Sovereign Wynyard Centre Pty Limited

1 Carrington Street

Fire & Life Safety Report - DA

REP/229103

Rev B | 24 March 2014

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 229103

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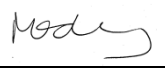
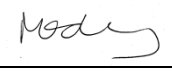
		Signature			
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Appendices

Executive Summary

This fire and life safety report has been prepared on behalf of Sovereign Wynyard Centre Pty Limited or its nominee referred to herein as Brookfield, as part of the submission for a Development Application (DA) for the proposed One Carrington Street development, Sydney. This report sets out the primary aspects of the fire safety strategy that relate to planning and the approval of the DA and has been prepared in accordance with the Director General's Requirements issued for the project.

The fire safety design of One Carrington will generally satisfy the Performance Requirements of the Building Code of Australia (BCA) by complying with the Deemed-to-Satisfy (DTS) Provisions. However, there are some aspects of the design that are developed using performance based fire engineering to achieve compliance with the Performance Requirements of the BCA. Detailed assessments of these fire engineering Alternative Solutions will be provided in subsequent reports following approval of the DA.

Based on our fire engineering assessment to date, it is considered that there are no issues that would affect the building layout arising from fire safety and hence no impediments to the Consent Authority issuing development consent.

1 Introduction

Arup has been engaged by Sovereign Wynyard Centre Pty Limited to develop a performance based fire safety strategy for the proposed One Carrington Street development in Sydney, NSW. The fire safety objective of this strategy is limited to achieving compliance with the Performance Requirements of the Building Code of Australia (BCA) [1], meeting the Director General's Requirements and avoiding an adverse effect on the fire and life safety of the existing Wynyard station. The edition of the BCA to be used for this project is yet to be determined, but is expected to be either the 2014 or 2015 edition (not yet released at the time of writing).

The purpose of this Fire & Life Safety Report is to support the Development Application (DA) for the One Carrington Street development in accordance with the Director General's Requirements issued for the project. This report sets out the principles of the fire safety strategy for the building, focusing on the interface with existing properties, most notably Wynyard Station. Required fire safety measures are advised on a broad level, with more detail to be provided in subsequent Fire Engineering Briefs and Fire Engineering Reports as the design progresses. This report sets out the primary aspects of the fire safety strategy that relate to planning and the approval of the Development Application.

The approach adopted by Arup is generally in accordance with the International Fire Engineering Guidelines (IFEG) [2] by adopting worldwide best practice and standards as outlined in Section 0.1.1 (of the IFEG). The document is used as general guidance on the analysis process without strictly following each individual sub-system as outlined in Section 1.3 of the IFEG which permits different approaches to demonstrate compliance. In addition the approaches outlined in the earlier Fire Engineering Guidelines [3] as well as the Society of Fire Safety Code of Practice [4] are adopted where appropriate.

The design for the building will incorporate the prescriptive Deemed-to-Satisfy (DTS) Provisions of the BCA where appropriate. However, where the DTS provisions are either inappropriate, or prove overly onerous or restrictive to the design, it will be demonstrated that the Performance Requirements of the BCA are achieved by a performance-based, fire engineered Alternative Solution. By satisfying the Performance Requirements of the BCA, an acceptable level of life safety will be achieved by the design.

This report discusses in broad terms some of the non-compliances with the DTS Provisions that are proposed to be addressed via fire engineering Alternative Solutions. Generally, the primary Alternative Solutions that are relevant for the DA are discussed; other Alternative Solutions, such as those for the office tower, will be outlined in subsequent reports following approval of the DA. It is noted that the non-compliances discussed in this report are those that Arup is aware of to date in relation to the DA and is by no means a comprehensive list, as the design is at an early stage of development.

In relation to the strategies, criteria and methodologies to be applied, in principle agreement will be sought with project stakeholders and appropriate regulatory authorities regarding their applicability and suitability.

Arup makes all reasonable efforts to incorporate practical and advanced fire protection concepts into its advice. It is to be recognised, however, that fire protection is not an exact science, and that no building design can guarantee freedom from either ignition or fire damage.

2 Project Description

This section describes Arup's understanding of the project, based on the drawings thus far produced, and other information provided by the project team. For a full description of the development, the reader is referred to the project documentation. The following brief description is provided to set the fire safety strategy in context.

2.1 Building Characteristics

The proposed One Carrington Street development is located around and above Wynyard Station. Key elements of this development include:

- Demolition of the Menzies Hotel building on Carrington Street
- Demolition of 301 George Street
- Construction of a new Premium grade commercial tower (27-storey tower with 71,230m² GFA, commercial and retail)
- Refurbishment of the adjacent Shell House heritage building (12-storey building with 10,611m² GFA, commercial and retail)
- Refurbishment of the existing 285 George Street heritage building (6-storey building with 2,780m² GFA, commercial and retail)
- Reconfiguration and refurbishment of some of the Wynyard Station unpaid concourse areas within the development site boundary, including the basement Hunter connection

The complete development will contain the following uses: car parking, loading dock, end of trip facilities, Wynyard unpaid concourse areas (within the site boundary) and Hunter Connection, retail, lobby/entry areas, plant, office levels and ancillary uses. Part of the development involves maintaining access and egress to and from Wynyard Station.

Access to different parts of the development is provided from George Street, Wynyard Lane and Carrington Street.

The building will be greater than 50m in effective height.

2.2 Documentation

This Fire & Life Safety Report is based on the project documentation as provided in Section 5.1.

