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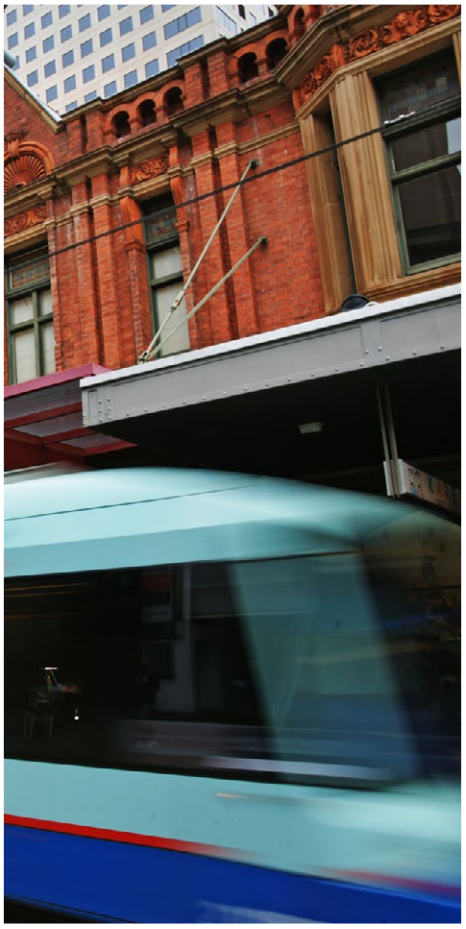

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OCTOBER 2010

SYDNEY LIGHT RAIL EXTENSION
STAGE 1 – INNER WEST EXTENSION
Volume 2 - Technical Reports

NSW GOVERNMENT Transport

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TECHNICAL PAPER

1

TRAFFIC AND TRANSPORT

Traffic and Transport Impact Assessment:

Sydney Light Rail Extension Stage 1

October 2010

Transport NSW

Parsons Brinckerhoff Australia Pty Limited
ABN 80 078 004 798

Level 27, Ernst & Young Centre
680 George Street
SYDNEY NSW 2000
GPO Box 5394
SYDNEY NSW 2001
Australia
Telephone +61 2 9272 5100
Facsimile +61 2 9272 5101
Email sydney@pb.com.au

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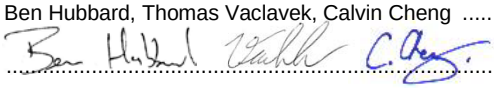
Signed: 

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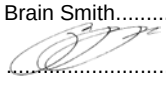
Signed: 

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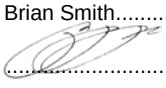
Signed: 

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Glossary

SLRE	Sydney Light Rail Extension
RTA	Roads and Traffic Authority
LATM	Local Area Traffic Management
CBD	Central Business District
CTMP	Construction Traffic Management Plan
AADT	Annual Average Traffic Volume
PEA	Preliminary Environmental Impact
LoS	Level of Service
DoS	Degree of Saturation

1. Introduction

1.1 Background

In February 2010, the New South Wales (NSW) Government announced, as part of the Metropolitan Transport Plan, a $500 million commitment to extend the existing Sydney light rail system in the Inner West along the disused Rozelle goods line corridor from Lilyfield to Dulwich Hill and in the central business district (CBD) from Haymarket to Circular Quay via Barangaroo. This comprised:

- Stage 1 — an Inner West extension of 5.6 kilometres along the disused Rozelle goods line corridor from Lilyfield to Dulwich Hill
- Stage 2 — a CBD western corridor extension from Haymarket to Circular Quay via Barangaroo with consideration of a future light rail option from Circular Quay to Central via George Street.

Collectively these two stages are known as the Sydney Light Rail Extensions (SLRE).

In the 2010-11 NSW Budget funding has been allocated to start construction on the SLRE Stage 1 (the Inner West extension) following the environmental assessment process, as well as to undertake pre-construction work on Stage 2.

In finalising the scope of work for the SLRE Stage 1 (the Inner West extension), the NSW Government took into account the many practical suggestions received from the community following the public release of the *Sydney Light Rail - Inner West Extension Study* (GHD 2010).

The community strongly favoured the inclusion of a walking and cycling shared path in the corridor, along with a number of bush care sites – termed a 'GreenWay' - from the Cooks River to Iron Cove. On 19 July 2010 the NSW Government announced that the GreenWay would be included in the SLRE Stage 1 (the Inner West extension) project.

SLRE Stage 1 (the Inner West extension) including the GreenWay forms the project and is the subject of this traffic assessment.

1.2 Director-General's requirements for traffic and transportation

The Director-General's requirements related to traffic and transport for the SLRE Stage 1 project included:

'General Construction Impacts – the EA must assess the impacts of, and present a management framework for:

- Traffic and Access, including a considered approach to minimising construction traffic impacts on public and private access with consideration given to:
  - construction traffic impacts, including potential disruption to the local and regional road network; and

- a strategy for managing traffic impacts, with particular focus placed on those activities identified as having the greatest potential for adverse traffic flow, access or safety implications, and a broader, more generic approach developed for day-to-day traffic management.'

Land Use and Transport Integration – including but not limited to:

- The integration of light rail stops and the GreenWay with surrounding land uses and transport infrastructure and networks, including:
  - urban connectivity, stop accessibility and impacts to adjoining land use access
  - pedestrian and cycle networks and infrastructure
  - interchange with CityRail and bus services
  - kiss-and-ride and parking, including demand and allocation for commuter and surrounding land uses; and
- road network interactions including:
  - kiss-and-ride and parking, including demand and allocation for commuter and surrounding land uses
  - service vehicular access to the corridor
  - network changes, including bridges, clearances, intersections and pedestrian crossings, and the modelling of key changes such as the signalised pedestrian crossing at Marion Street, Leichardt.

1.3 Scope

This report:

- describes the proposed Stage 1 - Sydney Light Rail Extension (SLRE) and GreenWay project
- reviews the existing (2010) transport and traffic conditions on the transport networks adjacent to the project
- reviews the future traffic and transport conditions, including:
  - forecasts for future Light Rail patronage (2016 and 2026) and travel access mode
  - forecast of construction vehicle trips
  - Light Rail stop interchange requirements
  - Light Rail parking requirements
- describes the traffic and transport impact of the SLRE and GreenWay
- provides recommendations to mitigate impacts including strategies for parking at each stop and an outline of for the Construction Traffic Management Plan (CTMP).

2. Description of the project

2.1 The light rail extension

An overview of the key features of the project are shown on Figure 1.1 and comprise:

- A 5.6 kilometre extension of the light rail between the existing Lilyfield light rail stop and the proposed Dulwich Hill Interchange stop. The extension would be located within the existing disused Rozelle goods line corridor.
- Nine new light rail stops — Leichhardt North, Hawthorne, Marion, Taverners Hill, Lewisham West, Waratah Mills, Arlington, Dulwich Grove and Dulwich Hill Interchange.
- Minor modifications to the existing Lilyfield stop and surrounding track to tie-in new track and overhead wiring infrastructure with the existing light rail.
- Modifications to the existing northern car park at Bedford Crescent to accommodate the Dulwich Hill Interchange stop.
- Raising of the existing bridge over Parramatta Road which will carry the light rail.
- Provision of the GreenWay, a shared pedestrian and cycle path from Iron Cove at Dobroyd Point to the northern bank of the Cooks River.
- Provision of pedestrian linkages (access pathways) to surrounding neighbourhoods to enable access to the GreenWay shared path and light rail stops.
- Modification of the existing road bridge structures to accommodate the GreenWay shared path – namely at Hercules Street, Old Canterbury Road, Constitution Road, Davis Street and Longport Street.
- New pedestrian/cycle bridge at Parramatta Road adjacent to the light rail overbridge.
- New pedestrian/cycle bridge across the Hawthorne Canal near Hawthorne stop.
- New infrastructure to ensure accessibility and connectivity between the shared path, local streets and light rail stops.
- Provision of sites for bush care and vegetation remediation areas in order to provide for existing, and an increase in, local habitat for fauna.
- Appropriate safety fencing or separation of shared path and light rail operations, and the light rail operations and the heavy passenger rail operations at Dulwich Hill.
- Provision of overhead wiring, substation and utilities infrastructure.

Figure 2.1 SLRE project overview plan

3. Existing situation

This section of the report establishes the existing traffic and transport conditions related to the SLRE, as a basis for assessing the impacts of the projects' operation and construction.

3.1 Public transport and cycling

The study area is well served by public transport, with numerous bus routes providing a mix of frequent line-haul services from inner-west suburbs to Sydney CBD; and feeders to local rail stations including Dulwich Hill and Lewisham Stations, the CityRail Inner West line and Bankstown Line which provide frequent train services to CBD stations, as well as Burwood, Strathfield and further west; and the existing Sydney Light rail which runs from Lilyfield to Central station via Pyrmont. Figure 3.1 below shows bus, rail and existing light rail in the vicinity of the project.

The SLRE will extend from Lilyfield to Dulwich Hill, with nine stops as follows:

- Leichhardt North
- Hawthorne
- Marion
- Taverners Hill
- Lewisham West
- Waratah Mills
- Arlington
- Dulwich Grove
- Dulwich Hill Interchange.

The following sections of the report describe bus and rail services in the vicinity of the planned SLRE stations, as well as existing cycle routes.

Figure 3.1 Existing public transport network with light rail extension

3.1.1 Leichhardt North

Currently there are no train services close to the Leichhardt North stop. Table 3.1 shows the current services provided by the bus network with Figure 3.2 showing a map of the routes. The map shows existing bus stops on Norton Street, some 250 m from the light rail stop.

While relatively close, accessing some bus stops from the light rail stop will require passengers to cross two major and heavily trafficked intersections on City West Link.

The current and proposed bicycle network around this stop is shown in Figure 3.3. Local on-path and on-street cycle routes will provide good access to the SLRE stop and proposed GreenWay.

Table 3.1 Current bus services servicing Leichhardt North stop

Station	Bus routes	Inbound AM peak hour trips	Outbound AM peak hour trips	Interchanging distance (m)	Interchange* time (min)
Leichhardt North	440	6	3	250	3.21
	444	5	3	250	3.21
	445	0	0	250	3.21
	L37	4	0	250	3.21
	470	4	4	800	10.30

* Interchange time does not include time spent waiting at intersections

Figure 3.2 Leichhardt North bus routes

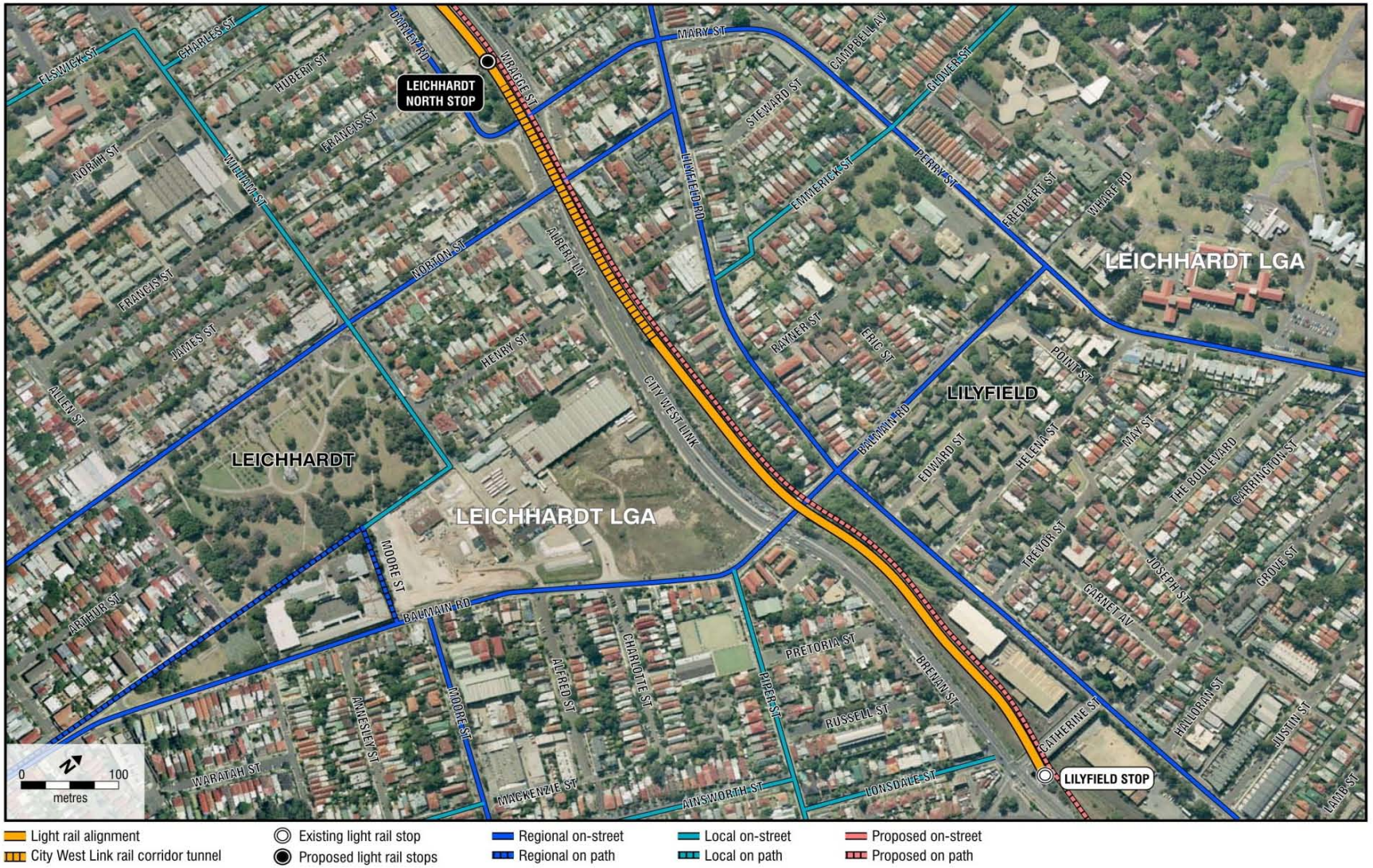


Figure 3.3 Leichhardt North cycle network

3.1.2 Hawthorne

Currently there are no bus or rail services operating near the Hawthorne stop. The current and proposed bicycle network is shown in Figure 3.4. The proposed stop is well located with respect to cycle routes.

Figure 3.4 Hawthorne cycle network

3.1.3 Marion, Taverners Hill and Lewisham West

There are no train stations in close proximity of the Marion and Taverners Hill SLRE stops. Lewisham railway station is approximately 400 m from the proposed Lewisham Stop.

Tables 3.2, 3.3 and 3.4 show the current services provided by the bus network for Marion, Taverners Hill and Lewisham West. Table 3.5 shows the train services available at Lewisham railway station. Figure 3.5 shows a map of the bus routes and the current and proposed bicycle network is shown in Figure 3.6.

Existing bus stops are located close to the Marion stop in Marion Street (within 90 m) and two blocks south in Flood Street (which also provides access to routes 370 and 445).

The Taverners Hill SLRE stop is close to bus routes 461, 480 and 483 but there are no bus stops close by which could be used to access the SLRE stop.

No existing bus routes serve the Lewisham West SLRE stop. However, Lewisham station is located to the south of the SLRE stop within walking distance.

With respect to cycle facilities, each of the three stops (and associated GreenWay) has existing cycle routes close by.

Table 3.2 Current bus routes servicing Marion stop

Station	Bus routes	Inbound AM peak hour trips	Outbound AM peak hour trips	Interchanging distance (m)	Interchange time (min)
Marion	436	4	2	90	1.15
	438	6	3	90	1.15
	439	0	0	90	1.15
	L37	4	0	90	1.15
	L38	6	0	90	1.15
	L39	3	0	90	1.15

Table 3.3 Current bus routes servicing Taverners Hill stop

Station	Bus routes	Inbound AM peak hour trips	Outbound AM peak hour trips	Interchanging distance (m)	Interchange* time (min)
Taverners Hill	461	5	3	175	2.24
	480	3	0	175	2.24
	483	4	3	175	2.24

* Interchange time does not include time spent waiting at intersections

Table 3.4 Current bus route servicing Lewisham West stop

Station	Bus routes	Inbound AM Peak hour trips	Outbound AM Peak hour trips	Interchanging distance (m)	Interchange time (min)
Lewisham West	413	4	3	220	2.82

Table 3.5 Current rail line servicing Lewisham West stop

Station	Train lines	Inbound AM peak hour trips	Outbound AM peak hour trips	Interchanging distance (m)	Interchange* time (min)	Station AM peak hour patronage
Lewisham West	Inner West	5	4	480	6.15	1140

