

Berala Interchange Precinct
Accessibility Upgrade

Traffic, Transport and Access Impact Assessment



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Document Information

Prepared for	Transport for NSW
Project Name	Traffic, Transport and Access Impact Assessment
File Reference	Appendix I - TTAIA.docx
Job Reference	TAP-0310-REP-0001
Date	30 November 2015
Version Number	3
Effective Date	27/11/15
Date Approved:	27/11/15

Document History

Version	Effective Date	Description of Revision	Prepared by:	Reviewed by:
1	06/11/15	Draft Report	KDD	QN
2	12/11/15	Draft Report	KDD	TKG
3	27/11/15	Final	KDD	QN

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1 Introduction

Multimodal transport interchanges are critical pieces of urban infrastructure within the transport network. Efficient and well-designed interchanges enable people to move conveniently between different parts of the transport network and provide a viable alternative to the private car. These facilities should be integrated with surrounding land uses and also enhance the user experience when navigating the transport network by providing access to desired destinations via a range of mode choices.

The NSW Government places a strong focus on the transport customer, aiming “...to create interchanges that are places for people, rather than just facilities for vehicles” (*Making Interchange Places Product Strategy Draft, May 2012*). Recognising that interchanges should accommodate the needs of all people, Berala Station was identified for inclusion in the Transport Access Program (TAP) through an evidenced-based selection process. This station does not adequately accommodate mobility impaired customer access to and from public transport services. An upgrade to provide accessible infrastructure at the station would be supported by increased capacity for future patronage demands and convenient and legible interchange and wayfinding between transport modes. Berala will be considered for funding for an Easy Access Upgrade to provide equitable access for all customers.

Berala Station is considered a community railway station in the Sydney metropolitan area which provides local residents with an entry point to the Sydney Trains network. Customers seek to access employment, shopping and education in nearby Parramatta and destinations further afield including Auburn, Bankstown, Sydney Olympic Park and the Sydney CBD. Improvements to the station access and functionality have the potential to impact positively on the public transport experience for all customers.

1.1 Background

The TAP is an initiative to provide a better experience for public transport customers by delivering accessible, modern, secure and integrated transport infrastructure where it is needed most. The aim of the program is to provide:

- Station precincts that are accessible to people with mobility impairments, including the disabled, aging and parents with prams;
- Modern facilities for all modes that meet the needs of a growing population;
- Modern interchanges that support an integrated network and facilitate seamless transfers between all modes for all customers;
- Safety improvements including extra lighting, help points, fences and security measures for car parks and interchanges, including stations, bus stops and wharves;
- Wayfinding and signage improvements so customers can more easily use public transport and transfer between modes at interchanges;
- Other improvements and maintenance such as painting, new fencing and roof replacements.

The TAP will deliver customer-focused and high quality public transport interchanges through upgrades and improvements, providing customers with easier travel connections and access to the different transport services. The program, with its customer focus, will transform interchanges from a vehicle focus to a people focus and in doing so improve the comfort and ease for all station users.

The scope of this project encompasses the rail station, associated interchange facilities and passenger access between those facilities and the station proper. It includes station platforms, buildings, gates, pedestrian and cycle access paths, pedestrian bridge access, pedestrian linkages to adjacent streets and commuter car parks, bus stops and shelters, taxi stands, Kiss & Ride locations and bicycle facilities.

1.2 Study Objectives

The objective of this Traffic, Transport and Access Impact Assessment is to assess the impact of the new station infrastructure and detail how the new station configuration can be best integrated into the area with minimal disruption to the local transport network.

1.3 Reference Documents

The following documents were used as reference as a part of this assessment:

- Australian Standards AS2890 – Part 1: Off-street car parking;
- Australian Standards AS890 – Part 6: Off-street car parking for people with disabilities;
- RMS – Technical Direction – Stopping and Parking Restrictions at Intersections and Crossings TDT02002/12c;
- Proposed scope of works as provided within the report;
- An inspection of the site and its surroundings; and
- Any documents as referenced within the context of this assessment.

2 Existing Station Conditions

2.1 Study Area

Berala Interchange includes the Berala Station and surrounding precinct including nearby bus stops, Kiss & Ride bays, taxi zone, bike parking facilities and the footpath network. It is located in Sydney's south western region that provides access to the Sydney Trains network via the T3 Bankstown Line. This station is located approximately 1.5 kilometres south-west of Lidcombe Station and approximately 16 kilometres west of the Sydney CBD. Berala Station was originally opened in its current location in 1924, as an extension of the railway from Regents Park to Cabramatta to provide a relief to the West and South lines.

The suburb of Berala, located within the Auburn Local Government Area (LGA) is predominantly low density residential. There are also some properties of medium density residential development and a concentration of high density residential land use located to the north of the Interchange. There are industrial land uses to the southwest of the precinct, while retail and local services integrate with the interchange.

The study area in its regional context is shown in Figure 2-1.

Figure 1.1: Regional Context



Basemap source: Nearmap

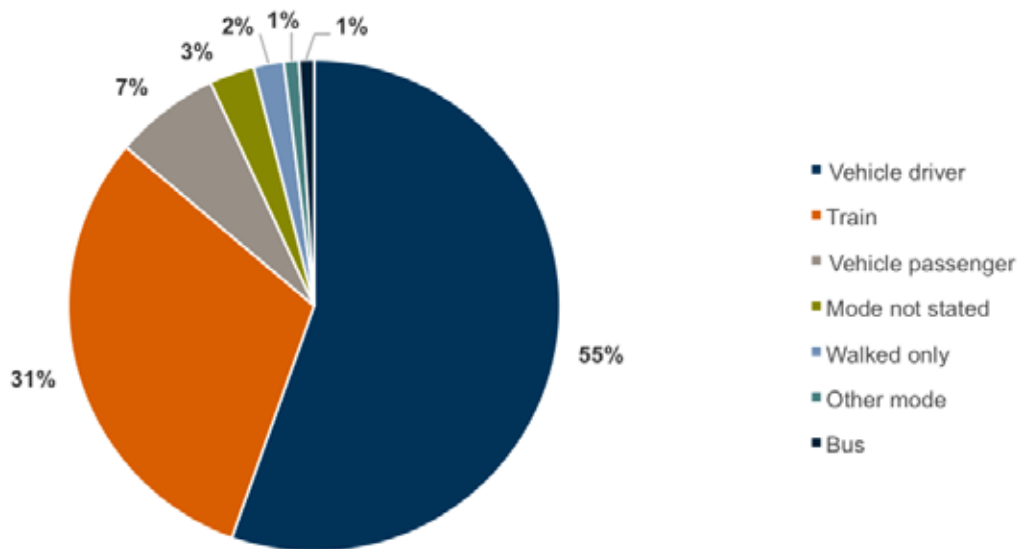
2.2 Mode Share

2.2.1 Journey to Work

2.2.1.1 Residents of Berala Interchange Travel Zone

The majority of employed residents who live in the Berala Interchange travel zones, travel to work via a private motor vehicle. This includes 55% of journeys to work as a vehicle driver and 7% as a vehicle passenger. Public transport accounts for 32% mode share, with almost all of this (31%) attributable to train travel, most likely due to the limited number of bus services in the area and the proximity of the travel zones to the interchange. **Figure 2.2** shows how residents of Berala’s travel zones travel to work.

Figure 2.2: Employed Resident Journey to Work - Berala Travel Zones



Source: BTS, based on ABS 2011 Census data

A comparison of Journey to Work mode share for Berala’s employed residents to the Sydney metropolitan region shows that public transport use is higher; 32% for Berala compared to the 20% average for Sydney which includes travel by both train and bus. Private vehicle use is less than that for Sydney, which is consistent with the motor vehicle ownership data. 62% of residents in Berala use a car as their main mode of transport compared to 72% for the Sydney region. The percentage of residents walking to work is half that of the Sydney region, with only 2% using this mode. **Table 2.1** provides the comparisons between the Berala travel zones and the Sydney region for JTW data.

Table 2.1 Comparison of Berala and Sydney Employed Residents Journey to Work

	Train (%)	Bus (%)	Ferry/ Tram (%)	Vehicle driver (%)	Vehicle passenger (%)	Walked only (%)	Other/ not stated (%)
Berala	31	1	0	55	7	2	4
Sydney	14	6	0	67	5	4	4

Source: GMA Sydney employed person characteristics, BTS 2011

People who live within the four surrounding travel zones to Berala Interchange are most likely to travel to workplaces in the ABS Statistical Area Level 3 (SA3) of Auburn (21%) and Sydney Inner City (18%). The top ten workplace locations for residents of the travel zones surrounding Berala Interchange are listed in **Table 2.2**.

Table 2.2: Employed Residents - Top Ten Workplace Locations

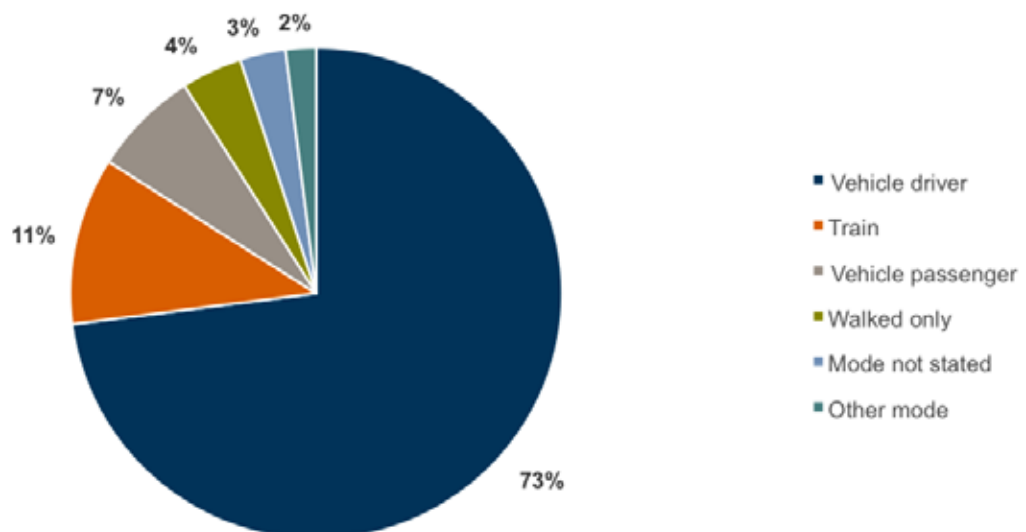
# Ranking	Workplace (SA3)	%
1	Auburn	21
2	Sydney Inner City	18
3	Strathfield – Burwood – Ashfield	7
4	Bankstown	7
5	Parramatta	5
6	Merrylands – Guildford	5
7	No fixed place of work	4
8	Ryde – Hunters Hill	3
9	Canada Bay	3
10	Fairfield	3
Representation of top 10		76%

Source: BTS, based on ABS 2011 Census data

2.2.1.2 Workers within Berala Interchange Travel Zones

Of the 1,011 people who attend jobs located within the Berala Interchange travel zones, travel to work is dominated by the private motor vehicle as shown in **Figure 2.3**.

