**Rawson Place stop**

The Rawson Place stop would be located along Rawson Place between Pitt Street and George Street and would allow flexibility for bus stop locations either in Rawson Place itself, on Pitt Street or Barlow Street (to the north of Rawson Place). Rawson Place would serve as the main interchange stop for the Parramatta Road/Broadway bus services.

The Rawson Place stop would include an approximately six metre wide central island platform and an approximately 3.5-metre wide, 45-metre long side platform on the southern side of the light rail alignment. The central island platform would allow for a light rail track on the southern side of the platform and a dedicated bus lane on the northern side of the platform. The central island platform would allow for cross-platform bus to light rail movement. Buses would travel along Rawson Place in a westbound direction entering from Pitt Street, and exiting onto George Street.

The southern platform would tie into the existing pedestrian levels at Pitt Street with a series of steps and benches along the outer edge of the platform addressing the change in levels where required. The footpath on the northern side of Rawson Place would be raised to match the proposed bus lane level. The interface along the frontage of the adjoining building (the McKell building) would also require some level changes to maintain access to this building.

The existing gradient of Rawson Place is approximately four per cent. As such, Rawson Place would be re-graded to accommodate the stop platforms to allow for a maximum gradient of approximately 2.5 per cent, including raising the western end of the stop by less than one metre. Ramped access would be provided at the western end of both platforms.

There is currently vehicle access from Rawson Lane into Rawson Place. This access is primarily for waste collection vehicles to service the buildings on Rawson Lane and would be closed as part of the Rawson Place stop. Preliminary assessment resulting from the closure of Rawson Lane has identified that access is possible for waste collection vehicle access to Rawson Lane via Pitt Street, with a 6.4 metre small rigid vehicle. Access for larger vehicles (standard 8.8 metre vehicles) would not be possible. Further development of access to this location would be undertaken during detailed design.

An indicative section of the stop is shown in Figure 5.19 and an indicative plan of the stop is shown in Figure 5.20.

**Figure 5.19 Indicative section – Rawson Place stop**
Figure 5.20 Indicative plan – Rawson Place stop
Central Station stop

The Central Station stop would be located on Chalmers Street to the east of Central Railway Station and would be the key rail interchange for the CSELR light rail network and other transport modes. Central Station stop would generally service the southern part of the CBD and western Surry Hills. The stop would also serve as a transport interchange with existing railway services at Central Railway Station, with bus routes along Chalmers Street, Elizabeth Street and Eddy Avenue, and with taxis.

The Central Station stop would provide an approximately six metre wide central island platform and an approximately 3.2-metre wide side platform on the western side of the light rail alignment (adjacent to Central Railway Station). The western platform would tie into the existing pedestrian footpath on the western side of Chalmers Street. The central island platform would allow for a light rail track on both the eastern and western sides of the platform. The Central Station stop would allow for special events services to operate from this stop. Each platform would be 90 metres in length to enable 90-metre LRVs (two coupled 45-metre LRVs) to serve high patronage events at both Moore Park and Royal Randwick racecourse as required.

The easternmost track (in Chalmers Street) would be used during special events to allow LRVs to use this platform. During normal operations, this track would not be utilised by LRVs, but would operate as a traffic lane and bus stop. The remaining eastern traffic lane would be utilised by general traffic in a northbound direction on an ongoing basis. Access to the platforms would be via new pedestrian crossings at either end of the platforms, which would be managed by marshals for special events.

A single general traffic lane would be provided on Chalmers Street, with traffic using this lane only permitted to turn left into Eddy Avenue. To compensate, Randle Street would be reversed from one-way southbound to one-way northbound together with additional northbound lanes in Elizabeth Street. At the corner of Chalmers and Randle Street, the existing footpath would also be extended, as Randle Street would change to two-way traffic movements and the turn from Randle Street into Chalmers Street would be removed. The road network around the Central Station stop would also include a cycleway alignment which would be determined during detailed design in consultation with the City of Sydney.

An indicative section of the stop is shown in Figure 5.21 and an indicative plan of the stop is shown in Figure 5.22

Figure 5.21 Indicative section – Central Station stop
Figure 5.22 Indicative plan – Central Station stop
Surry Hills Precinct

Surry Hills stop
The Surry Hills stop would be located on Devonshire Street adjoining to Ward Park, an important local park for the residents of Surry Hills. The central island platform stop would be located midway between Chalmers Street and Bourke Street opposite the intersection of Devonshire Street and Riley Street. The Surry Hills stop would primarily service the local residential, dining and entertainment area as well as a large proportion of Crown Street bus service customers.

The stop would consist of an approximately 4.2-metre wide, 45-metre long central island platform arrangement with access from both ends of the platform. The Surry Hills stop would be located on an approximately 2.5 per cent grade and would include a vertically curved platform to limit the amount of earthworks that would be required to provide a level stop. A single eastbound traffic lane on Devonshire Street would be located on the northern side of the stop and new pedestrian crossings would be provided at each end of the platform.

The stop would require the realignment of the pedestrian footpath adjacent to Ward Park to the south of the proposed stop. The design of the stop would also incorporate a new frontage to Devonshire Street for Ward Park to replace the existing landscaped seating area and new tree planting. More detailed concepts for this interface would be developed during detailed design in conjunction with the City of Sydney. An indicative section of the stop is shown in Figure 5.23 and an indicative plan of the stop is shown in Figure 5.24.

Figure 5.23 Indicative section – Surry Hills stop
Figure 5.24 Indicative plan – Surry Hills stop
Moore Park Precinct

Moore Park stop

The Moore Park light rail stop would be located adjacent to Anzac Parade within the Moore Park Precinct, providing the main interchange for the Moore Park sports and entertainment complex, including the Sydney Cricket Ground, the Sydney Football Stadium and the Entertainment Quarter (which includes entertainment venues such as Hordern Pavilion).

The stop would include a 90-metre platform designed to serve as a major event stop serving the Sydney Sports and Recreation Grounds and Entertainment Quarter and would maintain normal services during the non-event days to service the Moore Park Precinct, which includes the Sydney Boys and Sydney Girls High Schools. Access to the Sydney Boys and Sydney Girls High Schools would be via the existing pedestrian footpath and the existing pedestrian crossing of Anzac Parade. Appropriate wayfinding signage would be used to assist movement within the vicinity of the stop for both special event and normal running services.

The Moore Park stop would be configured to accommodate one 90-metre long island platform with four vertical access points to an above-ground mezzanine. During a major event, a central marshalling area would be provided at ground level for the queuing of passengers, before entering the stop. At-grade access to the platform would be provided at the eastern end for non-event services. The key features of the Moore Park stop would include:

- A feature canopy providing shelter over the stop with canopies proposed over pedestrian links
- Stairs and ramps evenly distributed along the length of the platform for even loading of passengers
- A new public plaza located at the north end of the stop to connect walkways, potential bridges and proposed bus services
- Maintenance of visual connectivity across the Anzac Road corridor and AFL Training Oval.

The design of the Moore Park stop and associated pedestrian pathways would not preclude the future development of a potential pedestrian bridge over Anzac Parade (which is outside the scope of this EIS).

An indicative section of the stop is shown in Figure 5.25 and an indicative plan of the stop is shown in Figure 5.26.
Figure 5.26 Indicative plan – Moore Park stop
Randwick Precinct

Royal Randwick racecourse stop

The Royal Randwick racecourse stop would be integrated into the existing Royal Randwick forecourt plaza. The stop would function as a major event stop for horse racing carnivals, conventions and conferences, and other events that the racecourse hosts throughout the year. These events would likely require a shuttle service to be operated with patrons queuing in front of the light rail stop during events. As with the Moore Park stop, safe and easy access would be provided for large numbers of people to and from the light rail platforms for events.

This stop would also serve as a local light rail stop for the residential area to the north-east, Randwick TAFE on Darley Road and the UNSW Randwick campus on King Street.

The Royal Randwick Racecourse stop would be located to the south of Alison Road within the Royal Randwick site and would comprise a 45-metre long, approximately 5.2 metre-wide central island platform to cater for large crowds during special events at the racecourse.

New pedestrian crossings would be provided at each end of the new platforms providing access to the racecourse entry. Some regrading of the existing ground level would also be required to allow the light rail track and stop to be at a similar level to the existing footpath, to enable customers to cross the light rail stop to access kerbside bus and taxi services. Access to the predominately residential areas to the north of the Royal Randwick racecourse would typically be via the existing pedestrian crossing at the intersection of Alison Road and Darley Road.

An indicative section of the stop is shown in Figure 5.27 and an indicative plan of the stop is shown in Figure 5.28.

Figure 5.27 Indicative section – Royal Randwick racecourse stop
Figure 5.28 Indicative plan – Royal Randwick racecourse stop
Wansey Road stop

The Wansey Road stop would be located at the northern end of Wansey Road near the junction of Alison Road and Wansey Road. The stop would be located on the western side of Wansey Road and would generally service the western Randwick residential area to the north and south of Alison Road.

The stop would consist of an approximately 4.4-metre wide central island platform and would be accessed from the north and south ends via adjoining pedestrian crossings across Wansey Road.

A shared pedestrian bicycle path would be provided on the western side of the platform to maintain the existing cycle path along Wansey Road and Alison Road. A northbound and southbound traffic lane would also be maintained along the length of Wansey Road between Alison Road and High Street.

There are number of large mature fig trees on both sides of Wansey Road with overarching branches that span over the roadway. The trees along the western side would need to be removed prior to construction of the CSELR (refer section 15.6). The proximity of the proposed platforms and overhead wires to the trees along the eastern side of the alignment would be considered during detailed design with the aim of retaining these trees.

An indicative section of the stop is shown in Figure 5.29 and an indicative plan of the stop is shown in Figure 5.30.

Figure 5.29 Indicative section – Wansey Road stop
Figure 5.30 Indicative plan – Wansey Road stop
UNSW High Street stop
The UNSW High Street stop would be located at the southern end of Wansey Road at the
junction of Wansey Road and High Street, on the western side of Wansey Road. The UNSW High
Street stop would generally service the upper campus of the UNSW and the UNSW campus
accommodation as well as the broader Randwick residential area to the east of the Royal
Randwick racecourse.

The UNSW High Street stop would include two approximately 3.2-metre wide side platforms.
The eastern side platform would provide a traffic-facing platform adjacent to the proposed
traffic lanes along High Street, whilst the western side platform would provide an interface
with the proposed pedestrian cycleway and footpath. A new pedestrian crossing across High
Street between the southern end of the stop and the UNSW campus would also be provided.
Appropriate way finding signage would be provided at the stop to indicate the pedestrian travel
paths between the UNSW High Street stop and UNSW.

The UNSW High Street stop would require some regrading on the west side of the stop to provide
for pedestrian access, as the site falls away to that side. This would include the provision of a
new retaining wall in this location. Details regarding the proposed retaining wall structure along
Wansey Road are provided in section 5.2.4.

As part of the Randwick Urban Activation Precinct planning that is currently being undertaken by
the Department of Planning and Infrastructure (DP&I), a ‘Randwick Village’ cluster development
around the intersection of Wansey and High Street has been proposed. The scale of built form
identified for this precinct is between approximately six and 12 storeys which may affect traffic in
the precinct. As part of the development, a plaza has been identified around the High Street stop
with a narrowing of Wansey Road. This concept would require the reduction of the existing traffic
along Wansey Road into a one-way configuration. Transport for NSW will continue to work with
the DP&I with respect to the development of the Randwick Village development during detailed
design of the CSELR proposal to ensure that the two projects integrate with the road network.

