CBD AND SOUTH EAST LIGHT RAIL PROJECT

ENVIRONMENTAL IMPACT STATEMENT

VOLUME 2

Technical papers

TECHNICAL PAPER 2: CONSTRUCTION TRAFFIC MANAGEMENT PLAN

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FINAL REPORT

Construction Traffic and Transport Management Strategy

TRANSPORT FOR NSW

07 NOVEMBER 2013

SYDNEY

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Executive Summary

Purpose of the Report

This report outlines potential traffic and transport impacts during construction of the CBD and South East Light Rail (CSELR) project and identifies proposed transport management measures that would be adopted to mitigate these impacts. This assessment has been undertaken at two levels:

- Network level construction impacts and mitigation measures – which aim to minimise any reduction in network performance and journey times for all road users. This includes travel demand management measures, to ensure demand is better matched to the temporarily reduced network capacity.
- Precinct level construction impacts and mitigation measures – which addresses the day-to-day activities undertaken on and around the corridor. This includes local traffic, pedestrian, cycle and emergency vehicle access.

This report is one of a number of technical documents prepared to support the planning approvals process for Transport for New South Wale (TfNSW) State Significant Infrastructure Application for the CSELR proposal under Part 5.1 of the NSW Environmental Planning & Assessment Act 1979 (EP&A Act). It should be read alongside the Transport Operations Report (prepared by the Integrated Transport and Land Use Technical Advisers), which identifies potential impacts and proposed transport management measures for the end-state operation.

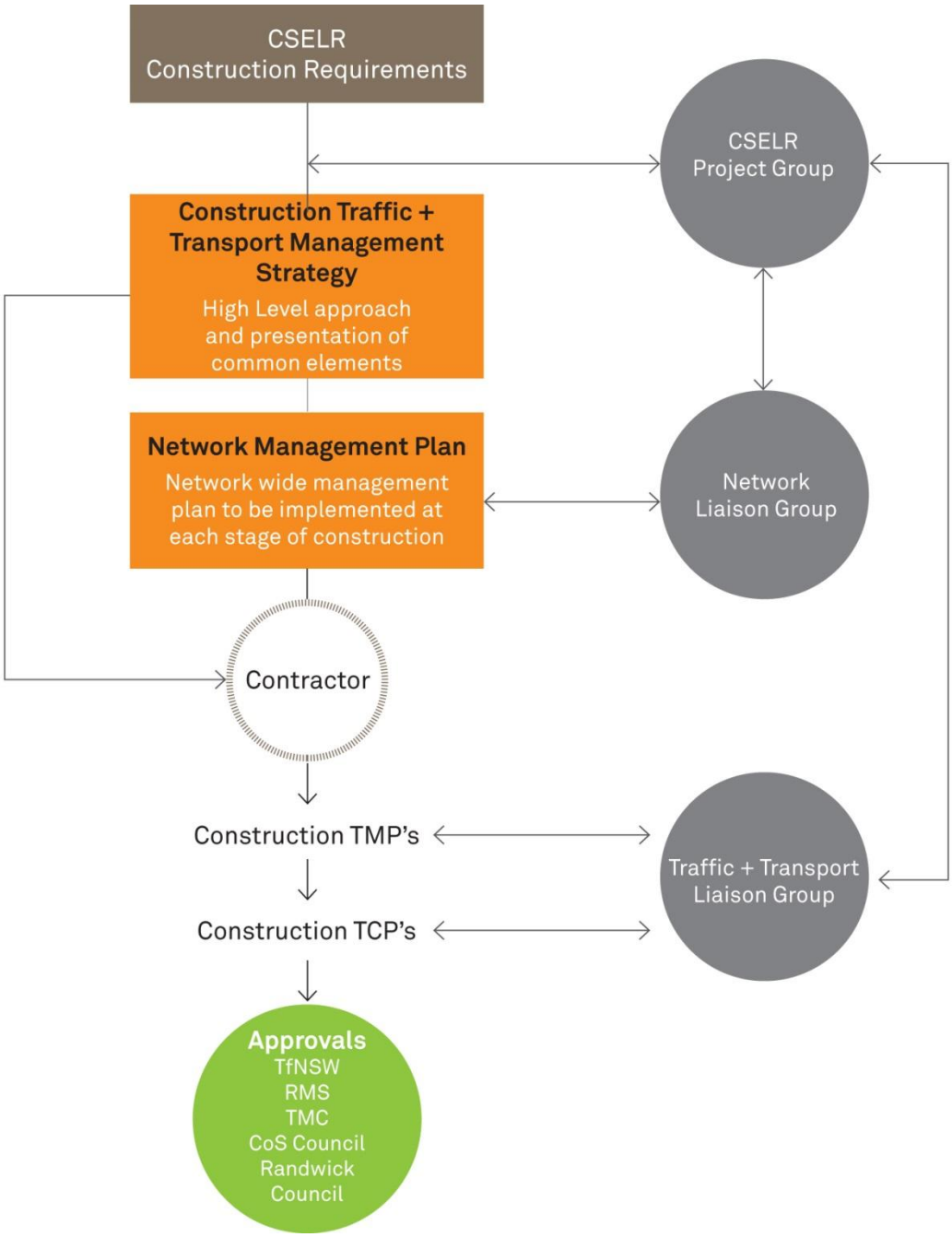
This report aims to inform the planning approvals process by assessing the potential transport and traffic impacts of constructing the CSELR project. This CTTMS identifies one likely approach to construction and set out the framework by which adverse impacts of construction on the operation of the transport network could be managed. The CTTMS represents the first in a series of progressively more detailed management plans that would be developed for the construction of the Sydney CBD and South-East Light Rail (CSELR).

In total, there would be four levels of documentation to help manage and mitigate traffic and transport network impacts during construction of the CSELR:

- Construction Traffic and Transport Management Strategy (TfNSW and ITLU) (this document);
- Network Management Plan (TfNSW, Enabling Works and Civil Works Contractors);
- Site Specific Construction Traffic Management Plans (Enabling Works and Civil Works Contractors); and
- Site Specific Construction Traffic Control Plans (Enabling Works and Civil Works Contractors).

The process to be followed and hierarchy of these plans is shown below in Figure 0-1.

Figure 0-1: Hierarchy of Traffic & Transport Management Plans



Construction Staging

Construction of the CSELR will consist of three key stages – Early Works, Main Civil Works and Commissioning. Estimated time periods for each of these main stages of construction are shown in Table 0-1. Allowing for some overlap between stages the total construction program is expected to occur over a period of 6 years.

Table 0-1 Construction Program Overview

Construction Phase	Estimated Length
Early Works Construction	1-2 years
Main Civil Works Construction	3-4 years
Testing & Commissioning	1 year
Total Construction Program	Up to 6 years

Construction Scenario

The Construction Traffic and Transport Management Strategy (CTTMS) assumes maximum worksite footprints would be required during the civil works and that early works utility adjustments can be undertaken within the same footprint as developed by the construction advisor. This assumption has been made to assess the worst case traffic and transport impacts - with the full length of the corridor as an active worksite and all proposed road closures in place concurrently and managed accordingly. However, as a general principle to improve legibility for users, it has also been the objective of this CTTMS to minimise the number of required changes to the road network. As such, wherever appropriate, the CTTMS proposals align with the end-state network configurations. More specific construction scenario implications are summarised below.

- Within the CBD and Surry Hills:
  - Alfred Street between George Street and Loftus Street would be closed to general traffic with only local and emergency access permitted;
  - George Street would be closed to general traffic with only local and emergency access permitted. The majority of intersections along George Street would remain open, however full intersection closures would occur on weekends but in accordance with Transport Management Centre approvals;
  - Chalmers and Devonshire Streets would be closed to general traffic with only local and emergency access permitted; and
  - The coach station and bus lane along Eddy Avenue would be relocated.
- Anzac Parade would be unaffected north of Dacey Street, but would operate with two of the six lanes closed south of Dacey Street. There would also be a change in operating arrangements and weekend closures of some intersections.
- Alison Road would remain open, but would operate with two of the six lanes closed with weekend closure of some intersections. This would reduce the number of right turn lanes on Darley Road and the intersection with Alison Road.
- Wansey Road would be closed to general traffic with only local and emergency access permitted.
- High Street would remain open, with weekend closures of some intersections.
- The closures of intersections would be in accordance with TMC approvals.

Network Level Construction Impacts and Mitigation

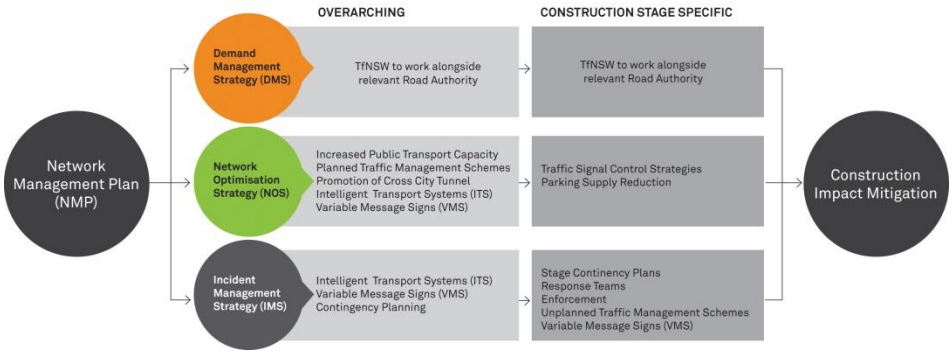
Management and Mitigation Principles

The following overarching principles have been applied to determine management or mitigation measures for network wide construction impacts:

- Manage transport efficiency against an extended construction program to identify a balanced outcome;
- Implement demand management measures to reduce the demand for travel to levels that can be serviced by the capacity available during construction;
- Minimise impact to active transport modes;
- Minimise impact to property and emergency vehicle access along the corridor; and
- Manage impacts safely.

Based on these principles, the CSELR Network Management Plan (NMP) identifies the key measures that would be implemented during construction to ensure journey times and congestion levels are kept at acceptable levels. The structure of the plan is set out below in Figure 0-2.

Figure 0-2: CSELR Construction Network Management Plan



The NMP seeks to align the peak period travel demand with the traffic capacity available during construction. To maximise their effectiveness across the network, it is essential that these strategic measures are planned and coordinated as one.. Successful implementation of the NMP would ensure that network impacts during construction of CSELR can be adequately managed and negative impacts minimised.

A summary of the potential network level impacts and the proposed management and mitigation approach is outlined below.

Bus Management

The Sydney City Centre Bus Plan (SCCBP) removes all buses from George Street as part of a redesigned bus network. The majority of the SCCBP will be implemented prior to CSELR construction commencement. Changes to the south east bus network included within the SCCBP are however dependent on light rail, thus they will not be implemented until the CSELR is operational. As such construction management needs to maintain access for all bus services in the south east.

The SCCBP interfaces with the construction of light rail at four key locations:

1. Chalmers Street
2. Eddy Avenue
3. Rawson Place
4. Park Street/Druitt Street/George Street intersection

Local bus diversions have been developed to manage the impact on bus operations at these four locations during construction.

Traffic Management

As part of the NMP, targeted traffic management measures would address the reduction in traffic capacity that results during construction. Upgrade measures would include but not be limited to:

- Reversal in operation of one and two way streets to maximize operational efficiency and access. This includes:
    - Pitt Street two-way (between Alfred Street and Bridge Street)
    - Two-way operation of Hunter Street with Margaret Street
    - Reversal of O'Connell Street
- Removal of kerb blisters and extension of parking restrictions to increase the number of operational traffic lanes;
- Upgrade of intersection geometries and signal phasing to optimise the priority traffic corridors as set out in Section 4;
- Banning of traffic movements to increase intersection capacities and optimize priority routes; and
- Rephasing traffic signals.

Parking Management

All on-street parking and loading along the light rail corridor would be affected during construction. A parking utilisation study undertaken for the CSELR project concluded that, whilst parking demand based on current levels would reach or exceed the reduced capacity in some localised areas, these effects could be managed through:

- Extension of parking permit schemes, particularly in predominately residential precincts surrounding the project corridor. These would be designed to afford priority to local residents to park in the vicinity of their home with an allowance for short term parking for visitors and for vehicle access to commercial land uses and other short stay trip generators; and
- Providing priority on streets immediately adjacent to the project corridor where commercial land uses are present for loading and short term parking. For example, allocation of kerbside capacity on side streets directly off the corridor for locations where commercial land uses are present for loading and short term parking

Implementation of the above proposed measures would require consultation with Randwick City Council and City of Sydney Council.

Pedestrian Management

Site specific pedestrian management would be adopted to manage the existing longitudinal (along footpath) and transverse (across roads) pedestrian movements. For the majority of the construction works, the existing longitudinal pedestrian movements would be maintained along the footpaths. Appropriate management measures for transverse pedestrian movement would need to be adopted by the selected construction contractor.

During installation of overhead wiring poles and service relocations during the early works stage, additional localised footpath restrictions would be required. During such cases, the footpaths would be narrowed past the worksite or pedestrians would be diverted to adjacent footpaths via safe crossing facilities with appropriate barriers and signs.

Where worksites have an impact on footpaths, consideration would be given to the requirements of all pedestrians and especially vulnerable users. Disability Discrimination Act requirements would be adopted with drop kerbs and other necessary measures provided at crossings. Footpath widths would allow two-way pedestrian traffic facilitating access for pushchairs and wheelchairs.

Cycle Management

Existing cycle routes have been maintained along the corridor where the footprint of the worksite permits. Where the worksite occupies existing cycle facilities or makes their retention unsafe, alternative routes have been identified. For example:

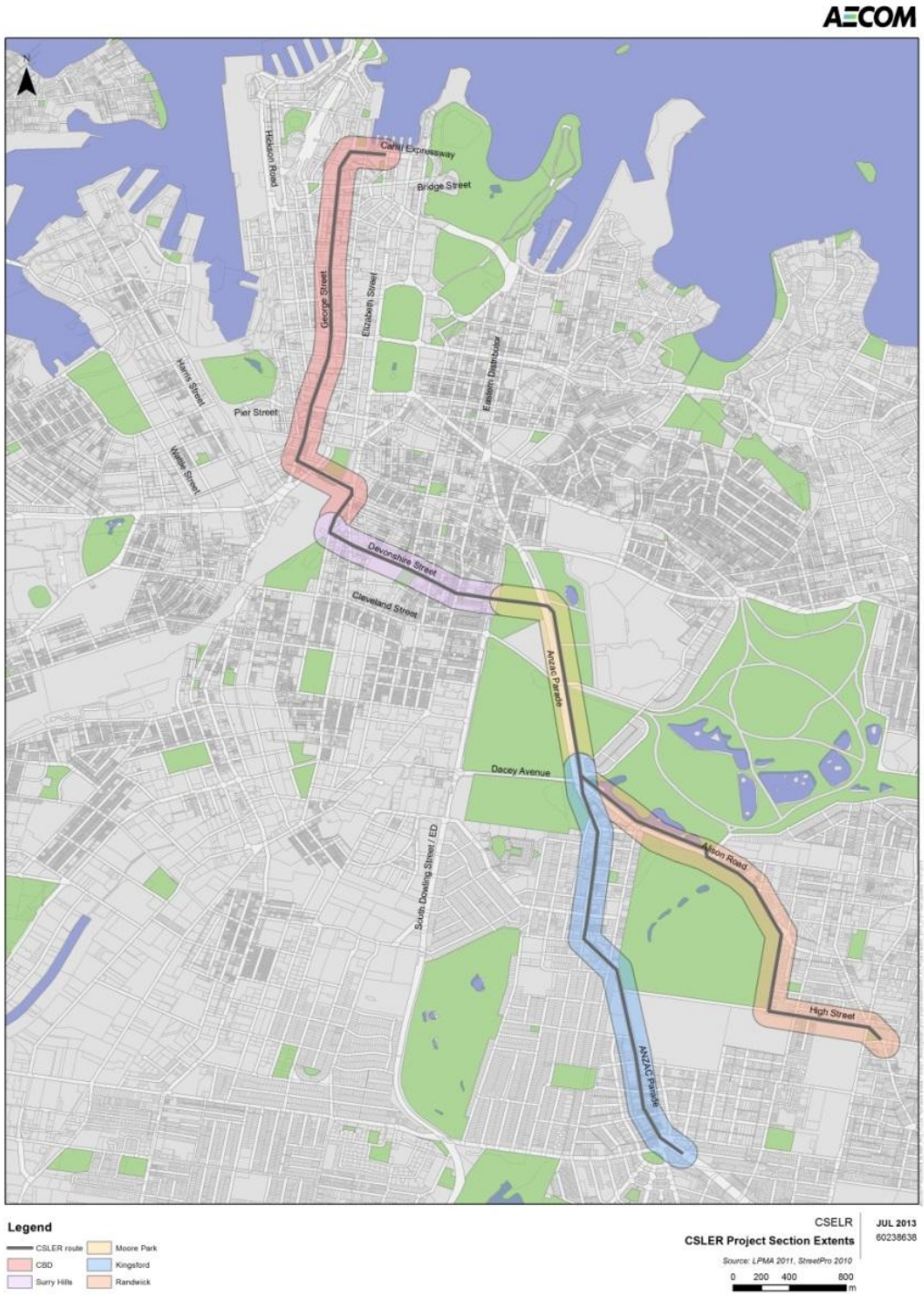
- To avoid Devonshire Street an alternative route along Cooper Street/Arthur Street is proposed; and
- To avoid Wansey Road and Alison Road an alternative route along Botany Street, Church Street and Kings Street is proposed.

Precinct level construction impacts and mitigation

The CSELR corridor has been segregated into five precincts as shown in Figure 0-2. At the precinct level CSELR construction has the potential to limit local, property and emergency vehicle access due to the extended worksite coverage along the corridor. In response to these risks this CTTMS outlines the key issues identified in each precinct and resulting mitigation measures.

Access for emergency vehicles would be maintained within all precincts and emergency services would be advised of all planned changes to traffic arrangements prior to applying the changes. During periods when major construction and loading/unloading activities are underway it may not be possible to allow emergency vehicles to traverse the full block length. However at these times access to an emergency within the block would still be maintained at an identified access point and diversion routes would be agreed with the emergency services prior to the activities commencing. The contractor would also consult with NSW Fire and Rescue regarding any specific requirements for any of the buildings adjacent to the rail alignment in preparing the site specific Traffic Management Plans. Details of property access diversions are included in Section 4.

Figure 0-2: CSELR corridor precincts[1]



[1] AECOM, 2013

CBD Precinct - construction impacts and mitigation

In the CBD precinct the key issues relate to property, local and pedestrian access. All properties that have active driveways directly accessed off the corridor would retain this access during construction through the provision of access only lanes in sections of George Street. Additional controls are needed at a limited number of locations that would require agreement with the property owners. These include:

- Scheduling of deliveries for early morning/late night for short periods when the active work zone is directly outside the property.
- Restriction of access to smaller trucks (this may depend on access to remote warehousing or centralised dispatch centre where large loads can be broken down).
- Use of road bridges / plates over the worksite to provide crossings.
- East-west cross streets in the CBD to remain open to traffic except for planned closures at weekends.

Prior consultation and agreement from property owners and any additional controls on access would be undertaken. The duration of any access restrictions would likely be limited to short periods when the active work zones are directly outside the property. However, contingency arrangements would need to be identified, such as limiting the extent of duration of any impacts and alternate parking arrangements or loading facilities.

Access to The Rocks precinct would be affected by the closure of Alfred and George Streets to through traffic; however access is maintained via alternative routes as shown in the precinct access map (Appendix A.1). Whilst access is maintained there would be some increase in the distance vehicles have to travel.

Pedestrian access would also be maintained to George Street at all times. The contractor would ensure traffic lanes and control devices provided adjacent to construction worksite are provided in accordance with RMS Traffic Control at Worksite Manual Version 4.0 and AS 1742, Part 3.0: Manual of Uniform Traffic Control Devices. Where existing controlled pedestrian crossing facilities exist, pedestrian access through the worksite would be provided.

For special events which typically utilise George Street and Circular Quay, consultation with City of Sydney Council would be required in order to develop management measures and possible re-routing of events in the CBD. Weekend closures would not be undertaken on weekends when major events are scheduled, e.g. City to Surf, Anzac Day Marches and Sydney Running Festival.

Surry Hills Precinct - construction impacts and mitigation

Due to the constrained cross section of Devonshire Street a continuous traffic lane is not possible through the corridor. Traffic would be diverted to alternative east west corridors such as Cleveland, Foveaux and Albion Streets. All properties with direct driveway access to Devonshire Street would be maintained throughout construction, through the worksite under traffic control.

Local access to the Surry Hills precinct would be affected by the closure of Rawson Place and George Street to through traffic; however access is maintained via alternative routes as shown in the precinct access maps (Appendix A.2).

Moore Park Precinct - construction impacts and mitigation

Construction activities would infringe on the existing busway reducing the available width for bus operations. To manage these impacts the busway is proposed to operate in the peak direction only with buses in the counter peak direction being relocated onto Anzac Parade. To maintain bus services along Anzac Parade, especially for the major trip generator of UNSW, priority bus lanes in the counter peak direction should be examined further.

Special events at the Moore Park entertainment precinct generate increased pedestrian, car and bus demand in the area. In general, the proposed worksite areas do not infringe upon special event bus operations or parking, however it is recommended that local construction activities are paused during special events to improve safety for spectators accessing the venues.

Kingsford Precinct - construction impacts and mitigation

The Anzac Parade corridor is a key arterial route for the south-eastern suburbs. It has a number of key intersections along its length through which light rail would operate, and therefore requiring works that would temporarily reduce traffic carrying capacity. To minimise the effects of these intersection works, they are proposed to be staged during a combination of weekends and nights.

During construction, Anzac Parade would be reduced from a total of six lanes to four lanes. To prevent this reduced cross section from impacting upon existing bus services two options are to be further investigated in consultation with TfNSW, RMS and bus operators:

- Tidal flow operation on Anzac Parade to provide a peak direction bus lane along the kerbside lane and two peak direction traffic lanes. This would result in the non-peak traffic movement being constrained to a single lane.
- Local diversions on parallel roads. Noting the significant impact on a local, residential street such diversions would only be considered as a last resort and significant further investigations are required to determine the feasibility of this option.
- Investigate staged construction works along the Anzac Parade and Alison Road corridors. Assessments to date and resulting increase in forecast travel times on Alison Road and Anzac Parade assume concurrent works on both corridors. Staggering these works would provide additional capacity during construction and reduce travel time increases.

Randwick Precinct - construction impacts and mitigation

During construction access to Randwick Racecourse from Alison Road and Wansey Road would be restricted. Access would be provided via existing alternative entrances on Ascot Street and High Street and through internal circulating roads. During events, the current bus set down area on the Alison Road frontage would be unavailable and alternative drop off and pick up locations would be provided on Darley Road. This requires provision of a pedestrian crossing facility for Alison Road located to the west of Darley Road and the use of marshals to ensure pedestrian safety and legibility.

The UNSW and Prince of Wales hospitals are both accessible via High Street. Besides these developments there are high density residential apartments, medical practices and retail stores with off-street parking provisions. With an existing road width of 12.5 metres, the kerb and guttering would require realigning, to satisfy the minimum lane widths when light rail is operational. To minimise the impact to properties, and in particular the

hospital emergency access points, the light rail construction works are proposed to be undertaken in segments and stages, which maintains access at all times.

Localised changes are also required to existing bus operations, in all instances alternative stops and pedestrian access points have been defined, although some increase in walking distances would be experienced.

1. Introduction

1.1. Purpose of the report

This Construction Traffic and Transport Management Strategy (CTTMS) for the Sydney CBD and South East Light Rail project (CSELR or 'the Project') has been developed as part of the Environmental Impact Statement (EIS). It has been prepared by the Integrated Transport and Land Use (ITLU) Technical Advisor (Booz & Company and AECOM Pty Ltd) on behalf of Transport for NSW (TfNSW). As part of the report, detailed investigations were undertaken to determine how the Project could be delivered into a complex, congested and critical part of Sydney's transport network.

This Construction Traffic and Transport Management Strategy (CTTMS) outlines potential traffic and transport impacts during construction of the CSELR and transport management measures to mitigate these. The CTTMS establishes the key criteria to be considered and the overarching traffic management processes to be followed to facilitate construction.

The Project requires construction works to be undertaken on George Street in the CBD and within or adjacent to major arterial/sub-arterial and local roads between the CBD, Kingsford, Randwick and Surry Hills. This document sets out a coherent and organised approach to managing the direct and cumulative impacts of construction on the road and pedestrian networks.

This report should be read in conjunction with the CSELR Transport Operations Report which details the integration and operation of light rail within the wider transport network post construction and details the benefits of implementing the Project. It sets out the end-state operational characteristics of the light rail corridor which results in the required worksite and construction approach assumed in this CTTMS. As a general principle to improve legibility for users, it has also been the objective of this CTTMS to minimise the number of required changes to the road network. As such, wherever appropriate, the CTTMS proposals align with the end-state network configurations.

The CTTMS provides a framework of procedures and techniques for mitigating or managing impacts, including measures to:

- Protect pedestrians, cyclists, and maintain surface public transport services past the worksites;
- Manage traffic flows through, and around, the construction zone and haulage routes;
- Minimise impacts on the remainder of the road network;
- Minimise the impact on existing bus services travelling along or around the worksites;
- Minimise the impact of construction on local residents and businesses; and
- Address local and regional traffic impacts during construction.

The CTTMS considers the effects of construction and identifies mitigation measures at two levels:

- Network Level: construction impacts and mitigation measures to minimise any reduction in network performance and journey times for all road users. This includes travel demand management measures, to ensure demand is better matched to the temporarily reduced network capacity. Network modelling of the corridor and surrounding road network has been undertaken by others to identify network upgrade measures to increase capacity on alternative road links to offset the loss of capacity on the construction corridor.The network performance and management measures are discussed in detail in Section 4.
- Precinct Level construction impacts and mitigation measures: day-to-day activities undertaken on and around the corridor need to function satisfactorily. This includes local traffic, pedestrian, cycle, bus services and emergency vehicle access. Specific management measures would be detailed in the site specific Construction Traffic Management Plans and Traffic Control Plans to be developed at later stages of the Project for each individual worksite. Section 5 of this report identifies management principles for each of the CSELR precincts.

The Project is currently at the Planning Approval phase, and this CTTMS presents one potential construction management approach. Other approaches may be defined in future by a contractor. In either case, the construction contractor will be responsible in acquiring approvals for traffic and transport management approaches during construction.

Traffic and transport management would be required for up to 3 years, with the main civil works running from late 2015 to 2018. Construction impacts would occur in sections of the route as they are consecutively built. The concept traffic staging and phasing descriptions and drawings in this CTTMS detail the sequence and extent of potential temporary traffic diversions for the construction of the works.

1.2. Scope of the Report

This report has been prepared to inform the planning approvals process by assessing the potential transport and traffic impacts of constructing the CSELR project. The assessment has been based on the Definition Design (May 2013), and uses preliminary traffic assessment of wider network impacts (TfNSW, 2013). The assessment of these impacts is discussed in Section 3 (Network Impacts) and Section 4 (Precinct Impacts). This report is also to be read in conjunction with the ERSUD Definition Design Report – Volume 5 – Constructability Report.

The CTTMS is one of a series of management plans that would be developed for the construction of the Sydney CBD and South-East Light Rail (CSELR).

In total, there would be four levels of documentation to help manage and mitigate traffic and transport network impacts during construction of the CSELR:

- Construction Traffic and Transport Management Strategy (TfNSW and ITLU) (this document);
- Network Management Plan (TfNSW, Enabling Works and Civil Works Contractors);
- Site Specific Construction Traffic Management Plans (Enabling Works and Civil Works Contractors); and
- Site Specific Construction Traffic Control Plans (Enabling Works and Civil Works Contractors).

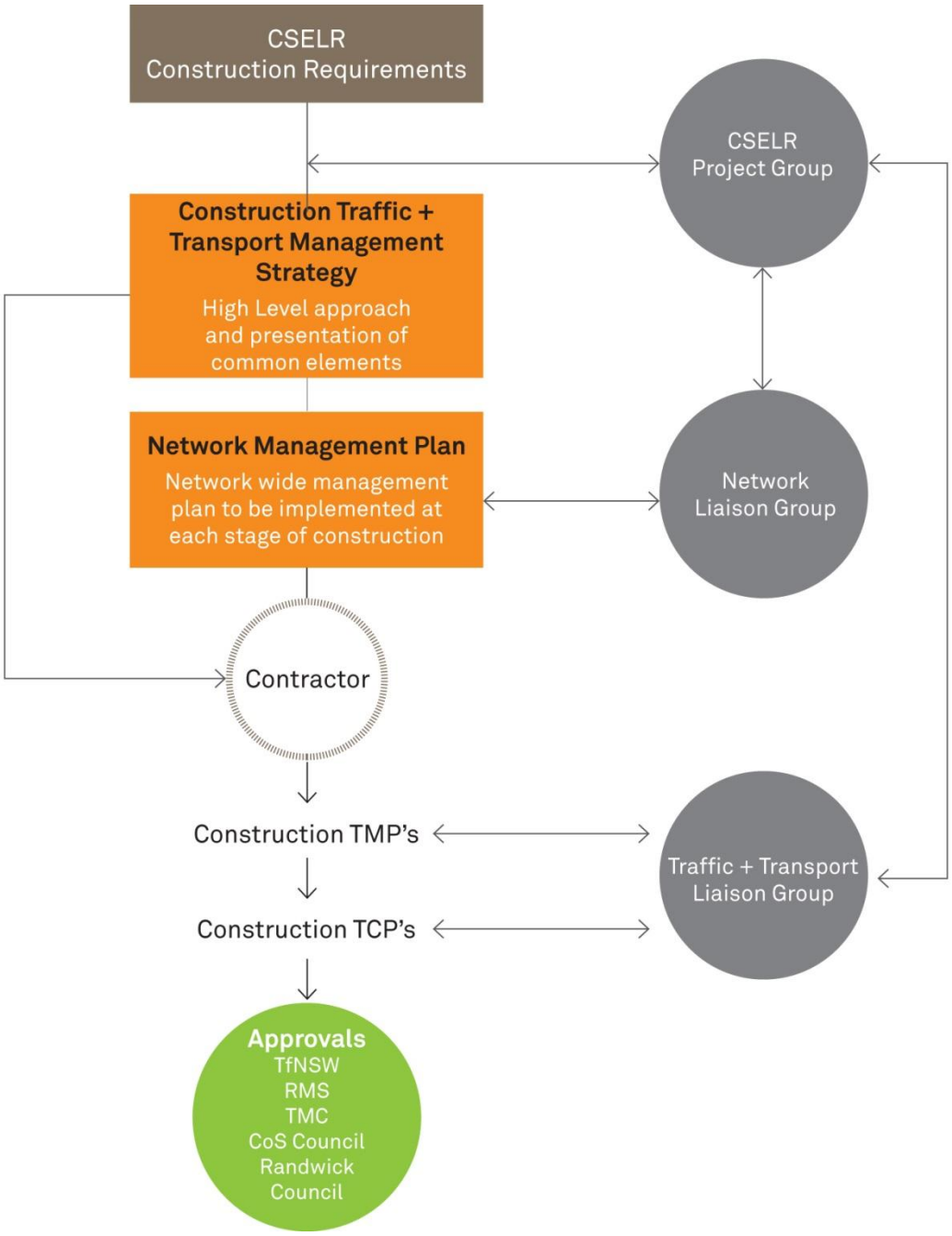
The purpose of each document is highlighted in Table 1-1.