Figure 2.3: Worker Journey To Work - Berala Interchange Travel Zones



Source: BTS, based on ABS 2011 Census data

80% of people working in the four Berala Interchange travel zones either drive to work, or are a passenger of a car. Public transport accounts for 11% of which all journeys are made by train, while walking accounts for 4% of all work trips.

Comparing Berala worker journeys to work to those that occur across the Sydney region shows that the Berala workers are more reliant on their cars to travel to work than workers across the Sydney region which averages at 72%. The number of people who walk is in line with the Sydney average. **Table 2.3** provides a comparison of mode share between Berala and Sydney workers journey to work mode share.

Table 2.3: Comparison of Berala and Sydney Workers - Journey to Work

	Train (%)	Bus (%)	Ferry/ Tram (%)	Vehicle driver (%)	Vehicle passenger (%)	Walked only (%)	Other/ not stated (%)
Berala	11	0	0	73	7	4	5
Sydney	14	6	0	67	5	4	4

Source: GMA Sydney employed person characteristics, BTS 2011

People who work close to Berala Interchange are most likely to travel from nearby areas; 41% of workers live in the SA3 of Auburn, with 8% living in Bankstown. The top 10 origins or places of residence for people working in the travel zones adjacent to Berala Interchange are shown in **Table 2.4**.

Table 2.4: Berala Workers - Top Ten Places of Residence

# Ranking	Residence location (SA3)	%
1	Auburn	41
2	Bankstown	8
3	Merrylands – Guildford	7
4	Strathfield – Burwood - Ashfield	5
5	Fairfield	3
6	Baulkham Hills	3
7	Canterbury	3
8	Liverpool	3
9	Parramatta	2
10	Campbelltown	2
Representation of top 10		77%

Source: BTS, based on ABS 2011 Census data

2.2.2 Household Travel Survey

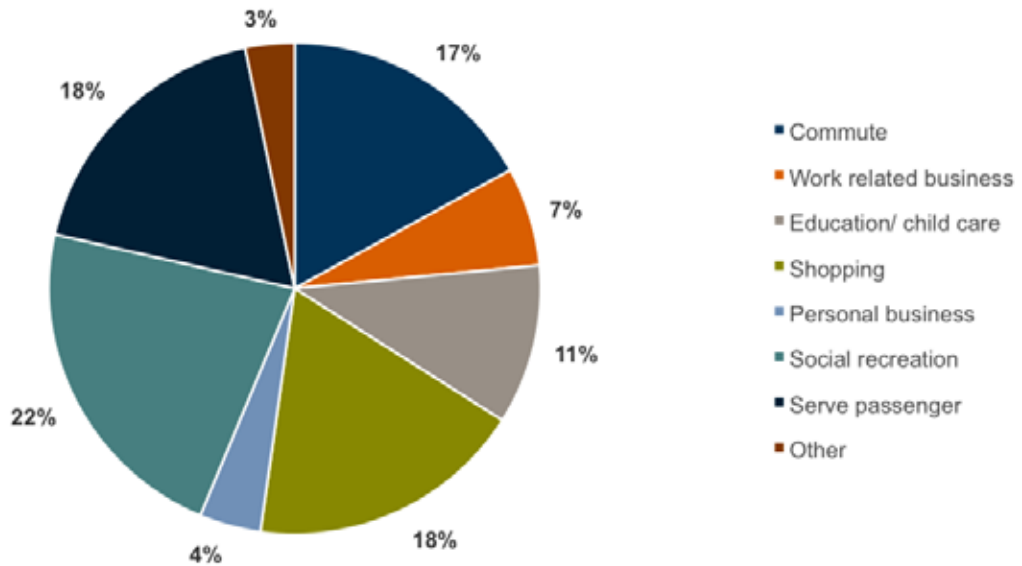
The Household Travel Survey (HTS) collects a randomly selected population sample of comprehensive travel data across the Sydney Greater Metropolitan Area (GMA) for a variety of trip types, purposes and modes. The smallest geographical area for publically available data is at the LGA level. Berala falls within the Auburn LGA and a summary of the data is provided in the following section.

2.2.2.1 Trip purpose

Review of trip purpose split indicates the majority of travel for the Auburn LGA is for social recreation trips (22%), followed by serve passenger (18%) and shopping (18%). Commute trips, those expected to account for a high proportion of peak period train customers account for approximately 17% of all trips.

Education/ child care trips accounted for only 11%, while personal business and work related business combined accounted for 11% of the total number of trips. The trip purpose breakdown is shown in **Figure 2.4**.

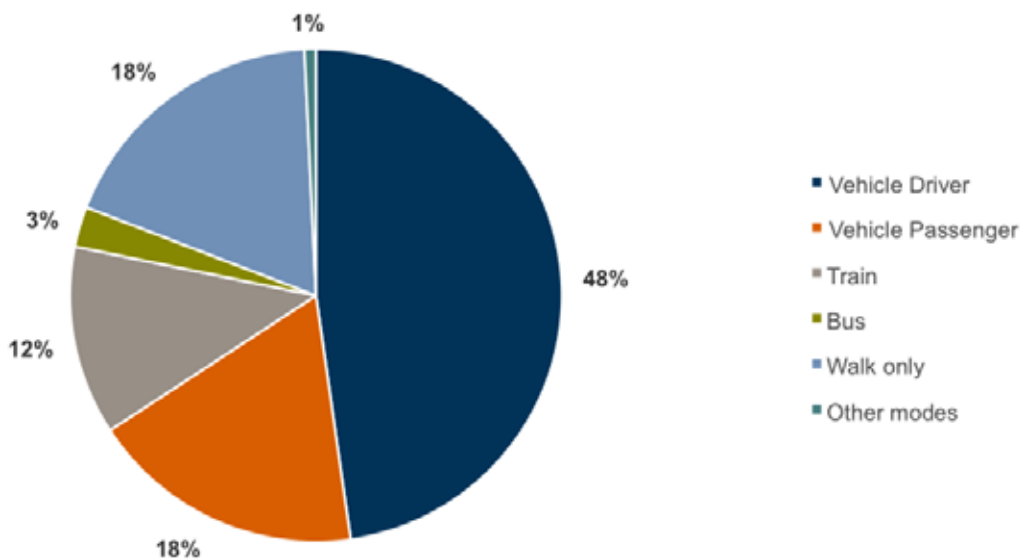
Figure 2.4: Trip purpose – Household Travel Survey



2.2.2.2 Travel mode

Vehicle travel is dominant across all household trips in the Auburn LGA; 48% of all trips are undertaken as a vehicle driver and an additional 18% as a vehicle passenger. Walking is the next most popular form of transport with 18% mode share, followed by train with 12% **Figure 2.5** presents the travel modes used within the Auburn LGA for all trip purposes.

Figure 2.5: Travel mode - Household Travel Survey



Source: BTS, 2012/2013 Household Travel Survey, Hornsby LGA (excluding return trip)

2.3 Vehicle Network

2.3.1 Parking Provisions

There are several unrestricted parking locations in areas around the interchange. Adjacent to Woodburn Road there is an unrestricted car park located to the west of the station which has the capacity for 80 vehicles (see **Figure 2.6**). In addition, on the northern side of the interchange there is unrestricted on-street parking to the west of the station along Elizabeth Street. On the southern side of the station there is unrestricted parallel parking located on both sides of Campbell Street, Burke Street and Berala Street. The parking on Campbell Street is shown in **Figure 2.7**.

On-site observations showed that parking demand was low after the AM peak period on 27 August 2015.

Figure 2.6: Unrestricted car park accessed from Woodburn Road



Figure 2.7: Unrestricted parallel parking along Campbell Street



The unrestricted parallel parking capacity on both sides of the interchange is summarised as follows (approximated using a ratio of 6 metres for 1 parking space where spaces are not delineated):

On the southern side of the station:

- There are 36 spaces available on the north side of Berala Street and 30 on the southern side.
- The southern section of Burke Avenue has 15 spaces available on each side of the road.
- On Campbell Street there are 49 spaces adjacent to the station and 46 on the southern side of the road.

On the northern side of the station:

- South of the roundabout of Elizabeth Street there are 21 spaces available on the western side and 16 spaces on the eastern side.
- 80 spaces are available in the carpark located on Woodburn Road to the west of the station.

Figure 2.8: Unrestricted on-street parking close to Berala Interchange



Basemap Source: Nearmap

2.3.2 Kiss & Ride

There are no formally identified Kiss & Ride facilities in the interchange precinct, however there are four kerbside locations where No Parking restrictions provide the same function, two of which are designated Drop-off Pick-up zones. These zones provide Kiss & Ride facilities for eight vehicles and are located as follows:

- On the northern side of Woodburn Road there is a time restricted No Parking Zone shared with the NightRide bus stop with space for two vehicles as shown in Figure 2-9.
- On the southern side of Woodburn Road there are two No Parking Drop-Off Pick-Up Zones, each with space for two vehicles. One of these zones is shared with the NightRide bus stop.
- South of the station on Campbell Street there is a No Parking Drop-Off Pick-Up Zone adjacent to the entrance of the station with space for two vehicles as shown in Figure 2-10.

Figure 2.9: Informal Kiss & Ride along Woodburn Road



Figure 2.10: Designated Drop-off Pick-up zone on Campbell Street



2.3.3 Local Road Network

The road network immediately surrounding Berala Interchange includes:

- Woodburn Road (northern boundary)
- Campbell Street (southern boundary)
- Burke Avenue (southern street)

The characteristics of Woodburn Road, Campbell Street and Burke Avenue are presented in **Table 2.5**.

Table 2.5: Characteristics of Streets Surrounding Berala Interchange

	Woodburn Road	Campbell Street	Burke Avenue
Road Class	Local Road	Local Road	Local Road
Cross- section	One lane each direction	One lane each direction	One lane each direction
Median	None	None	None
Function	Provides station access on the northern side of the station along a retail strip.	Provides access on the southern side of the station.	Small retail street that connects to Campbell Street opposite the station.
Posted Speed/s	50km/hr.	50km/hr	50km/hr
Pedestrian paths	Provided on both sides.	Provided on both sides.	Provided on both sides.
Cycleways	On-road.	Off-road shared path and on-road.	On-road
Parking	Restricted parking	Unrestricted parallel parking on both sides of Campbell Street.	Restricted parking in the vicinity of the station.
Bus Services	Bus services on both sides of the road.	Bus services on both sides of the road.	Bus services on both sides of the road.

