and assembly areas (Classes 5 and 9b), hence the maximum allowable floor area is 6500 m².

In addition, not more than three storeys are to be connected, as permitted by the BCA in a sprinklered building without triggering the Part G3 atrium provisions.

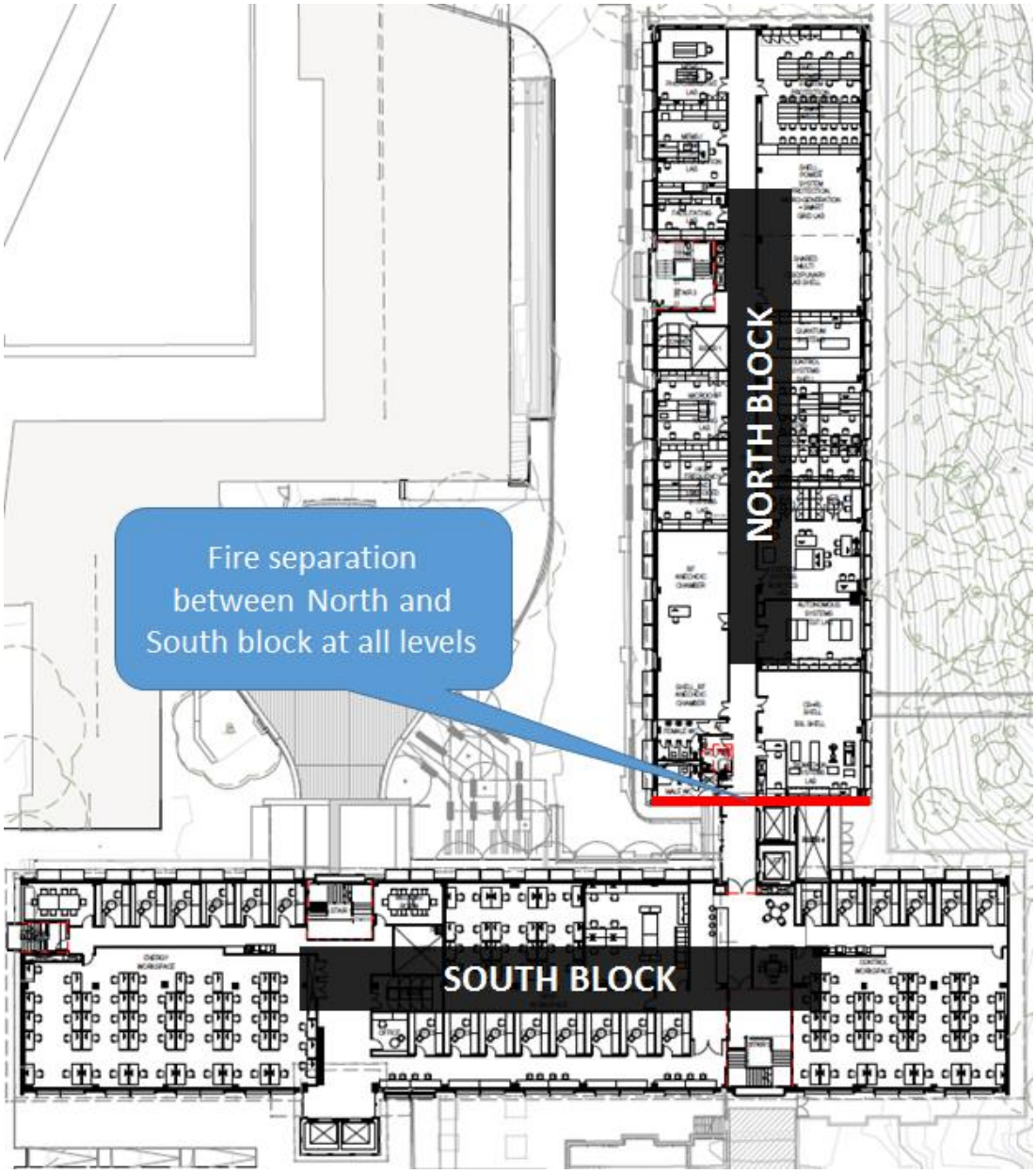

Figure 3: Fire separation of North and South blocks

North block includes: offices, several kinds of laboratories, lounge areas, teaching areas, meeting rooms and toilets. Each floor is a separate fire compartment.

