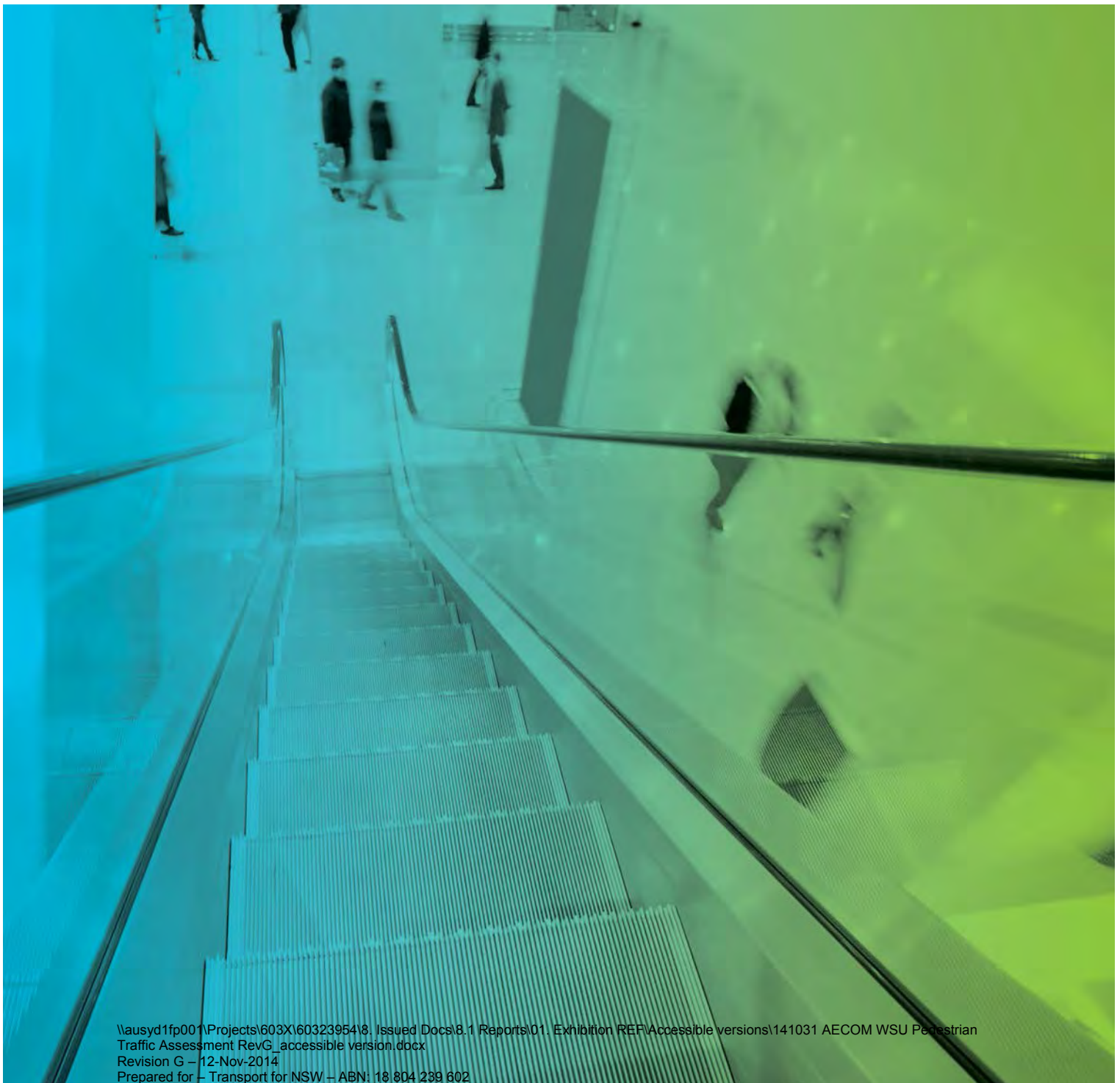


Appendix D – Traffic and pedestrian technical report

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Wynyard Station Upgrade

Pedestrians, Traffic and Transport



Wynyard Station Upgrade

Pedestrians, Traffic and Transport

Client: Transport for NSW

ABN: 18 804 239 602

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Quality Information

Document Wynyard Station Upgrade








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Date 12-Nov-2014

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1.0 Introduction

Wynyard Station is the third busiest station on the Sydney rail network and is the gateway to Sydney's financial district. The station is currently congested and receives approximately 39,000 passenger movements over the three and a half hour morning peak period. Passenger numbers are expected to increase with the opening of Wynyard Walk and ongoing development at Barangaroo (first components scheduled for opening in 2015). Future passenger numbers would also be influenced by the opening of the CBD and South East Light Rail (CSELR) project and other surrounding commercial developments (such as One Carrington Street). Additionally, the broader growth of Sydney's rail network, through projects such as the North West Rail Link, will see additional passengers utilising the rail network and place further pressure on Sydney's Central Business District (CBD) stations.

There is, therefore, a need to reconfigure the station to improve circulation in order to meet current and future capacity of the station and improve the safety and comfort of customers and staff.

Transport for NSW (TfNSW) proposes to upgrade Wynyard Station (the proposal) to accommodate the expected future passenger demand at the station and improve its amenity. The key features of the proposal include:

- Refurbishment of the York Street foyer.
- Reconfiguration of the unpaid concourse area, including widening the northern concourse area and inclusion of the southern unpaid concourse area within the expanded paid concourse.
- Expansion of the paid concourse area and reconfiguration of the gateline to respond to pedestrian movements, including the provision of new ticket gates.
- Refurbishment of the concourse level.
- Refurbishment and de-cluttering of Platforms 3 and 4 and provision of a new staircase between the platforms and the paid concourse area.
- Refurbishment and de-cluttering of Platforms 5 and 6, including demolition of the former escalator enclosures and re-orientation of one staircase between the platforms and the paid concourse area.
- Reconfiguration of the station facilities, including relocation of the Station Manager's Office and new or refurbished amenities (such as public and staff toilets).
- Fit out of Transport House basement levels for station facilities, including the reconstruction of stairs to the concourse.
- Other works relating to the provision of services to support the station upgrade, within roof and wall cavities throughout the station and within adjoining properties.

Further discussion on the proposal is provided in **Chapter 4**.

1.1 Purpose of this report

A Review of Environmental Factors (REF) has been prepared and presents an assessment of the proposal under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This technical working paper has been prepared to support the REF, and looks specifically at traffic, transport and pedestrian related impacts during construction. Changes to pedestrian flow as a result of the proposal, once constructed, has been subject to a separate assessment and report (*Existing Passenger Movements, Wynyard Station Pedestrian Modelling, Analysis of Pedestrian Level of Service using LEGION*, AECOM (2014)). The results of that modelling have been summarised in this report.

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2.0 Strategic background

The key strategic transport policies applying to the proposal and which set the strategic context and direction for the proposal are described below.

2.1 NSW Long Term Transport Master Plan

The *NSW Long Term Transport Master Plan* (Transport for NSW, 2012) establishes a framework for transport planning and transport funding priorities over the next 20 years. The Master Plan provides an integrated approach to transport planning and identifies six key challenges along with short, medium and long term actions to deliver a customer focussed, multi-modal transport system.

Section 4.3 of the Master Plan highlights a number of growing congestion issues on Sydney's rail network. These include limited platform space and stair capacity at Central, Town Hall and Wynyard Stations, which increase dwell times of trains and reduce the network's capacity to run more trains per hour across the entire network.

The Master Plan identifies the need for transport infrastructure such as the North West Rail Link (NWRL), Barangaroo Ferry Hub, CSELR and the second harbour crossing rail line. All of these projects have the potential to interact with Wynyard Station, further increasing passenger numbers and congestion. An upgrade of Wynyard Station is required to alleviate forecast pedestrian congestion and aligns with a key action of the Master Plan to upgrade and modernise city transport interchanges.

The proposal would be consistent with the objectives of the Transport Access Program, which was established in the Master Plan to improve the accessibility, safety, signage, maintenance and amenity of stations.

2.2 State Infrastructure Strategy 2012 – 2032

The *State Infrastructure Strategy 2012 – 2032* (Infrastructure NSW, 2012) offers independent advice to the NSW Government on priority infrastructure investments and a framework for increasing the quality of infrastructure spending in NSW. It uses multi-criteria analysis to identify and assess projects based on strategic fit, economic benefit and delivery risk.

The Strategy addresses the issue of public transport congestion in the Sydney CBD and specifically notes the existing high demand at Wynyard Station particularly the severe congestion on Platform 3 during morning and evening peak periods. An upgrade to Wynyard Station is also recommended in the Strategy, should the rapid transit system, which has commenced construction as part of the NWRL, be extended through to the CBD and beyond.

The proposal has been designed to address congestion issues and cater for increased growth in passenger demand, and to relieve congestion within the paid concourse area and the platforms by providing effective vertical transportation links between the concourse area and the platforms.

2.3 Draft Metropolitan Strategy for Sydney 2031

The draft *Metropolitan Strategy for Sydney 2031* (Department of Planning and Infrastructure, 2013) sets a new framework for Sydney's future growth and development, and is set to replace the *Metropolitan Plan for Sydney 2036* once finalised.

The draft Metropolitan Strategy supports the key goals, targets and actions identified in NSW 2021 and has been prepared in conjunction with the *NSW Long Term Transport Master Plan* and the *State Infrastructure Strategy* to provide fully integrated land use and infrastructure outcomes. It is built around achieving five key outcomes for Sydney: balanced growth, a liveable city, productivity and prosperity, healthy and resilient environment, and accessibility and connectivity.

The draft Metropolitan Strategy focusses on growth within both the Sydney CBD and also the regional centres of Metropolitan Sydney. Accessibility objectives in the draft Strategy focus on access to and from as well as in and around the Sydney CBD and the accessibility of regional centres and employment growth areas. The proposal would be consistent with this objective as it would relieve congestion at one of the key CBD stations and would therefore support better rail connections to the CBD. The proposal, in combination with surrounding projects such as Wynyard Walk, CSELR and the bus network changes that would occur as a result of the CSELR, would be expected to improve pedestrian access to public transport. Pedestrian accessibility within the CBD would be enhanced once the continuous public domain link from Pitt Street and George Street through to the western CBD and waterfront is established.

2.4 Sydney's Rail Future

Sydney's Rail Future – Modernising Sydney's Trains (Transport for NSW, 2012) has been developed as part of the *NSW Long Term Transport Master Plan*. It is a long term plan to increase the capacity of Sydney's rail network to accommodate employment growth in the CBD and surrounding employment centres through investment in new services and upgrading of existing infrastructure.

Crowded stations and narrow CBD platforms are identified as two of the bottlenecks that are considered to slow down the entire network.

In addition to existing congestion, the plan states that each of the three busiest CBD stations (Central, Town Hall and Wynyard) are expected to experience an increase of more than 10,000 additional passengers per hour in peak periods by 2031.

The plan recommends improving operational efficiencies across the network by de-cluttering platforms to improve passenger flow and improving dwell time management of trains. which would be achieved by the proposal.

2.5 Sydney City Centre Access Strategy

The *Sydney City Centre Access Strategy* (the Access Strategy) (Transport for NSW, 2013) was developed as a key action of the *NSW Long Term Transport Master Plan*. It is the first plan which shows how people will enter, exit and move in and around the CBD over the next 20 years. The Access Strategy is intended to provide an integrated approach to planning across all modes of transport in order to reduce congestion, support future growth and improve the customer experience.

The Access Strategy identifies Wynyard Station as a key transport hub and interchange precinct given its proximity to Barangaroo and multiple transport modes and its location between the proposed Barangaroo Ferry Hub and CSELR. This may result in further changes at the street level to provide ease of access for commuters using public transport services. Upgrades to Central, Town Hall and Wynyard Stations are identified within the Access Strategy as being critical to the provision of short term capacity increases on the rail network. The upgrade to Wynyard Station is also specifically identified as being required to accommodate future growth and relieve congestion.

As part of the Access Strategy, there would be a redesign of the bus network within the CBD. This would include the redistribution of buses from George Street to other CBD roads to facilitate the construction of the CSELR. The Access Strategy envisions a number of key bus corridors that skirt the core of the city centre that cater for high frequency, all day services and connect to key interchange precincts to cater for modal transfers (TfNSW, 2013). To facilitate this, the Access Strategy (in relation to the network in the vicinity of Wynyard Station) identifies the following:

- Key bus corridors are identified along Kent, Clarence, York and Erskine Streets. York and Clarence Streets, identified as priority bus corridors, would be developed with enhanced bus lanes and dedicated stopping bays.
- Some services that are currently traveling over the Sydney Harbour Bridge would be re-routed via the Cahill Expressway, Elizabeth Street and Castlereagh Street.
- Remaining bus services that enter the CBD via the Sydney Harbour Bridge would use York or Clarence Streets, and would terminate at Wynyard or at the Queen Victoria Building.

- Inner West services would terminate at Central Station, or would be through-routed to other destinations. The remaining services would continue to the northern end of the city via the eastern areas of the CBD.
- Interchange precincts would be enhanced through the de-cluttering of footpaths, new shelters, improved wayfinding and real-time information boards.

