PARRAMATTA BIKE PLAN

VOLUME 2: SADDLE SURVEY

CITY OF PARRAMATTA // MAY 2017

Parramatta Bike Plan
Saddle Survey Report

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About this report

This report presents the findings from a Parramatta Saddle Survey conducted in November 2016. It is the second in a series of volumes that will inform the *Parramatta Bike Plan 2016 - 2036*. This report builds on the earlier initial desktop analysis relating to cycling in Parramatta and offers an assessment of bicycle infrastructure (both existing and missing) relating to bicycle routes, bicycle signage and bicycle parking.

The findings from this Saddle Survey will be used as an input during later stages of the Bike Plan related to proposed network development.

Glossary of Terms

Shared paths

A path separated from roads, which is designated to carry only pedestrian and cycle traffic. Shared paths can either be adjacent to roads, or totally separated running through a reserve or adjacent to a waterway. Pedestrians and cyclists share these routes, and as such they should be considered lower speed than dedicated cycling facilities.

Parramatta Valley Cycleway shared path

Shared path on Cumberland Hwy

Protected bicycle lanes (vertical separation)

An on road bike lane that is separate from motorised road vehicles with physical infrastructure such as a vertical separation. These can be designed in a number of ways to suit varying conditions:

- With parking: a wide vertical separated path on the left of parked vehicles, protecting cyclist from motor vehicles and car doors.
- Without parking: a narrow vertical separated path to the left of moving traffic, protecting cyclists from motor vehicles.
- Contraflow/bidirectional: a wide or narrow vertical separation on either side of the road, separating two-way cycle traffic from motor vehicles.

Protected bicycle lane in Swanston Street, Melbourne

Buffered bicycle lane

A painted bike lane with additional painted buffers on the inside (to demarcate the dooring zone), outside (to encourage vehicles to give a wide berth when passing), or both.

Buffered bicycle lane, Queensbury Street, Melbourne

Painted bicycle lane

A bike lane painted between the kerb (or parked cars, where applicable) and moving vehicles. This typology is to indicate cyclists are encouraged on these roads, while forcing parked cars closer to the kerb and moving vehicles further towards the centre of the road space, creating more room for cyclists. Rumble stripes can be implemented on the outer marking of this lane type, discouraging motor vehicles from encroaching on the bike lane.

Painted bicycle lane on Barnetts Road, Parramatta

Advisory bicycle lane

A bike lane with a solid lane adjacent to parked cars and a dashed line between cyclists and moving cars. These are generally used on roads that are not wide enough to support a dedicated painted bike lane, but on which cycling is encouraged. The line markings fulfil the sale role as in a painted bike lane, but indicate that cyclists are not expected to remain in cycle lanes at all times and may diverge to navigate around obstacles.

Bus lane (bicycles permitted)

These are designated Bus Lanes which allow cycling. They offer some protection from private vehicles, but mix bikes and buses. It should be noted that Bus Only lanes do not permit cycling, and the nuanced difference may cause confusion. Painting PS2 symbols and possibly a dashed advisory lane on top of the red surface treatment of Bus Lanes may help avoid confusion.

Bus lane, which cyclists may use in Station Street East. Note the conflicting signage, with lane markings stating it is a Bus Lane and the traffic sign stating an end to a Bus Only lane.

Sharrows

A painted PS2 symbol with two chevrons. These indicate that motor vehicles are to share the road space with cyclists. They are intended to be used only where space is very tight and no other form of bike lane marking or typology is possible.

Sharrows

PS-2 Symbols only
A painted PS2 symbol on the road way. Currently Parramatta uses these to indicate to motorist that cycling is encouraged, rather than as a way of demarcating road space for the usage of cycling. This usage is inconsistently applied, with PS-2 logos often very close to the centre line or under parked cars. Ideally PS-2 logos should be positioned on the section of road which cyclists are expected to ride.

Bicycle Symbol (PS-2)
NB: Dimensions are 1100mm wide and 1800mm high

Bicycle lantern
An illuminated bike symbol connected to a signalised pedestrian crossing, legally permitting cyclists the use the crossing.

Cut throughs
A section of road where only cyclists and pedestrians are able to cross, as shown below.

Active transport cut through

Profile edge line marking (rubble strips)
Raised additions to a line marking which cause vibrations to be felt when driven on. They can be used to alert drivers who have encroached on a bicycle lane. they are veering outside of their lanes, while their discomfort discourages motorists driving on them.

Coloured surface treatments
Coloured surface treatments, usually green, are made to bike lanes in areas where extra awareness of cyclists is required, generally at intersections or curves in the road. The coloured surface treatment goes between the white lines, and can often have white bike symbols on top.

Green surface treatment applied to the bike lane in North Rocks Road

Bike box
A painted 'box' at a traffic light which sits ahead of a traffic lane (generally the left lane), allowing bikes to wait at the front of the traffic lane and therefore more easily viewable and safer.

Troughing
A smooth trough attached to a set of stairs to make it easier for bicycle riders to traverse stairs with their bicycles.

1. Introduction

A crucial determinant of cycling levels is the degree to which the urban environment offers safe, direct routes between origins and destinations (Heinen, Maat, & van Wee, 2011). Best practice network planning for cycling includes the principles of *coherence, directness, safety, attractiveness and comfort* (CROW, 2007). An aim of the Parramatta Bike Plan is to create an environment in which cycling is safe, and is perceived as safe for all members of the community. An initial first step is therefore to document current conditions, for both the street and path network in Parramatta and this report provides the results of a Saddle Survey conducted within Parramatta's new LGA boundaries. The best practice principles identified above have been used to inform this audit of current cycling conditions in Parramatta.

Section 2 offers an explanation of the methodology used to document existing and missing infrastructure opportunities. Section 3 provides a summary of the findings.

2. Methodology

A five day Saddle Survey was conducted in late November 2016. Two staff from the Institute for Sensible Transport were accompanied by at least one member representing the City of Parramatta (CoP). A bicycle route for each day was proposed by the Institute for Sensible Transport in the weeks leading up to the Saddle Survey and refined with involvement from the CoP. The routes taken are shown in Appendix 1.

A customised mobile App was developed by the Institute for Sensible Transport, using the Fulcrum platform (a commercial provider). The App contained three broad categories; bicycle routes, bicycle signage and bicycle parking, with a detailed set of drop down menus the surveyors could use to record data, of both existing and proposed conditions.

Any member of the Saddle Survey team was able to identify an issue, which was then recorded using the mobile App. This provided a geo-coordinates (latitude and longitude) of the issue, for upload into GIS software for analysis. In addition to the drop down menus, surveyors were also able to connect a photo taken of the issue to the record, to aid future analysis.

Figure 1 offers an illustration of the mobile App interface used to record data during the Saddle Survey. At each site, the surveyor selected either the bike parking, bike route or signage App, which opened up a customised set of options. Once the surveyor completed the form, it was uploaded to the cloud.

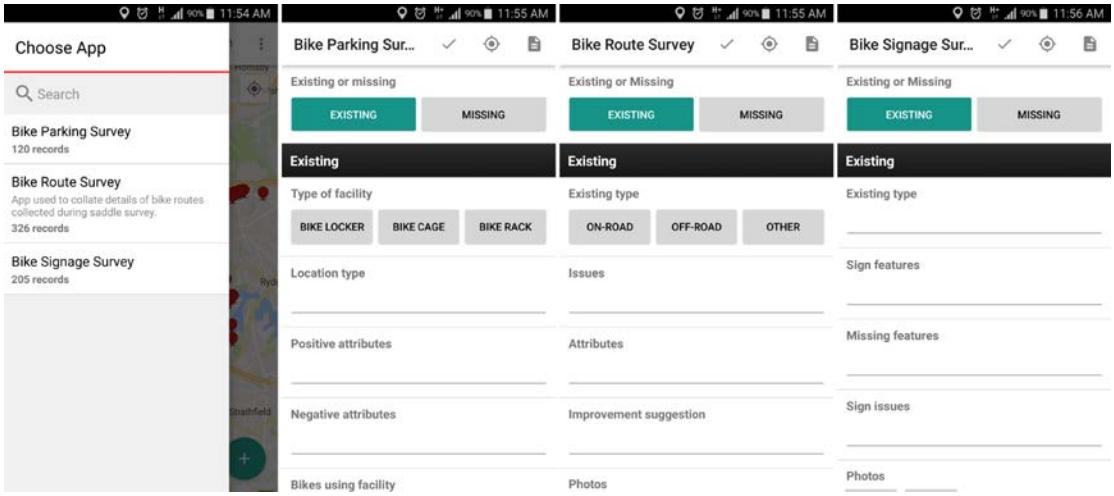

Figure 1 Mobile App interface screenshots

At the completion of the Saddle Survey, all mobile App records made across the five days were downloaded as a .csv file, containing all the information recorded by the survey team, in addition to the geospatial data automatically recorded from the GPS.

Figure 2 provides a snapshot of where mobile App records of bicycle parking, bicycle routes and signage were taken during the Saddle Survey.

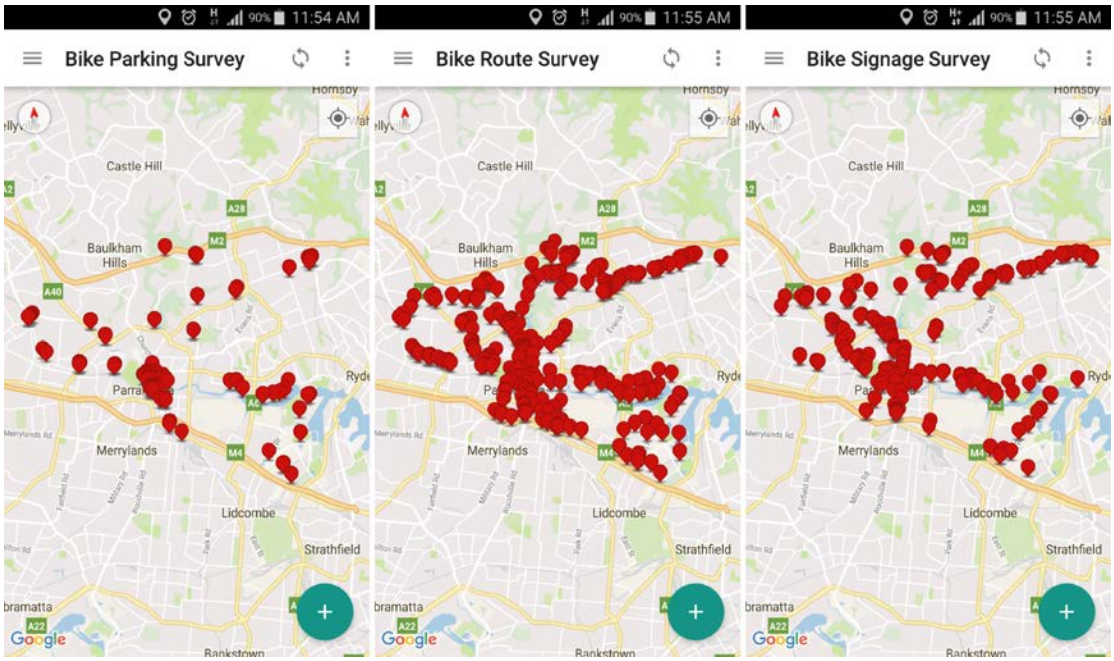

Figure 2 Location of records from Saddle Survey

Limitations: The Saddle Survey was restricted in its coverage of the CoP. Whilst every attempt was made to cover the most important areas in terms of potential for cycling, and current usage and safety issues, there may be areas that are also important for cycling that have been omitted. The public consultation component of this Bike Plan has been designed to capture

other important opportunities for network improvement that may not have been included in this Saddle Survey. The post-Saddle Survey analysis of route options will not be restricted the routes taken during the Saddle Survey.

3. Summary of findings

The survey team documented a total of 582 individual records using the mobile App, broken down broadly into *existing* and *missing*, according to whether they related to routes, signage or parking, as shown in Table 1.

	Existing	Missing	Total
Bicycle routes	172	140	312
Bicycle signage	155	39	194
Bicycle parking	37	39	76
Total	364	218	582

Table 1 Summary of audit entries completed during Saddle Survey

3.1. Bicycle Routes

The quantity of bicycle infrastructure has grown significantly over the last two decades in Parramatta. This has resulted in some outstanding environments for riding and the Saddle Survey identified the following areas as examples of high quality routes.

- Parramatta Cycleway offers an excellent corridor, suitable for all types of cyclists and serves to highlight the natural beauty of the area.
- Parramatta Park offers a scenic, low traffic speed environment within this historic precinct.
- M4 path offers an excellent level of service although some areas of discontinuity reduce overall levels of service.
- Very good shared path along Old Windsor Road.
- Excellent network of bicycle lanes in Sydney Olympic Park.
- High quality shared path parallel with Hill Road, Newington
- Excellent shared path along the southern aspect of Epping Road, crossing Terrys Creek.