* Interchange time does not include time spent waiting at intersections

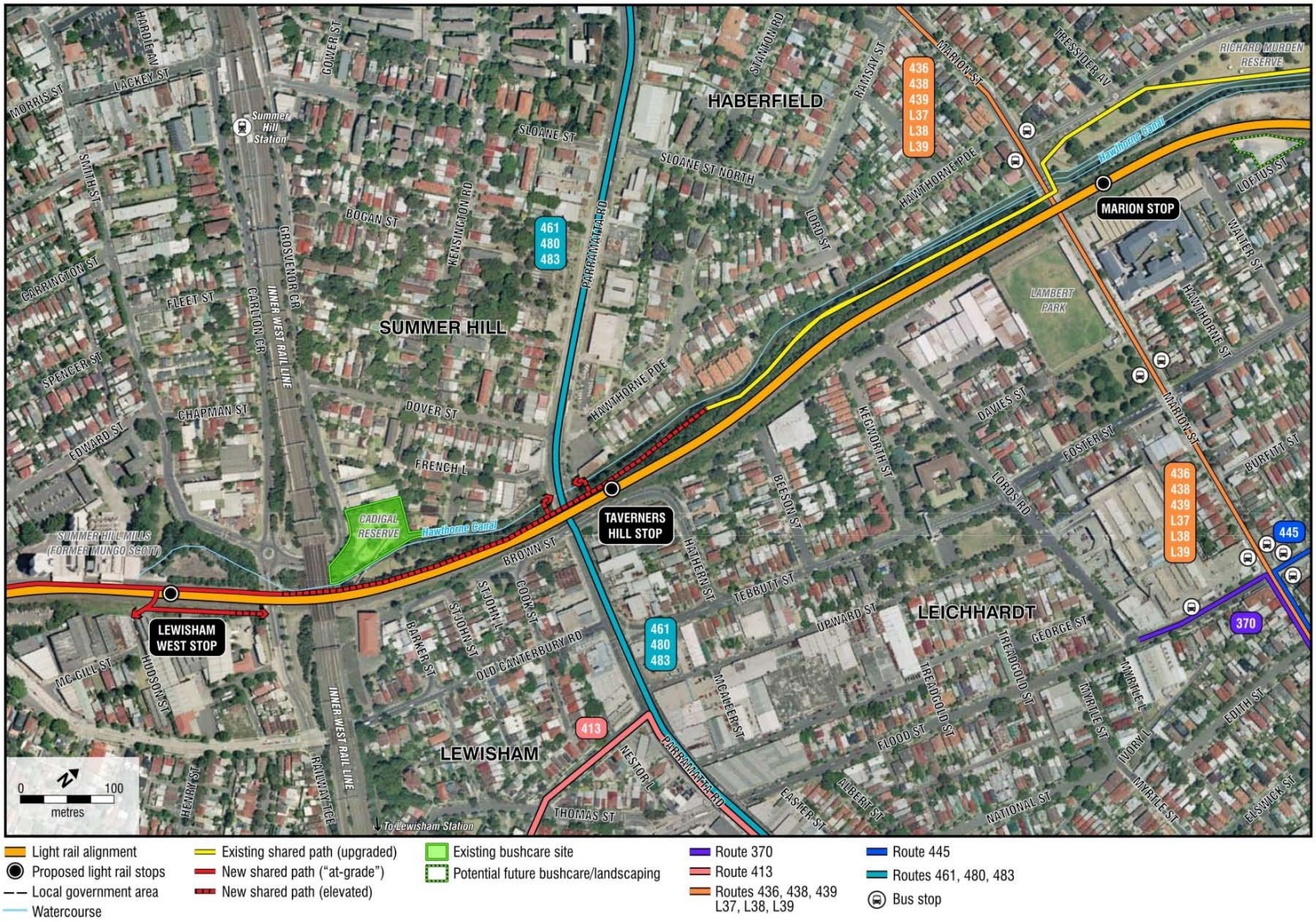


Figure 3.5 Marion, Taverners Hill and Lewisham West bus routes

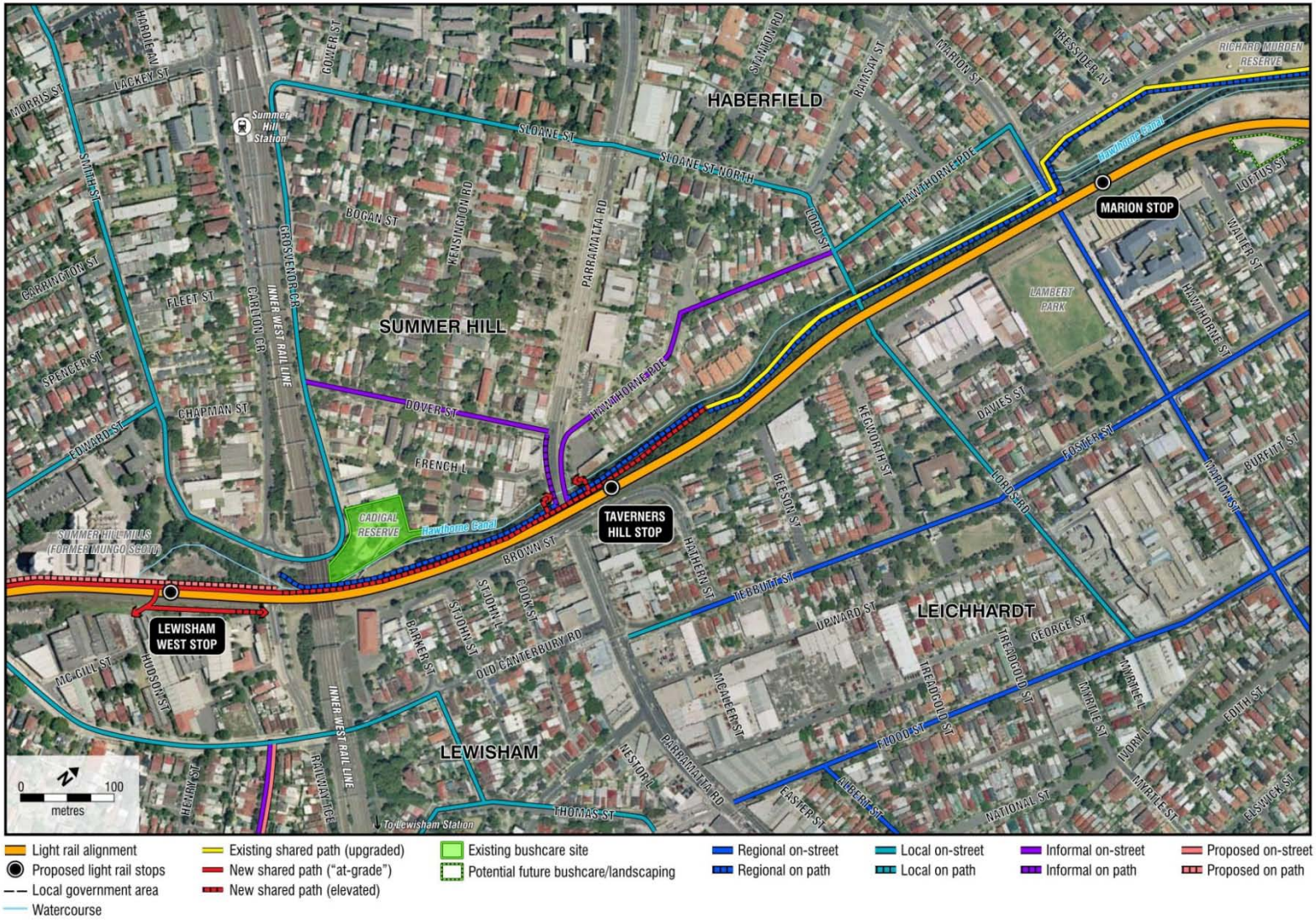


Figure 3.6 Marion, Taverners Hill and Lewisham West cycle network

3.1.4 Waratah Mills, Arlington and Dulwich Grove

There are no train stations close to the proposed Waratah Mills, Arlington and Dulwich Grove stops.

Tables 3.6 and 3.7 show the current services provided by the bus network for the Arlington and Dulwich Grove stops. There are no bus services passing close to the Waratah Mills stop. Figure 3.7 shows a map of the bus routes and Figure 3.8 shows the current and proposed bicycle network.

Table 3.6 Current bus routes servicing Arlington stop

Station	Bus routes	Inbound AM peak hour trips	Outbound AM peak hour trips	Interchanging distance (m)	Interchange time (min)
Arlington	418	3	3	340	4.36
	428	5	2	340	4.36
	444	5	3	340	4.36
	445	0	0	340	4.36
	L28	5	0	340	4.36

Table 3.7 Current bus routes servicing Dulwich Grove stop

Station	Bus routes	Inbound AM peak hour trips	Outbound AM peak hour trips	Interchanging distance (m)	Interchange time (min)
Dulwich Grove	418	3	3	65	0.83
	426	7	2	370	4.36
	428	5	2	65	0.83
	444	5	3	65	0.83
	445	0	0	65	0.83
	L28	5	0	65	0.83

Figure 3.7 Lewisham West, Waratah Mills and Arlington bus routes

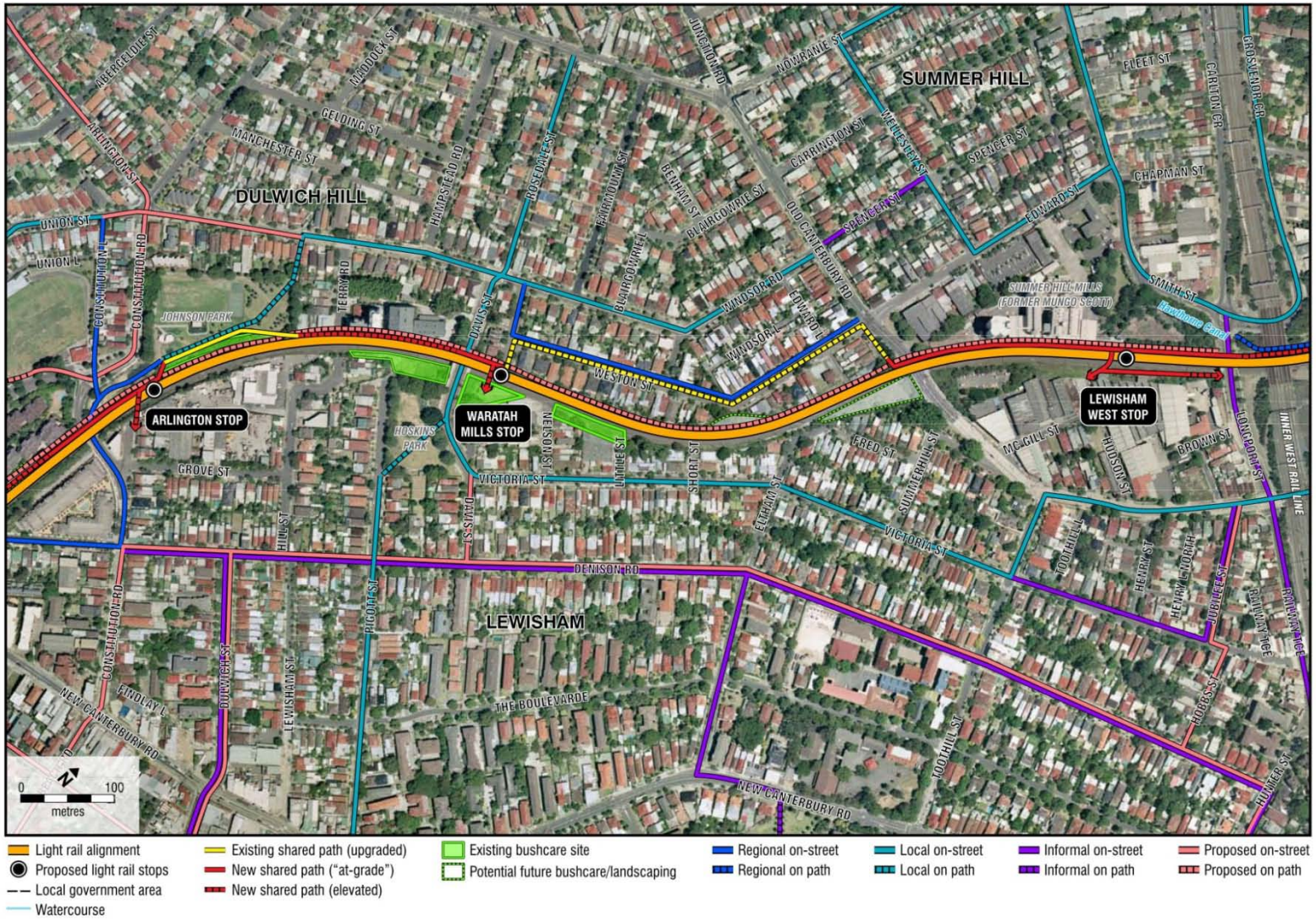


Figure 3.8 Lewisham West, Waratah Mills and Arlington cycle network

3.1.5 Dulwich Hill Interchange

The proposed SLRE Stage 1 will terminate at Dulwich Hill station. Table 3.8 shows the current services provided by the rail network with Figure 3.9 showing a map of the rail line and bus routes.

Table 3.8 Current rail line servicing Dulwich Hill stop

Station	Train lines	Inbound AM peak hour trips	Outbound AM peak hour trips	Interchanging distance (m)	Interchange time (min)	Station AM peak hour patronage
Dulwich Hill	Bankstown	4	4	90	1.15	1080

Table 3.9 shows the current services provided by the bus network with Figure 3.9 showing a map of the routes.

Table 3.9 Current bus route servicing Dulwich Hill stop

Station	Bus routes	Inbound AM peak hour trips	Outbound AM peak hour trips	Interchanging distance (m)	Interchange time (min)
Dulwich Hill	412	5	1	110	1.41

The current and proposed bicycle network is shown in Figure 3.10.

As the figures and tables show, the Dulwich Hill SLRE stop will provide access to relatively frequent train services on the Bankstown line and to route 412 which is a cross-suburban bus route providing relatively frequent (in peak periods) services between Campsie and Sydney CBD.

Figure 3.9 Dulwich Grove and Dulwich Hill bus routes

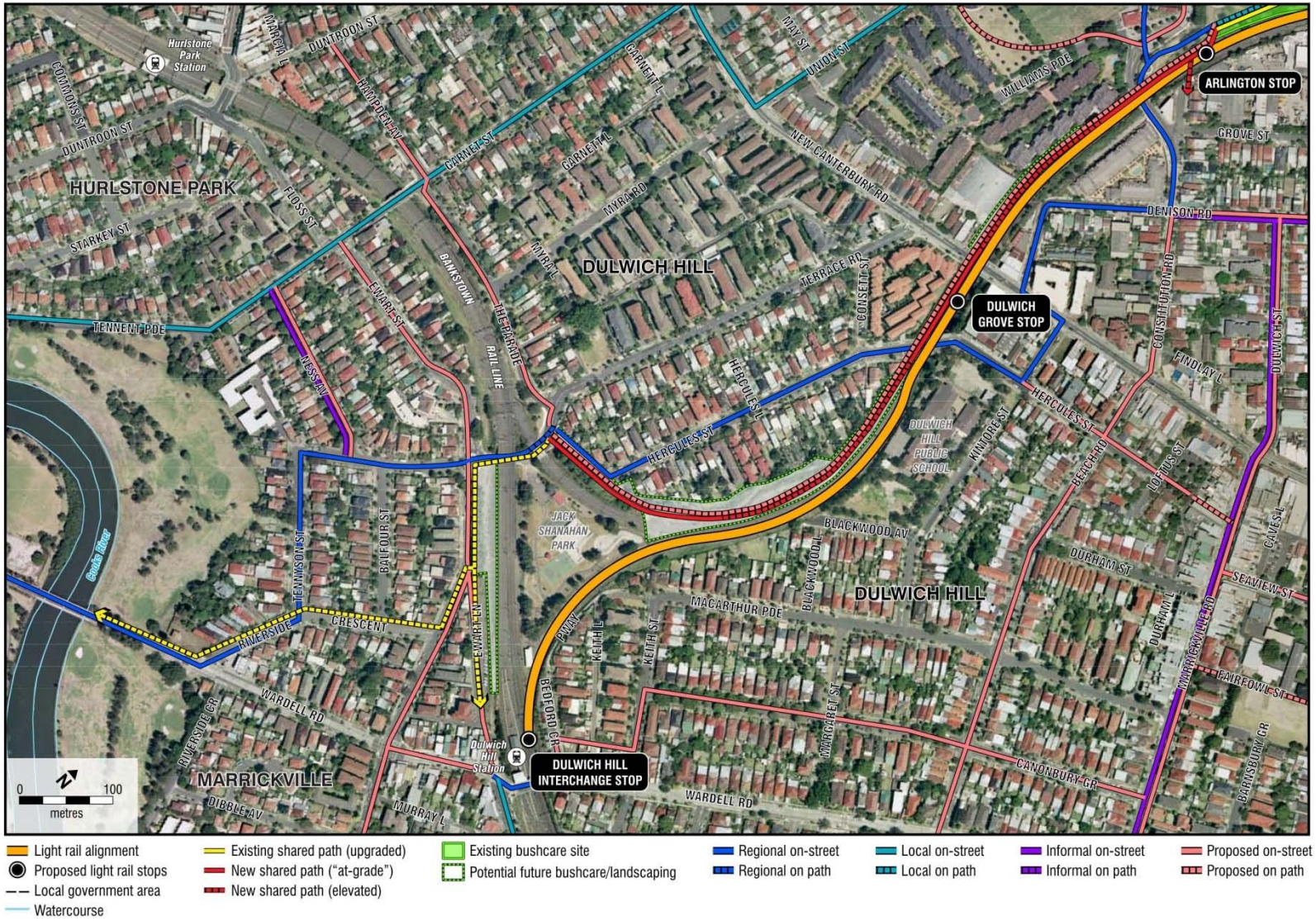


Figure 3.10 Dulwich Grove and Dulwich Hill cycle network

3.1.6 Cycling issues and opportunities

The GreenWay will become a link between the Iron Cove shared path and the Cooks River shared path. Both these off road facilities are important regional cycle facilities. The GreenWay would contribute another key link in the regional cycle network and will allow better cycle access for several neighbourhoods, while at the same time raising the profile of cycling through the association with a major project like the light rail extension.

Table 3.10 highlights issues and opportunities with the existing cycle network in the context of the GreenWay.

Table 3.10 Cycling issues and opportunities

Light rail stop	Issues	Opportunities
Leichhardt North	▪ cycle path along busy road leading to a very busy intersection with no cycle facilities ▪ cycle path abruptly changes into a traffic lane with no provision for cyclists	▪ provide an improved link between Darley Road and Lilyfield Road which is a RTA regional cycle route ▪ provide a cycleway facility at the intersection of Darley Road and City West Link
Hawthorne	▪ current shared path is indirect and narrow through Richard Murden Reserve leading to commuter cyclists using Hawthorne Parade instead ▪ current shared path leads to cyclist and pedestrian conflict and safety concerns especially around the existing playground ▪ Hawthorne Canal forms a major east/west barrier to cycling with limited crossings	▪ the construction of an additional bridge over the Hawthorne Canal will: ‣ create a link between Turner Avenue and Lyall Street ‣ links the cycle Ashfield Council cycle network on the eastern side of the canal with the Leichhardt Council network on the western side ‣ provides added amenity to patrons of Café Bones with a more direct access from the eastern side of the canal ▪ proximity to the café and other recreational facilities (tennis, netball and basketball courts) provides a demand for a quality, sheltered and secure cycle parking facility
Marion	▪ current path is overgrown on both sides of Marion Street ▪ current pedestrian refuge islands in the middle of Marion Street encourage crossing the street and riding on the sidewalk to reach the other part of the cycle way	▪ removal of the pedestrian refuge islands to encourage the use of the proposed at-grade pedestrian and cycle crossing ▪ realignment of the cycleway north of Marion Street to align with the desire line of users and join Marion Street as close to the proposed crossing as possible
Taverners Hill	▪ Parramatta Road is a major barrier to north/south movements ▪ current shared path is overgrown and dark	▪ addition of shared path to rail bridge will provide a key north/south link for pedestrians and cyclist
Lewisham West	▪ currently only roads with high traffic volumes cross the rail corridor ▪ no direct cycle route exists	▪ light rail stop will provide an additional safe east/west crossing point of the rail corridor ▪ creates a direct off road path via the rail corridor ▪ the potential development of the site between Hudson Street and Longport Street can provide additional demand for the GreenWay and light rail ▪ development should include cycle facilities and cater to transit oriented development

Light rail stop	Issues	Opportunities
Waratah Mills	▪ on street cycle path only between Old Canterbury Road and Davis Street ▪ road safety issues include: ‣ conflict between cyclists and cars at Old Canterbury Road and Weston Street intersection, will require a detailed design ‣ car doors ‣ poor road surfaces	▪ Westin Street is the best route choice because: ‣ it is the most direct route ‣ has no existing traffic management devices ‣ is 18 m wide ▪ create a buffer lane between parked cars and cycle path to prevent conflict between cyclists and car doors ▪ use colour to distinguish cycle path and make it easily identifiable
Arlington	▪ connectivity with existing cycle network	▪ Johnson Park and Arlington Recreational Reserve are both popular destinations and need to be easily accessed from the GreenWay ▪ station will need to provide a high quality and secure cycle parking facility that can serve the station and the two popular destinations ▪ Johnson Park has an existing wide off road shared path
Dulwich Grove		▪ connection to the existing cycle network at Hercules Street
Dulwich Hill	▪ Ewart Street roundabout is a road safety issue ▪ crossing of Wardell Road from Riverside Crescent is a safety issue ▪ Ewart Lane has a very poor and uneven surface treatment	▪ detailed design is necessary for the Ewart Street roundabout ▪ crossing of Ewart Street at the juncture with Ewart Lane will be complicated and will require a detailed design ▪ detailed design is needed for the Wardell Road and Riverside Crescent intersection ▪ resurface and designate Ewart Lane as a shared path which would connect the GreenWay to existing cycle paths following the rail line east towards Marrickville

3.2 Traffic and parking

3.2.1 Traffic

The road network surrounding the SLRE is mostly comprised of local streets with a typical Annual Average Daily Traffic (AADT) volume between 300 and 600 vehicles per day, which are low volumes. These streets are set out in an informal grid pattern largely orientated north-south and east-west.

The local roads fit within a coarser grid of distributor and arterial roads. Approximate AADT volumes for the main distributor roads and arterial roads close to the SLRE route are provided in Table 3.11.

Table 3.11 Road classification and indicative AADT traffic volumes

Road name	Classification	Approximate AADT
Darley Road/Forster Street	Distributor Road	5,000
Marion Street	Sub arterial	20,000
Marrickville Road	Distributor Road	25,000
Constitution Road	Distributor Road	5,000
City West Link	Arterial	50,000
Old Canterbury Road	Arterial	20,000
New Canterbury Road	Arterial	25,000
Parramatta Road	Arterial	70,000

Traffic volumes based on the RTA Sydney Region Traffic Volumes 2005

Traffic volumes on the distributor and arterial road network are high with many of these roads approaching capacity. The local road network by contrast has some capacity remaining. However, increasing traffic on local roads would be to the detriment of safety and amenity so should not be encouraged.

The roads surrounding each stop are briefly described in Table 3.12.

Table 3.12 Roads at stops where traffic generation is forecast to occur

Stop	Roads in vicinity
Leichhardt North	▪ City West Link has an AADT of approximately 50,000 vehicles. This is a busy urban arterial road with 24 hour clearways preventing parking. The speed limit of this street is 60 km/h. ▪ Darley Road is a low volume two way distributor road approximately 12 m wide (approximately AADT of 5,000 vehicles per day). Close to the Leichhardt North stop this road has some available parking on both sides. The speed limit of this street is 50 km/h.
Hawthorne	▪ Darley Road close to the Hawthorne stop has some available parking, except on the sharp bend on the approach to the children's playground and adjacent to the pedestrian refuge island at Lyall Street. The speed limit of this street is 50 km/h. ▪ Hawthorne Avenue is a two way distributor road approximately 14 m wide. This road has parking both sides and some local area traffic management measures (refuge islands and roundabouts). The speed limit of this street is 50 km/h.

