Fire Safety Strategy

Goodman Group
Australian Red Cross Blood Service

8 August 2008
Revision C - Fire Safety Strategy
Report No. s080367-rp01

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1 Introduction

RAWFire has been engaged to develop a performance based fire safety strategy for the proposed

Australian Red Cross Blood Service (ARCBS) Development. This Fire Safety Strategy document highlights the proposed alternative solutions to achieve compliance with the performance requirements of the Building Code of Australia 2008 (BCA) [1].

The innovative development of this building results in a number of non-compliances with the prescriptive Deemed-to-Satisfy (DTS) provisions of the BCA. This document outlines the scope of work for the future fire engineering analysis, sets down the basis on which analysis will be undertaken as agreed by the stakeholders and proposes a trial design for further evaluation. This will occur through the formalised approval process incorporating a Fire Engineering Brief (FEB) report and then a Fire Engineering Report (FER) in preparation for submission for a Construction Certificate (CC).

The documents will be updated throughout the fire engineering brief and report process to keep an accurate account of the discussions and agreement between the design team and the relevant authorities.

1.1 OBJECTIVES

The objective of this assessment is to develop a fire safety system, which satisfies the performance requirements of the BCA whilst maintaining an acceptable level of life safety, protection of adjacent property and adequate provisions for Fire Brigade intervention. At a community level, fire safety objectives are met if the relevant legislation and regulations are complied with. As stated in the BCA "A Building Solution will comply with the BCA if it satisfies the Performance Requirements".

1.2 BUILDING CODE OF AUSTRALIA

The following items are a summary of the fire and life safety objectives of the BCA:

- Life safety of occupants - the occupants must be able to leave the building (or remain in a safe refuge) without being subject to hazardous or untenable conditions.
- Life safety of fire fighters - fire fighters must be given a reasonable time to rescue any remaining occupants before hazardous conditions or building collapse occurs.
- Protection of adjoining buildings - structures must not collapse onto adjacent property, and fire spread by radiation should not occur.

1.3 FIRE BRIGADE

The overall philosophical Fire Brigade objectives throughout Australia are to protect life, property and the environment from fire according to the Fire Brigade Intervention Model (FBIM).

Over and above the requirements of the BCA the Fire Brigade has functions with regard to property protection and considerations regarding occupational health and safety for its employees.

1.4 RELEVANT STAKEHOLDERS

This alternative solution has been developed collaboratively with the relevant stakeholders as identified in Table 1.

Role	Name	Organisation
Client Representative	Adrian Tesoriero Richard Seddo	Goodman Group
Architect	Glenn Scott	Bligh Voller Nield
Interior Designer		DesignInc
Private Certifying Authority	Dean Goldsmith Tony Heaslip	BM+G
Fire Safety Engineers	Sandro Razzi	RAW Fire Safety Engineering
Fire Brigade	Mark Castelli	NSW Fire Brigade

Table 1.1 – Relevant stakeholders

1.5 SOURCES OF INFORMATION

The following sources of information have been provided by the design team:

- Architectural plans prepared by Bligh Voller Nield Architecture numbered DA-A-000/02; DA-A 001/01; DA-A-002/01; DA-A-003/01; DA-D-001/01; DA-D-002/01; DA-D-003/00; DA-D-004/01; DA D-005/00; DA-D-006/00; DA-D-007/00; DA-E-001/01; DA-E-002/01; DA-E-003/01; DA-F-001/01; DA-F-002/00; DA-F-003/00; DA-Z-004/02 dated August 2008.
- Architectural Plans prepared by DesignInc Melbourne numbered A.2002; A.2003; A.2004 and A.2005 dated 6 August 08.
- Preliminary BCA Assessment report by BM+G dated 8 August 2008.

2 Building and Occupant Description

2.1 LOCATION AND SURROUNDING CONTEXT

The new NSW/ACT Principal Site (NAPS) will be developed by Goodman Group at 17 O'Riordan Street, Green Square, NSW. Green Square is a major urban renewal area promoted by the NSW Government and Sydney City Council. The site is located approximately ¼ kilometre to the south of Green Square railway station.