An indicative section of the stop is shown in Figure 5.31 and an indicative plan of the stop is shown
in Figure 5.32.

Figure 5.31 Indicative section – UNSW High Street stop
Figure 5.32 Indicative plan – UNSW High Street stop
Randwick stop

The Randwick stop would be the final stop of the Randwick branch of the CSELR route. The Randwick stop would be located within the existing High Cross Park at Randwick and would provide a terminus and interchange with existing eastern suburbs buses. It would also service the retail precinct on Belmore Road and Avoca Street, the Sydney Children’s Hospital, the Prince of Wales Hospital, the Royal Randwick Hospital and the broader residential area of Randwick and the coastal inner south-eastern suburbs.

The Randwick stop would provide two 45-metre long side platforms between approximately 3.2 metres and 5.1 metres wide and would allow for interchange with buses in both the morning and afternoon peak periods. This would provide for the efficient transfer of passengers at this location. A track cross-over would be located to the north of the stop. The proposed bus interchanges would be located on Belmore Road servicing the morning peak period, and on Avoca Street and Cuthill Street servicing the afternoon peak services.

The side platforms would enable passenger access to the platforms as well as improved opportunities to integrate with the existing park. New tree plantings, a public plaza and new landscaping would be installed at High Cross Park to enhance the setting of the existing war memorial which would be retained in its present location. Appropriate wayfinding signage would be provided at the stop to indicate pedestrian movement options including access to other forms of transport, local shopping facilities and the Prince of Wales Hospital.

New pedestrian crossings would also be provided across Avoca Street (one crossing), Belmore Road (two crossings) and Cuthill Street (two crossings).

An indicative section of the stop is shown in Figure 5.33 and an indicative plan of the stop is shown in Figure 5.34.

Figure 5.33 Indicative section – Randwick stop
Figure 5.34 Indicative plan – Randwick stop
Kensington and Kingsford Precinct

Carlton Street stop

The Carlton Street stop would be positioned within the median of Anzac Parade just south of the intersection of Carlton Street and Anzac Parade. This stop would be located within an existing residential area and would serve as a local light rail stop for the residential catchment of Kensington.

The Carlton stop would consist of a single 45-metre long, approximately 4.4-metre wide central island platform and would be accessed from the northern end of the platform via a new signalised pedestrian crossing across Anzac Parade at Carlton Street. Full accessibility would be provided to the platform via a ramp at the northern end connecting to the new pedestrian crossing.

An indicative section of the stop is shown in Figure 5.35 and an indicative plan of the stop is shown in Figure 5.36.

Figure 5.35 Indicative section – Carlton Street stop
Figure 5.36 Indicative plan – Carlton Street stop
Todman Avenue stop

The Todman Avenue stop would be located just north of the Todman Avenue intersection which is one of the main junctions on Anzac Parade and the commercial centre of Kensington. The stop would serve the local residential catchment, as well as the businesses that exist along this part of Anzac Parade.

The Todman Avenue stop would consist of a single 45-metre long, approximately 4.4-metre wide island platform in the centre of Anzac Parade. The stop would be accessed from the southern end of the platform via a new signalised pedestrian crossing at Todman Avenue.

An indicative section of the stop is shown in Figure 5.37 and an indicative plan of the stop is shown in Figure 5.38.

Figure 5.37 Indicative section – Todman Avenue stop
Figure 5.38 Indicative plan – Todman Avenue stop
UNSW Anzac Parade stop

The UNSW Anzac Parade stop would be located adjacent to the University Mall which is the main pedestrian axis through the UNSW campus. The stop would be positioned on the eastern side of Anzac Parade along the existing footpath to the university. The UNSW Anzac Parade stop would primarily serve the lower campus of UNSW and NIDA on the western side of Anzac Parade. It is anticipated this stop would be one of the busiest on the network due to its proximity to the university and resident student accommodation.

The stop would comprise an approximately 4.4-metre wide, 45-metre long central island platform adjacent to Anzac Parade and an approximately 3.2-metre wide, 45-metre long side platform adjacent to the university. It is anticipated that the side platform would be used primarily by the large numbers of students alighting during the morning peak period.

The design of the stop would maintain clear lines of sight from the University Mall, through a widened public forecourt, which would assist in integrating the UNSW Anzac Parade stop with the existing mall. The design of the stop would also allow for the reinstatement of a new, widened pedestrian footpath along the eastern side of Anzac Parade. The existing pedestrian crossing of Anzac Parade opposite the University Mall would be maintained as part of the proposal.

An indicative section of the stop is shown in Figure 5.39 and an indicative plan of this stop is shown in Figure 5.40.

Figure 5.39 Indicative section – UNSW Anzac Parade stop
Figure 5.40 Indicative plan – UNSW Anzac Parade stop
Strachan Street stop

The Strachan Street stop would be located within the commercial centre of Kingsford and would be positioned within the median of Anzac Parade to the south of the intersection of Strachan Street and Anzac Parade. The Strachan Street stop would serve the surrounding local residential catchment of Kingsford.

The Strachan Street stop would consist of a single 45-metre long, approximately 4.4-metre wide island platform in the centre of Anzac Parade. The stop would be accessed from the northern end via a new signalised pedestrian crossing at Strachan Street.

An indicative section of the stop is shown in Figure 5.41 and an indicative plan of the stop is shown in Figure 5.42.

Figure 5.41 Indicative section – Strachan stop
Figure 5.42 Indicative plan – Strachan Street stop
Kingsford stop

The Kingsford stop would be the final stop of the Kingsford branch and would provide a major bus and light rail interchange at this location. The Kingsford stop would not only serve the immediate catchment of Kingsford residential area, but would also serve interchanging passengers travelling to the CBD from buses originating south of Kingsford such as Maroubra Junction and La Perouse. The stop layout would allow for passengers interchanging from bus to light rail at dedicated split platforms for both the morning and afternoon peak periods.

Kingsford stop would provide two approximately 45-metre long, 6-metre wide central island platforms. The light rail tracks would be located on the outside portion of each of the two central island platforms. Between the two central island platforms, new bus lanes (northbound and southbound) would be provided to allow passengers to alight from buses onto the light rail platforms. This would provide for efficient transfer of passengers between transport modes at this location. New pedestrian crossings would also be provided between the Kingsford stop and the adjoining pedestrian footpaths along Anzac Parade via new pedestrian crossings at both the northern and southern ends of the stop. Appropriate wayfinding signage would be provided at the stop to indicate pedestrian movement options including access to other forms of transport, local shopping facilities and other facilities such as Souths Juniors.

Due to the existing topography of the proposed stop location, the Kingsford stop would include a split level design separated by a small retaining wall approximately one metre in height. This would allow the stop to meet the required cross fall for the platforms and comply with the requirements of the DDA. The location of the proposed stop would also result in the loss of some of the existing median parking to the immediate south of the existing Nine Ways intersection.

Associated changes to the public domain around the stop would also be undertaken including a revised Nine Ways intersection, the provision of signalised pedestrian crossings, and opportunities for improved public domain. These pedestrian crossings at the upgraded Nine Ways intersection would also be the primary pedestrian access point to the stop.

An indicative section of the stop is shown in Figure 5.43 and an indicative plan of the stop is shown in Figure 5.44.

Figure 5.43 Indicative section – Kingsford stop
Figure 5.44 Indicative plan – Kingsford stop
5.2.4 **George Street pedestrian zone**

The establishment of a pedestrian zone along George Street between Hunter Street and Bathurst Street is an important feature of the CSELR proposal. The George Street pedestrian zone would include approximately one kilometre of paved pedestrian zone shared with the proposed light rail along George Street. This would represent approximately 40 per cent of the total length of George Street between Circular Quay and Central Railway Station.

The George Street pedestrian zone would provide a distinct public domain environment for the CBD that would allow pedestrians to experience a quieter and less chaotic environment with more space to move around. Light rail vehicles would travel through the pedestrianised area at low speeds, limited to a maximum of approximately 20 kilometres per hour. The CSELR tracks would be highlighted by either a different material colour, finish, texture or size of paving, so that pedestrians can visually and texturally distinguish between the pedestrian zone and the CSELR track zone.

Permanent infrastructure associated with the CSELR proposal would be kept to a minimum and be as transparent as possible to maintain views through the pedestrian zone. This would include overhead wire-free operation of the light rail within this zone. Public domain furniture, landscaping and way-finding devices would also be provided within the George Street pedestrian zone. The final form and location of these features would be determined during the detailed design of the proposal.

Emergency vehicles, property owners and occupiers, resident delivery and maintenance trucks would retain access to existing driveways and laneways within the pedestrian zone 24-hours a day. Larger delivery vehicles would be permitted during restricted hours to be determined during the detailed design of the proposal.

Motorists would be able to travel in an east-west direction along all cross streets in the pedestrian zone, as well as other north-south streets within the CBD. These changes would reduce bus and traffic congestion, improve travel time reliability in the CBD and create pedestrian friendly streets, open spaces and revitalised public areas. Signalised pedestrian crossing facilities would be provided at each traffic intersection to provide controlled crossing points of the light rail alignment at these locations. This would also provide protection and improved amenity and accessibility for visually, hearing or mobility impaired pedestrians.

The pedestrianisation of part of George Street, in addition to the proposed light rail would also require significant changes to the way traffic operates along the route and within the CBD. These impacts are considered in more detail in section 5.2.6 and Chapter 12.

An indicative visualisation of the proposed George Street pedestrian zone is shown in Figure 5.45.
5.2.5 Bridges, tunnels and other structures

As described in section 5.2, the CSELR proposal would generally be located along existing streets within the CBD and South East suburbs of Sydney, and typically responds to the existing topography of these streets. However, the proposal would require two main structures within the Moore Park Precinct in order to cross the Eastern Distributor, the Moore Park playing fields and Anzac Parade. A substantial retaining wall structure is also required at Wansey Road. The works associated with these structures are described below.

**Eastern Distributor bridge**

As described in section 5.2.1, the CSELR would cross both the northbound and southbound lanes of South Dowling Street at-grade and bridge spanning over the Eastern Distributor. The bridge would carry two light rail tracks and a shared use pedestrian and cyclist pathway.

The proposed bridge would allow for a clearance of approximately 4.6 metres from the surface of the Eastern Distributor which is consistent with the existing minimum clearance along this roadway. To maximise the vertical clearance to the Eastern Distributor, whilst minimising the raised at-grade intersection of South Dowling Street, a bridge spanning approximately 25 metres is proposed.

The deck of the bridge would be constructed of concrete and would allow for the light rail tracks to be embedded into the deck slab so the bridge is trafficable for an emergency vehicle. Anti-throw screens would be required over the length of the bridge and the shared use path spanning the Eastern Distributor. Support columns for the proposed overhead wiring and other services would be secured to the main bridge structure. The final design and material choice of the bridge structure and the specifications for anti-throw screens would be determined during detailed design.
To provide for a minimum clearance of 4.6 metres over the Eastern Distributor (consistent with the existing pedestrian bridge to the south of the proposed route), some localised regrading would be necessary along South Dowling Street. This would occur both along the northbound traffic lanes and southbound traffic lanes, to tie in finished levels of the Eastern Distributor bridge. To accommodate this, the at-grade crossing of the intersection of the proposal and South Dowling Street would be raised by approximately 0.5 metres, in particular along the southbound traffic lane.

An indicative illustration of the proposed bridge structure is provided in Figure 5.46.