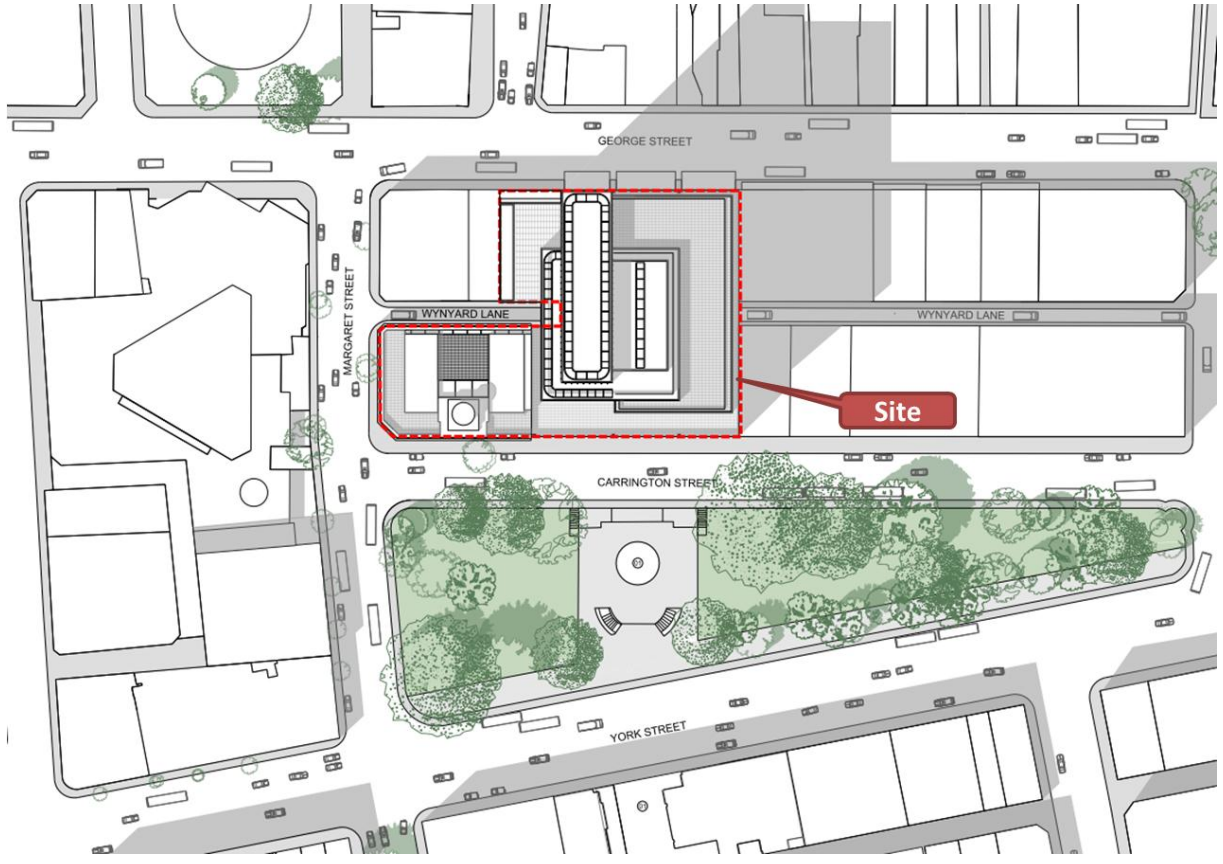

Figure 1 - One Carrington site plan

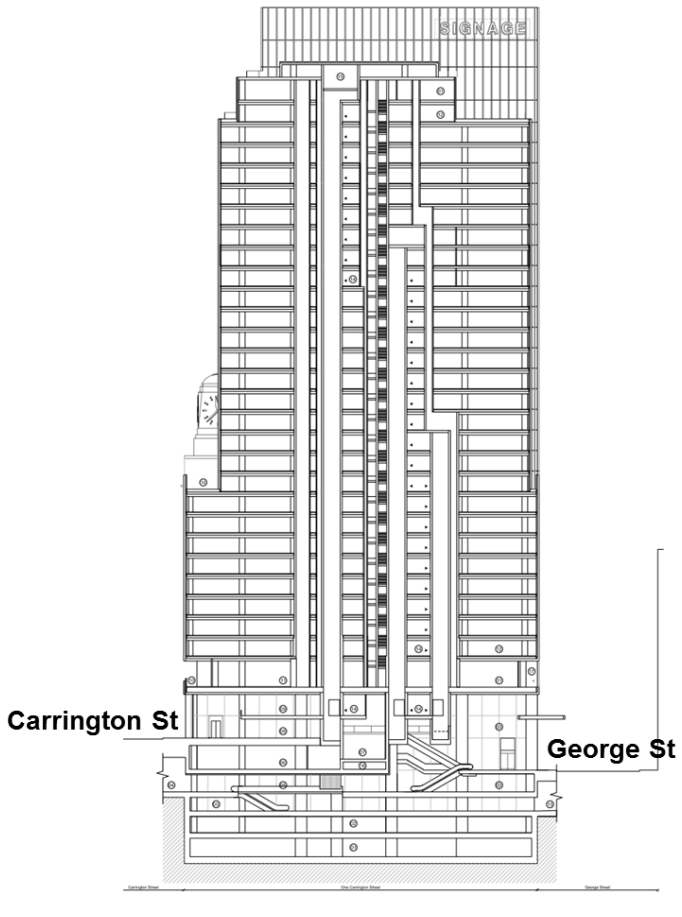

Figure 2 - Section (west-east)

3 Proposed Fire Safety Design Concept & Measures

3.1 Design philosophy

The concept of the fire safety strategy is to provide a design that gives a satisfactory level of occupant life safety, protection to other property and can facilitate Fire Brigade intervention. Fire engineering allows an increased level of design innovation and flexibility over a strictly code compliant design and can be used to design strategies that are particularly relevant to the fire safety risks of this building.

An important part of the development is the interface with Wynyard Station and maintaining access and egress to and from the station. This is described in more detail elsewhere in this report.

More details of the fire safety strategy are provided in the following sections. The fire safety strategy is based on the assumption that the fire safety provisions for the building are to comply with the DtS Provisions of the BCA except for the nominated departures described below. Note that more details of the required fire safety measures, including identification of all Alternative Solutions, will be outlined in subsequent reports later in the design. The fire safety measures described serve to outline the fire safety strategy for the DA and do not necessarily reflect the final set of required fire safety measures.

For clarity, the proposed fire safety measures are described as they relate to each portion of the One Carrington site.

3.2 Concourse/Hunter Concourse levels & Wynyard Station interface

1) The Concourse and Hunter Concourse levels will be connected to each other, to Carrington St and to George Street via open stairs and escalators. Egress provisions from these areas are described in detail in the assessment in Section 4.
2) The Fire Resistance Levels (FRLs) of construction elements, including fire-isolated stairways, are generally proposed to be in accordance with the DTS Provisions of the BCA for Type A construction, other than where noted below.
3) The FRL of the retail areas is proposed to be reduced from 180mins to 120mins via fire engineering assessment. Note that the primary columns for the commercial tower that run through the retail spaces are expected to achieve at least 180mins FRL due to their large section sizes.
4) It is necessary to maintain the operation of Wynyard Station during construction and for the final design to have no adverse effect on the current station. It is important to note that a train station is not intended to be designed under the BCA DTS Provisions; rather the fire strategy should be derived from first principles. A similar approach is taken for the interface between Wynyard Station and the One Carrington development, particularly as complete fire separation of the two is not feasible. This is because One Carrington must provide a link through the site between George Street and the station in a similar fashion to the existing arrangement. As large numbers of train passengers are required to pass through the One Carrington development, both in normal and emergency modes, the two areas cannot realistically be fire separated from one another through the middle of the existing concourse. This lack of fire separation will be addressed in detail as an Alternative Solution in subsequent fire reports.