Table 1-1: Purpose of Traffic Management Plans Hierarchy and Documentation

Document	Purpose	Produced by
Construction Traffic and Transport Management Strategy	Provides a framework for procedures and techniques to ensure effective traffic management to enable project delivery. Summarises the proposed traffic management and traffic safety requirements for the construction phases of the project. With general principles and key assumptions.	TfNSW and ITLU
Network Management Plan	Based on the framework presented in this document a network management plan would detail the specific measures implemented at each stage of construction to mitigate transport impacts	TfNSW, and Stakeholders, in consultation with Contractors
Site Specific Construction Traffic Management Plans (CTMP)	Individual site Construction Traffic Management Plans (CTMP's) to develop the specific staging areas of construction work or activities. CTMP describe in detail the area of work or activity, the extent of the expected traffic impact, and the management and responsibility measures to be implemented.	Contractor
Site Specific Traffic Control Plans (TCP)	Traffic Control Plans (TCP's) to be included as part of CTMP's and will identify specific traffic control measures to be implemented for each CTMP. CTMP's and TCP's will describe items such as temporary signage requirements, traffic barrier requirements and placement, traffic control crew requirements, delineation devices, ROL applications, temporary speed zones etc. which must be in place for the duration of the activity or work area impact. All Traffic Control Plans to be used during the construction activity will be developed in accordance with Australian Standard 1742.3 and the RMS's "Guide to Traffic Control at Worksites" by a suitably qualified person.	Contractor
Roads Agreement	Form of agreement between TfNSW and the relevant Roads Authority (RMS) documenting the responsibilities for undertaking design, construction and maintenance work in the Road Reserve.	TfNSW / RMS

The process to be followed and hierarchy of these plans is shown below in Figure 1-1.

Figure 1-1: Hierarchy of Traffic & Transport Management Plans



1.3. Structure of the Report

The remainder of the report is structured as follows:

- This chapter (Chapter 1) outlines the proposed project and the construction process, including:
  - A project overview;
  - The construction staging; and
  - Interfaces with related projects.

- Chapter Two outlines the assessment approach and principles followed to mitigate the impacts, including:
  - High level requirements for construction worksites;
  - Heavy vehicle forecasts and haulage routes;
  - Approach to intersection works and traffic control;
  - Midblock worksite requirements; and
  - The requirements for interagency liaison and approvals processes.

- Chapter Three outlines the overall network performance and mitigation measures to be implemented during construction, including:
  - High level management measures for all modes during construction;
  - Network management through a Network Management Plan (NMP);
  - Property and emergency vehicle access strategy;
  - Parking impacts; and
  - An assessment of the network impacts.

- Chapter Four outlines the local level impacts and mitigation measures, including:
  - Individual property access;
  - Local precinct access; and
  - Specific management requirements for all modes.

1.4. CSELR Project Overview

In December 2012, the NSW Government announced that it would extend light rail from Circular Quay to Kingsford and Randwick, through the heart of the Sydney CBD via George Street. The proposed light rail corridor is shown in Figure 1-2. The project comprises twenty stops, and would integrate with both the bus network and heavy rail stations at Circular Quay, Wynyard, Town Hall and Central.

Figure 1-2: Route of the CSLER project[2]

[2] AECOM, 2013

Services would be provided by 45 metre low floor light rail vehicles, providing capacity for up to 300 commuters (the equivalent of five standard length buses). The line would operate in a dedicated light rail lane, minimising competition with other modes of transport such as cars and buses. In summary the CSELR proposal comprises construction and operation of a light rail service from Circular Quay to Kingsford and Randwick via Surry Hills. The key features of the proposal include:

- approximately 12 kilometres of new light rail track from Circular Quay to Central and Kingsford and Randwick via Surry Hills and Moore Park (including track at the depot facilities);
- a pedestrianised zone on George Street between Hunter and Bathurst Streets, with light rail vehicles (LRVs) operating wire-free in this zone;
- 20 light rail stops along the alignment with platforms at all stops to accommodate 45-metre long light rail vehicles, except at Chalmers Street and Moore Park, where platforms would be provided to accommodate both 45 metre and 90 metre long light rail vehicles (double-length vehicles) running during special event services between Central Station and Moore Park;
- depot facilities adjacent to Royal Randwick Racecourse and at Rozelle for light rail vehicle stabling and/or general maintenance (including washdown);
- interchange with heavy rail, bus and ferry services at Circular Quay, Wynyard, Town Hall and Central stations;
- 45 metre vehicles, featuring air conditioning and accessible low-floor design capacity for approximately 100 seated and 200 standing passengers;
- a fleet of 30 vehicles providing a 3 minute peak service in the opening year increasing to 40 vehicles providing a 2.5 minutes peak service by 2036;
- integration with the existing light rail system;
- bus interchange at the Kingsford and Randwick stops;
- special event services between Moore Park and Central Station;
- George Street public domain improvements including concepts for paving, street trees, lighting and furniture;
- a new bridge structure overpassing the eastern distributor and an underground alignment in the form of a cut and cover tunnel through Moore Park and a canopy tube tunnelling methodology used under Anzac Parade;
- special events sidings at Circular Quay, Eddy Avenue, Chalmers Street, Moore Park and Royal Randwick Racecourse: and
- turn-back facilities at the Circular Quay, Wynyard, Kingsford and Randwick.

1.5. Construction Staging

The delivery phase of the entire project includes the following stages:

1. Preparation of surveys, geotechnical investigations, identification of location and depth of existing public utilities and underground structures, tree and arborist reports, specific heritage issues, other specific studies.
2. Communication and consultation with property owners and other affected stakeholders along the route
3. Planning of overall and localised traffic management plans in consultation with the local councils and roads authorities.
4. Establishment of the inspection and monitoring program.
5. Establishment of site compounds and erection of safety barriers around the sites of work. In most cases the site compounds may need to be established at the start of the Critical Early Works to support these works.
6. Establishment of site compounds and erection of safety barriers around the sites of work for the Critical Early Works and Main Works.
7. Implement site specific construction traffic management plan and site specific traffic control plan to enable construction works in the road reserve.
8. Construction of the Critical Early Works by the Managing Contractor for works that are classified in the following categories:
    a. Major works or service relocations / protection along the CSELR alignment that may have a long lead time;
    b. Major service relocations with a high risk cost profile for the Main Work Contract;
    c. Facilitation of bus and traffic re-routing to minimise future traffic disruptions;
    d. Third Party Works – Program and Existing Activities;
    e. Works that that have limited access dates;
    f. Vacant property access along alignment, including the relocation of existing facilities;
    g. Critical pre-works outside alignment; and
    h. RMS traffic signal works.
9. Construction of the remaining Early Works by the Main Works Contractor that are not covered in the Critical Early Works.
10. Track construction would begin once a clear corridor along a substantial part of the alignment has been established, with utility services diverted where necessary prior to works beginning.
11. Stop construction would be undertaken as separate work sites as the work front moves progressively along, so as to not interfere with the corridor works. These need to be undertaken after the work front has progressed through or the work corridor will be restricted and productivities impacted.
12. Intersection construction would involve partial or full closure of intersections with appropriate traffic diversions and would be primarily undertaken at the weekends and the intersections returned to normal operation prior to 5.00am on Monday morning. Intersection construction would be scheduled to suit the available workforce and current construction priorities.

13. Restoration of the road to allow for pedestrian and road traffic.
14. Installation of the overhead wiring will be able to start after a sufficient number of adjacent sections of the route that make up the length of a wire tensioning section are completed.
15. Finally, commissioning and trial running of the route can be carried out once all systems infrastructure are complete, including electrical connections to the overhead wiring and signals. Commissioning will require the complete route corridor available for a period of time, and will include integration of the new signalling system with the existing road signalling system.

Estimated time periods for each of these main stages of construction are shown in Table 1-2. Allowing for some overlap between stages the total construction program is expected to occur over a period of 6 years

Table 1-2 Construction Program Overview

Construction Phase	Estimated Length
Early Works Construction	1-2 years
Main Works Construction	3-4 years
Testing & Commissioning	1 year
Total Construction Program	Up to 6 years

This CTTMS assumes maximum worksite footprints would be required during the civil works and that Early Works utility adjustments can be undertaken within the same footprint. This assumption has been made to assess the worst case traffic and transport impacts. Early and main civil works activities would consider the requirements for Traffic Management Centre (TMC)'s approvals.

1.6. Related Projects

The CSELR forms part of a broader public transport solution aimed at improving access to and within the CBD. Other key projects related to the CSELR include the Sydney City Centre Access Strategy (CCAS) and the associated CBD and South East bus network changes. Each of these projects is explored in more detail below.

1.6.1. Sydney City Centre Access Strategy

The CSELR is a key project identified in the Sydney City Centre Access Strategy (CCAS), which has been developed within the context of the NSW Long Term Transport Master Plan and a number of modal delivery plans, to improve the way the CBD transport system operates. CCAS outlines a number of actions for all transport modes in the CBD being delivered in an integrated manner.

The other components of the CCAS are anticipated to be implemented over a number of years. One component of the CCAS of particular relevance to the CSELR is the city centre bus network redesign. These bus changes are being prepared in parallel with development of the CSELR proposal and would be consistent with the CSELR proposal. The proposed changes would undergo a separate planning approval process. These would not, therefore, form part of the EIS for the CSELR proposal, with the exception of cumulative impact considerations. An outline of the proposed city centre bus changes is provided below.

1.6.2. Sydney City Centre Bus Plan

The Sydney City Centre Bus Plan (SCCBP) also forms part of the CCAS to develop the bus network within the Sydney CBD to improve bus reliability and customer experience and modifications to the street network associated with the CSELR project.

The SCCBP is a key element for the delivery of the CSELR project, in particular the relocation of existing bus services from George Street and will therefore be delivered (subject to appropriate planning approvals) in advance of major construction works commencing for the CSELR project.. In addition to the SCCBP the south east bus networks have also been re-designed to facilitate the operation of light rail. The SCCBP was developed in parallel to the re-design of the south east bus network with a focus on aligning the networks.

A summary of the key objectives and proposed network for the SCCBP is provided in this section. A summary of proposed south east bus network changes is available in the Transport Operations Report prepared by Booz & Company and AECOM.

The CBD bus network would be redesigned to establish an easy to understand, all-day network of reliable, high frequency bus routes. The redesign would help to address congestion and capacity constraints in the short term but also responds to the future role of light rail and the integration of bus and light rail services.

Some of the key changes that would benefit customers include:

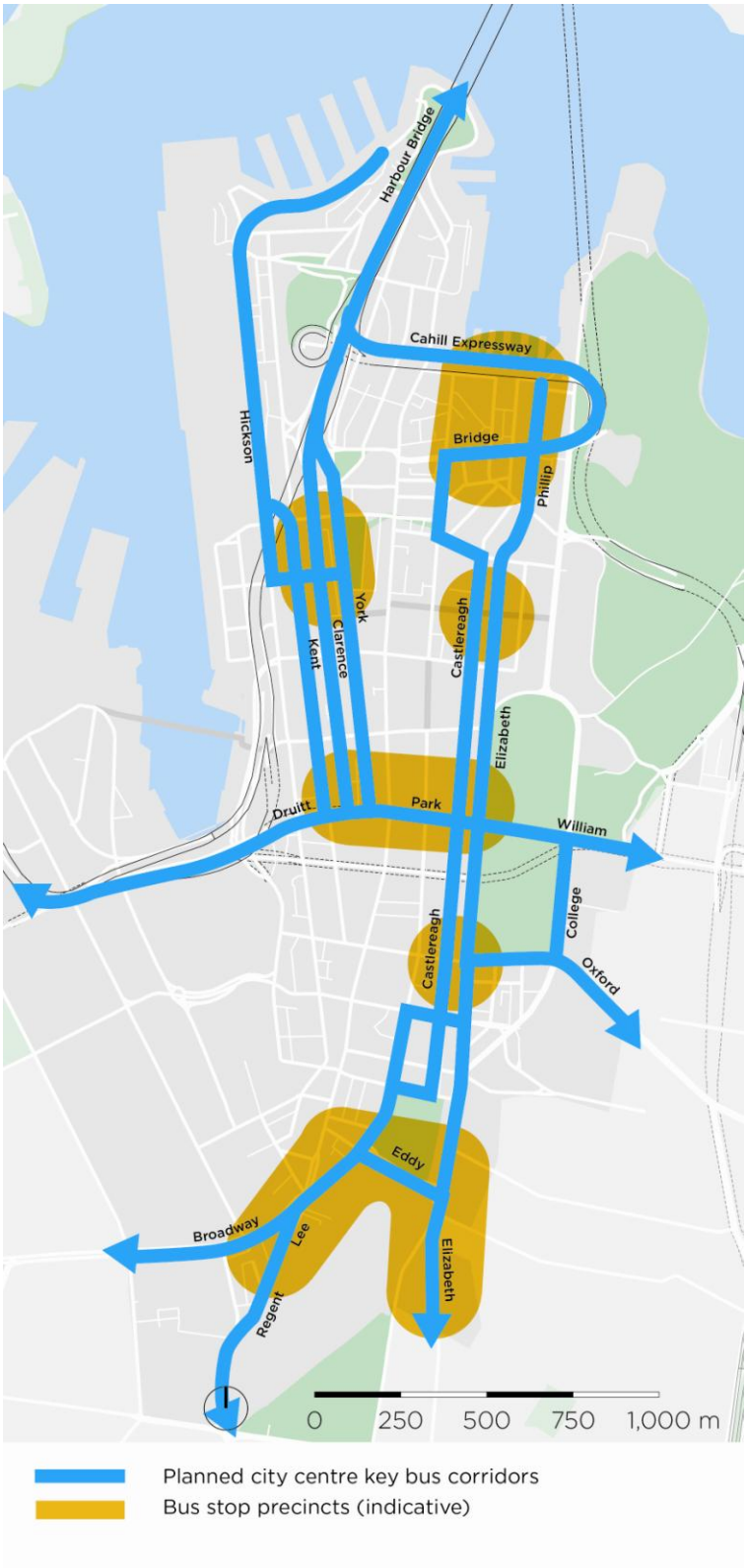
- Bus turning movements would be reduced at the Elizabeth Street and Park Street intersection. This would help simplify bus movements through the city centre.
- Existing Metrobus routes would be configured to operate more efficiently through the city centre and better serve customer demand. Sydney Harbour Bridge services to Railway Square would operate via the Cahill Expressway, Bridge Street, Castlereagh Street southbound and Elizabeth Street northbound.
- The remaining bus routes that enter the city centre via the Sydney Harbour Bridge would use York and Clarence Streets and either terminate at Wynyard or QVB (Town Hall).
- Buses from the Eastern Suburbs via William Street would run to Barangaroo and Walsh Bay or to Pyrmont.
- Approximately half of the Inner West bus routes entering the city centre via Broadway would only operate to Central in order to reduce the number of buses unnecessarily entering the city centre; while the remaining routes would continue to the northern end of the city centre via Elizabeth Street northbound and Castlereagh Street southbound.
- Several routes would be connected to operate as through-routed services to reduce the overlap of bus services on city centre streets and the need for bus lay-over in the city centre.
- Victoria Road bus routes that currently use George Street and terminate at Circular Quay would either continue through the city centre via Druitt Street and Park Street to lay-over outside the city centre or terminate at Wynyard

The key benefits of the redesigned bus network include:

- Turns at critical intersections are minimised within the city centre, improving intersection performance for all users. This change would bring specific improvements for articulated (or "bendy") buses which currently cause delays at certain intersections due to their length and lack of manoeuvrability.
- Trials of double deck buses are currently underway to assess potential benefits across the transport network.
- Concentrating more buses on fewer streets, reducing impacts on other road users and making the bus system easier to understand.
- Major bus stops located within key interchange precincts at Town Hall, Wynyard, Central and Circular Quay, and also at Martin Place and Museum. These interchange precincts would connect different transport modes such as rail, light rail, ferry and bus.
- Key interchange precincts providing increased comfort, for all customers through improvements such as de-cluttering walkways, providing new shelters, better signage and the provision of real time information.
- Other bus stops outside the interchange precincts rationalised to improve bus travel speeds and improve customer understanding of the network.
- Priority bus spines developed with enhanced bus lanes and dedicated stopping bays. They would improve travel time and reliability along Elizabeth Street/ Castlereagh Street, Park Street / Druitt Street and Clarence Street / York Street.

The SCCBP would be implemented prior to commencement of the main construction works for CSELR. It will be the subject of a separate planning approval and therefore is not assessed as part of the CSELR Project EIS with the exception of cumulative impact considerations.

Figure 1-3: Key Bus Route Paths in the Sydney City Centre[3]



A summary of proposed south east bus network changes is available in the Transport Operations Report prepared by Booz & Company and AECOM.

[3] Transport for NSW unpublished data, 2013

2. Assessment Approach and Construction Impact Management Principles

2.1. Assessment Approach

This section identifies construction management principles that could apply in future stages of design or in the preparation of construction management processes by others.

2.2. Construction Worksites

Site specific Traffic Management Plans would identify worksite boundaries, footpath controls and road controls. Activities within the worksite are excluded from the Traffic Management Plans except in relation to ensuring adequate geometry for construction traffic on entry and exit from the worksite.

In providing any hoarding and gantry structure, consideration would be given to ensuring sight lines for side roads, vehicle accesses, signposting, and traffic signals are maintained. Hoarding should comply with any TfNSW specific requirements.

For the remainder of work areas, approved barriers, anti-gawk screens and pedestrian fencing would be provided, as required, to prevent unauthorised access into work areas, protect workers and contain pedestrian movement on footpaths and diversion routes.

2.2.1. Hoardings

The design of hoardings for worksite compounds and depots would have an important impact on the success of worksites in public areas subject to higher levels of pedestrian movement, such as at First Fleet Park and Belmore Park. Construction hoardings should:

- Comply with relevant codes and standards;
- Have bright surfaces;
- Have smooth surfaces particularly for areas adjacent to footpaths to allow pedestrians to brush past without snagging (this reduces shying from the edge);
- Free of trip hazards at the base of the hoardings;
- Be clean and have a regular inspection of the surfaces;
- Have graffiti and advertisements removed regularly; and
- Have adequate lighting.

Worksite hoardings would discourage entry without approval and minimise vandalism. All access points to fenced compounds and depots would have lockable gates. Appropriate information signs should be provided at worksites to identify the project, safety and communication protocols and contact persons.

2.2.2. Site security, site access and signage

Access to individual work areas would consider:

- Safety of travelling public;
- Safety of construction workers and equipment;
- Impact on local communities in terms of safety, noise and road damage;
- Ease of access for emergency vehicles; and
- Site security, particularly outside work hours.

2.3. Heavy Vehicle Forecast

Minor volumes of materials are expected to be excavated for utility relocation or protection, or for the track slab. Larger volumes of heavy vehicles would be likely during the main works construction phase when heavy vehicles are required to transport spoil, concrete, equipment, tracks, overhead wiring etc.

Heavy vehicle movements would be in compliance with the NSW Road Rules 2008, Regulation 300-3 - Driving lengthy vehicles in the Sydney CBD. The size of truck used for haulage would be consistent with these access route constraints, safety and any worksite constraints. We have assumed the standard vehicle would be either a tip truck or truck and dog, with a capacity of up to 25 tonnes as shown in Figure 2-1.

Some construction activities (such as the delivery of track) may require truck and trailer combinations or semi-trailer. Access arrangements for these vehicles would be defined in the worksite Traffic Management Plans produced by the contractor.

Figure 2-1: Sample Construction Vehicle Types

The number of truck movements has been estimated based on the average number of truck movements per day and the individual peak number of movements for any activity throughout the works.

Generally, the peak level of truck movements in the CBD is associated with concrete pours and is of short duration extending over one to four shifts, nominally over one to four days, depending on whether day / night work is proposed.

For the south-east section, the peak number of truck movements is forecast to be associated with concrete pours, excavation of diaphragm wall, excavation and pavement construction. The major works in this section, such as the cut and cover tunnel, mean the peak movements extend over a longer timeframe, e.g. the excavation for the diaphragm wall extends over some 8 shifts.

The forecast average daily truck generation and peak daily movements for each of the precincts within the corridor is summarised in Table 2-1 and Table 2-2.

Table 2-1: Average & Peak Daily Heavy Vehicle Generation CBD Sector [4]

CBD Route							
Route	Street Start	Street End	Total Duration *	Average Daily Heavy Vehicle Trips * (Day)	Peak Daily Heavy Vehicle Trips* (Day)	Total Number of Peak Activity Shifts	Peak Activity
Chalmers Street	Eddy Avenue		8 months	3	87	3	Concrete delivery
Eddy Avenue	Chalmers Street	Pitt Street	9 months	3	84	4	Concrete delivery
Rawson Place	Pitt Street	George Street	11 months	1	87	1	Concrete delivery
George Street	Rawson Place	Hay Street	7 months	2	86	1	Concrete delivery
George Street	Hay Street	Goulburn Street	7 months	3	87	2	Concrete delivery
George Street	Goulburn Street	Liverpool Street	4 months	4	87	2	Concrete delivery
George Street	Liverpool Street	Bathurst Street	8 months	3	93	2	Concrete delivery & CSR backfill
George Street	Bathurst Street	Druitt Street	4 months	4	87	2	Concrete delivery
George Street	Druitt Street	Market Street	8 months	3	88	3	Concrete delivery

[4] CBD and South East Light Rail - Summary Schedule. - AI2MO2 - 6June 2013', ERSD, 2012

CBD Route							
Route	Street Start	Street End	Total Duration *	Average Daily Heavy Vehicle Trips * (Day)	Peak Daily Heavy Vehicle Trips* (Day)	Total Number of Peak Activity Shifts	Peak Activity
George Street	Market Street	King Street	5 months	4	87	3	Concrete delivery
George Street	King Street	Margaret Street	9 months	4	95	1	Concrete delivery & CSR backfill
George Street	Margaret Street	Grosvenor Street	9 months	2	96	1	Concrete delivery & CSR backfill
George Street / Alfred Street	Grosvenor Street	Loftus Street	9 months	6	86	4	Concrete delivery & CSR backfill

** Average / Peak Daily Heavy Vehicle Trips represent the total inbound and outbound truck movements of the worksite (construction works only; therefore excludes all early works, and systems construction component of civil works, rolling stock & rail systems contract component).*

** In the Total Duration, the number of days for overlapping sections of work would not be added separately, only the first and last date of that whole section of overlapping works is allowed for when calculating average truck movement.*

** Average / Peak Daily Heavy Vehicle Trips does not include the cumulative truck movements; shows only single site movements*

Table 2-2: Average and Peak Daily Heavy Vehicle Generation – South East Sector[5]

South East Route							
Route	Street Start	Street End	Total Duration*	Average Daily Heavy Vehicle Trips* (Day)	Peak Daily Heavy Vehicle Trips* (Day)	Total Number of Peak Activity Shifts	Peak Activity
Devonshire Street	Chalmers Street	Elizabeth Street	8 months	3	89	3	Concrete delivery
Devonshire Street	Elizabeth Street	Crown Street	10 months	5	87	5	Concrete delivery
Devonshire Street	Crown Street	Bourke Street	5 months	4	88	3	Concrete delivery

[5] 'CBD and South East Light Rail - Summary Schedule. - AI2MO2 - 6June 2013', ERSUD, 2012

South East Route							
Route	Street Start	Street End	Total Duration*	Average Daily Heavy Vehicle Trips* (Day)	Peak Daily Heavy Vehicle Trips* (Day)	Total Number of Peak Activity Shifts	Peak Activity
Devonshire Street	Bourke Street	South Dowling Street	5 months	3	84	2	Concrete delivery
South Dowling Street	South Dowling Street	Anzac Pde tunnel	15 months	18	80	8	Excavate to top of diaphragm wall for cut & cover tunnel
Anzac Parade	Anzac Pde tunnel	Lang Road	11 months	7	113	NA	Excavate and place pavement through offline areas
Anzac Parade	Lang Road	Alison Road	8 months	13	118	NA	Excavate and place pavement through offline areas
Anzac Parade	Alison Road	Todman Avenue	9 months	11	103	14	Concrete delivery
Anzac Parade	Todman Avenue	Doncaster Avenue	4 months	10	104	5	Concrete delivery
Anzac Parade	Doncaster Avenue	High Street	3 months	13	119	NA	Excavate and place pavement through offline areas
Anzac Parade	High Street	Barker Street	5 months	9	104	6	Concrete delivery
Anzac Parade	Barker Street	Nine Ways	5 months	11	103	7	Concrete delivery
Anzac Parade	Nine Ways	Terminus	8 months	14	111	NA	Excavate and place pavement through offline areas
Alison Road	Anzac Pde	Darley Road	11 months	16	126	NA	Excavate and place pavement through offline areas

South East Route							
Route	Street Start	Street End	Total Duration*	Average Daily Heavy Vehicle Trips* (Day)	Peak Daily Heavy Vehicle Trips* (Day)	Total Number of Peak Activity Shifts	Peak Activity
Alison Road	Darley Road	Wansey Road	10 months	13	126	NA	Excavate and place pavement through offline areas
Wansey Road	Alison Road	High Street	10 months	10	118	NA	Excavate and place pavement through offline areas
High Street	Wansey Road	Avoca Street / Belmore Road	19 months	5	112	8	Concrete delivery
Belmore Road	Avoca Street / Belmore Road	Cuthill Street	3 months	22	105	NA	Excavate and place pavement through offline areas
Randwick Stabling Alison Road	Doncaster Avenue	Randwick Racecourse Stabling Yard	9 months	2	116	NA	Excavate and place pavement through offline areas

** Average / Peak Daily Heavy Vehicle Trips represent the total inbound and outbound truck movements of the worksite (construction works only; therefore excludes all early works, and systems construction component of civil works, rolling stock & rail systems contract component).*

** In the Total Duration, the number of days for overlapping sections of work would not be added separately, only the first and last date of that whole section of overlapping works is allowed for when calculating average truck movement.*

** Average / Peak Daily Heavy Vehicle Trips does not include the cumulative truck movements; shows only single site movements*

The peak truck numbers by individual worksites will not necessarily coincide at any one time and therefore a total for all trucks movements has not been provided in the preceding tables.

2.4. Heavy Vehicle Haulage Route

Designated access routes for construction and spoil vehicles would be via the shortest viable route to the arterial road network. Where possible, the construction corridor would be utilised as much as possible for haulage to minimise negative impacts to other road users.

Details of all routes used for access and haulage during construction would be refined in consultation with relevant stakeholders and be detailed in the appropriate section of the site specific Traffic Management Plans.

Spoil haulage routes would be developed in a format such that a suite of individual instructions and maps are provided to contract operators for all points of origin to respective destinations and return. In addition, layover areas would be nominated for vehicles to 'store' prior to arriving at the spoil removal sites, if required. Approximate travel times during various periods of the day would be developed for each route as a guide to operators and also assist in more consistent and uniform arrival rates at each site.

While the volume of delivery materials and spoil removal are not high, a holding area would permit consolidated delivery and removal, potentially by larger trucks. It is the responsibility of the contractor to determine the requirements of truck storage and dispatching. However, no heavy vehicle storage would be provided in the CBD and would operate as a call in process. The contractor would determine any options in detailed worksite planning and TMPs.

Any additional heavy haulage or oversize vehicle routes that are required by the contractor are to be approved by TfNSW and the relevant Roads Authority.

2.5. Intersection Works

Disruption to current intersection movements should be kept to a minimum to maintain network operations. The following principles are recommended:

- Partial or full closures of major intersections are not undertaken during peak traffic periods i.e. are undertaken at weekends or nights;
- Intersection closures are staged in consultation with the relevant Roads Authority to minimise network impacts;
- Co-ordination of major closures at times in the year with reduced traffic demand e.g. school holidays;
- Days and times for intersection works need to be qualified and assessed/approved by the TMC; and
- The public are informed in advance of upcoming closures and alternative routes are developed and advertised.

To understand how these principles might manifest in management of specific intersections, briefing sessions were held on the 28 March, 4 April and 22 July 2013. The briefing sessions included the following stakeholders:

- TfNSW Planning & Programs Division;
- TfNSW Transport Services Division;
- TfNSW Transport Projects Division;
- RMS;
- TMC;
- City of Sydney Council;
- Engineering, Rail Systems and Urban Design (ERSUD); and
- Integrated Transport and Land Use (ITLU).

These sessions set out the high level principles around which the intersection and side road closures could be considered along the corridor. Based on these sessions a hierarchy of major and minor intersections was established, with appropriate closure treatments and interdependencies. Intersection works were grouped in two categories which define when works can be undertaken:

- Night Works (10.00 PM and 5.00 AM) – Staged and full intersection closures; and
- Weekend Works (11.00 PM Friday to 5:00 AM Monday) - Staged and full intersection closures.

During these closures pedestrian crossing movements would be managed by directing pedestrians around the intersection, to alternate footpaths or where permitted by the work, providing a path through the worksite.

2.6. Traffic Signal Modification

Any temporary or permanent works requiring reconstruction or adjustment to traffic signals requires prior RMS approval of traffic signal design plans and Transport Management Centre approval for the times for intersection works. Lead times for approvals can be more extensive than for other temporary works approvals, i.e. an indicative timeframe of 10 weeks or more dependent upon the scale of changes. Additional time may be required to facilitate the modification of traffic signals electronic hardware, in addition to undertaking any physical changes onsite to intersection layouts.

Additional traffic signal modifications are likely to be required to facilitate network management measures as identified in Section 3. These changes are likely to include:

- Phase adjustments;
- Temporary vehicle detection;
- Removal of kerb buildouts; and
- Geometry upgrades.

The Contractors would be responsible for the preparation of traffic signal designs and obtaining prior approvals in a timely manner. Designs would comply with the RMS manual, *Traffic Signal Design* and Specification SI/TCS/8 *Installation and Reconstruction of Traffic Light Signals*. Any works would be carried out by an RMS accredited traffic signal contractor.

2.7. Midblock Works

Midblock cross sections along the construction corridors dictate the number of traffic lanes that can be kept open during the construction program. The Engineering, Rail Systems and Urban Design (ERSUD) constructability advisors (Aquenta) have identified and provided the required midblock worksite areas and cross sections as input to this CTTMS.