Stop	Roads in vicinity
Marion	▪ Marion Street is a sub arterial road of approximately 14 m width. This road has an AADT of approximately 20,000 vehicles. Parking close to the Marion Street stop is in high demand and most of the kerb space parking is time limited. Parking demand on Marion Street is greatest to the east of the rail overpass bridge in the vicinity of the shops and businesses. Parking supply is reduced in this area because of accesses to business properties. ▪ Hawthorne Avenue close to the Marion Stop has indented 90 degree parking which provides 30 parking spaces many of which appear underutilised.
Taverners Hill	▪ Parramatta Road is one of the main arterial roads into the Sydney CBD. This road has an AADT of approximately 70,000 vehicles and a speed limit of 60 km/h. No parking is permitted on this road close to the Taverners Hill Stop. This road has two lanes in both directions which are separated by a concrete safety barrier which prevents pedestrian movement across the road other than at the Parramatta Road/Old Canterbury Road traffic signals. ▪ Brown Street and Hathern Street are two way local roads approximately 12 m wide. Both these roads have restricted parking along the majority of their length and have only a few unrestricted parking spaces (mostly on Hathern Street). Parking in this area was observed to be in high demand. Brown Street provides a bridge crossing over Parramatta Road. The speed limit on both these streets is 50 km/h. ▪ Cook Street is a one way street that connects Brown Street to Old Canterbury Road. This street is approximately 12 m wide and has parking both sides of the road. Demand for parking is this street is high and no available spaces were observed in this street during various site visits. ▪ Tebbutt Street links Brown Street with Parramatta Road. It is approximately 14 m wide and has restricted parking on both sides. Parking is in high demand in this street. The speed limit on Tebbutt Street is 50 km/h
Lewisham West	▪ Old Canterbury Road is a two way local distributor road with an approximate AADT of 20,000 vehicles. This road is approximately 14 m wide and has restricted parking on both sides of the road. Parking in this road is in high demand and supply is limited. The speed limit is 50 km/h. ▪ Hudson Street is a local road that serves a number of residents and businesses. This road is narrow (approximately 6 m wide) and does not have a footway. Parking is unrestricted in this street and demand for parking is high. The street can accommodate approximately 18 parked vehicles. The speed limit on this street is 50 km/h. ▪ McGill Street is a local road approximately 12 m wide that connects Hudson Street with Old Canterbury Road. The street has time restricted parking on both sides of its length.
Waratah Mills	▪ Winsor Road is a distributor road and is approximately 14 m wide. This road has some local area traffic management including speed humps and roundabouts. The road is used as a regional cycle route and has a 3 t weight limit beyond Davis Street. Some unrestricted parking is available in this road. The speed limit in Winsor Road in 50 km/h. ▪ Davis Street is a local road of approximately 12 m in width. This road connects between Winsor Road and Denison Road via a bridge over the SLRE rail line. This street has a low traffic volume of approximately 500 vehicles per day and some parking available on both sides. ▪ Weston Street is a local road with unrestricted parking on both sides. The many accesses on this street reduce the number of on street parking spaces that are available. The street generally runs parallel to Winsor Road but at the southern end bends through ninety degrees to join with Winsor Road. Weston Street also has a stub section of road east of the ninety degree bend providing access to the rail corridor. The width of Weston Street between Old Canterbury Road and the ninety degree bend is approximately 12 m. The section of Weston Street between joining with Winsor Road is approximately 9 m wide. However, demand for parking in this street is low. The speed limit on Weston Street is 50 km/h. This street is proposed to be used for the on road section of the GreenWay shared path.

Stop	Roads in vicinity
Arlington	▪ Constitution Road is a low traffic volume (approximately AADT of 5,000 vehicles) local distributor road. The road is approximately 12 m wide and has restricted parking on both sides. Parking in this road is in high demand particularly at weekends when sporting events attract people into this area. The speed limit on Weston Street is 50 km/h.
Dulwich Grove	▪ Hercules Street is a two-way local road with a low AADT of approximately 500 vehicles. This street is approximately 12 m wide and has speed humps to calm traffic speeds close to the Dulwich Hill Public School. Some parking is available on street but is in high demand at school start and end times. The speed limit on this street is 50 km/h except during school start and end times when a 40 km/h speed limit applies. ▪ New Canterbury Road is a two-way arterial road approximately 12 m wide. This road has an AADT of approximately 25,000 vehicles. New Canterbury Road has restricted parking both sides of the road, some of which appears to be underutilised. The speed limit of this road is 50 km/h. ▪ Beach Road is a local road that connects New Canterbury Road with Hercules Street. This road is approximately 12 m wide and has parking spaces on both sides. This road has some LATM measures, particularly close to the school. The speed limit on this road is 50 km/h.
Dulwich Hill	▪ Wardell Road is a two way distributor road with a width of approximately 12 m. This road has some time limited parking on both sides. Parking in the area is in high demand, particularly in front of the shops and businesses. The road over bridge crossing the rail line and a pedestrian crossing close to Bedford Crescent restrict the number of parking spaces that are available on street. The speed limit on this road is 50 km/h. ▪ Bedford Crescent is a local no through road that currently provides approximately 30 parking spaces for commuters. The street is approximately 15 m wide and has a speed limit of 50 km/h. ▪ Dudley Street, to the south of Dulwich Hill railway station is a two way local road that is approximately 14 m wide. This road has restricted parking on both sides which is in high demand by local businesses and the railway station. The speed limit on this street is 50 km/h.
The GreenWay	The GreenWay shared path will be installed on the following streets and roads: ▪ Weston Street has been described above in the roads in the vicinity of Waratah Mills stop. ▪ Hercules Street is a local road with a width of approximately 12 m. Parking is available on both sides of this street and is in high demand. At the location where the GreenWay will join this street no parking is permitted so the GreenWay would not reduce the current parking supply within this street. ▪ Terrace Road connects Hercules Street with Ewart Street. This street is a local road with a width of approximately 12 m. This street passes under the rail lines to join with Ewart Street at a roundabout. Forward visibility at the roundabout appears substandard which will need to be considered within the design of the cycle route. The speed limit on this road is 50 km/h. ▪ Ewart Street is a distributer road with width of approximately 12 m. Parking is available on both sides of the street with some of the parking spaces having time restrictions. ▪ Ewart Lane is a lane way that connects the rear of the properties on Ewart Street and provided access to the Dulwich Hill railway station commuter car park. ▪ Riverside Crescent is a two way local road with a width of approximately 12 m. This road has an approximate AADT of 500 vehicles. Unrestricted parking is available both sides of the road with some parking spaces available. The speed limit on this road is 50 km/h. ▪ Wardell Road is a two way distributor road with a width of approximately 14 m. This road has parking both sides with some parking spaces available at most times of the day. The speed limit on this road is 50 km/h.

Traffic generation by the SLRE is not expected to be significant, as described in Section 5, so the impact on performance of the street network is also likely to be minimal and does not, in PB's view, require detailed traffic analysis.

The stops where most traffic is expected to be generated, Dulwich Grove and Marion, are both located close to arterial or sub arterial roads that already carry significant daily traffic volumes. The small increase in traffic that could occur because of the SLRE would have little impact on the traffic conditions and performance of these streets and would be likely to fall within normal daily variations of traffic. As well, the SLRE's effect on traffic will generally be to redistribute some traffic already on the road network and encourage replacement of private car trips with public transport trips.

Parking on the arterial road network is generally highly regulated and controlled with kerbside space provided for a variety of users; and limited spare capacity. The parking on local roads is varied and depends on the demographics of each area. As a general observation local roads alongside the SLRE have some available parking spaces during the day but few available spaces at night. The existing parking situation at each stop is further described in the Parking Strategy appended to this report (Appendix A). The strategic policy framework for parking is briefly described below. This framework forms the basis for the parking management strategy described in Section 6.3.

3.2.2 Parking

3.2.2.1 Planning framework

The provision and management of parking in the vicinity of proposed stops on the SLRE is guided by the draft SLRE parking strategy, which recommends a strategy for car parking associated with the SLRE, on the basis of relevant parking policies and plans.

Draft metropolitan parking policy

The NSW Draft Metropolitan Parking Policy is intended to 'set a framework to support the use of more sustainable modes to locations with good public transport access and support the Government's investment in public transport'. It will be developed in conjunction with subregional plans and it is expected that it will see reduced parking requirements for areas with good public transport access.

The Draft Metropolitan Parking Policy has not been released but it is likely that at stops on the SLRE, there would be a policy of reducing parking supply for retail, commercial and residential development in light of the improved public transport access afforded by the SLRE. While the draft Metropolitan parking Policy is aimed at centres, its intent is relevant to suburban locations and suburban centres served by the SLRE and this would extend to parking provision associated with SLRE stops. As a sustainable transport mode, the SLRE is primarily aimed at providing local travel and improved access to Sydney CBD, Pyrmont and other smaller centres along the line. Provision of car parking at SLRE stops, which would have a close relationship to the centres it serves, could have negative impacts on traffic, on parking to serve the centres themselves and on the use of sustainable SLRE access modes, such as walking, cycling and bus.

Leichardt Municipal Council – the 2020+ Strategic Plan

The Leichardt Municipal Council 2020+ Strategic Plan identifies that strategic action needs to be taken to reduce the dependence on the car and promote the use of more sustainable transport. A parking strategy is still to be prepared as part of an Accessibility Plan. Council's stated intent is that parking strategies within an Accessibility Plan would need to fit with the State government and other transport agencies' strategies. This would discourage park-and-ride at light rail stops to support active travel and public transport.

Marrickville Council – Integrated Transport Strategy 2007

Marrickville Council's Integrated Transport Strategy (2007) acknowledges that 'prominent, plentiful, cheap and unrestricted parking encourages people to drive; public transport becomes a less attractive alternative.' The Strategy sets out guiding principles that can be used for policy development. Broadly these strategies:

- encourage land use and development that promote sustainable transport
- recognise the need to manage turnover of parking
- promote the use of restrictions/pricing that targets a needs hierarchy
- protects residential street from parking overspill for commercial and commuter activity
- minimises conflicts between parking and other transport modes including cycling and walking
- provide short term drop off and pick up at strategic locations.

Taken together, State and relevant local government policies and strategies are aimed at minimising parking demand and the effects of parking (especially long stay parking) on the encouragement of sustainable transport. While the proposed SLRE is a sustainable transport mode of itself, the extent to which it generates a demand for park-and-ride has the potential to conflict with the aims and objectives of these policies.

3.2.3 Stakeholder discussions

To gain an understanding of the main traffic and parking issues, PB undertook initial stakeholder discussions with Marrickville Council and with Leichardt Municipal Council. These discussions focused on the following topics:

- existing traffic and parking issues surrounding each stop
- the construction access routes
- pedestrian and cycle access to each stop.

3.2.3.1 Marrickville Council

Council's main issues included:

- Pedestrian movement in the locality of Dulwich Hill interchange. Council has some concerns regarding the existing pedestrian crossing facilities to the south of the Dulwich Hill railway station on Wardell Road (currently a zebra crossing) and Darley Road (currently provided with a pedestrian refuge island). Council has recently requested a signalised crossing at this location but have been informed by the RTA that this level of facility would not be warranted based on current traffic and pedestrian volumes.

- Commuter parking for the light rail at the Dulwich Hill Interchange stop. This is a concern to Council particularly because some spaces will be removed to provide space for the stop platforms. Council suggested that study of parking surrounding this stop should be undertaken.

- Parking close to the Arlington stop. The roads close to the Arlington stop have few available parking spaces at weekends when sporting events in the nearby parks are taking place. Council is considering introducing a residents parking scheme in this area.

- Construction worksite accesses using Hudson Street. Council agreed that this street would be a logical construction access route and that due to the narrow width of the road parking would have to be temporarily removed during the construction period. Council also agreed that removal of the parking was preferable to introducing a one way system on Hudson and McGill Street (the alternative approach).

- Potential lane closures on Davis Street, Constitution Road and Old Canterbury Road during construction. Council said that closure of any road should be avoided and lane closures minimised particularly on Old Canterbury Road which is an arterial route. If closures are required they would need to be coordinated so that access is maintained.

- Termination of the GreenWay on Wardell Road. Council asked how the cycle route would proceed across the Cooks River. This is beyond the scope of the project which terminates at the northern side of the Cook River Bridge.

- Cycle route along Weston Street. Council agreed that Weston Street was a good choice of route for an on street cycle way. Council's preferred cycleway treatment of this road would be a minimal approach using wayfinding signs and cycle symbol road markings.

3.2.3.2 Leichhardt Municipal Council

Council's main issues included:

- Connection of the GreenWay to the Leichhardt Municipal Council strategic commuter cycle route proposed for Darley Road. Council is considering providing an on street cycle route on Darley Road to provide a connection between Iron Cove and the existing on road cycle route on Lilyfield Road. This would require road space on Darley Road and could lead to reduced parking availability. Parking demand for Hawthorne and Leichardt North stops could impact on this proposed cycle route.

- Pedestrian movement and safety at the Leichardt North stop. Council has concerns about the safety of pedestrians and cyclists crossing James Street/Darley Road close to the proposed Leichhardt North stop and the increased likelihood of vehicle-pedestrian conflict from the SLRE in the locality.

- Pedestrians crossing Charles Street near the Leichhardt North stop. Council has received some complaints regarding pedestrian safety in this locality. However, on investigation Council found that a formalised crossing was not warranted. The increased pedestrian activity that could result from the SLRE may justify a crossing facility.

- Construction vehicle access to the Leichhardt North site. Council raised concerns that a site access off Darley Road close to the intersection of Darley Road/City West Link could be a safety concern and that safe sight distance should be checked.

- Commuter parking displaced from the Lilyfield area. Council has recently introduced a resident parking scheme in Lilyfield in response to complaints from residents about reduced parking availability after the extension of the light rail to Lilyfield. The new stop at Leichhardt North may be more attractive for commuters as it has some unrestricted parking and good access to City West Link road.

- The Hawthorne canal bridge providing access to parking on Hawthorne Parade. Council is aware of concerns from residents that the bridge could make Hawthorne Parade attractive for commuter parking. However, residents of Hawthorne are in support of the bridge which will improve accessibility.

- Commuter parking at the Marion stop. Unrestricted parking close to the Marion stop is in high demand particularly at weekends when sporting events are taking place in Lambert Park. Currently parking for events at Lambert Park is already intruding into the residential areas to the south of the rail bridge either side of Marion Street. This could be made worse by the light rail extension and residents parking schemes in this area may need to be considered.

- The proposed at-grade signalised crossing of Marion Street. Council had some concerns about the at-grade crossing on Marion Street. This crossing could be used by a large number of children from Kegworth Public School. A grade separated crossing such as a bridge would be preferred.

4. The proposed light rail extension

The Sydney Light Rail Extension – Stage 1, would provide a high quality and comfortable public transport connection between Dulwich Hill and Central Station via Pyrmont, serving Lewisham, Summer Hill and Leichhardt.

For local residents bound for the CBD the SLRE – Stage 1, will perform much the same function as existing bus and train services, while the light rail will provide access between Dulwich Hill, Leichhardt and Pyrmont not easily achieved by the public transport network at present.

The extension of the light rail would provide an opportunity to capture some of the new trips generated from proposed developments at Dulwich Grove, Arlington, Waratah Mills, Lewisham West and Marion. Also it can be expected that increasing travel costs and congestion for car trips would divert some existing trips onto the light rail system.

4.1 Light rail annual patronage forecasts 2016 and 2026

The Preliminary Environment Assessment (PEA) included a preliminary forecast of the annual patronage for the light rail system, both with and without the proposed extension. This showed that with the light rail extension the patronage could be expected to be approximately:

- 7.2 million patrons by 2016
- 9.6 million patrons by 2026.

These forecasts are made up of:

- the existing patronage of the light rail plus a modest annual patronage growth (base)
- an increase in patronage associated with trips diverted from existing modes due to relative costs between existing modes and the light rail (diverted trips)
- the trips generated from proposed developments along the SLRE corridor (new trips).

4.2 Light rail weekday boarding forecast 2016

Transport NSW has provided a preliminary 2016 weekday forecast of passengers boarding the light rail extension at each of the proposed stops. This forecast was based on market analysis calibrated against the Sydney Strategic Transport Model (STM). The forecast estimates the total number of passengers boarding at each of the proposed stops and the transport mode used to access the stop. Table 4.1 and Figure 4.1 show 2016 daily passengers boarding light rail by access mode. As the table shows, some 3100 passengers would board at SLRE Stage 1 stops per day in 2016.

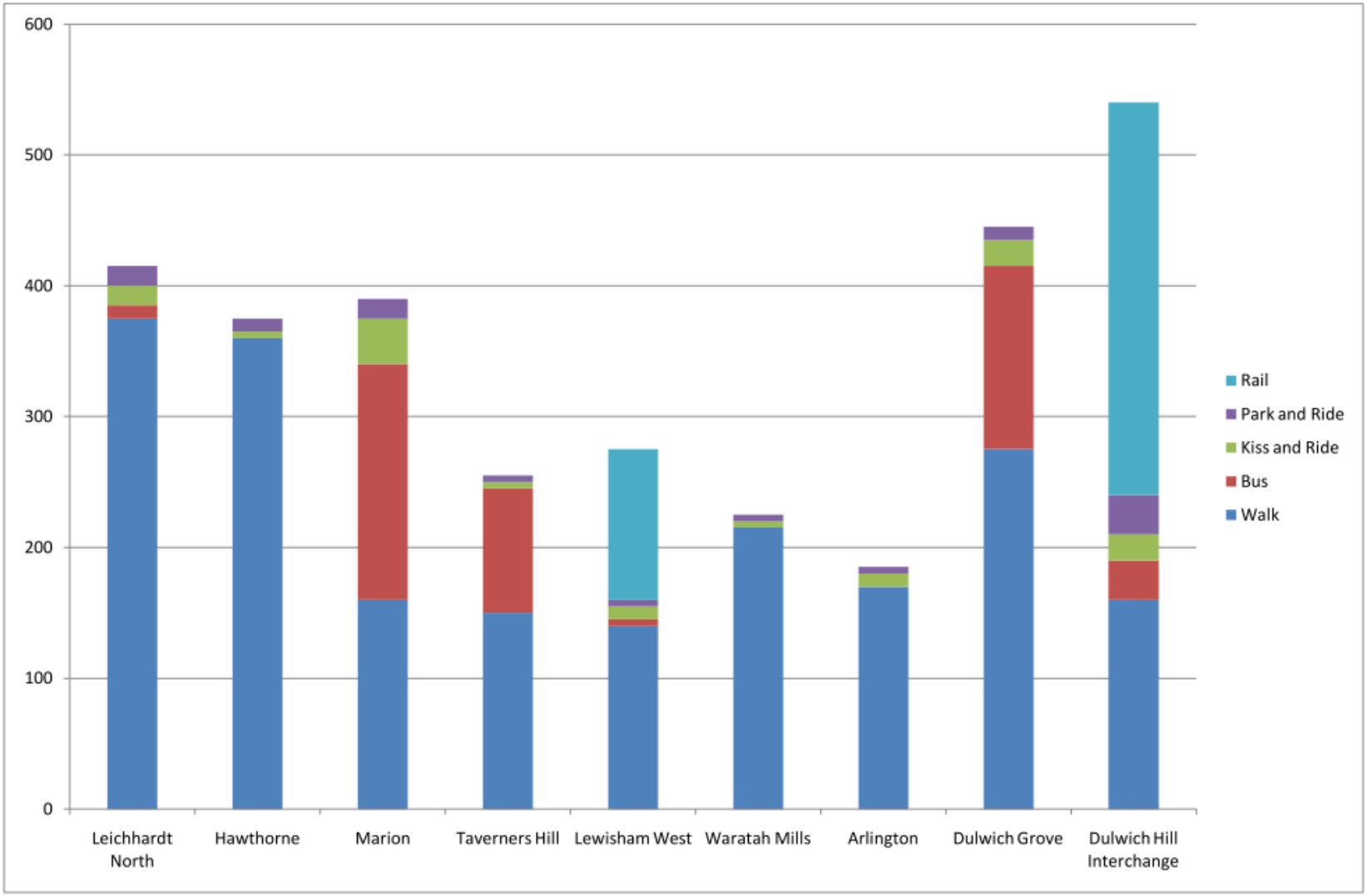
Table 4.1 Light rail weekday passenger boarding forecast 2016

Light rail stop	Total passengers boarding	Walk*	Bus	Car (KnR)	Car (PnR)	Rail
Leichhardt North	415	375	10	15	15	-
Hawthorne	375	360	-	5	10	-
Marion	390	160	180	35	15	-
Taverners Hill	255	150	95	5	5	-
Lewisham West	275	140	5	10	5	115
Waratah Mills	225	215	-	5	5	-
Arlington	185	170	-	10	5	-
Dulwich Grove	445	275	140	20	10	-
Dulwich Hill interchange	540	160	30	20	30	300
Total	**3105**	**2005**	**460**	**125**	**100**	**415**
Percentage	**100%**	**65%**	**15%**	**4%**	**3%**	**13%**

Source: Transport NSW *includes cycling

As Table 4.1 indicates, the SLRE – Stage 1 will generate some 3,105 passenger boardings per day. Overall, the majority of passengers will get to SLRE stops on foot (65%), while some 15% of daily passengers will arrive by bus and 13% by train. Car will be a minor mode of access to the SLRE – Stage 1 stops, with 4% of passengers being dropped off by car (kiss-and-ride) and 3% parking a car near stops (park-and-ride).

The proportion of passengers accessing the SLRE by each mode will vary from stop to stop, depending on the availability of other modes such as bus and rail, the nature of the stop catchment, and the location relative to the arterial road network. Demand for parking and kiss-and-ride (drop off/pick up) will be higher at those stops where the road network is more conducive to accessing the stop, either to drop off/pick up passengers, or to park-and-ride. Similarly, train as an access mode will only be relevant at SLRE stops close to train stations (Dulwich Hill and Lewisham stations).