2.4 Public Transport Network

2.4.1 Rail Network

Berala Interchange is currently serviced by trains operated by Sydney Trains on the T3 Bankstown Line and also less frequently on the T2 Inner West and South Line. Trains on the section of the T3 Line that stop at Berala operate between Lidcombe and the City Circle via Bankstown. Key stations along this line include Lidcombe, Bankstown, Sydenham, Redfern, Central and City loop stations. Customers travelling north are able to transfer onto the T1 Western and North Shore Line, T2 Inner West and South Line and T7 Olympic Park Line at Lidcombe. When traveling to Sydney CBD stations, it is generally quicker to catch a train and transfer to an express train at Lidcombe rather than travel to the CBD via Bankstown.

Customers travelling south are able to change at Birrong Station for west services to Liverpool or continue east for services to Sydney CBD. Figure 2.11 shows Berala on a segment of the Sydney Trains network map from 2015.

Figure 2.11: Sydney Trains Network Map Extract



Source: http://www.sydneytrains.info/stations/pdf/suburban_map.pdf, viewed 25/05/2015

Train frequencies at Berala Interchange are generally two trains per hour in each direction throughout the day, during off-peak hours. Trains run between 4:29am and 12:47am to the City, and between 5:26am and 1:19am to Berala. On Friday nights, trains run until 1:17am to the City and 1:49am to Berala. On Saturday night, trains run until 1:56am to the City and 1:06am to Berala. The train frequency throughout the day at Berala Interchange is shown in Table 2.6.

Table 2.6: Summary of Train Services at Berala Interchange

Direction	M-F AM Peak Services (6:00am-9.30am)	M-F PM Peak Services (3:00pm-6.30pm)	Services/ Weekday	Services/ Saturday	Services/ Sunday
To City via Bankstown	11	11	52	42	42
To Lidcombe	11	10	50	40	39
To City via Lidcombe	0	2	2	0	0
To Liverpool	1	0	1	0	0

Source: Sydney Trains timetable 2015

2.4.2 Bus Network

Berala Interchange is serviced by three bus routes during the week which include:

- Route 908 – Bankstown to Merrylands (Transdev)
- N50 NightRide – Liverpool to Central Station
- Community access loop – Council Depot (Auburn) to Wentworth Point via Berala, Regents Park and Wentworth Point

A visual representation of the bus route movements and bus stop locations in proximity to Berala Interchange is provided in Figure 2.12.

Figure 2.12: Bus routes and stops close to Berala Interchange



Source: Transdev bus route map. Basemap source: Nearmap

A summary of the route frequencies is provided in Table 2.7.

Table 2.7: Summary of bus services at Berala Interchange

Bus Route	To	M-F AM Peak Services (6:00am-9.30am)	M-F PM Peak Services (3:00pm-6.30pm)	Total Number of Weekday Services
908	Merrylands	5	5	15
	Bankstown	3	5	15
N50 (NightRide)	Liverpool	0	0	11
	Central Station	0	0	6
Access Loop (Community bus)	Auburn	0	0	3 (Thursdays)

Source: Transdev

The Route 908 bus stops are located on the south side of the station. This service connects Bankstown Station via Regents Park to Merrylands. The bus stops are located on both sides of Campbell Street.

Auburn City Council operates a free bus service for seniors and people with disabilities each Thursday between 10:00am and 4:00pm. The route forms a loop around the Auburn LGA. The service operates two anti-clockwise movements and one clockwise movement. Stops for this service are located on both sides of Woodburn Road near the access to the station. These bus stops share the same bus zones with the NightRide services.

2.4.2.2 Bus Facilities

The bus stops associated with the interchange are located on both the northern and southern sides of the rail corridor. On Woodburn Road, there are two bus zones in close proximity of the pedestrian arcade. Both stops on Woodburn Road are only signposted and do not have additional customer facilities provided. It should be noted there is no NightRide bus signage for the bus stop located on the northern side of Woodburn Road. This bus stop is only active during the night times (11pm – 6am), and operates as an informal Kiss & Ride zone with no parking permitted during peak periods, as shown in **Figure 2.13**. Both bus stops have signage for the community bus “Access Loop” which includes a map and timetable as shown in **Figure 2.14**.

The bus stop on the southern side of Campbell Street consists of the pole, bus zone sign and an attached timetable to the sign only. It is noted that the awning of the adjacent shop is available to provide shelter for waiting customers as shown in **Figure 2.15**. On the station side of Campbell Street a bus shelter, pole, bus zone sign and timetable have been provided, as shown in **Figure 2.16**.

Figure 2.13: Bus stops on northern side of Woodburn Road



Figure 2.14: Community bus stop signage on Woodburn Road



Figure 2.15: Bus zone on southern side of Campbell Street



Figure 2.16: Sheltered bus stop on station side of Campbell Street



2.4.3 Taxi Network

There is a designated taxi rank on the northern side of the interchange on Woodburn Road, located opposite the bus stops. The taxi zone has capacity for approximately two taxis.

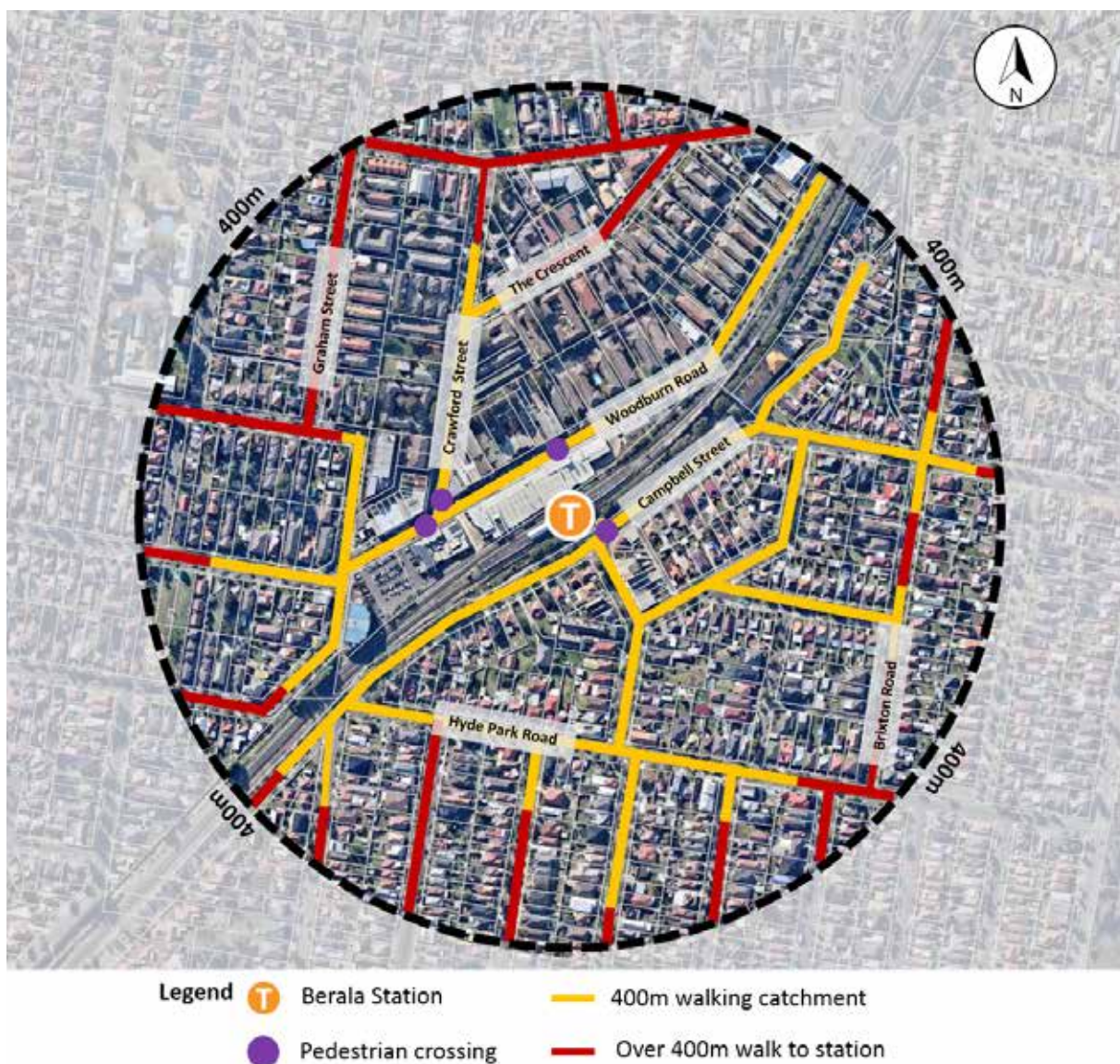
2.5 Pedestrian Network

2.5.1 Pedestrian Approach

Customers approach the interchange through the surrounding footpath network. The key approach routes and 400 metre walking catchment to and from the station are illustrated in **Figure 2.17** and are:

- From the south: Customers arriving along all roads from the south are fed into Campbell Street. A raised pedestrian crossing has been provided outside the underpass entrance for customers to safely cross the road.
- From the north: Customers are fed into Woodburn Road, where customers can access the pedestrian plaza (consisting of the Woolworths and BWS) which provides access to the pedestrian underpass.

Figure 2.17: Berala Interchange 400m walking catchment



Basemap source: Nearmap

2.5.2 Pedestrian Infrastructure

The pedestrian infrastructure on approach to Berala Interchange includes footpaths on both sides of the road and pedestrian crossings.

2.5.2.1 Deficiencies in pedestrian network

The deficiencies along the pedestrian network that may affect customers arriving at the interchange precinct are shown in Figure 2.18.

Figure 2.18: Pedestrian infrastructure deficiencies



Background image: Nearmap

The deficiencies are described in further detail as follows:

1: Missing footpath – The footpath on the southern side of Woodburn Road ends east of the Woolworths car park entrance/ exit point as shown in Figure 2.19.

2: Missing footpath – The footpath along the station side of Campbell Street, west of the station ends at a point approximately in line with the south west end of the station platform.

3: Long crossing distance – The crossing distance across Burke Avenue at Campbell Street is approximately 20m, which may be deemed as a difficult crossing location. The eastern kerb ramp of this intersection is also misaligned to the direction of crossing as shown in Figure 2.20.