Access should be maintained to local land uses, including residential, employment and retail. Traffic lanes provided adjacent to construction worksite are to be in accordance with RMS Traffic Control at Worksite Manual Version 4.0 and RMS D&C G10 Traffic Management.

All aspects of the Traffic Control Plan (TCP) including safety barriers adjacent to traffic lanes would be in accordance with Australian Standard 1742 *Manual of Uniform Traffic Control Devices* and the RMS *Traffic Control at Work Sites Manual Version 4.0* as well as Supplements to Australian Standards and other RMS complementary materials.

Further details on each of the midblock work components are detailed in the Definition Design Report, Volume 5 – Constructability Report.

2.8. Interagency and Community Liaison

Implementing a project of this scale involves effective and ongoing interaction between various organisations and the general public. It is recommended that the following groups would be established:

- Network Co-ordination Liaison Group and
- Traffic and Transport Liaison Group.

2.8.1. Network Co-ordination Liaison Group

The Network Co-ordination Liaison Group (NCLG) would provide a strategic and tactical forum for ensuring the various project works are coordinated with other development and public works; and to mitigate impacts on local business, residents and visitors. This would include works proposed by RMS and Councils. Chaired by TfNSW, this coordination group would include representation from:

- Roads authorities affected (i.e. RMS, Randwick City Council and City of Sydney Council);
- Transport Management Centre;
- NSW Police;
- Utility Service authorities;
- State Emergency Services;
- Contractor; and
- State Transit Authority.

2.8.2. Traffic and Transport Liaison Group

A Traffic and Transport Liaison Group (TTLG) would be formed to ensure the stakeholders most affected are aware of the proposed construction activities, upcoming works and related transport implications. It is anticipated that the TTLG would review early stage development of TMP's, TCP's, ROL's, network management and the TCS designs.

Given the range of approvals and consents that may be required to facilitate the construction of the light rail, the site specific TMPs would provide the main basis for any required approvals. These documents would be considered for approval by the relevant road authority and consulted on through the TTLG. Membership of the TTLG would include representatives of the main approval bodies. The TTLG, given its composition, could give in-principle approval by signing off the TMPs and TCMPs. This would streamline the delivery process.

The TTLG would be chaired by TfNSW and would have a range of functions. Possible terms of reference include:

- To improve and maintain communication between the Sydney Light Rail Program project and all other stakeholders;
- To plan and review the traffic management arrangements for the light rail works and approvals;
- To mitigate the overall impacts of the light rail works on the area;
- To allow co-ordination of works / schemes in the area;
- To obtain approval in principle for the traffic management arrangements;
- To develop measures that offers the best value for traffic and the project; and
- To ensure that plans are agreed in a timely manner in accordance with the overall project programme.

The participants may vary depending on the worksite and potential issues and areas affected, however the core group may consist of:

Approval authorities

- Transport for NSW;
- Transport Management Centre; and
- Relevant Road Authority.

Other Stakeholders

- NSW Police;
- RMS;
- State Emergency Services;
- Local Councils;
- State Transit Authority;
- Sydney Harbour Foreshore Authority;
- Sydney Business Chamber;
- Bus Operators;
- Centennial Parklands;
- Royal Randwick Racecourse;
- UNSW;
- Sydney Children's Hospital;
- Prince of Wales Hospital; and
- Contractors.

The TTLG would co-ordinate with other existing groups to ensure an integrated planning approach before, during and after the construction.

2.9. Role of Safety Audits

2.9.1. Purpose and Benefits

A Road Safety Audit Process is a formal procedure for checking the design, implementation and operation of road works from a safety perspective. The establishment of quality systems provides the philosophy underpinning the Road Safety Audit Process. The overriding objective of the process is to ensure that all existing road schemes and future routes operate at an acceptable level of safety, with safety being an integral part of the road network development process.

The benefits of road safety audits are that:

- The likelihood of accidents on the road and the adjacent network can be reduced;
- The severity of accidents can be reduced;
- Road safety is given greater prominence in the minds of road designers;
- The need for costly remedial work is reduced; and
- The total cost of a project to the community, including accidents, disruption and trauma, is reduced.

This process would need to ensure that rail safety regulations are also considered and followed where necessary. It also allows for testing of the Light Rail prior to the commissioning of the system. Specifically in relation to construction it should be noted that a construction site becomes a rail site from the point in time when traction power systems are being installed, or it is intended that rolling stock would operate, including rail vehicles or any other rail mounted vehicle.

2.9.2. Stages when road safety audits are undertaken

Road safety audits would be undertaken at the following stages:

Detailed design stage	At this stage, the geometric design, traffic signing scheme, line marking plans, lighting plans and landscaping plans are available and would be looked at in relation to the operation of the road.
Pre-openings	Prior to opening a site, an inspection would be made for all relevant conditions at night and during the day for all likely road users to ensure that the construction has addressed earlier audit concerns and to check for any hazardous conditions that were not apparent at the feasibility or design stages.
Road safety audits of temporary work	The Contractor would undertake regular safety audits of work zones to ensure all worksite safety arrangements are in place. These audits would be additional to the daily inspections by site staff. Particular attention would be given to OH&S guidelines, work areas adjacent to the road, movement of construction traffic, vehicle speeds, and all warning devices / systems.
Road safety audit procedure	All road safety audits would be undertaken in accordance with the RMS Publication "Guidelines for Road Safety Audit Practices, July 2011", but also with reference to Austroads Guide to Road Safety Part 6 January 2009.

2.10. Approvals

2.10.1. Traffic Management Plan Approvals Process

The site specific Traffic Management Plans (TMP) would provide details of individual Traffic Control Plans and Road Occupancy Licence TCP and ROL requirements. This should be prepared in accordance with RMS construction specifications and RMS *Traffic Control at Work Sites Manual Version 4.0*. Approval of these documents should be by the relevant Roads Authority and be submitted through TfNSW.

2.10.2. Road Occupancy Licence Approval Process

The contractor would comply with relevant Road Authority's procedures in applying for Road Occupancy Licences as summarised in this document. ROLs and supporting TCPs would include applications to the relevant Road Authorities for any required 'Speed Zone Authorisations' (SZA). The applications should be submitted to TfNSW, who would coordinate all submissions.

For the project initiation works, lead times for submission of TMPs and associated ROLs are likely to be extended due to the complex cumulative impacts during construction. The cumulative impacts of the construction works need to be assessed in detail by the construction contractor during the later stages of the project. To streamline this process, TfNSW is required to oversee ROL applications for CSELR construction corridors in order to satisfy the approval requirements and to reduce approval delays in the case of managing cumulative construction impacts. Once the worksites are established, relevant roads authority lead time for ROL applications may be applicable. The application period will be depending on the extent of proposed road network changes.

After the granting of the ROL, it would be the responsibility of the Construction Team to ensure that the works are carried out safely and in accordance with applicable legislation, regulations, Australian Standards and RMS specifications and procedures.

Implementation of the TCP submitted with the ROL would be the responsibility of the Construction Manager or delegate. Prior to the commencement of any changes to the existing traffic arrangements, a toolbox or daily pre-start meeting of all involved would be held, with the nature of the changed arrangements and procedures for their implementation being discussed.

2.10.3. Coordination of ROL Activities & Cumulative Considerations

TfNSW would oversee ROL applications in and around the CSELR construction corridor to manage cumulative impacts.

The cumulative impact on travel time resulting from multiple ROLs and operating concurrently would be assessed by the Road Authority. Proposed road occupancies will also be consulted with the TTLG and informed of the traffic management measures.

Where necessary concurrent works are expected to have unreasonable impacts on travel time or create unreasonable levels of disruption, communication strategies would be provided to advise motorists of extended journey times in accordance with the project Community Consultation protocols.

2.10.4. Speed Zone Authorisation (SZA)

An application to the relevant Road Authority should be made through TfNSW for any proposed adjustment to speed limits whether they are temporary, such as those required for short term road occupancies; longer term, such as for the duration of a construction stage; or permanent.

Temporary speed zones need to be implemented to control traffic through roadwork sites. The selection of speed zones would be dependent on the degree of vehicular conflicts, the type and extent of the work in progress, the characteristics of the road and the proximity of workers to passing traffic and it should be in accordance with the RMS's *Traffic Control at Work Sites Manual Version 4.0*. A Speed Zone Authorisation application usually accompanies a ROL application where a change in speed limit is proposed as part of the road occupancy.

The SZA process involves submission of a form available online from the RMS website, which is to be submitted to the Transport Management Centre's Planned Incident Unit through TfNSW. Depending on the extent of works and project familiarity, the application would be supported by project TMP and TCPs. Speed Zone approvals comprise part of the process for approval of the TCP. No adjustments to speed limits would be undertaken without an approved Speed Zone Authorisation.

2.10.5. Special Events

The RMS special event management guidelines process identifies four classes of special event:

- Class 1: is an event that impacts major traffic & transport systems and there is significant disruption to the non-event community. For example: an event that affects a principal transport route in Sydney, or one that reduces the capacity of the main highway through a country town.
- Class 2: is an event that impacts local traffic and transport systems and there is low scale disruption to the non-event community. For example: an event that blocks off a main street town or shopping centre but does not impact a principal transport route or a highway.
- Class 3: is an event with minimal impact on local roads and negligible impact on the non-event community. For example: an on-street neighbourhood Christmas party.
- Class 4: is an event that is conducted entirely under Police control (but is not a protest or demonstration). For example: a small march conducted with a Police escort vehicle.

Wherever possible, agreement would be sought with event organisers to ensure that Class 1 and 2 events do not occur concurrently if they are identified as having a cumulative impact on travel demand around the CSELR construction corridors. To this effect a calendar of all events would be kept during the construction period and coordination of these events and approval to proceed provided through the NCLG. All special events would be assessed and approved by RMS and the TMC in consultation with the Department of Premier and Cabinet.

The traffic management requirements of Special Events may require adjustment to times of operation and routes used by haulage or delivery operations as well as varying approved road occupancy licence (ROL) conditions for the construction. The ROL approval would identify time and day restrictions, where potential conflicts are known at the time of submission.

The Contractor would be responsible for incorporating known special events into the construction program and detailed responses and contingencies in the CTMP subject to further inputs from other stakeholders such as City of Sydney, Randwick Council, State Emergency Services and RMS.

3. Network Performance and Construction Management

3.1. Principles

This section of the CTTMS assesses the network wide traffic impacts of constructing the Project, and suggests management and/or mitigation measures. These impacts are typically caused by reduced capacity on the corridor diverting traffic onto other surrounding routes.

Details of specific construction impacts are assessed on a precinct by precinct basis in Section 4.

The overarching principles used to determine management or mitigation measures for network wide impacts are:

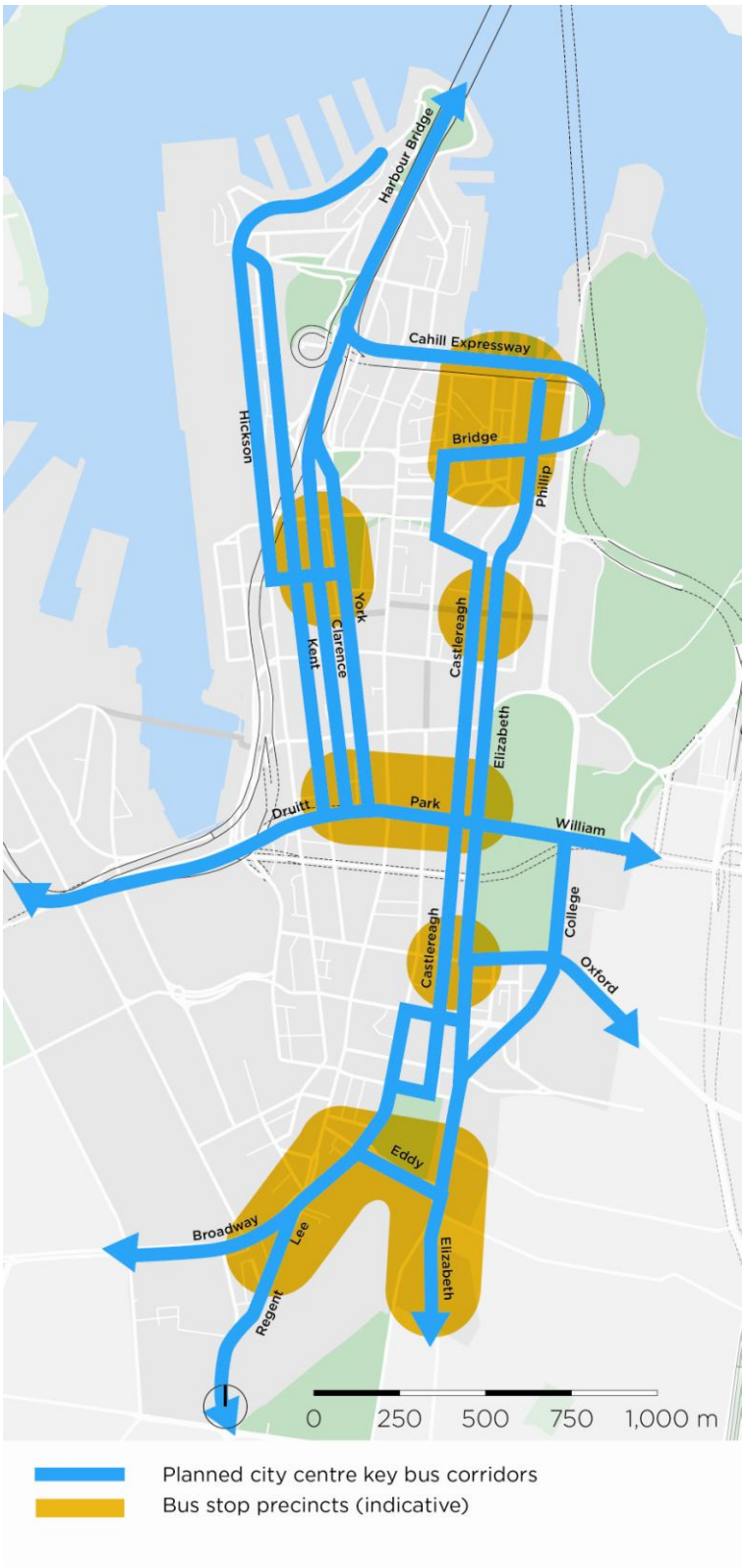
- Balancing transport efficiency against an extended construction program to identify a balanced outcome;
- Implement demand management measures to reduce the demand for travel to levels that can be serviced by the capacity available during construction;
- Minimise impact to active transport modes;
- Minimise impact to property and emergency vehicle access along the corridor;
- Implementation of traffic management measures to offset impact on of the road network; and
- Managing impacts safely.

3.2. Bus and Traffic Management

3.2.1. Bus Management

The Sydney City Centre Bus Plan (SCCBP), South East Bus Plan and the CCAS are to be implemented as separate projects to CSELR and do not form part of this EIS. They will however, be completed prior to commencement of the major construction works for the CSELR. Refer to Figure 3-1 below for the key arterial roads used by buses under the SCCBP.

Figure 3-1 Sydney City Centre Bus Plan Key Corridors



City Centre and South East Bus Operations

During construction, the SCCBP will have been implemented with services from the South East continuing to operate in advance of the introduction of light rail. Further detail on the development of both the South East Bus Plan and SCCBP is available in the Transport Operations Report; however the key features of both are summarized below.

The key features of the SCCBP are:

- Bus turning movements would be reduced at the Elizabeth Street and Park Street intersection. This would help simplify bus movements through the city centre. Existing Metrobus routes would be configured to operate more efficiently through the city centre and better serve customer demand. Sydney Harbour Bridge services to Railway Square would operate via the Cahill Expressway, Bridge Street, Castlereagh Street southbound and Elizabeth Street northbound.
- The remaining bus routes that enter the city centre via the Sydney Harbour Bridge would use York and Clarence Streets and either terminate at Wynyard or QVB (Town Hall).
- Buses from the Eastern Suburbs via William Street would run to Barangaroo and Walsh Bay or to Pyrmont.
- Approximately half of the Inner West bus routes entering the city centre via Broadway would only operate to Central in order to reduce the number of buses unnecessarily entering the city centre; while the remaining routes would continue to the northern end of the city centre via Elizabeth Street northbound and Castlereagh Street southbound.
- Several routes would be connected to operate as through-routed services to reduce the overlap of bus services on city centre streets and the need for bus lay-over in the city centre.
- Victoria Road bus routes that currently use George Street and terminate at Circular Quay would either continue through the city centre via Druitt Street and Park Street to lay-over outside the city centre or terminate at Wynyard

The SCCBP is supplemented by a South East light rail corridor bus strategy which features the termination of most existing all-stops CBD services at light rail interchanges and introduction of additional cross-regional bus routes. The South East light rail corridor bus strategy would only be implemented once CSELR is operational.

The SCCBP would be implemented in advance of construction of the CSELR with some adjustments to compensate for the absence of the mass-transit functionality that would be carried out by light rail in the end-state. Most significantly, eastern suburbs originating CBD all-stops services would continue to operate to the City Centre during construction.

Local Impacts

In addition to the continued operation of South East bus services, the SCCBP interfaces with the construction of light rail at four key locations:

1. Chalmers Street
2. Eddy Avenue
3. Rawson Place
4. Park Street/Druitt Street/George Street intersection

Local bus arrangements have been developed to manage the impact on bus operations at these four locations during construction.

Chalmers Street

With the closure of Chalmers Street, between Randle Street and Elizabeth Street, buses on Chalmers Street would proceed northbound via Randle Street and Elizabeth Street. The kerb realignment at the intersection of Randle Street and Elizabeth Street is proposed as part of the project and would be designed to accommodate the turning maneuver of buses at this intersection.

Bus stops on Chalmers Street would be maintained, with the bus stops relocated south of Devonshire Street to provide sufficient capacity for buses to divert to Randle Street. Exact locations of these bus stops are subject to further investigation and consultation with the operators and City of Sydney.

Eddy Avenue

At Eddy Avenue, all bus services will be retained and sufficient general traffic lanes are maintained to facilitate the continued operation of buses through this precinct during construction. The staging of works at the pedestrian crossing outside Central Station will need to cater for the demand for UNSW bus services and provide safe access to these bus stops.

Rawson Place

At Rawson Place, Route 555 is the only currently operating service directly impacted. As part of the SCCBP, significant volumes of Broadway/Inner West buses are proposed to operate via Rawson Place and George Street southbound. This would not be possible during the construction period, so buses anticipated to make this movement would travel north and southbound via Pitt Street to Railway Square.

Park/Druitt/George Street Intersection

The eastbound and westbound movement of buses through this intersection would be maintained during weekdays. Bus diversions may be required for eastbound bus routes during staging of intersection works at weekends. These diversions may be via Bathurst Street or King Street. Utility relocation and civil works required within the intersection would be managed under the intersection closure detour arrangements shown in Appendix D.

South East CSELR Corridor

As previously indicated, the south east bus network would remain in full operation during construction of the CSELR (i.e. bus network changes cannot be implemented until the substitute light rail product is in operation). Impacts to the operation of the network would be managed through a mixture of local route diversions and construction staging to ensure continuity of access. Key areas where this approach would be adopted to manage construction impacts include:

- Anzac Parade, particularly at Kingsford and Kensington;
- High Street;
- Alison Road;
- Anzac Parade/Alison Road intersection; and
- The Moore Park Bus roadway.

Operational Impacts

The rerouting of bus services would require modification of traffic facilities at adjacent intersections to facilitate bus maneuverability. Some precincts would require prior construction and installation of traffic facilities before the commencement of the early works to accommodate bus diversions.

Such a significant infrastructure transformation would result in impacts on bus management, and key issues are drawn out from the SCCBP below.

Occupancy

The forecast bus occupancy across all corridors during construction, as outlined in the SCCPB, is estimated to be 60%. The only gateway nearing full bus capacity during construction is the Eastern Distributor, while other gateways have the bus capacity to absorb diverted commuters from either terminating routes or alternative routes to the city centre.

Bus stop capacity

In order to accommodate for the bus volumes in the city centre during construction, sufficient kerb space and length is required. The bus stop capacity assessment in the SCCBP shows that all analysed bus stops have adequate capacity for the required activity within the city centre during construction, with some bus stops closer to exceeding capacity than others. Any modifications to the existing bus stops outside the CBD during the construction period must provide sufficient capacity for the number of bus services operating.

Layover facilities

The 21 potential layover facilities in the city centre were assessed for capacity to accommodate for terminating buses in the city centre. The SCCBP identifies some locations that may exceed layover capacity at certain periods. The provisions made in the SCCBP would be implemented, with the modification of excluding Rawson Place during construction for outbound buses. These services would instead be diverted to Pitt Street, and would continue across Lee Street and stop at Railway Square. Bus stops would need to be provided on Pitt Street to cater for bus layovers as required.

3.2.2. Traffic Management

Construction activities would disrupt existing traffic patterns in the surrounding areas. Minimising disruption through effective traffic management techniques across the network, in accordance with the project objectives, is fundamental to the overall success of the Project. Given the scale of the Project and the wide geographical area covered by the proposed corridor, traffic management would be key to providing network operations at a satisfactory level of service.

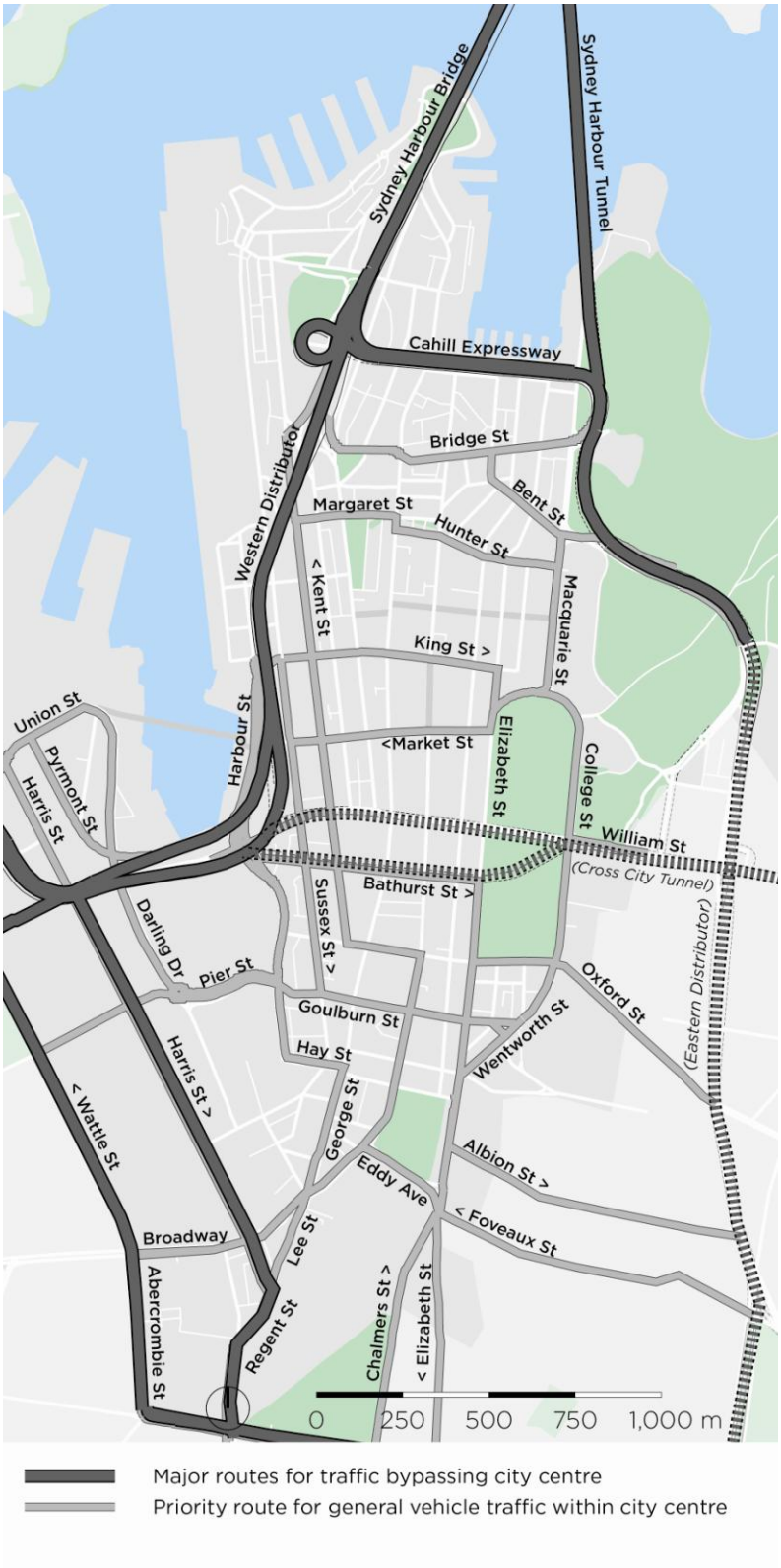
The principle of providing dedicated light rail services into the Sydney CBD is to reduce the demand on oversaturated bus and private vehicle road networks. In doing so the Project results in a fundamental change in the functionality and operation of the CBD road network. These wider network changes are integrated with two major initiatives that do not form part of the CSELR EIS submission:

- Surface transport changes outlined in the Sydney City Centre Access Strategy (CCAS)
- Sydney City Centre Bus Plan (SCCBP)

Traffic management measures associated with the wider CBD network form part of the CCAS, which has developed the priority traffic routes as identified in Figure 3-2 to complement the end-state for operations in the CBD.

The implementation of the SCCBP, SE Bus Plan and the CCAS will not be implemented by the CSLER project, however they are to be completed prior to the commencement of the CSLER project.

Figure 3-2: Priority Traffic Routes in the CBD[6]



[6] *Transport for NSW, unpublished data, 2013*

Additional measures required during construction of CSELR are in development based on model outputs that highlight key congestion hotspots during the construction phase; and in consultation with RMS and TMC. Results of this analysis to date and identified interventions to mitigate these effects are provided in Section 3.9.

3.2.2.1. Road functionality

Broadly speaking the road functionality required during construction would be consistent with the longer term functionality of the road network with light rail in operation. As such the network traffic management measures to be implemented during construction would optimise for the road functionality shown in Table 3-1 and Table 3-2.

Table 3-1: CBD north-south road functionality

Key North / South Street	Function
Sussex Street	Available for general traffic and to service Barangaroo and The Rocks
Kent Street	Available for general traffic with existing segregated cycleway
Clarence Street	Primarily for northbound buses, service vehicles and taxis. Limited availability for private cars
York Street	Southbound only Primarily buses with some limited capacity for service vehicles and taxis. Private car capacity severely diminished from existing due to displaced traffic from George Street and additional buses required
George Street	Local access, servicing and emergency vehicles only in pedestrianized zone Limited traffic capacity outside pedestrianized area
Pitt Street	Priority north-south connection between Railway Square and Liverpool Street Service vehicles taxis and limited private traffic
Castlereagh Street	Southbound only Primarily buses with service vehicles and taxis. Limited capacity for private vehicles. Planned cycleway
Elizabeth Street	Primarily buses, limited capacity for taxis and service vehicles. Private car capacity severely diminished
Macquarie Street / College Street	Available for general traffic

Table 3-2: CBD east-west road functionality

Key East / West Street	Function
Grosvenor Street / Bridge Street	Key east west street to distribute traffic to and from the Harbour Bridge
Hunter / Margaret Street	Only direct link between Barangaroo and Macquarie Street.
King Street	The only street to exit from the Western Distributor to City North Existing and planned cycleway
Market Street	The major street to provide access from City North to the Western Distributor
Druitt / Park Street	Key function is for bus services to access and depart the City. Secondary function is to provide access to the Western Distributor for City South
Bathurst Street	Connection for all traffic from the Western Distributor to City South and also to City east.
Liverpool Street	Key connection for all traffic to egress from City South and City East to Sydney Harbour Bridge.
Goulburn Street	Priority route, providing connectivity for all traffic to and from Darling Harbour / Pyrmont
Hay Street	Lower order connection from Pyrmont to City South
Eddy Avenue	Key function is for east west movements for public transport including light rail. Connection for traffic from Broadway to Wentworth Avenue and to north eastern CBD. Closure at Rawson Place limits westbound traffic use.

The road network functions outlined above would be achieved through measures that would include but not be limited to:

- Reversal in operation of one and two way streets to maximize operational efficiency and access. This includes:
  - Pitt Street two-way north of Bridge;
  - Two-way operation of Hunter Street with Margaret Street; and
  - Reversal of O'Connell Street.
- Removal of kerb blisters (subject to pedestrian safety audit and Council consultation) and extension of parking restrictions to increase the number of operational traffic lanes;
- Upgrade of intersection geometries and signal phasing to optimise the priority traffic corridors;
- Banning of traffic movements to increase intersection capacities and optimise priority routes; and
- Rephasing traffic signals.

The process for development and delivery of these traffic management measures is set out below:

- Develop an integrated roads strategy as part of the CCAS and SSCBP;
- Develop a co-ordinated network approach using traffic modelling tools that include AIMSUN network modelling and localised models e.g. LinSIg, SIDRA, Commuter;
- Implement identified infrastructure changes;
- Develop SCATS operational strategies prior to construction commencing; and
- Implement and refine SCATS strategies during construction

3.3. Pedestrian and Cycle Access Management

Much of the CSELR corridor is located in areas of high pedestrian activity, particularly the CBD precinct. Many CBD footpaths experience high levels of congestion at peak times which includes weekday lunchtimes. For these reasons the construction methodology has minimised the impact to footpath widths and crossing facilities to ensure sufficient pedestrian capacity is provided in a safe environment

All worksites would take consideration of issues of pedestrian safety and security issues as indicated below:

- Any hoardings, or other fixed site boundaries would have lighting as required by current standards.
- Consideration would also be given in design to the layout of any hoarding / fence lines to maximise sight lines for pedestrians, and design out hiding places and blind spots to improve pedestrian personal security. Any gantry arrangements or tunnels would have internal lighting.
- Consideration would be given to relocating or supplementing existing CCTV cameras if the worksite creates unacceptable blind spots.
- It is proposed that footway lighting is provided and that any barriers and pedestrian screens adjacent to pedestrian footway, permit observation from the worksite and opposite footway. For this reason, it is not proposed to use hoardings at the footway/ kerbline, which would block sightlines and tunnel pedestrians into long restricted passages.
- Pedestrian capacity on footpaths will be enhanced by the removal of bus stops and increased crossing opportunities at intersections, because of the reduction or elimination of George Street traffic movements.
- During the days when worksites are in operation, there will be overviewing of the footway from businesses and traffic controllers at intersections will be able to monitor the pedestrian movements and respond to incidents on footpaths and at crossings.
- At night, pedestrian numbers will be lower, but personal security will be more important. Depending on the extent of the work zone and whether frontage premises have extended operating hours, it may be necessary to maintain traffic controllers and/ or security staff. Prior to the start of work, the coverage provided by existing monitoring and the need for and type of any support at particular locations, should be agreed with NSW Police and local councils.
- Emergency evacuation requirements would need to be agreed with emergency service providers (Fire Brigade). Depending on the stage of work this may require
    - Temporary road plates to permit crossing of the work zone.
    - Assistance of traffic controllers in restricting public access to the street block and facilitating access for emergency service vehicles.
    - Protocols for managing emergency response will need to be agreed with service providers prior to the start of work.
    - Protocols to manage the evacuation of occupants adjacent to the worksite will need to be agreed with the building owners and service providers prior to the start of work.

