REPORT

No. 1 6 8 1 6

On the Strategy to be adopted for the -

FIRE SAFETY ENGINEREERING ASSESSMENT
OF ALTERNATIVE SOLUTIONS

At:-

"GRAYTHWAITE"
20 EDWARD STREET
NORTH SYDNEY NSW

For:-

SYDNEY CHURCH of ENGLAND GRAMMAR SCHOOL

Architects

Tanner Architects
52 Albion Street
Surry Hills NSW 2010

RECORD OF AMENDMENTS

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1.0 BACKGROUND

This Fire Safety Engineering (FSE) Assessment Strategy was prepared for Tanner Architects on behalf of Sydney Church of England Grammar School (Shore) for the conservation and adaptive reuse of Graythwaite House, the Coach House and the Tom O'Neill Centre at Graythwaite, 20 Edward Street, North Sydney. The report has been prepared to accompany the revised Part 3A Stage 1 Project Application for the works, and responds to issues raised by North Sydney Council in their assessment dated 8 March 2011.

The purpose of the report is to provide a strategy for the fire safety upgrade of Graythwaite House, the Coach House and the Tom O'Neill Centre whilst concurrently having regard for the heritage significance of each building.

2.0 INTRODUCTION

Based on information provided to Wallis & Spratt Pty Ltd by Davis Langdon Construction Consultants, the existing Heritage listed buildings known as Graythwaite House (GH), The Coach House CH) and Tom O'Neil Centre (TONC), hereinafter referred to as **"the Buildings",** do not meet a number of current "Deemed to Satisfy" (DTS) provisions within the Building Code of Australia 2011 (BCA 2011) and as such alternative solutions using fire engineered principles will be sought to be implemented on each of "the Buildings".

Implementation of strict BCA, DTS occupant safety provisions to **Heritage Building** usage would be impractical in most cases, without requiring the whole or part destruction of the fabric of the building. In such cases, it is useful to investigate the discretionary provisions incorporated into legislation rather than be forced to restrict the occupancy/type of use of the building. This pathway should be pursued rather than destroying the building fabric and losing the very elements for which the building was initially considered a heritage asset.

The BCA 2011, through Clause A 0.5, allows compliance with the performance requirements to be achieved either by a complying DTS design; an alternative solution complying with the performance requirements to the DTS design provisions, or a combination of both approaches.

Wallis and Spratt Pty Ltd have been requested to provide a strategy**,** to be implemented during the Design, Documentation & Construction Certificate stages, for developing and determining Alternative Solutions, using Fire Safety Engineering principles, that will comply with the relevant Performance Requirements of the Building Code of Australia (BCA) and at the same time address the preservation of the existing Heritage elements of "the Buildings".

The Fire Safety Engineering (FSE) assessment will be implemented to assess if proposed alternative solutions to the documented non conformances meet the performance requirements of BCA 2011.

The assessment methodologies to be employed for "the Buildings" shall be based on equivalence with the DTS provisions and the application of appropriate analytical procedures in accordance with BCA 2011, Clause A 0.9.

3. BUILDING DESCRIPTION & ALTERNATIVE SOLUTIONS

3.1 Building Descriptions

3.1.1 Graythwaite House (GH)

The project involves the conservation and refurbishment of the "House". The existing building is a significant Heritage building and is in a state of disrepair.

Building Use:	Office/Administration & Function Use
Class of Occupancy:	Classes 5 & 9b
Type of Construction:	Type C
Rise in Storeys:	Three (3). Note: subfloor not assessed as a storey.
Levels Contained:	Three (3)
Floor Area:	approx 1,200m^2
Effective Height:	Less than 12m

3.1.2 The Coach House (CH)

The project involves the conservation and refurbishment of the Coach House at Graythwaite, North Sydney. The existing building is of a significant Heritage nature and is presently disused.

Building Use:	Office & Caretaker's Residence Flat (1st Floor)
Class of Occupancy:	Classes 5 & 4
Type of Construction:	Type C
Rise in Storeys:	Two (2)
Levels Contained:	Two (2)
Floor Area:	approx 150m^2
Effective Height:	Less than 12m

3.1.3 Tom O'Neill Centre (TONC)

The project involves the refurbishment of the Tom O'Neill Centre at Graythwaite, North Sydney as a class room/teaching space. The existing building is of a significant Heritage nature and is presently in a state of disrepair.