**Moore Park tunnel**

Immediately east of the proposed crossing of the Eastern Distributor, the CSELR would enter a tunnel through Moore Park. The tunnel would extend west under Anzac Parade and the adjacent busway. From this point, the route would start to rise to surface level approximately 80 metres north of the Moore Park stop. With the exception of the proposed road crossings, the proposed alignment would be located in generally open terrain between the two playing fields west of Anzac Parade once it has surfaced from the cut-and-cover tunnel. The section of tunnel under Anzac Parade would be a ‘mined’ tunnel.

The total length of the tunnel would be approximately 310 metres. The overall internal width of the tunnel would be approximately 10 metres. Emergency egress and maintenance access would be provided for along the outside of the tracks along the length of the tunnel. The LVRs would be powered by an overhead power supply through the tunnel. The final design of the Moore Park tunnel would be determined during detailed design.

The proposed tunnel would be designed to support ground water pressures and minimise water ingress. A drainage system would collect runoff and groundwater seepage into the tunnel and discharge it to the low points of the tunnel. Sumps would most likely pump the collected groundwater to a water treatment plant located at the surface near the western portal. The water would be treated to a quality standard suitable for discharge into the surrounding stormwater network.

Tunnel entrance/exit structures would also be provided at each end of the tunnel. For both the eastern and western portals, the tunnel entrance/exit structures would include retaining walls to minimise the impact to the land adjoining the tunnel. The tunnel entrances/exits would also include screens around each portal to prevent unauthorised access into the tunnel.

The tunnel would also include the following infrastructure and services:

- **lighting and signage** — Lighting and egress signage within the tunnel would be provided to meet current standards.
- **fire safety** — Fire safety measures may include a water main, fire hoses and remote and local fire alarms, which would be provided for fire detection purposes to meet current fire safety and engineering standards.
- **other services and equipment** — These would be positioned above the emergency access and maintenance walkway.

An indicative illustration of the proposed Moore Park tunnel structure (western portal) is provided in Figure 5.46 and an indicative cross-section of the tunnel is provided in Figure 5.47.
Figure 5.46 Eastern Distributor overbridge and western Moore Park tunnel portal

Figure 5.47 Indicative Moore Park tunnel cross-section

Note: Depth will vary.
Wansey Road stop retaining wall

The proposal would include a new retaining wall structure at the Wansey Road stop to replace the existing structure and provide additional structural support for the CSELR. The proposed retaining wall would have a maximum height of approximately 4.5 metres, with an average height of approximately 3.5 metres. The retaining wall would span approximately 125 metres between the existing Wansey Road driveway into the Royal Randwick racecourse complex and Alison Road. The extent and height of the retaining wall would be finalised during detailed design.

The proposed retaining wall would also allow for a cantilevered pedestrian walkway and cycleway to be attached to the retaining wall along the eastern side of the Wansey Road stop. This walkway would be designed to minimise impacts to existing trees within the Royal Randwick racecourse site.

An illustrative section of the proposed Wansey Road stop retaining wall structure and proposed pedestrian walkway and cycleway is provided in Figure 5.48.

Figure 5.48 Illustrative section through proposed Wansey Road stop retaining wall
5.2.6 Associated light rail infrastructure and services

Overhead wiring
The majority of the CSELR network would use poles and overhead wiring (OHW). A combination of centre poles (poles located towards the centre of the CSELR alignment, refer Figure 5.23) and side poles (poles located on either one or both sides of the alignment and/or adjoining streets, refer Figure 5.5) would be used along the alignment. The final configuration of poles would be determined during the detailed design in consultation with the relevant councils and other key stakeholders.

The OHW structure types would depend on specific site characteristics along the length of the CSELR proposal. Within the constrained CBD streetscape, the OHW structure types would be predominantly cross span wire attachments from side poles. Typically, it is not proposed to affix OHW fixtures to existing structures along the route of the CSELR proposal.

The CSELR tracks and other infrastructure would be earthed so as to minimise the risk of any potential earth leakage.

Overhead wire-free operation between Circular Quay and Town Hall stops
Overhead wire-free operation would be provided between the Circular Quay stop and the Town Hall stop, negating the need for overhead wires and poles for the power supply between these stops. This would provide for an improved public domain in the George Street pedestrian zone between Hunter Street and Bathurst Street.

Overhead charging units for part of the length of the 45-metre platforms would be necessary to charge any on-board LRV power storage at each stop within the wire-free zone including at the following stops:

• Circular Quay
• Grosvenor Street
• Wynyard
• Queen Victoria Building
• Town Hall.

If on-board power storage is used, this would be recharged while the LRV is at a stop. The system would also recover the braking energy using a regenerative braking system. The detailed design of the system would not preclude the addition of further lengths of wire-free operation should improved technology permit this in the future.
Power supply and substations

Electrical power supply for operation of the LRVs is required in the form of direct current (DC) power, which requires conversion of supply from the existing Ausgrid supply network. Twelve substations and one sectioning hut would be required for the CSEL proposal (inclusive of proposed substations within the Randwick stabling facility and the Rozelle maintenance depot).

The substations would provide 750-volt DC electricity supply and would require approximately 80 square metres for the building footprint and 250 square metres for the overall substation land take (to allow for maintenance access, crane access for equipment replacement, parking and security fencing). Some of the additional land take would be accommodated through shared on-street areas, such as loading zones. The substations would each be housed in buildings within a fenced site to ensure safety and security at the facilities and to minimise noise impacts on the surrounding environment. In some locations, such as in the CBD, the substations would be located below ground level to minimise their visual impact. Typical examples of the potential treatments for the substations are shown in Figure 5.49.

The energy demand for both wired and wire-free systems is similar. Further design development would be required during the detailed design process to ensure that any rapid charging at the charging points would not adversely impact on the existing Ausgrid supply network.

The proposed locations for each of the 12 substations have been identified throughout the corridor of the CSEL proposal. Potential locations are identified in Figure 5.1a to Figure 5.1h. Typically, each of the proposed substations would be located above-ground, except for substations at Martin Place and Ward Park which are proposed to be located below-ground.

The final locations would be refined during detailed design following further investigations.

Figure 5.49 Example substation treatments for above and below ground substations
Security and safety

CSELR stops would be lit and located in highly visible locations with passive and active security systems to provide reassurance and comfort to waiting customers. They would be designated non-smoking and would have shelter and seating provided appropriate for the expected customer wait times.

A number of security measures would be provided including:

- Closed circuit television (CCTV) cameras for passenger security and to deter vandalism. The CCTV system would provide a direct link between each stop and the operations control centre for the light rail network. It is envisaged that CCTV cameras would be provided at the following locations:
  - stops
  - the Moore Park tunnel
  - critical intersections
  - junctions and crossovers (unless they are visible from an adjacent stop camera)
  - substations
  - the proposed Randwick stabling facility and Rozelle maintenance depot
  - on-board the LRVs.

- An appropriate level of lighting would be provided to maximise passenger safety (at each stop, on stairways and on access paths) and to enable the operation of CCTV. Lighting levels would be determined during the detailed design development of each stop.

- An emergency telephone/help points and warning signs would be provided at each stop.

Crime prevention through environmental design (CPTED) principles have been considered in the design of the CSELR proposal, in particular the design of the stops. CPTED refers to the application of a range of design initiatives to a site, location or area to maximise crime prevention and minimise the potential for that site to facilitate and support criminal behaviour (SA Government, 2004). One of the outcomes of the proposal is ensure customers are safe and feel safe when using the light rail – approaching stops, on stops, on board LRVs and alighting from stops.

Stops have been designed to ensure visual connectivity along the whole platform and through to the surrounding streetscape, with safe lighting and CCTV coverage of the entire platform. A summary of how the CSELR proposal has considered the principles of CPTED, and the measures that have been implemented, is provided in Table 5.1.

<table>
<thead>
<tr>
<th>CPTED PRINCIPLE</th>
<th>HOW THE CSELR PROPOSAL HAS CONSIDERED CPTED PRINCIPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surveillance</td>
<td>The Design considers the use of passive and active methods of surveillance. Passive measures for the CSELR include:</td>
</tr>
<tr>
<td></td>
<td>• maintaining clear sight lines across platforms</td>
</tr>
<tr>
<td></td>
<td>• reducing clutter and creation of dark corners</td>
</tr>
<tr>
<td></td>
<td>• maintaining clear sight lines from stops to the surrounding streets/public domain areas</td>
</tr>
<tr>
<td></td>
<td>• ensuring stops are located within active streets and precincts</td>
</tr>
<tr>
<td></td>
<td>Active measures for the CSELR include:</td>
</tr>
<tr>
<td></td>
<td>• CCTV camera coverage at stops and integration with other systems where possible (eg City of Sydney)</td>
</tr>
<tr>
<td></td>
<td>• ensuring adequate street and stop lighting including pathways along the alignment</td>
</tr>
<tr>
<td></td>
<td>• coordinating street lighting with stop lighting to ensure consistent coverage</td>
</tr>
</tbody>
</table>
HOW THE CSELR PROPOSAL HAS CONSIDERED CPTED PRINCIPLES

<table>
<thead>
<tr>
<th>CPTED PRINCIPLE</th>
<th>HOW THE CSELR PROPOSAL HAS CONSIDERED CPTED PRINCIPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access control</td>
<td>• Access to stops is critical to the success and function of the CSELR. This also includes safe access from streets and the surrounding areas. Measures for the CSELR include:</td>
</tr>
<tr>
<td></td>
<td>• Ensuring stops are clear and legible to find, at street level without the need for obstructions of tunnels</td>
</tr>
<tr>
<td></td>
<td>• Designing out the need for fencing where possible – to avoid creation of areas where someone can be trapped</td>
</tr>
<tr>
<td></td>
<td>• Compliance with accessibility requirements to provide easy access</td>
</tr>
<tr>
<td></td>
<td>• All stops are located away from private property</td>
</tr>
<tr>
<td></td>
<td>• Throw screens are provided on the Eastern Distributor bridge and tunnel portals</td>
</tr>
<tr>
<td>Territorial reinforcement</td>
<td>The CSELR creates distinctly identifiable stops which are for the use of the public. This ensures stops are defined as safe public spaces. Measures for the CSELR include:</td>
</tr>
<tr>
<td></td>
<td>• Clear and identifiable branding and signage</td>
</tr>
<tr>
<td></td>
<td>• Notification of CCTV presence</td>
</tr>
<tr>
<td></td>
<td>• Designing out potential hiding spaces including obstruction of views</td>
</tr>
<tr>
<td></td>
<td>• Mezzanine level for the Moore Park stop reinforces clear and easy open access</td>
</tr>
<tr>
<td></td>
<td>• All stops and pathways are open in nature, and where landscaping exists or is proposed, does not obstruct views nor create hiding spots</td>
</tr>
<tr>
<td></td>
<td>• Maintaining sight lines</td>
</tr>
<tr>
<td>Space management</td>
<td>Spaces which are well managed and maintained enhance feelings of safety, reduce illegitimate use, and increase legitimate use. Measures for the CSELR include:</td>
</tr>
<tr>
<td></td>
<td>• All stops and pathways designed to provide an open plan design including adequate proximity between adjoining vegetation</td>
</tr>
<tr>
<td></td>
<td>• Mezzanine level for the Moore Park stop would assist in managing crowds during sporting or other large events</td>
</tr>
</tbody>
</table>

A full review and assessment in accordance with CPTED principles (which include surveillance, access control, territorial reinforcement and space management) would be undertaken for each stop and along the CSELR route during detailed design.