5) The smoke hazard management strategy for these levels is to minimise the risk of smoke spread between levels. This strategy is anticipated to be achieved by providing smoke exhaust from all retail units, which is a common smoke exhaust strategy for retail malls, but is subject to further design development. It is also expected that smoke exhaust will be required from the Hunter Concourse area in order to reduce the risk of smoke spread between levels via escalator/stair voids and other openings.

6) Subject to design development, downstands may need to be provided around stairs and escalators as part of the smoke hazard management strategy.

7) It is assumed that the fire safety provisions in Wynyard Station are able to adequately control smoke from a fire in Wynyard Station. It is assumed that any smoke spread from Wynyard Station into One Carrington will be such that tenable conditions are still maintained for occupants within One Carrington. If smoke modelling data is received from Transport for NSW that demonstrates that smoke spread into One Carrington may result in untenable conditions in One Carrington, additional fire safety measures may need to be provided to mitigate this risk.

8) Automatic sprinklers are to be provided throughout in accordance with BCA Clause E1.5 and AS 2118.1:1999. It is proposed that fast response sprinkler heads will generally be provided throughout, other than in areas where fast response heads would be unsuitable (to be determined by the fire services designer). The sprinkler system shall be separately valved and monitored floor by floor.

9) Suitable means of detection will be provided on these levels, having due regard to the specific fire risks that are likely to be present. It is anticipated that a smoke detection system in accordance with AS1670.1:2004 will be required throughout.

10) A Sound System and Intercom System for Emergency Purposes (SSISEP) shall be installed in accordance with AS 1670.4:2004. The SSISEP shall be activated upon the activation of any smoke detection device, sprinkler or manual call point. A recorded voice message is required to assist in achieving the speediest occupant response to the alarm.

11) Fire hose reels in accordance with BCA Clause E1.4 and AS 2441:2005 are to be installed throughout the building. In achieving compliant coverage, fire hose reels may not pass through fire or smoke doors.

12) Fire extinguishers will be provided in accordance with BCA E1.6 (AS 2444:2001), particularly where a water-based fire fighting medium is inappropriate.

13) Fire hydrants are to be provided throughout the building in accordance with BCA Clause E1.3 and AS 2419.1:2005.

14) It is noted that the proposed pedestrianisation of George Street and introduction of Light Rail will also bring interfaces with the One Carrington development.

3.2.1 Met Centre

15) There is an existing pedestrian access between the Wynyard Concourse and the Met Centre that will be retained. The Met Centre link and the access to it from the Wynyard Concourse does not form part of the One Carrington development, but it is mentioned here for completeness. This pedestrian access does not serve as an emergency egress path from the station concourse (other than during the construction stage of One Carrington – this is described in Brookfield Multiplex's Construction Management Plan, referenced in Section 5.1). This is based on the understanding that there is local detection at the Met Centre/Wynyard Station concourse interface and that activation of these detectors results in a fire shutter automatically closing to separate the buildings.

3.3 Commercial tower

The commercial tower will span between George and Carrington Streets and will pass over the top of Wynyard Lane.

16) The commercial tower is proposed to largely comply with the BCA DTS Provisions, particularly for the required fire safety measures.

17) The office levels will be fire separated from all levels below (including plant, tower lobby, retail, concourse, Wynyard Station, loading dock etc).

18) The Fire Resistance Levels (FRLs) of the construction elements, including fire-isolated stairways, are generally proposed to be in accordance with the DTS Provisions of the BCA for Type A construction. There may be an opportunity through fire engineering assessment to reduce the fire rating of secondary structure throughout the tower; however, primary columns, beams and the slab are proposed to be 2 hour fire rated as per the DTS Provisions.

19) The commercial tower will likely be within 3m of the southern boundary of the site. In order to help protect against fire spread from the neighbouring property and to comply with the DTS Provisions, the non-fire rated façade is proposed to be provided with external wall-wetting sprinklers where within 3m of this southern boundary, unless analysis demonstrates that they are not necessary.

20) Façade openings for ventilation on the mezzanine plant level are currently proposed to be located above Wynyard Lane, within 3m of the adjacent building. Providing external wall-wetting sprinklers to these façade openings (louvres) would not be a DTS compliant solution for protection against fire spread. It is considered that this design can be addressed via a fire engineering Alternative Solution to demonstrate that the Performance Requirements of the BCA are met.

21) The commercial tower is to be provided with a minimum of two fire-isolated stairs serving all office levels. Each stair is proposed to have a clear width of 1.25m.

22) Options will be investigated for allowing a range of occupant densities on the office floors in lieu of the suggested 10m² per person given in BCA Table D1.13.

23) A zone smoke control system to AS1668.1-1998 shall be provided to the commercial tower.

24) It is proposed to omit subducts from return air shafts (required by AS1668.1-1998) and replace them with combined motorized fire and smoke dampers. The dampers shall not be provided with a thermal device/fusible link, as they need to be open on the fire floor to provide a smoke spill route for the smoke management systems. The dampers shall be connected to the emergency power supply for the building which will provide a secondary means of power supply in the event of failure of the normal supply. Dampers shall fail safe closed on loss of power.

25) An automatic stair pressurisation system in accordance with AS1668.1-1998 shall be provided to the fire-isolated exit stairs that serve the commercial tower.

26) Automatic sprinklers are to be provided throughout the building in accordance with BCA Clause E1.5 and AS 2118.1:1999. It is proposed that fast response sprinkler heads will generally be provided throughout, other than in areas where fast response heads would be

unsuitable (to be determined by the fire services designer). The sprinkler system is anticipated to be be separately valved and monitored floor by floor.

27) External wall-wetting sprinklers are required (by the DTS Provisions) to any sections of non-fire rated façade that are within 3m of a boundary. Specific details of the location and extent of external wall-wetting sprinklers will be developed as the design progresses.