3.3.1. Provision for vulnerable users (school children, elderly and mobility impaired)

Where worksites have an impact on footpaths, consideration would be given to the requirements of all pedestrians and especially vulnerable users. The Disability Discrimination Act requirements would be adopted with drop kerbs, etc. provided at crossings. Footpath widths are required to allow two-way pedestrian movements of pushchairs and wheelchairs.

Where high numbers of vulnerable users use a footpath, special provision and design consideration may be required to mitigate impacts.

3.3.2. Pedestrian Provisions

For the majority of the main civil works, the existing longitudinal (along the footpath) pedestrian movements would be maintained along the footpaths. Transverse (crossing of roads) pedestrian movement would be maintained at pedestrian crossings at intersections or controlled by traffic controllers, where works are carried out.

Installation of overhead wiring poles and service relocations during the early works stage would require the closure of the footpaths. During such cases, the footpaths would be narrowed past the worksite or pedestrians would be diverted to adjacent footpaths via safe crossing facilities with appropriate barriers and signs or temporary structures would need to be installed to facilitate the pedestrians over the worksites.

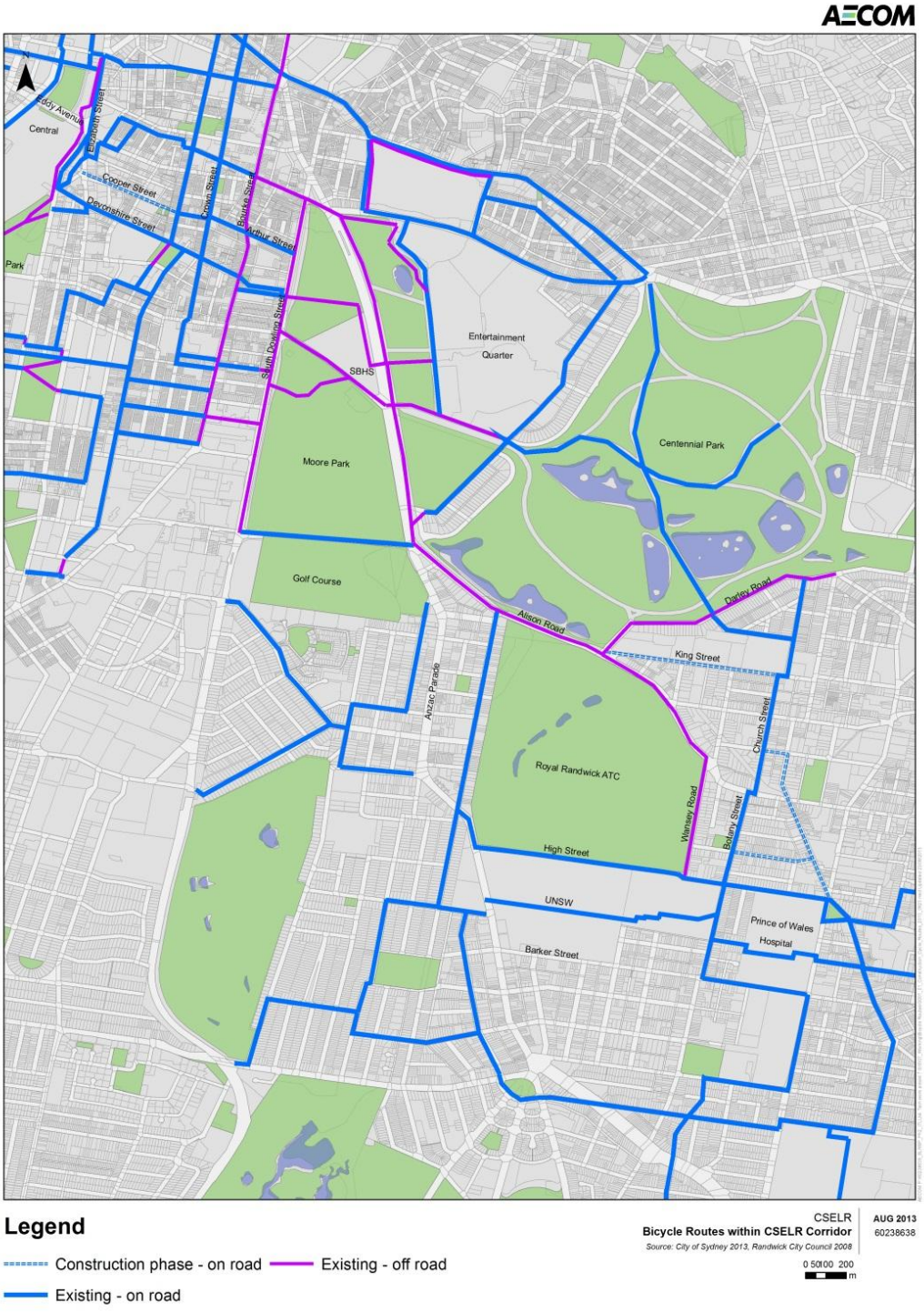
Footpaths adjacent to worksites, with high volumes of construction vehicle movements, would require traffic controllers to manage the conflict between construction vehicles and pedestrians.

3.3.3. Cyclist Provisions

Where existing cycle routes or facilities are occupied by the construction worksites, alternate routes have been identified as shown in Figure 3-3. In developing these temporary diversions, consideration has been given to their suitability based on the road environment and current function. Existing cycle paths located within the construction corridor but not occupied by the required worksite, would be maintained during the construction phase.

Alternate cycle routes would be reviewed by the relevant Road Authority with input from local Bicycle User Groups. Further details of the management measure to be implemented for each of these routes are contained in Section 4.

Figure 3-3: Required changes to cycle route during construction[7]



[7] AECOM, 2013

3.4. Network Management

Prior to construction of CSELR commencing, a coordinated approach to proactive management of the transport network would be required. This network management approach would be required to run through the entire construction program to ensure that the impacts of the rolling multiple worksites and resulting fluctuations in network capacity are offset by appropriate measures.

To ensure the most effective management approach is adopted, all assessment undertaken in this CTTMS is based upon a worst case scenario assessment. Under this scenario it is assumed that the full length of the corridor is an active worksite and as such all proposed road closures are in place concurrently. Once a contractor is appointed and detailed construction staging established, it is likely roads would be progressively reopened resulting in improved levels of network performance.

The network scenario assumed for assessment is shown Figure 3-4 to Figure 3-6.

Figure 3-4: CBD and Surry Hills (north) Construction Scenario[8]

[8] AECOM, 2013

Figure 3-5: Surry Hills, Moore Park and Kingsford (north) construction scenario[9]

[9] AECOM, 2013

Figure 3-6: Kingsford (south) and Randwick construction scenario[10]

Whilst an increase in localised delays and congestion is highly likely during construction, as a result of temporarily reduced network capacity, the key objective is to ensure congestion and network journey times remain at acceptable levels. Travellers on the

[10] AECOM, 2013

road network would often be accepting of increased journey times for short periods, provided their journey is reliable.

The approach to Network Management during construction of CSELR to deliver satisfactory network performance throughout construction is set out below.

3.4.1. Network Management Plan

The identification of appropriate management measures and coordination of their implementation would be delivered through development of a Network Management Plan (NMP). The NMP would have the high level objective of maintaining network journey times and congestion levels at acceptable levels as identified by the Network Coordination Liaison Group (NCLG). TfNSW would be responsible for developing and maintaining the NMP in coordination with the NCLG.

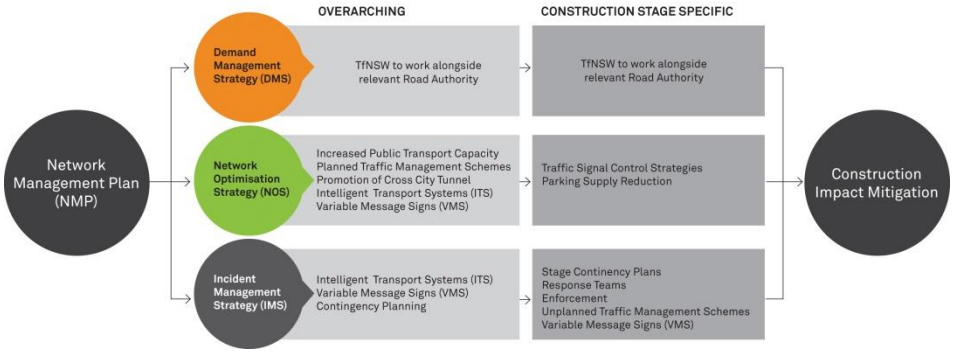
Through consultation with agencies and assessment of forecast impacts to the transport network, the NMP would result in a holistic approach to mitigate the effects of construction and result in the maximum effectiveness of these measures. The plan would consist of three main elements:

- Demand Management Strategy;
- Network Optimisation Strategy; and
- Incident Management Strategy.

When coordinated through the NMP, the above strategies would be able to match peak travel demand to the latent network capacity at each stage of construction.

The structure of the NMP is shown in Figure 3-7 with each of the strategies and available measures detailed in the following sections.

Figure 3-7: Construction Network Management Plan



3.4.1.1. Demand Management Strategy

A reduction in travel demand is necessary as the city cordon is currently operating at capacity, hence the reduction in road network capacity associated with construction of CSELR would lead to further congestion if appropriate measures are not taken. Managing traffic generation by congestion is considered an inappropriate way to reduce demand as it leads to increased travel times, air quality degradation and crashes. Further congestion also adversely impacts on public transport trips thus decreasing the efficiency of the whole transport system.

It is important to note that during construction there would be increased travel demands to be managed arising from the presence of construction vehicles and increased circulating traffic becoming accustomed to the new traffic conditions (with George Street

being a key two-way street in the city and most other being one-way, internal CBD trip lengths would be increased thus increasing the volume of traffic on each street).

To successfully mitigate these factors, measures would be required in two discrete categories:

- Overarching Strategies – Strategies that are promoted and implemented prior to construction commencing and run throughout the construction program to reduce peak period demands on the network. In broad terms the CBD traffic capacity is reduced by the volume of traffic using George Street and the network needs to be managed to achieve a similar level of demand reduction at peak times. To achieve this TfNSW will work alongside the relevant road authorities to develop appropriate demand management initiatives.
- Construction Stage Strategies – Generally more localised strategies that are applied during specific stages of construction to focused groups.

The majority of these overarching strategies would require implementation prior to construction commencing. Maximum levels of effectiveness are achieved when these demand management strategies are integrated with the network optimisation measures below.

3.4.1.2. Network Optimisation Strategies

To offset the loss of capacity on the corridor during construction, wider changes to the road network can deliver operational efficiencies and ensure more effective utilisation of available network capacity. These measures would be required in two discrete categories:

- Overarching Strategies – Strategies that are promoted and implemented prior to construction commencing and represent network optimisation objectives closely associated with the end-state:
  - Planned traffic management measures, as identified in Section 3.9.4. These measures would complement the CCAS and SCCBP. This would include modification to SCATS operation in the CBD to ensure traffic signals actively manage traffic onto the priority routes.
  - Implementation of VMS, ITS devices, priority routes enhancements, parking strategies and clearways.
  - Promotion of CBD bypass route and the Cross City Tunnel to increase usage and to reduce demand on the congested surface streets.
- Construction Stage Strategies – Generally more localised strategies that are applied during specific stages of construction to focused parts of the network:
  - Implementation of traffic signal control strategies that minimise delay based on the corridor and road network capacities associated with the current construction stage would be implemented by RMS.
  - Temporary removal or restriction of localised parking to provide additional traffic lanes.

The specific measures would be identified through focused traffic modelling to determine network pinch points and to ensure maximum network capacity is achieved.

3.4.1.3. Incident Management Strategies

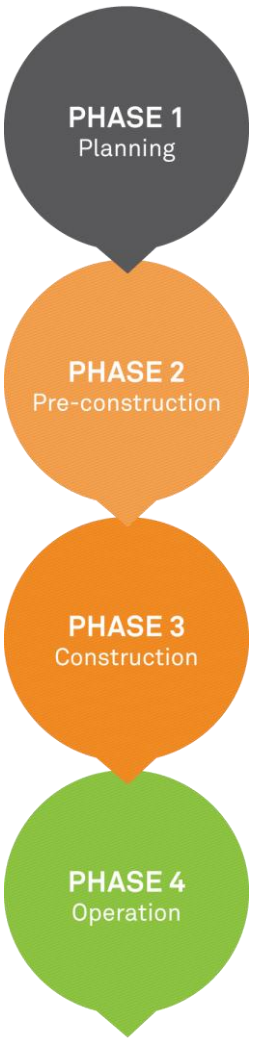
The demand and optimisation strategies identified earlier ensure that network demand and capacity during construction are matched under usual operation. However unplanned incidents such as broken down vehicles are a common occurrence. During the construction period such events have the potential to severely impact operations and it is essential effective strategies are in place to provide resilient operation of the network. These measures would be required in two discrete categories:

- Overarching Strategies – Strategies that seek to pre-empt possible unplanned events based on general network operations during construction. These strategies are likely to represent enhancements to current incident management tools that would remain in place following construction to assist light rail network operations:
  - Ensuring ITS capabilities are enhanced on the CSELR corridor and key alternative routes would facilitate quicker detection of events and provide additional management tools to respond to these events. For example ensuring full CCTV coverage of the corridor is provided would enable the TMC to identify incidents, whilst improved vehicle detection and SCATS enhancements would enable appropriate traffic control responses to be implemented remotely.
  - Provision of temporary and permanent VMS signage, in line with RMS technical direction TDT 2005/02b, to advise drivers of likely delays, upcoming works and diversion routes would influence driver behaviour and reduce demand on problematic corridors.
  - Development of contingency plans to deal with possible events would be required. This would include the review of current contingency plans that may not be suitable in light of construction activity and network changes.
- Construction Stage Strategies – More localised strategies that are applied during specific stages of construction to focused parts of the network and would be removed following completion of the construction program:
  - Incident response teams would be located at strategic points on the network and controlled by the TMC to provide a rapid response to any incidents. These response teams would have the objective of clearing the incident from the network in the safest and quickest time possible to minimise the impact. This is likely to require the provision of light and heavy vehicle tow capabilities.
  - Unplanned traffic management measures would be developed in response to specific hot spots that occur for longer periods and can be resolved through relatively low cost measures such as extension of parking restrictions and minor intersection modifications.
  - Mobile VMS units would be deployed in line with RMS technical direction TDT 2005/02b during each significant construction stage to advise drivers of upcoming works and suitable alternative routes.
  - Enhanced enforcement of traffic regulations would reduce the occurrence of negative network impacts that can occur through non-compliance, as well as improving operations; this would also provide a safety benefit.
  - Construction stage contingency plans developed and tested in advance of each major construction stage.

3.4.1.4. Network Management Plan Implementation

Successful implementation of the NMP would ensure that network impacts during construction of CSELR can be adequately managed and negative impacts minimised throughout the construction program. The NMP would operate in four phases as highlighted below in Figure 3-8.

Figure 3-8: Phases of NMP Operation



The NMP would represent a live document and constantly evolving plan that develops as the Contractor builds up a greater understanding of the construction staging during the planning phase and as new responses are identified in response to unforseen events during construction and light rail operations.

Demand management and network optimisation strategies work most effectively when planned and coordinated as one. The CSELR NMP would ensure this holistic approach is adopted to mitigate the negative impacts of construction.

3.5. Property Access

During construction, property access would be maintained, where possible, along the corridor to minimise the impact to local residents and businesses. However, due to the closure of some approach routes diversions to properties on or adjacent to the corridor would result in an increase to travel distance. The precincts most affected due to the closure of key corridors are:

- The Rocks (George / Alfred Street closures)
- Surry Hills (Devonshire Street closure)

For these precincts, access maps have been produced to detail the effect of these alternate routes. These precinct maps are located in Appendix A.

3.6. On-Street Parking

All on-street parking and loading along the light rail corridor would be affected during construction in order to provide sufficient worksite width and to maximise the number of traffic lanes available. Table 3-3 below quantifies the number of available spaces affected.

Table 3-3: Existing Parking Supply affected on the Corridor

Parking restriction	Parking Supply Impacts by Time Period		
	Pre-AM Peak	Inter Peak	Post-PM Peak
Car Share, Hospital, Mail Zone	5	5	5
Disability Parking	10	10	10
Loading Zone	25	63	24
Short Stay Parking (≤1P)	180	277	213
Long Stay Parking (Restricted)	114	149	153
Taxi Zone	31	31	64
Long Stay Parking (Unrestricted)	459	468	552
Total	**821**	**1000**	**1018**

When light rail is operational only 2% of these spaces would be reinstated during the post-PM peak. As such, the detailed study of parking supply and utilisation undertaken as part of the Transport Operations Report (see Section 6 of the Transport Operations Report) is appropriate during construction. The study concluded that whilst parking demand based on current levels would reach or exceed the reduced capacity in some localised areas; these effects could be managed through:

- Extension of parking permit schemes, particularly in predominately residential precincts surrounding the project corridor. These would be designed to afford priority to local residents to park in the vicinity of their home with an allowance for short term parking for visitors and for vehicle access to commercial land uses and other short stay trip generators. Extension of parking permit schemes would be implemented by the relevant parking authority.

- Providing priority on streets immediately adjacent to the project corridor where commercial land uses are present for loading and short term parking. For example, allocation of kerbside capacity on side streets directly off the corridor for locations where commercial land uses are present for loading and short term parking. All such measures would be developed on a case-by-case basis.

It is therefore concluded that through implementation of the end-state parking strategy prior to construction commencing, the parking impacts can be successfully mitigated. However, additional temporary loading zones may be required at adjoining side streets during construction if access to the off-street parking or loading bays cannot be maintained during construction. Those properties affected and the potential loading zone locations are identified in Section 4.

3.7. Emergency Vehicle Access

Access for emergency vehicles are to be in accordance with emergency vehicle requirements and would be maintained at all construction sites, including access to hospitals. The emergency services would be advised of all planned changes to traffic arrangements prior to applying the changes. Advice would include information about upcoming traffic switches, anticipated delays to traffic, extended times of work, locations of road possession or any likely major disruptions. The construction contractor is to liaise with Emergency Services to minimise the impacts of response times.

Measures to facilitate the movement of emergency vehicles through a worksite would be made available at all worksites and would be defined in the worksite specific TMPs, these measures may include clearways adjacent to worksites and/or road plates.

During short periods when major construction and loading/unloading activities are underway it may not be possible to allow emergency vehicles to traverse the full block length. Access to an emergency within the block would still be maintained at an identified access point and diversion routes would be agreed with the emergency services prior to the activities commencing. The contractor shall also consult with NSW Fire and Rescue regarding any specific requirements for any of the buildings adjacent to the rail alignment in preparing the site specific Traffic Management Plans to minimise the impact to emergency vehicle response times.

An Emergency Management Plan would coordinate these measures and provide a framework for input to the individual worksite TMPs.

3.8. Emergency Management and Planned Event Management

An emergency can be defined as:

An unforeseen event which requires urgent action to protect life or property, or an occasion when emergency services (Police, Fire Brigade, Ambulance or State Emergency Services) take control of a portion of the road network.

Examples of emergencies could include:

- Traffic accidents;
- Hazardous spillages;
- Power Failures;
- Terrorist attacks;
- Flood;
- Fire; and
- Structural damage to a rail line, building, road tunnel or bridge.

The RMS's Incident Response Plan Manual guides the appropriate procedure and responses required in the event of an emergency.

All details of emergencies that occur within ROL areas are to be recorded and forwarded to RMS's Traffic Operations Manager within 7 days of the incident occurring, with details of where the incident occurred, any contributing factors related to the ROL and any actions that have been taken with respect to the ROL conditions.

Incident Management Plans for light rail worksites would be developed in the site specific CTMPs.

The ROL database would maintain records of traffic accidents and incidents reported at work sites. Any complaints received regarding delays at work sites would be via the TfNSW project communications team and referred to the Contractor for investigation, the drafting of replies, and reporting. The person in charge of the work site would continue to be responsible for dealing with complaints regarding safety issues. Where action is considered necessary to address the matters of the complaint, an appropriate recommendation would be forwarded to the contractor.

3.9. Network Impacts

The network impacts during construction have been assessed through a mesoscopic modelling assessment undertaken by TfNSW.

3.9.1. Methodology

The modelling platform adopted includes the development of an area wide mesoscopic model with a large part modelled using a hybrid model concept. The extents of this model are shown in Figure 3-9. The hybrid simulator concept allows for dynamic simulation of an area large enough to account for regional route diversion, as well as micro-simulation modelling of smaller pockets that require representation of individual vehicle dynamics in the detailed road network.

3.9.1.1. 2016 construction scenario

A traffic forecast year of 2016 was adopted to represent traffic demand on the road network at the time construction would be underway. These traffic demands were derived by interpolating between TfNSW's 2011 and 2021 PTPM model forecasts.

Modelling has been produced for the AM peak (6am-10am) and PM peak (3pm-7pm) time periods. Consistent with the approach adopted throughout this CTTMS, the modelled scenario represents a worst case assessment in terms of network traffic demand and capacity reductions. Under this scenario it is assumed that the full length of the corridor is an active worksite and as such all proposed road closures are in place concurrently. This enables the identification of likely critical access and congestion points on the network. Additional detailed planning needs to take place to develop construction staging and access during construction.

Once a contractor is appointed and detailed construction staging established it is likely improved levels of network performance would be achieved.

Figure 3-9: Mesoscopic model area[11]

[11] Mesoscopic traffic modelling undertaken by TfNSW, 2013

3.9.1.2. Network Performance Measures

Global Performance

The high level network statistics provide a good indication of how the network performs and these can be defined in terms of average speed, vehicle hours travelled (VHT) and vehicle kilometres travelled (VKT) for all vehicles in the network in the defined study area. Such statistics enable a relative comparison to be made between the existing network performance and the 2016 Construction scenario. Increases in VKT indicate that vehicles are travelling longer distances to avoid congestion and thus minimise delay. Increases in VHT indicate increased delays and build-up of congestion in the network.

In addition, the "*Vehicles in Network*" parameter provides an indication of the ability for the modelled road network to cater for future demands. A greater number of vehicles within the network at the end of the modelled period indicate that congestion within the model has prevented these vehicles from completing their trip.

Network Traffic Volumes

The introduction of CSELR results in a reduction in traffic capacity on several key roads within the CBD and south-east suburbs, including George Street, Eddy Avenue, Chalmers Street, Elizabeth Street, Devonshire Street, Anzac Parade and Alison Road. Traffic volume changes on roads are an indicator of traffic redistribution resulting from traffic 'hot spots'.

Network Speeds

Complementary to traffic volumes changes, variations to the travel speeds by road segment throughout the network were also assessed. This is a measure of congestion on various roads as indicated by low operating speeds.

Intersection Delays

The intersection average delay is the primary criteria for assessing the Level of Service (LoS) for signalised intersections. The intersection average delay is calculated in the model by determining the average delay for each approach to the node.

3.9.2. Network Performance

This section outlines the wider network effects that occur as a result of the reduced traffic carrying capacity of the light rail corridor during construction. It accounts for the reassignment of traffic onto alternative routes and provides an indication of where the congestion hotspots may occur requiring the implementation of traffic management measures as part of the Network Optimisation Strategy (described in Section 3.4.1.2).

The resulting network wide performance measures and a comparison to existing conditions in the CBD and wider model area are shown in Figure 3-10 and Figure 3-11.

Figure 3-10: 2016 network performance statistics – AM peak[12]

Table 5.16: 2016 Construction Scenario Network Performance Statistics – AM Period

Statistic	2012 Base	2016 Construction Scenario	% Change
Full Model Area			
VHT (8-9am)	11,045hrs	12,582hrs	14%
Normalised VHT (6-10am)	36,338hrs	41,691hrs	15%
VKT (8-9am)	364,316km	377,465km	4%
Normalised VKT (6-10am)	1,259,408km	1,354,122km	8%
Average Speed All (8-9am)	34.0km/h	31.8km/h	-6%
Normalised Average Speed All (6-10am)	34.6km/h	32.5km/h	-6%
Average Speed Bus (8-9am)	18.6km/h	21.1km/h	13%
Average Speed Bus (6-10am)	19.4km/h	22.3km/h	15%
Average Delay (8-9am)	64sec/km	73 sec/km	14%
Average Delay (6-10am)	56sec/km	65 sec/km	16%
Vehicles in Network (at 10am)	8,705	11,038	27%
CBD Cordon			
VHT (8-9am)	2,651hrs	2,970hrs	12%
VHT(6-10am)	8,216hrs	9,103hrs	11%
VKT (8-9am)	72,287km	72,138km	0%
VKT (6-10am)	243,603km	251,289km	3%
Average Speed All (8-9am)	27.2 km/h	24.3 km/h	-11%
Average Speed All (6-10am)	29.6 km/h	27.6 km/h	-7%
Average Speed Bus (8-9am)	10.5 km/h	13.5 km/h	29%
Average Speed Bus (6-10am)	10.9 km/h	14.4 km/h	32%
Vehicles in Cordon (at 10am)	2,112	2,419	15%

The AM peak model results indicate the following potential outcomes could occur when compared to the 2012 base case:

Full Model Area:

- 15% increase in total time travelled by all vehicles
- 8% increase in total distance travelled by all vehicles
- 6% decrease in average speed for all vehicles to approximately 33km/h
- 15% increase in average speed for buses from to approximately 22km/h
- 16% increase in average delay for all vehicles to 65sec/km
- An increase of 2,300 vehicles retained in the network at the end of the peak period. This can be attributed to the additional demand in 2016 and the reduced vehicle speeds that result in fewer vehicles completing their trip by the end of the peak period.

CBD Cordon:

- 11% increase in total time travelled by all vehicles
- 3% increase in total distance travelled by all vehicles
- 7% decrease in average speed for all vehicles decreases to approximately 28km/h
- 32% increase in average speed for buses to approximately 14km/h.

[12] Mesoscopic traffic modeling undertaken by TfNSW, 2013

Figure 3-11: 2016 network performance statistics – PM peak[13]

Table 5.17: 2016 Construction Scenario Network Performance Statistics – PM Period

Statistic	2012 Base	2016 Construction Scenario	% Change
Full Model Area			
VHT (5-6pm)	11,816hrs	13,572hrs	15%
Normalised VHT (3-7pm)	46,278hrsc	53,148hrs	15%
VKT (5-6pm)	370,895km	375,996km	1%
Normalised VKT (3-7pm)	1,429,419km	1,543,499km	8%
Average Speed All (5-6pm)	32.8km/h	30.9km/h	-6%
Normalised Average Speed All (3-7pm)	30.9km/h	29.0km/h	-6%
Average Speed Bus (5-6pm)	16.8km/h	16.7km/h	-1%
Average Speed Bus (3-7pm)	17.2km/h	17.4km/h	1%
Average Delay (5-6pm)	70sec/km	88sec/km	26%
Average Delay (3-7pm)	69sec/km	82sec/km	19%
Vehicles in Network (at 7pm)	12,057	15,377	28%
CBD Cordon			
VHT (5-6pm)	2,894hrs	3,321hrs	15%
VHT(3-7pm)	10,829hrs	12,180hrs	12%
VKT (5-6pm)	71,778km	71,427km	0%
VKT (3-7pm)	278,874km	279,816km	0%
Average Speed All (5-6pm)	24.8km/h	21.5 km/h	-13%
Average Speed All (3-7pm)	25.7km/h	23.0 km/h	-11%
Average Speed Bus (5-6pm)	9.6km/h	8.2 km/h	-15%
Average Speed Bus (3-7pm)	9.9km/h	8.5 km/h	-14%
Vehicles in Cordon (at 7pm)	2,296	3,020	32%

The PM peak model results indicate the following potential outcomes could occur when compared to the 2012 base case:

Full Model Area:

- 15% increase in total time travelled by all vehicles
- 8% increase in total distance travelled by all vehicles
- 6% decrease in average speed for all vehicles to 29km/h
- Average speed for buses remaining relatively unchanged at approximately 17km/h
- 19% increase in average delay for all vehicles to 82sec/km
- An increase of 3,300 vehicles retained in the network at the end of the peak period. This can be attributed to additional demand in 2016 and the reduced vehicle speeds that result in fewer vehicles completing their trip by the end of the peak period.

[13] Mesoscopic traffic modeling undertaken by TfNSW, 2013

CBD Cordon:

- 12% increase in total time travelled; with a negligible change in total distance travelled by all vehicles
- 11% decrease in average speed for all vehicles to 23km/h
- 14% decrease in average speed for buses to approximately 9km/h.

Overall the road network is expected to function satisfactorily during the AM peak period, however the PM period conditions may present problems in the CBD, particularly noting the decline in bus travel times. Measures to address these impacts are identified in Section 3.9.4.

3.9.3. Travel times and intersection performance

Further to the above network statistics, travel times and intersection delays for key corridors have been extracted for the CBD and south east sections of the model.

3.9.3.1. Travel times

The travel time statistics are provided below in Figure 3-12 and Figure 3-13.

Figure 3-12: 2016 Construction scenario AM peak travel times[14]

Route	Direction	From	To	2012 Base		2016 Weekday Construction Scenario	
				Travel Time (sec)	Average Speed (km/h)	Travel Time (sec)	Average Speed (km/h)
Bathurst Street	EB	Day Street	Elizabeth Street	89	24	92	23
Liverpool Street	WB	College Street	Harbour Street	145	20	179	16
King Street	EB	Sussex Street	Elizabeth Street	113	25	117	25
Market Street	WB	Elizabeth Street	Sussex Street	106	20	122	18
Alison Road	EB	Anzac Parade	Belmore Road	264	29	242	31
	WB	Belmore Road	Anzac Parade	211	36	486	16
Anzac Parade	NB	Oxford Street	Sturt Street	628	31	894	22
	SB	Sturt Street	Oxford Street	711	27	742	26
High Street	EB	Anzac Parade	Belmore Road	271	20	225	24
	WB	Belmore Road	Anzac Parade	237	23	314	17

The travel time forecasts indicate the 2016 construction scenario would have the following impacts when compared to the 2012 base case, within the CBD and south-east in the AM peak:

- The Anzac Parade corridor would experience an increase in travel times in both directions.
- Traffic travelling on High Street would be subject to unchanged travel times in the eastbound direction and an increase in the order of 70 seconds in the westbound direction.
- An increased travel time of approximately 180 seconds along the Alison Road westbound corridor.