Other services

Utility infrastructure and services required along the CSELR alignment include the following:
• Cabling for communications systems (e.g. for CCTV system, emergency telephones/help points, public address, lifts, passenger information display systems (PIDS)), signalling and electrical supply for LRVs
• Cable paths (including access pits) for the above cabling
• Trackside signalling equipment (e.g. post-mounted signals, location cabinets, track circuits, points machines).

The CSELR proposal would provide a combined services route (CSR) which would provide the conduits and pits pathways for the CSELR system. This would include a number of conduits and pits dedicated to electrical, communications or signalling services. The CSR would be the essential pathway used to interface the rail system services to the stops, wayside equipment, Operations Control Centre and the tunnel equipment.

Utility infrastructure and services required at stops would include:
• Local power supply for stops (cabling, distribution boards, switchboards), lifts, lighting, signage, CCTV system, public address, ticketing and security systems
• Water supply for cleaning activities and staff toilets
• Operator amenities at terminating stops including toilets and crew sheds.

Conduits for ‘third party’ services may also be installed along and across the CSELR alignment during construction. Transport for NSW would collaborate with the City of Sydney and other stakeholders to ensure utility works align with the project works program for Sustainable Sydney 2030 (City of Sydney 2008) and also include appropriate provisions to facilitate the City of Sydney’s requirements. This would reduce the risk of future underground services requiring works
that may impact the operation of the CSELR and would assist in meeting Transport for NSW’s sustainability objectives for the delivery of the CSELR proposal (refer Chapter 7).

The design, location and provision for these services would be determined during detailed design.

5.2.7 Road configuration changes

The CSELR proposal would be integrated within the existing surface street environment and would require a number of significant changes to the way in which the existing road network operates. The proposed changes to the existing road network required to accommodate the introduction of light rail have been developed with an overarching objective to maximise transport system performance and deliver the best outcome for the community as a whole.

The CSELR proposal would result in a series of key road network changes within the CBD and South East including:

- the creation of a pedestrianised zone between Loftus and Pitt streets
- conversion of Pitt Street to two-way operation between Bridge and Alfred streets
- addition of a turning circle at the northern terminus of Pitt Street and Loftus Street
- conversion of Hunter Street between Pitt and George streets to two-way operation providing enhanced connectivity to the east and west
- the creation of a pedestrian zone along George Street between Hunter Street and Bathurst Street
- construction of a bus-light rail interchange in Rawson Place facilitating cross-platform interchange between bus and light rail for a significant number of customers travelling south-west of Railway Square along Broadway
- construction of the light rail line in the kerbside lane in Eddy Avenue and closure of Rawson Place to general traffic, which would require the relocation of existing coach facilities to a dedicated 4.5-metre wide island coach platform accessed (by coaches) from the existing Eddy Avenue traffic lanes
- modifications to Devonshire Street in Surry Hills including:
  - provision of a single eastbound traffic lane
  - limitation of right-turn movements for vehicles travelling eastbound along Devonshire Street wishing to head south to Elizabeth Street and Crown Street only
  - closure of a number of intersecting streets along Devonshire Street including Buckingham Street, Holt Street, Clisdell Street, Waterloo Street and High Holborn Street
  - removal of all current parking provisions along Devonshire Street
  - signalisation of the intersection of Devonshire Street and Marlborough Street
  - signalisation of the intersection of Devonshire Street and Bourke Street
  - reinstatement of the Adelaide Street connection between Waterloo Street and Riley Road
  - introduction of a westbound service lane connection between Bourke Street and Crown Street
  - removal of some footpath and outside dining space at the intersection of Devonshire Street and Bourke Street
- restriction of city-bound traffic to two through-lanes along Alison Road adjacent to the Darley Road/Alison Road intersection
- modification to the operation of High Street including:
  - introduction of traffic signals at the intersection of High Street and Hospital Road, as well as the intersection of High Street and Clara Street
  - consolidation of the entrance to the Prince of Wales hospital to a four-way intersection at Clara Street
  - restriction of access to Eurimbla Avenue to left in, left out
  - provision for indented bus bays for westbound buses on High Street adjacent to the Prince of Wales Hospital and between Botany Street and Wansey Road (within the UNSW site)
  - relocation of the westbound bus stop adjacent to the Sydney Children’s Hospital emergency entrance to Clara Street, with access to the hospital via a signalised intersection
• permitted right-turn locations from Anzac Parade south of Alison Road to the Nine-Ways intersection to be restricted in the future to:
  – southbound right-turns into Dacey Avenue
  – southbound and northbound right-turns into Todman Avenue
  – northbound right-turns into High Street
  – southbound and northbound right-turns into Barker Street
  – reconstruction and reconfiguration of the existing Nine Ways intersection.

Further details regarding the proposed traffic access management changes resulting from the CSELR proposal are provided in Chapters 12 to 16 (refer Volume 1b) and Technical Paper 1 (refer Volume 2).

5.2.8 Public domain

Revitalisation of the public domain

As described in Chapter 4, one of the key urban design objectives of the CSELR proposal is to create an improved public domain (refer to Figure 4.1). As part of the improvement of the public domain, three main urban typologies have been identified for the proposal corridor. These typologies have been previously discussed in Chapter 4 of this EIS.

During construction, some areas of the public domain would be impacted as a result of the construction of the CSELR. These include areas such as Alfred Street, George Street, Ward Park, Wimbo Park, Devonshire Street, Moore Park East, and High Cross Park. During construction, limited opportunities for revitalisation of these areas would occur; however sequencing of construction activities would be managed to ensure that impacts on public spaces are minimised. Where possible, construction works would also be sequenced to allow for progressive opening of upgraded public domain areas.

Clear signage around construction compounds utilising open spaces or other public domain areas would be provided advising of the project, timing, access arrangements and contact details for complaints. Alternate spaces would also be considered that could substitute for the use of public space required for the construction of the CSELR. Further potential impacts and the proposed mitigation measures during construction are detailed in each of the precinct chapters in Chapters 12 to 17.

Following construction of the CSELR, areas of the public domain and other public spaces utilised or impacted during the construction of the proposal would be reinstated and opportunities for revitalisation of public open spaces the public domain would be identified. Revitalisation of the public spaces and the public domain along the CSELR alignment would be undertaken in accordance with the strategies identified in Table 4.1 of this EIS, which detailed the proposed functional and urban form requirements for each of the three main alignment typologies identified across the proposal corridor.

Areas of potential revitalisation of the public domain and existing public spaces would include:
• reinstatement and improvement of the existing plaza around Alfred Street at Circular Quay with reference to the Circular Quay Strategic Framework (Sydney Harbour Foreshore Authority, August 2013)
• provision of the George Street pedestrian zone between Hunter Street and Bathurst Street
• reinstatement of Ward Park
• creation of a revitalised Wimbo Park within the current site of the Olivia Gardens apartment complex
• reinstatement of the Moore Park East playing fields
• provision of a new public domain which integrates with the light rail interchanges and surrounding urban development at Randwick and Kingsford.
Ongoing consultation with the City of Sydney Council, Randwick City Council and other relevant stakeholders would continue to be undertaken throughout the detailed design phase to identify opportunities for revitalisation of existing public spaces and the public domain and to determine the most appropriate form or revitalisation for these areas.

**Public art**
While a minor part of the project, there is potential for a public art strategy to be integrated into the CSELR corridor, incorporating the light rail, the George Street pedestrian zone and other adjacent public spaces throughout the proposal corridor. It is anticipated that the development of public art strategies would be led by the City of Sydney and Randwick City councils for respective areas along the proposal alignment. Transport for NSW would work with each council and other relevant stakeholders during the detailed design of the proposal. The design of the CSELR proposal would not preclude the development of public art in appropriate locations.

### 5.2.9 Street trees
Approximately 760 existing street trees would be required to be removed as part of the construction and for the operation of the CSELR proposal. This would include significant trees along Alison Road, Wansey Road, Devonshire Street and High Cross Park. Further details regarding the proposed impact of the CSELR proposal on existing street trees and the proposed mitigation strategies, including tree replacement strategies for each of the precincts, are provided in Chapters 12 to 17 in Volume 1b of this EIS.

### 5.2.10 Stabling and maintenance facilities
The proposal would require a stabling facility in Randwick to provide safe and secure storage of the LRVs and undertake some minor cleaning of LRVs. The Rozelle maintenance depot would provide facilities for the efficient inspection and cleaning of LRVs and for their regular maintenance. These are described in turn below.

**Randwick stabling facility**
The CSELR would include a purpose built stabling yard for the storage of the LRVs. The proposed stabling yard would be located on a privately-owned site adjacent to the current Royal Randwick racecourse site within the Randwick Precinct (refer to Figure 5.1e). The site is located on a parcel of land that backs properties facing Doncaster Avenue and the western entrance to Royal Randwick racecourse. The proposed stabling site is generally triangular in shape with a boundary length of approximately 400 metres and a street frontage to Alison Road of approximately 135 metres. The site is currently used for informal parking and contains a number of buildings that are currently not used. These buildings would be demolished as part of the proposal.

The Randwick stabling facility would be used:
- to temporarily store or retain LRVs overnight to return LRVs to service as is
- for LRV inspection and cleaning (including wash plant)
- for light maintenance or repair work, including vehicle sanding (topping up the sand boxes within the LRVs for use on wet/slippery tracks).

A staff facilities building would also be provided, which would house the staff required for the stabling yard operations, as well as the operational control centre for the light rail network and the head office for the light rail operator. Parking for up to 94 cars/private vehicles for staff and visitor use would also be provided within the site.

In addition to a light maintenance building, infrastructure storage areas would be provided for equipment associated with maintenance of the light rail network. LRV infrastructure maintenance vehicles and LRV emergency recovery vehicles would also be provided for at the stabling facility.

The stabling track layout has been configured to provide access to the Randwick branch of the CSELR, providing an entry/exit point along Alison Road following the crossing of Alison Road to the east of Doncaster Avenue. The yard configuration has adopted a single LRV entry/exit point to the stabling yard.
An access road would be provided through the site to the staff facilities building and car park, as well as to designated unloading and storage areas, the wash and sand plants, the light maintenance building and the stabling tracks.

The proposed indicative layout of the Randwick stabling facility is shown in Figure 5.50 with an indicative section provided as Figure 5.52. Note: The option of constructing a noise wall and/or acoustic shed at the facility to mitigate potential noise impacts on adjacent residences is discussed in Chapter 15 (section 15.5).

Figure 5.50 Randwick stabling facility - indicative layout

**Rozelle maintenance depot**

The Rozelle maintenance depot site is located at the western end of the existing Inner West Light Rail network in the suburb of Lilyfield. LRVs would access the proposed Rozelle maintenance depot from the CSELR light rail corridor via the existing light rail line between Lilyfield and Central via Pyrmont (refer to Figure 1.2). The depot would provide facilities for maintenance of LRVs for the light rail network. The maintenance depot configuration would provide a single track entry/exit, with a connection to existing Inner West Light Rail line, west of the existing Catherine Street overbridge. It is estimated that there would be approximately four LRV movements per day into and out of the maintenance depot. Further discussion regarding the integration of the existing Inner West Light Rail line with the proposed CSELR is provided in section 5.4.5.

The maintenance depot site is generally rectangular in shape with a boundary length along Lilyfield Road of approximately 370 metres and a maximum width of approximately 120 metres at the eastern end of the facility. The northern half of site currently includes industrial uses and contains a series of large warehouse buildings. These buildings would be required to be demolished as part of the proposal.