28) A combined sprinkler hydrant system is currently proposed. This would be designed in accordance with AS 2118.1:1999, AS 2118.6:1995 and AS 2419.1:2005.

29) It is anticipated that the fire strategy will require a smoke detection system in accordance with AS1670.1:2004 to be installed throughout the building to give flexibility for extended travel distances. Travel distances are anticipated to be in the order of:

- 30m to a point of choice;
- 50m to the nearest exit; and
- 80m between alternative exits (when measured via the point of choice).

An Alternative Solution is proposed to justify these travels distances as they exceed the DTS limits.

30) Manual call points are proposed to be provided throughout the building and installed in accordance with AS 1670.4:2004.

31) A Sound System and Intercom System for Emergency Purposes (SSISEP) shall be installed throughout the development in accordance with AS 1670.4:2004. The SSISEP shall be activated upon the activation of any smoke detection device, sprinkler or manual call point. A recorded voice message is required to assist in achieving the speediest occupant response to the alarm.

32) A phased evacuation regime will be employed. Evacuation zones and the cascading sequence will be determined later in the design.

33) Strobe lights are required for plant rooms containing noisy equipment to assist in occupant warning. As guidance, the requirement of AS 1670.4 is that the loudspeakers shall have a sound pressure level not less than 10dB above ambient sound levels. Therefore, the loudspeakers are required to be audible within the room, taking into account the noise levels within the plant room during fire mode (e.g. whether the mechanical equipment will be operating in fire mode). There is an upper limit to the sound levels emitted by the loudspeakers (as per AS 1670.4), which is 105dB. In the few rooms where the ambient sound level is high in a fire event, strobe lights will provide a form of redundancy, alerting any maintenance staff within the room of a fire event.

34) Fire hose reels in accordance with BCA Clause E1.4 and AS 2441:2005 are to be installed throughout the building. In achieving compliant coverage, fire hose reels may not pass through fire or smoke doors.

35) Fire extinguishers will be provided in accordance with BCA E1.6 (AS 2444:2001), particularly where a water-based fire fighting medium is inappropriate.

36) Fire hydrants are to be provided throughout the building in accordance with BCA Clause E1.3 and AS 2419.1:2005. As noted previously, a combined sprinkler hydrant system will be provided. Hydrants are to be provided in all required fire-isolated stairs as required by AS 2419.1:2005. Additional on-floor hydrants may be provided if required to achieve adequate coverage throughout the building. On-floor hydrants shall be in locations compliant with AS 2419.1:2005. Full hydrant coverage is to be likely to be provided with the use of a single hose length (unless from external hydrants, which may utilise two hose lengths), which is the preferred operational procedure for fire attack by FRNSW.

37) Emergency lifts shall be installed in accordance with BCA Clause E3.4, as the effective height of the building is more than 25m.

3.4 Shell House

38) Shell House forms part of the One Carrington development. It is proposed that Shell House will have a complete refurbishment, including full upgrade to the current BCA to bring in alignment with the new commercial tower. The required fire safety measures for the Commercial Tower are also proposed to apply to Shell House, unless the buildings form two separate buildings as per BCA, in which case Shell House will require fire safety measures for a building over 25m, but not over 50m..

39) It is assumed that the FRLs of all retained structure in Shell House will meet the minimum DTS requirements.

3.5 285 George Street

The building at 285 George St forms part of the One Carrington development. It is proposed that the lower four levels will be retail floors, with the upper levels remaining as office floors. 285 George St is understood to be greater than 25m in effective height.

It is proposed that 285 George Street will undergo a full upgrade to meet the Performance Requirements of the BCA. This means that a second exit will be required from each level and the fire safety measures will be the same as those required for the Commercial Tower. By undertaking a full upgrade to the current BCA, it will allow 285 George Street to connect through to One Carrington without requiring fire separation between the two buildings. This will allow good flexibility for future use of 285 George St and interconnection to One Carrington at multiple levels.

3.6 Car park & loading dock areas

40) Through fire engineering assessment, it is proposed that the FRL of the loading dock will be reduced from 240mins to 120mins. Other FRLs in these areas are proposed to comply with the DTS Provisions for Type A construction.

41) It is expected that an automatic stair pressurisation system in accordance with AS1668.1-1998 will be required to the fire-isolated exit stairs that serve these levels.

42) Car park ventilation systems should operate in fire mode as per AS 1668.1:1998.

43) Automatic sprinklers are to be provided throughout in accordance with BCA Clause E1.5 and AS 2118.1:1999. It is proposed that fast response sprinkler heads will generally be provided throughout, subject to design.

44) It is anticipated that sprinklers and manual call points will form the means of detection in these areas, rather than smoke detection, which is inappropriate due to vehicle fumes.

45) A Sound System and Intercom System for Emergency Purposes (SSISEP) shall be installed throughout the development in accordance with AS 1670.4:2004. The SSISEP shall be activated upon the activation of any sprinkler or manual call point. A recorded voice message is required to assist in achieving the speediest occupant response to the alarm. Note that the SSISEP voice announcements within the car park and loading dock areas are unlikely to meet the required speech intelligibility levels due to the reverberative environment however the system is still to contain the voice message and evacuation tones.

46) A phased evacuation regime will be employed. Evacuation zones and the cascading sequence will be determined later in the design.

47) Strobe lights are required for plant rooms containing noisy equipment to assist in occupant warning. As guidance, the requirement of AS 1670.4 is that the loudspeakers shall have a sound pressure level not less than 10dB above ambient sound levels. Therefore, the loudspeakers are required to be audible within the room, taking into account the noise levels within the plant room during fire mode (e.g. whether the mechanical equipment will be operating in fire mode). There is an upper limit to the sound levels emitted by the loudspeakers (as per AS 1670.4), which is 105dB. In the few rooms where the ambient sound level is high in a fire event, strobe lights will provide a form of redundancy, alerting any maintenance staff within the room of a fire event.

48) Fire hose reels in accordance with BCA Clause E1.4 and AS 2441:2005 are to be installed throughout the building. In achieving compliant coverage, fire hose reels may not pass through fire or smoke doors.

49) Fire extinguishers will be provided in accordance with BCA E1.6 (AS 2444:2001), particularly where a water-based fire fighting medium is inappropriate.

50) Fire hydrants are to be provided throughout the building in accordance with BCA Clause E1.3 and AS 2419.1:2005. As noted previously, a combined sprinkler hydrant system will be provided.