The Australian Red Cross Blood Service (ARCBS) requires the new NAPS facility to accommodate the NSW and ACT blood processing, testing and distribution operations, the National Transplantation Service (NTS) and supporting management and administrative functions. There will not be a Blood Donor Centre at NAPS.

The business activities of the ARCBS Operations Centre are currently performed in a number of locations, primarily at Red Cross House in Clarence Street, Sydney, and at Parramatta, Newcastle and Canberra. It is intended that the processing and testing activities undertaken in these locations will be combined into one operation at NAPS.

The Blood Service is licensed and regulated by the Therapeutic Goods Administration (TGA).

The principal activities of the NAPS facility will be:

- Blood processing
- Blood and tissue mandatory and non-mandatory testing
- Blood distribution

Additional activities will be:

- Management and administration of the Blood Service and NTS
- Warehousing and inventory management
- Research and Business Development

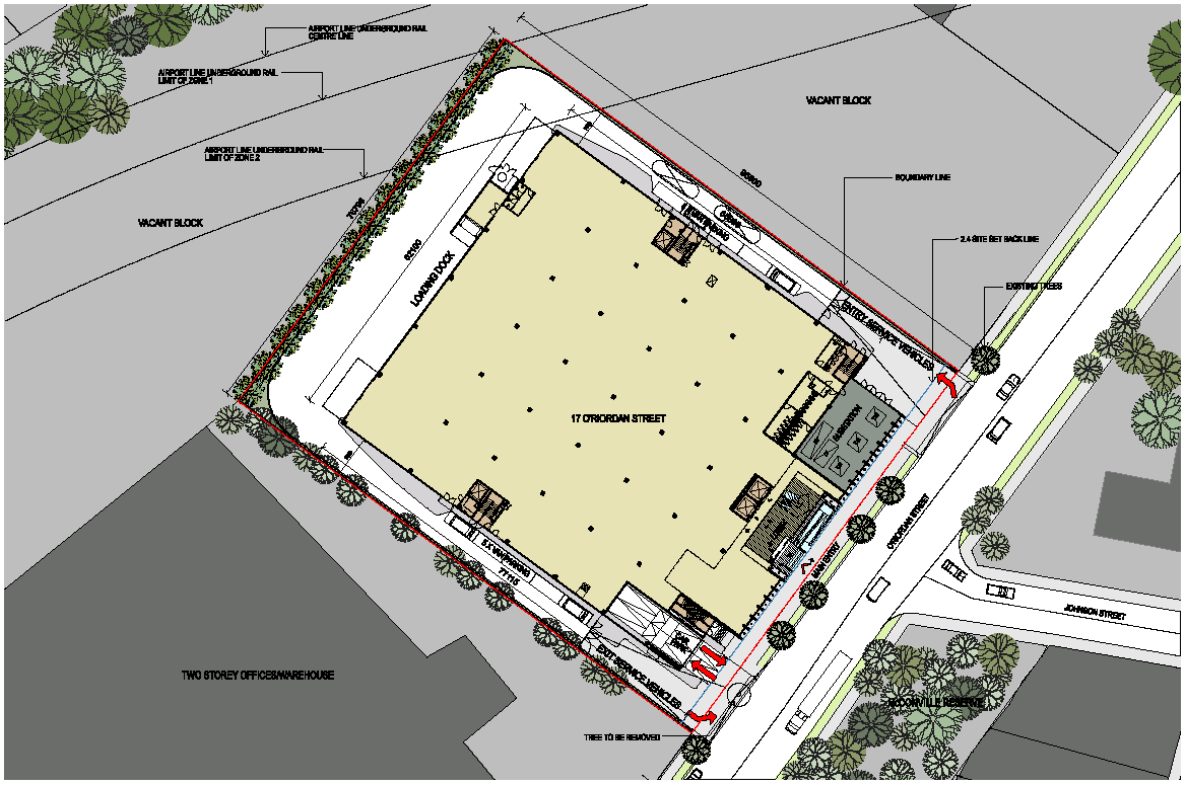

Figure 2.1 – Site Plan

In summary, the key building characteristics have been identified as follows:

BCA Characteristic	Building Use
Classification	Class 5 Commercial Offices Class 7a Carparking Class 7b Storage Class 8 Laboratory
Type of Construction	Type A – Large Isolated Building
Rise in storeys	Four (4)
Effective height	12.05 metres
Total Floor Area	Approx. 13,500m²

Table 2.1 - BCA classification summary

2.2 OCCUPANT CHARACTERISTICS

In consultation with the design team, the dominant building occupant characteristics for this development are considered to be as follows:

2.2.1 Population Distribution

The number of occupants present within this development is considered to be in accordance with the occupant densities listed in Table D1.13 of the BCA [1].

2.2.2 Physical and Mental State

Due to the use and function of the building, occupants are likely to be present during the following working hours. Occupants are generally expected to be alert and awake requiring minimal response time in the event of an emergency.

- 7am – 6pm;
- 4pm – 11pm; and
- 11pm – early morning

2.2.3 Familiarity with the Building

Occupants are generally expected to be familiar with the primary access and egress routes from the building. However, it is unlikely that occupants will be familiar with the emergency exits without the implementation of fire emergency training drills and adequate signage.

2.2.4 Emergency Training

Fire wardens are to be trained in early fire fighting and emergency response. All staff are to be advised on the actions necessary on the activation of the building emergency warning system.

3 Regulatory Framework

3.1 GENERAL

In order to determine whether the proposed alternative solution is satisfactory, acceptance criteria need to be set for the analysis. These acceptance criteria are expected to be appropriate to the analysis methods used, relate to the objectives of the performance assessment and be measurable (unless qualitative analysis proposed) and realistic.

The regulatory framework in Australia is spread over three levels of government, which are:

- Federal Government;
- State Government; and
- Local Government.

The Federal Government is responsible for the six states and two territories within the Commonwealth of Australia and coordinates the development of the national Building Code of Australia (BCA). The BCA contains the technical provisions for building design and is maintained by the Australian Building Codes Board.

The legislations and regulations required for the implementation of the BCA occurs at the State and Local Government level. Building approvals and occupancy permits are given by local council building surveyors and inspectors and in some cases by private building certifiers.

3.2 BUILDING CODE OF AUSTRALIA

One of the goals of the BCA is the achievement and maintenance of acceptable standards of fire safety for the benefit of the community. This goal extends no further than is necessary in the public interest, is considered to be cost effective and not needlessly onerous in its application.

The BCA has multiple levels within its hierarchy as depicted in Figure 3.1 where the only mandatory requirement for compliance is to the performance requirements of the BCA. This can be satisfied by either complying with the prescriptive provisions (Deemed-to-Satisfy) or via an alternative solution.

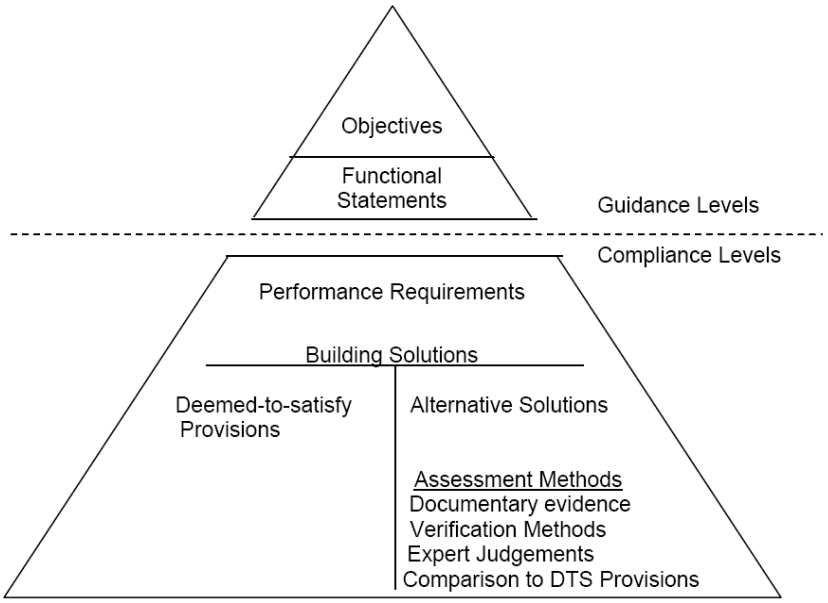

Figure 3.1 - BCA Hierarchy

Section A0.5 of the BCA outlines how compliance with the Performance Requirements can be achieved. These are as follows:

(a) complying with the Deemed-to-Satisfy Provisions; or

(b) formulating an Alternative Solution which –

  (i) complies with the Performance Requirements; or

  (ii) is shown to be at least equivalent to the Deemed-to-Satisfy Provisions or

(c) a combination of (a) and (b).

Section A0.9 of the BCA provides several different methods for assessing that an alternate solution complies with the Performance Requirements. These methods are summarised as follows:

(a) Evidence to support that the use of a material, form of construction or design meets a Performance Requirement or a Deemed-to-Satisfy Provision.

(b) Verification Methods such as:

  (i) the Verifications Methods in the BCA; or

  (ii) such other Verification Methods as the appropriate authority accepts for determining compliance with the Performance Requirements.

(c) Comparison with the Deemed-to-Satisfy Provisions.

(d) Expert Judgment.

Section A0.10 of the BCA provides methods for complying with provisions A1.5 (to comply with Sections A to J of the BCA inclusive). The following method must be used to determine the Performance Requirements relevant to the Alternative Solution: These methods are summarised as follows:

(a) Identify the relevant Deemed-to-Satisfy Provision of each Section or Part that is to be the subject of the Alternative Solution.

(b) Identify the Performance Requirements from the same Section or Part that are relevant to the identified Deemed-to-Satisfy Provisions.

(c) Identify Performance Requirements from the other Sections and Parts that are relevant to any aspects of the Alternative Solution proposed or that are affected by the application of the Deemed-to-Satisfy Provisions that are the subject of the Alternative Solution.

3.3 INTERNATIONAL FIRE ENGINEERING GUIDELINES

The International Fire Engineering Guidelines document has been developed for use in the fire safety design and assessment of buildings and reflects world's best practice. The document is intended to provide guidance for fire engineers as they work to develop and access strategies that provide acceptable levels of safety.

The document is particularly useful in providing guidance in the design and assessment of Alternative Solutions against the Performance Requirements of the BCA. The prescribed methodology set out in the International Fire Engineering Guidelines has been generally adopted in the fire engineering analysis.

4 Proposed Fire Safety Strategy

4.1 FIRE INITIATION & DEVELOPMENT

An initial review has been conducted to establish potential fire hazards for this building. The various preventive and protective measures have been identified to address the hazards, as listed in Table 4.1.

Area	Identified Fire Hazards	Preventative and Protective Measures
Production, Laboratory and Warehouse areas	Activities Processing and Analysing Repair and maintenance Disregarding safety procedures Ignition Sources Unauthorised smoking Electrical equipment Heating appliances Arson Fuel Load Stored goods Racked storage	Building Management Security General housekeeping Adherence to emergency procedures Evacuation plans Occupant training Fire Safety Systems Fire sprinkler system Fire hose reels Portable fire extinguishers Fire hydrants Occupant warning system Exit signage and emergency lighting
Office	Activities Administration Meeting Lunchroom Ignition Sources Unauthorised smoking Electrical equipment Heating appliances Arson Kitchen appliances Fuel Load Chairs and tables Rubbish bins Linings and coverings including blinds Books, folders and paper Storage cabinets and cupboards	Building Management Security General housekeeping Adherence to emergency procedures Evacuation plans Fire Safety Systems Fast Response, Light Hazard Fire sprinkler system Fire hose reels Portable fire extinguishers Fire hydrants Occupant warning system Exit signage and emergency lighting

Table 4-1 - Fire Hazards and Fire Safety Measures

4.2 FIRE GROWTH AND INTENSITY

The Chartered Institute of Building Services Engineers (CIBSE) Guide E [2] suggests fire growth rates for various types of occupancies as listed in Table 4.2.