Source: Transport NSW patronage forecast 2016

Figure 4.1 Light rail weekday passenger boarding forecast 2016

4.3 Operational traffic

The distribution of daily vehicle trips associated with the operation of the SLRE is shown in Table 4.2 below.

A total of 225 passengers will access SLRE stops by car per day in 2016, resulting in approximately 584 vehicle trips (taking into account passengers also being carried in these cars – a typical car occupancy of 1.2 has been assumed; and taking account of car trips to and from the stops). Of these, some 161 are expected to arrive in the peak hour.

Table 4.2 shows, for each stop, the total estimated number of car trips per day and car trips in the AM peak hour. This estimate is based on the 2016 passenger boarding patronage forecast and a travel survey of the existing light rail system undertaken in 2008.

Table 4.2 Operational traffic 2016

Light rail stop	Daily inbound passenger trips by car			Daily vehicle trips		AM peak hour vehicle trips
	Total	Kiss-and-ride	Park-and-ride	Kiss-and-ride	Park-and-ride	
Leichhardt North	30	15	15	50	25	21
Hawthorne	15	5	10	17	17	10
Marion	50	35	15	117	25	39
Taverners Hill	10	5	5	17	8	7
Lewisham West	15	10	5	33	8	11
Waratah Mills	10	5	5	17	8	7
Arlington Mills	15	10	5	33	8	11
Dulwich Grove	30	20	10	67	17	23
Dulwich Hill interchange	50	20	30	67	50	32
Total	**225**	**125**	**100**	**418**	**166**	**161**

From Table 4.2 it can be seen that:

- In 2016 the traffic volumes generated in the AM peak hour by the SLRE are expected to be low, with the most car trips generated at the Marion stop which could generate approximately 40 vehicle trips in the AM peak hour.
- The majority of the stops that will attract car access will generate less than 30 inbound car trips in the AM peak hour. This low number of trips is unlikely to have a significant impact on traffic performance of the existing road network.

The GreenWay is not expected to generate any vehicle trips in its own right, so has been excluded from the analysis.

4.4 Parking demand

The daily passenger boarding forecast for 2016 has been used to estimate the number of kiss-and-ride and park-and-ride spaces that may be needed to serve SLRE demand in 2016. Table 4.3 summarises the estimated parking space demand at each stop for kiss-and-ride and park-and-ride. It assumes that:

- 54% of park-and-ride trips are expected to be commuters (based on the trip purpose of existing light rail users) and will require a parking space all day.
- because of the high frequency of the light rail, the kiss-and-ride trips are expected to be constant across the peak hour and that each kiss-and-ride drop off will not take longer than 5 minutes (so that a kiss-and-ride parking space could accommodate 12 kiss-and-ride movements per hour).

Table 4.3 Parking space demand

Light rail stop	Kiss-and-ride daily vehicle trips	Commuter and leisure park-and-ride daily vehicle trips	Demand for commuter park-and-ride parking spaces	AM peak hour demand for kiss-and-ride parking spaces
Leichhardt North	50	25	10	2
Hawthorne	17	17	7	1
Marion	117	25	10	3
Taverners Hill	17	8	3	1
Lewisham West	33	8	3	1
Waratah Mills	17	8	3	1
Arlington Mills	33	8	3	1
Dulwich Grove	67	17	7	2
Dulwich Hill interchange	67	50	20	2
Total	**418**	**166**	**66**	**14**

From Table 4.3 it can be seen that:

- parking demand for park-and-ride is expected to be greatest at the Dulwich Hill Interchange. At this stop approximately 20 parking spaces could be required by 2016 to satisfy daily demand from commuters (parking all day) and leisure travellers (expected to have a lesser parking duration)
- parking demand for all day commuter parking (for work travellers) is expected to be greatest at Marion where up to 40 spaces may be needed by 2016
- the peak hour demand for kiss-and-ride parking spaces is likely to be minimal. Up to three kiss-and-ride spaces may be required at the Marion stop. However, most of the stops will only require one or two kiss-and-ride spaces in 2016 and this could be accommodated in the form of kerbside short stay parking spaces at peak times.

The GreenWay is not expected to attract vehicle trips so parking should also not be required.

5. Transport and traffic impact

5.1 Transport

5.1.1 Transport interchange policy and best practice

The Transport NSW Guidelines for the Development of Public Transport Interchange Facilities (2008) provides guidance for best practice interchange design and management. The Guidelines identify categories of interchanges from Global/Regional Interchanges through Major/Specialised and Multi-access Interchanges to Local Interchanges. Light rail stops are not specifically categorised but can be assumed to be Local Interchanges, which are characterised by:

- having walking and kiss-and-ride as the dominant access mode
- serving a local community
- having limited bus services or taxi stands
- access by cyclists.

The guidelines note that 'on-street commuter parking in surrounding streets or in designated commuter car parks may be considered where consistent with the Government's Draft Metropolitan Parking Policy'.

A separate SLRE Parking Strategy (Appendix A) provides more discussion on the State and local Government policies and strategies relating to car parking at SLRE stops; and this document concludes that provision of formal commuter parking supplies at SLRE stations would not be consistent with State and local government objectives.

The guidelines also describe the principles of interchange design and function and these are:

Modal priority access – promotion of the most efficient and sustainable access modes (in priority order - pedestrian/bicycle, bus/ferry, taxi, kiss-and-ride, park-and-ride).

Separation of travel modes – to increase efficiency and reduce conflicts.

Modal integration/ease of transfer – to reduce the impacts on passengers of changing modes at an interchange.

Transit oriented development outcomes – to enhance consolidation around transport interchanges and maximise integration of interchanges with their surroundings.

Legibility – to provide clear and uncomplicated transfer paths.

Overall, most SLRE users will walk to stops and use of car to access SLRE stops is expected to be modest. However, there is potential for car parking associated with SLRE park-and-ride to have an impact on communities which already have high demand for parking and restricted supplies of on-street parking. While it may be possible at some SLRE stops to provide formal supplies of off-street commuter parking, this could encourage park-and-ride trips to be made from areas where parking is more constrained, could discourage kiss-and-ride trips and draw demand from stops on the light rail line to Lilyfield.

The following discusses interchange issues and needs at the SLRE stops where bus and train could be used by SLRE Stage 1 travellers to access the stop.

These are:

- Leichhardt North
- Marion
- Taverners Hill
- Lewisham West
- Dulwich Grove
- Dulwich Hill Interchange.

5.1.2 Leichhardt North

Currently there are five bus routes providing services near the Leichhardt North light rail stop. The northbound bus stop for most routes is 260 m or 3.3 minutes walk (not including waiting time at the two major intersection crossings) away from the light rail stop. The southbound stop for most routes is 255 m or 3.3 minutes walk, not including waiting time at the two major intersection crossings, away from the light rail stop. The route 470 bus stop is further south, some 800 metres away from the Leichhardt North stop.

The current bus routes generally service Norton Street, and it would not be appropriate to reroute the services to come closer to the SLRE stop. Bus use as an access mode is expected to be low for this stop, so it is recommended that no more than signage improvements be carried out to direct light rail users to and from bus stops and Leichhardt centre.

5.1.3 Marion

Marion is a stop which would attract the most daily bus passengers. The current bus stops in both directions are 90 m or a 1.2 minute walk away from the light rail stop. There are six bus routes providing services directly along Marion Street. Due to the proposed location of the signalised cyclist/pedestrian crossing, existing driveways and on-street parking, there is no opportunity for relocating the bus stops closer to the light rail stop, however, this is not considered necessary due to their close proximity.

The location along the bus routes of the Marion Street bus stops means that there is a high likelihood of multiple buses arriving at the same time, meaning that the bus stop must have enough space to accommodate two buses at the same time. Maintaining the current bus stops would require an improvement to the pedestrian road crossing of Hawthorne Parade.

5.1.4 Taverners Hill

The Taverners Hill light rail stop is adjacent to Parramatta Road which has three bus routes travelling along it. The eastbound bus stop is 120 m away or a 1.5 minute walk, while the westbound stop is 195 m away or a 2.5 minute walk.

The physical layout of Parramatta Road does not allow the stops to be moved significantly closer to the light rail stop without increasing road safety risks. Additionally, east of the station there are multiple driveways preventing the relocation of the bus stop on both sides of Parramatta Road.

However this stop (which would generate some 46 daily bus passengers) would have good accessibility from existing bus stops.

5.1.5 Lewisham West

Currently there is only one bus route providing service along Old Canterbury Road with the northbound bus stop being 175 m away or a 2.2 minute walk, and the southbound stop is 275 m away or a 3.5 minute walk. The narrow width of McGill Street and Hudson Street does not allow buses to gain close access to the light rail station. As part of the redevelopment of the site between Hudson Street and Longport Street, it may be possible to allow for the widening of the roads to allow bus access. However, patronage projections suggest only 1 daily bus passenger would transfer to SLRE at this stop so therefore there is no requirement to relocate buses.

The Lewisham West light rail stop is also 390 m away or a 5 minute walk from the Lewisham train station. The walk time does not include the waiting time at the Longport Street and Old Canterbury Road intersection. The southern footpath along Railway Parade between Old Canterbury Road and the Lewisham Station is narrow, and must accommodate all pedestrian traffic as there is no footpath on the northern side.

This stop is expected to be used by some 138 rail-light rail transferring passengers each day. While this is relatively low (and peak demand may be less than 60 per hour), the footpath between the SLRE stop and the station should be upgraded and wayfinding signage provided (including train departure displays at the SLRE stop) to facilitate transfer to and from the station.

5.1.6 Dulwich Grove

Currently five bus routes provide services along New Canterbury Road and stop 65 m away or less than a minute walk from the light rail stop. Route 426 provides service along Marrickville Road with stops 370 m away or a 4.7 minute walk from the Dulwich Grove light rail stop. The current bus stops provide a good level of interchange between the buses and light rail and do not require to be relocated if properly sign posted.

The stop is expected to attract some 76 bus passengers per day.

5.1.7 Dulwich Hill Interchange

Route 412 provides the only existing bus service to the Dulwich Hill Interchange. The bus stop is 85 m away or a 1.1 minute walk from the light rail stop. This is an acceptable interchange distance at this location as the bus cannot access the north side of the train line without major route modifications. The stop is expected to attract only nine bus passengers per day transferring to light rail.

The Dulwich Hill rail station entrance is 45 m away or less than a minute walk from the light rail stop, leading to a very convenient interchange. There may be a need to widen the footpath on the west side of Wardell Road between the train station and light rail station to accommodate the future interchange demand, which is expected to be some 304 train passengers per day.

5.2 Transport integration

The operation of the SLRE – Stage 1 will see a substantial proportion (almost one-third) of passengers arrive at stops by bus and train. Train as an access mode will only be relevant at Lewisham West and Dulwich Hill Interchange stations and the location of the SLRE – Stage 1 stops relative to Lewisham and Dulwich Hill stations will allow for interchange between train and light rail, with appropriate signage.

However, some 460 passengers per day will use bus to get access to SLRE stops, mostly at Marion, Taverners Hill and Dulwich Grove stops. At the Marion stop, this represents almost four bus loads of people transferring from bus to light rail each day. In peak times this represents around 20 passengers per hour (or perhaps five per bus during this period), so while in general bus is an important access mode, the scale of bus to light rail transfer is not considered great enough to warrant relocation of bus stops which are currently serving local travel needs and are in any case generally within reasonable walking distance of SLRE stops.

However, during the design process, the potential for identifying optimum locations for bus stops, to serve both local access needs and facilitate bus to light rail transfer at the key SLRE – Stage 1 stops for bus transfer can be undertaken.

The SLRE is not expected to have a significant impact on bus patronage. It is considered unlikely that current bus passengers would change from bus to use light rail for journeys to the Sydney CBD, as the light rail would not offer a more attractive alternative to staying on the bus in terms of directness and CBD penetration. It is more likely that projected bus to light rail transferring passengers are new users for whom the combination of bus and light rail offers better access to destinations such as Pyrmont.

5.3 Traffic impact

5.3.1 Operational traffic

The traffic generation that could result from the extension of the light rail is likely to be modest. By 2016 approximately 584 vehicle trips per day are forecast to be generated across the SLRE light rail stops. The Marion stop with an AM peak hour traffic generation of approximately 40 vehicles is forecast to have the highest traffic generation. Because there are a number of routes by which vehicles could travel to the Marion stop, this AM peak hour demand is likely to be shared across the local road network and the impact would be minimum. Because the PM peak typically is spread over a longer period than the AM traffic in the PM is less critical than the AM.

The arterial road network currently provides for up to 70,000 vehicles per day on Parramatta Road and 50,000 vehicles on City West Link so an additional approximately 370 vehicles spread across the alignment is unlikely to have any discernable traffic impact.

5.3.2 The GreenWay

The sections of the GreenWay shared path that are to be constructed on-street are not expected to have an impact on parking. The GreenWay is also not expected to be a generator of vehicle trips so no impact is expected from generated traffic. Also, in these streets the additional cycle activity is unlikely to have an impact on traffic.

5.3.3 Marion Street pedestrian crossing

Currently, a pedestrian refuge island is provided across Marion Street to assist pedestrians cross this road and aid the movement along the existing Hawthorne canal shared cycle path. Because of the increased pedestrian and cycle activity that is expected to result from the SLRE – Stage 1 and the GreenWay shared path, a signalised pedestrian crossing is proposed to replace the existing pedestrian refuse island.

A SIDRA analysis of the proposed Marion Street signalised pedestrian crossing was undertaken for the future year 2016 for scenarios both with and without the SLRE.

To assess the likely performance of this intersection the likely future (2016) vehicle and pedestrian traffic was estimated based on:

- the historical traffic growth on Marion Street extrapolated to the future year 2016
- current traffic volumes
- the patronage forecasts for walking and car trip generation.

5.3.3.1 Historical traffic growth Marion Street

Historical AADT traffic volumes for the years 2002 and 2005 are shown in Table 5.1 for the RTA traffic count site 20.035 located on Marion Street at the Goods Railway Line, this being the closest count station to the proposed signalised pedestrian crossing.

Table 5.1 Historical AADT – Marion Street count site 20.035

2002	2005	% Growth
18028	18355	1.8%

5.3.3.2 Existing traffic 2010

PB undertook a count at the proposed location of the signalised pedestrian crossing on the 1 September 2010 between 4:00 pm and 5:00 pm. The results of the count are shown in Figure 5.1.

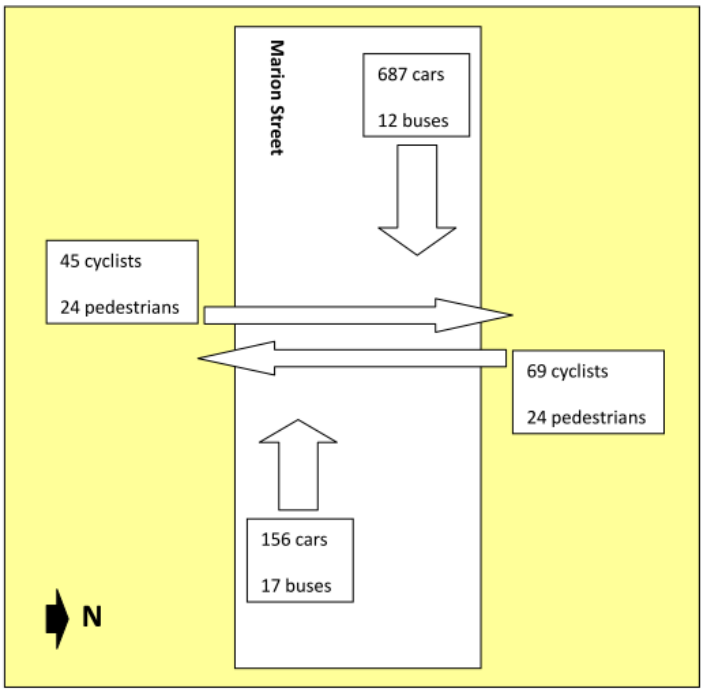


Figure 5.1 Traffic volumes on Marion Street between 4:00 pm to 5:00 pm

5.3.3.3 Forecast (2016) vehicle and pedestrian traffic

Tables 5.2 and 5.3 show the estimated AM and PM peak hour traffic for the Marion Street pedestrian crossing for scenarios with and without the SLRE. This includes existing pedestrian and cyclist crossing volumes (including an allowance for growth) and pedestrians and cyclists forecast to access the light rail station.

Table 5.2 Estimated AM and PM peak hour traffic (2016) without SLRE

	AM				PM			
Movement	N	S	E	W	N	S	E	W
Light vehicles	-	-	240	973	-	-	778	193
Pedestrians/cycles	129	96	-	-	77	104	-	-

Table 5.3 Estimated AM and PM peak hour traffic (2016) with SLRE

	AM				PM			
Movement	N	S	E	W	N	S	E	W
Light vehicles	-	-	264	997	-	-	802	217
Pedestrians/cycles	136	103	-	-	84	111	-	-

These future forecasts assume:

- an PM to AM peak hour conversion factor of 1.25 (this is based on the typical traffic flow profile for Sydney)
- a traffic growth of 1.8% per year
- 50% of park-and-ride trips arriving in the AM and departing in the PM peak hours
- 10% of kiss-and-ride trips in the AM and PM peak hours (based on typical flow profile)
- 10% of pedestrian trips in the AM and PM peak hours (based on typical flow profile)
- 50% of traffic heading to the west and 50% heading to the east.

As the tables show, there would be modest increases in pedestrian and vehicle movements through the crossing with the introduction of the SLRE – Stage 1.

5.3.3.4 Traffic performance

A signal controlled crossing is considered as an intersection by SIDRA which provides the following key metrics that can be used to determine traffic performance at intersections and signal controlled crossings.

- Level of Service (LoS)
- Degree of Saturation (DoS)
- average intersection delay.

Level of Service (LoS) is a basic performance parameter used to describe operation of an intersection. LoS range from A (indicating good intersection operation) to F (indicating over saturated conditions with long delays and queues). Table 5.4 shows the RTA LoS criteria from the Roads and Traffic Authority October 2002*, Guide to Traffic Generating Development.*

Table 5.4 Level of Service (LoS) criteria for intersections and signal controlled crossings

LoS	Average delay (sec/veh)	Traffic signals
A	Less than 14	Good operation
B	15 to 28	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Operating near capacity
E	57 to 70	At capacity; at signals, incidents will cause excessive delays

Degree of Saturation (DoS) is the ratio of demand flow to capacity, and therefore has no unit. As DoS approaches 1.0, extensive queues and delays could be expected. For a satisfactory situation, DoS should be less than the nominated practical DoS, usually 0.9. The intersection DoS is based on the traffic movement with the highest value.

Delay is the difference between interrupted and uninterrupted travel time through the signal controlled crossing and is measured in seconds per vehicle.

Tables 5.5 summarises the likely future (2016) performance of the Marion Street signal controlled crossing both with and without the development of the SLRE. The table shows the performance of the worst traffic movement.

Table 5.5 Future 2016 traffic performance

	AM			PM		
	LoS	**DoS**	**Average Delay (seconds)**	**LoS**	**DoS**	**Average Delay (seconds)**
Without SLRE						
Vehicles	A	0.80	11	B	0.87	20
Pedestrians	C	-	20	B	-	11
With SLRE						
Vehicles	A	0.82	12	B	0.88	20
Pedestrians	C	-	21	B	-	12

The above table shows that with a signalised pedestrian crossing of Marion Street could function up to 2016 with a level of service for vehicle traffic of B or better and that the additional traffic and pedestrians generated by the SLRE would not have a noticeable impact on traffic performance.

5.3.4 Parking

Demand for parking on the road network surrounding each of the SLRE stops has been assessed based on the weekday passenger boarding forecast for 2016, comments from Council and observations on site.

The main parking impact is likely to be from all day commuter parking. This is discussed in more detail in the sections that follow (and within the Draft Parking Strategy – Appendix A). All of the stops will have a demand for kiss-and-ride but this is not expected to exceed three parking spaces. It is likely that kerbside parking for kiss-and-ride could be found close to each of the stops within existing short-stay parking supplies, so no dedicated spaces would need to be provided. Existing parking spaces would be signposted as P5 parking during peak times.

In addition some non work related light rail trips (mostly for leisure) will access stops by car.

5.3.4.1 Leichhardt North

The Leichhardt North stop is forecast to require 10 commuter parking spaces by 2016 of which 7 are expected to be for all day parking. Darley Road, onto which this stop accesses, has unrestricted kerbside parking on both sides. In excess of 60 spaces were observed to be available so the impact of forecast commuter parking is likely to be minimal.

A resident parking scheme has recently (2009) been introduced around the Lilyfield light rail stop following concerns raised by residents about commuters using the local roads to park-and-ride the light rail into the city. Council has some concerns that when the light rail is extended some of the commuters displaced from the Lilyfield stop catchment will seek to park around the Leichhardt North stop, particularly because this stop has good access to the City West Link road and has unrestricted parking close to the stop.

It is considered that this issue would be exacerbated by provision of formal commuter parking supplies here. This would also be inconsistent with the draft SLRE parking strategy. Accordingly, no formal park-and-ride provision is recommended.