The maintenance facilities would consist of maintenance inspection roads with a two-storey maintenance building, workshops and storage. The maintenance facilities would be positioned within the overall maintenance depot to provide general maintenance activities and bogie/underframe inspections of the LRVs. The maintenance workshop would be integrated with the main maintenance building. The maintenance inspection roads would allow for inspection via an under floor pit, and inspection at roof level from elevated walkways, a wheel lathe, paint shop and crane lifting facilities.
Additional staff facilities would also be provided within the maintenance building. This would house offices and staff amenities. Parking for up to 46 staff and visitor vehicles would also be provided within the site. In addition to the maintenance building, infrastructure storage areas would be provided for equipment associated with maintenance of the light rail network. This would include storage for track, OHW and signalling infrastructure as well as spare bogies and storage for ancillary vehicles, such as forklifts and bogie trolleys. LRV infrastructure maintenance vehicles and LRV emergency recovery vehicles would also be provided for at the depot.

An access road would be provided around the perimeter of the site, which would provide access to all areas of the maintenance depot. Access would be maintained to other existing uses adjoining the maintenance depot. As part of the construction of the Rozelle maintenance depot, the existing buildings and sheds within the site would be demolished and replaced with the proposed main building as shown in Figure 5.51. The layout of the Rozelle maintenance depot is shown in Figure 5.51 with a section provided as Figure 5.53.

As part of the development of the Rozelle maintenance depot, amendment of the proposed Sydney Metro stabling and maintenance facility boundary would be required. The proposed amendment to the Sydney metro boundary is shown on Figure 17.3 in chapter 17.

Figure 5.51 Rozelle maintenance depot - indicative layout
Figure 5.52 Indicative section – Randwick stabling facility

[Diagram with labels: Access road, Buffer planting, Light rail tracks, Wash facility, Buffer planting, Loading and unloading zone, City West Link, Buffer planting, Stabling zone, Adjoining residential]

Figure 5.53 Indicative section – Rozelle maintenance depot

[Diagram with labels: City West Link, Access road, Buffer planting, Depot facilities, Loading and unloading zone, Buffer planting, Access road, Buffer planting, Road]
5.2.11 Utilities and services

Utility investigations to date include dial-before-you-dig enquiries in December 2011 and September 2012 field inspections and detailed survey to ascertain the location of existing utility services along the length of the CSELR.

A large number of utilities are located along the CSELR route. The types of utilities with the potential to be affected include:

- power
- telecommunications (above and below ground)
- water supply
- waste water (sewerage)
- stormwater
- secondary gas mains
- CCTV and Early Warning Systems
- City of Sydney and Randwick City street lighting
- Roads and Maritime Services (RMS) traffic lights and traffic monitoring equipment
- Sydney Trains power and communications.

Underground and aerial utilities in the Sydney area have a substantial footprint and interface with existing road, bus and rail infrastructure as well as areas of parkland (trees). Augmentation and/or relocation of a range of utility services would be required as a result of the proposal at a range of locations to accommodate changes in level between the existing and proposed infrastructure.

A series of underground utility assessments have been undertaken along the CSELR alignment to date. Additionally, a number of meetings have been held with relevant utility authorities to identify potentially affected services and commence the identification of potential management strategies. Utility organisations consulted are detailed in Chapter 2 (section 2.4.5).

Further detailed underground utilities detection surveys and consultation with utility service providers would be undertaken during the detailed design stage of the proposal. Detailed design would also consider maintenance access to existing utilities during construction and operation of the proposal. Further discussion of the proposed impacts and proposed strategy for the management of impacts to utilities as a result of the CSELR proposal is provided in section 10.8.

5.3 Property acquisition

The permanent footprint of the proposal would be largely within existing road reserves. However, some permanent property acquisition would be required to facilitate construction of the CSELR proposal. Additionally, some areas of land would need to be temporarily leased during the construction of the proposal for site compounds and other work sites.

Table 5.2 summarises the indicative permanent land acquisition for the CSELR proposal and Table 5.3 summarises the indicative temporary work site locations that would be leased to construct the proposal. The proposed locations and description of land uses are indicative and based on the current design, which is subject to change and refinement during the detailed design stage of the CSELR proposal. The proposed locations of the indicative temporary and permanent acquisitions and/or leased areas are shown on the land use figures within Chapters 12 to Chapter 16.
### Table 5.2 Permanent land acquisitions

<table>
<thead>
<tr>
<th>PRECINCT</th>
<th>LOCATION</th>
<th>DESCRIPTION OF EXISTING LAND USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>City Centre</td>
<td>Off George Street and Hay Street</td>
<td>Existing commercial property</td>
</tr>
<tr>
<td></td>
<td>Off Elizabeth Street and Eddy Avenue</td>
<td>Sydney Trains property – land reserve</td>
</tr>
<tr>
<td></td>
<td>Chalmers Street near Devonshire Street</td>
<td>Sydney Trains property – land reserve</td>
</tr>
<tr>
<td>Surry Hills</td>
<td>Devonshire Street at Surry Hills stop</td>
<td>Ward Park and part of neighbouring private property</td>
</tr>
<tr>
<td></td>
<td>Bourke Street near Devonshire Street</td>
<td>Wimbo Park</td>
</tr>
<tr>
<td></td>
<td>Existing apartment building on Olivia Lane, Surry Hills (Olivia Gardens)</td>
<td>Private property</td>
</tr>
<tr>
<td></td>
<td>Between South Dowling Street and Parkham Place</td>
<td>Car park</td>
</tr>
<tr>
<td>Moore Park</td>
<td>Off South Dowling Street</td>
<td>Centennial Park and Moore Park Trust land</td>
</tr>
<tr>
<td>Randwick</td>
<td>Off Alison Road</td>
<td>Private property Australian Turf Club (ATC) property</td>
</tr>
<tr>
<td></td>
<td>Off Alison Road – proposed stabling facility</td>
<td>Mixed (ATC property and private)</td>
</tr>
<tr>
<td></td>
<td>Off Alison Road</td>
<td>ATC property – west of Royal Randwick racecourse stop</td>
</tr>
<tr>
<td></td>
<td>Off Alison Road</td>
<td>ATC property – Royal Randwick racecourse stop</td>
</tr>
<tr>
<td></td>
<td>Off Alison Road</td>
<td>ATC property – east of Royal Randwick racecourse stop along Alison Road</td>
</tr>
<tr>
<td></td>
<td>Off Wansey Road</td>
<td>ATC property</td>
</tr>
<tr>
<td></td>
<td>Between Avoca Street, Cuthill Street and Belmore Road</td>
<td>Randwick City Council reserve</td>
</tr>
<tr>
<td>Kensington and Kingsford</td>
<td>Off Anzac Parade</td>
<td>Centennial Park and Moore Park Trust land</td>
</tr>
<tr>
<td>Rozelle</td>
<td>Off Lilyfield Road</td>
<td>Existing commercial/industrial properties</td>
</tr>
</tbody>
</table>

### Substations

<table>
<thead>
<tr>
<th>PRECINCT</th>
<th>LOCATION</th>
<th>DESCRIPTION OF EXISTING LAND USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>City Centre</td>
<td>Circular Quay substation</td>
<td>City of Sydney Council land reserve or underground but would require an easement in public area (proposed near Harrington Street)</td>
</tr>
<tr>
<td></td>
<td>Martin Place substation</td>
<td>Underground but would require an easement in public area</td>
</tr>
<tr>
<td></td>
<td>Parker Lane substation</td>
<td>Existing laneway</td>
</tr>
<tr>
<td></td>
<td>Chalmers Street substation</td>
<td>Sydney Trains property</td>
</tr>
<tr>
<td>Surry Hills</td>
<td>Ward Park substation</td>
<td>Ward Park/open space</td>
</tr>
<tr>
<td>Moore Park</td>
<td>Kensington substation</td>
<td>Centennial Park and Moore Park Trust land</td>
</tr>
</tbody>
</table>
### Table 5.2 cont.

<table>
<thead>
<tr>
<th>PRECINCT</th>
<th>LOCATION</th>
<th>DESCRIPTION OF EXISTING LAND USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Randwick</td>
<td>Royal Randwick racecourse substation</td>
<td>ATC property</td>
</tr>
<tr>
<td></td>
<td>Randwick maintenance depot substation</td>
<td>ATC property</td>
</tr>
<tr>
<td></td>
<td>High Street</td>
<td>ATC property</td>
</tr>
<tr>
<td></td>
<td>Randwick stop substation</td>
<td>Randwick City Council land reserve</td>
</tr>
<tr>
<td>Kensington and Kingsford</td>
<td>Abbotsford Street sectioning hut</td>
<td>Council land reserve</td>
</tr>
<tr>
<td></td>
<td>Anzac Parade substation</td>
<td>Within road reserve – no land acquisition required</td>
</tr>
</tbody>
</table>

### Table 5.3 Temporary leases for construction

<table>
<thead>
<tr>
<th>PRECINCT</th>
<th>LOCATION</th>
<th>DESCRIPTION OF EXISTING LAND USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>City Centre</td>
<td>Off Alfred Street at Circular Quay</td>
<td>Near First Fleet Park – incorporates Circular Quay substation</td>
</tr>
<tr>
<td></td>
<td>Off Hay Street</td>
<td>Existing commercial property – substation construction site requirements</td>
</tr>
<tr>
<td></td>
<td>Off Eddy Avenue</td>
<td>Belmore Park – site compound</td>
</tr>
<tr>
<td></td>
<td>Chalmers Street near Devonshire Street</td>
<td>Sydney Trains property – substation construction site requirements</td>
</tr>
<tr>
<td>Surry Hills</td>
<td>Devonshire Street at Surry Hills stop</td>
<td>Ward Park – site compound</td>
</tr>
<tr>
<td></td>
<td>Bourke Street near Devonshire Street</td>
<td>Wimbo Park – work site</td>
</tr>
<tr>
<td>Moore Park</td>
<td>Off South Dowling Street</td>
<td>Moore Park – tunnel construction area</td>
</tr>
<tr>
<td></td>
<td>Off South Dowling Street</td>
<td>Moore Park – site compound</td>
</tr>
<tr>
<td></td>
<td>Within Moore Park</td>
<td>Site compound – diaphragm wall compound</td>
</tr>
<tr>
<td></td>
<td>Off Anzac Parade</td>
<td>Sydney Cricket Ground Trust Land – site compound and tunnel construction areas</td>
</tr>
<tr>
<td></td>
<td>Off Anzac Parade</td>
<td>Randwick City Council land reserve – work site</td>
</tr>
<tr>
<td>Randwick</td>
<td>Off Alison Road</td>
<td>Laydown area (within permanent land take)</td>
</tr>
<tr>
<td></td>
<td>Off Alison Road</td>
<td>Site compound area (within permanent land take)</td>
</tr>
<tr>
<td></td>
<td>Off Alison Road</td>
<td>Royal Randwick racecourse – work site</td>
</tr>
<tr>
<td></td>
<td>Off Wansey Road</td>
<td>Royal Randwick racecourse – work site</td>
</tr>
<tr>
<td>Kensington and Kingsford</td>
<td>UNSW at Anzac Parade</td>
<td>UNSW property – work site</td>
</tr>
<tr>
<td></td>
<td>Anzac Parade at Nine Ways</td>
<td>Randwick City Council land reserve – work site</td>
</tr>
</tbody>
</table>
5.3.1 Subdivision

The CSELR proposal involves the subdivision of private and public land. In some cases, whole lots will be acquired to avoid creating small unusable lots. In seeking SSI approval, Transport for NSW is also, where relevant seeking approval for subdivision of all lots acquired to construct the proposal.