Building Area Providing Fuel	Growth Rate	Building Area Providing Fuel	Growth Rate
Dwelling	Medium	Hotel reception	Medium
Office	**Medium**	Assembly hall seating	Medium-Fast
Shop	Fast	Picture gallery	Slow
Warehouse	**Ultra-fast**	Display area	Slow-Medium

Table 4.2 – Fire growth rates [2]

The above growth parameters suggest that for the initial heat release rate of the items likely to be found within this commercial building will be representative of a fire growth between a medium and fast t-squared.

4.3 SMOKE DEVELOPMENT & SPREAD

As a potential fire develops, smoke will be produced and this can provide a greater risk to life safety than the flames or heat from a fire. Once sprinklers activate, a reasonable amount of smoke and steam is still produced, even though this is generally cooler and the volume is reduced from that of a non-sprinklered fire. This smoke is to be managed primarily through compartmentation, containment and extraction through both active and passive systems.

4.4 FIRE SPREAD

The risk of fire spread is to be primarily mitigated through automatic sprinkler suppression. Floor to floor compartmentation and protection of shafts also provides a barrier against spread.

4.5 FIRE DETECTION, WARNING & SUPPRESSION

4.5.1 Sprinkler Suppression

The building is to be provided with automatic sprinkler suppression throughout in accordance with AS2118.1. Fast response heads are to be used. It is likely that recessed heads will be preferred at office levels. There may be specific requirements for specialist suppression systems depending on the tenancy and fit-out of the building. For example, it may be undesirable for wet suppression systems in computer server rooms, and a gaseous system may be more appropriate. Similarly, if extensive mobile shelving (compactus) is required, special provisions for the sprinkler system may be necessary to account for the risk of a sheltered fire developing.

The loading dock is expected to be fairly minor in scale servicing only medium sized commercial vehicles to enter. Consequently the sprinkler protection as per AS2118.1 is considered appropriate.

4.5.2 Fire Hose Reels

Fire hose reels are being provided and it is expected that full coverage can be achieved using 36m hoses.

4.5.3 Automatic Detection & Alarm

Fire alarm and detection to BCA Clause E2.2a will be provided throughout.

4.6 OCCUPANT EVACUATION

4.6.1 Evacuation Sequence

On activation of a general fire alarm alerts tones will sound on the fire floor then escalate to evacuation tones on the fire floor and alert tones on all other levels. On activation of a sprinkler, the evacuation sequence should commence immediately.

It is envisaged that travel distances may exceed those prescribed in the BCA DTS provisions due to fit out requirements. The assessment will consider any adverse affect this may have and make recommendations in mitigating this risk.

4.6.2 Egress Capacity

The egress stairs will be provided in accordance with the standard DTS provisions; i.e. four fire isolated stairs each with a minimum width of 1m, giving a nominal stair capacity of 100 people per stair per floor; this total capacity of 400 should exceed the likely floor population.

4.6.3 Mobility Impaired Evacuation

It is likely that there will be some proportion of mobility impaired occupants. Despite the BCA having little requirement for providing means of escape for mobility impaired occupants, it is considered to be appropriate to accommodate this within the strategy.

4.6.4 Signage & Lighting

Adequate exit signage and emergency lighting is to be provided in accordance with AS 2293.

4.7 FIRE BRIGADE INTERVENTION

The provision of sprinkler protection throughout is considered to greatly improve conditions for fire fighting operations.

4.7.1 Fire Hydrants

Each fire isolated stair is to be provided with a fire hydrant for fire brigade intervention and is expected to provide the necessary coverage requirements.

4.7.2 Fire Control

Adequate fire control facilities are to be provided in a fire control centre at ground level.

5 Trial Concept Design

The following concept design identified below details the requirements necessary to achieve an acceptable level of fire safety considering the above fire safety strategy.

The concepts are preliminary and all recommendations need to be verified by a detailed fire engineering assessment. All other items not specifically addressed are to be in accordance with DTS provisions of the BCA or as accepted by the relevant authorities.