4: **Non-conforming kerb ramps** – The kerbs ramps and pedestrian crossing at the intersection of Woodburn Road and Crawford Street are misaligned and too narrow as shown in **Figure 2.21**. The angle of the crossing is non-compliant to RMS kerb ramp standards. Kerb ramps shall not be angled at less than 70 degrees to the direction of traffic and are ideally angled at 90 degrees.

5: **Bus stop along desire line** – A sheltered bus stop is located along the pedestrian desire line on Campbell Street as shown in **Figure 2.22**.

6: **Uneven footpath** – The footpath immediately outside the southern entrance to the underpass has an uneven surface as shown in **Figure 2.23**.

Figure 2.19: Missing footpath east of Woolworths



Figure 2.20: Long crossing distance at Burke Avenue



Figure 2.21: Non-compliant pedestrian crossing



Figure 2.22: Bus stop located along pedestrian desire line



Figure 2.23: Uneven footpath on southern entrance



2.5.2.2 Footpaths

Footpaths on approach to the interchange, apart from those mentioned in the previous section are in good condition with a minimum width of 1.2 metres. The material of the footpaths predominantly include pavers and concrete. Images of footpaths on approach to the interchange are provided in **Figure 2.24** to **Figure 2.27**.

Figure 2.24: Pedestrian plaza on northern side of underpass



Figure 2.25: Paved footpath along Woodburn Road



Figure 2.26: Footpath on approach to the station on Campbell Street



Figure 2.27: Newly constructed footpath along Campbell Street looking west



2.5.2.3 Pedestrian crossing

Four pedestrian crossings are provided in close proximity to the Berala Interchange shown in **Figure 2.17**. Three are located on the northern side, and a raised pedestrian crossing is provided on the southern side. Both the pedestrian crossings across Woodburn Road are designed to standard, shown in **Figure 2.28** and **Figure 2.29**. The kerb ramp for the Woodford Road pedestrian crossing, east of Crawford Street is misaligned. It should be noted that although the pedestrian crossings on Woodford Road are not raised, speed humps are provided before and after these pedestrian crossings.

As discussed in the above section, the pedestrian crossing across Crawford Street is non-compliant with relevant standards, mainly due to the intersection angle of Crawford Street and Woodburn Road.

The raised pedestrian crossing on Campbell Street has been constructed to RMS Standards. Repainting may be required due to faded crossing markings as shown in **Figure 2.30**.

Figure 2.28: Pedestrian crossing across Woodburn Road, connecting to underpass



Figure 2.29: Pedestrian crossings at corner of Crawford Street and Woodburn Road



Figure 2.30: Raised pedestrian crossing across Campbell Street

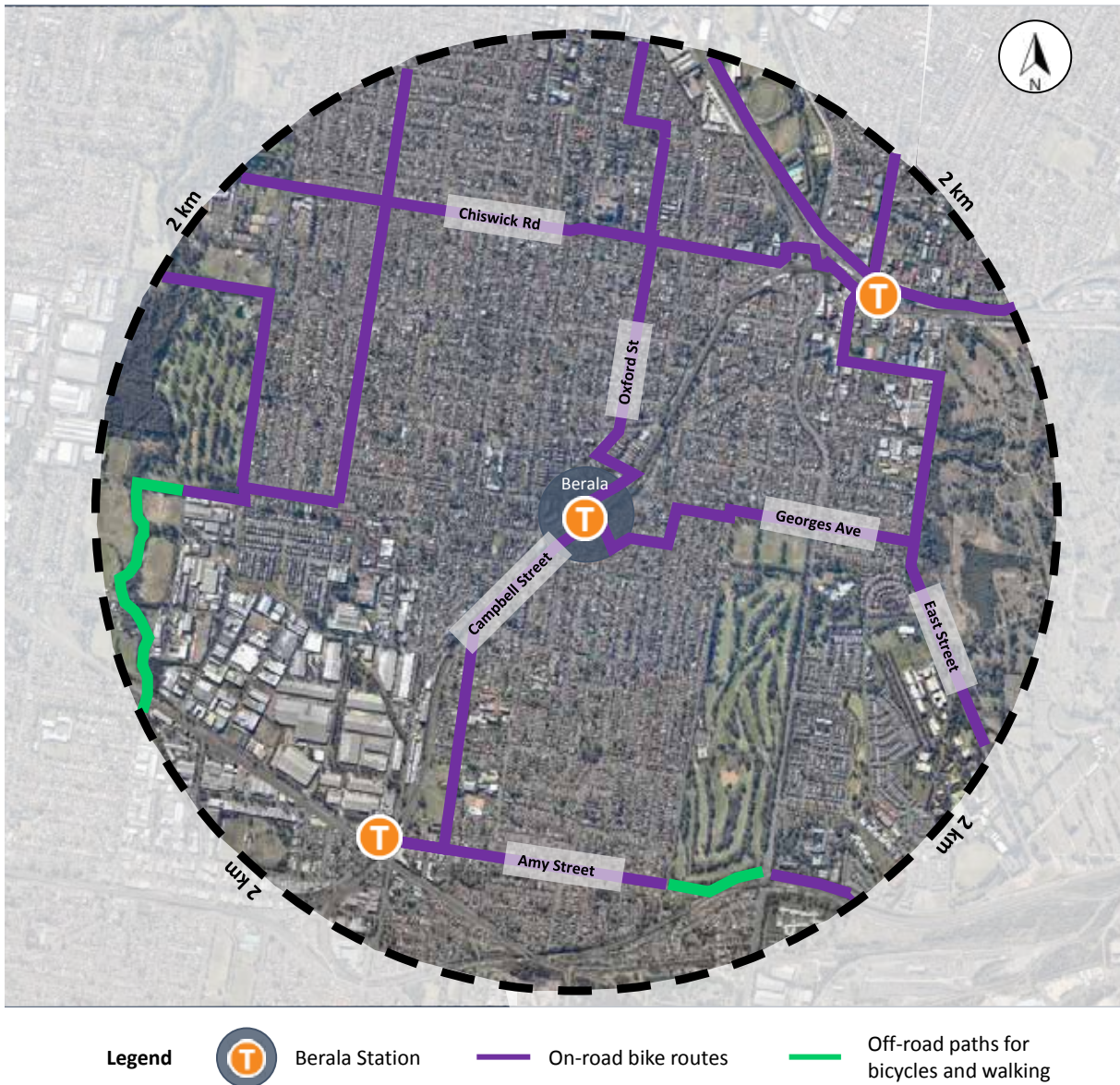


2.6 Cycle Network

Berala Interchange is serviced by two on-road bike routes as designated by Auburn City Council. A designated route to the interchange includes Oxford Street, Woodburn Road, through the underpass to Berala Station, Campbell Street and down Regent Street. A second route heads east of the interchange precinct via Burke Avenue, Berala Street, McDonald Street, Brixton Road and London Road/ Georges Avenue. An extract of the Auburn City Council bike plan within a 2 kilometre radius of Berala Interchange is provided in **Figure 2.31**.

It is clear from the Auburn City Council bike plan that the underpass at Berala Interchange is a key link for the bike network in the region to cross the railway line.

Figure 2.31: Auburn City Council bike map with 2 kilometres of Berala Interchange



Basemap source: Nearmap

2.6.1 Signage and on-road markings

On-road markings and signage was observed to be limited within close proximity to Berala Interchange. The only signage identified is located outside the southern entrance to the underpass on Campbell Street providing signage to Auburn, Lidcombe and Regents Park as shown in Figure 2.32.

Figure 2.32: Bike signage to Regents Park



2.6.2 Bike infrastructure

Bicycle infrastructure has been provided on the southern side of the interchange only, with space for ten bicycles. These bicycle racks were not observed to be used to their full capacity at the time of the site visit, shown in **Figure 2.33**. Bikes were found to be chained to the hand railings within the arcade on the northern side as shown in **Figure 2.34**.

Figure 2.33: Bike racks next to underpass entrance on southern side



Figure 2.34: Bikes chained to hand railings on the northern side (in plaza)



3 Station Patronage

3.1 Existing Station Patronage

Berala Interchange was the 115th busiest railway station in 2014 on the Sydney Trains and NSW TrainLink network, with approximately 4,520 trips recorded at the station on an average weekday. The customers entering and exiting the station over the 24 hour period, and in the morning and afternoon peak period from 2004 to 2014 are indicated in **Table 3.1** and historic AM peak period and daily volumes are graphed in **Figure 3.1**.

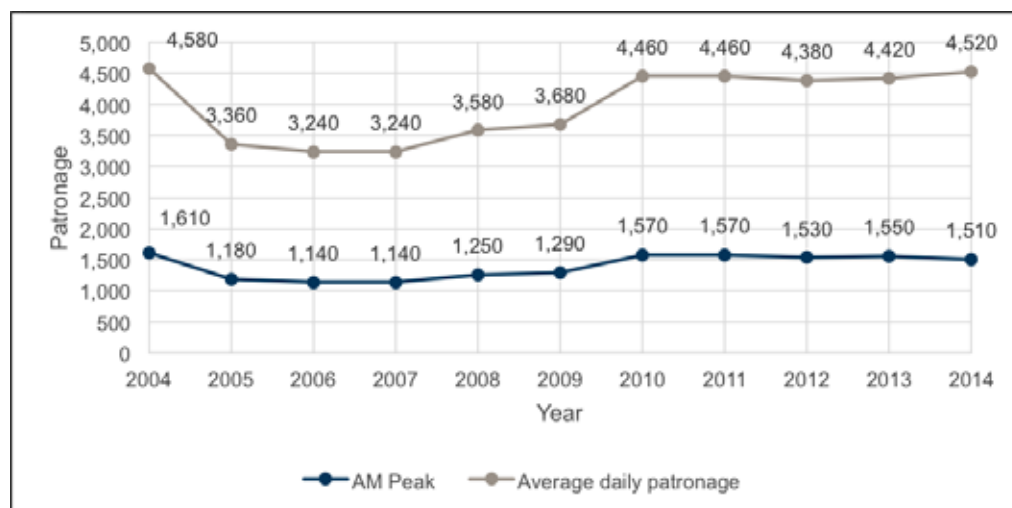
Table 3.1: Train Passenger Barrier Counts 2004 - 2013

Year	AM Peak Period			PM Peak Period			24 Hours		
	6:00 to 9:30am			3:00 to 6:30pm					
	Entering	Exiting	Total	Entering	Exiting	Total	Entering	Exiting	Total
2004	1,490	120	1,610	250	1,310	1,560	2,290	2,290	4,580
2005	1,050	130	1,180	280	980	1,260	1,680	1,680	3,360
2006	1,020	120	1,140	270	950	1,220	1,620	1,620	3,240
2007	1,020	120	1,140	270	960	1,220	1,620	1,620	3,240
2008	1,110	140	1,250	300	1,030	1,330	1,790	1,790	3,580
2009	1,140	150	1,290	310	1,060	1,370	1,840	1,840	3,680
2010	1,430	140	1,570	280	1,290	1,570	2,230	2,230	4,460
2011	1,430	140	1,570	280	1,290	1,570	2,230	2,230	4,460
2012	1,420	110	1,530	230	1,260	1,490	2,190	2,190	4,380
2013	1,440	110	1,550	230	1,270	1,500	2,210	2,210	4,420
2014	1,390	120	1,510	290	1,230	1,520	2,260	2,260	4,520

Source: Station barrier counts BTS (2015)

Over the ten year period there was an overall patronage decrease of 1% from 2004 levels. Between 2004 and 2005, there was a 27% drop in patronage, possibly due to the timetable change in September 2005. Following this, patronage steadily increased to 2008 followed by a significant increase between 2009 and 2010. There was another slight decrease in patronage in 2011, likely due to the October 2011 timetable change. Since 2012, Berala Station has seen slight increases in average daily patronage each year.