The redesigned bus network, together with the commencement of the CSELR, is expected to reduce the number of buses traveling into the city centre in the morning peak by around 220 buses (TfNSW, 2013). A further 160 buses would no longer enter the city centre once the NWRL is operational (TfNSW, 2013).

The changes to the bus network will result in modifications to existing bus infrastructure within the CBD, including in the vicinity of Wynyard Station, which is planned for completion in mid 2015. The changes to buses in the vicinity of Wynyard Station are discussed further in **Section 3.4**.

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3.0 Existing environment

Wynyard Station is located in the north of Sydney's CBD. At street level, Wynyard Station is surrounded by George Street, Clarence Street, Wynyard Lane, York Street, Erskine Street, Wynyard Street and Margaret Street (refer **Figure 1**). The platforms and paid concourse area are located directly below York Street and Wynyard Park. Part of the station is within Transport House, including the York Street foyer.

3.1 Surface road network

During the AM and PM peaks, the surrounding road network carries high volumes of traffic. Intersections located west of George Street, assessed as part of the Wynyard Walk REF in 2011, were found to operate with a Level of Service (LoS) B to LoS F during the AM peak and PM peak (Parsons Brinkerhoff, 2012).

George Street is a major two-way arterial road and the primary north-south corridor through the CBD. It is also currently a key bus corridor in the CBD. It carries a significant volume of traffic, which consists of a mix of buses, taxis, heavy vehicles and private passenger vehicles and has continuous bus lanes in both north and southbound directions. During the peak period, George Street carries around 1,950 vehicles and 360 buses per hour (Jacobs, 2014).

York Street and Clarence Street are key north-south sub-arterial roads that provide connections to/from the Sydney Harbour Bridge. York Street is one way (southbound) and carries around 1,010 vehicles and 370 buses per hour during the peak period (Jacobs, 2014). Clarence Street is also a one way street (northbound), and carries around 720 vehicles and 280 buses per hour during the peak period (Jacobs, 2014). Both York and Clarence Streets have continuous bus lanes.

Erskine and Margaret Streets provide access to the western areas of the CBD including Barangaroo and the King Street Wharf area. Both streets are sub-arterial two-way roads, which provide access for vehicles travelling to/from Sussex Street, Kent Street, Clarence Street and York Street. Wynyard Lane, which runs parallel to George Street and Carrington Street, is a rear service lane that connects Margaret Street and Wynyard Street. It is a one-way lane, and is narrow (around five to six metres in width).

Wynyard Street is an east-west road between York Street and Wynyard Lane. Wynyard Street is a two-way road only between York Street and Carrington Street. Between Carrington Street and Wynyard Lane, the road becomes one-way (westbound). The main function of Wynyard Street is to provide access to Carrington Street and Wynyard Lane, both one-way roads. Regimental Square is located at the eastern end of Wynyard Lane, which provides a connection for pedestrians to George Street. There is a strong desire line for pedestrians travelling to or from George Street to use Wynyard Street to access the Wynyard bus interchange, York Street and destinations to the west of York Street.

Wynyard Lane, which runs parallel to George Street and Carrington Street, is a rear service lane that connects Margaret Street and Wynyard Street. It is a one-way street (southbound), and is narrow (around five to six metres in width). A number of loading docks and car park entrances are provided off Wynyard Lane, including the Wynyard Lane Car Park and a loading dock that is used by Sydney Trains, Coles and the Menzies Hotel. A works zone associated with 333 George Street redevelopment is also currently in place on Wynyard Lane, near Wynyard Street. Pedestrian movements are limited. A pedestrian crossing is located near the entrance to the Wynyard Lane Car Park, which provides access to the Menzies Arcade (which provides access to George Street and Carrington Street).

York Lane is a rear service lane that connects Erskine Street and Clarence Street. It is a one-way road (southbound) and is narrow (around six metres in width). A number of businesses (bars, food outlets) have frontages on York Lane, and as a result it carries more frequent pedestrian traffic. The lane also provides access to car parks and loading docks for buildings that back onto York Lane. Access to the northern end of York Lane is temporarily restricted as a result of construction activities associated with the Wynyard Walk project.

All roads in the vicinity of Wynyard Station are controlled by City of Sydney Council, however Roads and Maritime Services (RMS) is responsible for the operation of all traffic signals in NSW including the City of Sydney.

The Wynyard bus interchange is centred along York Street and Carrington Street adjacent to Wynyard Park, and occupies the full length of kerb from Margaret Street to Wynyard Street (refer to **Figure 1**). During the evening peak, buses also layover on the western side of York Street to the south of the Wynyard Station pedestrian entry / exit. Taxi ranks and loading zones occupy the eastern kerb of Carrington Street. The interchange handles significant volumes of buses and commuters during the AM and PM peak.

Dedicated cycle paths in the vicinity of Wynyard Station are located on Kent Street and King Street. However, York Street, Clarence Street and George Street are identified as cycle routes on City of Sydney's cycling map.

The surface road network is used extensively by pedestrians. In some parts, footpaths are narrow and congested during peak periods. Controlled pedestrian crossings (signals) are located at key intersections. Surface pedestrian demand has increased as a result of the Kent Street tunnel closure following the commencement of construction of the Wynyard Walk project. Prior to the closure of the tunnel, it was estimated that up to 10,000 pedestrians per hour would be diverted to the surface road network (TfNSW, 2012). To cater for this diversion, existing footpaths along York Street and Margaret Street to the west of Wynyard Park have been widened by the reduction of an eastbound traffic lane in Margaret Street and removal of parking in York Street. The Wynyard Walk project is expected to be open to the public by 2016. A proportion of pedestrians currently using surface roads are expected to divert to Wynyard Walk, which would reduce pressure on the surrounding surface road network.

3.2 Station access

Key pedestrian access to the public domain areas of the station is provided via:

- four escalators within Transport House connecting the concourse level to the York Street foyer.
- escalators, a pedestrian lift and stairs to Carrington Street and Wynyard Park.
- stairs to the Hunter Arcade.
- direct access to the Metcentre.
- direct access via two ramps to George Street.

The Kent Street pedestrian tunnel has been closed as part of the Wynyard Walk project. Wynyard Walk is due to open in 2016 and will provide another key pedestrian access to the station.

There is no direct vehicular access to Wynyard Station. Deliveries to the retail facilities located in the unpaid concourse and surrounding pedestrian links are conducted via George Street, Carrington Street and York Street.

Access is also provided via two goods lifts located on Wynyard Lane and York Lane. The goods lift located on Wynyard Lane is also used by other businesses, including Coles (located above the unpaid concourse area) and the Menzies Hotel. The second goods lift, accessed via York Lane, is located in Transport House. This services the basement levels of Transport House. Currently York Lane has restricted access, due to construction works associated with Wynyard Walk.

Wynyard Lane Car Park (located in the former tram tunnels otherwise known as former Platforms 1 and 2) is located above the paid concourse area. This is accessed by pedestrians via the escalators to Wynyard Park. Vehicle access to the car park is provided off Wynyard Lane via Margaret Street, with egress off Cumberland Street.

Key accesses to the station are shown on **Figure 2** and **Figure 3**.

A number of developments are currently proposed or planned in the vicinity of Wynyard Station, which would change the use or influence the patronage of Wynyard Station. This is discussed further in **Section 3.4**.



Figure 1 - Regional context

- Existing light rail
- - -●- - - CBD and South East Light Rail
- Sydney Trains

- T Train
- F Ferry

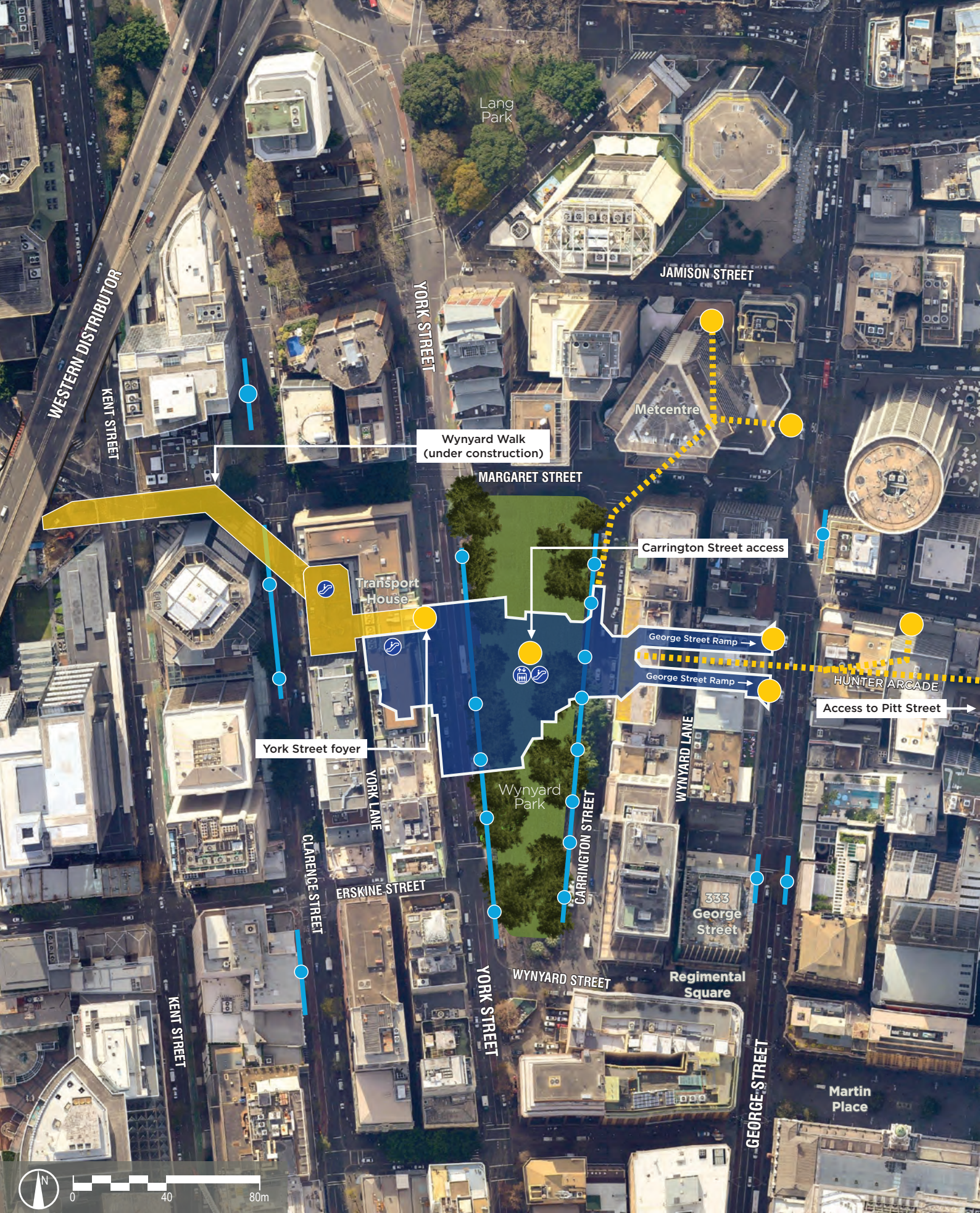
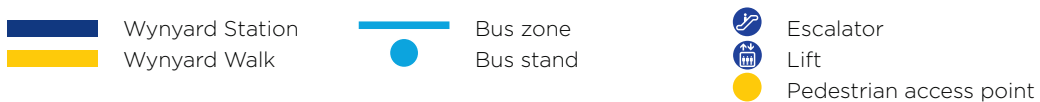
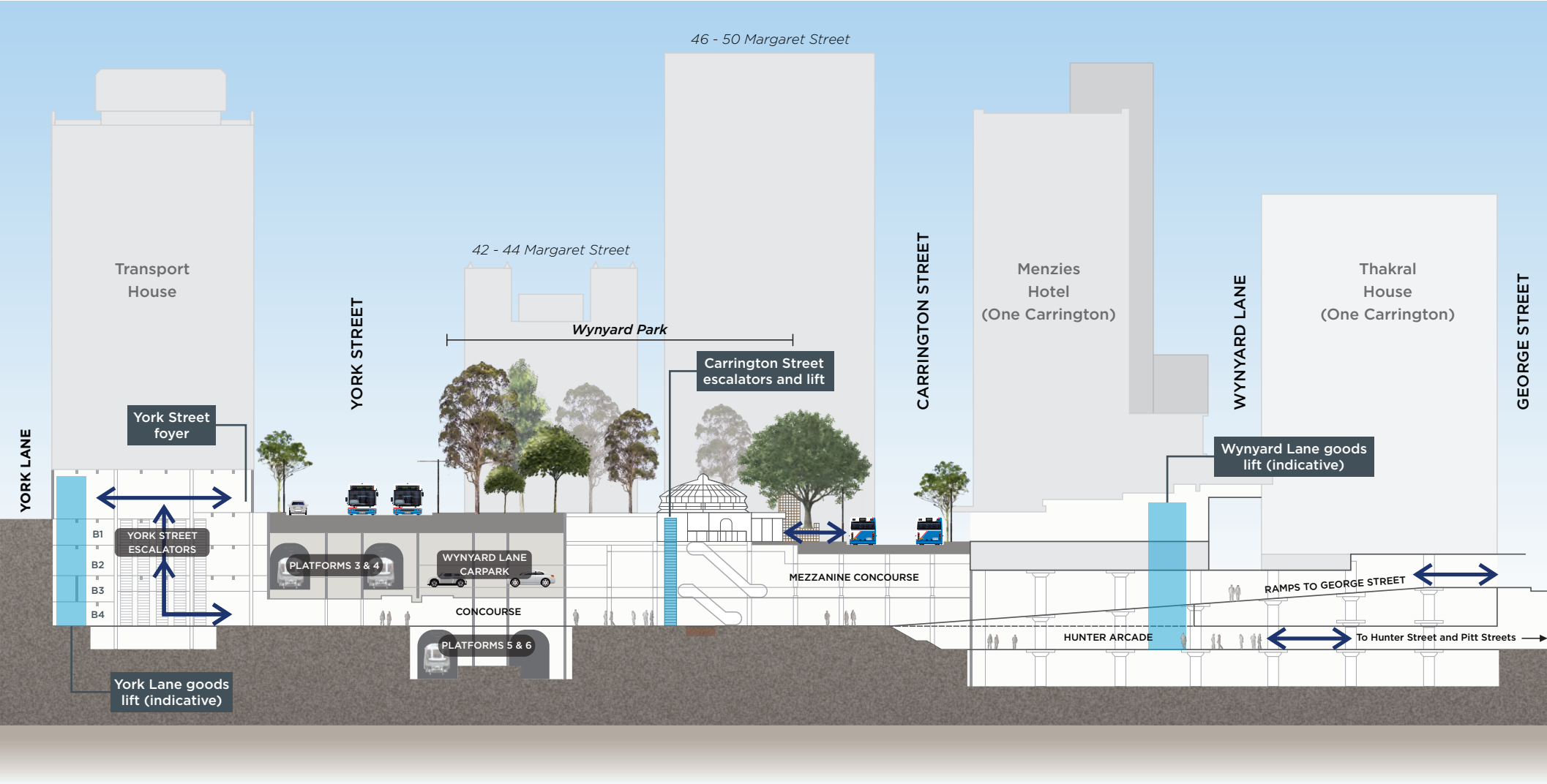


