Wynyard Station – Fire & Life Safety

1.0 Existing Wynyard Station

The current Wynyard Station is located beneath Wynyard Park in the heart of Sydney's CBD. It was built in the 1920's. The design of the steel framed "cut and cover" box enclosing the platforms and station concourse has made major upgrades of the station impossible without the station being closed to passengers and through traffic.

It is important to note that the standard of construction in the 1920's comprised the following elements:

- Structural elements made from steel structural members
- Large compartment sizes
- Large travel distances to exits or from dead ends
- Egress capacities based upon assumptions made as part of the 1920's design.
- Rudimentary fire and life systems

2.0 Improvements to Wynyard Station

In order to bring Wynyard Station up to a world class station (in terms of Fire and Life Safety) it is important that the Station comply with the current industry standards including those specified by RailCorp and the requirements contained within the Building Code of Australia.

A BCA compliance review of the existing Wynyard Station has identified that the following issues would need to be addressed to ensure compliance with the BCA.

- Fire resistance of the unprotected steel structure would need to be increased to ensure adequate structural stability in case of fire
- The excessive compartment size would need to be addressed by performance-based solution or reduced to comply with the Performance Requirements of the BCA.
- The egress provisions would need to be enhanced so that dead-end travel distances and distances to exits are decreased while increasing the exit capacity of the station.
- Changes would be required to the Smoke Hazard Management arrangements to cater for smoke exhausts from the platforms and concourse.

A review against the requirements contained within the RailCorp guidelines for fire and life safety has identified similar issues to the BCA review. These included:

- Egress arrangements would need to be significantly improved.
- Smoke control provisions would need to be upgraded.
- Levels of fire-resistance within the station would need to be upgraded to match RailCorp requirements; and
- Smaller compartmentation within the station would be required to comply with the guidelines.

The issues identified above are the major issues identified by Stephen Grubits and Associates Pty Ltd as part of the fire and life safety study undertaken for Thakral. Previous documentation relating to fire and life safety of Wynyard Station is referenced below:

- Stage 1 Report Wynyard Station, Fire & Life Safety Study, Report 2003/220 R6.0 August 2003
- Fire Safety Strategy, 'City One', George & Carrington Streets, Sydney, NSW, Report 2003/220.1 R1.0, June 2005
- Preliminary Fire Safety Strategy, CityOne, Report 2007/206 R3.0, October 2007

3.0 Concept Design

3.1 Thakral Concept Design

Thakral's concept design addresses where possible the necessary fire and life safety improvements for the Wynyard station in the following ways:

- fire and smoke compartmentation;
- smoke hazard management; and
- fire and smoke isolated egress routes.

This fire safety strategy is incorporated in the Station Concept Design as documented within the Hassell WYNYARD STATION CONCEPT STUDY - REVISION B - Dated 7 July 2008.

The fire and life safety strategy focuses on improving the fire safety systems to provide a station that complies with the RailCorp guidelines, the Building Code of Australia and achieves the objectives advised to Thakral by RailCorp.

The proposed Concept is based upon a fire safety strategy for Wynyard Station which consists of the following elements:

- Provide levels of fire resistance for the station structure (consistent with the nominated standards) to withstand the burn-out of a train carriage without structural failure (apart from localised damage/spalling).
- Provide adequate levels of fire resistance for the concourse area structure to withstand the reasonable worst-case fire scenarios identified.
- Provide smoke control that will provide for tenability for the reasonable worst-case station fire scenarios.
- To ensure early warning to occupants by way of provision of a smoke detection and EWIS system throughout.
- Provide sufficient egress to permit evacuation of the platform within 4 minutes.
- Provide sufficient egress to permit evacuation to a place of safety within 6 minutes.
- Provide automatic suppression systems for areas containing significant fire loads.
- Provide fire isolated egress routes from the platform to permit alternative evacuation routes in case of a concourse fire.

- Provide adequate means for emergency services personnel to undertake intervention including search and rescue.
- Provide adequate systems for manual fire fighting by emergency response personnel and occupants.
- Provide adequate emergency management systems to initiate and control emergency response measures.
- Provide a management in use plan to identify any conditions necessary for compliance with the fire-engineered design so that they can be maintained and certified accordingly.
- Provide emergency management and evacuation plans to ensure orderly and effective evacuation in the event of an emergency.

3.2 Benefits of Proposal

Section 3.1 identifies the benefits derived from improving the fire and life safety of the present station. The Environmental Planing and Assessment Act provides for the council to serve a fire safety order which would mandate a fire safety upgrade. Undertaking this work as a voluntary upgrade program is likely to avert such an order and the disruption it could cause. These benefits have not been quantified in dollar terms at this stage however the benefits are clearly evident when compared to the scenario of a station fire within the current station.

These benefits must be considered on a risk basis with consequent outcomes being realised should the risks eventuate. The consequences associated with the risk of having a major fire event in the current station are considered to be major in terms of risk to life, financial (structural repair) and disruption of services.

Should a major fire in the station eventuate, there would be significant weakening of the structural framework in the area of the fire. Repairs would require closure of the station for a period in order of potentially 6 months or more and consequently lead to major disruption to the rail network with associated community losses. The financial costs associated with the potential injury to rail users has not been addressed in this report.

A voluntary upgrade program would permit the upgrade works to be undertaken in a programmed manner and be consistent with the architectural language of the proposed design.