South block includes: offices, laboratories, workshop areas, teaching areas, meeting rooms and toilets. This block is sub-divided such that Lower Ground is a separate fire compartment, Ground Floor to Level 2 forms a three storey fire compartment and Levels 3 and 4 are individual fire compartments.

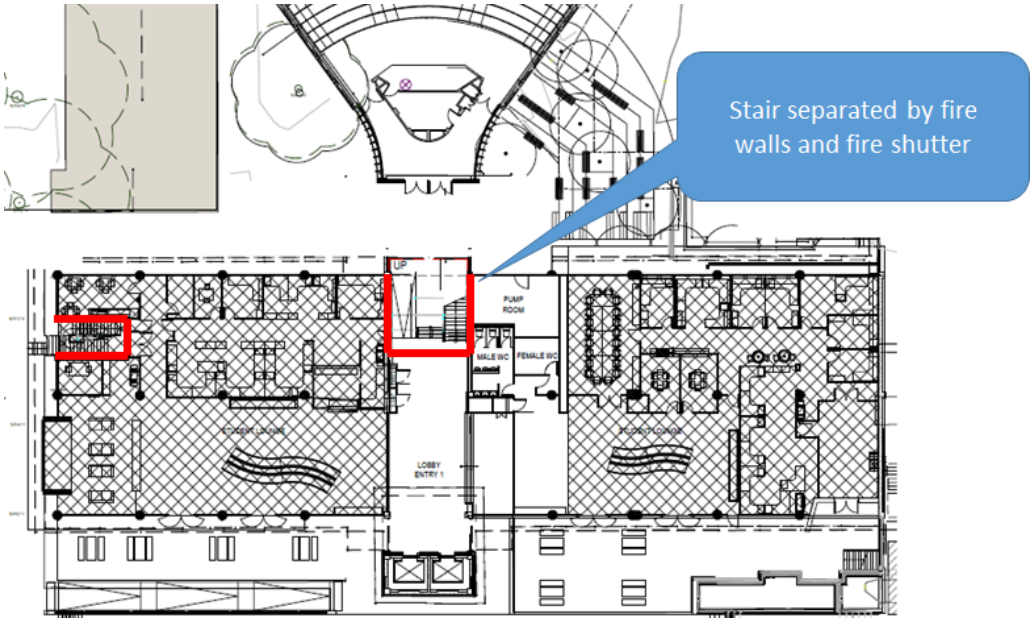

Figure 4: Fire compartmentation at Lower Ground

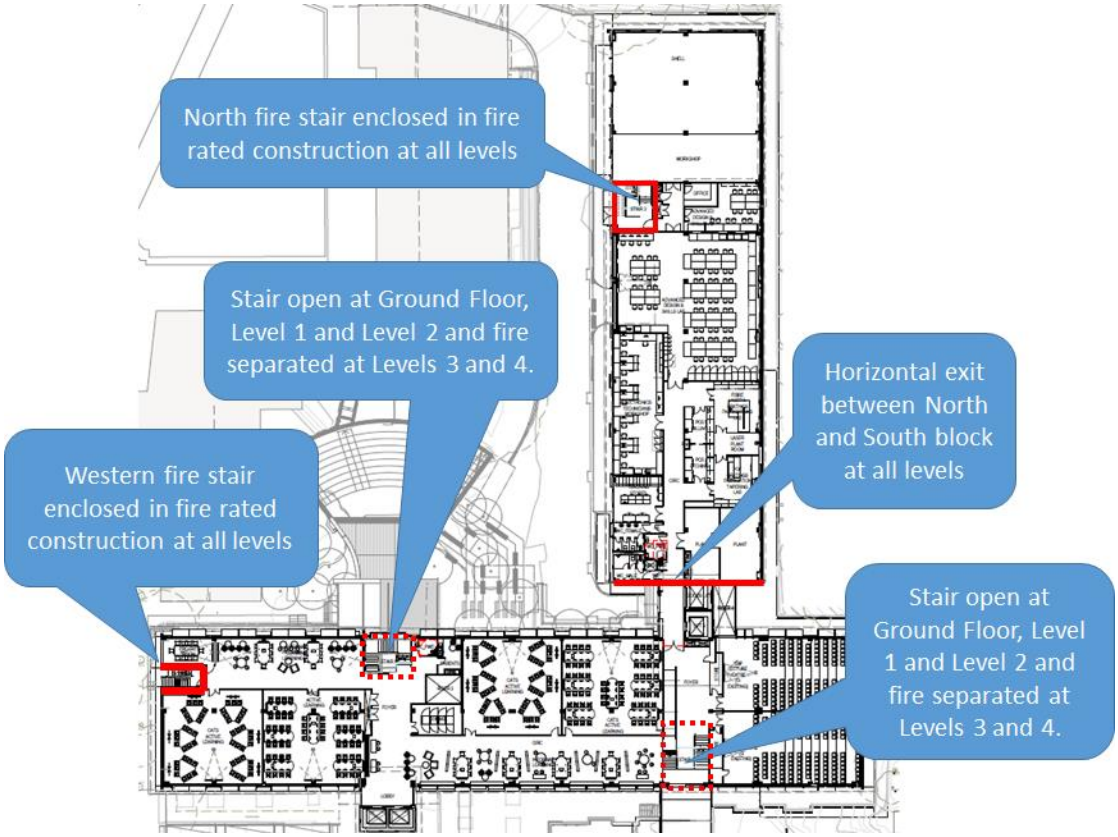

Figure 5: Fire compartmentation at Ground and above

An estimate of the total floor area of the largest compartment (South block's Ground to L2) is just under 5000 m^2, which is within the DTS limits.

2.4 Egress Provisions

In the event of fire, it is proposed to evacuate the buildings in two main parts, this being the North and South block. This is due to the use of the horizontal exit between the two blocks.

For a fire within the North block occupants of the north block would egress via the North fire stair or the horizontal exit to the south block, where they may use one of the available stairs to outside.

If a fire were to occur in the South block then those occupants on Levels 3 and 4 may egress via the western stair (which is open to outside) or the horizontally to the north block. As a result of the compartmentation strategy, the two larger stairs in the south block won't be available for egress from these two levels.

For occupants on Level 2 and below in the South block, all stairs are to be signed as exits, including the open stairs.

On Lower Ground floor and ground floor occupants have direct access to a road or open space due to the sloping site.

Refer Figure 6 to Figure 9, which show the available egress at each level.