[14] Mesoscopic traffic modelling undertaken by TfNSW, 2013

Figure 3-13: 2016 Construction scenario PM peak travel times[15]

Route	Direction	From	To	2012 Base		2016 Weekday Construction Scenario	
				Travel Time (sec)	Average Speed (km/h)	Travel Time (sec)	Average Speed (km/h)
Bathurst Street	EB	Day Street	Elizabeth Street	146	15	160	14
Liverpool Street	WB	College Street	Harbour Street	232	12	230	13
King Street	EB	Sussex Street	Elizabeth Street	109	26	192	15
Market Street	WB	Elizabeth Street	Sussex Street	124	17	131	16
Alison Road	EB	Anzac Parade	Belmore Road	262	29	241	31
	WB	Belmore Road	Anzac Parade	214	35	398	19
Anzac Parade	NB	Oxford Street	Sturt Street	560	35	888	22
	SB	Sturt Street	Oxford Street	865	22	918	21
High Street	EB	Anzac Parade	Belmore Road	275	20	277	19
	WB	Belmore Road	Anzac Parade	232	23	302	18

The travel time forecasts indicate the construction scenario would have the following impacts within the CBD and south-east in the PM peak:

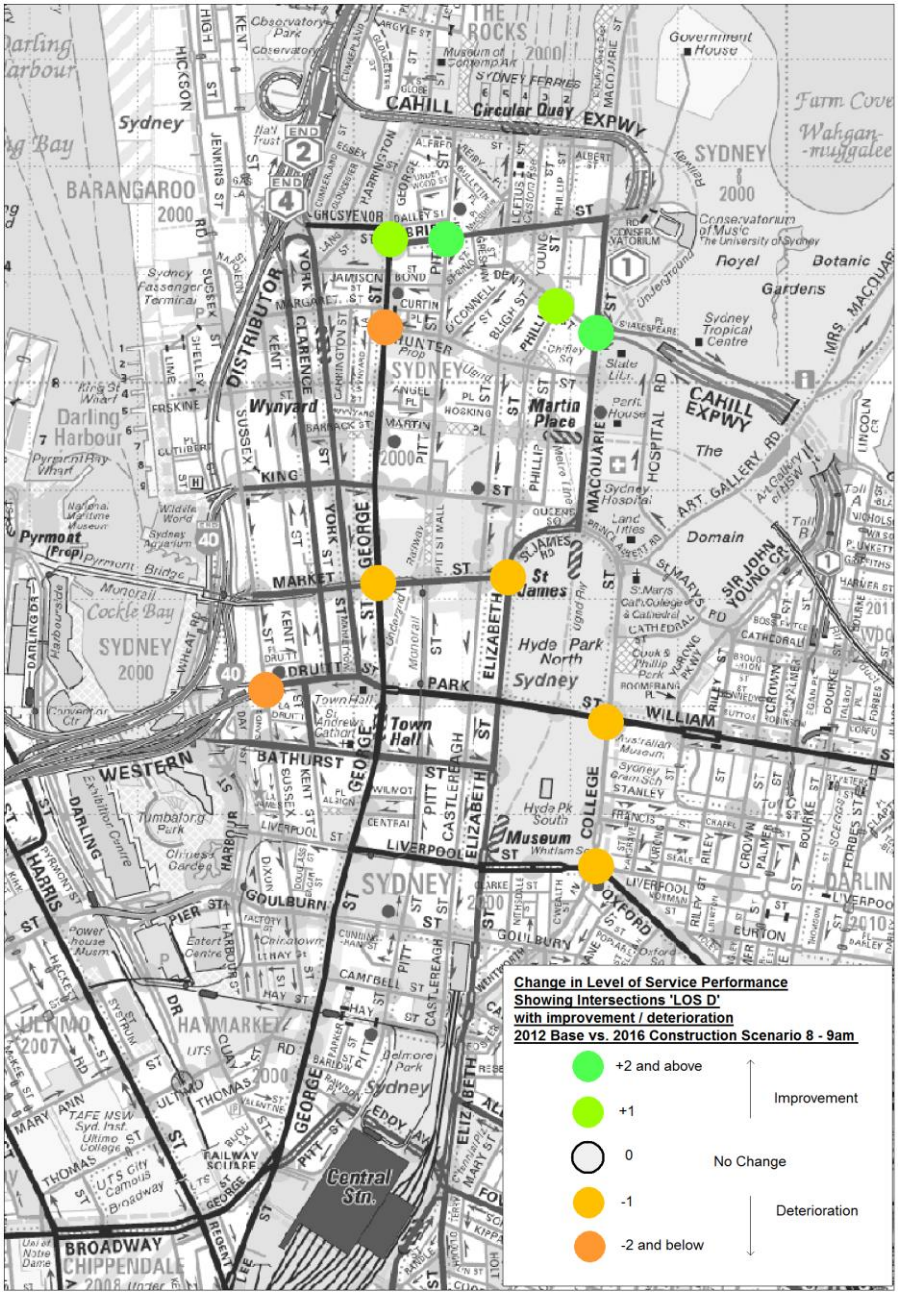
- Improvements to travel times on Liverpool Street.
- The King Street corridor would see increased travel times of approximately 80 seconds.
- Travel time increase for the routes within the south-east with the exception of the Alison Road eastbound which would experience travel time reduction of approximately 20 seconds.

3.9.3.2. Intersection delays

Within the CBD, an assessment of the change in level of service is provided in Figure 3-14 and Figure 3-15. The figures compare the forecast intersection performance of the 2012 Base and the 2016 construction scenario. The colour coding illustrates the performance of key intersections that operate at LoS D or worse in either scenario. The green denotes improved level of service during construction, whilst the amber identifies deterioration in level of service.

[15] Mesoscopic traffic modelling undertaken by TfNSW, 2013

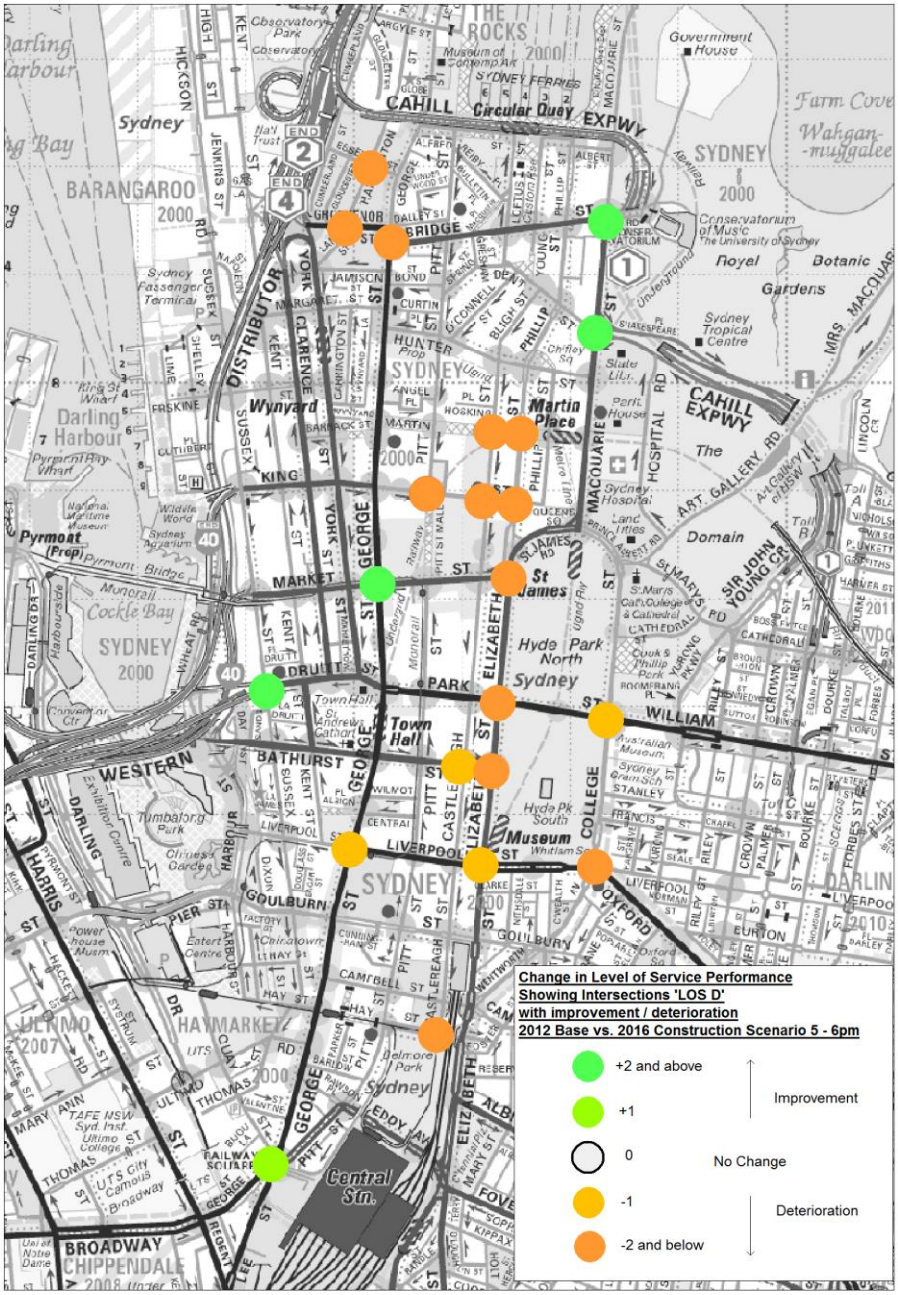
Figure 3-14: 2016 construction scenario vs. 2012 base change in level of service - AM peak[16]



The AM results illustrate that the construction scenario would impact on the performance of the intersections in the mid-city, especially along Park Street, Market Street, College Street and Hunter Street. The introduction of the CBD bus plan shows improvements to the intersections along Bridge Street as well as Bent Street.

[16] Mesoscopic traffic modelling undertaken by TfNSW, 2013

Figure 3-15: 2016 construction scenario vs. 2012 base change in level of service - PM peak[17]



The PM peak period results for the construction scenario show a contrasting pattern to the AM peak with the increase in intersections delays concentrated around Bridge Street and King Street in the northern CBD and around Elizabeth Street and Liverpool Street in the southern CBD. The increased delays along Elizabeth Street and Castlereagh Street corridors are due to increased bus activity associated with the SCCBP.

[17] Mesoscopic traffic modelling undertaken by TfNSW, 2013

3.9.4. Indicative planned traffic management measures

Both the operational and construction phases of light rail would result in a reduction in traffic capacity along the corridor that may require additional mitigation measures at the network level. The potential wider network intervention measures identified for the operational end-state would also provide a benefit during construction and as such these measures could be implemented prior to construction commencing. Potential measures identified by modelling undertaken by TfNSW are shown in Figure 3-16 and Figure 3-17. Further assessment is required to confirm the specific package of mitigation measures that could consist of ITS, CCTV, VMS and changes in traffic management.

Within the CBD, a key objective of these measures is to address a reduction in vehicle speeds on Elizabeth Street by promoting College and Macquarie Streets as the priority traffic routes.

Figure 3-16: Possible Area management intervention measures[18]

Area Management	**Recast SCATS Management Strategy** To include but not limited to the following points: 1. Bent Street / Macquarie Street – Promote a shift of traffic exiting northern CBD from Castlereagh and Elizabeth Street to Macquarie Street by increasing right turn phase duration from Bent Street into Macquarie Street southbound. 2. Goulburn Street / Harbour Street– Facilitate capacity for demand increase during PM for the westbound Goulburn St CBD egress to Harbour St northbound by increasing right turn phase duration. 3. Bridge Street and Bent Street at Macquarie Street– Promote a shift of traffic exiting northern CBD from Castlereagh and Elizabeth Street to Macquarie Street by increasing right turn phase duration from Bridge Street into Macquarie Street southbound. During PM facilitate demand increase for Bridge St CBD entry by increasing eastern approach from Cahill Expressway phase duration. 4. Oxford Street / College Street– Facilitate capacity for demand increase during PM for the westbound Oxford Street right turn into College Street northbound by increasing right turn phase duration. 5. Wentworth Street / Goulburn Street– Facilitate capacity for demand increase during PM for the eastbound Goulburn Street CBD egress through Wentworth Street by increasing eastbound phase duration. 6. Hunter Street / Macquarie Street– Promote a shift of traffic exiting northern CBD from Castlereagh and Elizabeth Street to Macquarie Street by increasing Hunter Street eastbound approach phase duration. 7. Goulburn Street / George Street– Facilitate capacity for east-west demand increase during PM along Goulburn Street by increasing east-west phase duration from proposed light rail signal timing arrangements for the junction. 8. Kent Street – Facilitate with improved co-ordination north bound flow to Harbour Bridge 9. Wattle Street / Harris Street – facilitate traffic movements to and from Western Distributor to encourage alternate route to Broadway / George Street
	Strategic Supplementary Corridor Directional Sign Posting To position traffic in corridors that best serve the network during the peak periods with light rail, the following corridors are recommended to be sign posted as key CBD entry and exit corridors: 1. Eastern CBD Periphery – Macquarie Street / College Street / Wentworth Street – "To Northern CBD and Cahill Expressway" 2. Western CBD Periphery – Kent Street / Clarence Street – "To Barangaroo, Northern CBD and Harbour Bridge" 3. South-Western CBD Periphery – Wattle Street/ Fig Street / Harris Street – "To Harbour Bridge and Northern CBD" 4. Southern CBD Periphery – Cleveland Street

[18] Mesoscopic traffic modelling undertaken by TfNSW, 2013

As part of the on-going process of developing a network management plan, RMS has initially identified further measures for optimisation of the CBD:

AM Peak Measures

Promote the following as alternative priority routes:

- Wattle Street and Harris Street

PM Peak Measures

Promote the following as alternative priority routes:

- City North to Sydney Harbour Bridge:
  - Hunter Street and Macquarie Street
  - Bent Street and Macquarie Street
  - Bridge Street
- City to Anzac – Goulburn Street and Harbour Street
- City to East Suburbs - Oxford Street and College Street
- Convention Centre to Sydney Harbour Bridge - Kent Street
- City to Anzac – Wentworth Street and Goulburn Street

Figure 3-17: Physical intervention measures[19]

Intervention Level	Details
Physical Changes	**Kent Street Corridor** Due to increased reliance of Kent Street for northbound CBD departing traffic to the Sydney Harbour Bridge with the implementation of light rail on George Street, increased capacity is required on Kent Street to manage queue lengths such that they do not significantly impede on traffic operations in the northern CBD precinct. It is recommended that a three lane corridor and a two lane right turn facility for the northbound movement onto the SHB is implemented with light rail.
	Cleveland Street Comprehensive arterial management incorporating turn conflicts reduction, kerbside parking, etc
	Removal of CBD On-Street Parking Facilities To facilitate enhance CBD network capacity during the PM period with light rail in critical areas, the following on-street parking facilities are recommended to be removed: 1. Hunter Street – 2 eastbound lanes between Elizabeth Street and Phillip Street with removal of westbound on-street parking provision 2. Bridge Street – 3 eastbound lanes between Young Street and Phillip Street with removal of westbound on-street motorcycle parking provision 3. Kent Street– provision of a three lane corridor from Liverpool Street to Druitt Street with removal of eastern on-street parking provision 4. Goulburn Street – 3 eastbound lanes between Elizabeth Street and Foy Lane with removal of westbound on-street parking provision
	Intersection Lane Changes It is recommended that the following intersections introduce dual right turn lanes in order to cater for the shift in traffic patterns with light rail: 1. Liverpool Street / Kent Street – two right turn lanes from Liverpool Street westbound to Kent Street (one lane shared with through movement) 2. William Street / College Street – two exclusive right turn lanes from William Street westbound to College Street 3. Macquarie Street / Bent Street – two right turn lanes from Macquarie Street northbound to Eastern Distributor eastbound on-ramp (one lane shared with through movement) 4. Kent Street / SHB On-Ramp – two right turn lanes from Kent Street northbound to the SHB on-ramp (one lane shared with through movement) 5. King Street / Elizabeth Street – improve left turn capacity from King Street to Elizabeth Street northbound including reduction of pedestrian conflict.

[19] Mesoscopic traffic modelling undertaken by TfNSW, 2013

In addition to the above changes it is also proposed that the following measures be investigated further for possible implementation during construction of CSELR:

- **Investigation of staged construction works of the Anzac Parade and Alison Road corridors**. The modelling undertaken to date and resulting forecast travel time increases on Alison Road and Anzac Parade assume concurrent works on both corridors. Staggering these works would provide additional capacity during construction and reduce these increases to travel time. Opportunities to adopt this approach are currently being investigated by TfNSW.
- **Signposting and promotion of alternative corridors** in the south east. Promotion of these wider diversion routes would result in lower traffic volumes along the construction corridor and as a result improved travel speeds to those identified by the traffic modelling. The alternative corridors identified include:
  - Wentworth Avenue, Gardeners Road and Botany Road for traffic travelling to/from south eastern suburbs such as La Perouse, Little Bay, Malabar and Maroubra.
  - Avoca Street, Carrington Road, Arden Street, York Road, Syd Einfeld Drive and Oxford Street from eastern suburbs such as Coogee, Clovelly, Bronte and Bondi.
- **Promotion of routes bypassing the CBD** such as the Eastern Distributor, Cross City Tunnel and Cleveland Street as alternative.
- **Review of current and proposed bicycle corridors** in the CBD to ensure they are integrated with the newly defined traffic priority routes.
- **Subject to further investigation, tidal flow operation on Anzac Parade** during construction, to provide a bus priority lane in the peak direction and protect bus journey time reliability along the corridor.
- **Retention of a single lane in the peak direction along the entire length of the existing Anzac Parade busway** and complementary bus priority kerbside lane on Anzac Parade in the non-peak direction as well as bus priority measures on Alison Road. This would facilitate bus priority through these congested sections of the network, but may have an impact upon the construction program for this section.

3.9.5. Conclusions

The assessment of the Construction Scenario indicates some traffic management challenges to be resolved prior to construction of CSELR. In particular, the PM peak forecasts indicate that implementation of management measures will be critical to ensure priority bus corridors are protected against increased levels of congestion. In the south east corridor the importance of maintaining acceptable operations on Anzac Parade and Alison Road during construction is clearly demonstrated.

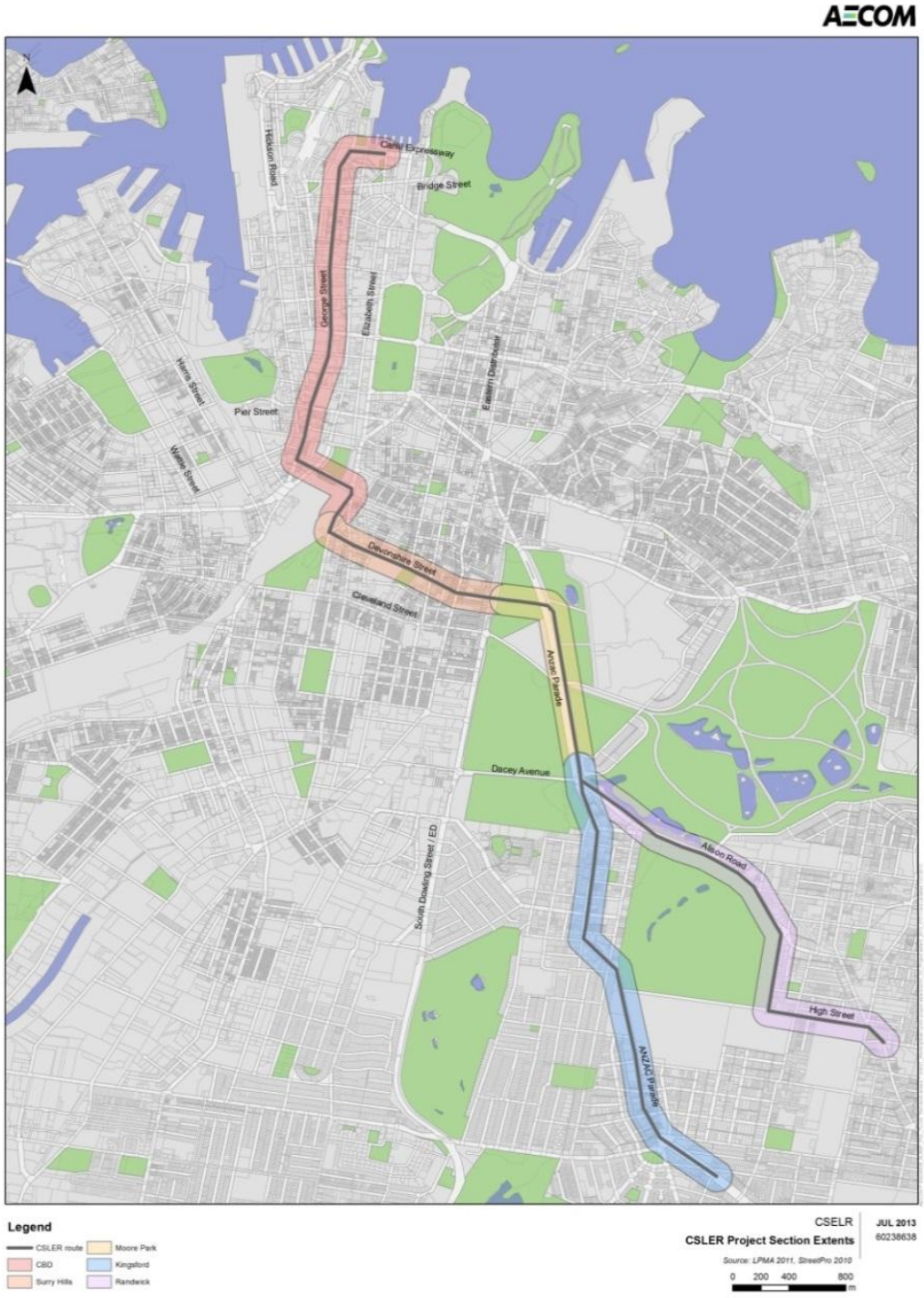
In conjunction with the Network Management Plan, the measures outlined in section 3.9.4 would serve to improve network and corridor performance over and above that described in the modelling analysis undertaken. Further refinement of these measures to target specific road network issues is being undertaken by TfNSW and RMS in consultation with other stakeholders.

4. Precinct Access and Construction Management

This section assesses the specific CSELR construction impacts and identifies construction management initiatives on a precinct by precinct basis. The assessment has been broken down into the following five precincts as shown in Figure 4-1:

- CBD – between Circular Quay and Central Station.
- Surry Hills – between Central Station and South Dowling Street.
- Moore Park – between South Dowling Street and Robertson Road.
- Kingsford – between Robertson Road and Nine Ways.
- Randwick – between Anzac Road / Alison Road intersection and High Cross Park.

Figure 4-1: CSELR precinct areas[20]



[20] AECOM, 2013

4.1. Key Objectives

A number of key objectives were established prior to development of the precinct access and construction management plans. These objectives are outlined below in Table 4-1 and discussed in detail in the following sections.

Table 4-1: Key Objectives for Construction Traffic and Transport Management

Key result area	Construction objective
Worksite operation	▪ Minimise local precinct impacts ▪ No worker injury accidents during construction ▪ No injury accidents to members of the public because of construction
Property access	▪ Minimise disruption to businesses, residents and uses local to construction sites ▪ Provide advance notice of upcoming works and traffic arrangements ▪ Maintain vehicle access to hospitals and emergency providers at all times ▪ Maintain pedestrian access to properties fronting George Street ▪ Develop alternate strategy for servicing, in consultation with property owners and businesses ▪ Consult public and private owners to agree options to maintain proposed operations during the works
Pedestrians and cyclists	▪ Minimise disruption to pedestrians and cyclists on footpaths and crossing at intersections ▪ Review existing traffic signal operation for pedestrian conflicts with traffic on access lanes ▪ Maintain pedestrian access to businesses during the works ▪ Maintain adequate conditions for security of footpaths at night / daytime, including lighting, surface free of trip hazards, overviewing (visibility to and from adjacent sites) of paths.
Traffic operations	▪ Provide advance notice of upcoming works and traffic arrangements ▪ Provide directional / detour signage to direct drivers around/ away from work areas ▪ Minimise the number of traffic changes to assist legibility for drivers ▪ Minimise conflict between bus routes and traffic detour routes ▪ Promote alternate travel times, modes and routes for drivers with CBD destinations or travelling across CBD
Communications	▪ Implement communications plan to notify changes to transport operations ▪ Provide advance notice of upcoming works and traffic arrangements ▪ Promote new bus routes and stops, preferred traffic routes and detours

4.1.1. Worksite operations

As detailed in Section 2.4, heavy vehicles generated during the construction phase would be consigned to key arterial roads. With concurrent activities at multiple construction sites, management of the heavy vehicle movements would be required to ensure that the construction vehicles do not congest the already constrained network, especially during peak hours. To reduce the impact, haulage vehicles would utilise the

construction corridor, where feasible, and the worksites would all have common haulage origins and destinations to the west, north and south so as to manage the truck movements and ensure they do not coincide at the same time.

Worksites are only to be accessed by defined access points to manage safety and road impacts.

Staff parking is not generally supported, and staff parking is not provided at worksites,with the exception of Moore Park and Randwick Racecourse. The following options are recommended to reduce the need for staff parking within, or around, worksites:

- Early utilisation of stabling yards as staff parking areas with transfers between the stabling yards and worksites;
- Long term lease of adjacent commercial parking spaces within the CBD; and
- Parking within Moore Park and Randwick Racecourse work sites with transfers to adjacent work sites.

4.1.2. Management of Property Access

Access to existing driveways and service points would be managed during the construction stage to ensure acceptable accessibility levels are maintained consistent with current works. The alignment of the light rail in some sections of the narrow road widths may hinder accessibility to adjacent properties. At such instances, the traffic management plan would consider:

- Managing access through worksite by traffic controllers where vehicle manoeuvring requirement dictates, i.e. truck turns into and out of property are restricted by barriers or the available traffic lane is on opposite side of the worksite.
- Short term restrictions to access, with prior notification of businesses.
- Provision of additional loading zones prior to commencement of construction on adjacent side streets in line with the CSELR Transport Operations Report.

Additional short term strategies would also be required when the active worksite is at the property frontage and when concrete pours etc. prevent service vehicles driving across the worksite. Short term strategies include:

- Agreeing with property owners / operators for scheduling of deliveries for early morning / late night or varying the size of vehicle. Other options include:
    - Identifying potential central consolidation / breakdown / warehousing centre for loading to reduce overall truck numbers through the construction sites and thus reduce impacts of delays for both the construction program and courier companies.
    - Providing temporary loading zones on side roads with the use of trolley / forklift transfer. However, this is not an option where ramped access and containerised garbage operations currently exist.
- Where no alternative locations are feasible and access is essential at all times, the construction methodology may require a bridge/ plate over the rail alignment to provide crossings.
- Prior consultation and agreement from property owners for any additional controls on access is required. Protocols will be developed for managing representations and in relation to any temporary controls.

4.1.3. Traffic signal operation

Changes to traffic signal operations may be required where construction activities have a significant impact on traffic movements. All operational changes for traffic signals would be provided by the contractor as part of ROL applications and subject to approval by TMC and relevant road authorities.

4.1.4. Communications and public liaison

A key element in successfully implementing the required changes to precinct operations is to manage the public's expectations and limit disruption. This can be achieved through provision of information to all road users affected by the construction activity. It is important that all parties are aware of restrictions and provisions during the whole construction period.

Information packs would be prepared that covers the proposals for the following activities:

- Pedestrian access to premises;
- Waste collection;
- Deliveries;
- Emergency vehicle access;
- Emergency pedestrian evacuation routes;
- Disability access;
- Event management; and
- Noise management.

The elements of access that would be covered in these information packs would include:

- Pedestrian routes and restrictions;
- Cycle diversions;
- Vehicular routes;
- Times restrictions of access if applicable;
- Vehicle size restrictions; and
- Speed restrictions.

All affected residents, surrounding businesses and road users will be notified in advance of the above issues and any disruptions to traffic. The methods of notification will be by various means such as:

- Driver warning signs;
- Variable message signs;
- Project information web-site;
- Newspaper leaflets; and
- Public notices in local publications.

The project newsletter will notify the local community of updates on the project and the current stage of the construction to inform on what changes, if any, are expected within the transport network. In addition, extensive liaison with UNSW, Randwick hospitals, Randwick Racecourse and Centennial Parklands Moore Park Trust would be undertaken given the significant trips generated by these developments.

4.2. CBD Precinct

Key construction traffic issues in the CBD precinct are:

- Managing the impacts of construction on George Street, Chalmers Street and Alfred Street, which are busy CBD roads carrying high volumes of cars and pedestrians. There is also a need to manage buses at;
  - The intersection of Pitt Street, Eddy Avenue and Rawson Place
  - East-west routes that cross George Street primarily on Druitt Street
  - Chalmers Street
- Maintaining property access to CBD retail, residential and office buildings.
- Maintaining safety for all road users in and around the corridor.
- Providing emergency vehicle access in constrained locations in the George Street corridor.

TfNSW has identified the following construction phases in the CBD precinct:

- Enabling works, associated with relocation or protection of utilities and site preparation.
- Civil works comprising site establishment, excavation for the track slab and laying of slabs and track.
- Installation of overhead wiring or alternate power supply in key sections; and
- Platforms, systems and fit-out.

This CTTMS has sought to minimise the number of traffic and transport changes during construction to improve the customer experience and reduce uncertainty.

4.2.1. Construction Worksites and Access

Two construction worksites are proposed within the CBD:

- Within First Fleet Park, adjacent to Circular Quay; and
- Within Belmore Park, adjacent to Central Station.