4.0 Implementation of Improvements

The Thakral Concept Design incorporates the elements identified within the series of investigations undertaken to quantify the scope of works. In particular we note the potential need for changes to the platforms, concourse and circulation routes associated with the pedestrian movement identified in the Connell Wagner Investigation.

4.1 Preliminary Emergency Egress Strategy

Emergency egress from the Station will consist of the following

1. Fire stairs are located at both ends of the platform (2m in effective width)

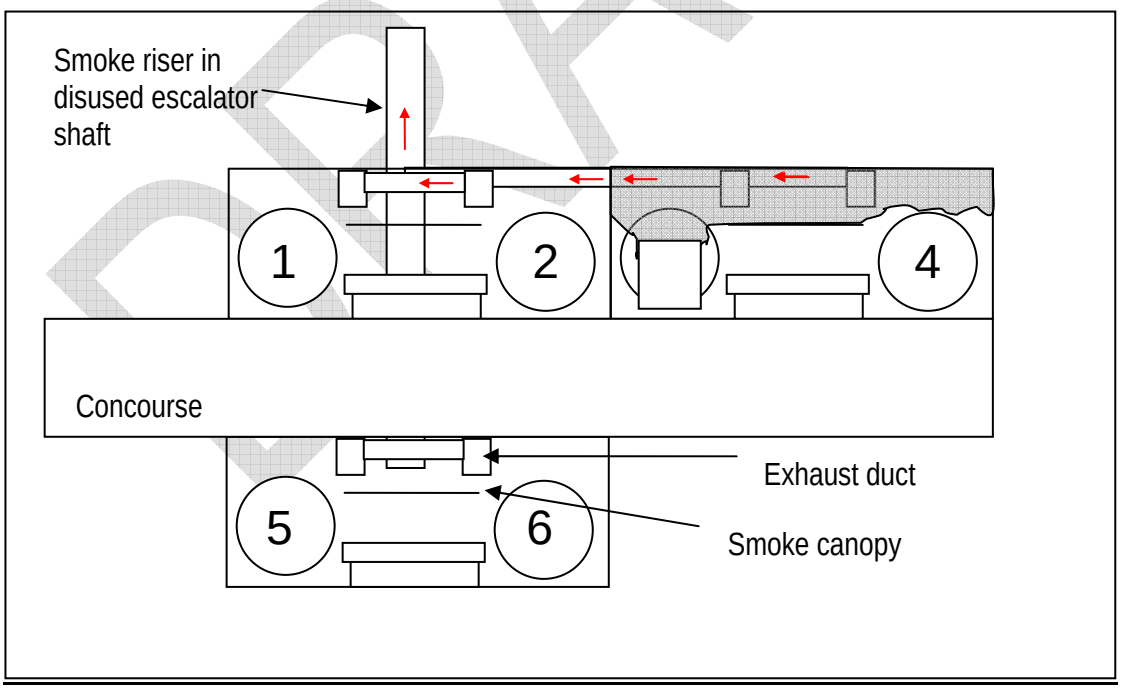
2. Fare gates should be specified with fail safe open
3. Break out doors should be provided from the paid concourse
4. Fire isolated stairs have been provided around the concourse to travel distances which are not excessive
5. Appropriate signage should be provided to direct occupants to exits
6. An upgrade to the York St exit is catered for by providing additional stairs rather than removal of the heritage listed wooden escalators.
7. Escalators within the station are to be specified to glide to a halt
8. Approximately 15 m of effective egress width is required from the station

4.2 Preliminary Smoke Hazard Management Strategy

Platforms

Smoke hazard management for the platforms will consist of the following:

1. Provide mechanical exhaust from each of the platforms (at least 60m^3/s)
2. Duct work located above the edged of the platform
3. Exhaust via the end of the platforms (disused escalator shaft from platform 5&6)
4. Exhaust duct work from Platforms 3&4, 5&6 and 1&2 would connect in the same riser
5. Smoke canopies may be required above the platform to allow for an increased smoke reservoir and occupants to egress safely under the hot layer. This would need to be assessed at the detailed design stage.



Concourse

Smoke hazard management for the Concourse will consist of the following:

1. Provide smoke exhaust within the paid concourse and unpaid concourse
2. Smoke separate the paid concourse from the unpaid concourse
3. Smoke separate the unpaid concourse into different smoke zones
4. Smoke exhaust provided via a mechanical system, utilising a combination of duct work and plenum systems

These elements would be specified in detail through the provision of the detailed design.

4.3 Preliminary Fire Resistance Strategy

Fire Resistance Strategy for the station will consist of the following:

1. Protecting critical steel structural elements
2. Improved smoke compartmentation
3. Protection of emergency platform egress stairs
4. Redundancy in fire sprinkler protection (connection to a Grade 1 water supply)

Protection of the critical steel structural elements in the station box could be achieved on a performance basis. The performance based design would be based on the burn out of an entire train within the station. Preliminary calculation have shown that an appropriate FRL could be achieved through the application of intumescent paint.

5.0 Conclusions

The items of work proposed by Thakral are practical solutions to improving the fire and life safety issues identified at Wynyard Station. The Concept design is based upon the current standards relevant to a station of this size and capacity.

We consider that the Thakral Concept Design as documented within the Hassell Wynyard Station Concept Study will result in a vastly increased level of fire and life safety afforded to occupants of Wynyard Station commensurate with contemporary standards and community expectations.