51) Emergency lifts shall be installed in accordance with BCA Clause E3.4, as the effective height of the building is more than 25m.

3.7 Wynyard Lane car park

52) A connection through to the existing Wynyard Lane car park will be provided in order to maintain access to this car park. It is assumed that DTS compliant fire separation and egress requirements are provided between Wynyard Lane car park and the One Carrington site. It is noted that there is an existing opening between the One Carrington site and the Wynyard Lane car park for vehicle access.

3.8 Fire brigade provisions

In addition to the measures described in the sections above, the following provisions are designed to allow efficient fire brigade intervention during any incident occurring within the One Carrington development.

53) The hydrant booster assembly is proposed to be located on Wynyard Lane alongside Shell House, as illustrated in Figure 3 (indicative location only). This location is subject to agreement with Fire & Rescue NSW (FRNSW), who will be consulted after a DA has been approved. It is noted that there is precedent for other buildings on George Street to have their boosters located on Wynyard Lane, including existing buildings and also new buildings currently under development.
- The design team will consider the implications of an alternative booster location (for example, on Carrington Street), should the proposed Wynyard Lane location not be accepted by FRNSW.

54) As the building is greater than 50m in effective height, a Fire Control Room is to be provided complying with BCA Specification E1.8. An indicative location is suggested in Figure 3 and is subject to further design development.

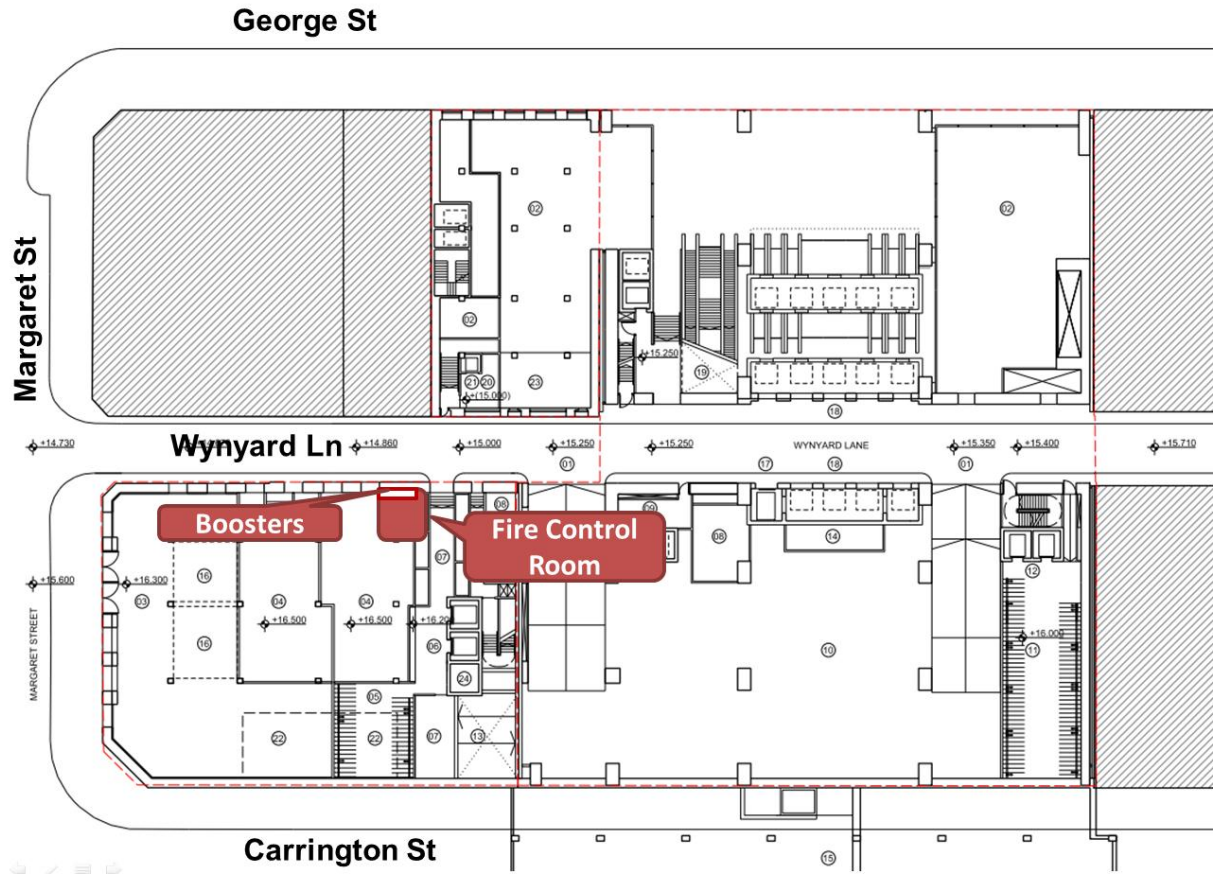

Figure 3 - Indicative fire booster and FCR locations (subject to design development and agreement by FRNSW)

3.9 Fire Safety Management & Maintenance

It should be noted that the maintenance of fire and other safety systems is a mandatory requirement for building owners under the provisions of the Environmental Planning and Assessment Act 1979 and the Environmental Planning and Assessment Regulation 2000.

All fire safety measures required by relevant Deemed-to-Satisfy provisions or the Alternative Solutions are considered to be essential to the performance of the Building Solution and must be maintained so that they are capable of operation in the event of fire in accordance with the standard to which they were originally designed and installed. AS 1851 is recommended to be followed for all fire safety features of the building.

The building is required to be managed under a fire safety policy which includes:

- A fire safety management plan in accordance with AS 3745; including procedures for the safety of people in buildings, structures and workplaces during emergencies, the appointment of an Emergency Planning Committee and setting up of an Emergency Control Organization.
- Good house-keeping and fire prevention procedures such as maintaining clear evacuation routes.
- Regular maintenance of all fire safety systems as outlined above.

4 Egress from Concourse

An important part of the development is to maintain the pedestrian connection between Wynyard Station and George Street, via the One Carrington site. With this come emergency egress provisions. This section of the report outlines the proposed emergency egress provisions from the concourse.

4.1 Occupant numbers

The emergency egress widths need to work for any time period during any day up to the year 2060, as per the planning requirements.

There are also special events, during which station operations are altered to cater for increased occupant numbers, often with a large bias for travel in one direction at any one time. Such special events include New Year's Eve and Anzac Day. For the special events management procedures are a significant part of the people safety strategy and are required to address potential issues associated with the additional patronage. The base building design is to cater for the day to day maximums without a management overlay.