Figure 3.1: Average daily station patronage from 2004 to 2014



3.2 Current Station Patronage

Pedestrian volume surveys were conducted at Berala Interchange on Tuesday 1 September 2015 in the AM Peak Period 6:00AM – 9:30AM, to understand passenger patronage and directional distribution. The results of the on-site pedestrian volume surveys indicate movements at the station are not evenly distributed throughout the 3.5 hour peak period as outlined in Table 3.2.

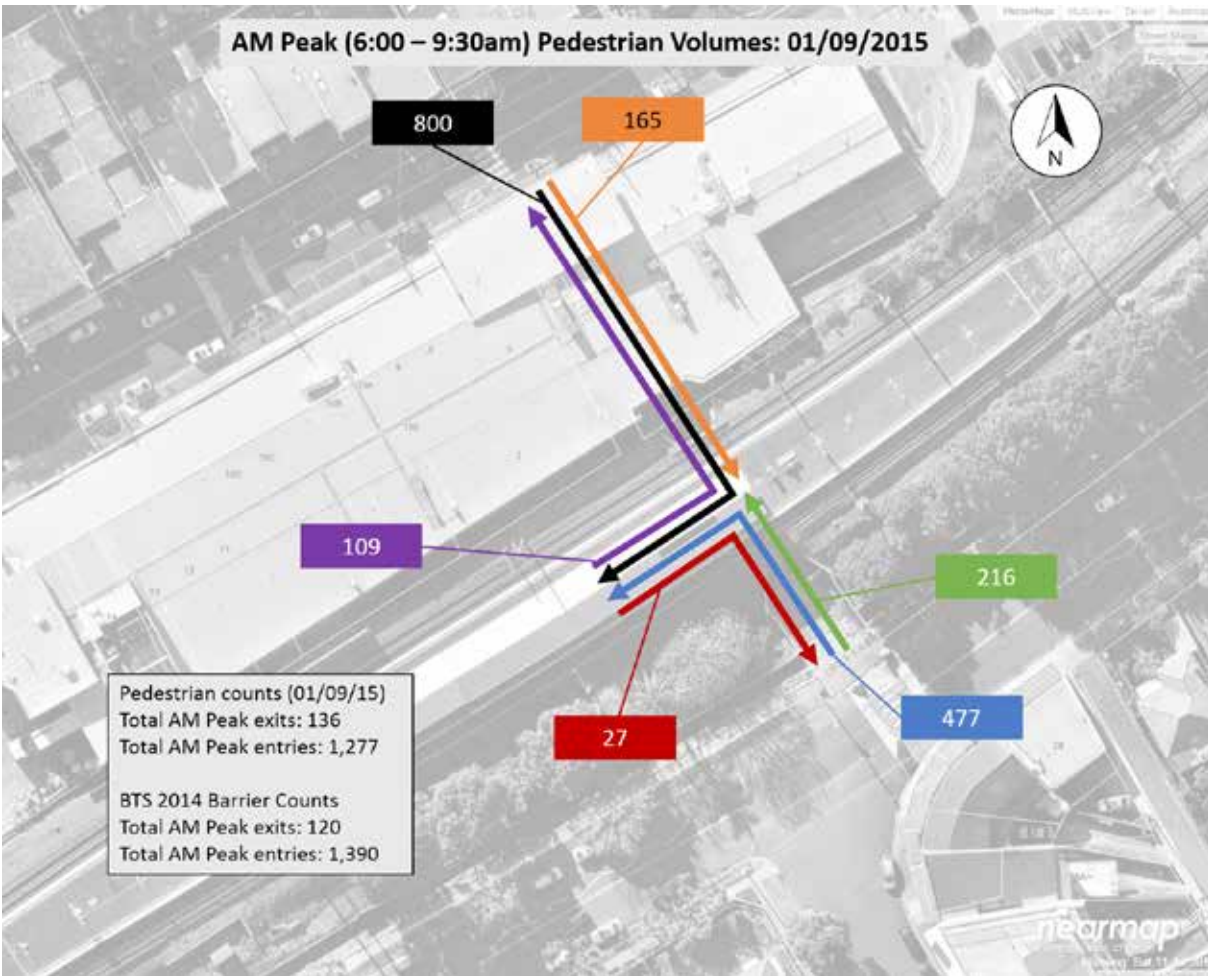
Table 3.2: 2015 Peak Period Summary

Peak	Time period	Entering (split %)	Exiting (split %)	Total	Percentage of total AM Period
2015 AM Peak period	6:00AM – 9:30AM	1,277 (91%)	132 (9%)	1,409	100%
15 minute	8:09AM – 8:23AM	193 (90%)	22 (10%)	215	15%
5 minute	8:07AM – 8:11AM	101 (90%)	10 (10%)	111	8%
1 minute	8:09AM – 8:10AM	24 (65%)	13 (35%)	37	3%
Period between train services	7:40AM – 7:54AM	172 (94%)	11 (6%)	183	13%

The peak period between train services is likely to indicate the peak volume of customers waiting on the platform, 172 people. Exiting movements occurred in the first two minutes of this period.

The AM peak period volumes to and from Berala Interchange as well as the pedestrian directional split is presented in Table 3.2 below.

Figure 3.2: AM Peak (6:00am – 9:30am) Pedestrian volumes and distribution



It was found that of all the pedestrian movements to the station:

- 62.6% of all station entry movements are from the northern side
- 37.4% of all station entry movements are from the southern side

Of the pedestrian movements from the station, it was found that:

- 80.1% of pedestrian movements from the station travelled north of the interchange
- 19.9% of pedestrian movements from the station travelled south of the interchange

It should be noted that 21.2% of all railway underpass movements were through movements.

3.3 Projected Station Patronage

Typical weekday passenger numbers at Berala Interchange are forecast to increase by approximately 10% from 4,520 in 2014 to 4,978 in 2036 (TfNSW, Berala BRS).

The TfNSW Transport Access Program specifies a design patronage contingency to reduce the risk of station improvements not being sufficient for passenger volumes in the intended design life. This adds an extra 15% to the 2036 estimate to provide a design volume of 5,725 passengers at Berala Interchange per typical weekday.

The BRS for Berala Station indicates that approximately 35% of the forecasted daily patronage in 2036 are AM peak entry and exit numbers. This proportion has been applied to the 2036 + 15% future daily passenger numbers to estimate the future AM peak passenger numbers as shown in **Table 3.3**.

Table 3.3: Forecast Daily and AM Peak period Passenger Volumes

Year	Daily passenger numbers (24 hrs)	AM Peak period (6:00 – 9:30AM)	AM Peak proportion of daily total
2036	4,978	1,736	35%
Design Patronage (2036 + 15%)	5,725	1,997	35%

The distribution of passengers entering and exiting the station in the AM peak from 2015 pedestrian counts have been provided in **Table 3.4**.

Table 3.4: Pedestrian Directional Split in the AM Peak (6:00AM - 9:30AM)

AM Period	Volume percentage of AM peak period	Entering	Exiting	Total
6:00AM – 9:30AM	100%	91%	9%	100%
Peak 15 minute	15%	90%	10%	100%
Peak 5 minute	9%	98%	2%	100%
Peak minute	3%	65%	35%	100%

3.3.1 2036 + 15% Peak patronage

The directional split analysis in **Table 3.4**, and forecast daily patronage in **Table 3.3** have been used to determine the expected number of passengers entering and exiting the station in the one minute, five minute, fifteen minute and total peak periods, shown in **Table 3.5**.

Table 3.5: 2036 + 15% forecast peaks

AM Period	Percentage of peak period	Entering	Exiting	Total
6:00AM – 9:30AM	100%	1,809	187	1,996
Peak 15 minute	15%	273	31	305
Peak 5 minute	9%	170	4	174
Peak minute	3%	34	18	52

4 Proposed Station Upgrades

The proposed upgrade to the Berala Interchange as part of the Transport Access Program predominately focuses on providing a pedestrian lift at the station to provide access between the station platform and the underpass.

It should be noted that major works to the external road network are currently being designed by Auburn City Council. Final detailed plans were not available at the time of preparing this report. A review of concept plans and discussions with Auburn City Council led to the following expectations of upgrades proposed as part of the Berala Village Public Domain Plan:

- Retention of the one mobility impaired parking spot on Crawford Street, and relocating the two spaces on Woodburn Road closer to the station entrance;
- Construction of a raised pedestrian threshold at the Woodburn Road and Crawford Street intersection;
- Removal of the three existing raised thresholds along Woodburn Road;
- Widening of the footpath along the eastern verge of Crawford Street;
- Installation of a raised pedestrian crossing on Woodburn Road in front of the entrance of the retail arcade and station entrance point;
- Installation of four bicycle racks along the southern kerb of Woodburn Road at the entrance to the station;
- Reduction of road width on Campbell Street and Burke Avenue to provide a raised pedestrian threshold;
- Widening of the footpath along both sides of Campbell Street adjacent to the southern station entrance;
- Installation of Tactile Ground Surface Indicators (TGSI) adjacent to driveways along Woodburn Road, Crawford Street, Campbell Street and Burke Avenue;
- Reconfiguration of current short-term and unrestricted parking arrangements, resulting in an additional eight spaces along Woodburn Road. In total, 27 short-term and unrestricted spaces are proposed on the northern side of Woodburn Road, and 21 on the southern (station) side;
- Relocation of the loading zone on the northern side of Woodburn Road closer to the intersection with Crawford Street;
- Retention of the mail zone in its current location on the northern side of Woodburn Road;
- Relocation of the bus zones to be adjacent to the proposed raised pedestrian crossing opposite the station entrance;
- Reconfiguring two out of the four taxi zone spaces as a Kiss & Ride zone, adjacent to the proposed raised pedestrian crossing on Woodburn Road. The remaining two taxi zone spaces are to be retained;
- Provision of parking spaces for motorbikes on the southern side of Woodburn Road, adjacent to the taxi zone;
- No changes proposed to existing parking arrangements along Campbell Street.