Building Use:	Classroom/teaching space
Class of Occupancy:	Class 9b
Type of Construction:	Type C
Rise in Storeys:	One (1)
Levels Contained:	One (1)
Floor Area:	approx 529m^2
Effective Height:	Less than 12m

3.2 Occupant Characteristics

The characteristics of the occupants expected to be in the buildings are listed below:-

Characteristic	Description
Familiarity	Occupants are expected to be teachers, staff and students. Students are understood to be supervised by a teacher at all times whilst within the buildings. Teachers are expected to be familiar with the layout of the buildings and capable of assisting students in the event of an evacuation.
Awareness	Occupants are expected to be awake and alert to a potential emergency event such as a fire in the buildings. The exception to this is the Caretakers Residence on the 1st Floor of the Coach House.
Mobility	Occupants are assumed to have the same level of mobility as the general population. This may include a limited proportion of mobility impaired occupants. These occupants may require crutches, a wheelchair or similar to evacuate on their own or need assistance from other occupants.
Age	The majority of students is understood to be aged between 10 to 13 years and will be supervised by a responsible adult.
Language	Although occupants may have English as their second language, they are expected to understand signs and verbal instructions in English to the degree necessary to not adversely impact upon evacuation.
Occupant Load	The populations of the buildings as confirmed by Davis Langdon and deemed compliant with clause D1.13 of the BCA are:- **Graythwaite House:** 18 staff, 76 Guests (function) **The Coach House:** 10 staff, 2 residents (1st Fl) **Tom O'Neill Centre:** 10 staff, 190 students

3.3 Alternative Solutions

The configuration of the existing "the Buildings" includes areas that do not comply with the DTS provisions of the BCA. We propose to implement, in consultation with the Heritage Architect, a performance based fire safety engineering approach to develop and determine alternative solutions to the DTS provisions of the BCA. The table below indicates the non compliances and describes the BCA requirements associated with the alternative solutions:-

3.3.1 Graythwaite House

No	Description of alternative solutions	DTS provision.	Performance requirements (A0.10)	Method of meeting performance requirements (A0.05)	Assessment method (A0/09).
1.	**Fire Resistance Levels** separating the Class 9b from the rest of the building is not proposed to be fire separated.	Clause C1.1 & Spec. C1.1	CP1, CP2, CP4	Complies with performance requirements A(0.5(b)(i)	Verification method A0.9(b)(ii)
2.	**Fire Hose Reel** on 2nd Floor needs to pass through smoke doors and is to be justified.	Clause E1.4(f)	EP1.1	Complies with performance requirements A(0.5(b)(i)	Verification method A0.9(b)(ii)
3.	**Fire Indicator Panel** non complying location to be justified.	Clauses E2.2	EP1.6	Complies with performance requirements A(0.5(b)(i)	Verification method A0.9(b)(ii)
4.	**Distances of travel** from the 1st Floor verandah and North Office wing are in excess of 20 meters and are to be justified.	Clause D1.4	DP4,	Complies with performance requirements A(0.5(b)(i)	Verification method A0.9(b)(ii)
5.	The **Main Egress Stair** connects three storeys in a non sprinkler protected building and is not proposed to be fire isolated.	Clause D1.3	CP1,CP2, CP4, DP5	Complies with performance requirements A(0.5(b)(i)	Verification method A0.9(b)(ii)
6.	**Dimensions of Exits** and Ceiling heights at the Attic level to be justified.	Clause D1.6	DP4	Complies with performance requirements A(0.5(b)(i)	Verification method A0.9(b)(ii)

3.31 Graythwaite House (c'td)

No	Description of alternative solutions	DTS provision.	Performance requirements (A0.10)	Method of meeting performance requirements (A0.05)	Assessment method (A0/09).
7.	Doors in path of travel to exits have **round door handles** and are not proposed to be changed and this is to be justified.	Clause D2.21	DP2	Complies with performance requirements A(0.5(b)(i)	Verification method A0.9(b)(ii)
8.	**Fire Hazard Properties** of existing floor, wall & ceiling materials unknown and may be subject to justification if maintained.	Clause C1.10	CP2, CP4	Complies with performance requirements A(0.5(b)(i)	Verification method A0.9(b)(ii)
9.	**Sub Floor Access Door,** beneath main egress stair, not to be upgraded to a fire door is to be justified.	Clause D2.8	DP5, CP4	Complies with performance requirements A(0.5(b)(i)	Verification method A0.9(b)(ii)
10	**Openings for Services,** non fire sealing to be justified.	Clause C3.15	CP6, CP4	Complies with performance requirements A(0.5(b)(i)	Verification method A0.9(b)(ii)
11	**Openings in Fire Isolated Exits,** non fire sealing to be justified.	Clause C3.8	CP2, CP8	Complies with performance requirements A(0.5(b)(i)	Verification method A0.9(b)(ii)