Where a part of any lot is identified as being surplus to operational requirements or requiring boundary adjustment following the completion of construction, detailed Deposited Plans of subdivision would be developed and lodged at Land and Property Information NSW for the subdivision of such land.

Note: Transport for NSW is a subdivision authority under the provisions of section 109D of the EP&A Act.

5.4 Operation of the proposal

The CSELR would have the capacity to move up to 9,000 people per hour in each direction, with up to 300 passengers per LRV. For special events at Moore Park, two light rail vehicles may be joined together to move higher volumes of people. Special event services may also be implemented for Royal Randwick racecourse events.

By 2021, users of the CSELR are expected to make approximately 14,000 trips in both directions in the morning peak hour (shortly after opening). Of these:

- 20 per cent are expected to interchange from rail
- 51 per cent are expected to interchange from bus and ferry
- 29 per cent are expected to walk up from the surrounding area.

It is currently proposed to operate the light rail under a public-private partnership (PPP) structure. Key features of the CSELR’s proposed operations are described below.

5.4.1 Light rail vehicles (LRVs)

The existing light rail system operates with a total fleet of seven LRVs with six additional LRVs proposed to be added to this fleet with the completion of the Inner West Light Rail Extension (currently under construction). The LRVs that operate on this network are Variotrams manufactured by Bombadier, a European design adapted for use in Sydney. These vehicles provide a vehicle length of approximately 30 metres and a capacity of approximately 70 seated and 130 standing passengers.

For the proposed CSELR network, an increased capacity would be required. A range of LRV types are available for operation. The proposed vehicle specifications for the CSELR proposal would include LRVs of approximately 45 metres in length with a capacity of approximately 300 people. The LRVs would be low floor, air conditioned, well lit, with adequate grab rails and handles positioned for standing passengers. Signage within the LRVs would designate wheelchair areas, priority seating areas and emergency procedures.

To accommodate the proposed service frequency for the CSELR at the commencement of operations, approximately 26 LRVs would be operated along the CSELR route with an additional four spare LRVs available for use if required and to rotate into service during maintenance of the other LRVs. The new vehicles would be procured using proven ‘off the shelf’-type rolling stock technologies. The rolling stock would be standard full, low-floor design LRVs with overhead traction power similar to the existing fleet. Each of the LRVs would also contain technology to allow them to operate without overhead wires in certain locations, such as the proposed wire-free zone between Hunter Street and Bathurst Street.

The LRVs would be equipped with modern passenger surveillance and communication systems and would have full disability access provisions (refer to section 5.4.10).

The key specifications identified for the proposed CSELR LRVs are summarised in Table 5.4.
Table 5.4 Typical rolling stock specifications

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle capacity (minimum)</td>
<td>300 (approximately 80 seated and 220 standing passengers)</td>
</tr>
<tr>
<td>Vehicle length</td>
<td>45 metres (approximately)</td>
</tr>
<tr>
<td>Design vehicle height</td>
<td>Approximately 3.6 metres (excluding pantograph)</td>
</tr>
<tr>
<td>Number of passenger decks</td>
<td>Single</td>
</tr>
<tr>
<td>Nominal height of floor above rail</td>
<td>350 to 360 millimetres (approximately)</td>
</tr>
<tr>
<td>Door configuration</td>
<td>Six double doors and two single doors per side of the LRV</td>
</tr>
<tr>
<td></td>
<td>Near level boarding any door – wheelchair access at nominated double doors</td>
</tr>
<tr>
<td>Driver positions</td>
<td>A driver cab at each end</td>
</tr>
<tr>
<td>Door entry height</td>
<td>300 millimetres (approximately)</td>
</tr>
<tr>
<td>Vehicle width</td>
<td>Approximately 2.7 metres (maximum)</td>
</tr>
<tr>
<td>Maximum speed</td>
<td>70 kilometres per hour</td>
</tr>
</tbody>
</table>

**Track sanding**

The LRVs to be used for the CSELR proposal would utilise sand to gain traction in slippery conditions, when required. The LRV would automatically spray a small amount of sand in front of the wheels to help it gain better traction. The tram sand boxes would be filled at the Randwick stabling facility as required at the end of each shift.

**5.4.2 Light rail services**

**Service routes**

The CSELR proposal comprises the operation of a light rail service along two service routes between Circular Quay and Randwick (via Royal Randwick racecourse) and Circular Quay and Kingsford (via Anzac Parade) (refer to Figure 1.2). For the CSELR services south of Moore Park, services for routes to Kingsford and Randwick would alternate throughout the day, according to demand.

The CSELR proposal would integrate with the Sydney Trains rail network, Sydney Ferries system and Sydney bus networks, and providing a range of interchange opportunities with each of these existing services (refer to section 5.4.6).

**Hours of operation**

On a typical operational day, the light rail would generally operate between 5.00 am and 1.00 am, seven days a week. These operating hours would be adjusted, if required, to cater for special events and/or to integrate with other public transport operations. The CSELR proposal would provide a ‘turn up and go’ service every two to three minutes during peak periods (between 7.30 am and 9.30 am and between 5.00 pm and 7.00 pm) within the CBD. The service frequency for both opening (2021) and future (2036) operations is summarised in Table 5.5. The CSELR proposal would initially operate with a three minute interval between LRVs. However, the proposal’s design capacity would allow for a service frequency with two minute intervals between LRVs when required.

The indicative overall daytime and night-time LRV numbers (i.e. the number of light rail movements per day) are also shown in Table 5.6.
Table 5.5 Indicative interval between LRV services (minutes)

<table>
<thead>
<tr>
<th>TIME OF DAY</th>
<th>CBD/SURRY HILLS/ MOORE PARK</th>
<th>KENSINGTON/ KINGSFORD</th>
<th>RANDWICK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Opening</td>
<td>Future</td>
<td>Opening</td>
</tr>
<tr>
<td>10.00pm to 7:30am</td>
<td>10</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>7:30am to 9:30am</td>
<td>3</td>
<td>2.5</td>
<td>6</td>
</tr>
<tr>
<td>9:30am to 5:00pm</td>
<td>4</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>5:00pm to 7:00pm</td>
<td>3</td>
<td>2.5</td>
<td>6</td>
</tr>
<tr>
<td>7:00pm to 10:00pm</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

Note 1: Service frequency based on Thursday/Friday/Saturday evenings when frequencies will be highest.

Note 2: The light rail would not operate between 1.00 am and 5.00 am. Between this time, a small number of LRV movements would occur to allow light rail vehicles to move to the Randwick stabling facility or the Rozelle maintenance depot and would allow for maintenance of the network as required.

Table 5.6 Indicative LRV services by period (total vehicles)

<table>
<thead>
<tr>
<th>SCENARIO</th>
<th>LOCATION</th>
<th>DAY (7AM TO 10PM)</th>
<th>NIGHT (10PM TO 7AM)</th>
<th>HOURLY MAXIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>INBOUND</td>
<td>OUTBOUND</td>
<td>INBOUND</td>
</tr>
<tr>
<td>At opening</td>
<td>CBD/Surry Hills/Moore Park</td>
<td>232</td>
<td>232</td>
<td>30</td>
</tr>
<tr>
<td>(2021)</td>
<td>Kensington/Kingsford</td>
<td>116</td>
<td>116</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Randwick</td>
<td>116</td>
<td>116</td>
<td>15</td>
</tr>
<tr>
<td>Future</td>
<td>CBD/Surry Hills/Moore Park</td>
<td>264</td>
<td>264</td>
<td>30</td>
</tr>
<tr>
<td>(2036)</td>
<td>Kensington/Kingsford</td>
<td>132</td>
<td>132</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Randwick</td>
<td>132</td>
<td>132</td>
<td>15</td>
</tr>
</tbody>
</table>

During periods of high demand, such as sporting events and concerts, a special event service would operate as a separate shuttle service every few minutes between Central Railway Station and the Moore Park stop or Royal Randwick racecourse stop, before and after events. Special event services would be in addition to normal scheduled services.

Should demand require it, the Central Station stop to Moore Park stop service could include two LRVs joined together to form a 90-metre LRV with special event services running in combination with regular services at a frequency of up to every 2.5 minutes.

Special event timetables to meet the demand of events at Royal Randwick racecourse, Moore Park, the city centre, and other major events would be developed and implemented during operation of the proposal as required. Indicative travel times between each of the stops along the CSELR route are shown in Table 5.7 and Table 5.8.
Table 5.7 Approximate cumulative run time (minutes) from/to Randwick stop

<table>
<thead>
<tr>
<th>STOP</th>
<th>NORTHBOUND</th>
<th>SOUTHBOUND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circular Quay</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>Grosvenor Street</td>
<td>28</td>
<td>2</td>
</tr>
<tr>
<td>Wynyard</td>
<td>26</td>
<td>3</td>
</tr>
<tr>
<td>Queen Victoria Building</td>
<td>24</td>
<td>7</td>
</tr>
<tr>
<td>Town Hall</td>
<td>22</td>
<td>9</td>
</tr>
<tr>
<td>World Square</td>
<td>21</td>
<td>10</td>
</tr>
<tr>
<td>Chinatown</td>
<td>20</td>
<td>11</td>
</tr>
<tr>
<td>Rawson Place</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td>Central Station</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Surry Hills</td>
<td>13</td>
<td>19</td>
</tr>
<tr>
<td>Moore Park</td>
<td>10</td>
<td>23</td>
</tr>
<tr>
<td>Royal Randwick racecourse</td>
<td>6</td>
<td>26</td>
</tr>
<tr>
<td>Wansey Road</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td>UNSW Upper Campus</td>
<td>2</td>
<td>31</td>
</tr>
<tr>
<td>Randwick</td>
<td>0</td>
<td>34</td>
</tr>
</tbody>
</table>

Note 1: Approximate cumulative run time. Travel times are an average of running times and take into account external influences including traffic signalling and road speed limits.

Table 5.8 Approximate cumulative run time (minutes) from/to Kingsford stop

<table>
<thead>
<tr>
<th>STOP</th>
<th>NORTHBOUND</th>
<th>SOUTHBOUND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circular Quay</td>
<td>32</td>
<td>0</td>
</tr>
<tr>
<td>Grosvenor Street</td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>Wynyard</td>
<td>29</td>
<td>3</td>
</tr>
<tr>
<td>Queen Victoria Building</td>
<td>26</td>
<td>7</td>
</tr>
<tr>
<td>Town Hall</td>
<td>24</td>
<td>9</td>
</tr>
<tr>
<td>World Square</td>
<td>23</td>
<td>10</td>
</tr>
<tr>
<td>Chinatown</td>
<td>22</td>
<td>11</td>
</tr>
<tr>
<td>Rawson Place</td>
<td>20</td>
<td>13</td>
</tr>
<tr>
<td>Central Station</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>Surry Hills</td>
<td>15</td>
<td>19</td>
</tr>
<tr>
<td>Moore Park</td>
<td>12</td>
<td>23</td>
</tr>
<tr>
<td>Carlton Street</td>
<td>8</td>
<td>26</td>
</tr>
<tr>
<td>Todman Avenue</td>
<td>7</td>
<td>27</td>
</tr>
<tr>
<td>UNSW Lower Campus</td>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td>Strachan Street</td>
<td>1</td>
<td>33</td>
</tr>
<tr>
<td>Kingsford</td>
<td>0</td>
<td>34</td>
</tr>
</tbody>
</table>

Note 1: Approximate cumulative run time. Travel times are an average of running times and take into account external influences including traffic signalling and road speed limits.
LRV speeds

Generally LRVs would operate within the existing posted road speeds except for the sections of the proposed CSELR route within the George Street pedestrianised zone or where LRVs are within a dedicated corridor. In the pedestrianised section of George Street, LRVs would be limited to a maximum speed of around 20 kilometres per hour. Speeds in the dedicated corridor sections would be up to a maximum of 70 kilometres per hour.