It should be noted that given the preliminary status of the works proposed by Auburn City Council, no assessment has been made on the traffic, transport and access impacts during and post construction.

The proposed works to the Berala Interchange are provided in **Appendix M** of the Berala Interchange Concept Design Plan Report. The council report with accompanying plans is provided in **Appendix J**.

5 Operation during Construction

5.1 Construction Activity

Construction of the proposed upgrade to Berala Interchange would where possible occur during general standard working hours, these being:

- 7:00am to 6:00pm on Monday to Friday.
- 8:00am to 1.00pm on Saturdays.

It is recommended that works that may disrupt the current train line service or the pedestrian and traffic network be undertaken on weekends during typical weekend rail possession periods. These generally start after 9.30pm on Friday and continue until early Monday morning.

The construction works will predominately be undertaken during non-peak commute times, with measures to be implemented to ensure that existing transport modes are not majorly impacted. Heavy vehicles with deliveries that may impact general traffic flow on the external road network should be restricted to non-peak hour times to avoid impacting fluency of the road network and disruption to public and active transport modes.

A construction office is expected to be located at the construction site. It is likely that the most suitable location for the construction office is on the south-eastern side of the station. The office must be sited outside of the existing key pedestrian paths, particularly around the local town centre.

Some works may be undertaken during non-standard working hours, including the evenings and throughout the weekend to ensure minimum disruption of the transport modes within the interchange as well as disruptions on the Bankstown train line. Where works are to be undertaken outside standard work hours, approval is to be sought from TfNSW and the affected community is to be advised as outlined in TfNSW's Rail Infrastructure Noise Guideline 2013.

5.1.1 Worker Induction

All workers and subcontractors involved in the construction works will be required to undertake a site induction before commencing work. It is recommended that work induction include the permitted access routes, driver and worker protocols, emergency procedures, WHS requirements and environmental measures. All workers, including construction and traffic controllers, are to hold all appropriate licences.

5.2 Construction Stage Impacts

5.2.1 Haulage Routes

The Berala Interchange is generally surrounded by local roads that serve property accesses in the local town centre. The potential site access location and haulage routes are shown below in Figure 5-1.

It should be noted that Park Road and Joseph Street have been listed as RMS Restricted Access Vehicle 25/26m B-Double routes.

Figure 5.1: Potential haulage routes



Basemap source: Google Maps

It is recommended that a Construction Traffic Management Plan (CTMP) be undertaken prior to construction works, which outlines the preferred construction vehicle routes. Furthermore, access in and out of the construction site is to be clarified by the contractor with all construction vehicles recommended to be traveling in a forward direction whilst entering and exiting the construction site. Swept path analyses are to be undertaken to ensure no conflicts occur along proposed haulage routes, in particular for ingress and egress from the construction site.

5.2.2 Traffic Impacts

The vehicles generated onto the road network as a result of the construction works are expected to generally be light vehicles from construction workers and minimal heavy vehicle trips for delivery and removal of materials, plants, and equipment when required. Heavy vehicles will be generally restricted to semi-articulated vehicles, as B-Double vehicles cannot be accommodated along the external road network to the construction site.

The classification of vehicles and their delivery time will vary day-to-day based on the proposed construction work. It is recommended that heavy vehicles be restricted to non-peak and rail possession periods.

The traffic generated as a part of the construction works is not expected to exceed 10 vehicles per hour, or one vehicle every six minutes. Site observations indicate that the traffic volumes on Campbell Street are generally quite low with minimal delays and queues. The minor increase in traffic as a result of construction vehicles is unlikely to result in any significant impact on the road. Longer delays were observed on Woodburn Road and Crawford Street, likely due to the close proximity of the Berala town centre and associated retailers.

Where assistance is required to guide vehicles in and out of the construction site, licenced traffic controllers are recommended to ensure that minimal delays are experienced on the local road network. The safety of vehicle movements in and out of the construction site as well as for pedestrians is to be maintained at all times.

It is recommended that construction works and access should be limited to Campbell Street where possible to avoid conflicts and disruption with vehicles and pedestrians accessing local shops and the station.

In summary;

- the traffic generation from the construction works at Berala Interchange is expected to be minimal,
- construction works impacting the external road network traffic flow are expected to be low and aided by traffic controllers where required,
- the anticipated impact on the external traffic network is expected to be negligible.

5.2.3 Parking Impacts

The proposed construction works, including construction site and access points, are recommended to be clarified and designated to avoid impacts on vehicles and pedestrians surrounding the interchange, as well as ensuring impact on parking provisions at the interchange are minimally impacted. Part-time loss of parking spaces may occur during construction, including on Campbell Street and Woodburn Road. This should be minimised where possible and the impact mitigated in the CTMP.

It is recommended that parking be provided on the construction site for construction workers, with encouragement made for construction workers to carpool or use public transport to ensure no loss of parking spaces for interchange commuters.

5.2.4 Pedestrian Impacts

Construction work is expected to have a minor impact on the pedestrian and cycle network given the restricted space in which construction works are to be carried out. Construction works to be undertaken in close proximity to the existing footpaths and cycle facilities would occur infrequently with closures expected to be temporary with safe and suitable detours provided as a part of the construction traffic control.

Pedestrian access closures and detours are to be outlined by the subcontractor prior to construction work commencement.

It is expected that pedestrians will continue to utilise the existing pedestrian network on Woodburn Road and Campbell Street. Minor disruption to the pedestrian network along the aforementioned streets is anticipated to occur during stages of the construction with clear warning signs and safe detours to be provided for pedestrians accessing the station.

6 Operation Post-Construction

6.1 Pedestrian Impact

The construction of the station lift as a part of the Transport Access Program is anticipated to address existing DDA needs by providing a complete accessible path between the station underpass and station platform.

It is anticipated that the pedestrian works undertaken by Auburn City Council will provide a complete pedestrian network, with full DDA compliancy throughout the interchange. It is recommended that the Council’s scope of works be reviewed to ensure the safety, accessibility, and connectivity between all transport modes within the interchange.

6.1.1 Pedestrian Level of Service

Fruin’s level of service is a series of density and flow rate bands that correspond to levels of service between A (best level of service) and F (worst), depending on location. It was developed by John J Fruin PhD in the 1970’s, and is the accepted industry standard for addressing pedestrian congestion.

The values of parameters for a given pedestrian LOS in a station vary according to different areas of the station, as varying densities of pedestrians are acceptable according to the location. The level of service for the platforms, stairs, service area and pedestrian access at Berala Interchange are thus assessed separately in line with the separate categories used in Fruin’s Level of Service (LOS), as outlined in **Table 6.1**.

Table 6.1: Fruin Level of Service (LOS)

Fruin’s Level of Service	Walkway		Stairs		Queue
	Density	Flow rate	Density	Flow rate	Density
A	>3.24	<23	>1.85	<16	>1.21
B	2.32 – 3.24	23 – 33	1.39 – 1.85	16 – 23	0.93 – 1.21
C	1.39 – 2.32	33 – 49	0.93 – 1.39	23 – 33	0.65 – 0.93
D	0.93 – 1.39	49 – 66	0.65 – 0.93	33 – 43	0.28 – 0.65
E	0.46 – 0.93	66 – 82	0.37 – 0.65	43 – 56	0.19 – 0.28
F	<0.46	>82	<0.37	>56	<0.19

The total number of pedestrians expected in the existing and design AM Peak 15 minutes, 5 minutes and 1 minute have been distributed to the platforms and entrances, in line with the existing directional splits. This includes whether they are entering or exiting the station, and whether they are walking or waiting on the platform. These variables are assessed by each station component in the following sections.

For areas where pedestrians are walking, such as the stairs, service area and footpath, the LOS is calculated using the flow rate values which measure the volume of pedestrians moving through the space per minute per metre width (ped/min/m). The LOS for the queues is measured in density of m² per pedestrian (m²/ped).

For LOS calculations, areas have been calculated from site plans.

6.1.1.2 Acceptable LOS

The Interchange Places Design Handbook (Draft) (November 2011) specifies customer design requirements for various areas throughout interchanges. The recommendations are reproduced in **Table 6.2**.

Table 6.2: Recommended Fruin LOS Standards for Transport Interchanges

Area	LOS	Comments
Walkways	A – C	Mid-point of C is usually designated. However, in high quality, enclosed or underground interchanges, higher LOS should be applied to improve space provision. Account for the impact of reverse flows and edges such as walls, platform edges and other objects.
Queuing area	A – C	Mid-point of C is usually designated. However, in high quality, enclosed or underground interchanges, higher LOS should be applied to improve space provision in queuing areas.
Stairs/ Escalators	E	Commuters naturally use stairs near their capacity at peak times. Account for the impact of reverse flows and edges effects from walls, platform edges and other objects.

6.1.1.3 Train Frequencies

As pedestrians in stations are travelling to and from trains, their movements are linked to the train timetable. The peak pedestrian flow occurs in platoons throughout the peak period as each train arrives at or departs from the station.

In terms of service frequency as of the most recent timetable, January 2015 and confirmed with www.transportnsw.info, the following weekday services operate in the AM period between 6:00 – 9:30AM:

- Berala to City via Bankstown – 11 services
- Berala to Lidcombe – 11 services
- Berala to Liverpool – 1 service

Train frequencies vary slightly throughout the AM peak period, however usually arrive/depart at 15 minute intervals between 7:00 – 9:00AM and 20 – 30 minute intervals before and after these times in each direction.

6.1.1.4 Key areas

As can be interpreted from **Table 6.2**, pedestrian capacity limitations are generally brought about by passage width and queuing areas. In many instances, walkways and queuing areas are shared, as in the platform and service area. The constraining parameter is generally walkway capacity. Walking requires more space per person than queuing and therefore assessments on shared walkways/ queuing areas are calculated on walkway capacity.