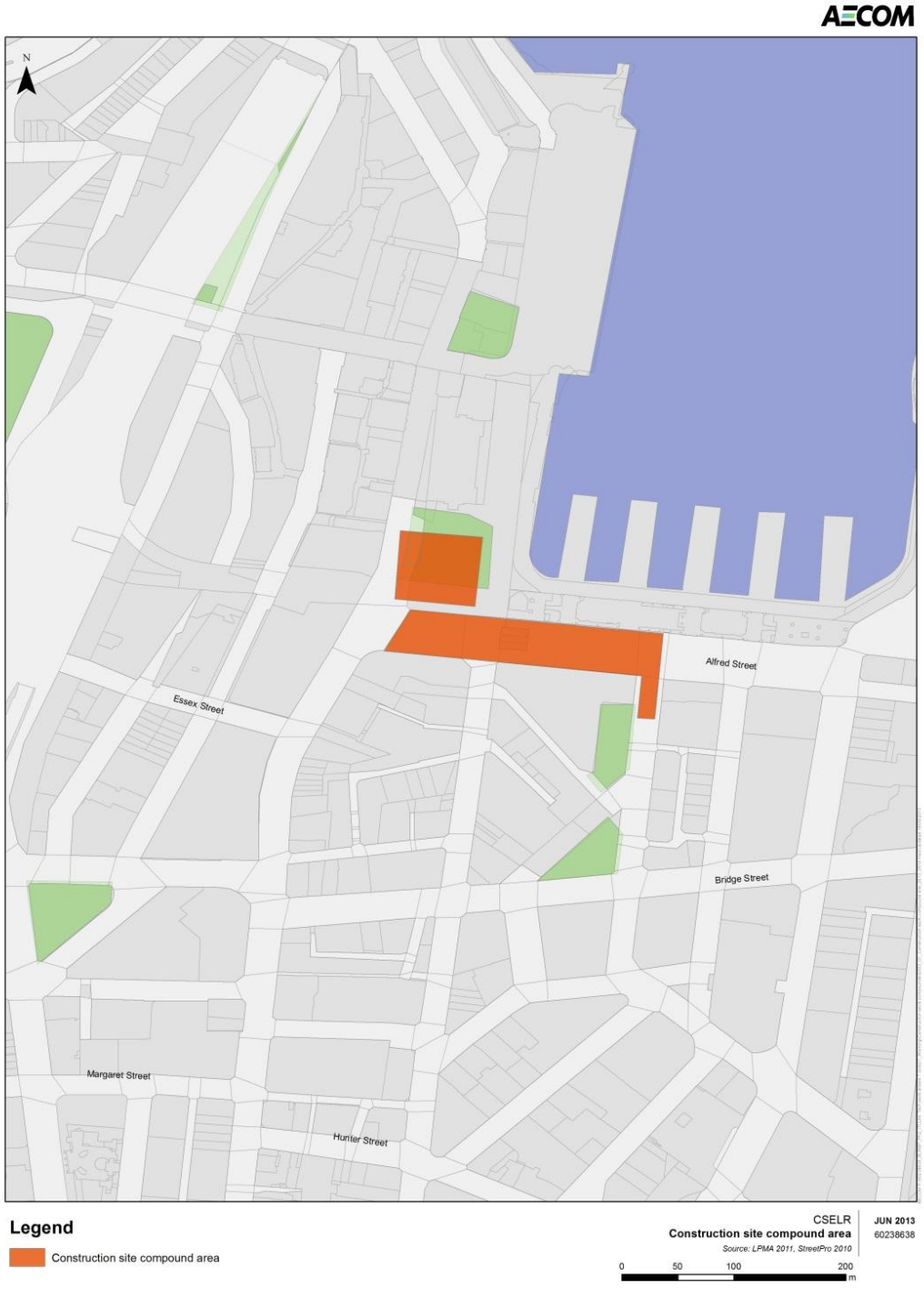
First Fleet Park Worksite

A northern worksite, of approximately 2,400 square metres, is proposed in First Fleet Park. An indicative location is shown in Figure 4-2. Vehicle access to the worksite would be:

- Harbour Bridge – via the Cahill Expressway, Bridge Street and Loftus/Pitt Streets.
- Anzac Bridge – The Rocks via Hickson Road
  - Construction vehicle parking is suggested along Alfred Street frontage continuing onto Loftus Street. This area would allow parking of construction vehicles for both the northern and southern CBD worksites.

No on-site parking is proposed for the construction workforce, who would be expected to utilise existing public transport. A potential option would be to provide remote parking on the stabling yard and shuttle transfer workers to site, which would depend on demand for this facility and the shift hours. Another option would be for the Contractor to establish long term leases, during the construction phase, of commercial parking spaces within the CBD.

Figure 4-2: Indicative Northern CBD Worksite – First Fleet Park

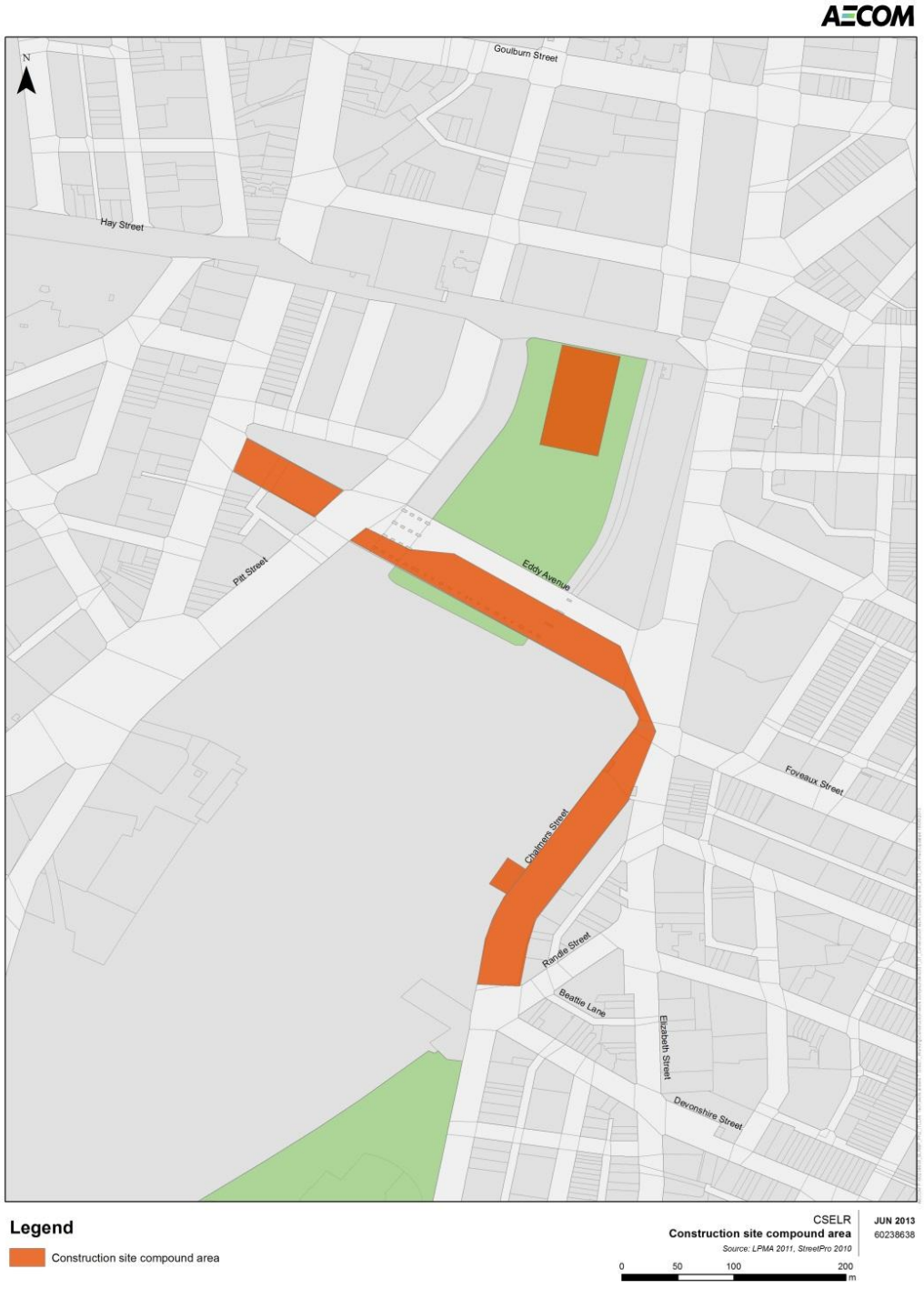


Belmore Park Worksite

A southern worksite, of approximately 3,200 square metres, is proposed in Belmore Park. An indicative location is shown in Figure 4-3.

The proposed worksite and access arrangements will be coordinated with the City of Sydney. Council's current proposals for upgrading the park may be impacted by the worksite and remediation of the worksite required on completion of the CSELR works.

Figure 4-3: Indicative Southern CBD Worksite – Belmore Park



Modifications would be made at the intersection of Pitt Street and Hay Street to allow heavy vehicles to access the worksite.

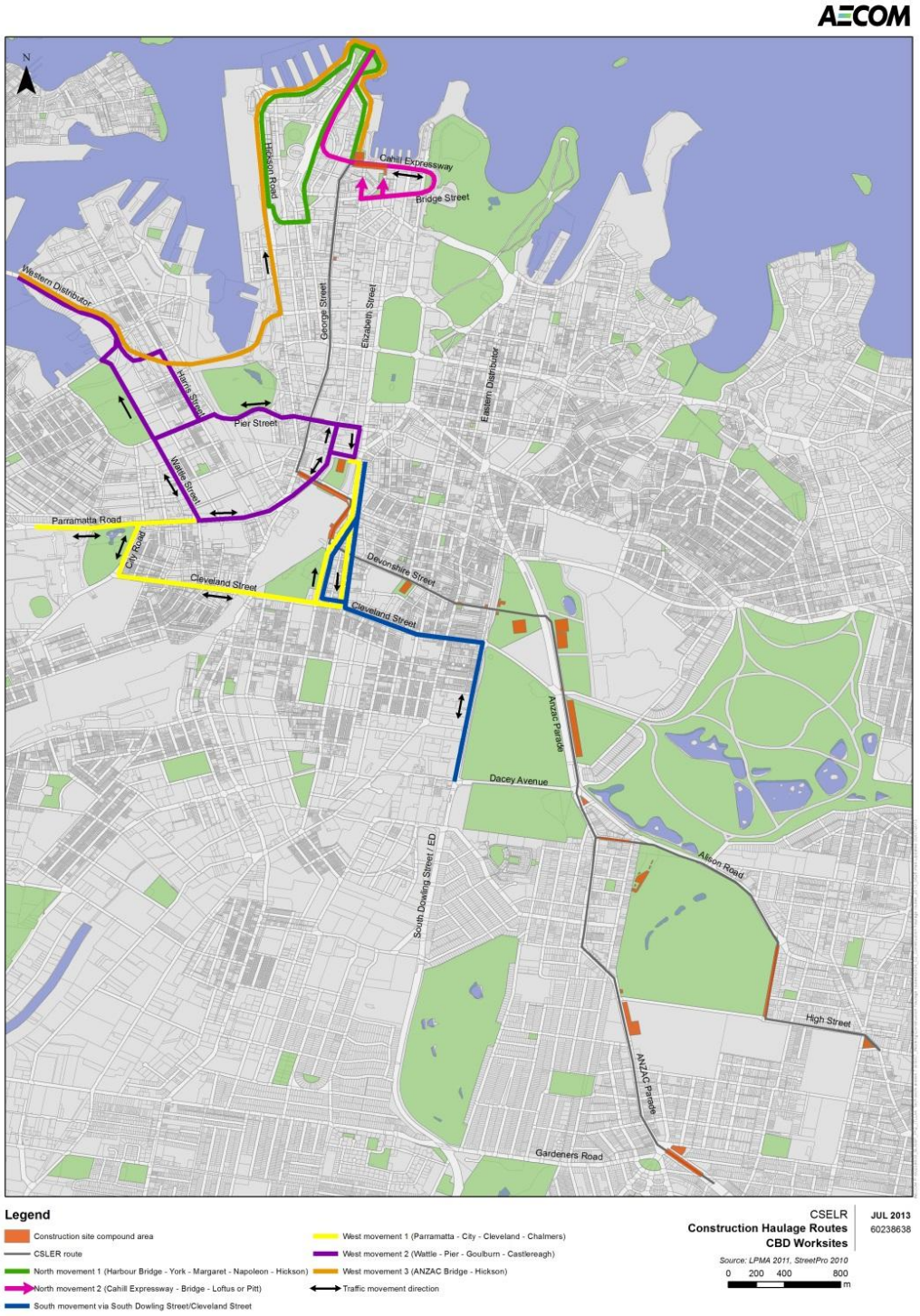
Vehicle access to the worksite would be:

- Harbour Bridge – no access is provided to this worksite from the north
- Anzac Bridge – via Pier and Harris Street or Broadway and Wattle Street
- Parramatta Road – via Elizabeth Street and Cleveland Street or Pitt Street and Broadway,

No on-site parking is proposed for the construction workforce, who would be expected to utilise existing public transport. An alternative arrangement would be to provide remote parking at the stabling yard and shuttle transfer workers to site, which would depend on demand for this facility and the shift hours.

The proposed haulage routes for the CBD worksites are shown in Figure 4-4. Where the current worksite activity permits, trucks from First Fleet Park or Belmore Park would travel through the George Street workzones.

Figure 4-4: CBD Construction Haulage Routes



These haulage routes have been chosen due to their suitability for carrying heavy vehicles and direct access routes out of the CBD. Once trucks are dispersed onto on these major roads, the effects would be low (less than 250 trucks per day); less than 0.4% of existing daily traffic volumes on Parramatta Road and Anzac Bridge.

4.2.1.1. Other potential construction sites within the CBD

Six potential building construction projects have been identified adjacent to, or near, the CSELR project as shown in Figure 4-5. The Network Coordination Liaison Group would be consulted prior to approving any construction activities within the CBD. The traffic management plan for any construction within the CBD would include a cumulative assessment of traffic changes.

Other known projects include the upgrade of Wynyard, Town Hall and Central Stations, surface transport projects associated with the CCAS and the redevelopment of Barangaroo. The construction impacts of these projects would be considered by TfNSW in the planning processes for those projects.

Figure 4-5: Location of Current and Planned Redevelopment Sites

4.2.2. Rozelle Maintenance Facility

All vehicles associated with the CSELR and Inner West Light Rail (IWLR) will be maintained at the new integrated maintenance facility located at Rozelle Goods Yard in Lilyfield.

The existing IWRL maintenance and stabling facility at Pyrmont will be retained with IWLR vehicles stabled at both the existing Pyrmont facility and Rozelle. The CSELR

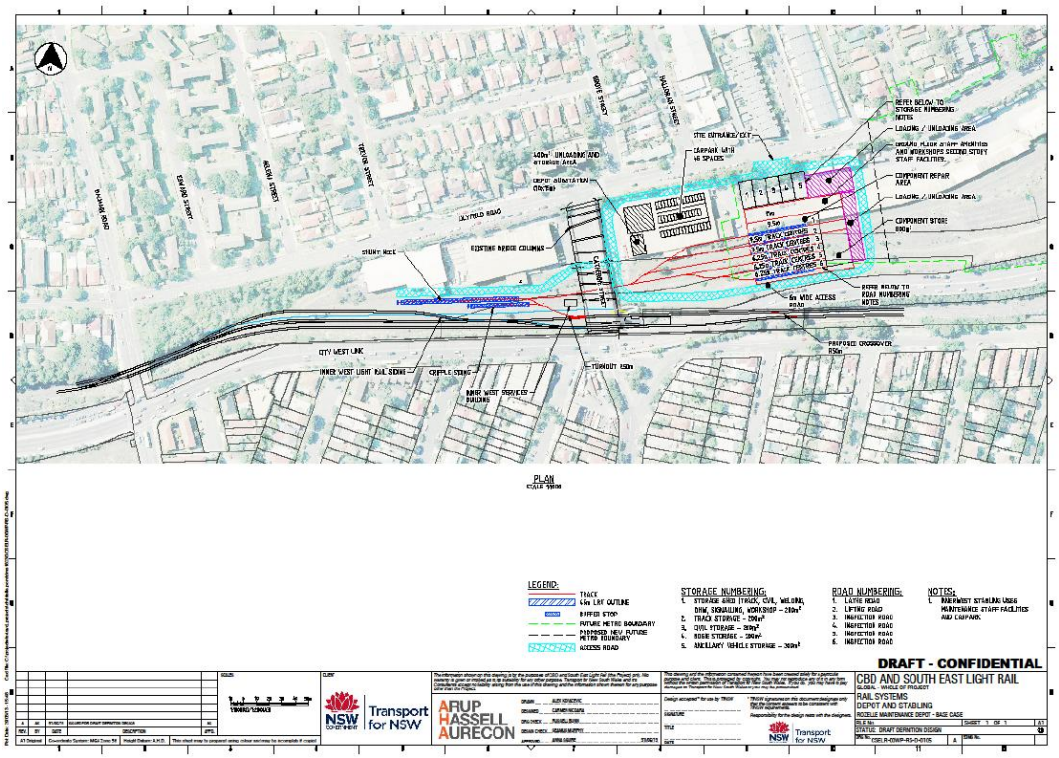
vehicles will be stabled at a site adjacent to Royal Randwick Racecourse which will also be where the integrated Operations Control Centre (OCC) will be located. The CSELR vehicles will infrequently transfer to Rozelle via the IWLR system.

The construction worksite associated with the Rozelle Maintenance Facility will be limited to internal activities within the former goods yard at Rozelle. In developing the Rozelle Maintenance Facility, the following potential construction activities will be required:

- Vehicle crossing between the site and Lilyfield Road;
- Demolition of existing buildings;
- Paving and track work;
- Equipment installation; and
- Fit outs.

The Rozelle Maintenance Facility is illustrated in Figure 4-6

Figure 4-6: Maintenance Facility at Rozelle (Preferred Option) [21]



The site is located within the Rozelle Goods Yard with access proposed on the southern side of Lilyfield Road, to the east of Catherine Street. Access to the Rozelle Maintenance Facility would be via the existing vehicle access point on Lilyfield Road, which is designed to accommodate heavy vehicles turning to and from Lilyfield Road.

The existing maintenance workshops and facilities on the site would need to be demolished to accommodate the new depot / stabling yard. However, as the yard is located in an existing rail corridor, potential land contamination may require the site to be

[21] CBD and South East Light Rail, Operations Advisor, Final Fleet, Stabling Requirements and Operating Protocols (Draft, 31 July 2013) Figure 10.2.4

capped in preference to disturbing material and transporting from site. Therefore, consequences of raising levels on drainage would need to be assessed.

The construction activities associated with the maintenance facility include:

- **Site remediation**/Clearing and grubbing typically undertaken through the utilisation of standard earthmoving equipment.
  Any material hauled offsite to a suitable disposal location may need to be treated as contaminated waste.
- **Building demolition**: An area is set aside on the site in order to test, sort and stockpile material to minimise offsite disposal costs.
- **Detailed excavation** and other preparatory activities.
- **Form, reinforce, concrete pour works**: formworking and steel fixing crews.
- **Mechanical and electrical activities**: these will be undertaken through the utilisation of small crews.
- **Specialised packages** e.g. Locowash.

4.2.2.1. Rozelle Maintenance Facility Truck Movements

Traffic movements during construction are anticipated to be low due to the minor works required to adapt the existing site. While a detailed breakdown of truck movements by activity has not been undertaken at this stage, it is anticipated that at peak times, truck movements would not exceed 100 truck trips (two way movements) per day.

Existing industrial premises and the existing site uses generate truck movements on Lilyfield Road, suggesting that the proposed site would be compatible with current uses. Once established, traffic movements would be limited to the movement of staff vehicles, deliveries and staff undertaking inspections of the rail alignment. Movement of the light rail vehicles would occur infrequently via the existing IWLR tracks.

The existing driveway access to Lilyfield Road is designed for and historically accessed by heavy vehicle movements and capable of accommodating the future traffic demands proposed by the Rozelle Maintenance Facility. Therefore, the existing traffic facilities on Lilyfield Road, such as bicycle lanes and footpaths are unlikely to be affected during both construction and operation of the proposed maintenance facility.

4.2.2.2. Rozelle Maintenance Facility Haulage Routes

Lilyfield Road provides direct access to City West Link via Catherine Street and Balmain Road. Therefore the majority of heavy vehicles generated by construction of the maintenance facility would utilise City West Link. Staff may have more dispersed origins / destinations and travel on local roads, via Balmain Road / Catherine Street / Darling Street / Victoria Road to access local suburbs, such as Leichhardt and Balmain. The proposed haulage route for the Rozelle Maintenance Facility worksite is shown in Figure 4-7.

Figure 4-7: Haulage Routes for Rozelle

4.2.3. Traffic Management

The variability of cross section and access requirements on George Street, and the completion of intersection works on weekends, requires varying traffic management by street block and intersection. As such the principles of the CBD traffic management and construction strategy are:

- Implement end state transport arrangements, where appropriate, and compatible with construction requirements, e.g.
  - Diversion of bus services, moving towards the end state bus arrangements identified in SCCBP with the exception of services from the south east which would continue to operate.
  - Closure of minor side road junctions and laneways proposed for closure at end state.
  - Enhancements to east-west capacity of cross streets, where possible and required to mitigate long term changes to traffic patterns.
- Minimise traffic disruption by undertaking intersection works at weekends.
- Provide clearly defined pedestrian paths and fencing to separate the pedestrian path from the worksite and prevent random crossings.
- Review traffic signal operation for turning movement conflicts with pedestrians crossing at intersections and vehicles on access lanes and accessing worksites.
- Minimise the number of traffic changes to maximise the legibility of the network for the public, businesses and emergency services to simplify network operations.

  Maintain access past the worksites on George Street for local access and emergency services. These access corridors may be via open access lanes outside the worksite boundary or via controlled access lanes through the worksite.
  - The open access lanes may be used by construction vehicles, where the current activity prevents vehicles driving through the worksite. Pull–off areas, between gaps in barriers would be provided to allow construction vehicles to stand clear of the open access lanes. In sections of the corridor where this is not feasible and delivery requirements dictate vehicles to stand for an extended time, e.g. while unloading track sections, these deliveries would be made outside business hours. Generally open access lanes are only achievable in the southern CBD due to the wider road cross section.
  - The controlled access lanes through the worksite would be managed by traffic controllers. The location of the lanes would be shifted within the roadway to suit the current work zone. Generally controlled access lanes are proposed in the northern CBD between Alfred Street and Bathurst Street.
  - Through traffic in the CBD would be discouraged by public education, signs, traffic controllers and enforcement.

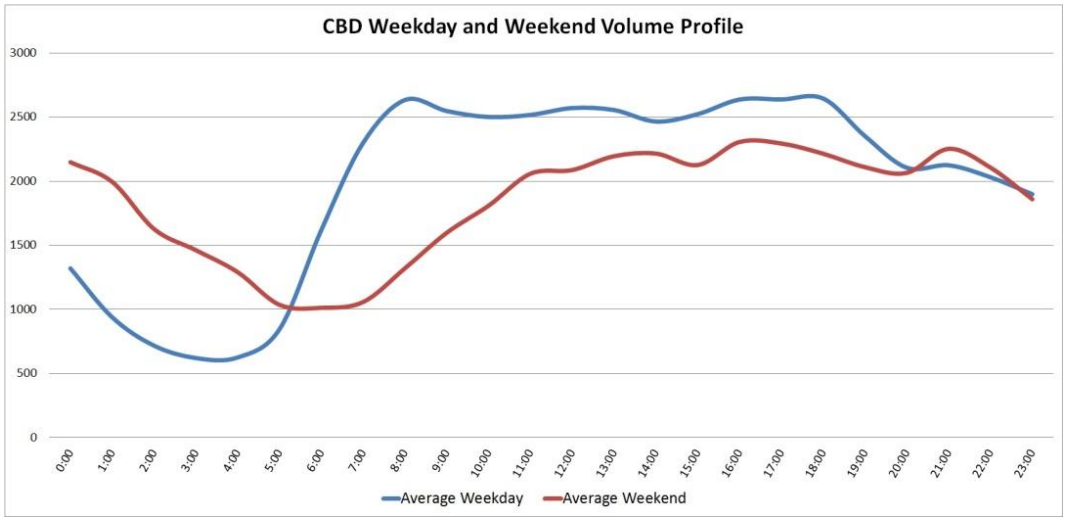
- Maintain property access based on a hierarchy of frequency of use and subject to agreement with property owners and business operators:
  - Infrequent access would be managed by traffic controllers on an ad hoc basis and/or scheduled deliveries outside work hours.
  - An access lane would be maintained for properties with frequent deliveries, such as the Westfield loading dock and car park access requirements such as 420 George Street.
  - Where feasible an open access lane would be retained for 24 hour property access. Where this is not feasible, traffic controllers would manage property access via controlled access lanes, 24 hours per day, or as otherwise required to meet the needs of frontage properties.
- Major intersections would be staged to maintain key traffic movements, e.g. Grosvenor Street / Bridge Street and Pitt Street / Eddy Avenue.
  - Other intersections would be closed at weekends and traffic diverted to alternate routes. The closure of these intersections would be conditional on the alternate route remaining open, e.g. Hunter Street westbound is open when Bridge Street westbound closed.
- Schedule disruptive major works to target times of lower traffic movement, e.g. Christmas New Year/ January; consistent with managing pedestrian movements, which may be higher at holidays times, e.g. in The Rocks/ Circular Quay, Chinatown areas.

4.2.3.1. Intersection works

All intersection works within the CBD would be undertaken during the weekend to minimise impacts on traffic movements. It is acknowledged that events often occur in the CBD during the weekend and as such any weekend work would require careful planning and close liaison with the City of Sydney. However, during major scheduled events such as City to Surf, Anzac Day and Sydney Running Festival, weekend works would not be permitted. Furthermore, there may be opportunities to undertake minor construction activities during weeknights.

An assessment of traffic volumes in the CBD has shown that peak weekend traffic volumes are approximately 88% of peak weekday traffic movements, this information is shown in Figure 4-8. Weekends provide the best opportunity for extended work shifts to complete the intersection works in an efficient manner.

Figure 4-8: CBD weekday & weekend traffic profiles (veh/hr)



Note: This data shows average George Street intersection traffic volumes at King Street; Market Street; Druitt Street; Liverpool Street; and Goulburn Street.

Source: NSW Roads and Maritime Services, 2013

Major intersection works would be staged to maintain key traffic movements at:

- Grosvenor Street at Bridge Street - Grosvenor Street eastbound movement would be maintained at all times (see Appendix B.1).
- Pitt Street at Eddy Avenue / Rawson Place would maintain through movements on Pitt Street. Completion of these intersection works is a prerequisite to enable diversion of bus routes from George Street to Pitt Street (see Appendix B.2).

Other intersections would be closed during weekends, during time periods specified in Section 2.5, and traffic diverted to alternate routes. Table 4-2 summarises the individual intersections and any conditions or works associated with the closure.

Table 4-2: Summary of Proposed Conditions for Intersection Closures

Intersection of George Street at	Condition of closure	Required works/issues to be resolved
Chalmers Street at Randle Street	Randle Street Open	▪ Reconstruct Chalmers Street/ Randle Street intersection for through movement to Randle Street, reversing existing southbound movement. ▪ Introduce contra flow (northbound) lanes on Elizabeth Street between Randle and Eddy Avenue. ▪ Modify geometry and traffic signal operation for northbound movement on Elizabeth Street at Eddy Avenue intersection. ▪ Review the geometry of the Randle Street to Elizabeth Street intersection to accommodate large vehicles turning left from Randle Street to Elizabeth Street northbound. ▪ Consultation with Council regarding access to Beattie Lane.
Pitt Street at Eddy Avenue	Pitt Street intersection works complete prior to bus diversion off George Street to Pitt Street.	▪ Introduce traffic and pedestrian management of bus routes/ stops and signal modification to permit George Street bus services to be transferred to Pitt Street, as per the SCCBP.
Rawson Place	Maintain eastbound and westbound through traffic on Eddy Avenue	▪ Maintain access to Sydney Central YHA & servicing on Rawson Lane. This would require some reversing of trucks, however initial discussions indicate this would be acceptable. ▪ Buses during construction would use stops located on Pitt Street, north and south of Eddy Avenue. ▪ Existing bus stops on Eddy Avenue remain operational.
Ultimo Road		▪ Maintain pedestrian crossing of George Street and stage crossing location, where necessary to suit current work zone. ▪ Maintain pedestrian access to existing signal pushbuttons or provide traffic controllers for short term works.

Intersection of George Street at	Condition of closure	Required works/issues to be resolved
Hay Street	Maintain light rail on weekdays. Temporary closure of LRT on weekends	▪ Maintain pedestrian crossings during the intersection works. ▪ Provide signage, traffic controllers and shuttle bus transfers for IWLR passengers ,where installation of turnouts, and commissioning of signalling at the junction, requires weekend closure of the existing IWLR and access to Central Station. ▪ Short running of the LRT during weekend closures would require shuttle bus transfers to connect to Central Station. Buses may be permitted to use Hay Street between Pitt Street and George Street and turn left onto George Street during this time, to permit LRT passenger transfer.
Goulburn Street	Liverpool Street open Bathurst Street open	▪ Provide advance warning and directional signage to redirect Goulburn Street traffic, e.g. Harris Street/Pier Street to Harbour Street to Bathurst Street (eastbound) or westbound on Liverpool Street or Park Street traffic to exit south (or north) on Harris Street. ▪ Maintain car park access to Goulburn Street frontage and two way traffic east of George Street. ▪ Monitor and where necessary control pedestrian movement at George Street intersection. ▪ Maintain bus access (EB) to Park Street.
Liverpool Street	Park Street-Druitt Street open	▪ Maintain Goulburn Street and Park Street open WB depending on required traffic capacity and split between CBD. ▪ Sign posting and advance warning
Central Street & Wilmot Street	Remain open-Access via Pitt Street	▪ Provide southbound service lane on George Street, between Wilmot and Central Street
Bathurst Street	King Street open	▪ Provide advance warning and directional signage of detour

Intersection of George Street at	Condition of closure	Required works/issues to be resolved
Park Street/ Druitt Street	Bathurst Street open. Market Street open	▪ Alternate CBD crossing could be achieved by promoting the CCT tollway. ▪ Divert CBD bus services eastbound to Bathurst Street. Consider staged intersection works to permit buses to turn right from George Street to maintain access to Park Street bus stops. Alternatively provide temporary bus stop on Bathurst Street, east of George Street. ▪ Divert general westbound traffic to Market Street. Maintain Liverpool Street as a secondary route, if additional capacity required. ▪ Stage intersection works to maintain single lane westbound bus only movement through intersection
Market Street	Druitt Street open Liverpool Street open	▪ Divert CBD bus services eastbound to King Street, southbound on York Street and QVB terminus. ▪ Manage pedestrian crossings near Town Hall Station. Entertainment precinct to the south would contribute to extended hours of pedestrian activity for weekend works. ▪ Maintain Goulburn Street as a secondary route to Liverpool Street, subject to required capacity.
King Street	Bathurst Street open	▪ Maintain Bathurst Street eastbound ▪ Promote Grosvenor Street eastbound (in lieu of King Street) for Sydney Harbour Bridge traffic. ▪ Provide advance warning and directional signage to redirect diverted traffic
Hunter Street	Bridge Street open	▪ Maintain Bridge Street westbound. Provide advance warning and directional signage to redirect diverted traffic.
Margaret Street	Bridge Street WB open Jamison Street open, with single NB lane on George Street maintained	▪ Maintain Bridge Street to the north or Market Street as secondary route, if additional capacity required. ▪ Implement staged intersection works (four stages) as required for Hunter Street to Margaret Street section of George Street. ▪ Maintain access to Jamison Street during Margaret Street closure, where sequence of intersection works permits.