3.3.2 The Coach House

No	Description of alternative solutions	DTS provision.	Performance requirements (A0.10)	Method of meeting performance requirements (A0.05)	Assessment method (A0/09).
1.	**Fire Hazard properties** of existing floor, wall & ceiling materials unknown, subject to justification if maintained.	Clause C1.10	CP2, CP4	Complies with performance requirements A(0.5(b)(i)	Verification method A0.9(b)(ii)
2.	Doors in path of travel to exits have **round door handles,** to be maintained subject to justification.	Clause D2.21	DP2	Complies with performance requirements A(0.5(b)(i)	Verification method A0.9(b)(ii)

3.3.2 The Coach House (c'td)

No	Description of alternative solutions	DTS provision.	Performance requirements (A0.10)	Method of meeting performance requirements (A0.05)	Assessment method (A0/09).
3.	**Discharge of Class 4** exit through Class 5 lobby to be justified. Note fire separation between classes proposed.	Clause C2.9	CP4	Complies with performance requirements A(0.5(b)(i)	Verification method A0.9(b)(ii)
4.	**Fire Resistance Levels** not proposed to be upgraded	Clause C1.1 & Spec. C1.1	CP1, CP2, CP4	Complies with performance requirements A(0.5(b)(i)	Verification method A0.9(b)(ii)

3.4 Response to Council's Executive Assessment Officer's Report

We have reviewed the Council's Executive Assessment Officer's Report wherein a number of specific non compliances were highlighted as requiring alternative fire engineered solutions. These items will be addressed as noted in Clause 2.3 above.

Council's specific non compliances have been summarized in the Tables below:-

3.4.1 Graythwaite House

Council Report Ref.	Council's Concern	Performance requirements (A0.10) to be adopted for CC
Item 3, page 29	Separation of classifications within the same storey	CP1, CP2, CP4
Item 5, page 29	FRL's of elements of construction	CP1,CP2,CP4
Item 10, page 30	Openings for service Installations	CP4, CP6
Item 9, page 30	Openings in Fire Isolated Exits	CP2, CP8

3.4.2 Coach House

Council Report Ref.	Council's Concern	Performance requirements (A0.10) to be adopted for CC
Item 4 page 29	Discharge of Class 4 exit through Class 5 lobby. Note fire separation between classes proposed.	CP4
Item 12, page 30	Fire separation required to Class 4 portion including stairs	CP1, CP2, CP4
Item 17, page 30	Smoke Hazard management	CP4

4. SCOPE & OBJECTIVES

4.1 Scope

The FSE assessment will address the issues of non compliance with BCA 2011 identified in Clause 3.3 of this Strategy Report.

The FSE assessment will be based on the assumption of a single ignition and fire source which is the expectation of a natural fire. It will not cover multiple fire start scenarios arising from arson or other such events. Analysis of incidents involving bomb threats or other such occurrences, requiring total evacuation of the buildings will not form part of the assessment.

The FSE assessment will be based on a completed design configuration incorporating proposed fire safety systems. The assessment does not cover the issues that may arise during the refurbishment works on "the Buildings" and does not consider the intermediate stages of construction for which temporary provisions of fire safety services and features may need to be implemented.

The FSE assessment for "the Buildings" shall be based on drawings and BCA information to be provided by Tanner Architects and Davis Langdon Construction Consultants.

4.2 BCA Objectives

The primary fire safety objectives of BCA 2011 are:-

- Occupant life safety
- Fire brigade access and
- Protection of adjacent properties

The occupant **evacuation process** will be assessed on the principle that "……conditions in any evacuation route must be maintained for the period of time occupants take to evacuate the part of the building…..". This implies that if tenable conditions in the evacuation route are sustained over a significant period of time in respect to predicted egress times, it is in a 'Place of Safety' where tenable conditions are effectively maintained and the occupants will have adequate time for evacuation beyond that place if the need arises.