In addition to the excellent examples of bicycle friendly environments highlighted above, the survey team noted a large number of important opportunities to utilise quiet, wide residential streets as direct routes for cycling. These and other opportunities will be identified briefly in this

section and used to inform the development of a proposed cycling network as part of future stages of the Parramatta Bike Plan.

Both surveyors were surprised by the generous passing distance almost all motorists provided. Although it is too early to make any conclusive statements, this may have been related to the recently introduced minimum passing distance laws introduced by the NSW Government.

The following sections describe a set of corridors focused on connecting the Parramatta CBD with centres located in other parts of the LGA. This is a user oriented approach designed to offer a connected set of safe, direct and continuous routes between home, shops and workplaces.

Parramatta CBD and surrounds

Suburbs
North Parramatta, Parramatta, Harris Park, Granville, and Clyde.

This section discusses *corridors* rather than routes, and the data is a composite of data collected across the five days of the Saddle Survey, primarily on bicycles, but also on foot, as the team explored the Parramatta CBD. This section seeks to identify legible routes into the CBD from surrounding suburbs.

North South corridors

Church Street
Church Street offers a shared path on both sides of the road from Windsor Road to Bourke Street. There is a gap (no shared path, either side of the street) between Bourke Street and By Street. The shared path continues from By Street to Pennant Hills Road. The surface adjacent to St Patricks Cemetery is composed of small pebbles and is only loosely adhered, as shown in Figure 3.

Figure 3 Loose gravel path along Church Street

Missing bicycle lanterns and a lack of awareness raising markings or signage at crossing points reduce the level of safety when cycling along Church Street. South of Pennant Hills Road, Church Street has no bicycle lanes, although there are bus lanes that are legally able to be used by cyclists. It is plausible that many novice cyclists might feel uncomfortable riding in a bus lane. Although no shared path signs were visible, the intersection at Church and Pennant Hills Road does contain Bicycle Lanterns, which suggests that a shared path exists on the western side of Church Street between the intersection with Pennant Hills Road and Harold Street. Increased clarity is required to reduce road user confusion in this area.

Between Harold Street and Lennox Bridge, no discernable bicycle infrastructure was visible, other than a bus lane (cyclists allowed). However, some intersections would be quite difficult to navigate on bicycle due to dedicated left hand turn lanes (e.g. intersection with Victoria Road). Indeed this situation emerged as a recurrent theme during the Saddle Survey.

After the crossing of the Parramatta River, Church Street offers one general traffic lane in each direction, and although there is no dedicated bicycle infrastructure, provides a relatively unhazardous environment for people to cycle.

Between Macquarie Street and George Street, Church Street is one lane, north bound only. Between Macquarie Street and Darcy Street, Church is a pedestrian only area (Centenary Square). While these two sections create a discontinuity for people to cycle, the long-term challenge will be the introduction of Light Rail, which is expected to run from Factory Street, through to Macquarie Street via Church Street. Consideration of options for including bicycle infrastructure should be included within the Light Rail project, from the earliest stage.

As Parramatta continues its re-development, new connections are required between Marsden Street, Hunter Street, Centenary Square through to Parramatta Square and Civic Walk. These areas are likely to have among the highest latent demand for cycling (due to present land use factors) and present a critical opportunity to make the Parramatta CBD more bicycle friendly.

Between Darcy Street and the Great Western Highway, Church Street has bicycle symbols, along this one lane in each direction road.

Between Great Western Highway and the M4 Motorway, Church Street is a multi-lane divided arterial road with a shared path along the western side. This section presents a number of issues for people on bicycles, including bus stops in the middle of the shared path, poor surface, worn markings and insufficient crossing points. Figure 4 shows the bicycle path and bus stop on Church Street.

Figure 4 Shared path and bus stop on Church Street

One option that would improve conditions for cyclists would be to move the timetable totem board slightly north, to provide extra space for cyclists to pass. Replacing the advertising with clear glass would provide improved visibility for both cyclists and waiting bus passengers.

The shared path ends at Boundary Road (even though it is marked at a shared path), forcing cyclists wishing to connect to the M4 to ride on the road. This corridor (known as 'auto alley') is slated for redevelopment and this offers considerable scope to enhance active transport opportunities. This is considered particularly important given that it will include large-scale residential development, a park, and serves as an important connection between the M4 cycleway and the Parramatta CBD.

The connection between Church Street and the M4 cycleway was highly convoluted, reducing legibility and attractiveness. Following the completion of M4 widening works, the area should be reassessed to create improved permeability into the shared path network. In the short term, continuing the shared path on the western side of Church street south of Boundary Road would enhance the level of service for cycling in this important region.

Parramatta Road and Woodville Road contained signalised crossings that lacked bicycle lanterns.

Villiers Street, Marist Place, Marsden Street

This corridor represents a potentially attractive route for North South travel, as an alternative to Church Street. In its present state, Villiers Street and Marist Place appear sufficiently wide to accommodate a marked bicycle lane. The bridge crossing the Parramatta River would benefit from clearly marked bicycle lanes (see Figure 5).

Figure 5 Marsden Street Bridge

Marsden Street crosses the Parramatta Valley Cycleway just north of the Parramatta River (Bridge shown in Figure 15), with the opportunity to improve connections on both sides of the road. For cyclists heading south on Marsden, converting the current set of stairs leading to the Parramatta Valley Cycleway (see Figure 6) would enhance the attractiveness of this potential route. The relative ease with which cyclists are able to access the Parramatta Valley Cycleway is another advantage of this route (compared to Church Street, which involves a substantially larger set of stairs).

Figure 6 Stairs between Marsden Street and the Parramatta Valley Cycleway

One issue reducing the level of safety offered by Marsden Street is the number of left hand only turn lanes. These will need to be assessed for modification to attract cyclists onto this potential route.

Between Argyle Street and Campbell Street, Marden Street has a substantial incline heading south and this also includes additional lanes. This is likely the result of an attempt to accommodate cars entering and exiting Westfield Shopping Centre. These turning vehicles present a risk to cyclists and one possible method of reducing cyclists' exposure to this traffic is to close Aird Street at Marsden Street to motor vehicle traffic. This would avoid potential conflicts between cyclists and turning motorists.

South of the Great Western Highway, Marsden Street is a quiet residential street that provides adequate width for a bicycle lane, and connection to the M4 Motorway shared path (via Railway Street).

O'Connell Street and Pit Street

O'Connell Street has a shared path on both sides between Argyle Street and the Parramatta River. These paths extend North, but this area was not able to be included in the Saddle Survey due to time constraints. The shared path on both sides of O'Connell Street were wide and smooth, but lacked

necessary pavement markings. The intersection of George and O'Connell Street has bicycle lanterns. At the intersection of Macquarie and O'Connell Street, some crossing points were missing bicycle lanterns.

Between Macquarie Street and the Greater Western Highway, Pitt Street is one way (North bound), while O'Connell Street is one way South bound (Macquarie Street also runs one way east bound between Pitt Street and O'Connell), although it runs west bound for the remainder of its length. It was ambiguous as to whether the footpath on the western side of Pitt Street just North of the Great Western Highway was classified as a shared path. It did however appear suitable for inclusion within the shared path network. South of the Great Western Highway, Pitt Street is an arterial road, not currently conducive to cycling. These streets do not offer an attractive route for cyclists, relative to Marsden Street. However, it would be possible to have a shared path along Pitt Street, on the western side. This would connect other shared paths and the Parramatta High School.

Lake Parramatta to Phillip Street via Brickfield

In the triangle of North Parramatta between Church Street, Pennant Hills Road and James Ruse Drive, Factory Street, Irons Street, Bellevue Street, Bourke Street, Gloucester Avenue, Sutherland Road and Saunders Street were all surveyed. A common feature among these streets were their generous width, low traffic volumes and overall suitability for cycling. The safety and legibility of the network would however be enhanced by the addition of painted bicycle lanes, helping to simultaneously demarcate the road area intended for cyclists to travel, increase motorists awareness of cyclists, and increasing the awareness of the bicycling network to potential cyclists. Figure 7 illustrates current conditions on Castle Street, in which the bicycle symbols are located in an area that can also be used for kerbside car parking. A painted bicycle lane to the right of the parked cars would provide a dedicated space for cyclists, regardless of whether kerbside cars are parked.

Figure 7 Castle Street bicycle symbols under parked cars

The crossing of Bellevue and Pennant Hills Road could be improved, possibly through the introduction of refuge islands. Brickfield Street provides a continuous north south route along a quiet residential street. One potential risk to cyclists along Brickfield Street is the roundabouts. These would benefit from painted bicycle symbols on the approach, to encourage cyclists to occupy the lane where insufficient width prevents both a cyclist and motorists to travel alongside one another. In the longer term, the removal of the roundabouts would have a beneficial impact on road safety, as roundabouts are a known hazard to cyclists.

The crossing of Brickfield Street with Victoria Road currently presents a challenge to cyclists, as Victoria Road is two lanes in each direction and heavily trafficked. A signalised crossing, or at least a refuge island would assist cyclists crossing this major road. One option would be to remove right hand turns from Victoria Road into Elizabeth street and Brickfield Street, which would provide space for a refuge island and reduce traffic along these streets (making them more attractive to cycling, and residential amenity).

Elizabeth Street runs between Victoria Street and the Parramatta River. A bridge crosses the Parramatta River, connecting via a shared path to Phillip Street.

Figure 8 shows the opposing side of the Parramatta River, across from Elizabeth Street.

Figure 8 The shared path connecting Phillip Street to Elizabeth Street, looking north from Phillip Street

A direct, highly visible connection between Elizabeth Street and the Parramatta Valley Cycleway would increase the overall network permeability and attractiveness of this route. There are currently stairs for those seeking to travel between Elizabeth Street and the Parramatta Valley Cycleway.

Alfred Street and areas immediately East and South of CBD

Alfred Street runs from the Parramatta River in the North to Parramatta Road in the South and this offers a potential important strategic link between areas of future development. It is primarily a residential street, with relatively low traffic volumes. Future enhancements could include a bridge over the Parramatta River, potentially funded through developer contributions, as well as an enhanced crossing point at Parramatta Road. The connection between Alfred Street and the M4 shared path could be enhanced. Specifically, a marked, painted bicycle lane connecting Alfred Street to the M4 shared path would reduce risk of collision. Moreover, a

raised, painted crossing over Alfred Street would increase safety outcomes for the large number of people using the M4 shared path. Given the importance of the M4 shared path to cyclists, compared to Alfred Street for motorists, it would appear that offering priority to shared path users would be appropriate.

The North side of Parramatta Road is classified as a shared path, but has poor crossing points, without bicycle lanterns and can be too narrow in places. Streets within Clyde are generally narrow, with industrial usage. This area presents a number of strategic opportunities, given that the area connects Duck Creek, Duck River and the M4 shared path to Clyde Railway Station and leads South into Granville (an area of future development). Kendall, Berry, Sutherland and Marsh Streets were surveyed and could benefit from improved cycling infrastructure, in order to enhance active transport permeability, as well as access for local employment.

The area between Granville Train Station and Parramatta Road will be the site of intensive redevelopment over coming years and this serves as an important opportunity to maximise sustainable mobility options through the use of improved bicycle infrastructure.

Station Street offers an important and relatively well-used connection between Harris Park Train Station to Parramatta Train Station. Interestingly, most of the observed cyclists elected to ride on the road, rather than the shared path that runs along the western side of Station Street. South of Parkes Street, Station Street is a relatively quiet road with significant width to comfortably accommodate both cyclists and motorists. The shared path on Station Street is insufficiently wide to accommodate both cyclists and pedestrians, especially two cyclists in opposing directions. It is recommended painted bicycle lanes be installed on Station Street South of Parkes. North of Parkes Street, Station Street continues to have a shared path on the western side, through to the Parramatta Train Station (Hassall Street).

Road space becomes more competitive North of Parkes Street, especially North of Hassall Street due to the addition of bus and bus only lanes. The survey team observed people on bicycles using the bus only lane, indicating demand, but a lack of sufficient bicycle infrastructure to conveniently and safely navigate this corridor. Conflicting bus lane signage also made it difficult to be certain whether one was in a bus lane or a bus only lane (see Figure 9 and 10).

Figure 9 Station Street East - buses, bikes and cars

Figure 10 Signage for bus lanes can make it difficult to know where it is legal to ride

Fitzwilliam Street and Valentine Avenue run parallel to the rail line, on the South side of Parramatta Train Station. Fitzwilliam Street is a two way street, while Valentine Avenue is one-way, allowing North West travel. This

is a potentially attractive bicycle route, as it connects into key Parramatta destinations, such as the Train Station, Westfield Shopping Centre and other important services. This corridor would however require infrastructure changes to present an attractive, safe option.