5.4.3 LRV road network integration

An essential feature of the CSELR proposal is the operation of LRVs within the road network. The safe interaction of LRVs with other road users has been a major consideration of the design development to date. Furthermore, this interaction influences the overall journey time and service reliability.

A key feature of the CSELR proposal is that, for the majority of the proposed route, LRVs would operate within an exclusive right-of-way. This provides an operating environment that is both safe and free from the adverse effects of road congestion. However, at intersections and at a limited number of other locations, LRVs would share the right-of-way with other road users.

It is proposed that LRVs would progress through intersections under signal control. Traffic signals would be designed to detect the approach of an LRV in sufficient time to activate a (‘call’) green signal for the LRV as it approaches the intersection. The traffic light controller would ensure that other conflicting movements (i.e. cross roads and pedestrian crossings) face red or stop signals. The design intent is for LRVs to be able to proceed through all intersections with minimal delay.

However, the design of each intersection would have regard to all road users and the overall performance of the transport network. The Sydney Coordinated Adaptive Traffic System (SCATS) is designed to ensure the operation of each intersection achieves the optimal performance for the network as a whole. The road network management system would be expanded in future to accommodate LRV operations.

In practice, LRVs are expected to experience small delays at some intersections depending on the direction of travel and the time of day. This is due to the need to maintain effective signal coordination for the road network. Estimates of these delays to LRVs have been factored into the proposed light rail journey time forecasts. The amount of delay would depend on the final design of the intersections and traffic light control system which would be completed during the detailed design phase of the proposal.

There are limited locations where LRVs would operate in a shared environment, as described below:

- LRVs would share the existing (modified) busway from Anzac Parade to Doncaster Avenue.
- Buses would share the LRV right-of-way from the Kingsford stop through to UNSW.
- Right-turning vehicles would also be permitted to share the LRV right-of-way in High Street at Botany Street.

In each case these arrangements are proposed to avoid increasing the land required for the CSELR proposal and to avoid unreasonable impacts on other road users.

5.4.4 Separated and mixed use running

The CSELR proposal would typically operate within a dedicated corridor for a large proportion of the proposed alignment, which is known as ‘separated running’. On the separated running sections, the LRV would have its own corridor and access for other traffic would not be permitted. Traffic signals would be required where the segregated track has to cross an existing road. This would help to improve the speed and reliability of the service leading to better journey times. It would also provide a safer environment than a traditional tramway as the number of interactions with other vehicles would be significantly reduced.

Two sections would allow for ‘mixed use running’ of buses and LRVs. The first section would comprise mixed use running with existing bus traffic within the existing busway on the northern side of Alison Road between Anzac Parade and Doncaster Avenue. The second section of mixed use running would generally comprise the section of Anzac Parade between High Street and the Kingsford stop.
For mixed use running sections of the track, the LRV would share its corridor with buses only and access for any other types of vehicular traffic would not be permitted.

To provide a single type of driver operation, all LRVs would operate on the ‘line of sight’ principle.

Before completion of the CSELR proposal, the existing road rules would need to be reviewed to confirm if any updates are required. The LRVs would be driven at the speeds indicated for the sections of line they are on, or the road condition where reduced speed may be required (in the same way other vehicles follow the road rules).

5.4.5 Integration with the existing light rail network

The CSELR proposal would provide the opportunity for integration with the existing light rail network at the following locations:

- A track junction would be constructed to provide a connection between the CSELR and the existing light rail tracks at Hay Street. This junction would allow all CSELR LRVs to access the proposed maintenance depot at Rozelle via the existing Inner West Light Rail line.
- The Chinatown stop would be located on George Street to the north of Campbell Street. This stop would provide an opportunity to interchange between the proposed CSELR stop and the existing Inner West Light Rail stop at Capitol Square.

The passenger movements for the Inner West Light Rail and CSELR proposal have been designed to operate independently of each other during the operation of the overall light rail network. This is partly driven by the different LRVs for each of the individual networks which are different lengths (30 metres for the existing Inner West line and 45 metres for the proposed CSELR).

However, as noted in section 5.2.10, the CSELR proposal would utilise the existing Inner West Light Rail line to access the proposed Rozelle maintenance depot. This facility would consist of maintenance inspection tracks with a building, workshops and storage and would allow for more extensive maintenance and repair of LRVs from both the proposed CSELR network and the existing Inner West Light Rail network.

5.4.6 Interchange with buses, the heavy rail network and ferries

The CSELR would provide a series of opportunities for integrating with existing bus and the heavy rail network as part of a multi-modal access strategy. This strategy would ensure that bus passengers and heavy and light rail users can easily change transport modes in order to access a range of destinations within the CBD and South East Sydney. The following interchange locations for bus and/or heavy rail would be incorporated into the proposal:

- Circular Quay stop would allow for the transfer of ferry, bus and heavy rail passengers to the light rail network.
- Wynyard Stop would allow the transfer of bus and heavy rail passengers from both the bus network north of the Harbour Bridge and heavy rail passengers at Wynyard Railway Station.
- Queen Victoria Building stop would allow for bus passengers to transfer in York Street.
- Town Hall stop would allow for a large volume of heavy rail transfer passengers travelling to destinations within the central and southern parts of the CBD. This stop would also allow for interchanges with buses within Park Street and Druitt Street.
- Rawson Place stop would allow for the transfer of bus passengers travelling to destinations south-west of Railway Square.
- Central Station stop would allow for a large volume of rail transfer passengers, particularly university students, accessing the stop during the weekday as well as significant crowds anticipated during major events.
- Kingsford stop would cater for the more than 1,400 bus transfer passengers per hour that are expected to use the interchange in 2021.
- Randwick stop would cater for the approximately 870 bus transfer passengers per hour that are anticipated to use the interchange in 2021.
5.4.7 Ticketing system and passenger information

Ticketing
The ticketing system for the CSELR proposal would integrate with the Opal card electronic ticketing system. Opal card top-up machines would be installed at selected stops that are not close to shops that might otherwise provide the card top-up service.

Top-up machines would be located so as to not impede passenger flow and avoid pinch points on stop platforms. The location of the Opal card top-up machines would be determined during detailed design. Validators for the Opal card system would be located on platforms and passengers would be required to validate their card before boarding the LRV.

Passenger Information Display System (PIDS)
The CSELR PIDS would provide passengers with the information necessary to make early, informed decisions on journey plans, both routinely and in response to abnormal conditions. PIDS would provide up to date service information both specific to the stop and general information. The display boards would show passengers real time information updates including:
- the departure times of the CSELR service
- accurate clock
- customer information
- special events notices
- safety messages.

5.4.8 Stabling and maintenance facility operations
The stabling and maintenance facilities would provide for the ongoing maintenance of the entire rolling stock fleet, including preventative and corrective maintenance, heavy lift and overhead work, general presentation area and associated office and storage facilities for infrastructure and LRVs whilst not in use.

Randwick stabling facility
The stabling facility would allow for the following functional requirements and activities (refer to Figure 5.50):
- entry and exit to the stabling yard from the main line alignment for LRVs
- stabling for the LRV fleet
- wash and sanding plants
- light maintenance shed
- infrastructure maintenance siding
- access roads and car parking
- staff facilities building, including the operational control centre and light rail operator facilities
- a traction substation
- unloading and storage area.

The Randwick stabling facility would be the main management and control base for the CSELR proposal. There would be regular activity at the facility on a 24-hour basis. Overnight activity may include interior LRV cleaning (mopping, sweeping, vacuuming of the LRVs), resulting in only low level noise within the LRVs.

Access and egress of LRVs between the stabling facility and the main alignment of the CSELR would be from either direction along Alison Road. Upon entering the stabling facility, each LRV would pass through the sanding plant and/or wash plant or directly travel to a stabling location within the site. All LRVs would be cleaned internally overnight.
To reduce the impact of the stabling operations to nearby residents located along Doncaster Avenue, stabling of the LRVs could be undertaken to prioritise the filling of stabling berths closest to these residents in the early evening after the peak periods to reduce LRV movements adjacent to these houses at later times during the night. Conversely, these LRVs would be the last vehicles to leave the stabling yard during the morning peak period. This approach to management of the stabling yard would assist in minimising noise and vibration impacts to these residents during the morning and late evening peak periods as much as possible (refer to section 15.5).

For private staff and other vehicles, two entrance and exit points would be located along Doncaster Avenue, and the proposed car park would allow for up to 94 staff and/or visitors such as operational control staff, LRV drivers and other visitors/deliveries etc. The site would be fenced from general public access and some lighting would be used at night for safety and security of the site.

The stabling of existing LRVs on the Sydney light rail system would continue to be located at the existing Pyrmont depot, supplemented by additional stabling at the Rozelle maintenance depot site.

Rozelle maintenance depot

The proposed Rozelle maintenance depot would accommodate the requirements of the CSELR network and maintenance work on LRVs would potentially be undertaken on a 24 hour basis. The depot would provide for maintenance, repair, refurbishing, upgrading, stabling, cleaning and a base for infrastructure maintenance activities.

The maintenance facility would allow for the following operational requirements and activities (refer to Figure 5.51):

- stabling, inspection and cleaning of LRVs
- staff facilities to service the inspection, maintenance and cleaning of LRVs
- various workshops
- shunt siding and cripple siding (short, dead end tracks used for storing LRVs, to let other LRVs pass, or to temporarily stable vehicles requiring maintenance)
- LRV maintenance activities
- operators offices
- underfloor wheel lathe and inspection pits
- bogie lifting and storage areas
- component repair and other infrastructure storage areas
- paint booth (including graffiti removal)
- a traction substation
- entry/exit to and from the LRT network into the facility.

LRVs from the CSELR fleet would be required to operate over the existing light rail system infrastructure to travel to and from the maintenance facility. It is estimated that, on average, one to two CSELR LRVs would be required to travel to the maintenance facility and one CSELR LRV would be required to travel from the maintenance facility each day. These movements could potentially occur at any time; however where possible these movements would be scheduled to avoid service disruptions to the CSELR proposal and the existing light rail network. A majority of the maintenance operations would be undertaken within the main maintenance building and would not generate a significant level of noise (refer to section 17.5).

5.4.9 Infrastructure maintenance

Maintenance would be required at times along the light rail track. Maintenance activities would likely include:

- regular activities such as track and OHW inspections, and inspection and cleaning of the track drainage system
- preventative maintenance and repair and minor repairs to failed infrastructure components as required
- maintenance of landscaping and appropriate clearances to overhead trees (branch trimming)
- cleaning of passenger facilities
- track grinding and periodic replacement of track and other light rail infrastructure.
5.4.10 Communications system

The communications system for the CSELR proposal would provide timely, safe and reliable transmission of voice, data and video traffic from key operational locations throughout the light rail system. Equipment for the communications system would be located at light rail stops, at traffic junctions, in traction substations, in a central control room (at the operations control centre), at radio transmission towers, within the LRVs and at stabling facilities.