5.3.4.2 Hawthorne

The Hawthorne stop is forecast to require 7 commuter parking spaces by 2016 of which 2 are expected to be for all day parking. Most of Darley Road close to the Hawthorne stop is unrestricted parking so spaces are available on street. It is unlikely that commuter parking would have a significant impact on the local parking supply.

Council has received some comments from residents that the new foot/cycle crossing over the Hawthorne canal could make Hawthorne Parade an attractive commuter parking location for light rail (however, it is more likely that these commuters would use Marion or Leichhardt North one of which they would need to pass to get to Hawthorne). Hawthorne Parade has some unrestricted parking available so the impact of any commuter parking that does occur close to the Hawthorne Stop is likely to minimal.

5.3.4.3 Marion

The Marion stop is forecast to require 10 commuter parking spaces by 2016, of which 7 are expected to park all day. Consultation with Council has highlighted parking around the Marion stop as an issue of concern to residents. The additional demand generated by the SLRE could lead to reduced availability of unrestricted parking spaces within the local roads surrounding the stop, particularly within Hawthorne Parade, which currently has some spare parking capacity during the day.

Parking close to Lambert Park, which is opposite the Marion stop, has been identified by Council as a significant issue at weekends and Council are considering the need for a resident parking scheme in the local streets on either side of Marion Street. No data are available on weekend SLRE – Stage 1 patronage.

5.3.4.4 Taverners Hill

The Taverners Hill stop accesses onto Parramatta Road and onto Hathern Street both of which have restricted parking close to the stop accesses. This stop is forecast to require three commuter parking spaces by 2016 of which two are expected to park all day. This number of commuters could be accommodated within the local roads so the impact on local residents and businesses would be minor.

5.3.4.5 Lewisham West

The Lewisham West stop is forecast to require three commuter parking spaces by 2016 of which two are expected to be for all day parking. This is unlikely to impact on the local parking supply.

5.3.4.6 Waratah Mills

The Waratah Mills stop is forecast to require three commuter parking spaces by 2016 of which two are expected to be for all day parking. This is unlikely to impact on the local parking supply.

5.3.4.7 Arlington

The Arlington stop was identified by Council as a location where parking demand is high at weekends because of events at the Arlington Recreational Park and Johnson Park. While there are no data on forecast SLRE – Stage 1 patronage on weekends, in general public transport patronage is lower on weekends than on weekdays. If this is the case with the SLRE, there is likely to be less demand for commuter parking spaces at other stops at weekends so there may be opportunities for some of the people going to the parks close to the Arlington Stop to use the light rail and park their cars close to other stops where parking is more available.

The Arlington stop is forecast to require three commuter parking spaces by 2016 of which two are expected to be for all day parking. This is unlikely to impact of the local parking supply.

5.3.4.8 Dulwich Grove

The Dulwich Grove stop is forecast to require 9 commuter car parking spaces by 2016, of which some 2 are expected to park all day. These spaces would need to be provided on street within local roads. Few unrestricted parking spaces are currently available within Hercules Street and on Old Canterbury Road. The number of available parking spaces changes throughout the day with parking at its most busy during school start and finish times. It was estimated that approximately 20 parking spaces would be available on Old Canterbury Road and Hercules Street so the impact on residential streets is likely to be minimal.

5.3.4.9 Dulwich Hill Interchange

Approximately 10 parking spaces are proposed to be removed from Bedford Crescent as part of the construction of the Dulwich Hill Interchange. The existing off street commuter car park to the south of the Dulwich Hill railway station appears to be underutilised (approximately 23 spaces used out of 53) and could provide parking for these displaced vehicles.

In addition to the displaced vehicles from Bedford Crescent, the SLRE is forecast to generate a demand for an additional 20 commuter parking spaces, of which 14 are expected to park all day at this stop in 2016. It is likely that all the commuter parking demand could be provide for within the existing commuter car park, however some commuters may still choose to park in local streets so some impact on parking may occur.

5.3.5 Construction impact

5.3.5.1 Construction activity and plant

Construction activity will be mostly being focused around individual stops and on streets used by the GreenWay. Typical construction activity at stops could include:

- site clearance and earthworks which will require earth moving equipment and small excavators
- platform construction, these are likely to require multiple concrete pours using premixed concrete mixer trucks, concrete pumping equipment, excavators and dump trucks
- construction of footways, lifts and stairways, this will be need small mobile plant such as a three tonne dump truck, road roller and small excavators
- concrete foundations for lift and stair structures, requiring premixed concrete mixer trucks, concrete pumping equipment, excavators and dump trucks
- construction of lifts and structures at stops, these are expected to be pre-made units constructed off site that would need to be lifted into place by crane
- finishing works, signs, railings, electrical work, drainage etc. These works are unlikely to require heavy plant.

In addition, the construction of the GreenWay could include:

- site clearance and earthworks to create a cycle/footway formation level. This would involve excavators, dump trucks and a small road roller
- construction of path surface which could require a mini paving machine, dump trucks and a small road roller
- construction of GreenWay railway bridge abutment tunnels which could require a mini tunnelling rig, dump trucks and excavators.

All this plant would need to be transported to site along with site offices, rest rooms and storage. In addition most of the materials needed to construct the stops and the GreenWay would need to be transported by road.

5.3.5.2 Construction worker vehicle trips

The project is expected to require up to 350 workers with most of these workers expected to be working from the main site compound at the Rozelle Goods Yard.

The use of public transport, shared journeys and use of contractor's mini buses would be promoted and encouraged for staff trips to work. During the working day the majority of staff trips are expected to be within the SLRE corridor instead of on roads.

Based on a staffing level of 350 people the number of vehicle trips per day and within the AM peak hour has been estimated and are shown in Table 5.6. This estimate assumes:

- 50% of staff located at the Rozelle Goods yard site compound
- 20% of staff based at Dulwich Hill Interchange

- 30% of staff based at stops along the SLRE
- 65% of staff arriving by car (approximate car mode share for the inner west suburbs)
- a car occupancy of 1.2 (approximate car occupancy for the inner west suburbs)
- 10% of daily vehicle trips in the AM peak hour (noting that workforce start and finish times are not expected to coincide with commuter peak periods).

Table 5.6 Preliminary construction staff vehicle trip generation

Compound	Number of staff	Staff trips per day	Public transport factor	Car occupancy factor	Daily vehicle trips	AM peak hour trips
Rozelle goods yard (main site compound)	175	4	0.65	0.83	378	38
Dulwich Hill interchange	70	4	0.65	0.83	152	15
Other stops on SLRE	105	4	0.65	0.83	226	23

The Rozelle Goods Yard would be accessed off the City West Link which is a major arterial road into the Sydney CBD. An increase of approximately 378 vehicle trips per day or 38 vehicle trips in the AM peak hour is minor when compared to the approximately 50,000 vehicles that use this road daily (RTA Traffic volumes 2005) so it is unlikely that construction traffic would have a significant impact on this road's traffic performance.

Likewise the impact of construction staff vehicle trips to the Dulwich Hill and the other SLRE stop compounds is unlikely to impact significantly on existing traffic performance. This is because the staff traffic volume is low and would be distributed between stops and each stop has several directions by which it can be accessed.

5.3.5.3 Construction heavy vehicles trips

The SLRE stop construction would require approximately:

- 1,430 cubic metres of concrete for the station platforms
- 940 cubic meters of selected fill material
- 180 cubic metres of asphaltic concrete
- removal from site of 1,800 cubic metres of spoil material.

The bridge and abutment works would require approximately:

- 100 cubic meters of concrete
- 90 cubic metres of selected fill material
- removal from site of 1,260 cubic metres of spoil material

The GreenWay works would require approximately:

- 370 cubic metres of concrete
- 2,740 cubic meters of selected fill material
- 365 cubic metres of asphaltic concrete
- removal from site of 1,500 cubic metres of spoil material.

The overhead wire support works would require approximately:

- 270 cubic metres of concrete
- removal from site of 230 cubic metres of spoil material.

The number of truck trips for the project has been estimated in Table 5.7. This assumes:

- a standard 20 tonne truck will be used for haulage
- an approximate density of concrete/spoil material of 1.25 kg/m^3
- a working year equal to 300 days
- a trip being a single journey from an origin to a destination.

Table 5.7 Construction heavy vehicle trips for project

Component/activity	Tonnes of material	Truck trips (includes an inbound and outbound trip)[1]	Duration of activity in days	Average daily truck trips
Stops	5,451	548	300	1.8
Bridges and Abutments	1,820	182	300	0.6
GreenWay	5,161	518	225	2.3
Overhead wire supports	625	64	300	0.2
Total	**13,057**	**1312**		***4.9***

Note: 1. Values rounded up to even number of trips

The main roads within Leichhardt and Marrickville are recognised by Council as having higher than usual heavy vehicle use, so the additional construction traffic generated by this project is unlikely to have a significant impact.

On average an estimated 4.9 truck trips per day during the peak six month period could be added to the road network along the SLRE alignment. This increase in truck traffic is unlikely to have a significant effect on traffic performance.

The construction traffic impact of heavy vehicles could be reduced by:

- ensuring that truck deliveries occur outside the AM and PM peak hours
- avoiding using residential streets
- where practical, combining deliveries and undertaking multi drop deliveries to minimise heavy vehicle kilometres travelled.

5.3.5.4 Construction compounds and access

Figures 5.2 to 5.7 show the location of the construction compounds and the preferred construction access routes. The traffic issues at each of the construction compounds are described in Table 5.8. None of the construction accesses will remove parking that is currently used except at Dulwich Hill Interchange stop. All the site compounds and worksite accesses can be designed to minimise the use of local roads, maintain good levels of amenity and road safety.

Figure 5.2 Worksites and construction access routes - Lilyfield

Figure 5.3 Worksites and construction access routes – Leichhardt North

Figure 5.4 Worksites and construction access routes – Hawthorne

Figure 5.5 Worksites and construction access routes – Marion, Taverners Hill and Lewisham West

Figure 5.6 Worksites and construction access routes –Lewisham West, Waratah Mills and Arlington

Figure 5.7 Worksites and construction access routes –Arlington, Dulwich Grove and Dulwich Hill Interchange

Table 5.8 Traffic issues - Construction worksite and compounds

Site	Issues/comments
Lilyfield/Rozelle railway goods yard	▪ Two access routes are proposed: via City West Link and via Lilyfield Road through the freight forwarded yard. ▪ The sight distances on City West Link exceed the minimum required but use of this access will require some additional signs and the preparation of a Traffic Control Plan. Exiting vehicles may have to wait a considerable time for a break in the traffic stream during peak hours because of the high volumes of vehicles at these times. ▪ The City West Link access would have to be a left in left out access. ▪ The Lilyfield Road access is an existing heavy vehicle access and has adequate sight distances. ▪ Neither access would require the loss of parking space. Some parking spaces within Lilyfield Road would be available for construction use and parking within this road is generally not in high demand.
Leichhardt North A construction compound is proposed within site of 7 Darley Road. Access to the construction compound would be via an existing access directly onto Darley Road (this access is currently disused).	▪ The sight distances for vehicles entering and exiting the proposed construction worksite access are good with more than 200 m unobstructed visibility in each direction. ▪ A route to this construction compound can be provided from City West Link Road minimising the use of local/regional roads. ▪ Queued traffic from the James Street/City West Link Road intersection could block the construction access. This could then prevent a truck turning right from Darley Road into the access. A temporary keep clear road marking should be considered as part of the temporary traffic management for this worksite. ▪ The construction compound would need to provide sufficient space to turn the size of truck expected to be used to deliver materials to site. This is to avoid truck reversing manoeuvres on Darley Road. ▪ On-street parking in the vicinity of the proposed worksite is available within unrestricted sections of Darley Road and the local road network.
Hawthorne A worksite access and construction compound are proposed adjacent to the proposed stop. Access to the worksite would be via a temporary site access onto Darley Road. An alternative compound access could be provided off Allen Street.	▪ A temporary construction compound access will need to be carefully positioned to maximise sight distances on Darley Road because to the north of the proposed Hawthorne construction compound Darley Road bends sharply. ▪ The temporary construction compound access should be positioned to avoid the refuge island currently connecting Lyall Street with the children's playground or the refuge should be removed and reinstated after the works. ▪ The preferred construction traffic access route would use Darley Road to connect with the City West Link Road. The construction program for the stops at Hawthorne and Leichardt North could be staged to minimise cumulative construction traffic. Multi drop deliveries of materials would be encouraged to minimise the number of truck trips. ▪ On-street parking in the vicinity of the proposed worksite is likely to be available within the unrestricted sections of Darley Road.

Site	Issues/comments
Marion	
A construction compound is proposed within the Council yard adjacent to the SLRE alignment. Construction of the proposed at grade signalised pedestrian crossing will require a worksite on Marion Street and temporary lane closures.	▪ The construction compound would use an existing access onto Marion Street. This access has good sight distance and is suitable for Heavy Vehicles. ▪ The preferred construction traffic access route to access the Marion site compound would use Marion Street, Ramsay Street and Dalhousie Street. ▪ Marion Street is approximately 14 m wide so during the construction of the proposed at grade signalised crossing of this street, it should be feasible to maintain two way traffic movement in two 3 m wide traffic lanes with a 1 m wide safety zone separating traffic from road workers. This worksite on Marion Street would require some loss of parking for the duration of these works (approximately six parking spaces).
Taverners Hill	
A construction compound is proposed within the SLRE corridor for the construction of the stop platforms. It is proposed that a shared cycle/foot bridge be installed to carry the GreenWay across the Parramatta Road. This may require a worksite.	▪ Access to this construction compound would be via the rail corridor gate off Brown Street to the south of Parramatta Road. Adequate sight distances for the site access can be provided. ▪ The preferred construction access routes to this work site would be via Parramatta Road using Tebbutt Street, Hathern Street and Brown Street or via Old Canterbury Road, Cook Street and Brown Street. ▪ Construction of the footbridge on Parramatta Road may require closure of Parramatta Road overnight. This will be dependent on the construction methodology. A closure of Parramatta Road even at night would require significant temporary management and planning.
Lewisham West	
A construction compound is proposed within the SLRE corridor and accessed via Hudson Street.	▪ Access to the compound would be via an existing gate into the rail corridor at the west end of Hudson Street. This access has good sight distance and is suitable for heavy vehicles. ▪ Hudson Street is narrow, approximately 5.5 m wide, and has parking along the south side which reduces the effective width for traffic to approximately 3.0 m which is wide enough for one way traffic only. This road section would not be suitable as a compound access without traffic management measures being implemented. Two traffic management options are proposed: ‣ Introduction of a temporary one way system allowing traffic to travel west only between Old Canterbury Road and McGill Street and south along McGill Street between Hudson Street and Old Canterbury Road. ‣ Temporary removal of the parking on Hudson Street to permit two-way traffic on this street. ▪ The preferred construction access route would use Parramatta Road and Old Canterbury Road to access via Hudson Road. The construction program for the stops at Lewisham West and Marion could be staged to minimise cumulative construction traffic. Multi drop deliveries of materials would be encouraged to minimise the number of truck trips.

Site	Issues/comments
Waratah Mills	
A construction compound is proposed within the SLRE corridor and accessed via Weston Street.	▪ Access to the compound would be via the existing gate onto the rail corridor at the southern end of Weston Street. This access has good sight distance and is suitable for heavy vehicles. ▪ Weston Street is approximately 12 m wide with parking both sides of the road. However, the street has sufficient width to provide access for heavy vehicles. ▪ The preferred truck access route would be Weston Street, Winsor Road to Old Canterbury Road. ▪ The GreenWay is proposed to be placed in a box culvert with the east side abutment of the existing Davis Road overpass road bridge. This work may require that Davis Road is closed to traffic so that ground strengthening can be undertaken (this would be confirmed by geotechnical investigations). Traffic could be diverted via Winsor Road to bridges on Old Canterbury Road or Constitution Road. The GreenWay is also proposed to underpass bridges at Constitution Road which may also require a road closure. The Contractor would need to coordinate these closures to ensure that access is maintained.
Arlington	
A construction compound is proposed within the SLRE corridor and accessed via a temporary access way on the no through road section of Constitution Road.	▪ Access to the compound would be via a temporary access onto the rail corridor at the eastern end of the no through road section of Constitution Road. This access has good sight distance and is suitable for heavy vehicles. ▪ This section of Constitution Road is a residential road serving approximately seven properties. The road is approximately 12 m wide and has unrestricted parking on both sides. However, the road has sufficient width to provide access for heavy vehicles. ▪ The preferred truck access route would be via Constitution Road to New Canterbury Road. ▪ The GreenWay is proposed to be placed in a box culvert with the east side abutment of the existing Constitution Road overpass bridge. This work may require that Constitution Road is closed to traffic. Traffic could be diverted via Winsor Road and Denison Road to the bridge on Davis Road. However, as the GreenWay is also proposed to underpass the bridge at Davis Road, which may also require road closure, so the closure of these bridges will need to be coordinated to ensure that access is maintained.
Dulwich Grove	
A construction compound is proposed within the SLRE corridor. A compound is also likely to be required on the west side Hercules Road bridge.	▪ Access to the compound would be via the existing rail corridor gate on Blackwood Avenue which has approximately seven properties to the south and Dulwich Hill Public School to the north. ▪ The preferred truck access route would be via Blackwood Avenue, Kintore Street, Macarthur Parade and Beach Road to New Canterbury Road. ▪ The compound on Hercules Street would be for the construction of the footway connecting Hercules Road and New Canterbury Road. This compound would reduce the available road space to a single lane and would require shuttle working or traffic to be diverted to an alternative route.

Site	Issues/comments
Dulwich Hill Interchange	
A construction compound is proposed within the SLRE corridor. In addition, a compound will need to occupy the existing commuter parking area on Bedford Crescent.	▪ Access to the compound would be via the existing rail corridor gate on Blackwood Avenue (this gate will be shared with the Dulwich Grove compound). ▪ The existing commuter car parking in Bedford Crescent will be removed to provide a compound for the construction of the Dulwich Hill interchange stop. Bedford Crescent is approximately 14 m wide with unrestricted parallel parking on the northern side and parking at 90 degrees to the kerb line on the southern side of the road. With the parking removed it should be feasible to retain a single lane of parking and two traffic lanes.
Pyrmont Stabling Yard	
A stabling yard and site compound is proposed at Pyrmont stabling yard.	▪ Access to the Pyrmont stabling yard worksite would be via the existing gates under the Pier Street overpass bridge at the southern end of Pyrmont Street. Sight distances and safety issues at this vehicle access have not been examined. However, on plan this access looks to have adequate sight distances. Vertical clearance of loads could be an issue and would require further investigation. The existing gates are on a section of road with a no stopping parking restriction so use of this gate would not impact on parking. ▪ The preferred heavy vehicle access route for inbound vehicles would be via Harris Street, Allen Street and Pyrmont Street and for outbound vehicles Pyrmont Street, Quarry Street onto Harris Street. Both these routes are suitable for occasional use by heavy vehicles. ▪ On street parking will not be affected by this proposed worksite.

5.3.5.5 Temporary lane closures and road closures

The construction of the GreenWay and light rail stops may require some temporary lane closures. These closures would need to be managed and coordinated so that accessibility on local roads is maintained. In addition the contractor will need to coordinate any lane or road closures with the relevant Council and the RTA so that the cumulative impact of any road works with the locality can be managed. The proposed construction method could require:

- overnight road closures of Parramatta Road during the lifting of the pedestrian/cycle bridge span
- road closures of Davis Road and Constitution Road for ground strengthening works prior to tunnelling for the GreenWay shared path
- lane closures of Marion Street to facilitate the construction of the proposed signalised crossing
- lane closures on Hercules Street to provide a construction compound and access for construction of the GreenWay
- lane closures on the southern side of Bedford Crescent to allow for the construction of the light rail stop.

5.3.5.6 Potential cumulative construction impacts

The delivery of the SLRE will need to be coordinated with other major construction projects within the local area. A Construction Traffic Management Plan (CTMP) will need to be prepared, once a detailed construction methodology is confirmed. The CTMP will need to consider the timing of works so that cumulative impacts are avoided.

5.3.5.7 Construction worker parking

Where practical, construction workers would be expected to park within the worksites or within site compounds so that the current demand for parking spaces on street is not increased and the construction impact on parking is minimised.

Construction workers would also be encouraged to use, where practical, the existing public transport network or to car share with other workers.

6. Impact mitigation and improvement measures

Impacts of SLRE on existing transport are expected to be minimal. However, measures could be considered to maximise the patronage and integration of the SLRE Stage 1 other transport modes and with the GreenWay shared path.

No significant impact on operational traffic is expected to result from the SLRE so improvement measures are not proposed. Some parking impacts could occur due to kiss-and-ride and park-and-ride activity at some stops. This impact on parking could be managed by implementing parking strategies aimed at discouraging car use, particularly park-and-ride; and encouraging use of walking, cycling, bus and train to access SLRE – Stage 1 stops. To improve accessibility by mobility-impaired travellers, disabled parking spaces can be provided at all SLRE – Stage 1 stops.