Valentine and Fitzwilliam could be made to function more effectively by making the entire length one way, westbound and using the road width this would create for a separated, bidirectional bicycle lane. This could then connect under the rail line along the existing shared path (North side of Parkes Street) to Station Street East (South bound). This design option would enable cyclists to make a safe connection between areas South and North of the Parramatta Train Station.

East West Corridors

Phillip Street runs from Marsden Street in the West to Charles Street in the East. Phillip Street offers one lane in each direction, as well as kerbside car parking. It does not appear to carry substantial traffic volumes, is 40km/h and has the potential to serve as a useful and well-used bicycle route. It holds strategic importance in terms of increasing the bicycle permeability of the Parramatta CBD, as it connects to the Brickfield Street/Elizabeth Street route (from North Parramatta), as well as future Marsden Street bicycle corridor. In the future, Phillip Street will also connect into the North end of Civic Walk (the location of the future Powerhouse Museum). On its Eastern edge, it connects to the Parramatta Valley Cycleway and the Parramatta Ferry Wharf. In addition, Phillip Street connects directly with Charles Street (North South), which also presents an important future bicycle route leading from the Ferry Wharf to the Parramatta Train Station and Harris Park.

To create a well used, safe and attractive bicycle route along Phillip Street, a marked, painted bicycle lane along both sides of the road will be necessary. Charles Street, between George Street and Macquarie Street is likely to have Light Rail. It is critically important to the future cycling network within the CBD for separated bi-directional bicycle infrastructure to be included within the redesigned Charles Street, as it offers a method of bypassing the centre of the CBD and provides the aforementioned connections with the Parramatta Valley Cycleway, and the Ferry Wharf and leads north towards the Parramatta Train Station. Without such a design, it is not possible to incorporate an effective bicycle route along Charles Street given the likely Light Rail route along this street.

George Street and Macquarie Street

George Street runs from the main entrance of Parramatta Park, East, through the CBD and then towards James Ruse Drive. Its current layout allows for at least two lanes of one way (East bound traffic), with intersection points providing more lanes. East of Alfred Street, George Street is two way, but much narrower. It is primarily within a 50km/h zone and the one-way nature of George Street, combined with dedicated left

hand turn lanes makes it difficult to cycle (when travelling East) and impossible to cycle travelling West. George Street contains an underpass at the MacArthur Street Bridge. The intended purpose of this underpass is to allow motorists to avoid the intersection of George Street and Macarthur Street. However an unintended consequence of this underpass is the severed connectivity between the Gasworks Bridge and the Parramatta Valley Cycleway. This presents an unnecessary road safety risk, and a poor utilisation of a high value community asset. George Street continues East providing a connection to the shared path on the western side of James Ruse Dr, via Alfred Street and River Road West (which appears wide enough for marked bicycle lanes in each direction). James Ruse Drive has a narrow shared path on the Western side of the road.

The construction on Macquarie Street for the Light Rail presents an opportunity to make George Street a two-way road. George Street is also slated to have Light Rail operating East of Charles Street. The introduction of Light Rail poses both challenges and opportunities for cycling. If cycling lanes/paths are not integrated into the redesigns of the streets that include Light Rail, it may cut bicycle access to and through the CBD. If bicycle lanes can be accommodated, it presents the opportunity to dramatically increase the permeability of the CBD to bicycle traffic. In addition, it may enhance the size of the Light Rail catchment, by allowing people to access Light Rail stops by bike. Connecting rail with bicycle infrastructure increases the catchment area by a factor of 15 (Hudson, 1982). Moreover, there are some large schools on Macquarie Street and bicycle lanes would appear to support wider strategic objectives of encouraging healthy lifestyles among school aged children.

A future bicycle lane on George Street would connect with the currently-under-construction Civic Walk and would also connect with Marsden Street and Alfred Street, and travels further East and West than Phillip Street. George Street's connection with the Parramatta Park affords an excellent link for people seeking to travel both within Parramatta Park, as well as through it, to Westmead and beyond.

Barrack Lane (shown in Figure 11 below) is a small, one way road connecting George Street with Macquarie Street. The survey team were surprised at the number of pedestrians using this lane, presumably on route to the Parramatta Train Station. This lane could serve as an important cycling connection between George and Macquarie Street, should these streets be adapted to better accommodate cyclists.

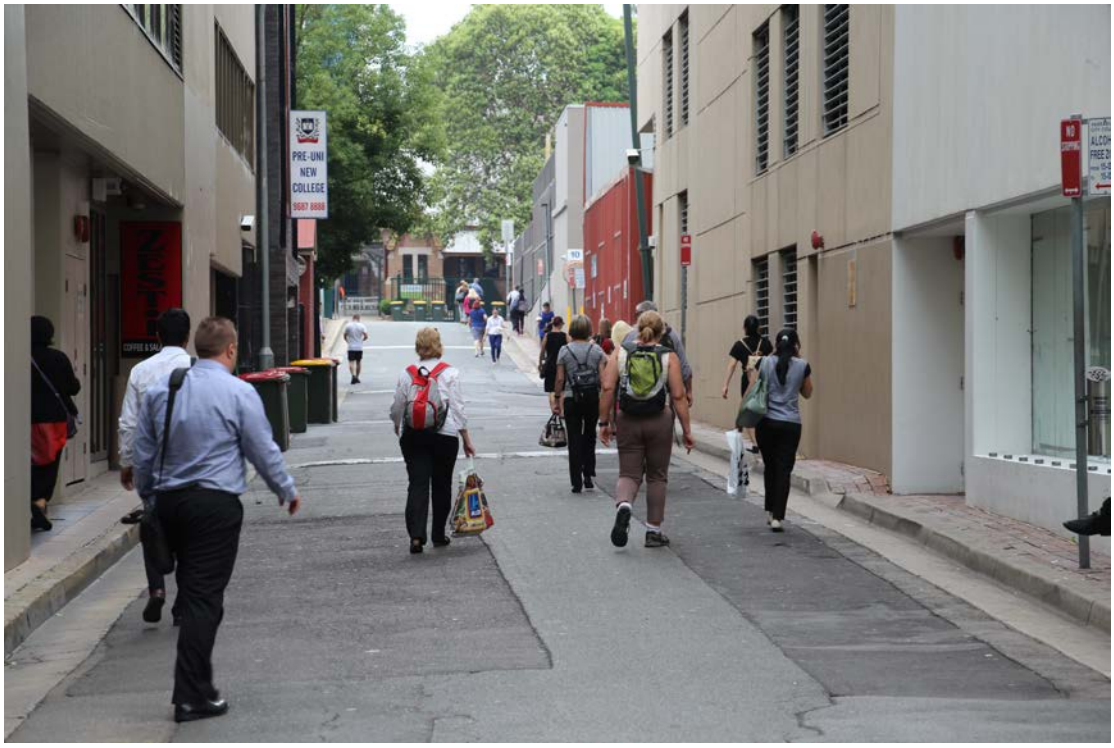

Figure 11 Pedestrians using Barrack Lane

Crown Street, Marion Street and Prospect Street

These streets, all located in Harris Park, form one East West corridor. All of these streets were suitably wide for cycling and do not carry heavy traffic volumes. The inclusion of painted bicycle lanes along these streets will enhance the legibility and safety of the bicycle network. The survey team were struck by the potential Harris Park offers for cycling. The suburb borders the Parramatta CBD and offers characteristics that lends itself to cycling (e.g. short cycling distance to the CBD, Westmead and the Parramatta Valley Cycleway, mixed use development, population of young adults). Its grid structure also makes it very legible for cycling. Finally, Harris Park receives cycle traffic generated from those riding from the M4 shared path on route to the Parramatta CBD. Integrated on road painted bicycle lanes would capitalise on the potential Harris Park offers to grow cycling participation in Parramatta. An image from Crown Street shown in Figure 12 is emblematic of the street structure present within the residential streets of Harris Park.

Figure 12 Crown Street, Harris Park

Parramatta Valley Cycleway

The survey team travelled along the Parramatta Valley Cycleway from Meadowbank through to Parramatta Park. Record taking began at Wharf Road, which forms an Eastern border of the LGA. The survey team found the Parramatta Valley Cycleway to be a generally high quality route that was legible and showcases the natural beauty of Parramatta River. High quality boardwalk has been used sensitively to permit travel through an area of Mangrove.

Figure 13 Parramatta Valley Cycleway through Mangroves

The survey team were asked to consider potential methods of reducing conflict between fast moving cyclists and those walking along the Parramatta Valley Cycleway (see Figure 13 and 14). Some painted markings have been applied, in an effort to improve interactions between pedestrians and cyclists, but this has not significantly reduced the issue. It should be noted that this is in no way unique to Parramatta and complaints between pedestrians and cyclists is common in Australian cities, although it is very rare for these interactions to result in serious crashes. Nevertheless, whilst it is unlikely this issue can ever be resolved entirely, one potential option to help mitigate this issue would be the construction of a gravel, pedestrian only path running roughly parallel to the existing path. Appropriate signage would be required to both alert pedestrians to this new path, make it clear cyclists are forbidden. It would also be important to remind pedestrians they are still welcome to use the Parramatta Valley Cycleway. The issue of pedestrian and cyclist conflict may also be improved through a re-consideration of the name *Parramatta Valley Cycleway*, as it implies that it 'belongs' to cyclists more so than pedestrians (which is not the case). It is possible a more appropriate name would be the *Parramatta Valley Trail*, which is actually what it is called at various locations. Consistency in naming this excellent active transport corridor ought to be seen as a priority.

There were many long stretches of the Parramatta Valley Cycleway that could benefit from additional shade trees. The median maximum temperature in January is 28.4 degrees Celsius, which can make it unpleasant to cycle. There are 42.8 days over 30 degrees Celsius each year and this is likely to increase due to climate change. Shade trees would create a more welcoming environment and help make cycling (especially

for work trips) a more viable option during the summer months (Figure 14). In addition, shade trees can also reduce the degree to which people become wet when riding in the rain for short periods.

Figure 14 Stretches of the Parramatta Valley Cycleway could benefit from shade trees

Significant residential development has occurred in Ermington over recent years. The residents of Ermington could benefit from enhanced connectivity and legibility between their residential street network and the Parramatta Valley Cycleway. Figure 15 shows a footpath that could connect the medium density streets of Ermington with the Parramatta Valley Cycleway, if it were upgraded to a shared path.

Figure 15 Footpath between Ermington and the Parramatta Valley Cycleway

The Thackeray Bridge holds a gas pipeline and also has pedestrian access. Whilst cyclists are permitted to cross this bridge, it contains a large number of steep stairs and is very narrow, which reduces the usability of this bridge as a connection between Camellia and Rydalmere (see Figure 16).

Figure 16 Thackery Bridge Stairs

Given the popularity of the Parramatta Valley Cycleway, combined with the sharp rise in population (3,678 additional people according to the ID Forecast), an improved cycling connection is necessary. Whilst it is not the role of this document to discuss detailed design considerations, it would appear that mounting off the existing bridge is a possibility and that developer contributions may help finance its construction. Figure 17 shows the current clearance between the Ferry and the Thackery Bridge.

Figure 17 Thackery Bridge

The Parramatta Valley Cycleway currently has a missing link along Subiaco Creek between the Parramatta River and South Street. The Parramatta Valley Cycleway West of Pike Street is a dead-end at Subiaco Creek, meaning all through traffic must go on-road along Pike Street and South Street.

Pike Street is a cul-de-sac, with two ninety-degree turns, and primarily of industrial use. It has bicycle symbols painted on the road, but no bike lane markings. Given Pike Street's heavy truck traffic, insufficient width exists for dedicated bike lanes; chevrons and bicycle symbols (sharrows) could be used to help legitimise cyclists' use of Pike Street among other road users.

South Street, east towards Clyde Street, has painted bicycle symbols, but no bike lanes, although its width is sufficient for dedicated bike lanes. The intersection with Clyde Street contains a roundabout, with a shared path continuing straight, but on the north side of the street. There have been two crashes involving cyclists reported at this roundabout in the past five years. This interface could be improved by extending the on-street infrastructure further east, and having well signed kerb cuts to allow access to the shared path, moving the transition from on-street to off-street away from the roundabout.

A dedicated off-street shared path crosses Subiaco Creek, and connects with Alan Street. The bridge contains bollards, to stop motorised vehicle traffic, but insufficient warning is given, posing a safety risk to cyclists, especially in low-light conditions.