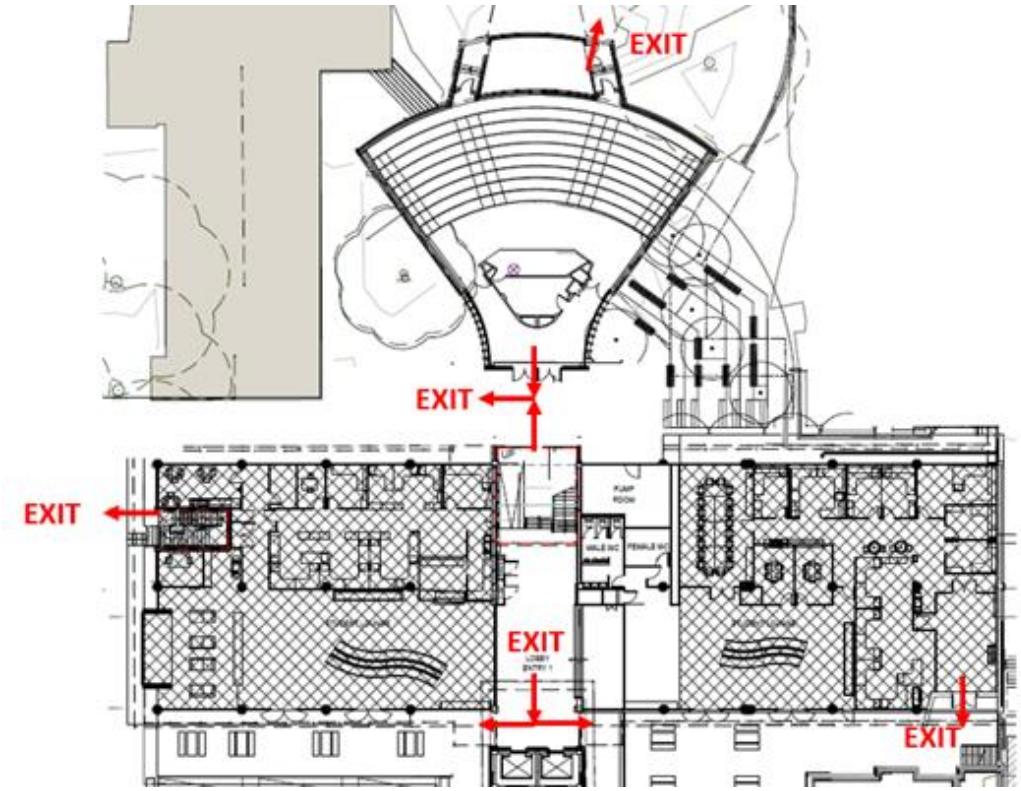

Figure 6: Lower Ground egress

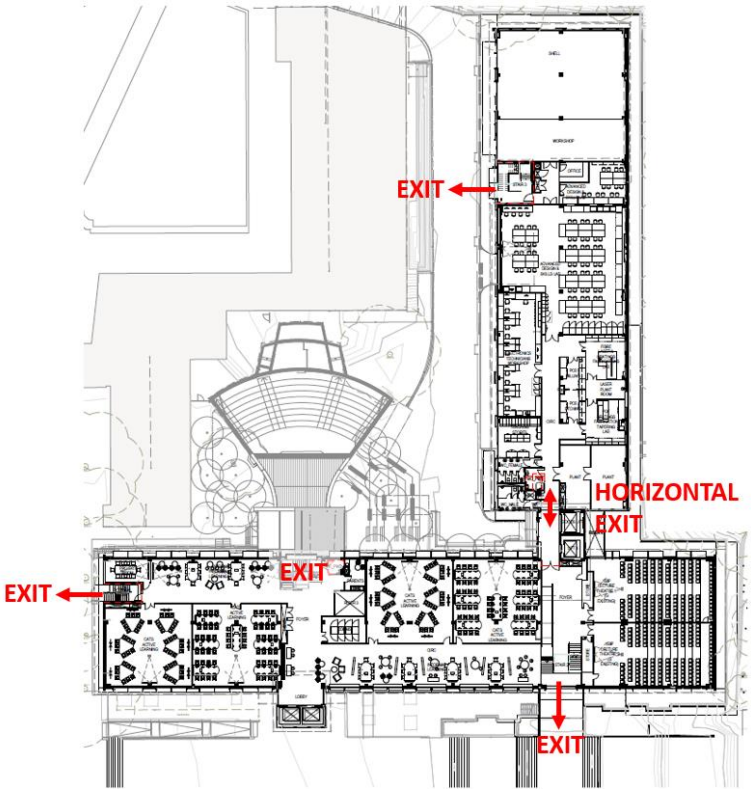

Figure 7: Ground Level egress

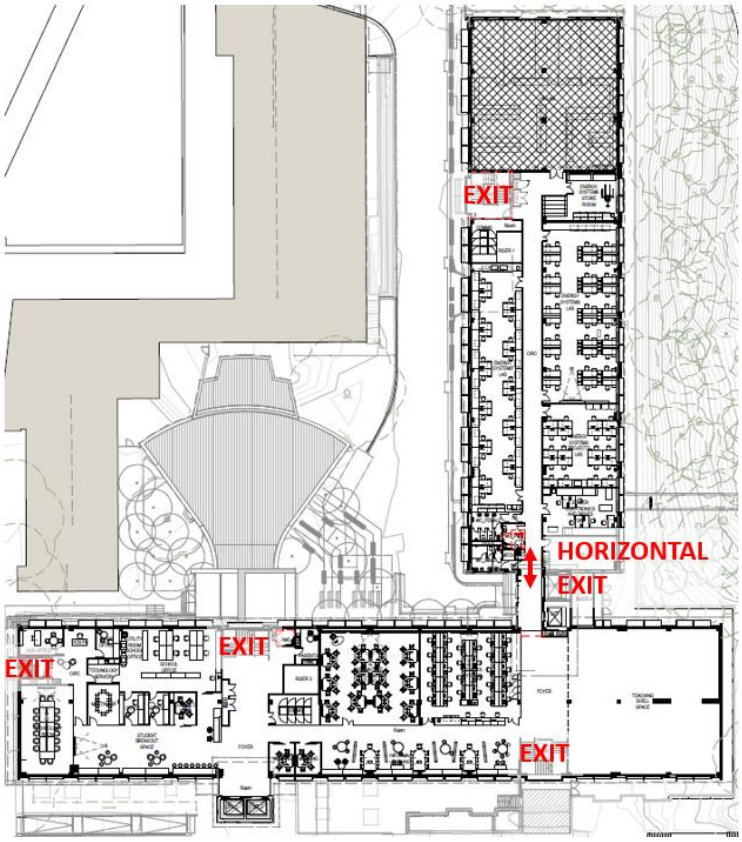

Figure 8: Egress provisions from Level 1 and Level 2