Figure 2 - surrounding road network and key pedestrian accesses for Wynyard Station





WEST

EAST



NOT TO SCALE

Figure 3 - Wynyard Station cross section

-  Lift
-  Current main access

3.3 Wynyard Station

Wynyard Station is the third busiest station on the Sydney rail network and provides connections to the T1 (North Shore, Northern and Western line), T2 (Airport, Inner West and South line) and T3 (Bankstown line) rail lines.

Wynyard Station comprises public domain areas (consisting of the paid concourse area, the unpaid concourse area and the platforms) and station facilities. Station facilities include back-of-house facilities, Station Manager's Office and ancillary activities, and retail and commercial spaces, such as the Concourse Bar and individual food, service related and retail outlets.

The existing configuration of Wynyard Station is shown in **Figure 4**.

To assess the current performance of Wynyard Station in 2014, an analysis of the pedestrian level of service during the AM, PM and midday peaks within the concourse and station platform areas was undertaken using the LEGION model (AECOM, 2014).

The modelled 2014 pedestrian/commuter movements during the peak periods are provided in **Table 1**.

Table 1 Existing passenger / commuter movements (1 hour)

Movement	Period		
	AM	PM	Lunch time
Rail exits	21,750	2,600	1,650
Rail entries	1,800	17,150	1,900
Rail transfers	1,600	1,600	400
Through trips	3,150	3,150	8,200
Total	28,300	24,500	12,150

Source: Existing passenger movements, Wynyard Station Pedestrian Modelling, Analysis of Pedestrian Level of Service using LEGION, AECOM July 2014 for Transport for New South Wales

Note 1: Rail transfers – refers to trips involving transfer to a different rail line at Wynyard Station

Note 2: Through trips – refers to a non-rail related pedestrian movement (that is, a pedestrian travelling through the station public domain to access adjoining streets or buildings. For example, a pedestrian travelling from York Street to George Street via the station public domain)

The analysis for 2014 AM, PM and midday peaks (and based on the existing configuration of the station) found that:

- Commuters predominately enter and exit the paid concourse area via the eastern gates in the AM, PM and lunch time peak.
- During the AM and PM peak, pedestrians that access or egress the eastern unpaid concourse area use the Carrington Street escalators and George Street ramps. The Metcentre arcade also attracts high flows during the AM and PM peak.
- The York Street escalators and foyer attracts a high volume of pedestrians, which has been attributed partly to the closure of Kent Street tunnel for the Wynyard Walk project. This results in queuing on the western unpaid concourse area in the AM peak. High volumes are also experienced during the PM peak.
- Areas close to the Carrington Street escalators experience a high level of pedestrian movements during the AM peak, which is considered to be mixture of pedestrians travelling to/from Carrington Street, Metcentre, Hunter Street arcade and George Street.



Figure 4 - Existing Wynyard Station layout - concourse level

- No significant crowding was observed (on average) during the lunch time peak. During the lunch time peak, the key pedestrian movement within the public domain is attributed to through movements. This includes east-west movements, and movements through the eastern unpaid concourse area. Pedestrian movements also predominantly shift to the Metcentre and George Street ramps during the lunch time peak, with reduced flows to/from York Street and Carrington Street.
- The closure of the Kent Street tunnel has also reduced the level of pedestrian demand within the northern unpaid concourse during the lunch time peak. This reduction has been estimated at approximately 50 percent based on a comparison of results from a 2008 and 2014 survey.
- Crowding on platforms is related to the timetable pattern, however, the preference for commuters to use certain staircases is observed during the AM or PM peak. On Platforms 3 and 4, all staircases are heavily and relatively evenly used in the AM Peak. However, queuing and a high level of pedestrian activity do occur on the station platforms near the two central staircases, which are mostly attributed to alighting passengers). During the PM peak, the central staircases are favoured by commuters accessing the station prior to spreading out along the platform. On Platforms 5 and 6, there is high level of commuter activity and demand at the northern end of the platform as a result of limited space for manoeuvring. In the PM peak, commuters tend to spread along the platform areas until the correct train arrives.

Using the Fruin Level of Service (LoS) (J J Fruin, 1987), criteria as a measure of pedestrian crowding, the analysis found that Wynyard Station typically operates during the AM peak (20 minute, average peak) at a LoS of A to D within the public domain. There are some limited areas of LoS E, located near the Carrington Street and York Street escalators, some ticket gate lines and the station platform staircases. A LoS of E suggests queuing and restricted mobility for commuters (refer to **Appendix A**).

By 2021, in the absence of the proposal and with the completion of Wynyard Walk, the paid concourse is expected to experience in the AM peak a LoS C of 19 per cent of the time and LoS D or worse 54 per cent of the time (AECOM, 2014b). This indicates that there would be significant crowding at the paid concourse as a result of the increased demand.

3.4 Surrounding future development

Projects that are currently in planning or construction phases in proximity to Wynyard Station include:

- Wynyard Walk.
- One Carrington Street.
- CSELR – provision of light rail along George Street.
- Modifications to existing bus infrastructure in the vicinity of Wynyard Station as part of the Access Strategy to accommodate the construction on the CSELR.
- 333 George Street redevelopment.

There are also a number of other developments located near Wynyard Station (such as Barangaroo and the Barangaroo Ferry Hub project) or on the Sydney rail network (such as the NWRL and Sydney Rapid Transit) that would both directly and indirectly influence passenger and pedestrian demand and use of the station.

Table 2 Surrounding Development

Project	Description	Timeframe
One Carrington Street (formerly referred to as the CityOne development) Brookfield	<ul style="list-style-type: none"> • New commercial office tower between Carrington Street and George Street, incorporating Thakral House (301 George Street), 14-28 Carrington Street (which includes the Menzies Hotel), the former Shell House (2-12 Carrington Street) and 285 George Street. • An upgrade of the eastern access ways to Wynyard Station, including retail and concourse areas (i.e. the George Street ramps) as well as links to Wynyard Lane, Hunter Connection and Wynyard Park. This includes pedestrian access over and under Wynyard Lane. • Five levels of retail linking George Street, Carrington Street and Wynyard Station. New ground level retail on Margaret Street. • Basement level car park. 	Mid 2015 to 2018

Project	Description	Timeframe
Wynyard Walk TfNSW	<ul style="list-style-type: none"> A new western entrance to Wynyard Station. An underground pedestrian link (tunnel) from Wynyard Station to the intersection of Kent Street and Napoleon Street (approximately 100 metres long). Public pedestrian plaza (Napoleon Plaza) and pedestrian bridge to link to Barangaroo development (delivered as part of the Barangaroo development) and the Barangaroo Ferry Hub (proposed by TfNSW). Pedestrian bridge over Sussex Street. 	Currently under construction. Due for completion in 2016
CBD and South East Light Rail (CSELR) TfNSW	<ul style="list-style-type: none"> Approximately 12 kilometres of new light rail track between Circular Quay, Central, Kingsford and Randwick, including 20 light rail stops one of which is to be located on George Street adjacent to the Wynyard Station entrance. A pedestrian zone on George Street between Hunter Street and Bathurst Street. Associated infrastructure, maintenance and stabling facilities and public domain improvements. 	Mid 2015 to 2019
Sydney City Centre Bus Infrastructure Roads and Maritime Services	<ul style="list-style-type: none"> Installation or removal of bus stops and bus shelters on Jamison Street, York Street (south of Barrack Street) and Clarence Street. Provision of new bus layovers, including areas along York Street near Wynyard Park. Removal or relocation of parking, loading zones and/or taxi zones, including parking and an off-peak taxi zone on York Street opposite Wynyard Park. Longer term, the area generally encompassing the bus infrastructure, rail station and light rail station at Wynyard would be further developed as a strategic interchange precinct under the Access Strategy. 	Subject to approvals, late 2014 to mid 2015
333 George Street redevelopment Charter Halls Funds Management Ltd	<ul style="list-style-type: none"> New retail and commercial development, with ground floor retail, incorporating 331 George Street and 333-339 George Street. Basement car park accessed off Wynyard Lane. 	Currently under construction. Due for completion in mid 2016

In the vicinity of Wynyard Station, the construction of Wynyard Walk has resulted in the partial closure of York Lane. Construction activity would also have a direct interface at York Street foyer, Transport House basement levels and at the unpaid concourse.

The conditional approval of the One Carrington Street concept plan development includes partial closure of Wynyard Lane for vehicular traffic. The Proponent (Sovereign Wynyard Centre Pty Ltd) submitted a modification to the approved concept plan in May 2014 to maintain vehicular access in Wynyard Lane. However, as structures would be built over the laneway, Wynyard Lane would be partially closed to traffic during construction. Other changes that are expected during construction of One Carrington Street include:

- Closure of the Wynyard Lane public car park, with use for construction storage and laydown. Construction vehicles would use the existing egress point for both access and egress, given the access restrictions at Wynyard Lane.
- Staged closure of the George Street pedestrian ramps to Wynyard Station, maintaining at least one access path between George Street and Wynyard Station for pedestrians.
- Establishment of work zones during construction along Carrington, Margaret and Wynyard Streets, subject to City of Sydney approvals.
- Impact to Wynyard Lane goods lift.

In the long-term the CSELR would also result in the closure of a one kilometre section of George Street to general traffic between Bathurst Street and Hunter Street on a permanent basis. During the construction of the CSELR there is potential for this closure to occur in a staged manner, however this is yet to be confirmed. At worst case, the entire section may be closed from mid 2015. This will include the George Street frontage at Wynyard Station. This closed section of George Street will be the site of several construction activities associated with CSELR including engineering services deviations, construction of light rail pavement, the installation of rail and the erection of the power supply systems.

To accommodate the CSELR, it is planned to relocate buses from George Street to other CBD roads prior to the commencement of construction. The following bus infrastructure changes, as detailed in the Sydney City Centre Bus Infrastructure – Review of Environmental Factors Submissions Report (Jacobs, 2014) are planned in the vicinity of Wynyard Station as part of the Access Strategy:

- Installation or removal of bus stops and bus shelters on Jamison Street, York Street (south of Barrack Street) and Clarence Street.
- Provision of new bus layovers, including areas along York Street near Wynyard Park.
- Removal or relocation of parking, loading zones and/or taxi zones, including parking and an off-peak taxi zone on York Street opposite Wynyard Park

For the 333 George Street redevelopment, City of Sydney has permitted a works zone along the eastern kerb of Wynyard Lane to enable construction vehicles to load and unload materials. This currently operates between 7am and 7pm, Monday to Friday, and from 7am to 5pm Saturdays. Traffic control is required as part of Council's approval to manage the movement of large construction vehicles within the laneway. Scaffolding has been erected along the project boundary. Vehicular access to the construction site appears to be via Wynyard Lane (via Margaret and Wynyard Streets) and directly off George Street.