An additional, short break in the Parramatta Valley Cycleway requires cyclists to utilise shared paths on Alan Street and Brodie Street. This path is high quality, and very legible, with no ambiguity about how to continue on the Parramatta Valley Cycleway.

From here the Parramatta Valley Cycleway crosses Vineyard Creek and continues West, connecting with Western Sydney University and passing considerable development between MacArthur Street and James Ruse Drive. At MacArthur Street cyclists must dismount to cross the street, and head south over the Parramatta River along a shared path on the west side of the Gas Works Bridge.

The Parramatta Valley Cycleway continues west on the Southside of the Parramatta River, although the connection between MacArthur Street and the Cycleway is complicated by the road underpass (discussed earlier in the George Street section of this report). It should also be noted that the path continues East from MacArthur Street, to Noller Parade, with plans to extend it further to Alfred Street, where a potential new bridge would connect shared paths on both sides of the Parramatta River.

The Parramatta Valley Cycleway continues on the southern side of the Parramatta River to the Lennox Bridge. The weir at Parramatta Ferry Wharf allows cyclists to cross to the north side of the Parramatta River, where the Parramatta Valley Cycleway continues east, past O'Connell Street, and around to Parramatta Stadium. From the north-bank there are connections from the Parramatta Valley Cycleway to: Queens Avenue (via stairs); Elizabeth Street (via stairs); Sorrell Street; Church Street (via stairs); Marsden Street; O'Connell Street, and to Parramatta Park. While the south-bank offers connections to: Phillip Street; Wilde Avenue (via George Khatter Lane); Church Street (via stairs); Marsden Street; and O'Connell Street. This creates a highly permeable environment, notwithstanding the stairs, which greatly increases the attraction and utility of the Parramatta Valley Cycleway in the CBD. The staircases could be made more accessible by installing troughing to the edges, allowing bikes to be pushed up, or coasted down.

Melrose Park to Parramatta CBD (alternative to Cycleway)

Route description

Hope Street; Atkins Road; Boronia Street; Spurway Street; Tristram Street; Hilder Road; Coffey Street; River Road; South Street; Parramatta Valley Cycleway; and Thomas Street.

This route has been surveyed with the intention of providing a direct, quick, commuter route for cyclists travelling from the East of Parramatta. It is intended to give cyclists who do not wish to ride on the Parramatta Valley Cycleway an alternative path into Parramatta CBD and to assist in mitigating the complaints of pedestrians regarding fast moving cyclists.

Hope Street runs west of Wharf Street (Parramatta LGA's eastern boundary) and has bicycle symbols painted on-street, but no dedicated lanes. It has heavy, fast moving traffic and sufficient width for bicycle lanes. Hope Street terminates at a T-Intersection with Atkins Road, with on-street bicycle symbols and arrows directing cyclists to turn left (south). If continued, this route will connect to the Parramatta Valley Cycleway.

Shortly south of the termination of Hope Street, Boronia Street begins, heading west to Spurway Street. It does not contain any bicycle symbols or

markings, but makes a logical route for cyclists wishing to travel into Parramatta CBD from the west. Boronia Street's width is sufficient for an on-street bicycle lane. There is a large tract of land on the northern side of Boronia Street, which could be utilised for a dedicated path in the future.

The survey team rode Spurway Street, Tristram Street, Hilder Road, Coffey Street, and River Road to access South Road, but this route is not recommended as it is hilly and illegible. A shared path through Ken Newman Park and a tract of land between River Road and Hilbert Road would provide a direct, convenient connection for cyclists. However, this path would require alterations to the roundabout at Spurway Street and Boronia Street. Such modifications could also improve access to a shared path from Broadoaks Street (as Spurway Street is called south of Boronia Street), which currently requires a right turn, with no signage.

South Street is currently signposted as 50km/h and carries significant volumes of heavy traffic, due to its proximity to industrial facilities. There are currently bicycle symbols placed close to the centreline on both sides of South Street, however this design does not appear to maximise the safety of cyclists, as it may encourage cyclists to occupy the centre of the travel lane, rather than the left hand portion. Historically, bicycle symbols are used to indicate where cyclists should travel, and should cyclists interpret the symbols located on South Street in this way, would be placed at heightened risk of collision with motorised traffic. Line marking to encourage kerbside cars to be parked closer to the kerb would create sufficient width to accommodate a painted, dedicated bicycle lane.

There is currently an elevator to enable the crossing of Silverwater Road. This elevator can comfortably carry one person and their bicycle at any one time (although the survey team was able to 'squeeze' two bikes and people). It is unlikely this arrangement would meet the expectations of multiple cyclists crossing Silverwater Road at the same time. A tunnel or bridge would offer a significantly higher level of service to people seeking to cross Silverwater Road using active transport. A tunnel would be preferred as cyclists are able to build up speed in order to reduce the difficulty of climbing up the incline (CROW, 2007).

From River Street to John Street, South Street is residential. This section, like Boronia Street, has a large reserve on its northern side, and could accommodate a high quality bicycle path/protected lane in the future. Should this reserve be used to widen the South Street/Boronia Street corridor in the future, this would be an ideal opportunity to provide a high quality on or off road protected bicycle route along the entire corridor.

Between John Street and Park Road, painted bicycle symbols are not present on South Street, and cyclists are asked to deviate one block South (along Antoine Street). This arrangement conflicts with the bicycle planning principle of *directness* highlighted earlier.

The catchment of the Parramatta Valley Cycleway could be enhanced by constructing a shared path on the western side of Park Road, as there is currently a linear track of land that is not being utilised (see Figure 18) and this would help to connect existing bicycle routes to the North and South.

Figure 18 Opportunity for shared path along Park Road

The route from South and Thomas Street has been described in the Parramatta Valley Cycleway section.

Thomas Street runs between James Ruse Drive and Elizabeth Street. Thomas Street has painted bicycle symbols that are quite worn in places and appears to be suitably wide to accommodate a painted bicycle lane. This would enhance safety and legibility for a route that may have relatively high latent demand due to its direct connection between the Parramatta CBD and Western Sydney University. Moreover an analysis of the NSW Crash Database reveals that Thomas Street has seen five police reported crashes in the last five years involving cyclists, and dedicated bicycle facilities (e.g. bike lane) would increase safety outcomes. All of these crashes occurred at intersections, and therefore green painted bicycle lanes may be necessary to minimise the risk faced by people cycling along Thomas Street. In addition to the crashes involving cyclists, Thomas Street has emerged as a crash hotspot for motorists (not involving cyclists). In all, there have been a total of 22 other crashes in which motorists but no cyclists were involved in the past five years. In consideration of the above factors, it is recommended that Thomas Street be converted into a bicycle boulevard in which no motorised through traffic is permitted, but all properties are able to be accessed by car. Figure 19 offers an example of the type of treatment recommended for Thomas Street. A temporary, 12 month trial of this recommendation may be suitable, given that Parramatta does not have extensive experience using this style of treatment.

Figure 19 Cyclists cut through in Napier Street, Fitzroy

M4 Shared Path

The M4 Shared Path runs parallel to the M4 Motorway and provides a high quality East West connection along Parramatta's southern border. It connects areas from the West of the LGA, through to Haslams Creek in Newington. A dedicated off-road path runs along the southern side of the Motorway, between Burnett Street and Church Street. This section is completely grade separated and provides a number of high quality treatments designed to increase the safety and legibility of the path, as shown in Figure 20. Further, there are connections to Franklin Street, Pitt Street (via Ledger Road) and Railway Street available from this section.

Figure 20 Shared path just West of Franklin Street

East of Church Street the shared path runs primarily under the M4 Motorway to Arthur Street, crossing Good Street, Alfred Street and Arthur Street. These crossings increase permeability of the path, but because of low light and low signage, the safety of cyclists is compromised.

Between Alfred Street and Martha Street the path is elevated, passing over James Ruse Drive (see Figure 21), the Carlingford Railway Line and Duck Creek. This section of path is of very high quality, providing an excellent connection into Parramatta from the south and east.

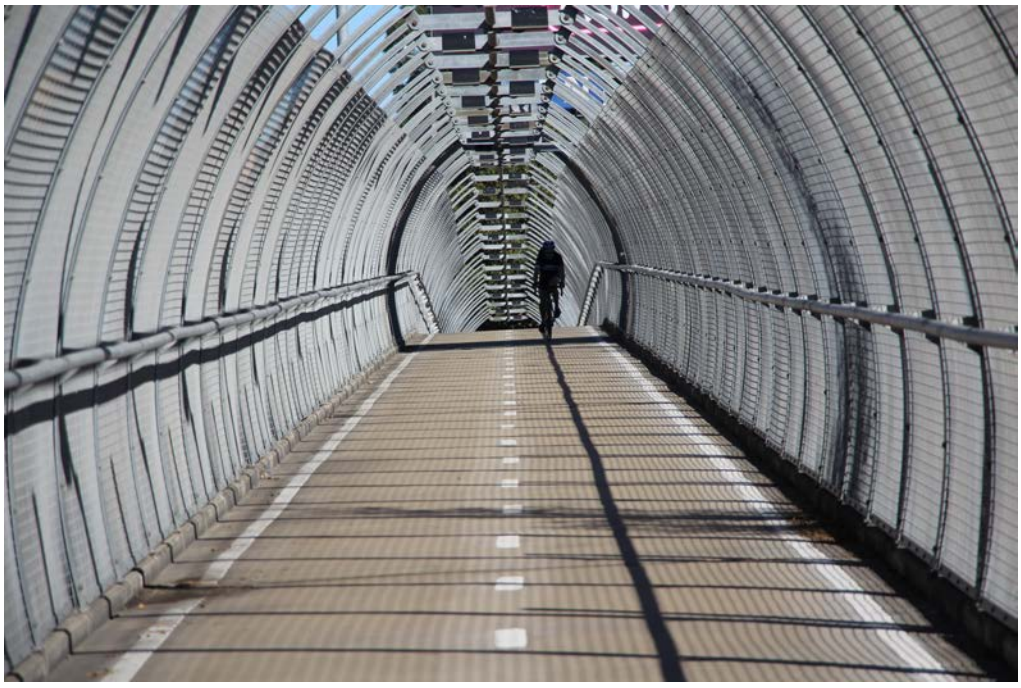

Figure 21 M4 Shared Path crossing James Ruse Drive

There are sighting issues on the down slope towards the east, which could be remediated through mirrors. The path then ends, with cyclists

continuing along Martha Street, to Duck River, where an off-road path begins, crossing Duck River and entering Cumberland LGA, where the M4 shared path continues along Adderley Street West. At Haslams Creek the path passes north under the M4 Motorway, entering Parramatta LGA and connecting into Newington. Future paths along Duck River or further east along side the M4 Motorway will increase the utility of this shared path. Figure 22 offers an example of where enhanced active transport priority is justified based on the importance of this corridor for pedestrians and cyclists.

Figure 22 M4 shared path as it crosses Alfred Street

Toongabbie to Westmead

Route description

Wentworth Avenue to Bridge Road, crosses railway tracks, Hawkesbury Road to Westmead Hospital.

Key findings

Wentworth Avenue does not have a bicycle lane but due to its critical importance in connecting Toongabbie with Westmead and further on to the Parramatta CBD, requires a bicycle lane. It was estimated that the current road width would be sufficient for a marked bicycle lane. This would require line markings to assist kerbside cars to be parked against the kerb, to create the width required for a bike lane.

At Pendle Hill Train Station, the survey team noted that cars are able to park at 90 degrees on Wentworth Avenue outside the train station. By removing kerbside car parking close to this area (see Figure 23), a wide bicycle lane could be provided that offers substantially improved safety without any significant loss of convenience for those seeking to park a car outside Pendle Hill Train Station.

Figure 23 Wentworth Avenue outside Pendle Hill Train Station

There are two intersections that pose an unreasonable safety hazard to cyclists. Bungaree Road has brick like objects adhered to the road and present a hazard to passing cyclists and inconsistent with the Safe

Systems approach, in which small errors should not result in serious injuries/death. The treatment in question is shown in Figure 24.

Figure 24 Brick-like objects present a hazard to cyclists on Bungaree Road

The intersection of Binalong Road and Wentworth Avenue has two right merge lanes designed to reduce waiting times for motorists. This has resulted in design features that present a significant risk to the safety of cyclists through the intersection. Specifically, the brick like objects makes it impossible for motorists to pass cyclists with a safe buffer, which encourage reckless behaviour.

Binalong Road has a dedicated painted bicycle lane. This represents a road allocation model that could be used more extensively in Parramatta. A greater use of bicycle symbols would help increase awareness of the presence of the bicycle lane and cyclists (see Figure 25).

Figure 25 Marked bicycle lane on Binalong Road

The intersection of Wentworth Avenue and Cumberland Highway presents a safety issue for approaching cyclists (from the West). This intersection also presents a poor outcome for cyclists from the East, as it requires cyclists to cross traffic lights twice, dismounted. An investigation of improved design for cyclists is required at this intersection.