The most onerous normal time periods in a day are the AM peak period (6am to 9am) and the PM peak period (4pm to 7pm), due to the large patronage numbers.

A static analysis has been used to determine the required egress width through One Carrington development. For this analysis, it is assumed that the platform to concourse travel elements are fully utilised in the egress direction, as this places the maximum load on the concourse exits. This means that the analysis is not reliant upon the detailed occupant numbers on trains and platforms and can accommodate train delays and patronage growth over years (provided the station still works with respect to safety at platform levels).

4.2 Design scenario

The scenario that drives the fire emergency egress width requirements is the PM peak period, because escalators at the station entry/exit points are biased towards moving occupants out of the station in the AM peak, compared with moving occupants into the station in the PM peak. This means that the available egress is less in the PM peak than the AM peak.

This is especially relevant for the number of escalators running into the station, as escalators cannot (easily) be made to automatically reverse direction and therefore those escalators that are flowing into the station are not be considered as available for egress.

4.3 Platform to concourse widths

The effective width of stairs from the platforms to the concourse is 25.8m (this is made up of 11.3m from P5/6 to concourse and 14.5m from P3/4 to concourse). Effective stair width allows for a 150mm boundary layer inside each handrail. Therefore, a 1500mm wide stair has an effective width of 1200mm.

The flow rate of occupants into the unpaid concourse given by this exit width must then be matched by the flow rate of occupants out of the unpaid concourse to prevent queuing in the unpaid concourse.

4.4 Wynyard Station Concourse layout

The proposed future egress widths from the concourse are anticipated to be as per Figure 44 below, with the exception of the connection to George St. The width of platform to concourse travel elements is also shown on the below figure.

The widths include known proposed upgrade works to the existing station facilities, including:

- Construction of the Wynyard Walk project, including the Wynyard Connection;
- Widening of pinch points at the northern concourse fire escape stairs, which is anticipated to occur as part of the Wynyard Walk project;
- Removing the stair adjacent to (on the eastern side) the York Street escalators, which is believed to be required as part of the Wynyard Walk project;
- The addition of a new stair from Platforms 3/4 to the concourse. This is to be at the southern end of the paid concourse, where the existing male toilets are.

The Met Centre is not considered to serve as an emergency egress path from the station concourse.

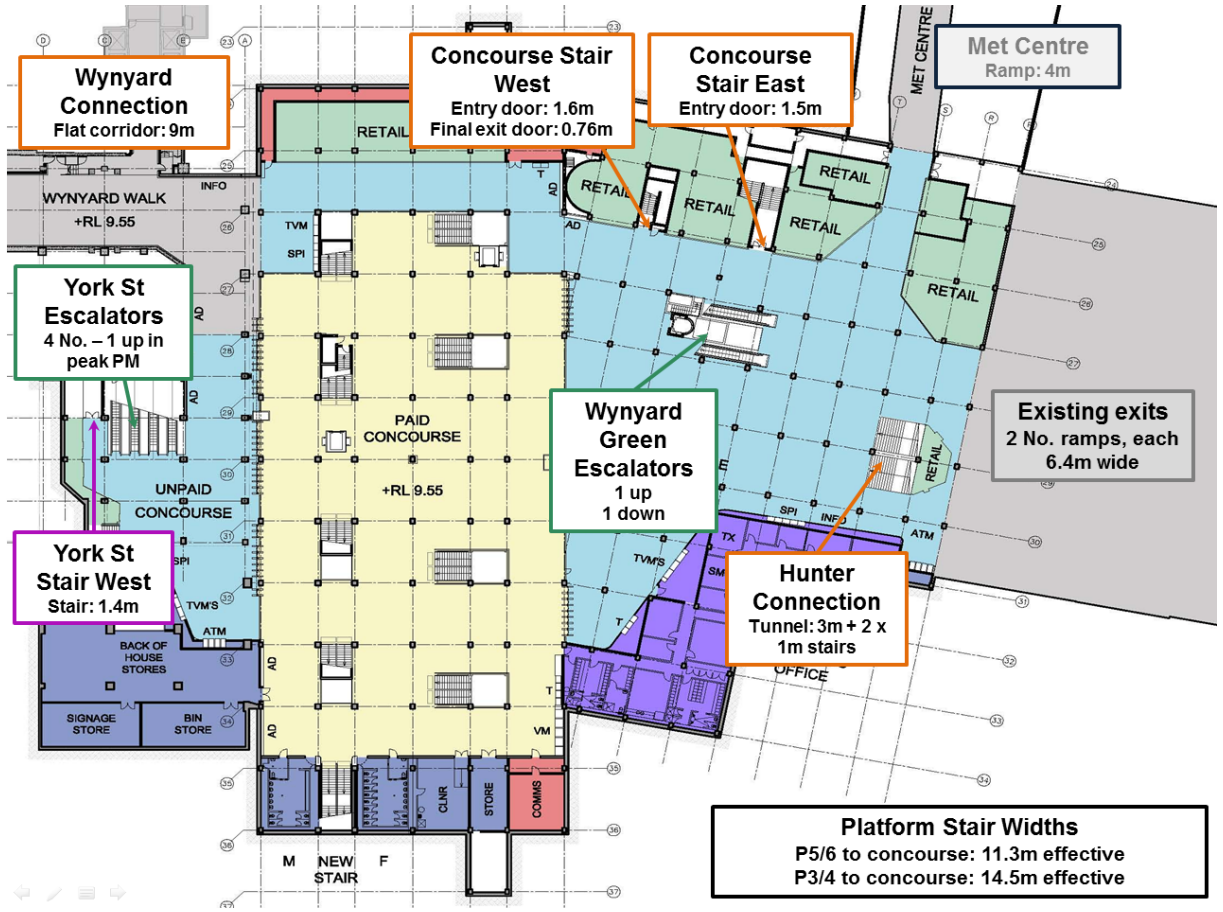

Figure 4 - Proposed Wynyard Concourse layout

The analysis below considers egress capacity requirements up to 2060 based on the concourse layout shown above being applicable. Any future major station developments are not considered, as it is assumed that these would include appropriate emergency egress. .

4.4.1 Concourse exit widths

Referring to the concourse layout shown above, the following table shows the PM peak concourse effective exit widths for various elements (colours in the table below relate to colours on the concourse diagram for various egress elements). This **does not** include exits through One Carrington to George Street, but does include the Hunter Connection.