4.0 The proposal

4.1 Proposal overview

The upgrade to Wynyard Station would increase capacity and improve pedestrian flows in order to meet current and future passenger demand. The key features of the proposal include:

- Refurbishment of the York Street foyer.
- Expansion of the paid concourse area to the east, west and south, demolition of existing structures and provision of new ticket gates.
- Reconfiguration of the unpaid concourse area, including widening the northern concourse area and inclusion of the southern unpaid concourse area within the expanded paid concourse.
- Refurbishment of the concourse level.
- Refurbishment and de-cluttering of Platforms 3 and 4 and provision of a new staircase between the platforms and the paid concourse area.
- Refurbishment and de-cluttering of Platforms 5 and 6, including demolition of the former escalator enclosures and re-orientation of one staircase between the platforms and the paid concourse area.
- Reconfiguration of the station facilities, including relocation of the Station Manager's Office and removal of the existing facilities in the northern unpaid concourse area.
- Fit out of Transport House basement levels for station facilities, including the reconstruction of stairs to the concourse.
- Other works relating to the provision of services to support the station upgrade, within roof and wall cavities throughout the station and within adjoining properties.

Works associated with the proposal would be undertaken across multiple levels: York Street level, the basement levels of Transport House, the station concourse and upper concourse levels, station platforms, basement levels of the Menzies Hotel and within the Hunter Arcade. Construction access may also require temporary works within the Wynyard Lane public car park and in Wynyard Park.

Wynyard Station would remain operational during the upgrade and passenger services would be maintained throughout construction of the proposal. The following key functional requirements would be maintained during construction:

- A safe and operational station.
- Effective flow paths, fire and life safety provision for pedestrians throughout all stages of work
- Appropriate interfaces with surrounding land uses and developments, including the Metcentre, Wynyard Walk, and the proposed One Carrington Street development including the George Street ramps and the Hunter Arcade.
- Minimal disruption, where feasible, to surrounding businesses and properties.

The proposal illustrated in **Figure 5** would:

- Increase concourse capacity for Wynyard Station to meet current and future passenger demand.
- Relieve congestion within the paid concourse area and the platforms by providing effective vertical transportation links between the concourse and the platforms.
- Improve amenity at Wynyard Station, including improved customer experience, station facilities, wayfinding and surveillance.
- Establish a continuous public domain link from Pitt Street and George Street and through to the western CBD and waterfront, that is complementary to the CSELR, Wynyard Walk and the proposed One Carrington Street development and Barangaroo Ferry Hub.



Figure 5 - Proposed Wynyard Station - concourse layout (indicative)

4.2 Construction program and activities

The estimated construction duration of the proposal is approximately 18 months, with site establishment scheduled to occur in the first quarter of 2015.

An indicative construction program is provided in **Table 3**. The final staging and works associated with each stage would be determined by the contractor during detailed design and construction planning.

As shown in **Table 3**, a number of construction activities would occur concurrently. However, some activities must occur sequentially to ensure the station remains operational. **Table 4** provides an overview of the potential overlap of construction activities associated with the proposal and other major construction activity in the locality (as described in **Section 3.4**).

Table 3 Construction program

Activity	2015				2016	
	Q1	Q2	Q3	Q4	Q1	Q2
Site establishment and enabling works						
Station platform works						
Unpaid concourse						
Eastern concourse						
Northern unpaid concourse						
Western concourse and York Street foyer						
Station facilities construction and fit out, including Transport House basements						
Paid concourse						
Concourse de-cluttering and refurbishment						
Widening to the east and ticket gates						
Widening to the west and ticket gates						
Demobilisation						

Table 4 Indicative construction periods for surrounding future developments, as relevant to Wynyard Station Upgrade

Development/Proposal	2014	2015				2016	
	Q4	Q1	Q2	Q3	Q4	Q1	Q2 & beyond
Wynyard Station Upgrade ¹							
One Carrington ¹							
CSELR							
Bus Infrastructure ¹							
331 and 333 – 339 George Street redevelopment							

Note 1: Timing is subject to obtaining the relevant approvals under the *Environmental Planning and Assessment Act 1979*

4.3 Construction access

4.3.1 External access points

There are multiple access points to Wynyard Station that would be used during the construction of the proposal as detailed below. It is anticipated that the primary access points would be used regularly for the duration of construction works, and the secondary access points would be used less frequently.

Primary access points

- **Margaret Street and George Street.**

Direct access to the concourse via the George Street ramps would be facilitated by the provision of a works zone on the westbound lane of Margaret Street between George Street and Carrington Street. This would allow materials to be loaded/unloaded and transported to/from the George Street ramps via the existing footpath using forklifts, skates and trolleys. There may be a need to trim or remove the existing tree adjacent to the loading/unloading area in Margaret Street to accommodate the works zone, and temporary closure of pedestrian pathways for safety reasons while material is moved to/from the station via the George Street ramps.

Loading/unloading may also occur directly on George Street.

- **Wynyard Lane**

Two access points are proposed on Wynyard Lane, an existing goods lift (located in the Menzies Hotel) and the Wynyard Lane Car Park. As part of the Wynyard Lane Car Park access point, a temporary construction hoist would be established between the car park and the station concourse below.

The material would be transported to/from Wynyard Lane to the goods lift (via an existing driveway) or to/from Wynyard Lane Car Park (to access the temporary construction hoist) using a forklift, skates or trolleys.

If Wynyard Lane becomes unavailable, heavy vehicles would load and unload on Cumberland Street opposite the current exit of the Wynyard Lane Car Park with material transported to the temporary construction hoist via the car park tunnels. The Cumberland Street access would require the use of space on the westbound lane of Cumberland Street, which currently contains four restricted off street car parking areas (for authorised vehicles).

Secondary access points

- **York Lane**

Occasional construction access would be provided via York Lane to access Transport House and the York Lane lift. Heavy vehicles would load and unload in York Lane. The lift would be used until it is decommissioned and reconstructed as part of the proposal. As York Lane is partly closed due to Wynyard Walk construction, vehicles would need to reverse into the lane under traffic control.

- **York Street**

An existing loading zone on York Street would be used for the purposes of the project until the zone is removed as part of the Sydney City Centre Bus Infrastructure modifications

- **Carrington Street**

Occasional access to the concourse would be provided using the passenger lift and escalators within the Wynyard Park dome via Carrington Street. The material would be transported from Carrington Street to the lift using forklifts, skates or trolleys

- **Hi-rail access**

Hi-rail access to Platforms 5 and 6 would be provided via hi-rail on-ramps west of Circular Quay Station. For Platforms 3 and 4, hi-rail access points south of North Sydney Station and north of Central Station would be used. Material would then be transported by rail using on-track plant such as a lifter and trailers to bring in materials. This option would only be accessible when trains are not running, for example, during weekend possessions.

Priority would be given to using existing access points via the George Street ramps and the Wynyard Lane goods lift, together with access via the Wynyard Lane Car Park and temporary construction hoist constructed from the car park to the concourse (subject to negotiation with the landowner). Should these access points no longer be available or become insufficient for construction requirements, the Wynyard Park compound and associated construction hoist would proceed (refer to **Figure 6**).

An indicative layout of Wynyard Park compound is provided in **Figure 7**. The establishment and use of the Wynyard Park compound (if required) would occur within and outside standard construction hours to avoid peak periods in the adjoining road network, however deliveries would only occur between 8pm and 10pm. It would be necessary to utilise part of York Street to provide two heavy vehicle spaces for heavy vehicles to stop and unload/load Material would be loaded/unloaded using forklifts and trolleys between the stopping zone and the compound. Pedestrian and traffic control measures would be required while the loading and unloading of heavy vehicles is underway.

4.3.2 Internal access points

There would also be four internal vertical access points to improve access from the concourse areas to the platforms during construction, including:

- A new construction hoist from the southern concourse area to Platforms 5 and 6 close to the existing disused escalator enclosure.
- A new construction hoist from the southern concourse area to Platforms 3 and 4 via a new aperture in Platforms 3 and 4 that would be used for the proposed new staircase.
- The existing glass lift from the concourse area to Platforms 3 and 4.
- The existing glass lift from the concourse area to Platforms 5 and 6.

Access for personnel and minor hand held deliveries would be via:

- Transport House fire stairs via York Lane.
- Transport House lift via York Street foyer.
- York Street escalators.
- Platform stairs.
- Hunter Arcade tunnel and stairs.
- Metcentre.
- Northern fire stairs from the eastern concourse area to Wynyard Park and Carrington Street.
- George Street ramps.

4.4 Construction compounds and storage areas

During construction, laydown and storage areas would be provided at the following locations:

- Basement space below the Menzies Hotel, accessed via the Wynyard Lane goods lift.
- Areas behind hoardings along the unpaid concourse.
- Basement areas of Transport House.
- Wynyard Lane Car Park.
- Wynyard Park.
- Vacant retail spaces.
- Vacant station back of house areas.

Access via Wynyard Lane Car Park or Wynyard Park would be subject to negotiations with Brookfield and would require landowners consent. The use of Wynyard Park would only occur if Wynyard Lane is closed off for construction of the proposed One Carrington Street Development or they become insufficient for construction requirements. If this occurs, it is proposed to access the Wynyard Lane Car Park via Cumberland Street and the existing underground tunnel.

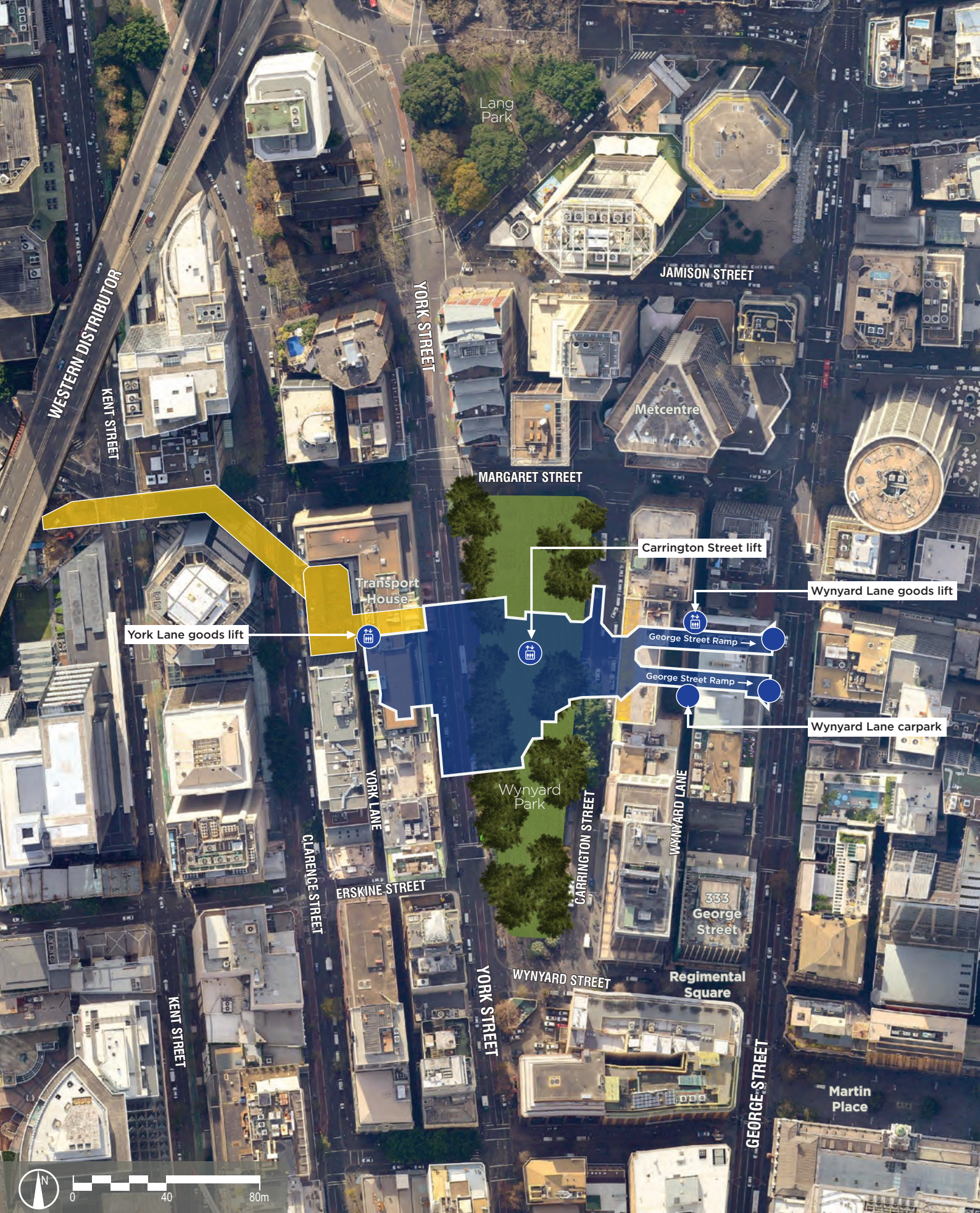


Figure 6 - Access points during construction

- Wynyard Station
- Wynyard Walk (under construction)
- Construction access point