Wentworth Avenue east of the intersection with Cumberland Highway is a quiet residential street that is sufficiently wide for a marked bicycle lane, to replace the current bicycle symbols, many of which are partially blocked by parked cars.

The Bridge crossing the railway tracks on Bridge Road presents a pinch point for cyclists. The current speed limit is 50km/h, making the speed differential between motorists and cyclists an unwarranted risk. It is recommended the speed limit be reduced to 30km/h in this short section of road, with additional features designed to encourage the motorist to travel within this speed limit. Given the short length of this lower speed limit it cannot be expected to have a noticeable impact on door-to-door travel times for motorists.

Alexandra Avenue, leading to Westmead Train Station has a 50km/h speed limit with a large number of kerbside cars parked along much of its length. This street appears sufficiently wide to accommodate a bike lane, and may require a 10km/h speed reduction, to safety accommodate some lane narrowing.

Hawkesbury Road is bicycle unfriendly with high traffic volumes, including buses and fast moving, turning traffic presenting a significant road safety risk. Many of the signalised crossing, especially at Darcy Road are difficult to navigate (there are three separate sets of lights to cross). This reduces both the convenience of cycling and increases risk, due to non-compliance associated with lengthy crossing times.

Parramatta CBD to Westmead

Route description

Parramatta Park, Park Avenue, Queens Road, Railway Parade, Hainsworth Street, and Hawkesbury Road.

Parramatta Park offers a very scenic path, with low speed traffic, providing a relatively safe and attractive cycling opportunity to connect the Parramatta CBD with Westmead Hospital. Allowing cyclists to ride in both directions (rather than just clockwise) would lower the travel distance for those travelling between Westmead Hospital and the CBD. Improved permeability into the park from surrounding streets would increase usage levels. Connections between Parramatta Park and the Parramatta River Trail exist at Noller Bridge.

The streets between Hawkesbury Road and Parramatta Park were relatively quiet (low traffic volume) and have sufficient width of painted bicycle lanes. Given the latent demand between the growing Westmead Hospital and the CBD, these streets represent potentially very well used bicycle routes connecting these two key areas.

Hawkesbury Road presents significant opportunities for enhancement to active travel, and the segment north of Queens Road contains a wider centre median that could be modified to enhance the safety of bicycle traffic.

Northmead to Westmead

Route description

Windsor Road, Hammers Road, Ferndale Close, Doig Street, Kevin Street, Old Windsor Road, Briens Road, Mons Road, Darcy Road.

Windsor Road contains traffic lights that are ill-suited to cycling, despite being noted as a Bike Route. The shared paths (similar to footpaths) were discontinuous and moved from one side of the road to the other in a manner that reduced directness and attractiveness. Windsor Road's current layout makes it unsuitable for on-road cycling due to heavy traffic. North of Francis Street the road has a time based allocation to assist the flow of peak direction travel for motorised traffic. North of Lombard Street, the reservation on the east side of the street is quite wide (in parts) to Fletcher Street. A continuous shared path along the eastern side of Windsor Road would increase the overall attractiveness of this key route to cyclists, and avoid some of the intersections that would be present along the western side.

Many of the signalised intersections connecting the shared path on Windsor Road did not have a bike lantern, meaning that cyclists must dismount to cross. In addition, some of these intersections did not contain kerb cuts, an example of which is shown in Figure 26.

Figure 26 A lack of kerb cuts reduce the attractiveness of walking and cycling

Darling Mills Creek from Windsor Road connecting to the Parramatta River presents an attractive option for enhancing cycling possibilities between North Parramatta, Westmead and the Parramatta CBD. Cycle traffic collected from a shared path on the eastern side of Windsor Road and the western side of North Rocks Road could be funnelled under the Windsor Road/North Rocks Road intersection (at its northern aspect), to continue

along the Darling Mills Creek. This path would need to be sensitive to the creek environment, but numerous precedents exist of successfully blending shared use paths within ecologically sensitive environments. Moreover, numerous, very large arterial roads cross the Darling Mills Creek, which present significantly greater threat to the flora and fauna of Darling Mills Creek. In addition to the transport benefits offered by such a route, it would help connect the community to this important natural asset.

Hammers Road contains one motor vehicle travel lane in each direction and a wide kerbside bicycle lane combined with car parking. The current line markings offer insufficient protection for cyclists and many of the bicycle symbols are faded. The intersections (primarily roundabouts) do not have bicycle symbols to increase drivers' awareness of the potential presence of cyclists as they enter the roundabout. The intersection with Kleins Road has very poor visibility, which is a safety risk to all road users. Hammers Road would be significantly improved as a bicycle route through the use of a line to encourage cars to park against the kerb, creating sufficient width for a distinct, marked bicycle lane. Traffic calming measures could be introduced that would encourage through traffic to use Old Windsor Road and Cumberland Highway.

Ferndale Close, Doig Street, Kevin Streets form a quiet on road path connecting two off street routes that run parallel to the North West T Way. These streets are wide enough to accommodate bicycle lanes and this would increase the legibility of the network, not just for current cyclists, but for those *'would be'* cyclists.

The connection between Ferndale Close and the Old Windsor Road shared path could be improved.

Although not included in the Saddle Survey, the shared path along Old Windsor Road provided a very high quality route.

The intersection of Old Windsor Road and Hart Drive contains three sets of traffic lights for cyclists, which are un-coordinated, so cyclists must wait at each one. The slip lane on the north of Hart Drive can have cars bank over the crossing, making it difficult to see the lantern.

Briens Road has a shared path running the northern side of the road, between Mons Road and North West T-Way shared path. It has a cluster of crashes involving cyclists, mostly due to driveways crossing the shared path. The Saddle Survey found a lack of awareness raising treatments was a likely contributing factor to these crashes and more could be done to encourage safer road user behaviour. The cyclists using Briens Road observed during the Saddle Survey elected to use the road rather than the shared path, as this may be considered safer for those cycling relatively fast (e.g. >22km per hour).

Mons Road is a relatively small road with one lane in each direction, with a bridge over Toongabbie Creek that is bus only. A shared path runs the length of Mons Road and requires cyclists to cross from the west side of the road to the east side of the road (South-bound). Once on the eastern

side, a number of obstacles are presented, one of which is shown in Figure 27.

Figure 27 Mons Road Shared Path

Darcy Street contains a shared path on the eastern side of the road. This path is wide and separated from pedestrians. All crossing points are signalised, with bicycle lanterns. The path leads to Hawkesbury Road, which has been previously described.

Northmead to Toongabbie

Route description

Churchill Drive, Willmott Avenue, Reilleys Road, Barnetts Road, Goliath Avenue, off-road path following Pendle and Toongabbie Creek, Cooyong Crescent, un-named laneway, Toongabbie Train Station.

With the exception of the T-Intersection with Windsor Road, Churchill Drive offers one travel lane in each direction with minimal kerbside car parking. Bicycle symbols are located adjacent to the kerb and are faded, though legible. Churchill Drive is sufficiently wide to accommodate a marked bicycle lane and would provide improved safety due to the fast motorised travel speeds.

At the intersection of Churchill and Willmott, a short shared path has been created, to help cyclists avoid the roundabout. Painted bicycle lanes at the entry and exit points would help signal this diversion to cyclists and also assist motorists in terms of their awareness of cyclists at this intersection. Another problem with this intersection is that the road markings suggest all cycling traffic must turn left at Willmott, even though it is possible for cyclists to head north on Willmott or continue westbound on Churchill Drive, as both roads are categorised as bicycle routes.

Willmott Road offers a wide road with low traffic volume and bicycle symbols adjacent to kerb. Painted bicycle lanes would increase both the awareness of cycling (as a transport option) and to enhance safety for those already cycling. The transition from Willmott Avenue into Lanhams Road involves a curve that combined with at times high motor vehicle speeds, presents an unnecessary risk to cyclists (see Figure 28). This section could be enhanced through the use of a number of different treatments, such as a continuous, marked bicycle lane, green painted bicycle lane and rumble strips.

Figure 28 Willmott and Lanham

Reilleys Road continues a similar street form to Willmott, with some faded bicycle symbols along a quiet, wide road. It appears sufficiently wide to accommodate a painted bicycle lane. Whilst the traffic is not heavy on Reilleys Road, it is high speed for a residential street and this, combined with bicycle symbols in the middle of the road and crests (see Figure 29) mean that there may be little opportunity for a motorists to see a cyclist, resulting in a potentially fatal crash. Providing a painted bicycle lane along Reilleys Road would create a consistency with Barnetts Road and increase overall safety outcomes.

Figure 29 Reilleys Road

Barnetts Road offers one of the best examples of on road bicycle infrastructure within the City of Parramatta. As shown in Figure 30, it uses a broken line to encourage parked cars to stay close to the kerb and this helps provide sufficient width for the painted bicycle lane.

Figure 30 Barnetts Road Painted Bicycle Lane

The intersection of Barnetts Road and Oakes Road requires cyclists to mount onto a footpath style shared path in order to continue west, as a method of avoiding the roundabout. Figure 31 (facing east) illustrates the fence preventing cyclists from riding through the roundabout to access the shared path. Whilst this treatment is understandable, it does mean that cyclists heading east from the shared path are forced to cross two roads in order to begin cycling on Barnetts Road. As an improvement, the shared path could have entry and exit points at the western end of the roundabout. This would reduce the indirect manner in which cyclists must currently navigate this intersection. Additional awareness raising features may be needed, for both motorists and cyclists, to reduce the potential for conflict.

Figure 31 Corner Barnetts Road and Oakes Road and shared path

The shared path connects Oakes Road to Goliath Avenue. Goliath Avenue runs parallel to the Toongabbie Creek (creek to the south and housing to the north). At Old Windsor Road it connects through to a shared path that connects through to the North West T Way shared path and Goliath Avenue heads north. Goliath Avenue currently has bicycle symbols and given the road traffic volumes (low), this, perhaps with the addition of chevron markings are an acceptable treatment.

The shared path, as it approaches Old Windsor Road has a bollard with no line markers to act as a warning to cyclists approaching from the west, as shown in Figure 32. The reflective tape was also in disrepair (on both approaches) and presents an additional hazard to cyclists. Similar situations were encountered throughout the Saddle Survey and one generalised recommendation emerging from this Saddle Survey is a uniformed treatment of bollard warning features wherever they exist.

Figure 32 Bollard on shared path without line warning on both approaches

Riding underneath Old Windsor Road, a share path provided a connection along the Toongabbie Creek, Girraween Creek and Pendle Creek, which was of excellent quality. At Fitzwilliam Road (busy and unsuitable for cycling), the path ended. An informal path through an adjacent, un-named park to Cooyong Crescent provided the most direct access towards Toongabbie Train Station (and town centre) and this presents an opportunity for a formalised bicycle route. A quiet route along Cooyong Crescent offers a suitable route towards Toongabbie Train Station.

North Rocks to Northmead

Route description
Barclay Road, North Rocks Road, New North Rocks Road, Loyalty Road, Trent Road, Perry Street.

Barclays Road is categorised as an off road shared path. There are numerous driveways crossing this path and more could be done to increase the awareness of cycling along this path (to avoid collisions). In addition, a number of walls blocked site lines, amplifying the risk of collision. No bicycle lanterns at signalised intersections, requiring cyclists

to dismount to cross Tiernan Avenue. It should be noted that this intersection connects to Muirfield High School and leads to Don Moore Reserve, which contains a former BMX track. The shared path ends at the intersection of North Rocks Road but should continue east along North Rocks Road to New North Rocks Road, as the on road environment is not conducive to cycling due to high motor vehicle speeds and volumes. This will require bicycle lanterns to be installed outside the Westfield Shopping Centre and at the intersection of North Roads Road and New North Rocks Road. Currently at the aforementioned intersection there are three crossing points with both crossings across North Rocks Road containing bicycle lanterns while the crossing at New North Rocks Road does not have a bicycle lantern. Additional bicycle lanterns would be required at Barclay Road and North Rocks Road and North Rocks Road and New North Rocks Road.

A continuous shared path on North Rocks Road that remains on one side of the road will allow for more continuous, direct cycling without the need for numerous crossings, as is currently the case.

A shared path connects the intersections of New North Rocks Road and North Rocks Road with Jenni Place. A standard bollard is used here to prevent cars accessing this path, however it contains no line markings to warn approaching cyclists and a significant amount of debris had collected along this path. This path connects to an on street bicycle route along Haines Avenue.

The south east entry point to the Westfield Shopping Centre has no access for pedestrians and cyclists. Investigating measures to allow for the safe entry/exit for pedestrians and cyclists should be undertaken.