The impacts of construction parking and traffic would be managed by a CTMP a framework for which is described within this chapter.

6.1 Functional interchange improvements

Measures could be taken to improve the functional interchange of the SLRE stops. These measures would assist the SLRE to maximise patronage and to promote safe and accessible interchange between light rail and the other travel modes in the vicinity of stops. The proposed interchange improvement measures are listed in Table 6.1.

Table 6.1 Functional interchange improvements

Light rail stop	Improvement	Stakeholder
Leichhardt North	▪ construct footpath or shared path on the north side of Darley Road between the light rail stop and City West Link. Provide disabled parking space at kerbside near stop	▪ Leichhardt Council
Marion	▪ removal of pedestrian refuge islands on Marion Street to encourage the use of proposed signalised crossing ▪ move proposed signalised crossing west in-line with existing crossing to maintain the strong desire line ▪ provide wayfinding to shopping centre ▪ provide disabled parking spaces at kerbside near stop	▪ Ashfield Council and Leichhardt Council ▪ Ashfield Council and Leichhardt Council ▪ Leichhardt Council
Taverners Hill	▪ the shared path to be added to the existing rail bridge should be at least 4 m wide to allow pedestrians and cyclists to pass ▪ provide disabled parking spaces at kerbside near stop	▪ Transport NSW
Lewisham West	▪ investigate options for widening the footpath along Hudson Street ▪ construct a footpath connecting the light rail station to Longport Street ▪ resurface footpath on the south side of Longport Street between Old Canterbury Road and Lewisham Station to remove tripping hazards and footpath obstructions where possible ▪ provide rail timetables at the light rail stop ▪ provide light rail timetables at Lewisham Station ▪ provide disabled parking spaces at kerbside near stop	▪ Marrickville Council ▪ Transport NSW and Marrickville Council ▪ Marrickville Council ▪ Transport NSW ▪ Transport NSW ▪ Marrickville Council
Dulwich Grove	▪ ensure that adequate wayfinding exists to both the light rail stop and existing bus stops ▪ provide disabled parking spaces at kerbside near stop	▪ Transport NSW
Dulwich Hill	▪ investigate installing a signalised pedestrian crossing south of station ▪ provide disabled parking spaces at kerbside near stop ▪ investigate widening of footpath on the west side of Wardell Road between Dudley Street and Bedford Crescent ▪ provide rail timetables at the light rail stop ▪ provide light rail timetables at Dulwich Hill Station	▪ Marrickville Council and RTA ▪ RTA ▪ Transport NSW ▪ Transport NSW

6.2 GreenWay integration improvements

The benefits of the GreenWay shared path would be maximised by good integration with the wider regional and local cycle networks. Table 6.2 provides a summary of measures that could be introduced to maximise the benefits of the GreenWay.

Table 6.2 Cycle network improvements

Light rail stop	Improvement	Stakeholder opportunity
Leichhardt North	▪ investigate a cycle lane or cycle reserve on Darley Road at City West Link intersection	▪ Leichhardt Council ▪ RTA
Hawthorne	▪ provide a safe, secure and weather protected cycle parking at stops and facility near the GreenWay such as cafés and park facilities	▪ Leichhardt Council and Transport NSW ▪ Ashfield Council
Marion	▪ vegetation pruning on cycle path south of Marion Street ▪ in order to convert the footpath into a shared path investigate the width of footpath on Marion Street between the entrances of the cycle way	▪ Leichhardt Council ▪ Ashfield Council and Leichhardt Council
Taverners Hill	▪ trim overgrown vegetation along existing cycle path	▪ Leichhardt Council
Lewisham West	▪ investigate the need for a safe, secure and weather protected cycle parking facility to service the light rail stop and train station, possibly within the new development	▪ Marrickville Council and developer and Transport NSW
Waratah Mills	▪ investigate intersection treatment for on-road cycle path at Old Canterbury Road and Weston Street ▪ provide a high quality road surface to clearly demarcate on-road cycle path	▪ Marrickville Council ▪ Marrickville Council
Arlington	▪ investigate the need for a safe, secure and weather protected cycle parking facility to service the light rail stop and park facilities ▪ investigate possible connections to existing cycle network at Hercules Street	▪ Marrickville Council and Transport NSW ▪ Marrickville Council
Dulwich Hill	▪ investigate road safety and measures to reduce vehicle speeds at the Ewart Street/Terrace Road roundabout ▪ resurface Ewart Lane to reduce tripping and cycling hazards	▪ Marrickville Council and RTA ▪ Marrickville Council

6.3 SLRE commuter parking strategy

A draft SLRE parking strategy has been developed to guide provision and management of car parking and accessibility at SLRE stops, consistent with State and local government policies, principles and plans.

This parking strategy aims to:

- provide and promote more sustainable access modes such as walking, cycling, bus and train; and kiss-and-ride as an alternative to park-and-ride if a car journey is necessary
- support interchange function at each of the SRLE stops
- minimise the parking impact on residential streets attributable to the SLRE
- recognise that parking at each of the SLRE stops has a local context and differing priorities.

The parking strategies for each of the SLRE stops is summarised in Table 6.3. Within the table the forecast need for parking is indicated as required spaces. These spaces do not need to be provided and indeed it is recommended that these parking spaces are not provided.

Table 6.3 Summary of parking strategies for stops on the SLRE

Stop name	Issues	Parking strategy/control measures
Overall line	<u>General issues</u> Overall the SLRE has a relatively low demand for private vehicle access, but the demand it could generate is likely to be concentrated at some stops more than others. This also concentrates the impact at these stops. Both Leichhardt and Marrickville Councils recognise that there is a lack of parking supply at most of the stops on the SLRE and that because of this lack of supply there is a risk of substantial impacts on communities, from park-and-ride demand. The lack of supply also tends to be at the stops where demand will be greatest. Parking restrictions and supply at stops of the SLRE needs to be consistently applied and consistent with the existing light rail stops so that migration of parking between stops and the associated increase in vehicle kilometres travelled is avoided. Parking strategies for the SLRE need to support and encourage sustainable modes in accordance with Transport NSW's transport interchange guidelines. Land use adjacent to the SLRE should maximise opportunities for Transit Oriented Development (TOD) thus minimising vehicle trip generation and parking demand and maximising sustainable land use.	Encourage alternative modes by not providing formal designated park-and-ride parking spaces. Opportunities to provide formal parking may exist, but should not be pursued because of: ▪ the risk of diverting sustainable access modes from other stops to park-and-ride (i.e. perhaps providing supply for other parts of line instead of SLRE) ▪ the local traffic impact of traffic attracted to park-and-ride and loss of car parking for the community ▪ the use of land for park-and-ride would not the best use of land and would conflict with other policies (urban design objectives for communities), would discourage transit orientated development which could contribute in greater ways to SLRE investment rather than car parking ▪ the use of the land as a car park would not be consistent with land use and transport planning outcomes of the SLRE and would increase private vehicle kilometres travelled.

Stop name	Issues	Parking strategy/control measures
Leichhardt North	The demolition of the former factory adjacent to the proposed Leichardt North stop could provide some land for a commuter car park which, because of easy access to this stop from City West Link, could offer some benefits including: reduced need for parking control measures at the Hawthorne and Lilyfield stops and additional weekend and overnight parking of residents within the local area. Approximately 10 commuter parking spaces are forecast to be required by 2016. These spaces would need to be accommodated on street. Some unrestricted parking spaces are available within the vicinity of this stop. Kiss-and-ride could attract approximately six vehicles per weekday by 2016. Because of the availability of unrestricted on street parking close to this stop Council has some concerns that commuter parkers currently restricted from parking near Lilyfield may migrate to this stop.	Use of the land adjacent to the Leichardt North stop for an off road car park would not be consistent with State or local council policy objectives. Formal park-and-ride spaces should not be provided so that commuter parking trips are discouraged in favour of more sustainable travel modes. A two vehicle time restricted parking space for kiss-and-ride could be installed close to the stop on Darley Road. Providing a formal signed space would ensure that kiss-and-ride occurs close to the stop where interchange between the modes is optimal. A two vehicle space designated kiss-and-ride space would be sufficient to meet the likely peak hour demand and would serve to encourage kiss-and-ride as an alternative to park-and-ride. A single vehicle parking space for disabled drivers located close the stop access should also be provided. The parking in area should be monitored and if migration of commuter parking from the Lilyfield stop does occur then a resident parking scheme would need to be considered in consultation with Council.
Hawthorne	Hawthorne stop is forecast to generate a demand for seven commuter parking. The proposed foot/cycle bridge over the Hawthorne canal could make Hawthorne Parade more attractive to commuter parking and could attract some commuters from the Marion stop where there is a lack of parking supply.	A two vehicle time restricted parking space for kiss-and-ride could be installed close to the stop on Darley Road. Providing a formal signed space would ensure that kiss-and-ride occurs close to the stop where interchange between the modes is optimal. A two vehicle space designated kiss-and-ride space would be sufficient to meet the likely peak hour demand and would serve to encourage kiss-and-ride as an alternative to park-and-ride. A single vehicle parking space for disabled drivers located close the stop access should also be provided.

Stop name	Issues	Parking strategy/control measures
Marion	Approximately 10 commuter parking spaces are forecast to be required by 2016. These spaces would need to be accommodated on street. Some unrestricted parking spaces are available within Hawthorne Parade but generally there is a lack of parking supply of in the vicinity of this stop. Kiss-and-ride could require up to three vehicles parking spaces for the weekday AM peak hour by 2016. Marion also experiences a high demand for parking at weekends for events at Lambert Park.	Formal park-and-ride spaces should not be provided so that commuter parking trips are discouraged in favour of more sustainable travel modes. The parking within residential streets and in particular Hawthorne Parade should be monitored and if necessary time restricted parking could be introduced close to the stop. Three kiss-and-ride time restricted parking spaces should be installed close to the stop on Marion Street. Providing a designated space would ensure that kiss-and-ride occurs close to the stop where interchange between the modes is optimal. Three kiss-and-ride spaces would be sufficient to meet the likely peak hour demand and would serve to encourage kiss-and-ride as an alternative to park-and-ride. The SLRE could provide an alternative to driving to events at Lambert Park. Information, signs and promotional material to support sustainable travel to these events via the light rail would be encouraged. A single vehicle parking space for disabled drivers located close the stop access should also be provided.
Taverners Hill	Approximately three commuter parking spaces are forecast to be required by 2016. These spaces could not be accommodated by local road because there is a lack of parking supply of in the vicinity of this stop. Kiss-and-ride could attract approximately 17 vehicles per weekday by 2016. Parramatta Road has a clearway restriction that prevents parking on this road. Brown Street and Hathern Street, have some restrictions and a high demand for existing on street parking spaces.	Formal park-and-ride spaces would not be provided so that commuter parking trips are discouraged in favour of more sustainable travel modes. The parking within residential street surrounding the stops would be monitored and if necessary time restricted parking/residents parking could be introduced close to the stop. A single vehicle time restricted parking space for kiss-and-ride could be installed close to the stop on Hathern Street. Providing a formal signed space would ensure that kiss-and-ride occurs close to the stop where interchange between the modes is optimal. A single signed kiss-and-ride space would be sufficient to meet the likely peak hour demand and would serve to encourage kiss-and-ride as an alternative to park-and-ride. A single vehicle parking space for disabled drivers located close the stop access should also be provided.

Stop name	Issues	Parking strategy/control measures
Lewisham West	Approximately three commuter parking spaces are forecast to be required by 2016. These spaces would need to be accommodated on street. Some unrestricted parking spaces are available on Old Canterbury Road but generally there is a lack of parking supply of in the vicinity of this stop. Kiss-and-ride could attract approximately three vehicles per weekday by 2016 so a kiss-and-ride parking space would not be required. This stop is located to serve the new developments proposed off Hudson Street and off Smith Street. The design of these developments should take advantage of the light rail and minimise dependency on private car use.	No formal commuter parking spaces or kiss-and-ride parking spaces should be provided at this stop. A single vehicle time restricted parking space for kiss-and-ride could be installed close to the stop on Hudson Street. Providing a formal signed space would ensure that kiss-and-ride occurs close to the stop where interchange between the modes is optimal. A single signed kiss-and-ride space would be sufficient to meet the likely peak hour demand and would serve to encourage kiss-and-ride as an alternative to park-and-ride. A single vehicle parking space for disabled drivers located close the stop access should also be provided. The land redevelopment should adopt a minimal parking supply approach in accordance with the principles of sustainable land use and the principles of TOD.
Waratah Mills	This stop is forecast to require three commuter parking places by 2016. Some parking supply is available in local roads surrounding this stop but other stops are likely to be used for park-and-ride in preference to this stop because of its location.	No formal commuter parking spaces should be provided at this stop. A single vehicle time restricted parking space for kiss-and-ride could be installed close to the stop on Weston Street. Providing a formal signed space would ensure that kiss-and-ride occurs close to the stop where interchange between the modes is optimal. A single signed kiss-and-ride space would be sufficient to meet the likely peak hour demand and would serve to encourage kiss-and-ride as an alternative to park-and-ride. A single vehicle parking space for disabled drivers located close the stop access should also be provided.
Arlington	This stop is forecast to require three commuter parking places by 2016. Parking in the area surrounding the Arlington stop is in high demand and there is a lack of supply particularly at weekends when sporting events in the Arlington Memorial Park can attract a significant number of car trips.	No formal commuter parking spaces should be provided at this stop. A single vehicle time restricted parking space for kiss-and-ride could be installed close to the stop on Constitution Road. Providing a formal signed space would ensure that kiss-and-ride occurs close to the stop where interchange between the modes is optimal. A single signed kiss-and-ride space would be sufficient to meet the likely peak hour demand and would serve to encourage kiss-and-ride as an alternative to park-and-ride. A single vehicle parking space for disabled drivers located close the stop access should also be provided.

Stop name	Issues	Parking strategy/control measures
Dulwich Grove	Approximately nine commuter parking spaces are forecast to be required by 2016. These spaces would need to be accommodated on street. Approximately 20 unrestricted parking spaces were observed to be available on New Canterbury Road and on Hercules Street but generally there is a lack of parking supply of in the vicinity of this stop. Kiss-and-ride could attract approximately 67 vehicles per weekday by 2016.	Formal park-and-ride spaces would not be provided so that commuter parking trips are discouraged in favour of more sustainable travel modes. Commuter parking would need to be monitored and a residents parking scheme implemented if required in consultation with Council. Two time restricted parking space for kiss-and-ride could be installed close to the stop on New Canterbury Road. Providing a formal signed space would ensure that kiss-and-ride occurs close to the stop where interchange between the modes is optimal. Two signed kiss-and-ride spaces would be sufficient to meet the likely peak hour demand and would serve to encourage kiss-and-ride as an alternative to park-and-ride. A single vehicle parking space for disabled drivers located close the stop access should also be provided.
Dulwich Hill interchange	Dulwich Hill interchange would have a loss of commuter parking of approximately 13 vehicles within Bedford Crescent. These vehicles could relocate to the existing commuter car park to the south of the rail line which appears to be underutilised. In addition for the SLRE approximately 20 commuter parking spaces are forecast to be required by 2016. Kiss-and-ride could attract approximately 67 vehicles per weekday by 2016.	Ten formal park-and-ride spaces would be provided parallel to the kerb on Bedford Crescent. This would be a reduction in the parking supply in Bedford Crescent. No additional commuter park-and-ride spaces would be provided so that commuter parking trips are discouraged in favour of more sustainable travel modes. Two time restricted parking space for kiss-and-ride could be installed close to the stop on Bedford Crescent or the existing kiss-and-ride space on Wardell Road, by the railway station, could be extended both would provide a formal signed parking space that would ensure that kiss-and-ride occurs close to the stop. Two signed kiss-and-ride spaces would be sufficient to meet the likely peak hour demand and would serve to encourage kiss-and-ride as an alternative to park-and-ride. A single vehicle parking space for disabled drivers located close the stop access should also be provided.

6.4 Construction Traffic Management Plan (CTMP) framework

A detailed Construction Traffic Management Plan (CTMP) will need to be prepared for this project at the design stage of this project. This CTMP will identify the measures and controls that will need to be put in place to minimise the impacts of construction traffic on the communities along the SLRE alignment.

The main construction traffic impacts and the strategies for managing construction traffic impact are summarised in Table 6.4.

Table 6.4 Construction traffic management issues and strategy

Construction traffic impact	Traffic management strategy
Heavy vehicle traffic	▪ Minimise the number of heavy vehicle trips on road by using the rail corridor to transport materials where feasible. ▪ Minimise the vehicle kilometres travelled by heavy vehicle by encouraging multi drop delivery trips. ▪ Minimise disruption on the local road network by using preferred truck access routes (described in Section 5 of this paper). ▪ If feasible avoid running empty trucks.
Construction staff traffic	▪ Encourage use of alternative travel modes to work site. ▪ Encourage car sharing where alternative travel modes not practical. ▪ Locate main site compound at Rozelle off City West Link.
Construction staff parking	▪ Provide staff parking at the Rozelle site compound. ▪ Provide some car parking at other compounds. ▪ Minimise staff car parking on-street, particularly in locations where parking supply is lacking. ▪ Provide emergency vehicle parking in worksites.
Temporary worksite access	▪ Use existing accesses where possible. ▪ Use traffic controller personnel to manage worksite access gates. ▪ Close and lock gates after construction hours. ▪ Minimise construction traffic during the school start and end times at the Dulwich Grove stop construction compound and worksite access.
Oversized/overmass deliveries	▪ Coordinate all oversized/overmass deliveries with the RTA traffic management unit and the police. ▪ Where practical divide loads onto smaller vehicles.
Emergency works	▪ Prepare an emergency works response traffic management plan. ▪ Provide an emergency works coordinator.
Construction of the GreenWay shared path bridge over Parramatta Road	▪ Develop construction methodology that minimises duration of works. ▪ Undertake work on Parramatta Road at night when traffic volumes are minimal. ▪ Stage work so that two way traffic flow can be maintained where practical. ▪ Prepare Traffic Control Plan in consultation with council, police and the RTA.

Construction traffic impact	Traffic management strategy
Construction of the GreenWay underpass tunnels	▪ Develop construction methodology that minimises duration of works. ▪ Stage work so that a lane can remain open to traffic. ▪ Prepare Traffic Control Plan in consultation with council police and the RTA. These to be completed as part of the detailed design.
Construction of the GreenWay on street sections (this is expected to be mostly installation of road markings)	▪ Develop construction methodology that minimises duration of works. ▪ Undertake works outside of the peak hours. ▪ Prepare Traffic Control Plan in consultation with council, police and the RTA. These to be completed as part of the detailed design.
Construction of the Marion Street signalised mid block pedestrian crossing	▪ Develop construction methodology that minimises duration of works. ▪ Stage work so that two way traffic flow can be maintained. ▪ Use construction methods that do not require road work within the traffic lanes (e.g. micro bore tunnelling for duct crossings). ▪ Prepare Traffic Control Plan in consultation with council, police and the RTA. These to be completed as part of the detailed design.

7. Summary and conclusions

Transport NSW proposes to reuse the currently disused rail corridor between Lilyfield and Dulwich Hill to extend the existing Sydney light rail system.

The SLRE – Stage 1 will include nine stops to provide access to local communities and centres along the route, as well as connecting with existing bus and train services to improve accessibility by public transport. It is expected to attract some 3,100 daily passenger boardings in 2016, with most walking to stops. Some car trips are expected to be generated by the SLRE – Stage 1, with some 225 passengers using a car to get to the stop (kiss-and-ride and park-and-ride).

In addition to the SLRE, the rail corridor will also provide an improved and landscaped shared cycle and footway to be known as the GreenWay that will connect the Iron Cove with the Cooks River. This GreenWay is an initiative that has widespread community support and would provide a much improved facility for cyclist and walkers.

7.1 Transport

Some local buses will provide feeder services to the SLRE Stage 1. This will be mostly concentrated around the stops at: Marion, Taverners Hill and Dulwich Grove where some 460 passengers are expected to access the light rail by bus. Interchange will be provided for at most stops to facilitate access to the SLRE by bus and train.

The impact of the GreenWay would include:

- an improved corridor for cyclists and pedestrians with improved interconnectivity and integration with existing cycle and walking routes including a new footbridge over the Hawthorne canal neat to the Hawthorne stop which will open up the suburb of Hawthorne to the SLRE and to the GreenWay
- a safer crossing of Marion Street with the existing pedestrian refuge removed and replaced with traffic signals
- a shared pedestrian/cycle bridge crossing of Parramatta Road, which currently does not have a crossing at this location. This bridge will significantly reduce the severance effect of Parramatta Road at this location
- increased number of cyclists using Weston Road, Ewart Street and Riverside Crescent. These roads are to be signed as part of the GreenWay. These roads are low volume, low vehicle speed and are suitable for a cycle route. The increase in cyclists is unlikely to detract from the safety and amenity of these streets.

A range of measures to improve accessibility of stops and the connectivity of the GreenWay are included in Section 6 of this report including: footpath widening, way finding, improved footway surfaces. All these measures would assist the SLRE maximise its future patronage.