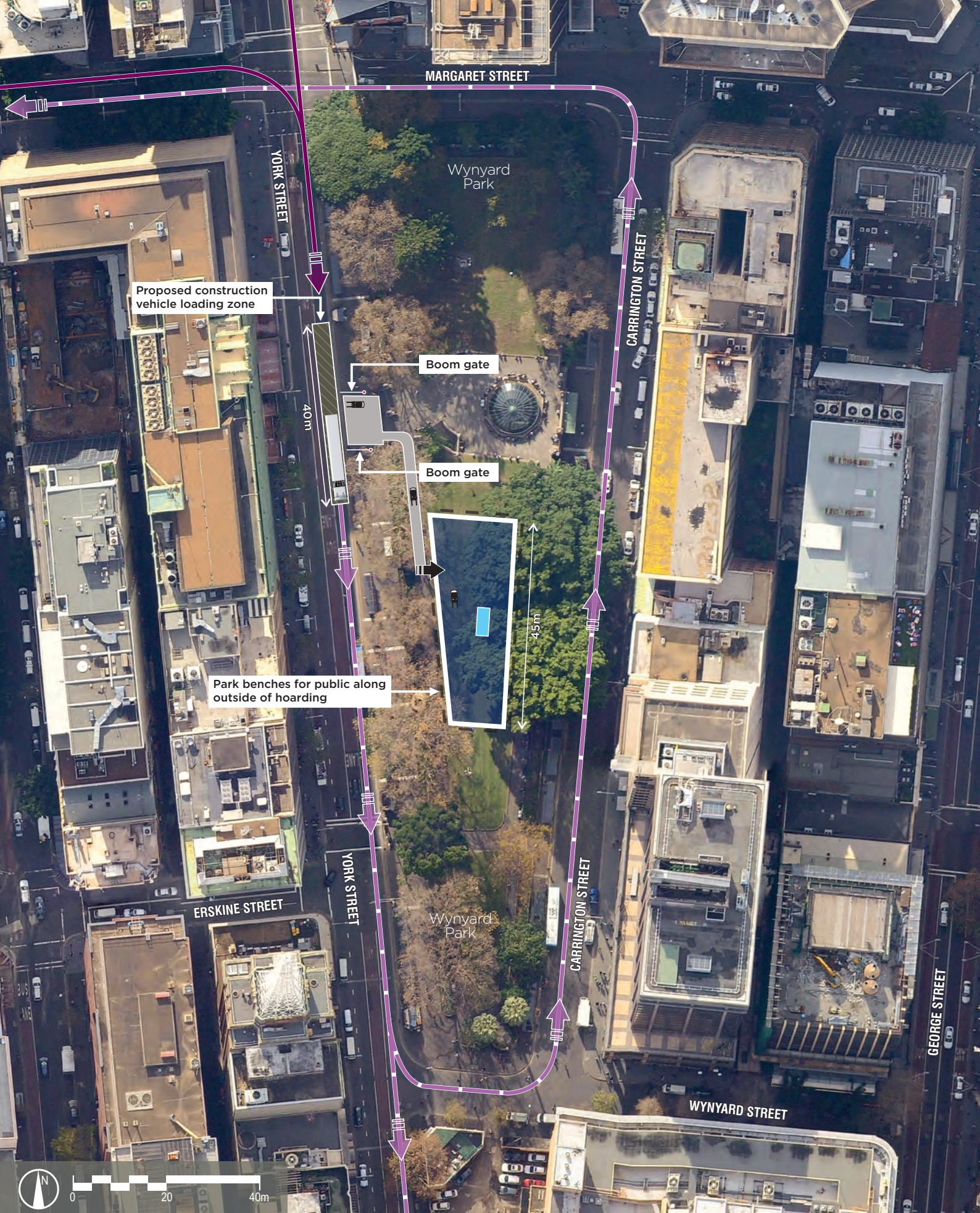







Figure 7 - Wynyard Park compound

- | | | | |
|---|--|---|------------------------|
|  | Proposed hoist location |  | Inbound vehicle route |
|  | Proposed Construction vehicle loading zone |  | Outbound vehicle route |
|  | Proposed Construction path (forklift) | | |

The proposal would also be supported by an off-site compound to ensure the limited space available at the station is efficiently used. This off-site support compound would be used to store materials and waste generated by the proposal. This site is likely to be located in an industrial area in proximity to the CBD with good arterial road access, such as Homebush Bay, White Bay or Port Botany. This would be confirmed during detailed design and would be subject to a separate assessment.

4.5 Construction and delivery hours

Construction works are required to be carried out 24 hours, seven days a week to enable the station to remain operational, to avoid unacceptable impacts on the broader Sydney rail network and to manage noise impacts on passengers, station staff, retailers and commercial properties. By virtue of being an underground station, construction access to the station is also constrained and would become increasingly constrained as other developments surrounding the station commence construction.

Works that predominately occur in areas behind hoardings within the concourse area or in areas outside the public domain, or works that are typically less noisy (in order to minimise noise impacts) would be carried out during the following standard construction hours where feasible and reasonable:

- 7 am to 6 pm Monday to Friday.
- 8 am to 1 pm Saturdays.
- No works on Sundays or Public Holidays.

However, as Wynyard Station is a busy underground station that needs to remain operational during the upgrade, many construction activities may potentially be completed at night to minimise pedestrian impacts and noise impacts on rail customers, staff and retail operators (and their customers). For this reason a number of construction activities would be completed outside of standard construction hours. These may include (but are not limited to):

- Installation and removal of hoarding.
- Demolition works.
- Removal of redundant services.
- Installation of utilities (such as lighting), ceiling works and station systems.
- Waterproofing and fire insulation.
- Concrete works (including preparation of reinforced concrete).
- Removal and installation of ticket gates.
- Tiling and other architectural finishes.
- Commissioning of operational systems.
- Deliveries of construction material and plant, and the removal of construction wastes.

The use of the Wynyard Park compound (if required) would occur within and outside standard construction hours, however deliveries would only occur between 8pm and 10pm. If the Wynyard Park compound is required, materials handling between the compound and the station below would occur 24 hours a day, 7 days a week

Works that are required to be undertaken outside standard construction hours would be conducted in accordance with Transport for NSW's *Construction Noise Strategy* (2011), where practicable. Out of hours works that have been assessed in this REF would not require a further out of hours work assessment.

Deliveries of plant/equipment and materials to the site would be undertaken outside the peak traffic periods of 7am to 9am and 4pm and 6:30pm, Monday to Friday where feasible, to minimise potential disruption to the local traffic network and bus services in the vicinity of the works. Lunchtime periods during the weekday would also be avoided, where feasible and reasonable.

Given the need to avoid disruption to rail and bus commuters and the limited accesses to construction areas, out of hours deliveries would be required, including:

- Deliveries via York Lane between 8pm and 10pm Sunday to Thursday.
- Deliveries via Wynyard Lane Car Park and Wynyard Lane goods lift would occur 24 hours, 7 days a week except between 7am and 9am, weekdays and subject to City of Sydney requirements.
- Deliveries via Margaret Street and the George Street ramps between 10 pm – 5am, Monday to Thursday.
- Deliveries via Wynyard Park between 8pm and 10pm Sunday to Thursday.

The scheduling of construction activities for the proposal would:

- Maintain safe and adequate access for customers to access and egress the public domain.
- Maintain a sufficient level of noise amenity for customers, station staff and people using the station public domain, adjoining pedestrian arcades and surrounding retail spaces.
- Minimise disruption to the surrounding road and pedestrian network, in particular, the Wynyard bus interchange on York and Carrington Streets.
- Ensure a safe working environment for construction workers within areas that interface with rail systems.
- Minimise conflicts with surrounding businesses or major construction activities, due to competing access requirements.
- Minimise disruption to services within the station or surrounding buildings (for example water and power).

The need for out of hour works has been assessed in detail in the REF including in the assessment of noise and vibration impacts.

4.6 Construction vehicle movements

To ensure the functionality of the surrounding road network, as well as the safety of construction workers and the general public, construction traffic would be subject to careful traffic management.

Generally, construction heavy vehicle movements would be restricted to when accesses are available (as discussed in **Section 4.3** of this report). The average daily and maximum heavy vehicle demands associated with each access point are provided in **Table 5**.

The maximum and average number of vehicle trips for each access point as identified in **Table 5** would not occur at the same time. The maximum number of heavy vehicle trips generated per day is 30 heavy vehicles trips (or 60 movements) during peak periods, which would reduce to approximately 15 heavy vehicle trips per day (or 30 heavy vehicle movements).

The origin and destination of heavy vehicle movements is presently unknown. However, regional access / egress to the construction site would be via the Sydney Harbour Bridge, the Eastern Distributor and Western Distributor. This would require the use of streets including (but not limited to) York Street, Wynyard Street, Margaret Street, Erskine Street, Kent Street and Hunter Street. Possible routes to Wynyard Lane are shown on **Figure 8** and **Figure 9**, which would be confirmed by the construction contractor. The possible routes may also need to alter once CSELR construction commences.

Heavy vehicles accessing the site via Wynyard Lane would require traffic controls due to the width of the lane relative to the size of the vehicles. Vehicles of up to 10 tonne would be allowed to enter Wynyard Lane; however no heavy vehicles would be allowed to enter the Wynyard Lane Car Park due to height restrictions. It is likely that time restrictions would be required by City of Sydney due to competing vehicular movements on Wynyard Lane.

Heavy vehicles would load and unload material onto forklifts on Wynyard Lane, which would then transfer the material to the construction areas either via the goods lift located on Wynyard Lane or the temporary construction hoist in the Wynyard Lane Car Park.

Table 5 Construction heavy vehicles

Access point	Proposed hours	Vehicle size (up to and including)	Daily heavy vehicle trips	
			Average	Maximum
George Street ramps (including via Margaret Street)	10pm – 5am, Monday to Thursday	Up to and including 45 tonne	3	7
Wynyard Lane (via goods lift and/or Wynyard Lane Car Park)	24 hours, 7 days a week, excluding 7am – 9am , Monday to Friday and subject to any further hour restrictions imposed by City of Sydney.	Up to and including 10 tonne	12	18
Cumberland Street (only required if Wynyard Lane is no longer available)	24 hours, 7 days a week, excluding 7am – 9am , Monday to Friday	Up to and including 15 tonne	10	20
York Street loading bay	8pm – 10pm, Sunday to Thursday	Up to and including 15 Tonne	3	5
York Lane	9am -6pm, Monday to Friday and 8am – 1pm Saturday	Up to and including six tonne	5	10
Wynyard Park compound ¹	8pm – 10pm, Sunday to Thursday	Up to and including 15 tonne	9	18
Hi-rail ramp from west of Circular Quay Station, south of North Sydney Station and north of Central Station	Weekend track possessions deliveries 24 hours, weekend only	Up to and including 10 tonne	15	30
Hi-rail ramp from west of Circular Quay Station, south of North Sydney Station and north of Central Station	Mid-week (overnight) track possession deliveries	Up to and including 10 tonne	5	10

Note 1: The trips associated with the Wynyard Park compound would only occur if other (priority) access points are not available or are insufficient (particularly Wynyard Lane Car Park).

Workforce

The construction workforce would vary depending on the stage of construction. Construction activities would also occur across a morning and evening shift, with an average of around 120 workers per day (including site management staff).

The majority of the workforce is anticipated to access the site via public transport, using the Wynyard train station and bus interchange.

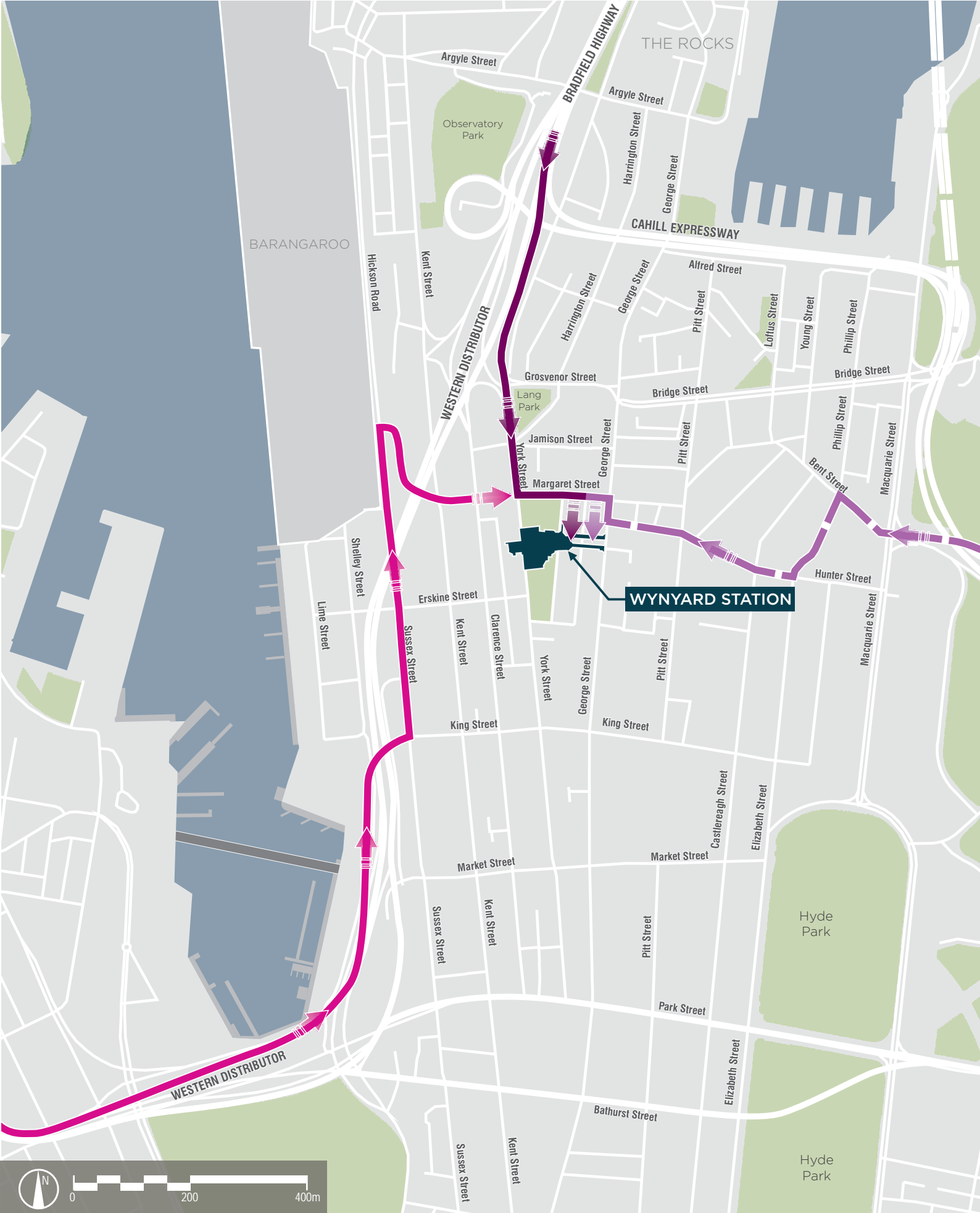
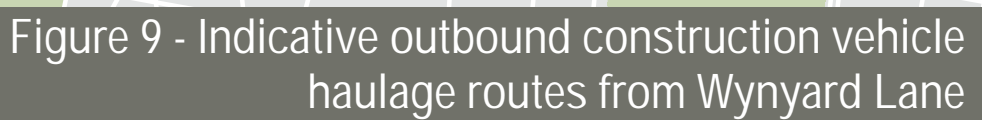