New North Rocks Road is wide and contains cycling lane markings, which in some cases include a dedicated lane, and in others, car parking is permitted. The zebra crossing near Pembury Avenue has blisters, which creates a pinch point that forces cyclists right, into the same lane used by motor vehicle traffic. The speed limit is 50km/h. Figure 33 offers an illustration and similar instances were found in other areas.

Figure 33 Blisters force cyclists into the path of motor vehicle traffic on New North Rocks Road

New North Rocks Road could be made safer by replacing the concrete blister with a traffic lane separator, which offers the vertical separation required without taking up road width that currently comes at the expense of cyclists safety.

Figure 34 Vertical separation of cycle lane and general traffic, Christchurch

To navigate from New North Rocks Road to North Rocks Road, cyclists must go off road onto shared paths. Between New North Rocks Road and Statham Avenue it is a bi-directional path on the south part of the road. West of Statham Avenue, North Rocks Road has a shared path on either side of the road, that transitions to on road paths approx. 100m west of Statham Avenue. Although this shared path contained some hazards related to driveways and path quality, no immediate alternative is readily available.

North Rocks Road contains a wide kerbside lane with bicycle symbols, containing one lane in each direction, carrying heavy and at times fast moving traffic. North Rocks Road presents risks to cyclists in terms of passing traffic and car door openings. Other issues noted on North Rocks Road include:

- Intersection with Loyalty Road contains a slip lane for north bound traffic. Although treated green to increase awareness, vehicles were observed travelling through at high speed. One member of the survey party had a heavy vehicle pass at an unsafe distance (<0.8m). This slip lane could be closed, creating a bicycle cut through combined with a shared zone for driveway access. Motor vehicles seeking to

enter Loyalty Road would do so by making a 90 degree turn at the intersection slightly north of the current slip lane.

- Between James Ruse Drive and Windsor Road, heavy traffic, curved road, and hills, in addition to kerbside car parking make this section a hazard for cyclists. Contested road space make on road bicycle lanes unlikely, however there may be opportunities to create improved off road bicycle paths by expanding the footpath under James Ruse Drive.

Loyalty Road, Trent Road and Perry Street offer an alternative connection between the M2 Motorway and North Rocks Road. These roads are relatively quiet and provide a direct north south connection. The major limitation to this option currently is the bush land reserve that crosses Rifle Range Creek joining Trent Road and Perry Street. In the long term, there may be an opportunity to create a bridge across this creek. In the shorter term, sealing this path would create a more attractive option than the current track.

Figure 35 Rifle Range Creek Track

Carlingford to Parramatta CBD

Route description

Carlingford Railway Station, James Street, Thallon Street, Post Office Street, Jenkins Road, Hunts Creek Path, Bettington Road, Belmore Street East, Webb Street, Gladstone Street, and Pennant Hills Road.

The survey noted that the area around Carlingford Train Station presents a number of challenges for cycling, including very heavy traffic on Pennant Hills Road as well as somewhat lighter motorised traffic on Jenkins Road.

Figure 36 illustrates the site to the North West of Carlingford Train Station, which is undergoing a rapid intensification of its density. Figure 36 shows Thallon Street, which presents a potential opportunity to be developed into a high quality bicycle route, especially through a re-purposing of the kerbside car parking area once the apartments are complete.

Figure 36 Development near Carlingford Train Station

Carlingford Railway Station has the potential for a shared path to Boundary Road. Access from Pennant Hills Road from the East is difficult (potential for shared path to continue East)

Access to Carlingford Train Station is currently difficult from the South East, as Pennant Hills Road has no shared path East of the train station and Jenkins Road carries significant traffic at the intersection of Pennant Hills Road, including a dedicated left hand turn lane (which reduces 'cyclability'). Post Office Road offers a less trafficked alternative to access Jenkins Road than Pennant Hills Road and Jenkins Road accessed from the south of Carlingford Station. There is currently a shared path (in a poor state of repair) that connects Boundary Road and Carlingford Station, through a reserve, however this path could be upgraded. Moreover, a desire line is also apparent to Shirley Street, and given the development that is occurring in the immediate vicinity, this may also require an infrastructure upgrade.

Jenkins Road North of Post Office Road is more favourable to cycling, but still lacks any bicycle infrastructure. This could be improved by replacing one car lane in each direction with a bicycle lane. As the impediment to vehicular traffic flow is greater at the intersection with Pennant Hills Road, it is quite plausible that this reallocation of road space would have no noticeable impact on motorised traffic speeds.

Parkland Road offers access to Hunts Creek Trail, which between Parkland Road and Norfolk Place is unsealed, with vegetation covering much of the path at times. This reduces the usable width of the path to around 50% of its original width. There is potential for connections through the reserve to Lindisfarne Crescent. Kerb cut-outs for access at Karingal Avenue (t-intersection with Muruba Avenue) would enhance the usability of this shared path.

The trail then continues on-street along Norfolk Place, to a shared path along the northern side of Norfolk Place and East of Northam Drive. This section has poor legibility, and is too narrow on Northam Drive (see Figure 37).

Figure 37 Shared path along Northam Drive
NB: Shared path is to the left, parallel to the road

The trail continues off-road between Northam Drive and Bettington Road. This path is sealed, however requires regular maintenance, as debris and vegetation had reduced the useability of this track. Connection to Bettington Street would be improved though the installation of a refuge island, and traffic calming measures to slow motor vehicles. Figure 38 illustrates a section of high quality path along Hunts Creek.

Figure 38 Shared path along Hunts Creek

Bettington Road, Belmore Street East and Webb Street form a continuous corridor from the Hunts Creek Trail to Gladstone Street.

Bettington Road has bike symbols however the fast motorised traffic makes it difficult to comfortably cycle for new or novice cyclists and would benefit from bike lanes.

Belmore Street East (Oatlands shopping centre) has a neighbourhood shopping strip that has the potential to offer improved levels of service for active transport users. In particular, raised speed tables currently connecting both sides of the shopping strip should be converted to formalised zebra crossings, to the aide of shoppers, regardless of the mode of transport they used to arrive at the shops. There is also potential to create a shared path along a lane connecting to St Aidans Avenue, assisting active transport permeability.

Continuing South along Belmore Street, an off-road shared path would provide a safer method for students to access Oatlands Public School. Currently, bicycle symbols are located in the middle of the road, which, as previously mentioned, has the potential to confuse road users, as many novice cyclists would assume they should ride on the part of the road in which the symbols are located. The intention however is to alert motorists to the potential presence of cyclists. In general, bike symbols should only be used on the road when seeking to indicate where cyclists should travel, and vertical signs should be used when seeking to alert motorists to the presence of cyclists. Belmore Street, as a relatively direct connection

between Carlingford and the Parramatta CBD requires a bike lane. Whilst Pennant Hills Road offers a more attractive alignment, it does not appear the necessary road space could be allocated to bicycles under the current paradigm. Belmore Street on the other hand has potential to allow kerbside car parking on one side only, allowing for a bike lane on each side of the road.

Webb Street is the continuation of Belmore once turning South, following the crossing of James Ruse Drive. Webb Street has bicycle symbols but given the motor vehicle speed limit is 50km/h, painted bicycle lanes are required. The current bicycle symbols are located near the centreline, which as indicated earlier, places cyclists at risk unnecessarily. Currently, the kerbside parking space has low occupancy and this space could be reallocated to allow parking on only one side of the road, to create the space necessary for bicycle lanes.

Gladstone Street connects through to Pennant Hills Road. The road has bike symbols, but no bike lane, and is 50km/h. The same recommendations made for Webb Street apply to Gladstone Street. The crossing at Pennant Hills Road is difficult as there are no lights or refuge islands and partly for this reason, it is recommended cyclists heading towards the CBD turn left into Brickfield Street. Additionally a signalised crossing point is recommended for the intersection of Pennant Hills Road and Bellevue, as there is currently a gap of 1.1km between existing signalised crossings (Church Street and James Ruse Drive).

Pennant Hills Road is two lanes each way, with fast moving and sometimes heavy traffic. It has a short section of shared path on its western side, from Church Street (possibly Isabella Street, the signage is poor) to Castle Street. There is no path constructed further north, however, and constructing a path would provide a useful cycling connection between Church Street and Bellevue Street. Given the current constraints to cycling on Pennant Hills Road, it is recommended that Brickfield be the preferred route for cyclists heading South towards the CBD from the North West of Parramatta.

Brickfield Street has previously been described.

Carlingford to Epping

Route description

Carlingford Railway Station, Pennant Hills Road, Keeler Street, Pennant Parade, Willoughby Street, Ryde Street, Boronia Avenue, Kent Street, Bridge Street, and Rawson Street.

Pennants Hills Road has a shared path on the eastern side of road, between Carlingford Railway Station and Keeler Street. The path is generally wide and of high quality, but has a number of deficiencies, including:

- No bike lantern at the intersection with Coleman Avenue, which makes accessing Carlingford Station more difficult.
- Insufficient visibility between the shared path users and motorists exiting driveways for the residential units at 346-362 Pennant Hills Road.

- At Marsden Road there is a gap of under 10m between the shared path and the crossing point, which would legally require the bicyclists to dismount, walk and then once the intersection has been reached, the cyclist could then resume riding, as there is a bicycle lantern at this intersection (see Figure 39).

Figure 39 Short gap in off road shared path, Pennant Hills Road

Keeler Street does not currently have a marked bicycle lane, but does have bicycle symbols, although instances were recorded of the symbol being occluded by pavement infrastructure works or parked over (see Figure 40). This serves to highlight the need for a general recommendation that any infrastructure work that interferes with a bicycle symbol must also include a requirement that these symbols are replaced immediately upon the conclusion of work.

Figure 40 Keeler Street bicycle symbols

Given the critical importance of Keeler Street in creating a high quality, continuous connection between Carlingford and Epping, a painted bicycle lane is necessary. It is likely that car parking would need to be restricted to one side of the road. At Pennant Parade, a lack of suitably located bicycle symbols reduced the level of awareness and safety cyclists were afforded when travelling through the roundabout at the intersection with Willoughby Street.

Willoughby Street, Boronia Avenue and Bridge Street are all suitably wide to accommodate a dedicated bicycle lane of between 1.2 - 1.4m (depending on the width of the street). Some conceptual designs are shown in Figure 41 and serve simply to highlight one potential treatment that has widespread applicability to the residential Parramatta street context, given that the major arterial roads are generally considered unavailable for on road bicycle infrastructure.

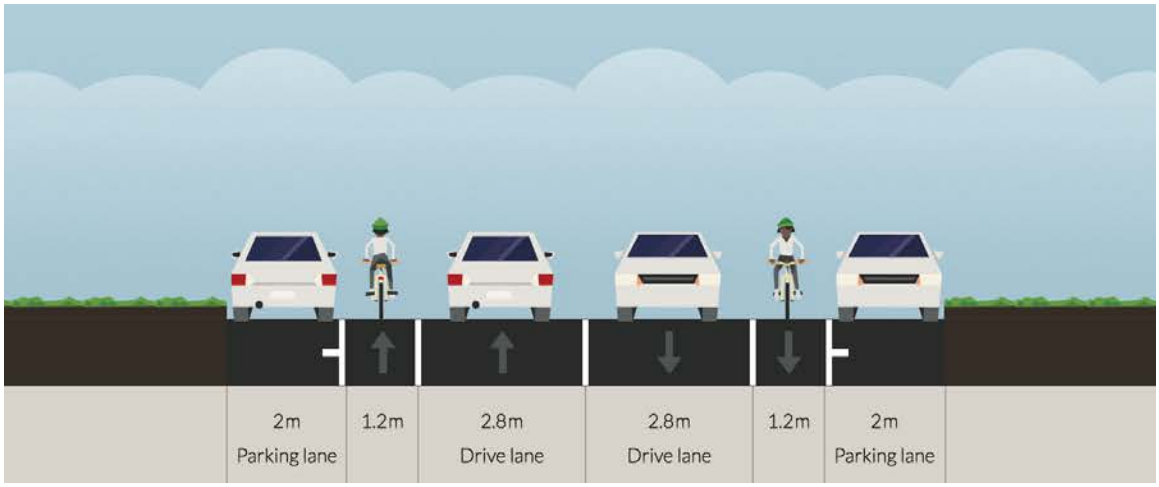

Figure 41 Potential redesign of Willoughby Street

Whilst the design shown in Figure 41 does not comply with Austroads *Guide to Road Design: Part 3: Geometric Design* it does offer a substantial improvement in safety and amenity for cyclists without any substantial reduction in level of service for other road users. It should also be noted that there are many instances in which Australian roads have allocations similar to those outlined in Figure 41 without any reduction in safety or overall road performance. Indeed examples of treatments shown in 41 can be seen within Parramatta itself (e.g. Binalong Road and Barnetts Road).