7.2 Traffic

The operational traffic impact of the SLRE and GreenWay is likely to be low. This is because:

- operational traffic generation will be minimal, approximately 580 vehicle trips per day by 2016
- most vehicle trips will be generated at the Leichhardt North, Marion, Taverners Hill, Lewisham and Dulwich Grove stops. The maximum vehicle generation would be at the Marion stop which could have 40 vehicles arriving in the AM peak hour
- the road network, at stops where traffic generation may occur, carries a high volume of vehicles each day so the small increase caused by the SLRE is unlikely to have an impact
- as well, the SLRE Stage 1 will serve primarily to redistribute car trips and replace car trips already on the road network, rather than generating new trips in its own right.

The proposed signalised crossing on Marion Street is unlikely to have a significant impact on traffic and would operate in both peak hours with a level of service B or better.

Construction traffic will contribute approximately 756 staff vehicle trips per day and an average 4.9 heavy vehicle trips per day to the road network for the 12 month duration of the project. These trips are unlikely to have a significant impact on the road network because:

- the majority of staff vehicle trips will be to the main compound at Rozelle (approximately 380 vehicle trips) which will be accessed from City West Link which is a major arterial road
- those trips not to the Rozelle compound will be distributed between the other stops with worksites accessed by many different routes. This will dilute the traffic impact to the extent that construction worker traffic will be minimal
- construction traffic impact could be further reduced by promoting alternatives to private car use and encouraging use of train, bus and the existing light rail
- some of the local streets along the SLRE have low traffic volumes and low numbers of heavy vehicles on these streets. Residents may perceive an increase in heavy vehicle traffic. However, the impact of heavy vehicles will be low. The impact of heavy vehicles can be managed by coordinating works, arranging truck trips to minimise empty trucks on the road network and undertaking multi-drop deliveries.

Other minor traffic impacts during construction would include:

- potential lane closures on Hercules Street, Constitution Road, Davis Street, Old Canterbury Road and Longport Street, to allow for ground stabilisation works prior to the GreenWay tunnelling under these roads
- lane closures on Parramatta Road to allow the GreenWay shared foot/cycle way bridge span to be installed
- lane closures on Marion Street during the construction of the signalised pedestrian crossing

- installation of road markings on Weston Road, Ewart Street, Hercules, Terrace Road and Riverside Crescent for the on road sections of the GreenWay shared path.

Traffic impacts are likely to be minor and would not require any road improvements works.

The construction traffic will also be minor. Any impact of construction on traffic would be managed through the development and implementation of the Construction Traffic Management Plan (CTMP).

7.3 Parking

The SLRE Stage 1 and GreenWay would have a minor impact on parking. This would be focused at the stops where traffic generation would be greatest (Leichhardt North, Marion, Taverners Hill, Lewisham and Dulwich Grove stops). These are generally also the stops where supply of parking is least plentiful.

Opportunities to provide formalised park-and-ride parking spaces do exist at Leichhardt North, Hawthorne and Dulwich Hill Interchange. However, it is not recommended that commuter car parks are constructed for the SLRE because:

- this would be contrary to State and local government policy aimed at encouraging alternatives to the use of private car
- has the potential to divert demand from other sections of the SLRE and increase the total vehicle kilometres travelled on the local road network
- would not support the public transport objectives of the SLRE to encourage transit orientated development and deter private car use.

Where parking impacts do occur the strategies set out in Section 6.3 should be applied. These generally include introduction by Councils of permit parking schemes and discouragement of commuter parking by promotion of alternative modes.

8. References

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Appendix A

Draft Commuter Parking Strategy

Sydney Light Rail Extension - Stage 1

Draft Parking Strategy

September 2010

Transport NSW

Parsons Brinckerhoff Australia Pty Limited
ABN 80 078 004 798

Level 27, Ernst & Young Centre
680 George Street
SYDNEY NSW 2000
GPO Box 5394
SYDNEY NSW 2001
Australia
Telephone +61 2 9272 5100
Facsimile +61 2 9272 5101
Email sydney@pb.com.au

Certified to ISO 9001, ISO 14001, AS/NZS 4801
A+ GRI Rating: Sustainability Report 2009

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Revision	Details	Date	Amended By
	Original		

Author: Brian Smith, Ben Hubbard .....

Signed: .....

Reviewer: .....

Signed: .....

Approved by: Brian Smith .....

Signed: .....

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1. Introduction

1.1 Background

In February 2010, the New South Wales (NSW) Government announced, as part of the Metropolitan Transport Plan, a $500 million commitment to extend the existing Sydney light rail system in the Inner West along the disused Rozelle goods line corridor from Lilyfield to Dulwich Hill and in the central business district (CBD) from Haymarket to Circular Quay via Barangaroo. This comprised:

- Stage 1 — an Inner West extension of 5.6 kilometres along the disused Rozelle goods line corridor from Lilyfield to Dulwich Hill
- Stage 2 — a CBD western corridor extension from Haymarket to Circular Quay via Barangaroo with consideration of a future light rail option from Circular Quay to Central via George Street.

Collectively these two stages are known as the Sydney Light Rail Extensions (SLRE).

In the 2010-11 NSW Budget funding has been allocated to start construction on the SLRE Stage 1 (the Inner West extension) following the environmental assessment process, as well as to undertake pre-construction work on Stage 2.

In planning studies associated with the SLRE Stage 1, car parking was identified as an important issue - in providing access to SLRE stations, as well as in managing the impacts on the community of the operation of the SLRE.

This Draft Parking Strategy was prepared to guide the provision and management of car parking at SLRE Stage 1 stops in the context of State and local Government policies and strategies, as well as levels of demand and conditions at SLRE stops.

1.2 Scope

This report:

- Reviews the State and local government policies, strategies and plans that relate to parking and commuter parking in the areas alongside the SLRE.
- Provides an assessment of likely parking demand based on a patronage forecasts for 2016 developed by Transport NSW.
- Reviews the current parking issues and parking supply surrounding each of the stops on the SLRE Stage 1.
- Recommends proposed parking measures at each stop including parking spaces for kiss-and-ride and park-and-ride.

2. Transport planning framework

2.1 Draft metropolitan parking policy

The NSW Government's Metropolitan Strategy, City of Cities – a Plan for Sydney's Future, (2005) is a 'broad framework to facilitate and manage growth and development over the next 25 years'. The Transport section of the strategy states that Sydney's transport system 'must encourage travel choices which create stronger communities and improve people's health while reducing impact on the environment'.

Of the objectives and actions that are intended to help implement the strategy, under Objective D3 – Influence Travel Choices to Encourage More Sustainable Travel, Action D3.2 is to 'develop and implement a metropolitan-wide parking policy to encourage use of public transport to centres and ensure a consistent approach across centres'.

The NSW Draft Metropolitan Parking Policy is intended to 'set a framework to support the use of more sustainable modes to locations with good public transport access and support the Government's investment in public transport'. It will be developed in conjunction with subregional plans and it is expected that it will see reduced parking requirements for areas with good public transport access.

The Draft Metropolitan Parking Policy has not been released but it is likely that at stops on the SLRE, there would be a policy of reducing parking supply for retail, commercial and residential development in light of the improved public transport access afforded by the SLRE. While the draft Metropolitan parking Policy is aimed at centres, its intent is relevant to suburban locations and suburban centres served by the SLRE and this could extend to parking provision associated with SLRE Stage 1 stops in so far as the availability of parking supplies near stops could influence access mode split to the stop (and hence traffic around the stops) and affect local amenity and development potential.

As a sustainable transport mode, the SLRE is primarily aimed at providing local travel and improved access to Sydney CBD, Pyrmont and other smaller centres along the line. Provision of car parking at SLRE stops, which would have a close relationship to the centres they serve, could have negative impacts on traffic, on parking to serve the centres themselves and on the use of sustainable SLRE access modes, such as walking, cycling and bus.

2.2 Leichhardt Municipal Council

2.2.1 Leichhardt 2020+ Strategic Plan

Leichhardt Council's 2020+ Strategic Plan aims to establish a 'clear direction and framework to guide the community, councillors and staff to build a 'sustainable and liveable community'. There is a strong environmental sustainability theme in the plan and some of the key issues and goals identified include:

- reduction of dependence on private cars at the community level
- integration of local access needs with regional transport including partnerships with State Government and other agencies to reduce impacts of regional transport on local amenity
- integration of community, business and service activities to reduce dependence on cars.

2.2.2 Leichhardt's Draft Environmental Sustainability Strategy 2010-14

Council's Environmental Sustainability Strategy 2010-14 is currently in draft form with public comment sought to October 2010. However, the draft document provides an indicator of the sustainability strategies that will be implemented in the Strategic Plan.

A key desired outcome is sustainable transport, particularly the promotion of more sustainable forms of transport and better integration of transport networks. The Strategy recognises that the proposed SLRE Stage 1 and GreenWay projects represent 'significant enhancement to sustainable transport options for Leichhardt' but also recognises that over 67% of residents who travel outside the LGA for work travel by car; and 81% of non-residents travelling to the LGA from outside it, for work. Council aims to reduce the burden of private cars through:

- developing comprehensive pedestrian and cycle networks
- encouraging car share and car pooling
- applying restrictive parking policies.

2.2.3 Leichhardt Business Centres Parking Review Part C (Leichhardt)

This 2005 study provides some information on current levels of parking supply and demand in LGA centres.

The study found:

- a peak parking demand of 69% of supply on a weekday, with 73% occupancy of on-street parking and 58% of off-street parking
- parking demand is substantially higher on the weekend than weekday
- 25% of local visitors walked.

Parking availability is identified as a problem in the Leichhardt centre, with the greatest parking shortfall in the zone west of Norton Street between Parramatta Road and Marion Street.

The study recommended increasing the supply of parking for shoppers and visitors by reducing parking permit entitlements for residents and property owners and occupiers, increasing the supply of off-street parking in residential and commercial/retail uses and reducing time limits for on-street parking to increase turnover; as well as improving public transport accessibility. It is noted that this study predates Council's sustainability strategies.

2.3 Marrickville Council

2.3.1 Marrickville Urban Strategy

Transport and access issues and concerns highlighted in the Council's Urban Strategy include:

- car parking demand often exceeding supply
- traffic congestion on the LGA's street network
- importance of local accessibility and amenity
- importance of walking and cycling and its compatibility with the LGA's high density and connected on and off-street network
- high demand for commuter parking and short-stay parking associated with train stations
- low car ownership and use; and high public transport use for all purposes
- high use of walking and cycling, with cycle use increasing
- limited opportunities to increase parking supply in Marrickville.

Key objectives for integration of land use and transport include:

- new development focused within walking distance of centres and public transport, to encourage walking and cycling
- making public transport, walking and cycling more attractive than private car for travel needs by prioritising those modes and 'managing parking traffic in centres to increase pedestrian safety' and to achieve better land use transport integration.

2.3.2 Marrickville Integrated Transport Strategy 2007

The integrated transport strategy contains a number of issues and objectives relevant to the SLRE including:

- support for extension of light rail (seen as a mechanism for reducing buses), with supportive measures including:
  - parking limitations
  - park-and-ride opportunities
  - pedestrianisation of streets
  - cycleways
- an awareness of the need to move beyond the 'predict and provide' model of road capacity to management of demand and promotion of sustainable travel options
- an understanding of issues of induced traffic

- a commitment to continue with Local Area Traffic Management (LATM) to reduce traffic volumes and speeds, supporting a community objective to see less traffic
- a need for improved parking management including avoiding an oversupply of 'free' parking
- use of resident parking schemes to protect residential areas from spill-over of parking from unmet commuter parking demand
- further discouragement of commuter parking using price mechanisms
- provision of short-term pick up and drop off parking at strategic locations
- recognition of the amenity impacts of parking, including financial and visitation impacts
- a need to expand resident parking schemes in some areas to deter non-resident long-term parking.

2.4 Ashfield Council

2.4.1 Ashfield Strategic Plan 2006-2010

With respect to transport and accessibility, the strategic plan recognises the need to improve public transport, pedestrian and cycling networks, but also to make provision for private cars. Actions in the plan include:

- Develop appropriate strategies to prevent traffic and parking intrusion from non-residential uses into residential areas.
- Promote cycling
- Promote pedestrian movement over car and truck traffic in centres

2.4.2 Urban Planning Draft Strategy 2010

The Urban Planning Draft Strategy is intended to provide the long term direction for land use planning decisions in the Ashfield LGA.

As with Marrickville and Leichhardt Councils, the concept of sustainability is a strong theme in Ashfield Council's urban planning draft strategy. There is a high level of public transport use in the LGA, with some 35% of Ashfield residents travelling to work using public transport, compared with the Sydney average of 18%.

Council's draft strategy includes actions aimed at 'proactive promotion of alternative, 'carbon friendly' forms of travel such as public transport, light rail, cycling and walking'.

The principles of Transit Oriented Development (TOD) are considered to be demonstrated in Ashfield LGA, with a development intensity and street network that makes 'walking to and from the public transport nodes easier'.

Council will 'continue to improve the public domain, pedestrian amenity and safety of areas around rail stations and main bus stops so as to facilitate better public transport use'. As well, Ashfield Council, in contrast to the two other relevant Councils, aims to lobby Government for expansion of commuter parking and kiss-and-ride at Ashfield Station.

The former Flour Mills site adjacent to the SLRE Stage 1 corridor is seen as an important redevelopment opportunity to support the light rail extension, with Council intending to prepare a master plan for the site and an amendment to Council's 2007 Development Control Plan to preserve public access to the light rail and incorporation of the GreenWay, as well as planning for residential, commercial and retail activities on the site.

2.5 Previous planning for SLRE Stage 1

Studies of the proposed SLRE Stage 1, including the Product Definition Report, Impact Identification Report and the Preliminary Environmental Assessment, have identified and assessed the role of private car as a means of accessing SLRE Stage 1 stops.

These have identified that at two stops - Leichhardt North and Dulwich Hill interchange – there is potential for commuter parking to have impacts on existing parking provision, and for commuter parking requirements to be investigated.

However, the documents stress the objective of encouraging sustainable access modes to the stops, with stop design to give priority to access by pedestrian and cycle, followed by public transport, and then private vehicles last of all.

The planning studies to date also recognise that while commuter parking demand is predicted to be low, this issue is a potential concern for residents particularly in the context of existing resident parking schemes implemented to reduce the community impacts of long-stay parking, much of which is generated by public transport commuters. In general, there are 'potentially limited car parking options' at stops.

2.6 Parking issues for SLRE Stage 1

Transport sustainability is clearly a critical issue at the State and local Government levels, with most policies and strategies aiming to reduce reliance on private cars by managing the supply and availability of car parking, particularly in centres. At the local Government level, Council through which the SLRE Stage 1 will run overwhelmingly have policies and strategies to promote walking, cycling and public transport use over the private car.

The proposed SLRE Stage 1 is a sustainable transport project which consistent with these policies and strategies and has as its aim, to provide a public transport alternative to private car. As will be seen later in this document, the majority of users of the SLRE Stage 1 are expected to arrive at stops by foot, cycle or other public transport (bus and train). However, patronage projections predict some demand for park-and-ride and kiss-and-ride at all SLRE stops.

This creates a conundrum. While commuter parking at SLRE Stage 1 stops may encourage public transport use by increasing the catchment of the SLRE, the traffic generated by park-and-ride supplies; and the potential to attract park-and-ride trips away from more sustainable modes, may be in conflict with strategies and policies aimed at reducing private car use. The concepts of induced traffic apply to car parking supply as well as road space enhancement. Induced traffic is the inflated traffic generation response to improvements in private vehicle provision, such that the effective life of enhancements resulting in reduced traffic congestion can be more short-lived than expected. Effectively, the concept of induced traffic is that traffic will quickly increase to fill the available capacity.

As identified by Todd Litman (2008) and Donald Shoup (1980), parking is related to induced traffic – 'parking is closely tied to car travel: increasing parking supply is one of the most efficient ways to encourage driving and induce demand for road space'.

The risk of providing commuter parking supplies at SLRE stops is that rather than accommodating expected commuter parking demand, additional park-and-ride demand will be induced, potentially at the expense of more sustainable access modes; and that rather than reducing the impact on local communities of commuters parking on-street, the demand will increase beyond the supply of car parking and increase pressure on on-street parking supplies more than if no commuter parking was provided.

In addition, there is the potential for park-and-ride supplies at the Leichhardt North stop to attract demand from other stations on the existing light rail line (such as Lilyfield), where Councils have implemented measures to deter park-and-ride demand.

Our view of this issue is that the provision of car parking at SLRE Stage 1 stops could have a negative impact on sustainable access modes to SLRE stops, as well as a greater negative impact on on-street parking demand than if park-and-ride supplies are not provided.

3. Parking demand

Demand for parking spaces generated by the SLRE relates to the travel mode of access and the forecast patronage at each stop. Each stop has a different parking space demand because:

- the travel mode of access at each stop is different. Travel mode of access is closely related with the availability, proximity and interchange function of transport services to each stop. Walking is expected to be the primary mode of access for all SLRE stops. Where stops have good access by other transport modes, such as rail and bus, these modes will also have a significant share. Some stops have convenient road access and available parking close to stops and these stops may attract more car trips than others

- the patronage at each stop depends on the available catchment. For example, walking as a single travel mode has a limited catchment because patrons will generally only walk a maximum distance of 800 m (approximately 15 minutes). The catchment for kiss-and-ride and park-and-ride patrons is larger. However, as the SLRE is competing with other modes there will need to be a benefit for these users to use the SLRE.

Patrons accessing the SLRE stops by private motor vehicles and requiring parking have differing parking space occupancy needs:

- commuter park-and-ride - these users generally park all day often arriving before the AM peak hour for traffic and leaving after the PM peak hour for traffic. Observations of commuter parkers at various railway station has shown that these users are often habitual, arriving at very similar times each day and parking in the same locations

- leisure park-and-ride – a substantial proportion of existing light rail travellers are travelling for purposes other than work. These users generally only require parking spaces for part of the day. This means that for the other part of the day the space is available for use by others, reducing the total number of spaces in demand

- kiss-and-ride - users generally occupy a space for less than 5 minutes for dropping off patrons and up to 10 minutes picking up patrons, depending on the frequency of public transport service. Commuter kiss-and-ride generally occurs within the peak hours while leisure kiss-and-ride occurs during the off peak periods. Kiss-and-ride is generally an efficient access mode.

In addition, some of the parking demand at stops could be for users with mobility impairments. Best practice in transport interchanges is to provide at least 3% of the parking spaces at a facility for mobility impaired users drivers and to ensure these are located within around 50 metres of the station or stop.

3.1 SLRE stage 1 forecast parking demand (2016)

Transport NSW has provided a preliminary 2016 weekday forecast of passengers boarding the SLRE Stage 1 at each of the proposed stops. This forecast was based on market analysis calibrated against the Sydney Strategic Transport Model (STM). The forecast estimates the total number of passengers boarding at each of the proposed stops and the transport mode used to access the stop. Table 3.1 and Figure 3.1 show 2016 daily passengers boarding light rail by access mode. As the table shows, some 3100 passengers would board at SLRE Stage 1 stops per day in 2016.