Architectural and Compartmentation Requirements

(a) The building must have a minimum structural fire resistance level (FRL) in accordance with the BCA Type A fire resisting construction.

(b) Additional compartmentation requirement to ensure adequate smoke control between the connected levels of the building. The compartmentation will be a combination of both active and passive systems; utilising solid construction, drencher protected glazing as well as fire/smoke curtains separating each floor in fire mode.

Access and Egress Requirements

(c) Egress provisions in accordance with BCA DTS provisions with the exception of potential extended travel distances.

(d) Door hardware on all required exits, including main entrance doors, in accordance with current regulations such that all required exits shall be available for emergency egress.

Building Services Requirements

(e) An automatic fire sprinkler system should be provided throughout in accordance with relevant Australian Standards and Authority requirements throughout the building. The system should be designed and installed in accordance with AS 2118.1-1999. Including the following:

- (i) Exposed or semi-recessed sprinkler head (i.e. no fully recessed type sprinkler heads except in sterile areas such as lobbies and the like where little combustibles are present).
- (ii) Sprinkler activation temperature no greater than 68°C below ceiling throughout.
- (iii) Sprinkler response time index (RTI) of less than 50 $m^{1/2}s^{1/2}$ (i.e. fast response type).
- (iv) Class A fault monitoring devices shall be provided in accordance with AS 2118.1 requirements.

(f) Smoke detection system in accordance with BCA Clause E2.2a throughout all areas of the development except the basement car park(s) and loading dock.

(g) Emergency warning system in accordance with AS 1670.1 throughout all areas of the building.

(h) Zone smoke control in accordance with AS 1668.1 shall be provided throughout the building.

(i) Fire hose reels shall be provided in accordance with BCA DTS provisions.

(j) Portable fire extinguishers in accordance with the BCA DTS provisions.

(k) Emergency lighting and exit signage in accordance with the BCA DTS provisions and AS 2293

(l) Emergency lifts shall be provided in accordance with BCA DTS provisions.

(m) Fire control centre shall be provided in accordance with BCA Specification E1.8.

Commissioning and Maintenance Requirements

(n) Periodic inspection, testing and maintenance of all fire safety systems shall be implemented in accordance with regulatory requirements and AS1851.

(o) Under all circumstances, it is important to keep as much of the systems fully operational as is practical. Should any building works extend over a number of days, the system should be re-instated as far as practical at the end of each day.

(p) Maintenance contracts shall be in place and supplemented by building management on a regular basis.

Building Management Requirements

(q) Non-smoking policy shall be implemented throughout all covered areas of the building.

(r) Management procedures are to be incorporated so that Dangerous Goods and highly flammable fuels are not stored internally (i.e. no petrol, etc). Dangerous goods may only be stored if the method of storage is in accordance with the requirements of Dangerous Goods Act" and applicable regulations.

(s) A fire safety manual shall be developed to define the fire safety strategy for the facility, all fire protections systems present and a description of how they operate. The manual shall also include maintenance requirements and inspection procedures.

(t) The fire wardens shall be appointed and trained in emergency evacuation procedures and initial attack on fire when safe to do using fire hose reels and portable fire extinguishers. All staff shall be advised on the actions to take when they hear the occupant warning system.

(u) Implementation of emergency training and fire drills shall be undertaken at least every 6 months and within the first month from building occupation to familiarise staff with the alternate egress routes and location of the required exits.

6 Reference

[1] Australian Building Codes Board, 'Building Code of Australia 2008 Volume 1 Class 2 – Class 9 Buildings', May 2008.

[2] Inter-jurisdictional Regulatory Collaboration Council (IRCC), Australian Building Codes Board (ABCB), National Research Council of Canada (NRCC), United States of America and Department of Building and Housing, New Zealand (DBH), International Code Council (ICC), 'International Fire Engineering Guidelines', Edition 2005, March 2005.

[2] Chartered Institute of Building Services Engineers, "CIBSE Guide E – Fire Engineering", CIBSE Publications Department, Second Edition, 2003.