The communications system would consist of the following sub-systems:

- **a communications backbone network** – to provide timely, safe and reliable transmission of voice, data and video traffic from key operational locations throughout the CSELR system to the operations control centre located at Randwick
- **combined service route** – to provide the required conduits and pits pathways for the CSELR rail system services. This would include a combination of a number of conduits and pits dedicated to either electrical, communications or signalling services
- **radio system** – to provide wireless communications for the efficient and reliable operation of the light rail, capable of delivering voice and data communications between the operations control centre and the staff on the system (including drivers, operations and maintenance staff)
- **tunnel communications systems** – to provide good radio coverage throughout the proposed Moore Park tunnel, which would potentially include distributed antennas and/or radiating cables
- **stop communications systems** – which would include the following:
  - CCTV
  - emergency help points
  - public address systems
  - clock systems
  - ticketing systems
  - PIDS.

The communications system network for the proposal would be finalised during the detailed design.

5.4.11 Traffic management and access

A number of principles were used to guide the development of the future road network and maintain property access along the length of the CSELR route. The principles were designed to ensure that, in specifying the road network, the overall objective of maximising transport system performance and usage, and successfully integrating the light rail network with the road network, was upheld. The key principles are outlined below:

- reducing and minimising congestion
- consolidation of right turn movements across the alignment with these only permitted at signalised intersections (This provides light rail reliability benefits as well as traffic capacity and safety improvements by minimising uncontrolled conflicting vehicle movements.)
- balancing the future needs of the various transport modes within the limited cross sectional road space available
- prioritising light rail where appropriate
- providing signal controlled pedestrian crossing access to stops to ensure less mobile passengers or those with a disability are given audible and visual invitations to cross traffic under full signal protection
- providing high quality interchange functionality with sufficient capacity for future operations
- minimising of traffic capacity reduction
- providing sufficient capacity on footways and crossing points to accommodate the growth in pedestrian traffic (particularly around light rail stops)
- maintaining bus lanes where bus volumes are such that bus priority measures are warranted
- retaining property accesses on the corridor, although time or movement restrictions may be applied.
As the CSELR would be integrated within the surface street environment, it would require a number of significant changes to the way in which the road network operates and is designed. The key functional changes for each of the precincts are described in greater detail in Chapters 12 to 16.

5.4.12 Event management

Table 5.9 lists the different types of special events operation scenarios envisaged for the CSELR proposal.

Table 5.9 Special events operation scenarios

<table>
<thead>
<tr>
<th>SPECIAL EVENT</th>
<th>SPECIAL EVENT SHUTTLE SERVICE</th>
<th>NORMAL SERVICES ELSEWHERE ON THE LIGHT RAIL NETWORK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TO/FROM</td>
<td>TO/FROM</td>
</tr>
<tr>
<td>Cricket, football, concerts etc.</td>
<td>Moore Park</td>
<td>Central</td>
</tr>
<tr>
<td>Royal Randwick Races, concerts etc.</td>
<td>Royal Randwick racecourse</td>
<td>Central</td>
</tr>
<tr>
<td>New Years Eve/Anzac Day March/St Patricks Day Parade, Vivid Festival etc.</td>
<td>Randwick and Kingsford stops</td>
<td>Town Hall</td>
</tr>
</tbody>
</table>

Most special events would typically be held outside peak of hours and therefore some spare LRVs would be available to supplement normal services.

The CSELR operator would advise customers of upcoming special event and the additional services and/or service changes available via social media, on board and platform PIDS in the days leading up to an event, or as detailed in a special event plan. On the day of a special event, the CSELR operator would make announcements (such as through the use of PIDS) at relevant stops advising customers of special event arrangements.

Special events at Moore Park

Special event operations for the Moore Park Precinct cover operations at both the start and end of each event. The movement of passengers to the event typically happen over several hours and would be able to be catered for by normal operations supplemented by special event operation shuttles as needed. The most intensive part of the special event would be passengers returning to the Central Station stop in the one hour following the end of an event. In advance of each special event 90-metre LRVs (i.e. two combined 45-metre LRVs) would be positioned on the system for quick deployment as needed. Locations for this staging would include:

- Moore Park Precinct turnback
- Eddy Avenue turnback
- Randwick stabling facility.

Special event LRVs would operate at approximately five minute intervals between LRVs in conjunction with a five minute regular service from Kingsford or Randwick.

Special events at Royal Randwick racecourse

In addition to race day events, large music festivals are staged at Royal Randwick racecourse on an occasional basis (once or twice a year). To cater for the potential events at Royal Randwick racecourse, the CSELR proposal has been designed to allow for the shuttling of passengers between the Central Station and Royal Randwick racecourse stops with track turnbacks at both Royal Randwick racecourse and Eddy Avenue.

Operation of special event LRVs for Royal Randwick racecourse events would occur at a frequency of approximately every five minutes in conjunction with a 10 minute regular service from Randwick and approximately five minute headways from Royal Randwick racecourse to the connecting point with the Kingsford branch. The Kingsford branch would continue to operate at 10 minute regular service.
There would be slight delays to regular services to and from Kingsford and Randwick of approximately one minute to achieve special event operations.

**Special events on George Street north of Town Hall**

Each year there are a number of special events that either require George Street to be fully closed or require George Street to be used as a major traffic and transport event by-pass (i.e., traffic is diverted onto George Street, or part of George Street, due to other road closers within the CBD). These events and their current impact on George Street are described in Table 5.10.

As a governing principle, the CSELR proposal would operate on the maximum part of the route possible during such events outside of the area of impact of the proposed event. This may be achieved through the strategic placement of track crossovers or turnouts enabling shortened services to be provided.

<table>
<thead>
<tr>
<th>MONTH</th>
<th>EVENT</th>
<th>EFFECT ON GEORGE STREET</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>Sydney Festival First Night</td>
<td>George Street used as transport event by-pass. Other street closures as needed</td>
</tr>
<tr>
<td></td>
<td>Australia Day</td>
<td>George Street closed north of Grosvenor Street for part of the morning</td>
</tr>
<tr>
<td>February</td>
<td>Chinese New Year Parade</td>
<td>George Street affected between Town Hall and Chinatown</td>
</tr>
<tr>
<td>March</td>
<td>St Patricks Day Parade</td>
<td>George Street used as transport event by-pass</td>
</tr>
<tr>
<td></td>
<td>Gay and Lesbian Mardi Gras</td>
<td>George Street used as transport event by-pass</td>
</tr>
<tr>
<td>April</td>
<td>Anzac Day March</td>
<td>George Street closed between Grosvenor and Bathurst streets, plus lots of other closures</td>
</tr>
<tr>
<td>May</td>
<td>May Day March</td>
<td>Crosses George Street</td>
</tr>
<tr>
<td></td>
<td>SMH Half Marathon</td>
<td>George Street closed north of Grosvenor Street for part of the morning</td>
</tr>
<tr>
<td></td>
<td>Vivid Festival</td>
<td>Future plan similar to New Years Eve event</td>
</tr>
<tr>
<td>June</td>
<td>Possession of the Blessed Sacrament</td>
<td>George Street closed north of Hunter Street for part of the morning</td>
</tr>
<tr>
<td>July</td>
<td>No events</td>
<td>Not applicable</td>
</tr>
<tr>
<td>August</td>
<td>City to Surf</td>
<td>George Street used as transport event by-pass.</td>
</tr>
<tr>
<td>September</td>
<td>Sydney Running Festival</td>
<td>George Street closed north of Grosvenor Street for part of the morning</td>
</tr>
<tr>
<td>October</td>
<td>Sydney Spring Cycle</td>
<td>George Street closed north of Grosvenor Street for part of the morning</td>
</tr>
<tr>
<td>November</td>
<td>Movable Feast</td>
<td>George Street closed near cinema strip between Bathurst and Goulburn streets</td>
</tr>
<tr>
<td>December</td>
<td>New Years Eve</td>
<td>Alfred Street and George Street closed to Town Hall; very crowded.</td>
</tr>
</tbody>
</table>
It is assumed that a majority of these special events would involve the closure of George Street somewhere to the north of Town Hall stop. As a result the proposed CSELR operations would seek to maximise normal services by running LRVs as far as Town Hall and turning back at this stop. Therefore, during special events within the CBD affecting George Street, no light rail operations would occur between the Town Hall and Circular Quay stops.

Further consideration of the management of these events, and the implications for the CSLER proposal, would be undertaken during detailed design and consultation with stakeholders.

5.4.13 Road and LRV safety

The operator of the Sydney light rail network would have responsibility for the safe and efficient operation of the total system. The network operator would produce a safety management system and a full suite of operational rules, procedures and manuals, describing how the system is to be operated and maintained.

In principle, the LRVs would drive on line-of-sight operation. On in-street sections, LRVs would form part of road traffic and drivers would be required to observe the relevant provisions of the NSW Road Rules. The drivers would be required to give due consideration to traffic flows and pedestrian movements, assessing LRV speeds and braking requirements against their perceptions of actual or potential hazards. On observing a signal ahead displaying a stop aspect or a stationary obstacle in the swept path, the driver should be able to stop the LRV by use of the service brake only.

Disruptions to CSELR services and incident management

During operation of the proposal, unforeseen incidents may disrupt CSELR services, preventing parts of the CSELR network from being operated. Such incidents could include:

- road traffic accidents (including a collision between an LRV and motor vehicle or pedestrian)
- major fault or failure of an LRV, requiring police attendance to divert traffic until the disabled LRV has been recovered
- fire onboard an LRV
- infrastructure faults (e.g. track, overhead wires and signals)
- derailment of an LRV vehicle
- overhead power supply failure
- unruly or ill passenger(s).

Preliminary operational contingency measures that would be implemented in the event of such incidents occurring on the CSELR network are outlined in Appendix J of this EIS. These contingency measures would be further refined and developed by the Operator, in consultation with all relevant stakeholders (including the Transport Management Centre).

Typically, incidents requiring the recovery of a disabled or damaged LRV from the network could involve the following:

- Transfer of the disabled/damaged LRV to a suitable temporary storage location (e.g. Circular Quay, Eddy Avenue turnback, Kingsford stop turnback) for later recovery. During such events, the LRV service following the disabled/damaged LRV would be used to push or tow the disabled LRV to the temporary stabling location. This approach could be preferable during peak times on the network.
- Recovery of the disabled/damaged LRV and directly returning it to the stabling facility for further attention. During such events, the disabled/damaged LRV would be pushed or towed to the stabling facility using another LRV or a dedicated road tow vehicle so that disruptions to other services are minimised. Situations where this approach may be required include derailment, seized wheel or fire onboard the LRV.

Recovery of a damaged/disabled LRV from the road network (e.g. from George Street) is anticipated to be a relatively simple operation due to the presence of level paved areas around the CSELR tracks that would allow ready access by a tow vehicle (truck). However, recovery from such an area would require police attendance to manage road traffic around the scene and, if the LRV is not located at a stop, the safe disembarking of passengers.
Recovery of a damaged/disabled LRV from areas away from the road network would not necessarily require police attendance due to the lack of nearby road traffic.

Where an unforeseen incident prevents part of the CSELR from being operated, shortened services would be provided where possible (dependent upon the location and nature of the incident).

If an incident causes an extended interruption to normal operations it may be desirable/necessary to implement shuttle services whereby LRVs continue to operate a truncated service either side of the incident site within the constraints of the available crossover locations.

5.4.14 Customer safety

The nominated CSELR operator would be responsible for the safety of customers at all times. The CSELR operator would develop a customer safety plan that would identify how customers would be made aware of the safety risks associated with being in the proximity of LRVs. This plan would be agreed and implemented in consultation with Transport for NSW. The CSELR operator would also be responsible for the security system for the CSELR network. Active and passive security measures would be implemented as part of the operation of the CSELR proposal.