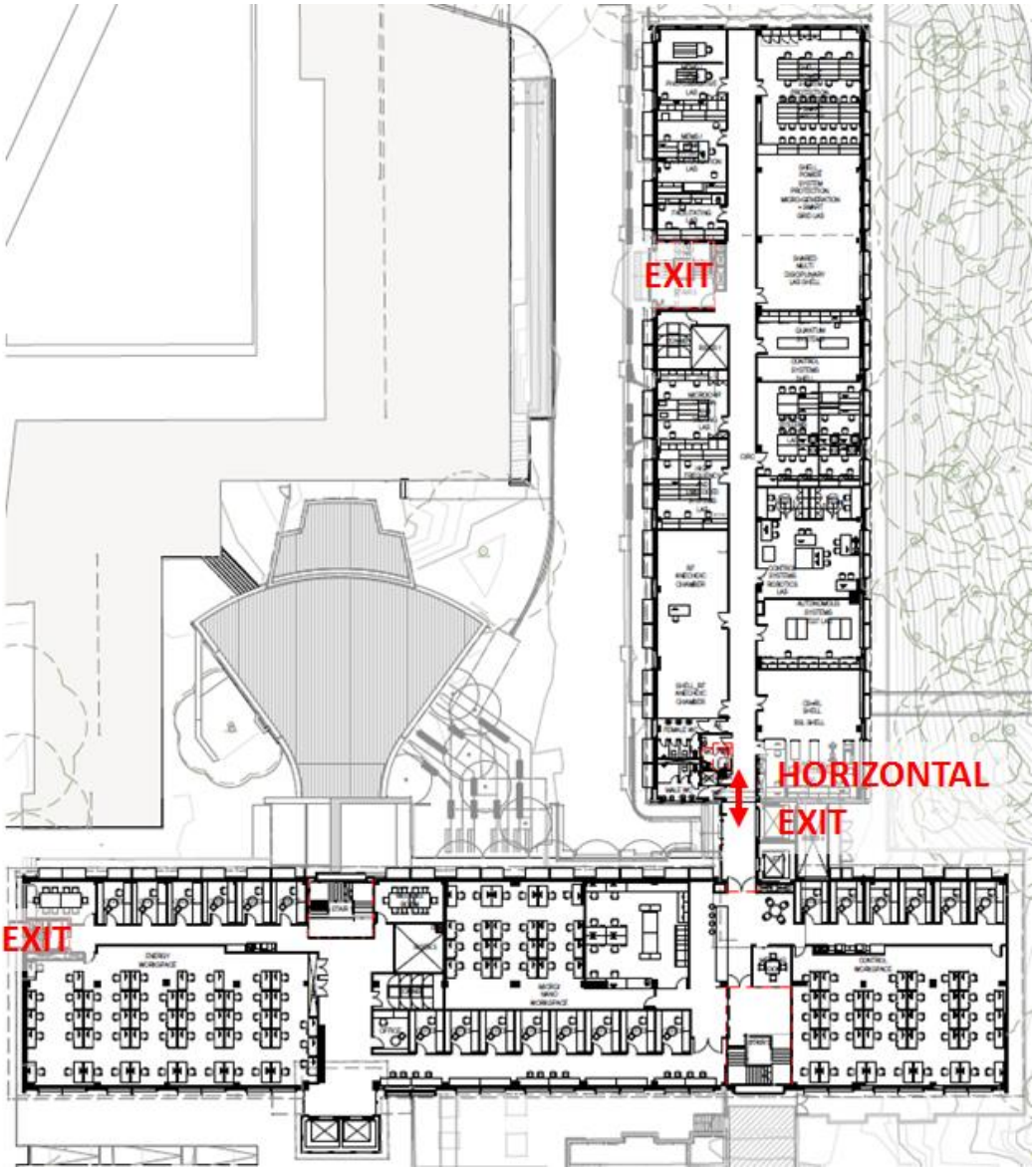

Figure 9: Egress provisions from Level 3 and Level 4

Any active fire compartmentation (e.g. fire shutter used to enclose the two central stairs of the south block in the event of fire), must not prevent egress of occupants already on the stairs.

2.5 Fire Brigade Access

Vehicle access to the fire hydrant booster assembly is via Gate 14, from Barker Street, onto Southern Drive and then Engineering Road. This route and the booster location are depicted in Figure 10.