The route between Carlingford and Epping has three doglegs (Pennant Parade, Ryde Street and Kent Street). In recent years this section of road between Boronia Avenue and Bridge Street in Kent Street has been reconfigured from two T-Intersections to an S-Bend in which East-West traffic has right of way. This design has removed all kerbside car parking from a short section of the street and introduced a painted median refuge island. Figure 42 provides an indication of the before (top) and after (bottom) treatment, showing the median refuge in the bottom image and the change in right of way. Although dedicated bicycle infrastructure has not been included in this design, the design does not preclude the inclusion of bicycle lanes (note the curbside buffers visible in the bottom image). Potential exists to include a green, painted bicycle lane to the left of the through traffic lanes.

Figure 42 Kent Street, Before and After

Existing roundabouts at the intersections of Willoughby Street and Pennant Parade *and* Ryde Street are essentially T-Intersections and could be converted to the treatment described immediately above Figure 42. This would remove a known hazard to cyclists (roundabouts) and provide dedicated bicycle infrastructure, which improve both real and perceived safety outcomes. Additionally, buses operate on these routes and removing roundabouts at these locations will make it easier to navigate.

The survey team travelled along Rawson Street, through an unnamed, one way shared zone. The status as a one way shared zone made it ambiguous as to whether cycling was legal in both directions. The survey team could not find any safety reason why people on bicycles should not be able to travel in both directions.

Epping to Macquarie Park

Route description

Epping Train Station, Pembroke Street, Vimiera Road, Waterloo Road, Macquarie University, Waterloo Road, Macquarie Park Train Station.

Pembroke Street leads West from Epping Train Station and varies in terms of width and traffic volume. It is a classified bike route with wide kerbside lanes and bicycle symbols. Figure 43 shows the bicycle symbol on Pembroke, which also demonstrates the opportunity to narrow the parking bays to create the necessary width for a marked bicycle lane.

Figure 43 Pembroke Street bicycle route

The intersection of Pembroke Street and Epping Road is complex to navigate on a bicycle. For cyclists heading East, they must use a kerb cut to

mount the shared path and then activate the pedestrian crossing signal to cross Pembroke Street, and then activate the pedestrian crossing signal to cross Epping Road. A shared path can then be used on the South side of Epping Road, in order to continue along Pembroke Street. One potential solution to reduce the difficulty of navigating this intersection is permitting the crossing of Epping Road directly from the North side of Pembroke Street, through the creation of another crossing point.

Once the intersection with Epping Road has been crossed, Pembroke Street continues as a very quiet residential street, parallel to Epping Road. A high quality shared path allows cyclists to cross Terrys Creek and continues in parallel with Epping Road. Heading East, the survey team crossed into the LGA of Ryde, along Pembroke Road, which has a residential form on one side and a CSIRO facility on the other. Vimiera Road and Waterloo Road offer relatively conducive conditions for cycling to Macquarie University.

The survey team continued through Macquarie University to Macquarie University Train Station on Waterloo Road. It was not always clear which paths would be best to take in order to travel through to Macquarie Park. Any improvement in legibility would enhance connectivity from the campus to the train station, in addition to assisting those seeking a connection from the North West to the South East. The shared path on the Northern side of Waterloo Road was of very good quality, in terms of smoothness, width, and direct connection to key destinations.

Sydney Olympic Park, Newington, Wentworth Point and Silverwater District

This area was largely constructed in the lead up to, and following the Sydney 2000 Olympic Games. The planned Parramatta Light Rail and urban redevelopment will radically alter the urban landscape of this area in coming years. Carter Street and Uhrig Road will be the site of intensive re-development and potentially serviced by the new Parramatta Light Rail. Currently, Carter Street is not marked as a bicycle route and has no bicycle infrastructure. It is currently used by heavy vehicles to access what is essentially an industrial site in its present day form.

The southern side of Carter Street contains a wide gas easement that restricts development. There is potential to create a high quality shared path along Carter Street, to the benefit of the new residents and workers that will occupy the area once the re-development project has taken place. Additionally, any plans for Light Rail through the area should attempt to integrate bicycle infrastructure, to improve the precinct's active transport permeability.

The M4 Motorway forms the southern perimeter of Sydney Olympic Park and the shared path along the M4 can be used as an entry/exit point for Sydney Olympic Park. However the M4 Motorway shared path ends on the Parramatta side of Haslams Creek. The gas easement along Carter Street could be used to create a new link directly into the M4 Motorway shared path.

Hill Road, whilst a relatively direct route due North from the M4 Motorway shared path, lacks legibility. Specifically, it is unclear whether cycling is permitted on many parts of the off road path. The structure of the path would suggest that it may be classified as a shared path, but a lack of signage made it ambiguous. At some points, the path is narrow and has vegetation growing over it, which reduces its width. Bicycle lanterns at intersections are required. The survey team also noted that the connection between the path on the western side of Hill Road and new development at Wentworth Point was frequently lacking. Notably, there is a locked gate that blocked what would otherwise be the most logical connection between the path and the Wentworth Point development (see Figure 44).

Figure 44 Locked gate between Hill Road Path and Wentworth Point

Footbridge Boulevard is a short length of road from Hill Road to Bennelong Bridge (active transport and bus only). This section of road has the potential to connect these two pieces of active transport infrastructure, however its current treatment makes it ambiguous as to where cyclists are expected to ride. Given the low volume, low speed, dead end nature of this street in terms of motorised vehicle traffic, there are a number of options that could be selected to enhance the street's role in connecting two segments of the bicycle network and enhance the vibrancy of the street itself. The simplest option would be to lower the speed limit to 30km/h and place sharrows to indicate that cyclists and motorists share the same road space. More intensive options also exist, but would involve changes to the street surface to create a plaza-like shared zone between all road users and a more substantial lowering of speeds, to 15km/h (similar to a Dutch Woonerf).

Other streets that were surveyed within the Sydney Olympic Park area were Edwin Flack Avenue, Sarah Durack Avenue, Bennelong Parkway, Marjorie Jackson Parkway. These streets were of a similar typology and generally contained a bicycle lane and no kerbside car parking. Vegetation frequently grew over the bicycle lane however and may require more regular pruning. Bennelong Parkway (at approximately 102 Bennelong Parkway) required cyclists to mount the kerb and ride on the footpath for approximately 150 - 200m and then re-enter the roadway. This treatment reduces the convenience of cycling and places cyclists in danger of being struck by a motor vehicle as they re-enter the roadway. One overarching impression from the survey team after travelling through Sydney Olympic Park was that more could be done to highlight how the internal network connects with the surrounding Sydney region and to key destinations *within* Sydney Olympic Park.

The survey team travelled down the following roads: Holker Street, Avenue of Asia, Avenue of Europe, Avenue of the Americas, Faroila Street, Wetherill Street North, Beaconsfield Street and a shared path on the northern side of the M4 Motorway.

Between Marjorie Jackson Parkway and Hills Road, Holker Busway is a shared active and public transport corridor and is potentially along the route of the future Parramatta Light Rail. Should this Light Rail route eventuate, the footpaths adjacent to the roadway could be classified as shared path, as for the majority of the week it is unlikely to experience significant foot traffic. The survey team undertook measurements of the Holker Busway, finding that the eastern footpath is 2.9m wide and the road was 4.8m for the eastern travel lane.

Holker Street west of Hill Road contains a multi-lane, 60km/h, divided arterial road with a narrow, marked bicycle lane on each side, as shown in Figure 45.

Figure 45 Holker Street bike lane
NB: Left is east bound, right is west bound.

Given the volume and speed of traffic along Holker Street, a bidirectional path on the southern side of the road would improve real and perceived safety.

Avenue of Asia and Avenue of the Americas have a similar typology, marked as 50km/h, though frequent curves and relatively narrow widths suggest a lower speed limit is more appropriate. Part of Avenue of the Americas has indented parking bays. Given the combination of street activity and narrowness and curvature, a lower speed limit would improve overall safety levels without any substantial increase in overall travel time (as travel in this area does not constitute a large proportion of journey distance). This is consistent with the Safe Systems approach. A lowering of the speed limit may allow for the inclusion of sharrows, as existing street widths limit the possibility of marked bicycle lanes. It is important that a lowering of speed limits is a necessary prerequisite for the adoption of sharrows, as they are inappropriate when the speed differential between cyclists and motorists becomes too great. Crash data reveals that there have been 10 reported crashes in the area over the last five years, two of which involved pedestrians. None involved bicyclists. The intersection of Avenue of the Americas and Fariola Street account for three of the 10 crashes in the past five years. The RUM description of these crashes suggests that speed was a contributing factor and lower speeds and traffic calming measures are likely to prevent crashes and injuries in the future. Post-Saddle Survey, the team became aware of many instances in which barriers have been erected in the last year or two in many parts of Newington that prevent the permeability of active travel modes within this area, increasing overall travel distance and time unnecessarily.

Fariola Street currently has little in the way of line markings of any type, other than double white lines near intersections. The road is of sufficient width to accommodate dedicated bicycle lanes. Wetherill Street North is of a similar width to Fariola Street but does contain lane markings and a wide kerbside parking lane. Both streets would be enhanced via the use of line markings to encourage closer kerbside car parking, to enable the inclusion of dedicated bicycle lanes. Measurements for Wetherill Street North were: kerb to outer edge of car parking lane was 2.95m and the edge of the parking line to the centreline was 3.4m. By reducing the parking lane to 2.0m and the travel lane to 3m that would provide a 1.35m bicycle lane per direction. Beaconsfield Street is of a similar situation to the above streets and marked bicycle lanes could be included without any negative impact on other road users and connect into the shared path that begins around 149 Beaconsfield Street. The connection between Beaconsfield Street and the shared path could also benefit from a smoother kerb lip.

The Beaconsfield Street path connects to the M4 Motorway shared path along Haslams Creek and to shared path near John Ian Wing Parade (on street connection to Hill Road). These shared paths have good connectivity with the residential development in Newington. However, one general finding from the Saddle Survey, as indicated previously, was the need to more consistently provide awareness raising line treatment on the

approach to bollards on shared paths. An example of a lack of line marking in advance of these bollards can be seen in Figure 46.

Figure 46 Bollard on shared path near Haslams Creek and M4 Motorway

3.2. Bicycle Signage

Cycling signage is a necessary requirement to support the legibility of the bicycle infrastructure network. Effective signage enhances the usability of the bicycle infrastructure, by providing directional guidance, especially to those unaccustomed with cycling in the area. Signage plays a crucial role for fledgling cycling communities, not simply for directional guidance but also to indicate distance and time suggestions for key destinations. The routes, distances and travel times for cycling can vary compared to other modes of transport and therefore cycling specific signage complements the existing bicycle infrastructure network (i.e. bicycle lanes and paths). This is particularly important given that people who do not regularly cycle over-estimate how long it would take to travel by bicycle and under-estimate how long the same trip would take by car.

The survey team documented all signage and wayfinding found during the five day Saddle Survey. In each instance, the mobile App was used to identify both existing signage, as well as opportunities to enhance wayfinding outcomes, either through improvements to existing signage or the introduction of signage where it was found to be required.

The survey team recorded a total of 194 signage audit records, of which 155 documented existing signage and 39 in which signage was missing. Locations in which signage records were made by the survey team are highlighted in Figure 47. Yellow dots highlight existing signs and blue are for instances in which the survey team found signage was required.