Intersection of George Street at	Condition of closure	Required works/issues to be resolved
Bond Street	Closed- two way access to Pitt Street	▪ Directional and intersection signage.
Jamison Street	Entry from controlled access lane	▪ Directional and intersection signage. ▪ Two way movement on Jamison Street and traffic signal modifications at York Street
Bridge Street	Hunter Street WB is open, if Bridge Street WB closed Margaret Street open	▪ Maintain Hunter Street to Margaret Street westbound connection as alternate route with George Street open between Hunter and Margaret Street
Dalley Street	Closed. Two way access to Pitt Street	▪ Provide two way movements on Pitt Street.
Grosvenor Street	Grosvenor Street EB open	▪ Stage intersection works to maintain two lanes on Grosvenor Street eastbound at all times.
Essex Street	Access via Harrington Street at Grosvenor Street maintained	▪ Modify kerb extension at Essex Street / George Street corner to facilitate left turn from Essex Street to open access lane.
Blue Anchor Lane	Access via Essex Street and northbound open access lane	▪ Access to and from the northbound open access lane on the western side of George Street. ▪ Managed access across worksite required.

Intersection of George Street at	Condition of closure	Required works/issues to be resolved
Alfred Street / Circular Quay Station	Pedestrian access maintained	▪ Direct pedestrians on Alfred Street to the southern edge. ▪ Contain southbound pedestrians from The Rocks George Street North to the western footpath of George Street or via the foreshore to Circular Quay. ▪ Convert Pitt Street north of Bridge Street to two way traffic. ▪ Provide approach from Bridge Street at Loftus Street and right turn northbound, to Reiby Place as through site link to Pitt Street. ▪ Provide U-turn facility on Pitt Street, south of Alfred Street ▪ Maintain pedestrian access around foreshore between Circular Quay and Overseas Passenger Terminal and The Rocks beyond.
George Street North	Northbound lane on George Street, north of Essex Street U-turn facilities	▪ Provide roundabout at George Street/Alfred Street for U-turn for trucks up to 8.8m length. ▪ Provide work site driveway on George Street North. Accommodate 3-point turn for larger trucks (>8.8m) at site driveway on George Street. ▪ Maintain access to Four Seasons Hotel port cochere from northbound open access lane on George Street ▪ All exit via Alfred Street roundabout to George Street north/ Hickson Road. ▪ Alternate rear access on Harrington Street to hotel is feasible, but less attractive.

4.2.3.2. Detour Routes during intersection closures

The proposed detour routes for intersection closures are shown in Appendix D.

4.2.4. Property Access

Existing properties with access to car parking or loading docks adjacent to the light rail corridor are shown in Figure 4-9.

Figure 4-9: Location of Existing Driveways on George Street

Loading dock and servicing access for existing premises would be maintained. Consultation with property owners would be undertaken to fully understand servicing requirements, but measures would need to include:

- Provision of an access lane and sufficient manoeuvring space for required vehicle turning movements into driveways. This would be dictated by the alignment of travel lane through worksite, current worksite activity and vehicle types requiring service access.
- Scheduling deliveries outside work hours, when active worksite is across driveway would be considered, where feasible; and
- Managing access through worksite by traffic controllers.

To maintain this access, open access lanes or controlled access lanes have been provided on George Street. When determining required lane widths, consideration would need to be given to the potentially constrained environment due to barriers or pedestrian fencing on both sides and the geometry required for vehicles to access each driveway. As a minimum these lanes are to be in accordance with RMS Traffic Control at *Work Sites Manual Version 4.0.*

4.2.5. CBD Construction Zone 1: Alfred Street

The construction strategy proposes to close Alfred Street to traffic between Loftus Street and George Street to allow the First Fleet Park worksite to be connected to the CSELR alignment. This is consistent with the end-state design.

4.2.5.1. Driveway Access

There are no properties with driveways on Alfred Street.

Goldfields House with frontage to the southern side of Alfred Street has a construction access driveway on George Street, the driveway will not be required once refurbishment of the building is completed, which is anticipated prior to the start of CSELR works.

Businesses on the northern side of Alfred Street would be serviced from either Pitt Street or Alfred Street to the east of Loftus Street.

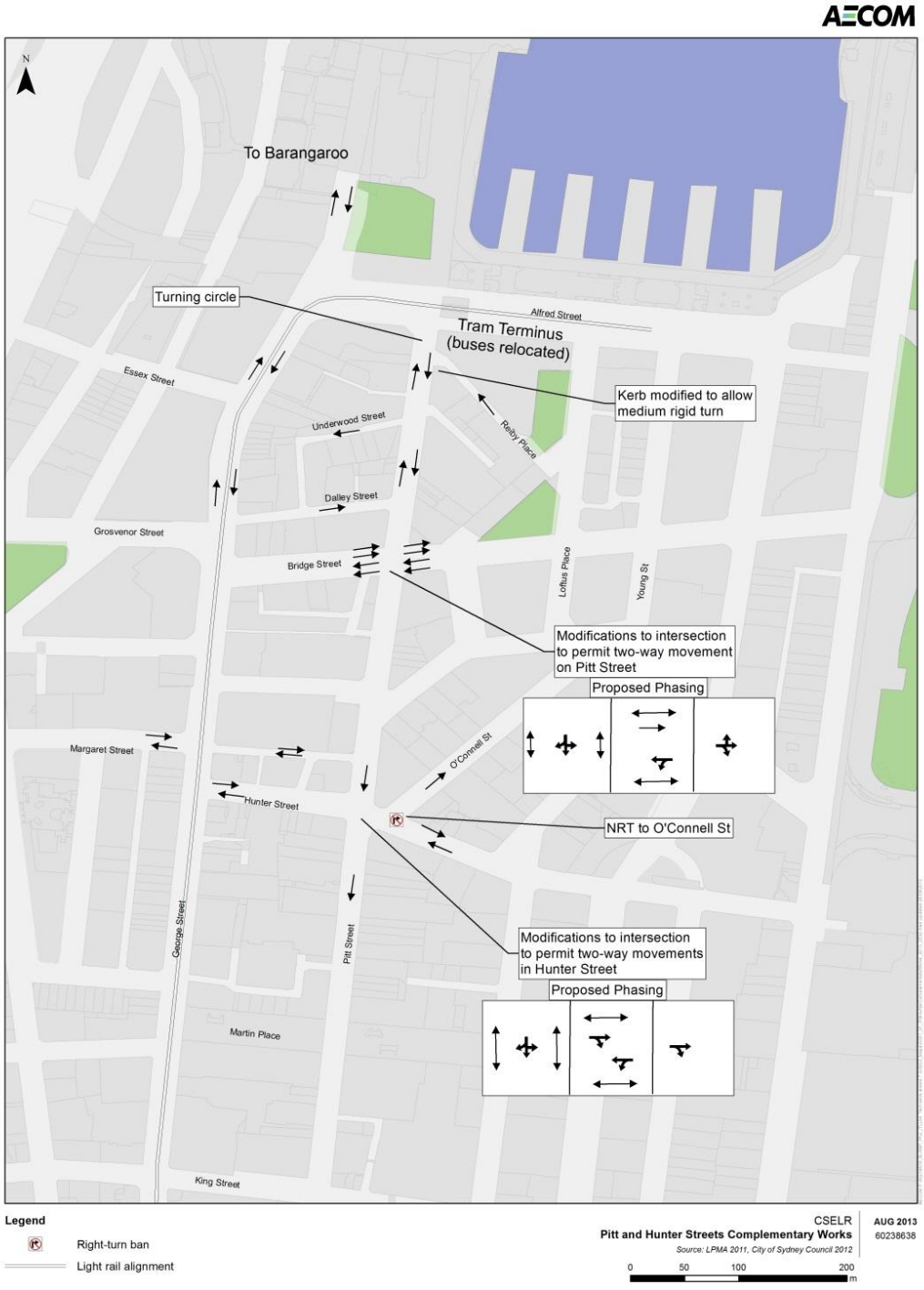
4.2.5.2. Local road network changes

The proposed changes are shown in Appendix C (sheet 1).

Pitt Street would be converted to two way traffic north of Bridge Street to allow for local property access. Access from the east would be via Loftus Street and Reiby Place. The proposed changes to traffic conditions on Pitt Street are shown in Figure 4-10.

Northbound vehicles on Pitt Street would be able to turn around prior to the worksite and exit southbound. The proposed turning head has a diameter of 40m, as shown in Appendix C, which will accommodate up to medium size trucks. For larger vehicles a three point turn would be required. The turning head is located within Herald Square, which will impact the pedestrian footpath, but will not require property acquisition.

Figure 4-10: Proposed Traffic Management for Pitt Street



George Street provides a connection for CBD traffic into The Rocks. During construction, alternate routes would include:

i. Sussex Street - Hickson Road (in both directions).This route would also service the Overseas Passenger Terminal via the upper level concourse or access controlled road opposite Argyle Street;

ii. Kent Street to Argyle Street or Lower Fort Street (inbound) to Cumberland Street or Harrington Street; and

iii. Cumberland Street or Harrington Street (outbound) to Grosvenor Street / Bridge Street or Jamison Street.

A precinct access map for The Rocks is provided in Appendix A.1.

George Street will be closed to southbound traffic at Albert Street. A temporary roundabout is proposed at the George Street / Alfred Street intersection to allow U-turn movements for these these vehicles. The geometry of the roundabout would limit vehicle size to a small / medium truck up to 8.8m long. Larger trucks would need to make a three point turn using the driveway access to the First Fleet Park worksite under traffic control.

With these measures in place, access to The Rocks would be retained at all times. Hickson Road, as the main access route, would experience an increase in congestion, which would likely occur at the traffic signals under the harbour bridge which control a section of one-way traffic movement. A review of current peak hour traffic, exiting The Rocks southbound, at Alfred Street shows about 400 peak hour vehicles. If it is assumed all of this traffic travels north along Hickson Road to exit The Rocks, a total of approximately 600 vehicles per hour can be expected on Hickson Road. Based on the available green time at the signals sufficient capacity can be maintained. In addition, the travel demand management measures put in place during construction would further reduce demand from existing levels. Initial network modelling has shown that traffic speeds along Hickson Road, during construction, would remain at similar levels to existing conditions, thus suggesting that sufficient capacity would be maintained along Hickson Road.

4.2.6. CBD Construction Zone 2: George Street between Alfred Street and Jamison Street

4.2.6.1. Driveway Access

The majority of properties in this section are serviced via laneways.

The Four Seasons Hotel has a port cochere on the western side of George Street. The hotel also has a back of house arrivals area on Harrington Street for tourist coaches.

Two options exist for providing access to the hotel:

- Providing a northbound lane within George Street;
- Temporarily relocating port cochere activities to Harrington Street.

This CTTMS has assumed providing a northbound lane in George Street would have least impact on the hotel operations and has therefore been assumed as the preferred option. All vehicles exiting the hotel would be required to travel north via George Street through The Rocks.

The northbound lane would be established between Essex Street and Alfred Street by removing kerb indents and an existing taxi bay. Access into the open access lane would be via Essex Street. Depending on the stage of work, it will be feasible to retain some

taxi parking adjacent to the access lane. When work on the track slab is occurring at the site frontage, an alternate taxi parking area could be made available on Harington Street

Two sites are being redeveloped in this section of George Street. Goldfields House at the southern corner with Alfred Street and the Mirvac redevelopment at 190 George Street.

Goldfields House

Goldfields House is located at the corner of Alfred Street / Herald Square and George Street. This building is being refurbished and has temporary access to George Street, as shown in Figure 4-11. The site has access to Pitt Street for car parking and loading, and no proposed access to George Street in the approved development application.

Figure 4-11: Temporary George Street Driveway at Goldfields House

190 George Street

190 George Street (opposite Essex Street) is being redeveloped with hoardings erected on the George Street frontage. There is currently no driveway to George Street, although a potential construction access is available via Crane Place, a small narrow laneway adjacent to the site, but with no driveway crossover to George Street. A construction zone on George Street has been approved until 2015; requirements for worksite access would be confirmed in discussions with building owners.

Access to and from Essex Street would be feasible, given the site location opposite Essex Street, with a crossing through the worksite maintained.

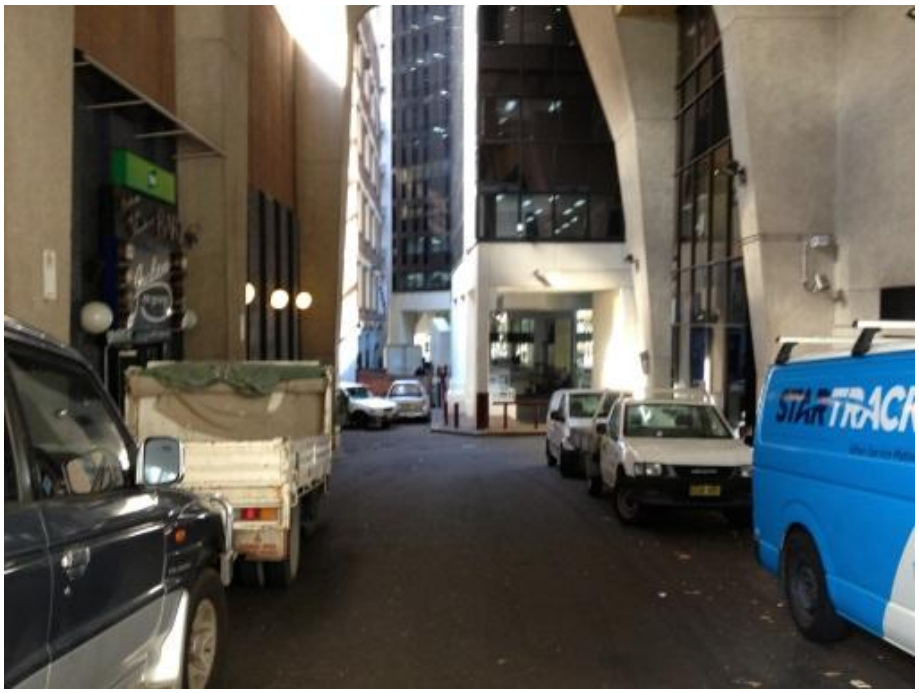
4.2.6.2. Local road network changes

Blue Anchor Lane

Blue Anchor Lane (located at CH 2740) is on the eastern side of George Street and permits servicing of properties fronting George Street and is shown in Figure 4-12.

Access would be maintained with entry and exit to the northbound travel lane on the western side of George Street. This would require access across the construction zone; depending on the work stage, a road plate may be required to provide continuous access.

Figure 4-12: Blue Anchor Lane



Dalley Street

Dalley Street is a one-way eastbound street immediately to the east of George Street, although drivers were observed accessing the car parking station, shown in Figure 4-13, westbound on Dalley Street. Dalley Street would be closed at George Street with entry/exit movements provided via Pitt Street.

Dalley Street intersects with a one way east-south bound loop road, Underwood Street from Pitt Street. It is proposed to retain this one way loop with the section of Dalley Street between Underwood Street and George Street becoming two-way. Drivers needing to access the section of Dalley Street between George Street and Underwood Street would be limited to the parking station and informal loading, where drivers would be able to utilise the existing premise or driveways to turn around. However 'No stopping" signposting of the western end of Dalley Street would provide a temporary turn-around facility for cars.

A controlled southbound access lane on George Street is proposed with entry from Essex Street. Alternate access arrangements, under traffic control, may be considered to maintain left turn entry to Dalley Street.

The width of the street is adequate for two-way movements, although removal of kerbside parking could be considered to provide additional capacity, should this prove desirable.

Figure 4-13: Dalley Street

Jamison Street

Jamison Street is located to the west of George Street. It is currently one-way westbound with access from George Street.

The George Street entrance to Jamison Street would be closed during construction and access and egress would be provided via York Street. A turn-around facility would be provided for vehicles on Jamison Street.

Temporary changes would be required to the signalised intersection of York Street / Jamison Street to facilitate access and egress to Jamison Street.

The proposed changes are shown in Appendix C (sheet 2).

4.2.7. CBD Construction Zone 3: George Street between Jamison Street and Barrack Street

4.2.7.1. Driveway Access

No direct property access is provided onto George Street. Access to properties in this section is via adjacent streets and laneways, as described in the following section.

4.2.7.2. Local road network changes

Bond Street

Bond Street, shown in Figure 4-14, is proposed to be closed at George Street, with "No Stopping" restriction proposed prior to George Street, to permit cars and vans to turnaround for entry and exit to Pitt Street.

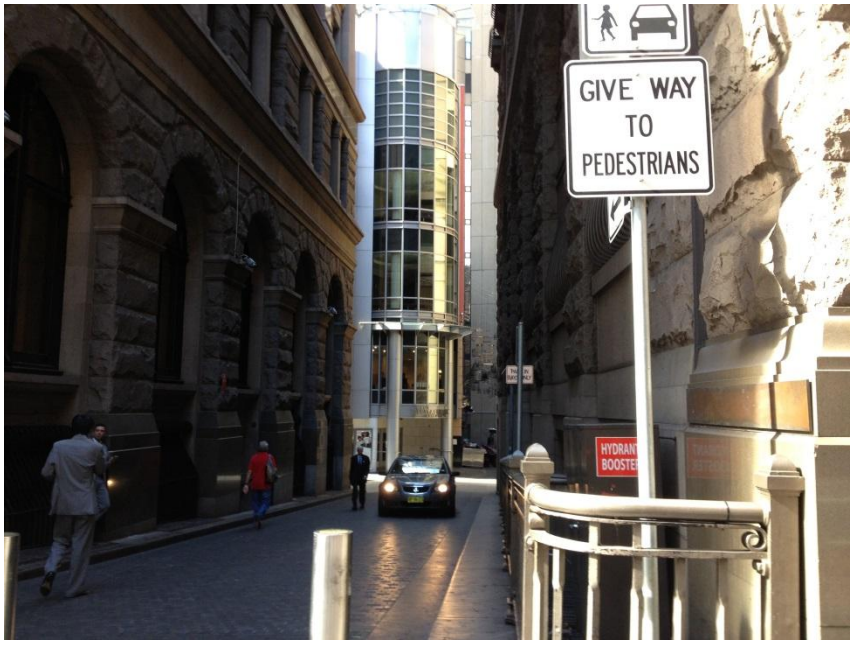
The proposed changes are shown in Appendix C (sheet 3).

Figure 4-14: Bond Street, looking east at George Street

Angel Place

Access to Angel Place (located at CH2200), shown in Figure 4-15, would be from the controlled access lane on George Street, with exit to Pitt Street, as permitted under existing conditions. An alternative would be to close the George Street access with entry from and exit to Pitt Street as there are no property access on the western section of Angel Place, which would permit 'No Entry' signage to be installed at the Ash Street junction. The narrow width of the lane would make U-turns difficult unless the side road junction at Ash Street or driveways could be utilised. The preferred arrangement will be subject to negotiation with adjacent property owners and businesses.

Figure 4-15: Angel Place looking east at George Street

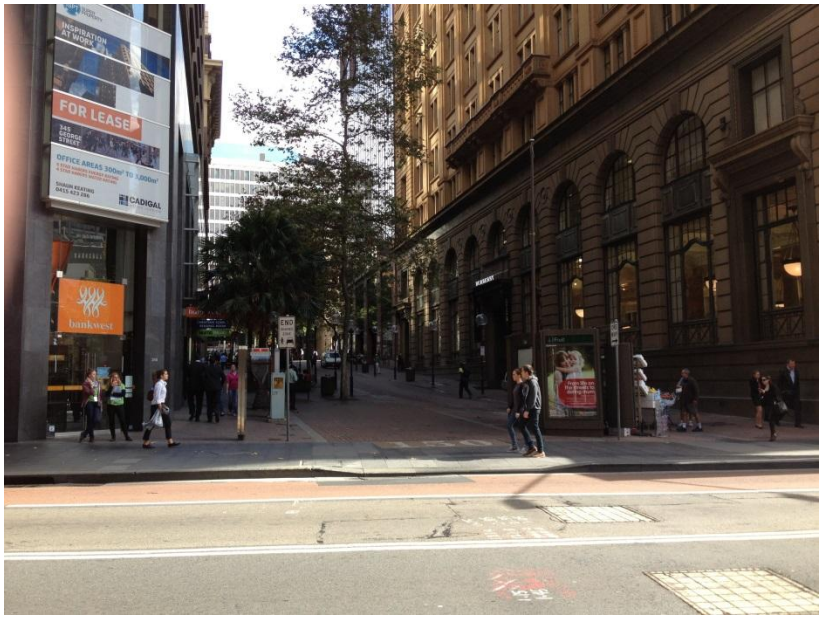


Barrack Street

Barrack Street, shown in Figure 4-16, is located to the west of George Street. It is currently a shared zone, with access via York Street and one-way eastbound movement to George Street.

The exit to George Street is proposed to be closed during construction, requiring Barrack Street to be two-way with access and egress to York Street. Cars and small delivery vehicles would be able to turn around in Barrack Street. Consideration may be given to scheduling early morning deliveries to business premises in this section. Any contingency arrangements would be subject to negotiation with business owners.

Figure 4-16: Barrack Street looking west at George Street

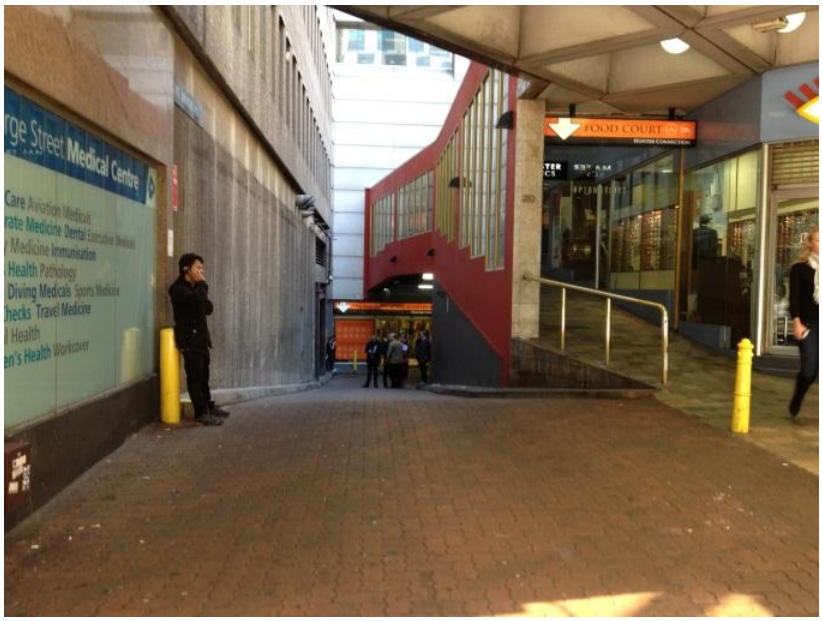


De Mestre Place

De Mestre Place, (located at CH2290), is proposed to operate as left-turn entry and exit to George Street with a southbound controlled access lane provided between Hunter Street and King Street. Demestre Place currently services the Hunter Connection loading docks as shown in Figure 4-17.

Based on the likely driveway geometry and available lane width it may be necessary to limit the size of truck to a maximum of 8.8m length. This would be adequate for typical small to medium trucks, which currently service the lane and would be confirmed in discussions with business owners.

Figure 4-17: Demestre Place access to Hunter Connection loading dock



4.2.8. CBD Construction Zone 4: George Street between Barrack Street and Market Street

4.2.8.1. Driveway Access

This section of the CBD construction zone has the highest demand for access to properties. Surveys in the section between King Street and Market Street have indicated approximately 300 vehicles arrive and 290 vehicles depart this zone between 7.00am-7.00pm (City of Sydney, 2010). A breakdown of the vehicle movements by driveway is shown in Table 4-3.

Table 4-3: King Street to Market Street driveway movements[22]

Access	Vehicles In (7am-7pm)	Vehicles Out (7am-7pm)	Vehicle types
Westfield	201	186	▪ cars / utes / vans (76%) ▪ small to large rigid trucks (23%) ▪ articulated trucks (a few per day)
420 George Street / Mid City	77	104	▪ cars / utes / vans (67%) ▪ small to large rigid trucks (33%)
Dymocks	22	0	

A southbound controlled access lane is proposed on the eastern side of George Street, between King Street and Market Street, to provide access to these properties. The location of the access lane would be varied to suit the current work location.

Depending on the current work zone and proximity of the access lane to the eastern kerbline, access to 420 George Street, Dymocks and GPO / Westin Hotel may be restricted to 8.8m long vehicles at times, due to geometric constraints and available lane width.

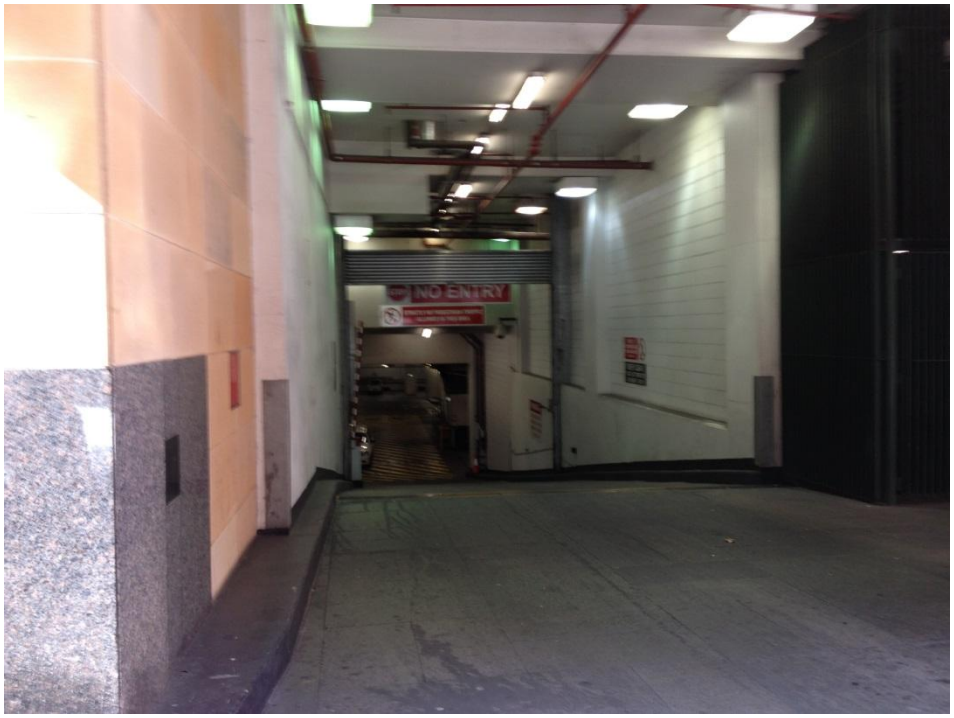
Figure 4-18 shows the GPO / Westin hotel loading dock driveway.

The 8.8m vehicle restrictions would be adequate for typical mail vans and medium sized trucks. The site also has other driveway(s) accessed from Pitt Street, which offer a viable alternative, where exit movements can be accommodated.

Further south, on approach to the Market Street intersection, the road cross section widens for the right turn lane from George Street to Market Street. The driveway to Westfield loading docks, Tower Apartments and Swisshotel is located in this section. The wider access lane enables larger vehicles to service the Westfield loading dock; however, depending on the work area, these may be limited to 12.5m rigid trucks.

[22] *Sydney CBD George Street Driveway Surveys, ROAR Data Pty Ltd for City of Sydney Council, 4 August 2010*

Figure 4-18: GPO/Westin Hotel loading dock driveway south of Martin Place



4.2.8.2. Access changes to minor side roads

Temperance Lane would be closed to traffic and no access provided, which is consistent with the City of Sydney's laneways program.

The proposed changes are shown in Appendix C (sheet 4).

4.2.9. CBD Construction Zone 5: George Street between Market Street and Bathurst Street

4.2.9.1. Driveway Access

Hilton Hotel (exit only)

The Hilton Hotel driveway on George Street caters for exiting vehicles only, as shown in Figure 4-19.

Figure 4-19: Hilton Hotel Exit driveway from port cochere

An alternate option of providing an on street facility at the Pitt Street frontage for pick-up set-down of patrons was considered. However the driveway access can be maintained to George Street, with a southbound controlled access lane provided between Market Street and Park Street.

Taxis and hire cars exiting the hotel would be permitted to turn left into the Park Street bus lanes, whilst general traffic would proceed southbound to Bathurst Street.

Energy Australia loading dock access

An existing loading dock access to the Energy Australia building is located on George Street, south of Park Street. This building is currently vacant and the dock gated at the time of inspection. The building has a separate car park access off the Bathurst Street frontage. However, the loading dock access to George Street would be maintained during construction. The wider cross section in this section of George Street permits a southbound controlled access lane to be maintained.

St Andrews/ Town Hall forecourt driveway

A driveway is located on the western side of George Street which provides access to the St Andrews / Town Hall House forecourt areas. Lockable bollards generally prevent access during the day. This access would not be maintained during construction. Alternate access is provided via a gated driveway located on Bathurst Street, west of George Street. It is proposed that the Bathurst Street access would be used, subject to prior agreement with St Andrew's Cathedral staff.

478 George Street (former Mick Simmons building),

A development application for this site proposes a new 16 storey office building with retail on the lower level and upgrades to the existing State Theatre Annex Building.

Access is via a work zone in a temporary, indented parking bay in the George Street footpath, which permits vehicles to stand and unload material without obstructing the George Street Bus Lane.

The works zone will not be available on major event days (including New Year Eve and Day, Australia Day, etc) and no construction activity will occur during December. The controlled access lane will be available for access to the indented work zone, however the building owners and contractor will be consulted to coordinate work and access requirements, particularly for the time when CSELR works are in this section of George Street.

4.2.9.2. Local road network changes

There are no changes proposed to side roads in this section.

The proposed changes are shown in Appendix C (sheet 5).

4.2.10. CBD Construction Zone 6: George Street between Bathurst Street and Goulburn Street

The cross section in this section of George Street widens to 15.3m, which will generally permit an open access lane to be maintained for both the northbound and southbound travel directions.

4.2.10.1. Driveway Access

No driveways have direct access to George Street in this section.

4.2.10.2. Local road network changes

The proposed changes to side road operations in this section are outlined below.

Wilmot Street and Central Street

The existing one way movement on Wilmot Street and Central Street would be reversed with Wilmot Street becoming one-way westbound and Central Street one way eastbound. This requires a southbound lane to be maintained on George Street for circulation between Wilmot Street and Central Street.

In this section of George Street a southbound controlled access lane will maintained between Bathurst Street and Liverpool Street. This access would need to be managed for the duration of work on utility adjustments and track slab and track laying. Once this work is completed an open access lane would be available. The width of the lane and turning geometry onto George Street may limit the truck size to 8.8m at times; this limitation would need to be agreed with businesses using the lane, including NSW Police.