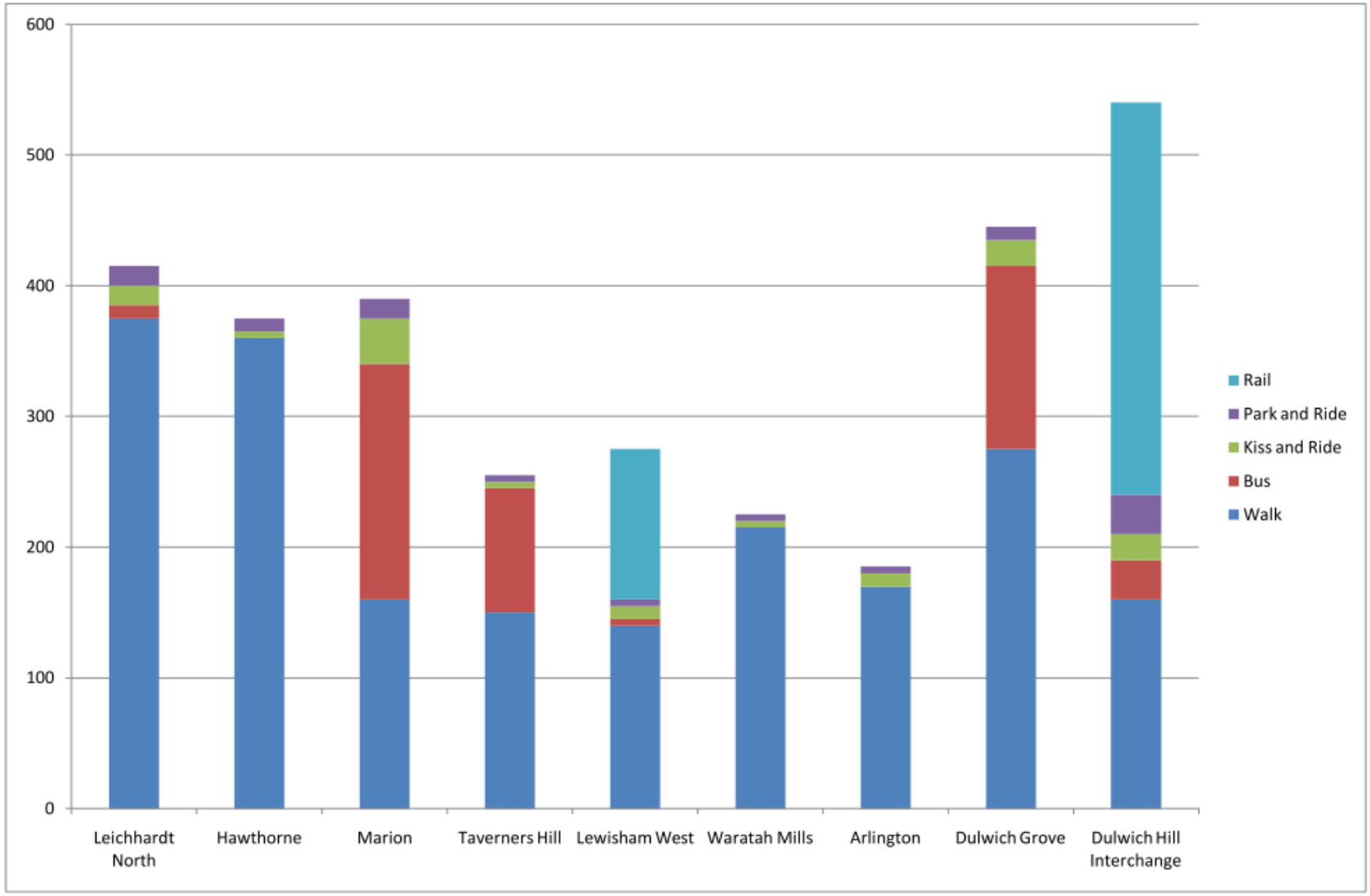
Table 3.1 Light rail weekday passenger boarding forecast 2016

Light rail stop	Total passengers boarding	Walk*	Bus	Car (KnR)	Car (PnR)	Rail
Leichhardt North	415	375	10	15	15	-
Hawthorne	375	360	-	5	10	-
Marion	390	160	180	35	15	-
Taverners Hill	255	150	95	5	5	-
Lewisham West	275	140	5	10	5	115
Waratah Mills	225	215	-	5	5	-
Arlington	185	170	-	10	5	-
Dulwich Grove	445	275	140	20	10	-
Dulwich Hill interchange	540	160	30	20	30	300
Total	**3105**	**2005**	**460**	**125**	**100**	**415**
Percentage	**100%**	**65%**	**15%**	**4%**	**3%**	**13%**

Source: Transport NSW *includes cycles

As Table 3.1 indicates, the SLRE – Stage 1 will generate some 3,105 passenger boardings per day. Overall, the majority of passengers will get to SLRE stops on foot (65%), while some 15% of daily passengers will arrive by bus and 13% by train. Car will be a minor mode of access to the SLRE Stage 1 stops, with 4% of passengers being dropped off by car (kiss-and-ride) and 3% parking a car near stops (park-and-ride).

The proportion of passengers accessing the SLRE by each mode will vary from stop to stop, depending on the availability of other modes such as bus and rail, the nature of the stop catchment, and the location relative to the arterial road network. Demand for parking and kiss-and-ride (drop off/pick up) will be higher at those stops where the road network is more conducive to accessing the stop, either to drop off/pick up passengers, or to park-and-ride. Similarly, train as an access mode will only be relevant at SLRE stops close to train stations (Dulwich Hill and Lewisham stations). These issues are further discussed below.



Source: Transport NSW patronage forecast 2016

Figure 3.1 Light rail weekday passenger boarding forecast 2016

The daily passenger boarding forecast for 2016 provided by Transport NSW and shown in Figure 3.1 has been used to estimate the number of kiss-and-ride and park-and-ride spaces that may be needed to serve SLRE demand in 2016.

Table 3.2 summarises the estimated parking space demand at each stop for kiss-and-ride and park-and-ride. It assumes that:

- 54% of park-and-ride trips are expected to be commuters (based on the trip purpose of existing light rail users) and will require a parking space all day.
- because of the high frequency of the light rail, the kiss-and-ride trips are expected to be constant across the peak hour and that each kiss-and-ride drop off will not take longer than 5 minutes (so that a kiss-and-ride parking space could accommodate 12 kiss-and-ride movements per hour).

Table 3.2 Parking space demand

Light rail stop	Kiss-and-ride daily passenger boardings	Park-and-ride daily passenger boardings	Commuter park-and-ride parking spaces	Leisure park-and-ride parking spaces	AM peak hour demand for kiss-and-ride parking spaces
Leichhardt North	15	15	7	3	2
Hawthorne	5	10	5	2	1
Marion	35	15	7	3	3
Taverners Hill	5	5	2	1	1
Lewisham West	10	5	2	1	1
Waratah Mills	5	5	2	1	1
Arlington Mills	10	5	2	1	1
Dulwich Grove	20	10	7	2	2
Dulwich Hill interchange	20	30	14	6	2
Total	**125**	**100**	**48**	**20**	**14**

From Table 3.2 it can be seen that:

- parking demand for park-and-ride is expected to be greatest at the Dulwich Hill Interchange. At this stop approximately 20 parking spaces could be required by 2016 to satisfy daily demand from commuters (parking all day) and leisure travellers (expected to have a lesser parking duration)
- up to three kiss-and-ride spaces at Marion and one or two kiss-and-ride spaces at most of the stops would provide an adequate facility up to 2016 and could be accommodated in the form of kerbside short stay parking spaces.

4. Parking supply

4.1 Existing parking supply and known parking issues

This section provides a qualitative assessment of the parking supply and known parking issues at each stop on the SLRE Stage 1. The information is based on a site inspection on the 20 September 2010 and on discussions with Marrickville and Leichhardt Councils.

Table 4.1 summarise the existing parking a local parking issues.

Table 4.1 Parking and parking issues

SLRE stop	Parking and issues
Leichhardt North	The proposed stop will access directly onto Darley Road, a distributor road, which road has restricted parking close to the intersection with City West Link but mostly unrestricted parking both sides within a close proximity to the proposed stop. Currently kerb side parking on Darley Road is only occasionally used and most of the kerbside is free from parked cars. Francis Street, Hubert Street, Charles Street, Elwick Street and Fall Street (all residential roads) intersect with Darley Road within close proximity of the proposed stop. All these streets have only a few parking spaces that are not currently used by residents. Council was concerned that: Commuter parking might be displaced from the Lilyfield area. Council has recently introduced a resident parking scheme in Lilyfield in response to complaints from residents about reduced parking availability after the extension of the light rail to Lilyfield. The new stop at Leichhardt North may be more attractive for commuters as it has some unrestricted parking and good access to City West Link road. A total of 10 vehicles, of which 7 would be commuters, are forecast to require parking close to this stop by 2016. All these vehicles could find parking spaces within Darley Road without impact on the residential streets.
Hawthorne	The proposed stop will access onto Darley Road which has unrestricted parking on both sides within close proximity of the proposed stop. Current demand for parking in Darley Road was observed to be low. However, the sharp curve in the road to the north of the stop and the existing pedestrian refuge island do restrict parking close to the stop. Athol Street and Lyall Street, residential roads, both intersect with Darley Road close to the stop, however, neither of these streets has vehicle access off Darley Road. These residential roads have few parking spaces that are not currently used by residents. Council has raised concern that: The proposed Hawthorne canal bridge crossing close to the Hawthorne stop would provide access to Hawthorne Parade and encourage commuters to park there. Council is aware of concerns from residents that the bridge could make Hawthorne Parade attractive for commuter parking. However, residents of Hawthorne are in support of the bridge which will improve accessibility. A total of seven vehicles, of which five would be commuters, are forecast to require parking close to this stop by 2016. All these vehicles could find parking spaces within Darley Road without impact on the residential streets.

SLRE stop	Parking and issues
Marion	The proposed stop would access on to Marion Street, a distributor road, which has restricted parking on both sides. The northern side of Marion Street close to the stop has some time restricted parking spaces. These spaces are in high demand most of the day. The southern side of Marion Street has a clearway restriction which prevents parking during the peak hours and would prevent this street from being used by commuter parkers. Hawthorne Parade to the west of the stop has un-time-restricted 90 degree angled parking spaces. Close to the stop these spaces are in high demand during the day. Further from the stop demand reduces and some spaces may be available. Council raised the following issue: Unrestricted parking close to the Marion stop is in high demand particularly at weekends when sporting events are taking place in Lambert Park. Currently parking for events at Lambert Park is already intruding into the residential areas to the south of the rail bridge either side of Marion Street. This could be made worse by the light rail extension and residents parking schemes in this area may need to be considered. Council is considering the need for residents parking to manage the existing parking situation, particularly at weekends. A total of 10 vehicles, of which 7 would be commuters, are forecast to require parking close to this stop by 2016. These vehicles are likely to have an impact on the parking supply, particularly in Hawthorne Parade and Council may need to consider introduction of a residents permit scheme or time limited parking to prevent all-day commuter parking.
Taverners Hill	The proposed stop would access onto Parramatta Road, (an arterial road, and Hathern Street/Brown Street, a distributor road. Parramatta Road has restricted parking on both sides of the road close to the stop and would not be suitable for any commuter parking. Hathern Street/Brown Street has some unrestricted parking but the geometry and high traffic flows on this road do not make parking on this road desirable. Hathern Street joins with Tebbutt Street which is a distributor road that has some unrestricted parking, however, the unrestricted parking in Hathern Street is in high demand and few spaces are available during the day. The local roads close to the stop include Hawthorne Parade, French Lane, Cook Street, St John's Street and Benson Street. All these streets are predominantly residential but have some commercial businesses. Parking in these streets is in high demand and there are very few spaces that are not occupied most of the day. Council commented that parking in the local roads alongside Parramatta Road is in high demand from residents and businesses and that these roads may be considered for a resident parking scheme. A total of three vehicles, of which two would be commuters, are forecast to require parking close to this stop by 2016. These vehicles would be unlikely to have an impact on parking in local roads.

SLRE stop	Parking and issues
Lewisham West	Lewisham West stop will access onto Longport Street which is a local distributor road that has some time restricted parking both sides so providing no parking close to the stop. Local roads close to the stop include: Smith Street, Edwards Street which are residential streets but have few available spaces, Hudson Street serves a mix of residential and commercial properties and has no parking restrictions but is in high demand and McGill Street which has time restricted parking and is also a street with a high demand for parking. Council had no comments regarding parking at this stop. A total of two vehicles, of which one would be commuters, are forecast to require parking close to this stop by 2016. These vehicles could find parking within local roads without significant impact on local parking supply.
Waratah Mills	The Waratah Mills stop will access onto Davis Street and Weston Street both of which are residential streets. These roads are not time-restricted and some parking spaces were observed to be available within these streets during the day. Council had no comments regarding parking at this stop. A total of two vehicles, of which one would be commuters, are forecast to require parking close to this stop by 2016. These vehicles could find parking within local roads without significant impact on local parking supply.
Arlington	The proposed stop will access onto Constitution Road which is a local distributor road. Parking is restricted on most of Constitution Road with a mix of no parking, time limited parking and bays for buses and setting down and picking up because of the sports and recreational parks nearby. Constitution Road is a residential street and has a high demand for parking spaces. No unoccupied spaces where observed during the site visit. Local residential roads include Winsor road, Grove Street and William Parade. All these roads had few parking spaces on street that were not occupied during the site visit. Council acknowledged that the area surrounding this stop was in high demand for parking by residents, particularly at weekends when sporting events attract additional parking into the area. Council may consider resident parking to control existing parking issues in this area. A total of two vehicles, of which one would be commuters, are forecast to require parking close to this stop by 2016. These vehicles could find parking within local roads without significant impact on local parking supply.

SLRE stop	Parking and issues
Dulwich Grove	The proposed stop at Dulwich Grove would access onto New Canterbury Road, an arterial road, and Hercules Street a local road. New Canterbury Road has time restricted parking and clearway restrictions that prevent all day parking so is not suited to commuter parking. Hercules Street has unrestricted parking on most of the road close to the proposed stop. During school pick up and drop off times parking in Hercules Street was observed to be in high demand but at other times parking spaces were available. Local roads close to the proposed stop also include Consett Street, Kintore Street and Blackwood Avenue. Consett Street is residential and has no unused parking spaces baaed on observations in this street. Some parking spaces may be available in Kintore Street and Blackwood Avenue, also residential streets. However, both these streets front the Dulwich Hill Public School which was observed to have a high demand for parking at the start and end of school. Council had no comments regarding parking at this stop. A total of seven vehicles, of which five would be commuters, are forecast to require parking close to this stop by 2016. These vehicles would be unlikely to have an impact on parking in local roads.
Dulwich Hill Interchange	The Dulwich Hill interchange stop would access onto Bedford Crescent a residential road that currently has approximately 30 ninety degree angled commuter parking spaces on the southern side and 20 non-time limited parking spaces parallel to the kerb line on the north side. All these spaces are generally occupied during the day by commuters. Approximately 10 spaces will need to be removed when this road is narrowed as part of the construction of the SLRE stop. However, additional spaces appear to be available in the commuter car park to the south of the Dulwich Hill railway station. This commuter car park can accommodate up to 53 vehicles but appears to be only regularly used by about 20 to 30 commuters. Wardell Road, a distributor road that Bedford Crescent intersects has a mix of no parking and time restricted parking on both sides. Where parking spaces are provided these are in high demand. No unused spaces were observed during the site visit. Local roads surrounding the stop include Keith Lane and Keith Street both of which are residential. Keith Lane is not wide enough to accommodate parking. Keith Road has unrestricted parking both sides some parking spaces may be available during the day. Council has some concern about parking surrounding this stop, particularly because some spaces will be removed to provide space for the stop platforms. Council suggested that a study of parking surrounding this stop should be undertaken. A total of 20 vehicles, of which 14 would be commuters, are forecast to require parking close to this stop by 2016. These vehicles may be accommodated within the existing commuter car park to the south of Dulwich Hill railway station. Those vehicles that can't be accommodated would need to seek parking in local streets.

5. Parking management strategy

Several strategies are available to manage parking supply and demand in centres and residential areas. Broadly these include:

- demand management measures:
  - DCP/LEP parking controls
  - transit orientated development policies
- supply management
  - restricting hours of use
  - not providing parking supply or limiting or reducing parking supply
  - restricting user types (i.e. resident's permit schemes)
  - paid parking.

5.1 Demand management

The SLRE achieves an objective of the Metropolitan Strategy by providing greater access to public transit within the inner west of Sydney so reducing the dependency on the private car. Commuter car parks at SLRE stops could encourage some patrons to park-and-ride that may otherwise walk or cycle to the light rail stops. Park-and-ride should be discouraged at SLRE stops and commuter parking should not be provided as means of discouragement.

5.2 Supply management

The supply of private and public off street parking should be minimised to restrain car ownership, to promote active transport and the use of public transport including light rail.

The Marrickville Integrated Transport Strategy echoes State policy on parking supply and says:

> 'The oversupply of free parking can impose significant financial and other costs on governments and private landholders, including:
>
> - land cost, which includes the opportunity cost of preventing land being developed for other income-generating purposes
> - construction costs
> - operation and maintenance cost
> - environmental cost, including costs associated with managing increased run-off , heat generation, light pollution and visual blight
> - social costs, attributable to reducing active uses in centres, such as loss of vitality and loss of casual surveillance'.

Where parking is needed it should be managed and a hierarchy of need should apply:

- priority should be given to benefit specific uses such as disabled drivers, residents, deliveries, and emergency services
- parking in accessible areas should be managed to achieve a high turnover
- paid parking should be considered where demand is high and a high turnover is desirable
- residents parking should be designed to avoid overspill impacts
- shared parking should be encouraged
- parking should not impede bus or cycle routes

short term parking for drop off and pick up should be provided a strategic locations.

6. Recommended parking management measures

The following parking management measures are proposed for the stops on the SLRE Stage 1:

- For all stops it is proposed that a single disabled parking space is provided. Transport NSW policy, in line with Australian Standards, is to provide up to 3% of parking spaces for disabled drivers. A total of 225 parking spaces could be required by the SLRE and 3% of this equals seven spaces. A disabled parking space at each stop would provide nine spaces and would facilitate access to the SLRE by mobility-impaired travellers.

- Parking for kiss-and-ride should be provided at each stop, consistent with Table 3.2. Kiss-and-ride parking should be provided as kerbside parking spaces with waiting time restricted to 5 minutes during the AM and PM peak hours. At other times of day these spaces would be available for casual parking.

- No additional formal commuter parking spaces would be provided at any of the SLRE stops. Providing commuter parking would be contrary to the stated objectives of the SLRE along with State and local government parking policy. As well, it could be expected to induce additional park-and-ride demand at the expense of more sustainable access modes.

- Table 6.1 provides proposed approximate locations for disabled and kiss-and-ride spaces along with proposed parking management measures for each stop.

Table 6.1 Proposed strategy measures

Stop	Strategy measures
Leichhardt North	▪ Provide one disabled parking bay located on the north side of Darley Road within 50 m of the stop access. ▪ Provide two kiss-and-ride spaces located on the north side of Darley Road within 50 m of the stop access. ▪ Monitor commuter parking on Darley Road. ▪ If commuter parking exceeds forecast and commuter parking migrates into residential roads then Council could consider implementing a residents parking scheme.
Hawthorne	▪ Provide one disabled parking bay located on the west side of Darley Road within 50 m of the stop access. When locating this bay consideration will need to be given to the location of the pedestrian refuge island. ▪ Provide one kiss-and-ride spaces located on the north side of Darley Road within 50 m of the stop access. ▪ Monitor commuter parking on Hawthorne Parade. ▪ If commuter parking migrates into Hawthorne Parade then Council could consider implementing a residents parking scheme.
Marion	▪ Provide one disabled parking bay located on the north side of Marion Street within 50 m of the stop access. The parking bay will need to be positioned so that it does not obscure sight lines out of the Council depot or the proposed signalised crossing. ▪ Provide three kiss-and-ride space located on the north side of Marion Street within 50 m of the stop access. Alternatively a kiss-and-ride could be provided in Hawthorne Parade. ▪ Monitor commuter parking on Hawthorne Parade. ▪ If commuter parking migrates into Hawthorne Parade then Council could consider implementing a residents parking scheme or time limited parking spaces
Taverners Hill	▪ Provide one disabled parking bay located on the north side of Hathern Street between Tebbutt Street and Brown Street as close to the stop as practical. ▪ Provide one kiss-and-ride space located as close to the disabled parking space as practical ▪ Monitor commuter parking on local roads ▪ If commuter parking migrates into local roads then Council could consider implementing a residents parking scheme or time limited parking spaces.
Lewisham West	▪ Provide one disabled parking bay on the south side of Longport Street within 50 m of the stop access lift. Consideration will need to be given to how cyclists are directed around this parking space. ▪ Provide one kiss-and-ride space located on the south side of Longport Street within 50 m of the stop access lift. ▪ Monitor commuter parking on local roads. ▪ If commuter parking migrates into local roads then Council could consider implementing a residents parking scheme or time limited parking spaces.
Waratah Mills	▪ Provide one disabled parking bay located at the end of Weston Street within 50 m of the stop access. ▪ Provide one kiss-and-ride space located at the end of Weston Street within 50 m of the stop access.

Stop	Strategy measures
Arlington	▪ Provide one disabled parking bay located on the west side of the SLRE on the east side of Constitution Road within 50 m of the stop access. This parking space would reduce the number of unrestricted parking spaces on this road and may be used by mobility impaired drivers visiting the park or sports field. ▪ Provide one kiss-and-ride space located on the east side of Constitution Road within 50 m of the stop access.
Dulwich Grove	▪ Provide one disabled parking bay located on the south side of New Canterbury Road within 50 m of the stop access lift. Alternatively, this parking space could be provided on Hercules Street within 50 m of the access lift. ▪ Provide two kiss-and-ride space located on the south side of New Canterbury Road as close a practical to the stop access lift. A kiss-and-ride space on Hercules Street is not recommended to minimise increasing traffic in front of the Dulwich Public School. ▪ Monitor commuter parking on local roads. ▪ If commuter parking migrates into local roads then Council could consider implementing a residents parking scheme or time limited parking spaces.
Dulwich Hill Interchange	▪ Provide one disabled parking bay located on the south side of Bedford Crescent as close to the stop access lift as practical. ▪ Provide two kiss-and-ride space located on the south side of Bedford Crescent as close to the access lift as practical. Alternatively two kiss-and-ride spaces could be provided on the north side of Dudley Street near to the existing bus stops. ▪ Monitor commuter car parking numbers within Bedford Crescent and commuter car park to the south of the Dulwich railway station on Ewart Lane