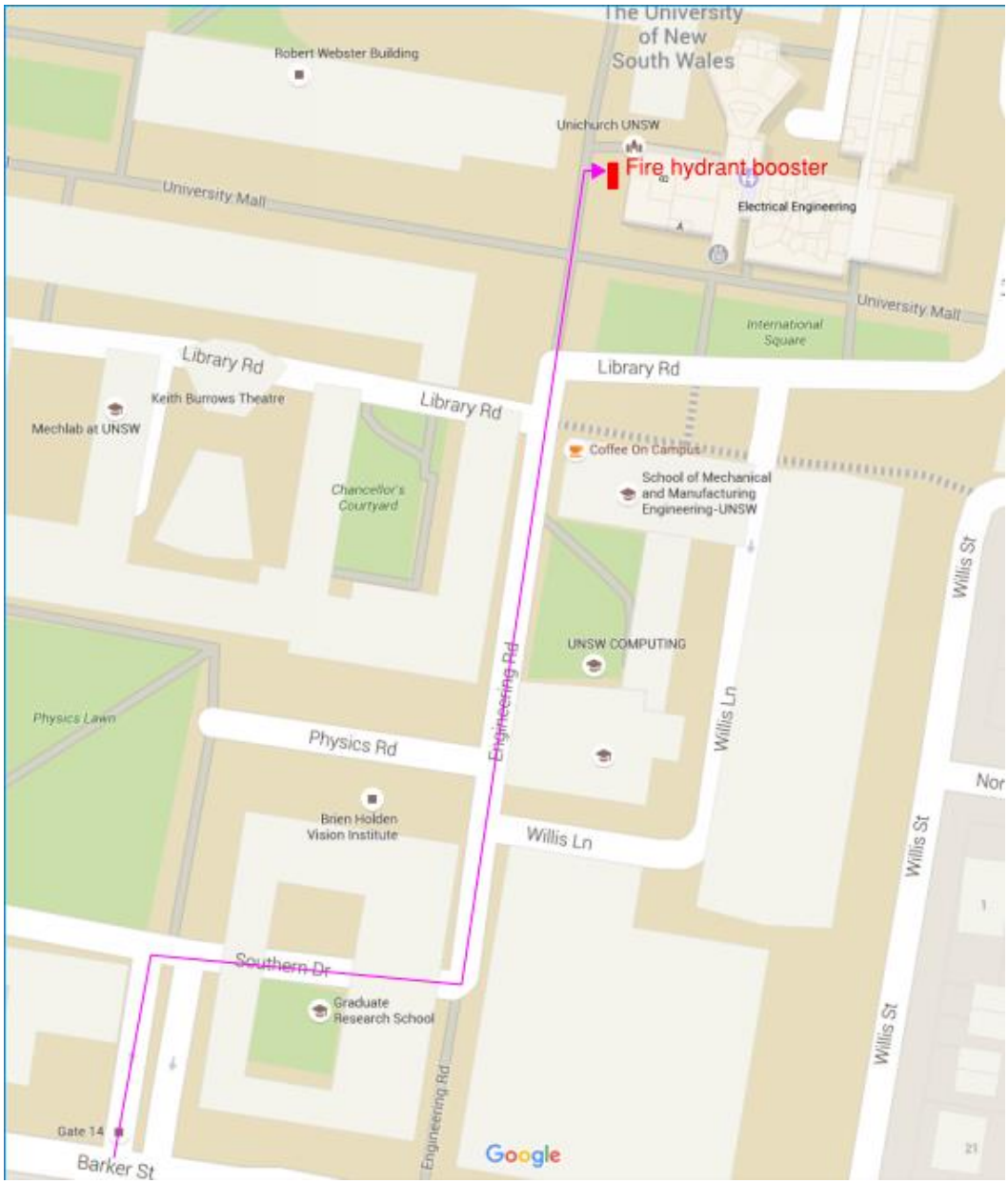

Figure 10: Fire Hydrant Booster Assembly Location

The FIP is to be accessed at Lower Ground in the main entry foyer of the building.

2.6 Fire Safety Measures

To support the fire strategy described above the following key fire safety measures are proposed:

- All loadbearing structural elements are to achieve 120 minutes FRL, including for integrity and insulation, where appropriate (e.g. all floors);
- The western stair in the south block and the northern stair in the north block will be fire-isolated on all storeys in accordance with BCA Clause D1.3;
- The two other stairs in the south block will be open at Ground, Level 1 and Level 2. At other levels, these stairs will be separated from the floor plates by fire rated construction, which may normally be open and only close upon fire detection or power failure (e.g. shutters, curtains, hold-open doors);
- A sprinkler system compliant with BCA Specification E1.5 and AS 2118.1-1999. The fire services designer has advised that the system will be designed to Ordinary Hazard II and that no sprinkler tank is required/proposed;
- A fire hydrant system installed in accordance with AS 2419.1-2005. A booster will be positioned in the same location as the existing booster, and will comply with AS 2419.1-2005;
- Automatic smoke detection throughout the building. Due to there being extended travel distances within the building, detection is to be installed to achieve coverage as per AS 1670.1-2004.

All other fire safety measures not identified in this report are to be as per the requirements of the DTS Provisions.

3 Further Work

The proposed fire safety strategy will need to be discussed with the Principal Certifying Authority and Fire and Rescue NSW prior to Construction Certification documentation.

The next deliverable is a Fire Engineering Brief report, developed for submission to the approving authorities and project stakeholders.

4 DTS Non-Compliances

The following provisional list of non-compliances has been identified by the project team.

Issue	Proposed Alternative Solution or design amendment