The following sections each outline the pedestrian assessment in each of the separate areas of Berala Station:

- Platform
- Ticket purchase facilities
- Stairs to Platform
- Constraint point at the ticket office and machine, at the top of the stairs
- Constraint point between stairs and platform
- Underpass

Platform

Berala Station is configured with an island platform, where Citybound via Bankstown trains depart from Platform 2 and Lidcombe-bound trains depart from Platform 1.

The movements of pedestrians on the platform have been considered as part of this assessment. Given the island layout of the platform, customers share the circulation and queuing area, including the queuing area for ticket purchases.

The usable platform area calculations are based on Nearmap and are outlined in **Table 6.3**.

Table 6.3: Platform Useable Area Calculation

Description	Area (m ²)
Estimate gross platform area	1,825
Subtractions	
Station building (including ticket purchase queue area)	190
Stairs	85
Safety zone	490
Other facilities and infrastructure (seating, poles, ticket machines, estimated to be 10% of gross)	182.5
Net queuing and circulation area	877.5

Platform LOS assessment

The platform LoS assessment has been undertaken by assessing the peak volume of customers entering and exiting the station between trains. It was established that this occurred on the survey day between 7:40am and 7:54am when 172 in and 11 out movements were recorded. During this period, 10 of the exit movements occurred in the last two minutes and therefore they may have been up to 182 customers on the platform at the peak moment at 7:54am when trains arrived on both platforms.

As measures of conservatism:

- the full number of passengers arriving and departing in this 15 minute period has been used in the LoS assessment in **Table 6.4**
- As passengers were observed to favour queuing on the east end of the platform, the useable area has been reduced by a further 50%.

Table 6.4: Platform peak load

AM Period	2015	2036 + 15%
Passengers arriving	172	233
Passengers departing	10	14
Volume of passengers on platform	182	247
Area (usable)	438.75m ²	438.75m ²
m ² /ped	2.4 m ² /ped	1.7 m ² /ped
LOS		
Walking	B	C
Queuing	A	A

The assessment outlined in **Table 6.4** indicated the current platform configuration is sufficient to handle future passenger volumes with the existing frequency of services with an acceptable LoS.

There is a limited width of 1.4 metres between the stairs towards the underpass and the safety zone. Customers were observed to leave enough circulation area for other customers to pass.

Ticket purchase facilities

The ticket purchase area located on the platform currently includes a service window and one ticket vending machine (TVM). These facilities are located at the top of the stairs, creating a constraint point with the possibilities of queues developing down the stairs. Opal card readers are located within the underpass.

The introduction of the Opal Card across the rail network has significantly reduced the demand for ticket purchases and queuing at stations on the Sydney Trains network. It is anticipated that fare payment for services will continue to be required by infrequent travellers who do not have an opal card. It is estimated that 10% of customers may need to purchase a paper ticket.

This assumption that 10% of passengers would need to buy a ticket, with the remainder using Opal, is reasonable as the assessment is of the morning peak when most customers will be regular commuters and the convenience and cost-saving of Opal would make it an attractive option.

Based on a 45 second service time estimate for ticket purchases, three ticket purchase facilities would be required to accommodate 95% of the peak 5 minute demand as outlined in **Table 6.5**.

Table 6.5: Ticket purchase assessment

AM Period	2015	2036 + 15%
Period	5 minute	5 minute
Passengers arriving	120	170
Estimated proportion requiring ticket purchase	12	17
95% of customers	11	16
Time for ticket purchase @ 45 seconds each	8.25 minutes	12 minutes
Number of ticket purchase facilities required to satisfy 95% of peak 5 minute demand.	2	3

Stairs to Platforms 1 & 2

The stairs to the Platforms have a nominal width of 2.75m and effective width of 2.4m. The pedestrian directional split in the AM peak period is approximately 91% in and 9% out.

Based on the effective stair width of 2.4m, and a LoS D flow rate of 43 ped/min/m, the stairs maximum capacity would be 103.2 pedestrians per minute.

The existing stairs have been assessed in the peak one and fifteen minute periods as outlined in **Table 6.6** and **Table 6.7**.

Table 6.6: Stair Capacity to Platforms, Peak 15 Minutes

AM Peak 15 minute period	2015	2036 + 15%
Pedestrians	215	305
Average pedestrians on stairs / 1 minute	14.3	20.3
Effective width of stairs	2.4	2.4
Flow rate (peds/min/m)	6.0	8.5
Average LOS	A	A

The assessment in **Table 6.6** indicates that the existing stairs have adequate capacity to accommodate average peak demands at LOS A, and would remain at a LOS A based on the projected 2036 + 15% design volume.

Table 6.7: Stair Capacity to Platforms, Peak Minute

AM Peak 5 minute period	2015	2036 + 15%
Pedestrians	37	52
Effective width of stairs	2.4 m	2.4 m
Flow rate (peds/min/m)	15.4	21.8
Maximum flow rate, LOS E (peds/min/m)	56	56
Maximum flow rate reached	No	No
LOS	A	B

The assessment in **Table 6.7** indicates that the stairs are currently operating effectively under the peak one minute period. Under the future predicted pedestrian flows, the stairs would operate within peak maximum flow at a LoS B.

Constraint point between ticket office and stairs

A pinch point is located at the top of the stairs, due to the location of the current ticket office and ticket vending machines as shown in **Figure 6.1**.

Figure 6.1: Constraint point between ticket office and stairs



This has reduced the circulation space for customers entering and exiting the platforms, and increases the potential for congestion to occur during the AM Peak period.

The constraint point has a nominal width of 2.6 metres, with an effective width of 2.42 metres. An assessment was completed on the constraint point during both the fifteen and one minute peak periods. Given the point is located very close to the stairs, the LoS is assessed at the stairway rate. The results are provided in **Table 6.8** and **Table 6.9**.

Table 6.8: Ticket office and stairs constraint point, peak 15 minute

AM Period	2015	2036 + 15%
Pedestrians	215	305
Average pedestrians through access point/ 1 minute	14.3	20.3
Effective width of access point (metres)	2.42	2.42
Flow rate (peds/min/m)	5.9	8.4
Average LoS	A	A

Table 6.9: Ticket office and stairs constraint point, peak minute

AM Period	2015	2036 + 15%
Pedestrians	37	52
Effective width of access point (metres)	2.42	2.42
Flow rate (peds/min/m)	15.3	21.5
Maximum flow rate, LoS E (peds/min/m)	56	56
Maximum flow rate reached	No	No
LoS	A	A

The results of this assessment are consistent with those of the stair capacity to platform results, where the constraints point performs at a high level of service during the peak 15 minute and during the peak minute.

Constraint point between telephone and platform safety zone

A constraint point is located on the platform between the stairs and the safety zone on the southern side of the platform. In addition, the telephone further reduces the effective width of the circulation space to 1.2 metres between the telephone and safety zone, shown in **Figure 6.2**. However, it should be noted that customers are likely to use part of the safety zone (to the yellow tactile tiles), thus the effective width is has been extended to 1.5 metres.

Figure 6.2: Constraint point between the telephone and platform safety zone



An analysis of this constraint point during the peak fifteen and one minute are provided in **Table 6.10** and **Table 6.11**. Due to the higher volume of customers that circulate to the eastern side (Lidcombe side) of the platform, and customers not having direct access from the stairs to Platform 1, it is assumed 70% of customers use this constraint point.

Table 6.10: Telephone and platform safety zone constraint point, peak 15 minute

AM Period	2015	2036 + 15%
Pedestrians	215	305
% of pedestrians walking to eastern side of platform	70%	70%
Pedestrians using constraint point	150.5	213.3
Average pedestrians/ 1 minute	10	14.2
Effective width of access path	1.5	1.5
Flow rate (peds/min/m)	6.7	9.5
Average LoS	A	A

During the peak fifteen minute, this constraint point achieves of LoS A, both now and into the future.

Table 6.11: Telephone and safety zone constraint point, peak minute

AM Period	2015	2036 + 15%
Pedestrians	37	52
% of pedestrians walking to eastern side of platform	70%	70%
Pedestrians using constraint point	25.9	36.4
Effective width of constraint point	1.5	1.5
Flow rate (peds/min/m)	17.3	24.3
Maximum flow rate, LoS E (peds/min/m)	82	82
Maximum flow rate reached	No	No
LoS	A	B

The assessment indicates that the constraint point currently operates at a LoS A, and would reduce to a LoS B in 2036 + 15%.

Underpass

The underpass beneath the station is used by both commuters entering and exiting the station platforms, as well as being a thoroughfare for pedestrians through which to access facilities on either side of the rail corridor. It is important that the underpass provides adequate capacity to cater for both customer trip purposes.

From the pedestrian counts completed in the AM peak on Tuesday 1 September 2015, it was evident that the majority of pedestrians entered and exited the underpass via Woodburn Road on the northern side. This direction accounted for 68% of pedestrian movements during the peak one minute, and 61% of movements in the peak 15 minute period, as shown in **Figure 6.3** and **Figure 6.4**.

Figure 6.3: 2015 AM peak minute

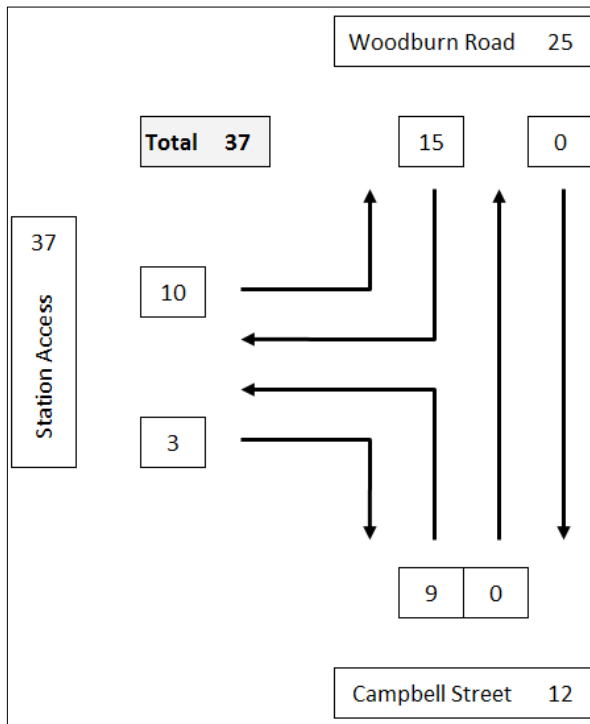
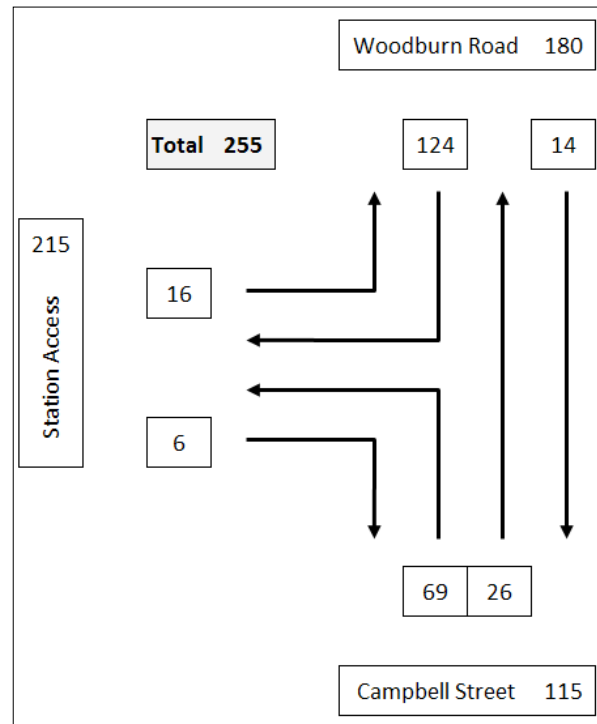


Figure 6.4: 2015 AM peak 15 minute



The results of the observed peak movements have been scaled up to 2036 +15% volumes, which indicates the peak movement of pedestrians to Woodburn Road would be 35 people in the AM peak minute and 255 people in the AM peak 15 minute period as shown in Figure 6.5 and Figure 6.6.