Figure 8 - Indicative inbound construction vehicle haulage routes to Wynyard Lane

- Parks and reserves
- Inbound from the north
- Inbound from the south
- Inbound from the south/west



- Outbound southbound
- Outbound northbound
-  Outbound southbound/westbound

5.0 Impact assessment

5.1 Construction impacts

5.1.1 Pedestrian-related impacts

Certain construction activities would occur behind hoardings (erected along the current extent of the unpaid concourse perimeter) or within areas isolated from the public domain (such as works within the basement levels of Transport House). As these would be unlikely to conflict with pedestrian or commuter movements within the public domain, these activities would predominately occur during standard construction hours.

Works within the public domain (being the paid/unpaid concourse and platforms) would largely need to be undertaken outside peak commuter periods, during the night time periods or at other times when at least one rail line is closed for maintenance or rail possessions. While commuter and other pedestrian movements would be low during these periods, construction works would at times restrict or close certain pedestrian accesses within the station public domain. This would include (but is not limited to):

- Closure of the southern unpaid concourse area. This would be a permanent closure to the concourse, and would occur early within the construction program. The timing of the permanent closure, within the overall construction program, would be confirmed by pedestrian modelling during detailed design. This may require east-west through movements to occur via the northern unpaid concourse area.
- Occupation of small areas of station platforms and paid concourse areas to allow the installation and use of temporary construction hoists.
- Temporary occupation of small areas of station platforms for construction activities that do not require rail possessions.
- Temporary occupation of small areas of the paid and unpaid concourse area (behind temporary hoardings).
- Temporary short term closures of one of the George Street ramps during the delivery of materials and removal of waste via Margaret Street and George Street.
- Temporary closure of ticket gates while the concourse area is widened and the ticket gate line moved. The temporary closure and installation of ticket gates would be staged in sections to maintain commuter access to the paid and unpaid concourse areas.

It is not anticipated that a significant number of commuters would alter travel patterns to avoid construction activity at the station due to the walking distance between stations within the CBD and interchange with bus services at Wynyard Park. As such, the staging of construction activities within the public domain would be critical in terms of maintaining adequate and safe movement of commuters. This would be documented within a detailed construction staging strategy and Construction Traffic and Pedestrian Management Plan (CTPMP) which would be prepared during detailed design. The strategy would likely entail:

- Scheduling of works within public domain areas that experience high pedestrian flows to avoid, where feasible and reasonable, peak commuter and shoulder periods (being 7:30 – 9:30am, and 4:30pm – 7pm, Monday to Friday) and special events.
- The establishment and implementation of minimum width passageways within the public domain based on peak and off-peak commuter movements, guided by the Fruin Level of Service for walkways, stairs and queuing areas. A preliminary analysis of minimum widths during the AM 20 minute peak, using the results of the operational pedestrian model (AECOM, 2014), is provided in **Table 6**.
- The removal of obstructions within the eastern concourse early in the construction program to minimise conflicts with existing high pedestrian flows.

- The staging of construction activities near the western and northern unpaid concourse area with consideration to the opening of Wynyard Walk, given the likely demands placed on the western ticket gate line and the northern concourse area.
- The staged widening of the paid concourse area and ticket gates.
- The staged refurbishment of platform staircases and the construction of new staircases.
- The management of interfaces with the proposed One Carrington Street development, once the redevelopment of George Street ramps commences.

Table 6 Preliminary analysis of the minimum required walkway widths during construction

Station area	Maximum 20 minute peak ¹	Minimum walkway width required (metres) ²
To/from George Street ramps	2,620	3.2 metres
To/from Metcentre	2,410	3 metres
To/from Hunter Arcade	1,560	2.2 metres
Northern concourse ³	840	1.5 metres
York Street foyer/western concourse	3,520	4.1 metres
Ticket gates (eastern concourse)	5,990	6.6 metres
Ticket gates (western concourse)	2,960	3.6 metres

Note 1: The 20 minute peak is assumed to be 38 percent of the 1 hour AM peak in 2014.

Note 2: The minimum width has been calculated from the 20 minute flow/capacity per metre plus 0.3 metre clearance on both sides of the walkway.

Note 3: Pedestrian flows associated with the lunch time peak following the closure of the Kent Street tunnel has been applied to the northern concourse, given pedestrian flows are greater when compared to the AM peak.

Anecdotal evidence suggests that the closure of the Kent Street tunnel has reduced through movements in the station public domain. As such, the temporary changes to the public domain, combined with the Carrington One development, may further discourage pedestrian through movements during construction. However, this would not give rise to the need to augment surrounding pedestrian routes, given the low volume of pedestrians using the station public domain as a thoroughfare, the number of available alternative routes, and the need to maintain pedestrian accesses for commuters. Wayfinding measures would need to be implemented to ensure pedestrians within the station public domain areas can navigate to the relevant entries and exits in the station once hoarding has been erected.

Conflicts with pedestrians and construction activities may also occur at street level. However, traffic control measures would be put in place to control pedestrian movements, should this occur. This would primarily be associated with the compound at Wynyard Park (if required), and deliveries during evening periods at George Street, Wynyard Lane, York Lane and York Street. It would be necessary to install and dismantle pedestrian barriers and any temporary fencing at the beginning and end of each shift in order to allow for longitudinal pedestrian access along the street footpaths during the day. Pedestrians would be diverted around the Wynyard Park construction site through Wynyard Park or via Margaret Street, Carrington Street and Wynyard Street. Appropriate signage would be erected during these periods. However, given the diversions would be occurring during evening and night time periods, this is not expected to cause significant disruption to pedestrians.

Cumulative impacts

Surrounding future developments have the potential to further impact on pedestrian movements to and from Wynyard Station during construction. **Table 4** provides an indicative program of all the potential developments that may be underway concurrently with the construction of the proposal and in the immediate vicinity of the station.

Table 7 provides an overview of the potential impacts of other projects on Wynyard Station and the potential cumulative impacts to pedestrian flows.

Overall, there is the potential for cumulative impacts to pedestrian flows along surface roads, such as congestion or the re-distribution of flows along surface roads, as pedestrians attempt to avoid construction zones. This is likely to be compounded by an increase in pedestrian flows near Wynyard Station as a result of permanent changes to bus routes under the Access Strategy. This includes an increase in the number of buses now terminating at or near Wynyard Station.

The potential impacts would be largely attributed to other major construction works or public transport initiatives at street level, given the majority of works associated with the proposal are located underground. Commuters would still need to access the station and it is not anticipated that a significant number of commuters would alter travel patterns to avoid construction activity at or near the station (due to distances to other train stations). As such, coordination between the major construction projects and the proposal would be critical in ensuring adequate pedestrian flows to/from the station are maintained. This would be particularly important where there are direct interfaces with the One Carrington development and indirect interfaces with CSELR.

Confirmed changes to bus routes and bus scheduling, as a result of the Access Strategy, are still under development by Sydney Buses. Until these changes have been confirmed, the potential impacts cannot be fully defined. However, it is expected that pedestrian flows at street level would increase, including along York Street, Wynyard Street, Regimental Square, and Martin Place as commuters walk to destinations further south. A percentage of commuters may choose to travel by train via Wynyard Station. Any impacts arising from permanent bus service changes would be accommodated by the infrastructure upgrades identified in the Sydney City Centre Bus Infrastructure REF Submissions Report, or would be addressed through longer-term initiatives for Wynyard interchange precinct as identified in the Access Strategy. The timing and potential interfaces associated with the changes to bus services would be confirmed during detailed design and in consultation with Sydney Buses.

Table 7 Potential impacts on Wynyard Station and cumulative impacts

Development/Project and the Potential Impact on Wynyard Station	Cumulative Impact
<p>Wynyard Walk</p> <p>Wynyard Walk is currently under construction, which has resulted in a reduced number of through movements within the station domain (particularly given the closure of the Kent Street tunnel).</p> <p>Staging of construction for the proposal would be managed with consideration to the staging of Wynyard Walk to ensure commuters using the station are catered for.</p> <p>The final stages of construction activity associated with the proposal may still be underway once Wynyard Walk is commissioned. This may result in through movements within the station domain increasing over time.</p>	<ul style="list-style-type: none"> - Key aspects of the proposal would be completed prior to the opening of Wynyard Walk to cater for the pedestrian flows from this project. - Changes to pedestrian flows at surface may result in cumulative impacts, as through movements are further discouraged.
<p>One Carrington Street</p> <p>The proposed project would involve the staged partial closure of George Street ramps and a temporary full closure of the Hunter Arcade, which would result in:</p> <ul style="list-style-type: none"> - Redistribution of some pedestrian flows to the Metcentre and Carrington Street escalators. - During the full closure of Hunter Arcade (estimated at around four months), pedestrians that would otherwise use this arcade would be required to use surface roads, such as George Street and Hunter Street to access areas to the east of George Street. - Impact to minor pedestrian movements along Wynyard Lane. 	<ul style="list-style-type: none"> - Increased potential for pedestrian congestion during peak commuter periods given the direct interface between the two projects. - Increased demand on other alternative pedestrian accesses, such as the Metcentre and the Carrington Street escalators, given increased potential for congestion or general disruption. - Re-distribution of through movements in the station domain to the surface. - Increased "green walk time" at intersections along diverted pedestrian routes such as the intersection of York and Margaret Streets may be required to clear pedestrians.

Development/Project and the Potential Impact on Wynyard Station	Cumulative Impact
<p>CSELR</p> <p>It is unlikely that this project would directly impact or close any accesses to Wynyard Station. However, there is potential for pedestrian access along George Street to be affected by its construction.</p> <p>However, access would be maintained as part of that project, given the high pedestrian flows and the number of businesses along George Street.</p>	<ul style="list-style-type: none"> - Increased demand on alternative pedestrian accesses to the George Street ramps, such as the Metcentre, the Carrington Street escalators and York Street foyer, given increased potential for general disruption along George Street.
<p>Sydney City Centre Bus Infrastructure / Access Strategy</p> <p>Along with the associated changes to the bus network under the Access Strategy, there would be an increase in the number of buses that would terminate in the vicinity of Wynyard Station. A number of bus routes would also be re-routed along York and Clarence Streets.</p> <p>The exact bus routes that would be impacted in this way are yet to be confirmed by Sydney Buses.</p>	<ul style="list-style-type: none"> - The re-routing of bus services would increase the number of pedestrians alighting in and around Wynyard Station adding to pedestrian volumes at this location and potential impacts during construction. - It is expected that only a small percentage of pedestrians that alight from these bus services would access Wynyard Station for the purposes of modal change onto a rail service to access their final destination. However, this would be dependent on the final changes to bus routes and timetabling. - Given the access restrictions resulting from construction works during the construction of the station upgrade, the majority of pedestrians that alight from bus services (that do not have to continue their journey via train) would likely choose to travel along the surface road network rather than underground through the station.
<p>333 George Street redevelopment</p> <p>Pedestrian thoroughfares have been maintained along George Street and Regimental Square. However, the scaffolding has been erected along the site boundaries and the columns along the George Street frontage restrict pedestrian capacity along George Street.</p> <p>The construction of this project would not have a direct interface or impact on Wynyard Station.</p>	<ul style="list-style-type: none"> - The re-distribution of pedestrian flows that could result from a combination of all projects could increase pedestrian flows through Regimental Square, which is already a key pedestrian route between the Wynyard bus interchange, George Street and Martin Place.