Protection of property, which is generally an objective of the building owner and fire brigades, will not be an identified objective of this assessment. However, it is an indirect objective of the BCA as protection of property, where incorporated, aids in the primary objectives being met. Therefore, for this assessment, the primary objective will be to demonstrate that the life safety objectives of the BCA for the occupants can be met and whether tenable conditions will exist at the times of fire brigade intervention.

5.0 FIRE SAFETY MEASURES

5.1 General

There are a variety of features which are recognized as being those which will lessen the hazards and risks of a serious fire. It is envisaged that as part of the alternative solution, the FSE assessment will recommend incorporation into **"the Buildings"** a range of fire safety measures, which may include:-

- Non combustible construction
- Smoke Management Systems (early detection and warning)
- Smoke Management Systems (smoke extraction/control)
- Building Occupant Warning Systems (BOWS)
- Suppression systems (sprinklers)
- Passive Draft Curtains
- Hydrants & Hose reels
- Fire Brigade notification, proximity and access
- Portable Fire extinguishers
- Egress System & Emergency Evacuation Plan
- Training
- Maintenance of Egress Routes

As noted previously any such measures that are introduced to provide occupant fire safety will be done in close consultation with the Heritage Architect with due regard being given to the heritage elements of the "the Buildings".

5.2 Measures Currently Incorporated in Part 3A Documentation

The following fire measures have been incorporated into the current Part 3A documentation.

5.2.1 Graythwaite House

- Level 3 to be configured as an **Attic storage area** with access to be restricted.
- Smoke seals and door closers to doors at Attic level (Level 3)
- No mechanical plant to be located in Basement area beneath the ground floor Function Room (Class 9b)

- Early Warning smoke detection, alarm and warning system to be installed with due regard to the existing Heritage elements with the building.

5.2.2 Coach House

- **Fire rated enclosure** for new stair linking 1st floor Class 4 to ground floor Class 5
- Ceiling between First Floor (Class 4) and Ground Floor (Class 5) to be lined with fire rated material.
- Early Warning smoke detection, alarm and Warning System to be installed with existing Heritage elements with the building.

6.0 ASSESSMENT METHODS & ACCEPTANCE CRITERION

6.1 General

The evaluation methodology to be adopted will be to establish equivalence between different sub systems of the fire safety system. This is generally established by comparing the performance of an alternative **Trial Concept Design** with the performance of a "Deemed to satisfy" strategy as specified in the BCA.

To demonstrate that **"the Buildings"** meet the A0.10 performance requirements of BCA 2011, a number of fire scenarios will be examined. These fire scenarios will incorporate the sequence of events from fire ignition to fire detection, occupant response and evacuation, fire suppression (if available) and development of untenable conditions in the egress paths.

The time at which fire detection and untenable conditions occur will depend on the **"design fire"** considered for each scenario.

More specifically, events to be determined for each fire scenario will be:-

- time of fire detection
- occupant pre movement
- occupant travel time
- time to develop untenable conditions (smoke /fire spread)

The approach will then be to determine the **required time** (RSET) for occupants to evacuate the building and the **available time** (ASET) for evacuation before untenable conditions are present in the egress paths.

6.2 Fire Modelling

For the assessment of "the Buildings", a software package model similar to **FAST** or **Hot Layer** is proposed to be used to determine the Available Safe Escape Time (**ASET)**. FAST is a zone model smoke spread computational program.

6.3 Evacuation Modelling

For the assessment of "the Buildings", a software package model similar to **WAYOUT** or **EVACNET** is proposed to be used to determine the Required Safe Evacuation Time (**RSET)**. EVACNET is a **people movement** simulation model computational program.

6.4 Acceptance Criterion

The acceptance criterion for the assessment will be that fire measures proposed facilitate safe evacuation considering the occupant characteristics, the expected evacuation time and the risk of fire and smoke spread throughout “the buildings”

Subject to applicable factors of safety, the requirement for occupant safety or the acceptance criteria can be expressed as:-

Required Safe Egress (RSET) < Available Safe Egress Time (ASET)

where

RSET = (detection + pre-movement + travel) time periods

ASET = time for untenable conditions to occur