Ultimo Road

Ultimo Road is proposed to be limited to left in left-out traffic movements via the northbound open access lane on George Street.

Hay Street

The operation of the inner west light rail would be maintained during weekday hours, with the intersection constructed over five weekends, when there would be disruptions to services. Pedestrian movements at the intersection would be managed by traffic controllers, particularly at weekends when Daring Harbour and Paddy's Markets generate increased activity.

The proposed changes are shown in Appendix C (sheet 6).

4.2.11. CBD Construction Zone 7: George Street between Goulburn Street and Barlow Street

The cross section in this section of George Street widens to 17.6m, which permits an open access lane to be maintained for both the northbound and southbound travel directions, outside the work area.

4.2.11.1. Driveway Access

A small off-street car park is currently accessed via a driveway adjacent to the Central Baptist Church on the western side of George Street. Access to the northbound lane would be available with left-in left-out access.

4.2.11.2. Local road network changes

Campbell Street

Current one way westbound movement on Campbell Street will be maintained with left-out to the southbound open access lane on George Street. Peak hour right-turn movements out of this intersection are currently limited to 70-100 vehicles per hour, and an alternate northbound route is available via Pitt Street.

The proposed changes are shown in Appendix C (sheet 7).

4.2.12. CBD Construction Zone 8: Rawson Place and Eddy Avenue

Managing pedestrian crossing opportunities for the substantial volume of pedestrians crossing Eddy Avenue to access bus stops or continue through Belmore Park would be an important issue during construction. Staged works would be necessary to maintain the crossing locations. In association, this requires relocation of temporary traffic signal control.

4.2.12.1. Driveway Access

Access to a small number of car parking spaces and loading facilities at the Eddy Avenue frontage to Central Station is proposed to be maintained by progressively shifting driveway crossovers as construction work proceeds. Access to these driveways are proposed to be facilitated from the kerbside lane of Eddy Avenue.

4.2.12.2. Local road network changes

Rawson Place

Rawson Place would be closed to all traffic.

Rawson Lane

Rawson Lane current extends between Pitt Street and Rawson Place. It is proposed to close the lane at Rawson Place, which is consistent with end state proposals. Consultation with City of Sydney Council indicated concurrence with this approach. Service vehicles have been observed to turn within Rawson Place, although larger vehicles may need to reverse in and out.

Eddy Avenue

Eddy Avenue, shown in Figure 4-20, (and Chalmers Street) are closely linked to Central Station and associated interchange between rail, bus, coach, taxis and light rail. The

proposed Eddy Avenue works would remove existing coach parking, along the southern kerbline at the railway frontage.

The Eddie Avenue coach facilities are proposed to be relocated to the Western Forecourt on Lee Street and Chalmers Street.

The existing bus operations along Eddie Avenue would continue during construction, in particular the university express services would be maintained on Eddie Avenue during construction works along Eddie Avenue.

Figure 4-20: Eddy Avenue looking west toward Pitt Street (coach bays on aisle to the left)

The proposed changes are shown in Appendix C (sheet 8).

4.2.13. CBD Construction Zone 9: Chalmers Street between Eddy Avenue and Devonshire Street

4.2.13.1. Driveway Access

Access to the existing driveway for the Sydney Trains car park adjacent to the Devonshire Street portal would be retained with entry via Chalmers Street (south) and exit via Randle Street.

4.2.13.2. Access changes to minor side roads

Access to Beattie Lane via Randle Street would be maintained; although reversal of Randle Street (see Section 4.2.6.3) would affect approach routes.

4.2.13.3. Local road network changes

It is proposed to reverse the operation of Randle Street and provide two northbound lanes in Elizabeth Street (as shown in the proposed concept sketch in Figure 4-21 to facilitate northbound traffic movements during the closure of Chalmers Street.

This requires works to be undertaken at the following intersections prior to commencement of the main works in Chalmers Street:

- Elizabeth Street / Eddy Avenue / Foveaux Street;
- Devonshire Street / Randle Street / Chalmers Street; and
- Randle Street / Elizabeth Street.

Figure 4-21: Elizabeth and Randle Street Modifications

As shown in Figure 4-21, the intersection of Randle Street and Elizabeth Street would require adjustment of the layout to accommodate dual left turn movements onto Elizabeth Street, especially for buses travelling from Chalmers Street to Elizabeth Street.

The proposed changes are shown in Appendix C (sheet 9).

4.2.14. Parking and Loading Zones

As a primary north-south bus route, on-street parking on George Street has been removed together with the majority of driveway access, where properties have viable alternate frontages. No provision for on-street parking or loading along the light rail corridor during construction is proposed. Loading zones would be provided on adjacent side streets where possible with potential locations for mitigation measures provided in Table 4-4.

Table 4-4: Loading Zone mitigation

CBD Loading zone Mitigation
Network changes to intersections along the George Street corridor provide an opportunity to mitigate the impacts by relocating loading zones and off-peak parking to the additional kerb space provided at the cross streets for example, e.g. obsolete turning bays for movements onto George Street can potentially be converted into parking. The current design allows for the impacted loading and taxi zones to be relocated to the following locations: ▪ George Street North – potential to relocate the taxi zone at the Four Seasons Hotel, to the north of Alfred Street. ▪ Essex Street – reclassify short stay parking on the southern kerb. ▪ Bridge Street – The dedicated left turn lanes into George Street become obsolete due to the removal of access to George Street. This presents an opportunity to enhance the footpath and provide a taxi/loading zone on Bridge Street. ▪ Margaret Street –Opportunity to convert kerbside left turn lane into parking / loading due to George Street closure. ▪ Hunter Street – existing 4 lanes which would reduce in future, providing an opportunity for additional parking / loading on both sides of Hunter Street. ▪ Market Street – removal of monorail and left turn into George presents an opportunity for additional loading capacity on one side of Market Street to the east of George Street. ▪ Bathurst Street – left turn lane onto George Street would become obsolete creating opportunities for additional parking / loading spaces. ▪ Ultimo Road – dual turning lanes onto George Street become obsolete as George Street would have only one northbound lane therefore there is an opportunity to create new parking / loading spaces along the northern kerb.

All workers would be expected to park off-site with shuttle bus transfers of the construction workforce at shift change over to prevent an increase in demand for on-street parking.

4.2.15. Public Transport Access

Prior to construction commencing all bus services would be relocated from George Street as part of the City Centre Bus Plan. As a result, bus passengers would need to access the CBD via new corridors to the east and west of George Street on York, Clarence, Elizabeth, Castlereagh Streets and Park/Druitt Streets.

Access to the key heavy rail interchange hubs of Wynyard, Town Hall and Central would be retained, with existing controlled crossing points through worksites being maintained.

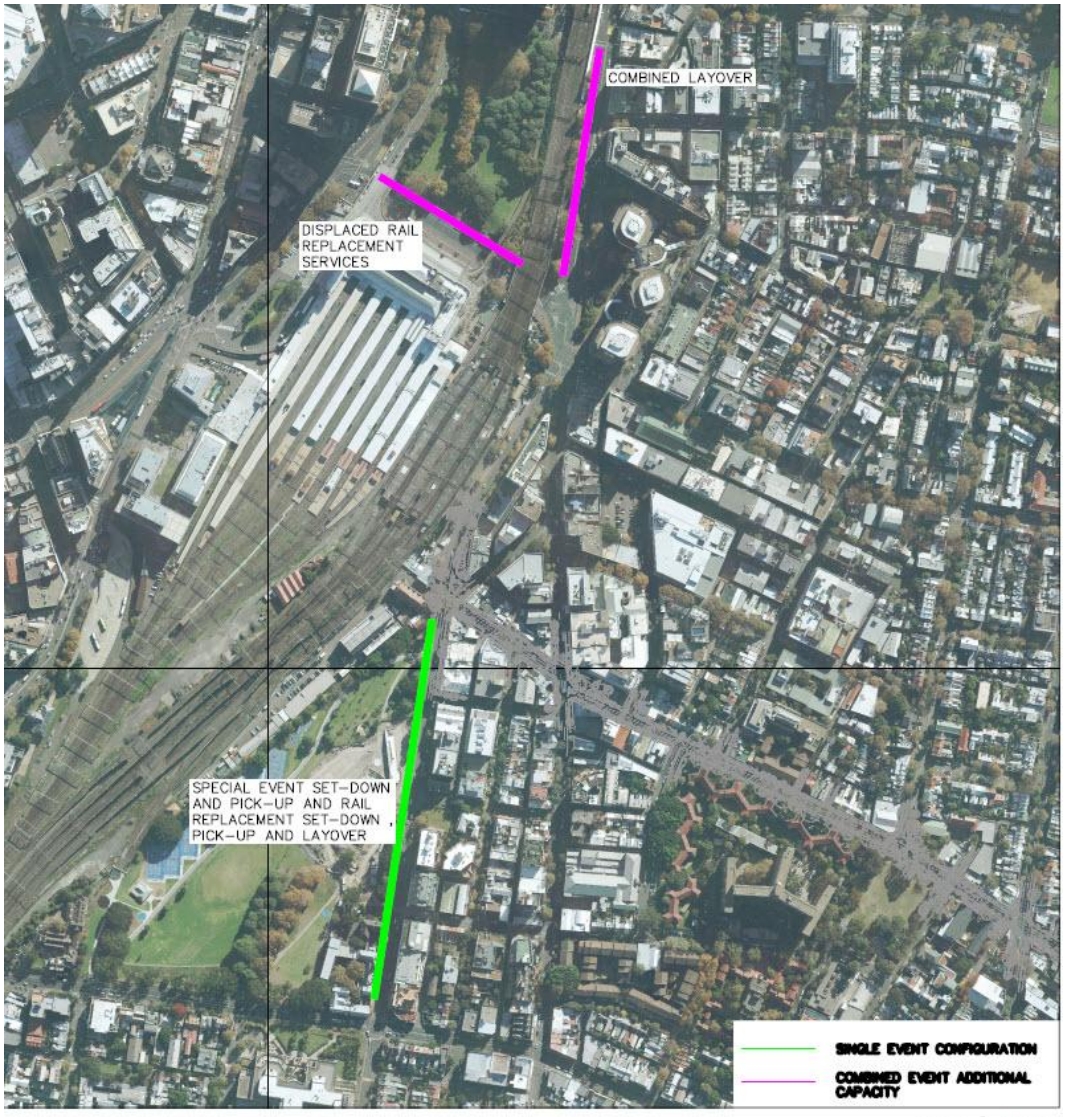
4.2.15.1. Special Event & Rail Replacement Bus Services

Special event buses currently operate between Central Station and Moore Park entertainment precinct and Royal Randwick Racecourse. At present, the buses pick-up and set-down passengers along Chalmers Street, between Devonshire Street and Elizabeth Street. However, with the construction closing off Chalmers Street to traffic, these services would be required to move south of Devonshire Street. This continues to provide a good connection for heavy rail passengers exiting Central Station from the Devonshire Street portal.

In addition to special events buses, rail replacement buses also operate via Chalmers Street, and during the construction phase, would also require relocation south of Devonshire Street. This location would not have sufficient capacity to accommodate these dual uses. Therefore two alternative mitigation measures are proposed:

- Wherever possible schedule rail replacement works during weekends when no special events are proposed;
- Where this is not possible, special events would continue to pick-up and set down passengers at Chalmers Street south of Devonshire Street, while rail replacement buses would need to be relocated to Elizabeth Street, north of Eddy Avenue as shown in Figure 4-22. In addition, changes to Sydney Trains maintenance schedules would be required to minimise the passenger transfer requirement at Central Station, such as maintaining operation of Central – Bondi Junction services under a Configuration 1a possession. Details of rail replacement bus requirements not impacted by construction are available from the Transport Operations Report.

Figure 4-22: Special Events Bus Operation at Chalmers Street with Rail Replacement Buses



4.2.16. Pedestrian and Cycle Access

Pedestrians would be protected in narrow footpath sections by fencing, to physically separate pedestrians from traffic lanes.

Where existing controlled pedestrian crossing facilities exist, these would be maintained and when required by the current work location, pedestrian access through the worksite provided under traffic control. Existing crossing widths at mid-block crossing points such as at Martin Place may be reduced to allow reduced construction periods. This is feasible without reducing pedestrian levels of service due to the greatly reduced traffic volumes (i.e. construction and service vehicles only) on George Street, which will only require traffic controllers to stop pedestrian movements infrequently.

North-south cycle movements on George Street could be moved to one of the existing on-road cycle corridors as defined by the City of Sydney;

- Pitt Street (on-road, two way)
- York Street (on-road, southbound only)
- Clarence Street (on-road, northbound only); and
- Kent Street segregated cycleway (two-way).

East-west cycle movements may be more restricted during the construction phase:

- While cyclists may dismount and use the Circular Quay foreshore or Herald Square to George Street/The Rocks; a temporary cycle route on Bridge Street could act as an alternative on-road cycleway to Alfred Street to support east-west movements.

  Bridge Street will provide two westbound traffic lanes during construction, which may permit an on-road cycle lane within the existing roadway. During intersection staging works, the lane would not continue through the intersection to Grosvenor Street due to the need to divert the two traffic lanes with restricted alignment around staged worksites. During these closures, Hunter Street is to remain open for westbound movement, which would also require temporary diversion of cyclists to this route.

  The potential use of Bridge Street is compatible with longer term operational plans which identify Bridge Street as a future cycle route (on-road, two ways east of Pitt Street)
- King Street (on road, eastbound only) provides the next west to east crossing opportunity

4.2.17. Emergency vehicles

Access for emergency vehicles would be maintained at all construction sites and emergency services would be advised of all planned changes to traffic arrangement prior to applying the changes. Advice would include information about upcoming traffic switches, anticipated delays to traffic, extended times of work, locations of road possession or any likely major disruptions.

As shown in the George Street corridor plans contained in Appendix C, there are a number of locations where no access lane external to the worksite is being provided. In these locations access to the block would be facilitated by traffic controllers to the location of the emergency. However during certain loading/unloading and construction activities a clear path through the length of the block to permit through travel cannot be provided. At these times emergency services would be advised in advance of the required alternate routes.

4.2.18. Taxis

All taxi ranks would be displaced from George Street during construction, many of which are off-peak or late night ranks only. This is consistent with the end-state and the corresponding end-state mitigation measures would be implemented prior to construction. Potential replacement loading zones as identified in Table 4-4 could also provide off-peak taxi rank facilities to mitigate these impacts.

4.3. Surry Hills

4.3.1. Construction Worksites and Access

The construction worksites within the Surry Hills to Moore Park precinct consist of the following:

- Rail tracks along Devonshire Street;
- Surry Hills platforms at Ward Park; and
- Bridge over the Eastern Distributor.

Construction along this route would involve closing Devonshire Street between Chalmers Street and Crown Street. East of Crown Street, an eastbound lane is proposed to be retained during the construction phase.

A number of adjoining streets along Devonshire Street would close as part of the proposals for CSELR. These streets are:

- Buckingham Street;
- Holt Street;
- Clisdell Street;
- Waterloo Street; and
- High Holborn Street

In addition to these road closures, the following network changes are proposed within Surry Hills:

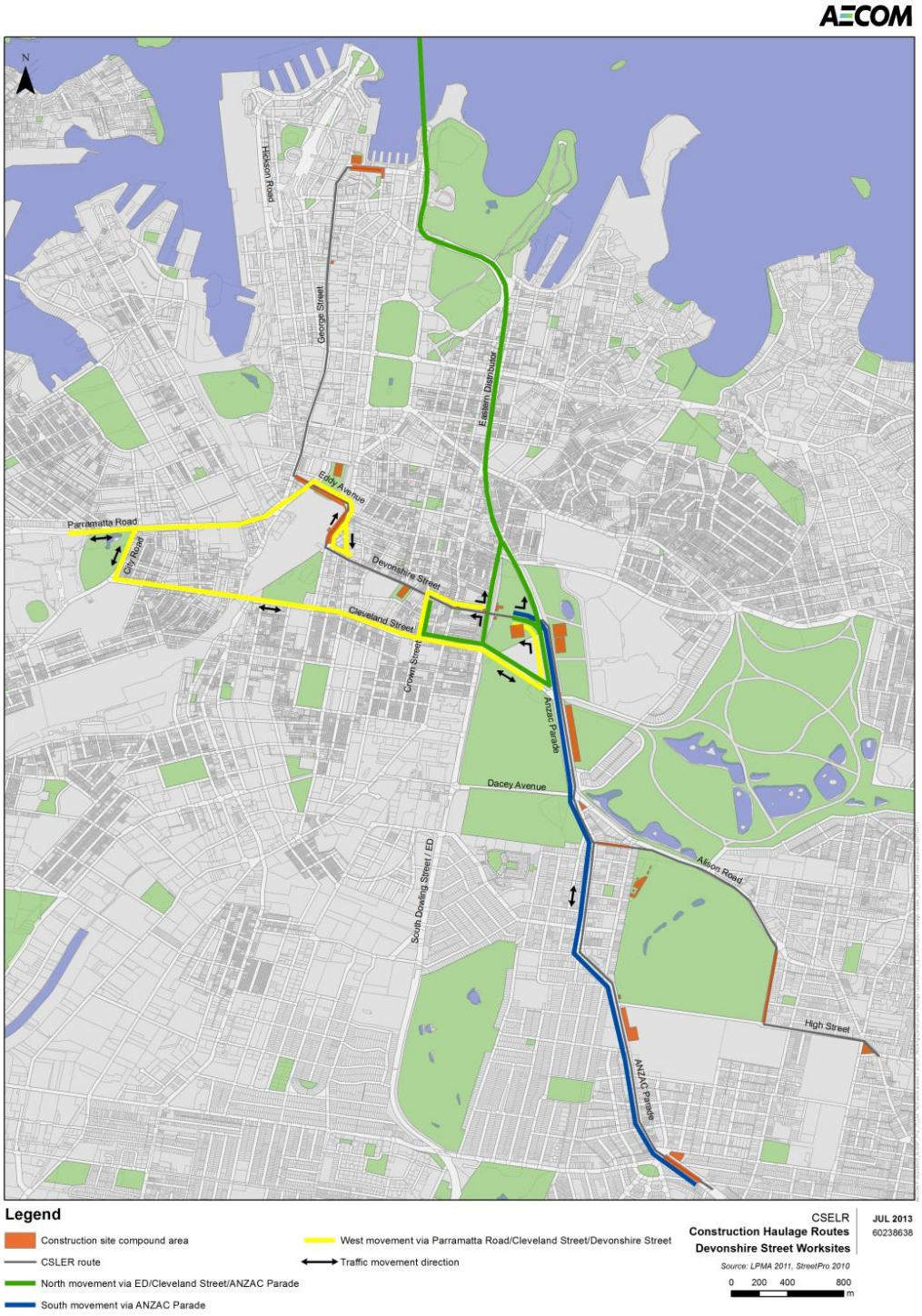
- Extension of Cooper Street onto Riley Street;
- Conversion of Steel Street to one-way southbound;

To facilitate local access and minimise the number of changes to the road network, all of the end-state measures would be in place prior to the commencement of construction, with the exception of the closure of Waterloo Street (discussed in the following Section 4.3.3).

4.3.1.1. Haulage Route

The haulage route for construction vehicles accessing Devonshire Street is shown in Figure 4-23.

Figure 4-23: Devonshire Street Construction Haulage Route



4.3.2. Traffic Management

The CSELR alignment crosses the following key road links, which would remain operational during construction:

- Elizabeth Street;
- Crown Street; and
- Bourke Street.

Works at these intersections would require staged construction to allow traffic to pass adjacent to the worksites and thus ensure property and network accessibility within the precinct. The staged intersection works are presented in Appendix B.3-B.5.

4.3.2.1. South Dowling Street and Eastern Distributor

Construction, and subsequent road closures, across South Dowling Street and the Eastern Distributor can only be undertaken during over-night shifts. For South Dowling Street, construction is to be undertaken in one directional flow at a time, due to the significance of the road within the greater transport network. During construction works at these sites, traffic would be diverted via alternate corridors via the shortest route possible.

During the closure of the northbound South Dowling Street carriageway, South Dowling Street will be closed at the intersection of Cleveland Street. City bound traffic would be diverted via Dacey Avenue and Anzac Parade to lead motorist to Flinders Street and South Dowling Street. Local traffic accessing Surry Hills will be diverted at the intersection of Cleveland Street.

During the closure of the southbound South Dowling Street carriageway, airport bound traffic will be diverted via Anzac Parade and Dacey Avenue. Surry Hills bound traffic will be diverted via Fitzroy Street.

Similarly, during the closure of the Eastern Distributor, to facilitate the installation of the pre-fabricated bridge over the Eastern Distributor, traffic will be diverted to Dacey Avenue and Anzac Parade. Northbound traffic would be diverted from Southern Cross Drive and directed to South Dowling Street with the entrance to the Eastern Distributor closed on approach to Todman Avenue. Motorists bound for the Eastern Distributor would then be directed to the Anzac Parade on-ramp adjacent to Moore Park Road.

Southbound traffic on the Eastern Distributor will be diverted to the Anzac Parade off-ramp within the tunnel and diverted to Anzac Parade, Dacey Avenue and South Dowling Street prior to joining Southern Cross Drive.

The detour routes are presented Appendix E.

4.3.3. Property Access

As Devonshire Street is proposed to be closed to through traffic, the properties with vehicle access from Devonshire Street would require mitigation measures to manage access during the construction phase. Existing properties with access to car parking or loading docks on Devonshire Street are shown in Figure 4-24 to Figure 4-27.

Figure 4-24: 483 Riley Street – car park to commercial business

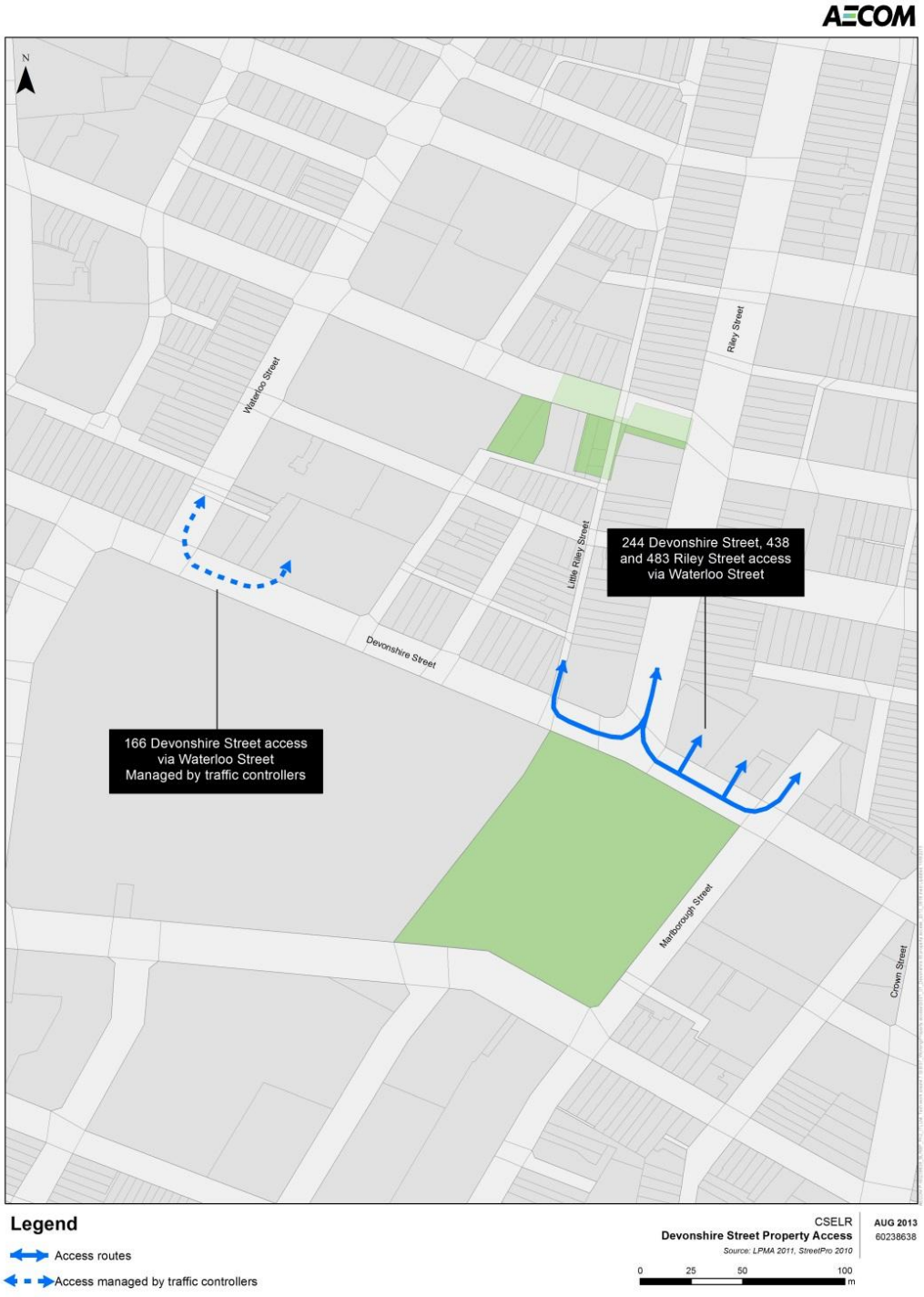
Figure 4-25: 244 Devonshire Street – low density residential

Figure 4-26: 438 Riley Street – driveway to St Patricks Business College

Figure 4-27: 166 Devonshire Street driveway - high density residential development

In addition to these driveways, the properties on Marlborough Street north of Devonshire Street and driveways on Nickson Lane are accessible only via Devonshire Street. To ensure accessibility to these properties during construction, Waterloo Street and Riley Street would remain open as shown in Figure 4-28.

Figure 4-28: Devonshire Street Property Access



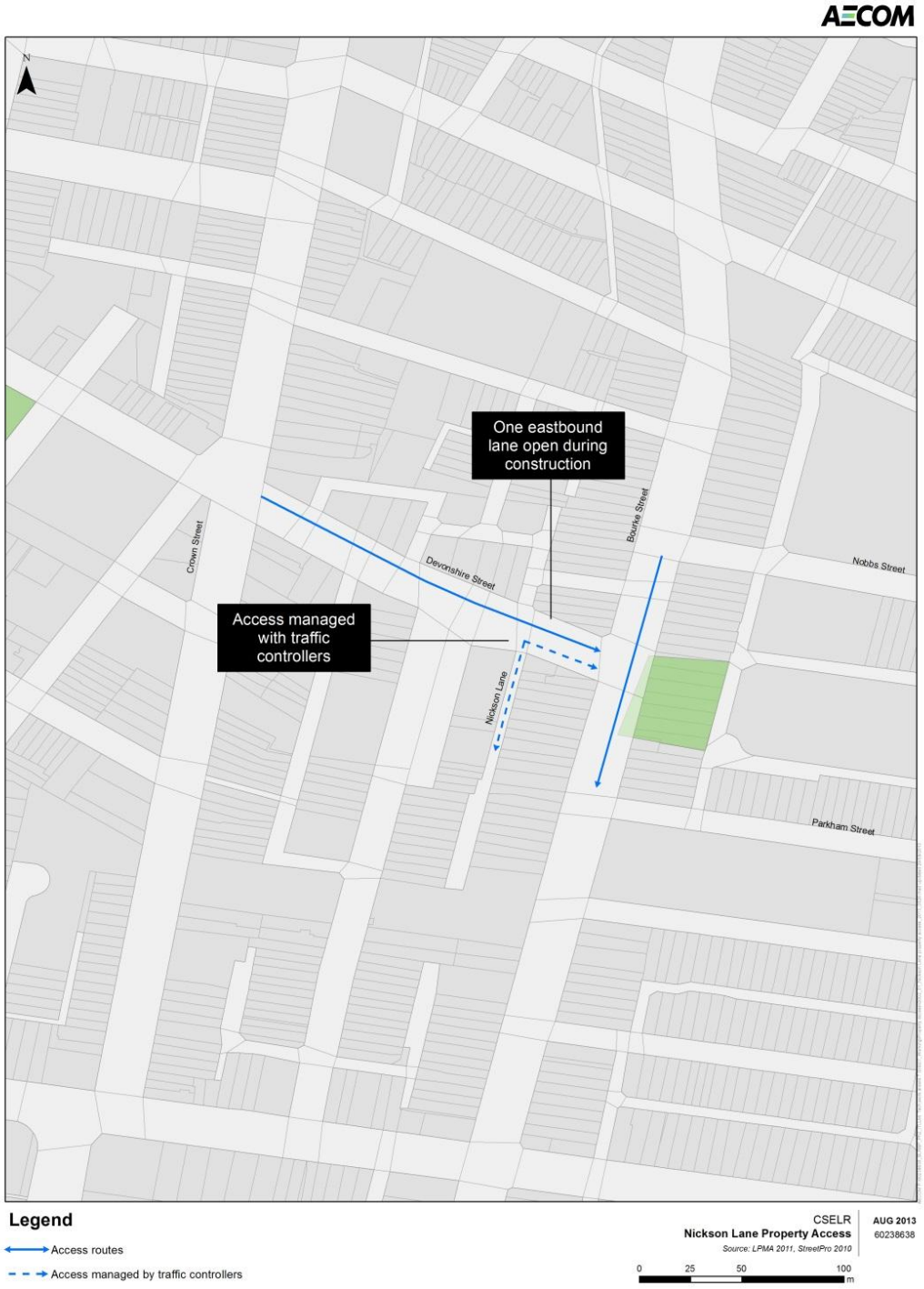
Since the light rail is aligned within Ward Park, sufficient road widths can be maintained adjacent to Riley Street to facilitate safe separation, with concrete barriers, between the worksite and vehicles accessing the properties. However, safe separation cannot be provided adjacent to Waterloo Street for vehicles accessing 166 Devonshire Street. Therefore, traffic controllers would be required to guide the vehicles between the driveway and Waterloo Street when works are undertaken adjacent to Waterloo Street.

Similarly, access to Nickson Lane would be managed by traffic controllers, as shown in Figure 4-29 due to the limited lane width.

With the closure of Devonshire Street the residents within the Surry Hills precinct may experience increased travel distances in their journeys. However, vehicles access to all adjacent properties would still be maintained during the closure of Devonshire Street. The precinct access plans are contained within Appendix A.2.

Consistent with the operational phase of the CSELR , the light rail alignment precludes access to the existing Langton Centre off-street car park at Parkham Place. During construction phase suitable alternative parking for the clinic will be provided within the general vicinity.

Figure 4-29: Nickson Lane Access



4.3.4. Parking

In the CSELR end-state, the restricted road cross section allows no opportunity for parking along Devonshire Street. The CSELR Transport Operations Report established that, with appropriate parking management, there is sufficient capacity within the adjacent road network to absorb the displaced parking demands during peak demand periods. This would also be the case during the construction phase, since the