Figure 6.5: 2036 +15% AM peak minute

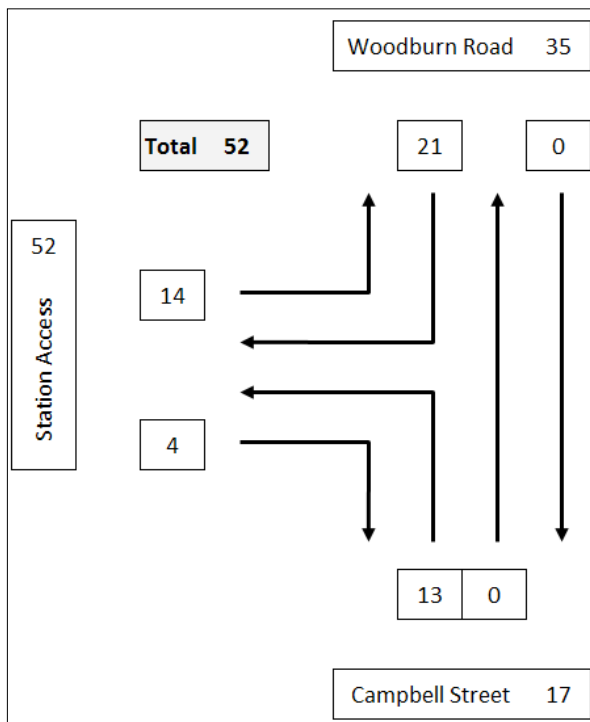
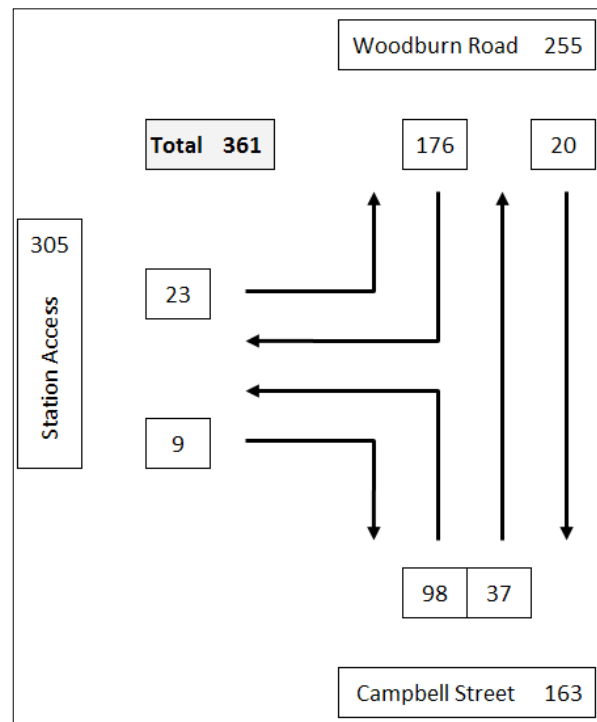


Figure 6.6: 2036 +15% AM peak 15 minute



Due to the northern side of the underpass receiving the greatest flow and an acceptable LoS, the LoS on the Campbell Street has not been calculated as it will also be acceptable. The nominal width of the underpass is 2.64m, however the constraint point is at the location of the Opal poles creating an effective width of the underpass at the Opal pole of 2.29m. The Opal poles are offset so as to minimise the effect of the reduction in available width.

The pedestrian assessment of the underpass using pedestrian flows for northern users during the peak 15 and one minute periods is provided in **Table 6.12** and **Table 6.13**.

Table 6.12: Underpass assessment, peak 15 minute

AM Period	2015	2036 + 15%
Pedestrians	180	255
Average pedestrians through the underpass/ 1 minute	12	17
Effective width of underpass	2.29	2.29
Flow rate (peds/min/m)	5.2	7.4
Average LoS	A	A

The assessment indicates that the subway will have adequate capacity to accommodate average peak demands at LoS A, and would remain at a LoS A based on projected 2036 + 15% design volumes.

Table 6.13: Underpass assessment, peak minute

AM Period	2015	2036 + 15%
Pedestrians	25	35
Effective width of the underpass	2.29	2.29
Flow rate (peds/min/m)	10.9	15.3
Maximum flow rate, LoS E (peds/min/m)	82	82
Maximum flow rate reached	No	No
LoS	A	A

The assessment on the peak minute indicates that the underpass is forecast to operate effectively during peak periods.

6.1.1.5 Summary of LoS results

The above analysis demonstrates that the station's current configuration would achieve satisfactory LoS during the AM Peak period for the 2036 + 15% design patronage. Overall average LoS in the peak 15 minute and one minute period would be LoS C or better.

6.1.1.6 Emergency capacity

In an emergency situation, the telephone and platform safety zone would be the constraining factor at the station, and it was calculated that this could facilitate the movement of 103.2 pedestrians per minute. Based on the stations location on the Sydney Trains network it is anticipated that a train would be no more than 50% full. Based Sydney Trains rated capacity of 1,000 people and a half full train of approximately 500 people, a train could be evacuated in just under 5 minutes.

6.2 Parking Demand and Supply

The proposed plans as part of the Berala Transport Access Program are not anticipated to impact parking surrounding the interchange. Site observations indicated that parking supply to the station on the external road network was sufficient to cater for the current demand. Whilst there is currently no dedicated commuter car park proposed to serve Berala Interchange customers, it is recommended that an investigation be undertaken to assess the provision of such a facility in the future.

It is understood that the parking along Woodburn Road and Campbell Street will be altered as part of works undertaken by Auburn City Council. It is assumed that the accessible parking spaces are provided as close as possible to the station entrances and all parking alterations be designed in accordance with AS2890. It is recommended that the works undertaken by Council restrict the loss of parking spaces (both time restricted and unrestricted) where possible.

6.3 Traffic Impact

The proposed scope of works is not anticipated to have a notable increase in traffic generation. It is anticipated that as a result of the scope of works, there may be a marginal increase by those that cannot currently easily access the station due to mobility impairment, prams or other factors.

It is anticipated that patronage increase as a part of forecast patronage growth will be from the surrounding precinct due to land use densification. It is projected that the increase in patrons will predominately access the interchange using active transport forms.

As a result, future traffic increase on the external road network due to the Transport Access Program is expected to be very minimal and will have a negligible impact on the external road network level of service.

It is assumed that the proposed works by Auburn City Council will support future traffic demands, maintain safe travel speeds and improve vehicle and pedestrian safety.

6.4 Buses

No changes are anticipated to the bus network or stops as part of the Transport Access Program.

It is recommended that connectivity, safety, compliancy and reliability of bus networks and stops are maintained as part of works undertaken by Auburn City Council.

6.5 Cyclists

No changes are anticipated to the cycle network as part of the Transport Access Program. Additional sheltered bicycle parking is proposed in the precinct and as part of the station upgrade. As such, bike riding will be encouraged and it is expected there will be an increase in bike riding to access the station and precinct.

6.6 Kiss & Ride and Taxi

No changes are anticipated to the Kiss & Ride and taxi zones surrounding the interchange as part of the Transport Access Program.

It is recommended that sufficient Kiss & Ride and taxi zones are provided in the works undertaken by Auburn City Council to support the demand at the interchange.

6.7 Property Access

No property accesses are anticipated to be impacted by the proposed scope of works.

7 Mitigation Measures

7.1 Construction Mitigation Measures

The construction works are to be completed and staged with consideration given to minimise the impact on the traffic, pedestrian and public transport surrounding the Berala Interchange.

It is recommended that a Construction Traffic Management Plan (CTMP) and a Traffic Control Plan (TCP) be undertaken and submitted to Council's Local Traffic Committee and RMS and, Auburn City Council respectively. The studies are recommended to outline the:

- Construction timeline;
- Heavy vehicle routes and arrangements (ensuring vehicles enter construction site in a forward direction only),
- Location of access points to and from the external road network (including swept path analysis if required);
- Provisions to ensure pedestrian safety and traffic fluency;
- Installation of signage and devices required used to manage traffic whilst construction is being undertaken;
- Pavement marking and any fencing and barriers required; and
- Any detours in traffic and pedestrians (if applicable).

To ensure minimal impact to the existing transport modes surrounding the interchange, the following recommendations are proposed to be undertaken:

- Heavy vehicles be restricted to non-peak periods and to be confined to rail possession periods;
- Traffic impacts due to construction works be minimised on Campbell Street and Woodburn Road as much as possible;
- Parking be provided within the construction site to workers, with encouragement made for construction workers to carpool or use public transport;
- Qualified traffic controllers be used during construction works to ensure safe and efficient movement of vehicle and pedestrian traffic on the external road as well as in and out of the construction site; and
- Fencing and barriers to be installed between construction site and outside construction zone to ensure safety and easy navigation of pedestrians and cyclists.

7.2 Operation Mitigation Measures

The proposed upgrades to the Berala Interchange are expected to improve the accessibility between the station platform and station underpass.

Whilst the current interchange does not have a dedicated parking provision, it is suggested that investigations be undertaken in the future to assess any need for such a facility in the future.