The building has a mixed classification of Class 5, 8 and 9b. Class 5 and 9b generally require 2 hour fire rated construction while Class 8 generally required 4 hour fire rated construction. The existing structure only achieves a 2 hour fire rating.	Class 8 (laboratory buildings) would require 4 hours fire rated construction under the DTS Provisions. This is not considered necessary as it can be demonstrated that laboratories like EEB generally have a lower fuel load than office buildings (Class 5) and therefore a fire will burn out quicker than a comparable office fire. This method of justification has been used on multiple laboratory projects.
3 of the proposed egress stairs connect more than 3 storeys in the building which is sprinkler protected but are not proposed to be fire isolated stairways	The upper floors of the open stairs will be fire separated off from the lower levels by a mix of fixed walls and/or fire curtains/ shutters. This philosophy has been used on a number of projects throughout Sydney.
Travel distances exceed DTS limits in some locations to a point of choice, to an exit and between alternative exits.	The building is provided with a sprinkler system and therefore would not require an automatic smoke detection system. It is considered that the provision of a smoke detection system throughout the building will significantly reduce the time taken to alert occupants of a fire in lieu of relying on a sprinkler head to break and operate the alarm system. Further, AS1670 coverage is proposed.
The clear width of the south block's western fire stair appears to be less than 1m.	The stair is wide enough for single file use, which could hinder Fire & Rescue NSW usage of this stair if occupants are still egressing. The assessment will look at the number of people that will likely utilise this particular stair, taking into consideration the use of the open stairs on the lower levels.
Paths of travel from the discharge of exits may pass within 6m of the EEB's external walls.	This will be looked at as the design developments. The central stair is provided with two ways out of the building which would mean the exit route would be compliant.
The hydrant booster is within 10m of the building and not within sight of the main entrance.	The new draft AS2419 removes the need to protect external booster assemblies in sprinklered buildings.