5.1.2 Traffic-related impacts

Heavy vehicle movements

During peak construction periods, approximately 30 heavy vehicle trips (or 60 movements) per day would be generated by the proposal. This would reduce to around 15 heavy vehicle trips (30 movements) per day during average construction periods. As detailed in **Section 4.3** and **Section 4.5**, heavy vehicle trips would not occur during AM peaks (7am – 9am) and would be spread across a 24 hour period given the access constraints to construction areas and the need to minimise potential impacts on the surrounding road network. As such, the maximum number of heavy vehicles within any one hour would be around three heavy vehicles (while the Wynyard Park compound is not operational).

If the Wynyard Park compound is established, the overall maximum and average movements per day would not increase as these would be redistributed from other access points. At this stage, the maximum trip generation per hour would increase from three to nine heavy vehicles per hour. However, these movements would occur between 8pm and 10pm, Sunday to Thursday.

The location and operating hours for the construction access points has been proposed to avoid and/or minimise the potential for adverse impacts on traffic flow and public transport). The expected maximum daily and hourly heavy vehicle trips are relatively low in comparison to traffic volumes on the surrounding network. For example, York Street carries around 1,010 vehicles and 370 buses per hour (Jacobs, 2014) during the peak period. The proposed use of an off-site compound (subject to any necessary separate approvals process) would also assist in scheduling deliveries and prevention of heavy vehicles queuing along the immediate road network. As such, the proposal (in isolation) is not expected to result in significant road network impacts. Potential cumulative impacts are considered below.

Construction vehicle movements would not occur during the AM peak. However, it is acknowledged that the road network in this area is congested during PM peaks. Therefore it is recommended that construction traffic avoids these times, where feasible and reasonable. Road space that would be temporarily occupied by heavy vehicles loading/unloading via Margaret Street, George Street, Wynyard Lane, York Street and York Lane would need to be negotiated with City of Sydney (as roads authority), and coordinated with Sydney Buses (where applicable). This is likely to be restricted to outside of peak hours. Traffic control measures would also need to be implemented during loading/unloading activities, and signage erected to notify motorists. After commencement of construction of CSELR access from George Street would have to be negotiated with the Light Rail contractor. This is anticipated to only be possible while CSELR enabling works are underway and prior to the commencement of main CSELR works along George Street.

During periods when loading/unloading via George Street or Margaret Street is not possible, Wynyard Lane would be used. This would involve heavy vehicles loading and unloading onto forklifts within the laneway. Forklifts would then move between the vehicle and the Wynyard Lane goods lift or the Wynyard Lane Car Park. The latter is required as the size of vehicles that can access the Wynyard Lane Car Park is to be restricted, given the size of the former tram tunnels, and would be done under traffic control.

Wynyard Lane is a narrow one-way street that provides rear access to buildings that back onto the laneway, and access to building car parks. Conflicts with other service vehicles, private vehicles using the laneway (and car park) and construction vehicles associated with the 333 George Street development could occur while deliveries are in progress. Traffic management would be required to ensure adequate access and circulation around a loading/unloading vehicle is maintained. However, once One Carrington Street construction commences, Wynyard Lane would be partially closed and alternative arrangements would be made to access and egress the car park via Cumberland Street. This is discussed further in this section.

York Lane would also be used for the delivery of the materials and equipment required for the upgrade of the York Lane goods lift in addition to occasional deliveries. York Lane is partially closed as a result of Wynyard Walk construction, and as such, heavy vehicles delivering equipment and materials for the proposal would need to reverse down York Lane from Erskine Street. In a worst case scenario, the sweep path of the vehicle would block oncoming traffic on Erskine Street as vehicles up to six tonnes reverse into York Lane.

This would occur under traffic control during which time Erskine Street and York Lane would be temporarily closed. The closure and reopening of Erskine Street would likely take up to 10 minutes. York Lane would be closed while the vehicle remains within the laneway, which would be around 30 to 40 minutes in duration. Given the function and use of Erskine Street in the CBD road network and the limited lane capacity (for vehicle storage) between York Street and Clarence Street, the delivery of material to York Lane would need to be limited to the evening period or during the daytime on weekends. The final arrangements and required traffic control measures would be subject to negotiations with City of Sydney.

For the Wynyard Park compound, it would be necessary to utilise part of York Street to provide two heavy vehicle spaces for deliveries. Preference would be given to the use of bus laydown areas to avoid disruption to bus stops, however, this would be confirmed during detailed design and in negotiation with City of Sydney and Sydney Buses. The occupation of the road space is planned to only be used during the evening when there is reduced bus demand (between 8pm and 10pm). If bus stops are impacted, this would require bus stop relocation during the evenings. The location for the alternative temporary bus stops would be subject to further investigation by Transport for NSW. In order to ensure that bus passengers are fully informed of these changes, notification arrangements would be developed in collaboration with the Transport Management Centre and bus operators (such as Sydney Buses). This would include advance notification via signage, web updates and other communication channels.

During periods where buses replace train services (such as during significant service breakdowns or rail possessions), the temporary heavy vehicle parking spaces may not be available due to increased bus demand. Construction scheduling would need to be coordinated with scheduled rail possessions (which are likely to be a time of high construction activity for this proposal), and procedures prepared to respond to incidents or emergencies that require increased bus services (such as a rail network breakdown).

The proposed bus infrastructure changes in the vicinity of the proposal occur along York and Clarence Streets, where new bus layovers would be provided or bus stops would be converted to layovers. As discussed in **Section 5.1.1**, the changes to bus scheduling and routes is yet to be finalised. As details of these changes are made available, the traffic and pedestrian management plans would be updated and additional mitigation measures implemented (if required).

Light vehicle movements

Construction workers would be encouraged to use public transport to travel to and from the construction site. The limited areas available for construction preclude the provision of any on-site parking for workers.

There may be occasional light vehicle movements associated with smaller deliveries or certain trades that may access the construction site. Parking for these vehicles would be negotiated with the operator of the Wynyard Lane Car Park and/or Brookfield.

Cumulative impacts

The road access arrangements to George Street and/or Wynyard Lane would change once the construction of CSELR and/or One Carrington Street commences. Construction activities associated with Wynyard Walk construction and Barangaroo would also still be underway when construction commences on the proposal. Heavy vehicle movements associated with each project would have a cumulative impact on the surrounding network, noting that:

- Approximately 100 heavy vehicles per day would be generated by One Carrington Street development at the peak of construction activities (concrete pours) (GTA consultants, 2014). Vehicles accessing or departing the site would use Wynyard Lane, York Street, Carrington Street, Margaret Street and Wynyard Street. Work zones would be established on Carrington Street, Wynyard Street and Margaret Street to accommodate construction vehicles (GTA consultants, 2014). Once construction works at One Carrington Street partially closes the George Street pedestrian ramps, the competing demands of each construction project and impacts to pedestrian flows would mean that access via George Street would need to be coordinated with Brookfield. There would also be competing demands for a works zone on Margaret Street (should this also be required by Brookfield), and within Wynyard Lane Car Park, should a construction compound be established at this location.
- Heavy vehicle movements associated with Wynyard Walk would peak to approximately 178 heavy vehicles per day (or 18 vehicles per hour), and approximately 30 to 50 heavy vehicles per day (or nine vehicles per hour) during non-peak stages of construction (Parsons Brinckerhoff, 2012). Streets between York Street and Hickson Road would be used by heavy vehicles to access and egress construction compounds.
- Heavy vehicle movements associated with the CSELR (First Fleet Park Worksite) would likely peak at around 80 to 100 vehicles per day within the CBD, but would average around three to six heavy vehicles per day (Booz & Company and AECOM, 2013). Heavy vehicle movements would primarily use the Cahill Expressway, George Street (north of Bridge Road) and Hickson Road to access and egress the main site compound in the CBD (located at Circular Quay). However, broader road network implications would be more significant, given the exclusion of general traffic from George Street.
- Construction has commenced for the 333 George Street redevelopment, which also involves a works zone on Wynyard Lane.

Given the relatively low volumes of construction vehicles associated with the proposal, the restriction of heavy vehicle movements to outside of peak hours on the road network, and the restriction of construction activities during commuter peaks, the proposal would not significantly contribute to any potential cumulative impacts. Minimising potential cumulative impacts on the broader road network in the CBD would be more effectively targeted at the major trip generators, should the peak periods of these projects overlap. However, there would be the need to ensure any changes in the road network, construction site access or activities that may impact road performance, are coordinated with the construction activities immediately adjacent to the project.

Once construction commences on the CSELR and/or One Carrington Street development, access to the construction site via George Street, Wynyard Lane, Carrington Street and Wynyard Street would become significantly restricted. To enable deliveries to continue via the George Street ramps, a works zone would be established at Margaret Street as loading/unloading directly on George Street would not be possible due to emergency vehicle access requirements once CSELR commences. Site safety procedures and traffic management controls would need to be implemented to manage the transport of material to/from the works zone. As noted earlier, Brookfield has also identified this as a potential works zone. Access to the works zone would need to be coordinated (should Brookfield proceed with its request). Given the different construction hours, a shared works zone is considered to be feasible.

Access arrangements once One Carrington Street construction commences would need to be coordinated and negotiated with Brookfield so that adverse cumulative impacts do not arise. This would include the use of Wynyard Lane Car Park, and negotiations concerning the level of access that could be provided to the proposal once access to the car park is restricted to Cumberland Street. This access would need to be jointly used by Brookfield as well as Coles supermarket until the Wynyard Lane goods lift has been replaced (GTA consultants, 2014). Large vehicles would also be unable to use this access, given height restrictions, the small radius at the entry/exit point, the inability to cater for two-way movements and the absence of u-turn movement facilities within the car park (GTA consultants, 2014). If this access can be negotiated with Brookfield, a joint traffic management plan would need to be implemented with participation with Coles supermarket. The works zone would displace four parking spaces, which would require necessary approvals from the Sydney Harbour Foreshore Authority.

Should cumulative impacts and restrictions due to surrounding construction projects unacceptably constrain proposal access options, the installation and use of the Wynyard Park compound (and construction hoist) may be considered.

5.2 Operational impacts

The proposal does not involve any permanent changes to the way in which pedestrians or commuters access the station at street level. Minor vehicle movements, associated with station maintenance or waste removal, occur presently and would not change in frequency as a result of the proposal. As such, there are no anticipated changes to the road traffic network as a result of the proposal.

However, there would be impacts to commuters and pedestrians within the station domain as a direct result of the proposal.

To assess the future performance of Wynyard Station in 2021, an analysis of the pedestrian level of service during the AM, PM and midday peaks within the concourse and station platform areas was undertaken using the LEGION model (AECOM, 2014).

Rail and pedestrian movements through Wynyard Station are expected to increase as a result of development currently being constructed and proposed in the immediate surrounds to the station and the wider precinct. To this end the performance of the station in the year 2021 has been assessed, which includes growth in demand associated with key rail network improvements (including the completion of the South West Rail Link and NWRL and increased train frequency across much of the network), as well as Barangaroo, One Carrington and the opening of Wynyard Walk.

Table 8 shows the pedestrian movements modelled for 2021 at Wynyard Station. The number of pedestrian movements within the concourse area is expected to increase by around 40 per cent compared to the existing situation. The use of Platforms 3 and 4 is expected to increase by around 20 per cent and Platforms 5 and 6 in the order of 70 per cent. This increase in passenger movements would further exacerbate pedestrian congestion at Wynyard Station and reduce the level of service from that currently experienced if no works were to progress at the station.

Table 8 2021 Modelled Pedestrian Movements at Wynyard Station during the 1-hour Peak Period (AECOM, 2014)

Location	AM 1-hour Peak	PM 1-hour Peak
Concourse	41,100	35,750
Platforms 3 and 4	17,800	16,050
Platforms 5 and 6	18,300	14,200

Operational Performance (with Proposal Upgrade)

The proposal would improve the layout of the public domain (both concourse and platforms) which would seek to remove pedestrian pinch points and improve sight lines, wayfinding, pedestrian flow and LoS. The key layout improvements would include:

- An increase in the total public domain area, primarily through the removal of retail space in the eastern and western unpaid concourse areas.
- Widening of the western unpaid concourse area at the approach to the Wynyard Walk tunnel and connection to the completed Wynyard Walk.
- Widening of the northern concourse area.
- An increased number of ticket gates and widened paid concourse area.
- An additional staircase connecting the paid concourse area to Platforms 3 and 4.
- Changed directional flow of the southern-most staircase to Platforms 5 and 6
- Removal of the unused escalator enclosures on Platforms 5 and 6.

These design improvements were modelled using the expected pedestrian movements presented in **Table 9** to determine the expected LoS following the construction of the proposal. The results show a general improvement in pedestrian flows in comparison to the existing situation, primarily the reduction in time spent under LoS D conditions in the paid concourse. The minor shortfalls in LoS C are considered acceptable given that this is the target LoS and the substantial improvement in customer time experiencing a LoS D or worse.

Improved pedestrian flows within the paid concourse area would be the result of the widening of the paid concourse area as well as an increased number of ticket gates. These improvements would help address the current safety concerns associated with passengers queuing along stairs and platforms.