Area	Stairs (m)	Flat/ramp/door (m)	Escalators
Concourse exits (excl. to George St)	1.1	11.2	1
Hunter connection	1.4 #	2.7	
Sub-totals	**2.5**	**13.9**	**1**
Sub-total equivalent stair widths*	2.5	20.9	2

* Equivalent stair widths are 1:1 for stairs, 1:1.5 for flat/ramp/door, 1:2 for escalators, as per assumptions below

Assumes that the visibility of the stairs from the Hunter Concourse is improved.

The total equivalent stair width for concourse exits, other than those to be provided through One Carrington, but including the Hunter Connection, is 25.4m.

The One Carrington development needs to provide sufficient exit width from the unpaid concourse (within the One Carrington site boundary) up to George Street to accommodate the shortfall in egress widths/flow rates from the concourse, based on the difference between platform to concourse widths and concourse exits not via One Carrington (but including Hunter connection).

That shortfall is 0.4m of equivalent stair width, which could be achieved by a single stair or escalator flowing out of the station. However, this analysis is simplistic and other considerations need to be addressed such as the impact of contraflow, the visibility of the exits, the mix of stairs/escalators/ramps. Allowances will need to be made for additional exit width to compensate for such factors. These are discussed below.

4.5 Assumptions

Static egress assessments require simplifying assumptions, as they are not suited to modelling complex fluctuations in flow speeds and directions over time. The following assumptions have been used to simplify the analysis at this early stage of design:

- Evacuation of unpaid concourse occupants does not delay platform occupants. This is considered to be slightly optimistic and an allowance for additional exit width is be made to offset this.
- No-one enters the station unpaid concourse against egress flow. This is an optimistic assumption for the PM peak and is unlikely to be fully realised, even with additional measures aimed at limiting occupant numbers continuing to enter the station. An allowance for additional egress width is incorporated to offset the impact of this contraflow at each of the many station entry points, not just those via One Carrington.
- All platform to unpaid concourse stairs are used to their maximum extent simultaneously. This is conservative as it gives the maximum flow rate into the unpaid concourse.
- Paid concourse to unpaid concourse gateline is ignored on the basis that it will not limit flows.
- All unpaid concourse exits are used to their maximum extent simultaneously. Although this is in line with NFPA 130, it is slightly optimistic and an allowance for additional egress width is considered to offset sub-optimal exit usage. This is especially applicable for less obvious/visible exits, which are unlikely or less likely to experience contraflow. Those exits for which contraflow is most likely are not considered to need a further allowance, as those exit/entry points are likely to be known to station occupants.
- A fire blocking an exit does not need to be considered in this egress assessment.
- Applicable egress flow rates are as follows:
  - Stairs: 50 people/minute/metre effective width
  - Flat/ramp: 75 people/minute/metre effective width (≡ 1.5m stair)
  - Escalators: 100 people/minute/metre effective width (≡ 2m stair)

  The flow rates of the flat areas/ramps and escalators are converted into equivalent effective stair width (as shown in brackets above), so that flows from the platform to concourse and then from concourse to the station exits can be compared. The analysis is presented in terms of effective width of stair.
- The number of escalators included for in the egress capacity calculations is the number of escalators normally running out of the station during PM peak periods, less one, which may be stopped due to failure or for maintenance. The exit width from the concourse should not be excessively reliant upon escalators, which may be interpreted as not more than 50% egress capacity via escalators (which is in accordance with NFPA 130).
- It is assumed that Wynyard Walk is always available for emergency egress and is adequately designed to cater for emergency evacuations.

The potential for contra-flow that may be experienced (i.e. occupants continuing to enter the station in the event of an emergency incident) is a significant factor in the egress assessment. The introduction of additional measures to reduce the number of people entering the station in the event of a fire during the PM peak period would facilitate speedier evacuation of the station and assist in minimising the required egress widths. Such measures may be introduced at a later stage in the design and could include active signage and warning lights/sounders at station entry portals.

Note that the assessment presented here is for emergency egress only. Normal mode pedestrian access and egress is covered in the pedestrian planning reports.

4.6 Proposed width provided to George St/Wynyard Ln

A review of the current design for the DA, shows that the following egress elements are currently included:

Link to George Street
6 escalators (three flow out during PM peak)
Three stairs with *minimum* aggregate clear width of 3.4m (measured between handrails). We note that the DA drawings appear to show slightly width more than this minimum value.

Stairs to Wynyard Lane
Two 1m wide fire egress stairs

Link to Hunter Connection
Already accounted for in previous table

This equates to an equivalent stair width from the concourse to George Street/Wynyard Lane of:

- Stairs to George Street: minimum 3.4m (across three. stairs) = 2.86m effective stair width*
- Stairs to Wynyard Lane: two 1000mm wide stairs = 1.4m effective stair width*
- Escalators: three ≡ 6.0m effective stair width

Total effective stair width = 10.26m

* Effective stair width allows for a 90mm boundary layer inside each handrail. Therefore, a 1500mm wide stair has an effective width of 1320mm. Note that for the fire stairs, a boundary layer of 150mm has been applied per stair, which also allows for the doors into the stairs.

This design results in approximately 38% more exit width from the station concourse than the platform to concourse widths. Given the proposed layout, this is considered by Arup to be a reasonable allowance at this stage of the project to offset the considerations identified above.

The minimum stair width advised above is based on the expected operation of the six escalators in the PM peak being 3 up (to George St) and 3 down (to Concourse level), as advised by the Pedestrian Planner for One Carrington.

4.7 Construction Management Plan

Arup has reviewed the Construction Management Plan (see reference in Section 5.1) and confirms that the plan accurately reflects the egress provisions that have been determined by Arup as being required to maintain adequate egress from the Wynyard Station concourse during normal operations. We note that the Construction Management Plan requires modifications to the connection through to the Met Centre prior to Phase 2, in order to allow egress through to the Met Centre during construction. Also, the Construction Management Plan relies on Wynyard Walk being available for emergency egress from Phase 3 onwards.

5 References

5.1 Project Documentation

This report is based on the documentation listed below:

- Architectural drawings prepared by Make + Architectus, as follows:
  Drawing no. DA2000 – DA2041 and DA2100 – DA2201, Rev 00, 'Development Application Submission', dated 19/03/14
- Construction Management Plan, One Carrington Street, prepared by Brookfield Multiplex Constructions on behalf of Sovereign Wynyard Centre, dated 5 March 2014

5.2 Information References

[1] Australian Building Codes Board. *National Construction Code Series – Building Code of Australia - Class 2 to Class 9 Buildings – Volume One*. Australian Building Codes Board, Canberra ACT, Australia

[2] Australian Building Codes Board (2005). *International Fire Engineering Guidelines – Edition 2005*. Australian Building Codes Board, Canberra ACT, Australia

[3] Fire Code Reform Centre (1996). *Fire Engineering Guidelines – First Edition*. Fire Code Reform Centre Limited, Sydney NSW, Australia.

[4] Engineers Australia Society of Fire Safety (2003). *Code of Practice for Fire Safety Design, Certification & Peer Review in accordance with the Building Code of Australia*. Engineers Australia Society of Fire Safety, Australia

Appendix A

Objectives, Assumptions and Limitations

A1 Fire Safety Objectives

The Building Code of Australia (BCA) [1] gives a number of Performance Requirements that a building solution must achieve for fire safety. The purpose of these requirements is to:

- Provide adequate occupant life safety;
- Assist the protection of other property; and
- Facilitate Fire Brigade operations.

The objectives will be further refined in the development of the Fire Engineering Brief report used as a basis of Stakeholder consultation.

A1.1 Compliance with the Building Regulations

The Building Regulations state that the building must comply with the BCA.

BCA Clause A0.4 states: "a building solution will comply with the BCA if it satisfies the Performance Requirements".

Therefore, the Performance Requirements are the only part of the BCA with which a design must comply. The BCA Objectives and Functional Statements are given as guidance to explain the intent of the Performance Requirements.

Clause A0.5 of the BCA states the methods whereby compliance with the Performance Requirements may be achieved, by-:

(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).

Accordingly, the Alternative Solutions, of this report will be demonstrated to comply with the Performance Requirements using Clause A0.5 (b) of the BCA.

Fire brigade safety during operations is considered to be primarily achieved through Fire Brigade operational procedures. However, the BCA requires that the design and systems facilitate Fire Brigade operations.

Subject to any limitations imposed by the commercial terms of our appointment, the approach adopted by Arup is generally in accordance with the International Fire Engineering Guidelines [2] and the earlier Fire Engineering Guidelines [3], as well as the Society of Fire Safety Code of Practice [4] where appropriate.

Any Alternative Solution will be subject to the approval of the Project Certifier.

A2 Assumptions and Limitations

A2.1 General Assumptions

Any change to the building design or use may mean that the assumptions are not valid, in which case the report is to be reviewed by a suitably qualified Fire Safety Engineer and/or Building Surveyor. The conclusions of this report may not be valid if the assumptions are incorrect.

The following assumptions have been made in this report:

- All fire safety aspects of the development which are not addressed within this report comply with the design standards adopted at the time of construction, unless otherwise noted.
- The assessment and analysis are based on the assumption that the development is complete and operational, apart from the review of the Construction Management Plan.
- Any significant changes to the design drawings and/or specifications will be referred to the relevant Fire Safety Engineer for review prior to acceptance.
- It is assumed that the design drawings and specifications supplied and upon which this assessment is based, as detailed within this report, are accurate with respect to the final as-built condition of the facility (as far as can be expected at DA stage). No liability is taken for the accuracy of the supplied documentation, which forms the basis of this assessment.
- All occupants are assumed to be alert and awake, but not necessarily familiar with the building layout or fire-fighting systems and facilities, particularly in the concourse and retail areas.
- All staff in the Commercial Building are assumed to be awake and familiar with the building, the locations of exits and the actions to take in the event of a fire.
- The fire safety strategy for One Carrington assumes that Wynyard Station has its own fire safety strategy that is appropriate for the fire safety risks of such a facility. The fire safety strategy for One Carrington therefore does not consider large scale fire events within Wynyard Station, other than accounting for occupant egress from the station to George Street.

A2.2 Limitations

Any limitations which are not complied with may invalidate the conclusions of this report, and hence are to be referred to a suitably qualified Fire Safety Engineer for review.

- Any change in the building, occupant characteristics or fuel conditions outside the parameters of this report may invalidate the conclusions of this report.
- The conclusions of this report may not apply if all requirements are not fully implemented as described in this report.

A2.3 Arson

The client has not indicated that the subject facility is considered a likely target for organised terrorist or criminal arson attack and has not requested that deliberate large scale malicious arson events be included in our fire engineering assessment of Alternative Solutions.

However, in accordance with the International Fire Engineering Guidelines (IFEG) [2], fire engineers are required to consider the possibility of single ignition arson events, in addition to accidental fires. There are two basic approaches under accepted practice for the consideration of arson; i.e. prevention or protection. Either of these approaches is acceptable in accordance with the IFEG, as described by Costello and Gildersleeve.

- The "Protective" approach would involve assessing the impact of escalating the design fire scenarios to test the sensitivity to accelerated fire growth rates, failure of sprinklers, fires occurring in unlikely locations etc. which would potentially lead to more onerous requirements being placed on the design.
- The "Preventative" approach would aim to minimise the possibility of a malicious attack, by use of suitable security measures.

It is assumed that the client prefers not to adopt the protective approach and will therefore prefer to rely on building security and/or operational measures to reduce the risk of arson. The specification of suitable measures lies outside the scope of this report however the reader is directed to the UK arson prevention website and the recommendations contained in the Fire Protection Association handbook on the Prevention and Control of Arson.

It is noted that Wynyard Station could be considered a potential target for organised terrorist of criminal arson attack. It is assumed that Transport for NSW has suitable security and management-in-use measures in place to mitigate the risk of these malicious attacks.

A2.4 Exclusions

This report does not assess the level of property protection, business interruption or environmental protection associated with the development. The assessment is limited to compliance with the Building Regulations, which excludes the above issues.

This report does not address insurance issues. It is recommended that relevant insurers are advised of the contents of this report, so that insurance issues can be appropriately addressed between the building owner and/or operator and their insurer.

Issues related to Occupational Health and Safety or community protection are outside the scope of this report, except where directly relevant to the Alternative Solutions presented.

With regard to arson protection, the assessment considers only an amateur attack of limited proportions. Organised criminal or terrorist attacks have not been considered. The client has not indicated that the subject facility is considered to be a likely target for this type of attack and has not requested that it be included in the assessment.