However, even with the pedestrian flow improvements in the paid concourse, the LoS on all platforms would still be expected to deteriorate by 2021 given the strong growth in rail demand expected over this period. This would be a direct result of passenger demand increasing by over 70 per cent on Platforms 5 and 6, and 40 per cent on Platforms 3 and 4. These are whole of network capacity issues that are not able to be addressed through improvements to the existing Wynyard Station alone. There are longer term strategies to increase capacity and relieve congestion on the rail network in the Sydney CBD, including the Sydney Rapid Transit project which includes a second harbour crossing and a new Sydney CBD rail line.

Table 9 Existing and Modelled Pedestrian Movements at Wynyard Station during AM 20 min peak average

Concourse	Level of Service	No upgrade (2014 – existing) Percentage (%) of time	No upgrade (2021 – modelled) Percentage (%) of time	With upgrade (2021 - modelled) Percentage (%) of time
Paid	C	21	19	24
	D or worse	36	54	27
Unpaid	C	24	26	26
	D or worse	13	10	10

6.0 Mitigation and management measures

Mitigation and management measures that would be implemented during construction are detailed in **Table 10**. As no permanent adverse impacts to pedestrians or the road traffic network would occur during operation of the station, no mitigation and management measures have been recommended.

Table 10 Mitigation and management measures

Identification Number	Condition
1	A pedestrian flow analysis would be completed prior to the commencement of construction based on the final staging strategy. This would assist in identifying minimum width passageways within the public domain based on peak and off-peak commuter movements and to confirm that adequate flows can occur following the closure of the southern concourse, prior to the widening of the northern concourse.
2	<p>A Construction Traffic and Pedestrian Management Plan (CTPMP) would be prepared and would be developed in consultation with the Roads and Maritime Services and City of Sydney prior to the commencement of construction. This would be supported by a pedestrian flow analysis and construction wayfinding strategy for the final staging strategy for the proposal. The CTPMP would include measures such as:</p> <ul style="list-style-type: none"> - <i>Construction traffic</i> <ul style="list-style-type: none"> • Signage (for example, deploying temporary speed restrictions, changes to the road environment, traffic management controls). • Traffic control plans for access points and Wynyard Park compound, if used. • Scheduling heavy vehicle movements outside the morning and evening peak periods, where feasible and reasonable. • Temporary bus infrastructure changes in the vicinity of Wynyard Park to accommodate access to the construction compound. Any such changes would be coordinated with Sydney Buses, and would account for rail possessions. • Driver protocols and communication methods to avoid queuing of heavy vehicles on the road network. - <i>Pedestrian management</i> <ul style="list-style-type: none"> • The establishment and implementation of minimum width walkways within the public domain based on peak and off-peak commuter movements to enable safe passage of pedestrians, guided by the pedestrian flow analysis. • Early removal of redundant structures within the station to minimise unnecessary obstructions to pedestrian flows. • Installation of appropriate signage to support wayfinding and allow public awareness of changed pedestrian flows and conditions. - Managing staging of works to accommodate high-demand special events (e.g. Vivid, New Years Eve) during which public transport is provided in addition to timetabled services and for extended hours. - Monitoring procedures to assess the effectiveness of management measures, and the implementation of corrective action(s) if required. - Contingency measures that would be implemented to manage construction site access in the event that an emergency requires bus services to replace train services at Wynyard Station.
3	Where feasible, construction vehicle movements would be scheduled outside the weekday peak (7am – 9am, 4pm – 6pm) to minimise disruption to surrounding road network.

Identification Number	Condition
4	<p>Pedestrian access would be maintained to Wynyard Station at all times when the station is open. Where possible, construction work within the public domain would be undertaken outside of peak commuter periods to minimise congestion and maintain pedestrian safety.</p> <p>Adjustments to regular pedestrian routes to and within the Station (e.g. movement of hoardings) would occur outside commuter peak periods.</p>
5	<p>Necessary approvals to temporarily occupy Wynyard Lane, York Street, Margaret Street, York Street, York Lane and Cumberland Street (such as Road Occupancy Licences) would be obtained from the relevant authority (City of Sydney and Sydney Harbour Foreshore Authority) prior to works that would require the possession of a road. These would be supported by traffic control plans.</p>
6	<p>Transport for NSW and the contractor would coordinate with Sydney Buses, any other relevant bus operators and the Traffic Management Centre on required changes to bus infrastructure around Wynyard Park resulting from the Sydney City Centre Bus Infrastructure modifications proposal and Access Strategy. If the establishment of the Wynyard Park compound is required, the same parties would be consulted. This would be considered within the CTPMP.</p>
7	<p>Consultation with key authorities, including Roads and Maritime Services and City of Sydney, in addition to contractors responsible for the delivery of the CSELR and the proposed One Carrington Street, would be undertaken to manage potential cumulative traffic and transport impacts in the vicinity of Wynyard Station. If necessary, forums, such as a CBD Transport Taskforce, would also be utilised.</p>
8	<p>The traffic management plan will be developed in consultation with Brookfield and Coles supermarket for the use of Wynyard Lane Car Park, Wynyard Lane goods lift and Cumberland Street.</p>
9	<p>Opportunities to enable deliveries to occur via the George Street ramps would be explored with the CSELR contractor.</p>
10	<p>Temporary changes to bus infrastructure, as a result of this proposal, would also be communicated to bus commuters using methods such as signage, website updates, transport applications and real time text / SMS updates. The required communication protocols and methods would also be detailed within the CTPMP.</p>
11	<p>A community liaison plan would be prepared and implemented to manage consultation during construction. This would detail procedures for the seeking and receiving feedback from the community and businesses, and for procedures to respond to any enquiries or complaints</p> <p>In particular, procedures would be implemented to provide advance notice of upcoming works that would restrict or disrupt traffic or pedestrian movements, and these would be clearly signposted ahead of the construction activity.</p> <p>Contact details for a 24-hour construction response line, project info line and email address would be provided for ongoing stakeholder contact throughout the construction stage. Complaints during construction would be managed in accordance with Transport for NSW's <i>Community Engagement Policy</i>.</p>

7.0 Conclusion

In comparison to traffic volumes on the surrounding network, the daily heavy vehicle movements associated with the proposal would be low, with the maximum movements expected to peak at around 30 heavy vehicle trips (60 movements) per day (or three heavy vehicle movements per hour on average). As construction activities for projects in the vicinity of Wynyard Station commence, construction vehicle access and egress would become increasingly difficult. In order to maintain adequate access throughout construction, and to avoid cumulative impacts on the surrounding road network, the contractor would need to enter into agreements with the contractors delivering the CSELR and the One Carrington Street development. In particular, the feasibility of dual use of the Wynyard Lane Car Park by both contractors should be explored, as this could assist in avoiding the need to establish the Wynyard Park compound. Should the Wynyard Park compound be required, impacts to bus infrastructure would need to be further investigated and coordinated with Sydney Buses. The use of forums, such as the CBD Traffic Taskforce, would also assist in coordinating effective responses to the increased demand on the surrounding road network.

It is not anticipated that a significant number of commuters would alter travel patterns to avoid construction activity at the station, due to the walking distance between stations within the CBD and interchange with bus services at Wynyard Park. As such, the staging of construction activities within the public domain would be critical in terms of maintaining adequate and safe movement of commuters, and pedestrians who use the station domain to pass through to neighbouring areas. This would be documented within a detailed construction staging strategy and CTPMP which would be prepared during detailed design. Coordination between other surrounding projects would be required to ensure cumulative impacts on pedestrian movements are appropriately managed. This includes wayfinding strategies, coordination at direct construction interfaces and the coordination with Sydney Buses in light of the anticipated changes to bus scheduling within the CBD.

Conflicts with pedestrians and construction activities may also occur at street level, where access or construction compounds would be established. However, traffic control measures and signage would be put in place to direct pedestrian movements and minimise impacts, should this occur.

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Appendix A

Fruin Level of Service

Appendix A Fruin Level of Service

Appendix Fruin Level of Service Criteria

J J Fruin developed a set of planning principles to assess pedestrian crowding and is documented in his book 'Pedestrian Planning and Design'; 1987. These principles have since been adopted as the global industry standard approach to planning for pedestrians. This methodology is used to interpret the performance of space and how people move and interact under certain conditions and results are categorised into Levels of Service.

The purpose of the analysis is to identify potential pinch-points of the proposed design based on the predicted level of pedestrian demand. The analysis assesses circulation areas including stairs, walkways and queuing areas. The flow rates, densities and performance of space are informed by Fruin Levels of Service (detailed in the figure below) and categorised into bands that are graded from 'A' to 'F'.

Figure Fruin Levels of Service metrics

FRUIN Level of Service Parameters - Walkways										
LEVEL OF SERVICE	DENSITY (ped / m ²)		SPACE (m ² / ped)		FRUIN SPACE (ft ² / ped)		FLOW RATE (ped / m / min)		FRUIN FLOW RATE (ped / ft / min)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
A		0.31	3.25		35		23.0		7	
B	0.31	0.43	2.32	3.25	25	35	23.0	32.8	7	10
C	0.43	0.72	1.39	2.32	15	25	32.8	49.2	10	15
D	0.72	1.08	0.93	1.39	10	15	49.2	65.6	15	20
E	1.08	2.15	0.46	0.93	5	10	65.6	82.0	20	25
F	2.15			0.46		5	82.0		25	

FRUIN Level of Service Parameters - Stairs										
LEVEL OF SERVICE	DENSITY (ped / m ²)		SPACE (m ² / ped)		FRUIN SPACE (ft ² / ped)		FLOW RATE (ped / m / min)		FRUIN FLOW RATE (ped / ft / min)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
A		0.54	1.86		20		16.4		5	
B	0.54	0.72	1.39	1.86	15	20	16.4	23.0	5	7
C	0.72	1.08	0.93	1.39	10	15	23.0	32.8	7	10
D	1.08	1.54	0.65	0.93	7	10	32.8	42.7	10	13
E	1.54	2.69	0.37	0.65	4	7	42.7	55.8	13	17
F	2.69			0.37		4	55.8		17	

FRUIN Level of Service Parameters - Queues										
LEVEL OF SERVICE	DENSITY (ped / m ²)		SPACE (m ² / ped)		FRUIN SPACE (ft ² / ped)		FRUIN INTER-PERSON SPACING			
	Min	Max	Min	Max	Min	Max	Min	Max		
A		0.83	1.21		13		4			
B	0.83	1.08	0.93	1.21	10	13	3.5	4		
C	1.08	1.54	0.65	0.93	7	10	3	3.5		
D	1.54	3.59	0.28	0.65	3	7	2	3		
E	3.59	5.38	0.19	0.28	2	3		2		
F	5.38			0.19		2				

Circulation zone
Comfort zone
No touch zone
Touch zone

When used as an output metric, the Level of Service demonstrates the relationship between speed, density and flow rates; a Level of Service A indicates a high speed, free-flowing environment with a low flow rate, whereas a Level of Service E or F demonstrates a high density, low-speed environment with a high flow rate. The desired Level of Service depends on the context of the environment.

The Fruin Levels of Service are displayed in following figures to indicate what each Level of Service (LoS) would represent for each criterion. The accompanying diagram represents a view of the density based on a 3 metres by 2 metres area (delineated by the grey shaded section).

Figure Description of levels of service for walkways













Fruin LoS	Description of LoS for Walkway	
A	Normal walking speed can be freely selected & slower pedestrians can be easily overtaken. Cross conflicts can be easily avoided.	
B	Sufficient space is available to select normal walking and to bypass other pedestrians in primarily one-directional flows. Where there are reverse-direction or crossing movements, minor conflicts will occur.	
C	Restricted ability to select normal walking speed & freely pass others. High probability of conflict where crossing movements & counter-flows exist. Conflict avoidance requires frequent adjustment of walking speed & direction. Flow is reasonable fluid, however considerable friction & interaction between pedestrians is likely to occur.	
D	Restricted walking speed; overtaking slower pedestrians is difficult. Counter-flows & crossing movements severely restricted. Some probability of reaching critical density causing temporary stoppages.	
E	Walking speed & passing ability is restricted for all pedestrians. Forward movement is possible only by shuffling. Counter-flows & crossing movements extremely difficult. Flow volumes approach limit of walking capacity.	
F	Severely restricted walking speed; frequent unavoidable contact with others; reverse or cross movements are virtually impossible. Pedestrian flow is sporadic & unstable.	

Figure Description of levels of service for queuing areas

Fruin LoS	Description of LoS for Queuing	
A	Space is provided for standing and free circulation through the queuing area without disturbing others.	
B	Space is provided for standing and restricted circulation through the queue without disturbing others.	
C	Space is provided for standing and restricted circulation through the queuing area by disturbing others. It is within the range of the personal comfort body buffer zone established by psychological experiments.	
D	Space is provided for standing without personal contact with others, but circulation through the queuing area is severely restricted, and forward movement is only possible as a group.	
E	Space is provided for standing but personal contact with others is unavoidable. Circulation within the queuing area is not possible. This level of area occupancy can only be sustained for short periods of time without physical and psychological discomfort.	
F	Space is approximately equivalent to the area of the human body. Standing is possible, but close unavoidable contact with surrounding standees causes physical and psychological discomfort. No movement is possible, and in large crowds the potential for panic exists.	

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