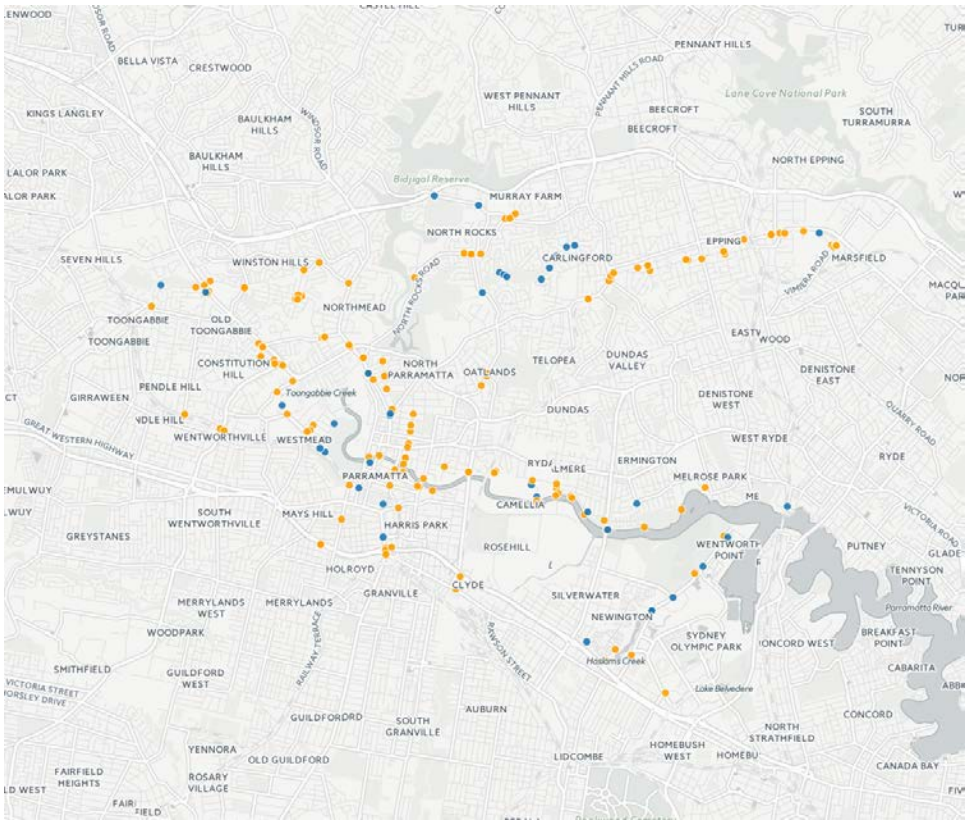

Figure 47 Signage records

In general, the survey team were impressed with the quantity of signage, much of which was relatively recent and positioned in areas that assisted cyclists in their understanding of routes and destinations. The signage generally noted a key destination and often the distance as well. Figure 48 is illustrative of a common sign type, designed to assist cyclists in Parramatta.

Figure 48 Common cycling signage in Parramatta
NB: Photo taken on corner of Alan and Brodie Streets

Another common signage typology can be seen in Figure 49, showing only the destination. Given the substantial distance between this sign and some of the destinations shown, coupled with the high visibility of this sign to other road users, *distance* and *time* would be useful additions.

Figure 49 Typical cycling signage in Parramatta
NB: Photo taken on corner of Pembroke Street and Epping Road

Figure 50 provides an excellent example of a new signage junction along the Parramatta Valley Cycleway, just prior to Western Sydney University. Providing both distance and time increases the sign's usefulness and the range of destinations and public transport interchanges helps to increase the integration of cycling with public transport.

Figure 50 Best practice signage junction
NB: Photo taken on corner of Alan and Brodie Streets

There were a small number of instances in which conflicting information was included on signs, including the example shown in Figure 51 from the Parramatta Valley Cycleway (distances to Sydney Olympic Park conflict).

Figure 51 Conflicting signage on Parramatta Valley Cycleway

A common finding during the Saddle Survey was signage that highlighted a relatively distant destination when a nearer destination was omitted. For instance, in Figure 52, the sign shows the destination for the Parramatta River, yet was only 1.7km to Carlingford.

Figure 52 Signage showing a distant destination rather than those more proximal

NB: Photo taken on corner Keeler Street and Pennant Parade

Signage principles

A number of principles have been developed that would enhance the effectiveness of wayfinding signage, to both aide the navigation of existing cyclists, as well as act as a passive behaviour change tool highlighting cycling possibilities to those not currently cycling. These principles are intended to supplement rather than replace signage guidelines recently prepared for Austroads (see Austroads, 2015) and are offered below:

- If a destination is shown, ensure the closest one is included. Often, the survey team found a relatively distant destination was made the headline destination of a sign, rather than the nearest destination. By highlighting the nearest destination, people are able to progress along the route and each advancing sign brings them closer to the point in which their destination of choice may be highlighted.
- Highlight more than one destination if there are multiple key destinations along the route.
- When a route has been signposted, it is important that all instances in which a turn is required includes a wayfinding sign, as without this, cyclists cannot be expected to know which way to turn to continue to their intended destination. The use of pavement markings can be a useful method of ensuring cyclists are provided with the necessary guidance to travel to their destination.
- For off road paths, a continuous centre line at junctions can be used to guide cyclists towards the main destination.
- Provide distance and time on signs unless there is a reason this cannot be done. As previously noted, the reason for including time is that novice and non-cyclists generally overestimate how long it takes to travel by bicycle and under estimate how long it takes to travel by car. Therefore including time can act to encourage people to cycle who may otherwise have not considered cycling a viable option. Time calculations should be based on an average cyclist speed of 15km/h. Faster cyclists will generally adapt their calculation to account for their own pace.
- Signage within 2km of train station, bus interchange or ferry, including directional, time and distance information to enhance integration possibilities between cycling and public transport.

High quality signage and wayfinding is critical to the growth of cycling in Parramatta. It is clear that considerable work has been undertaken to enhance the coverage of cycling signage in Parramatta over recent years. Applying the principles highlighted above, in addition to existing guidelines related to cycling wayfinding will assist more people in Parramatta electing to travel by bike, whether for transport or recreation.

3.3. Bicycle Parking

Existing facilities

The bicycle parking survey identified 74 formalised bicycle parking locations across the municipality. These are illustrated in Figure 53.

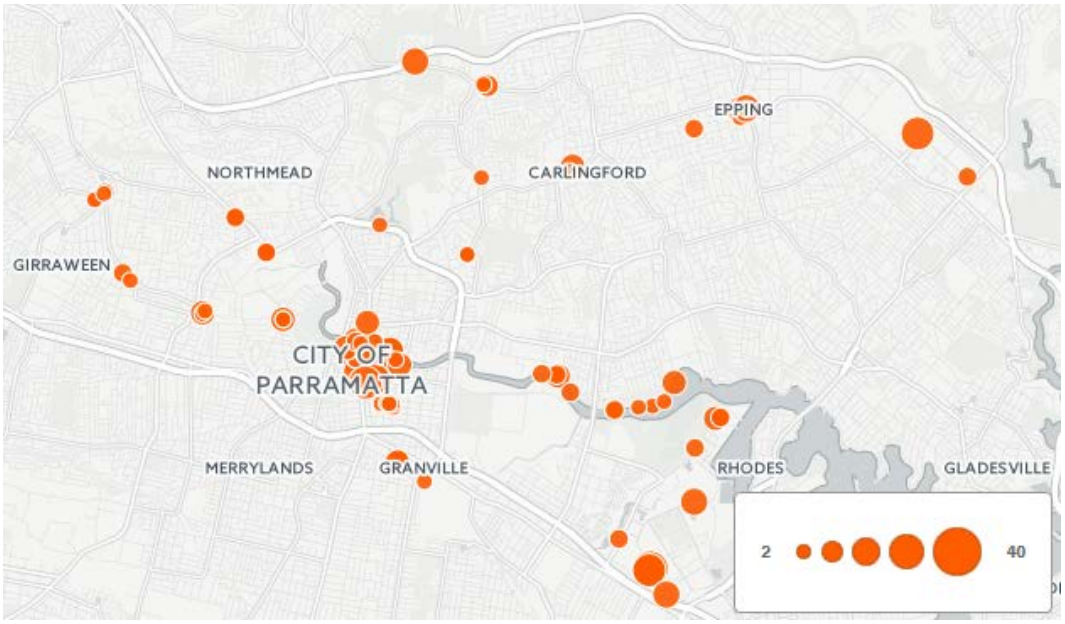

Figure 53 Bicycle parking capacity

The highest concentration of bicycle parking was located in the Parramatta CBD, and these are shown in Figure 54, in which the size of the dot is proportion to the capacity of the facility (how many bicycles can be parked).

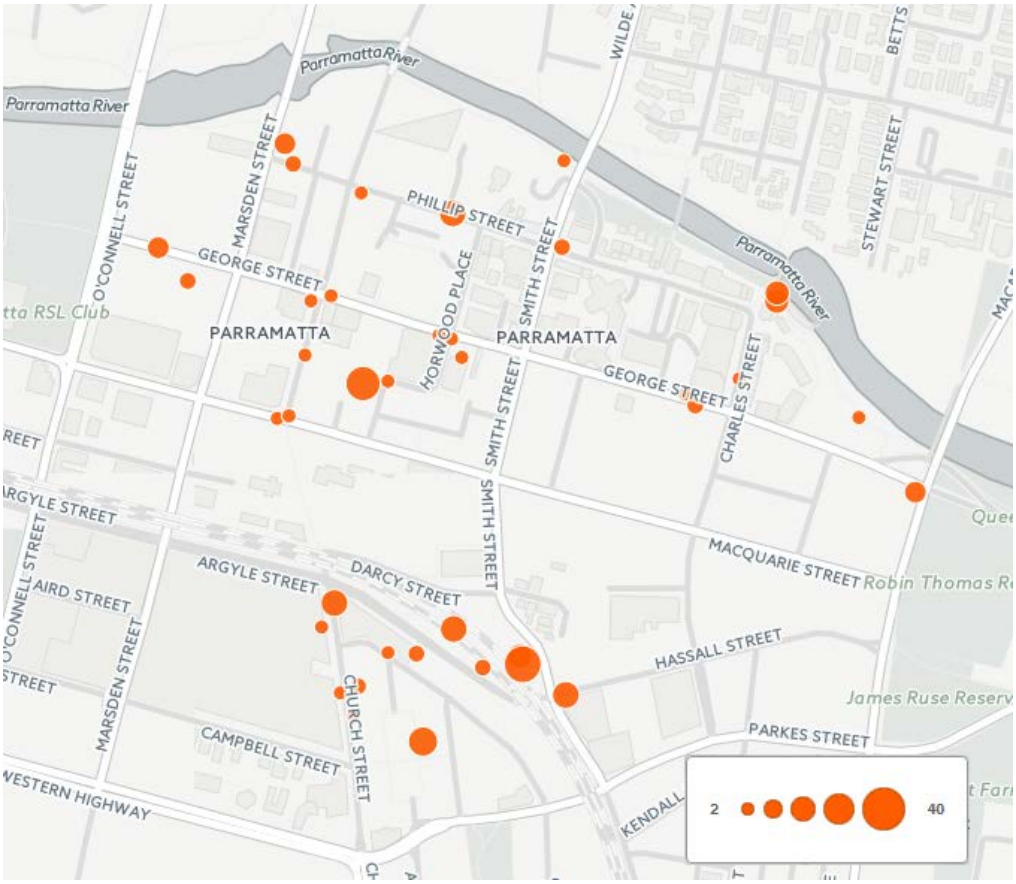

Figure 54 Parramatta CBD bicycle parking capacity

Occupancy at bicycle parking facilities was generally higher around public transport interchanges and outside major shopping precincts. Bicycle parking located at playgrounds were empty, although this is likely to be related to the weekday periods in which data was collected. Some bicycle parking was located near special event venues (such as stadiums at Sydney Olympic Park). Whilst these were unoccupied at the time of the survey, during sporting events, occupancy rates are expected to be considerably higher.

Table 2 provides a summary of the existing bicycle parking facilities within the City of Parramatta, proportional

Facility Type	Total capacity	Bikes using facility	Latitude	Longitude	Address
Bike Rack	10	0	-33.81361219	151.0099538	38 Charles Street, Parramatta
Bike Rack	10	0	-33.81351484	151.0099593	38 Charles Street, Parramatta
Bike Rack	6	0	-33.81173418	151.0028918	101 Marsden Street, Parramatta
Bike Rack	2	0	-33.83146376	151.0117622	27 Good Street, Granville

Bike Rack	6	0	-33.832296	151.0114945	2–8 Bridge Street, Granville
Bike Rack	12	1	-33.8125649	151.0053007	32A Phillip Street, Parramatta
Bike Rack	4	0	-33.81296732	151.0068702	30–32 Smith Street, Parramatta
Bike Rack	2	1	-33.81472028	151.0086384	150 George Street, Parramatta
Bike Cage	0	0	-33.81456706	151.0043679	24–70 Horwood Place, Parramatta
Bike Rack	4	1	-33.81485765	151.008785	150 George Street, Parramatta
Bike Rack	4	2	-33.8179819	151.0057329	Liverpool-Parramatta Transitway, Parramatta
Bike Cage	28	1	-33.81459526	151.004012	72 Horwood Place, Parramatta
Bike Locker	12	3	-33.81752164	151.0053156	Argyle Street, Parramatta
Bike Rack	10	4	-33.81784459	151.0062629	Station Street E, Parramatta
Bike Cage	40	12	-33.8179417	151.0063053	Station Street E, Parramatta
Bike Rack	12	5	-33.81721256	151.0036022	142 Church Street, Parramatta
Bike Rack	4	2	-33.81781748	151.0047801	Argyle Street, Parramatta
Bike Rack	12	0	-33.81830903	151.0069264	1A Hassall Street, Parramatta
Bike Rack	2	0	-33.81360885	151.003264	16 George Street, Parramatta
Bike Rack	2	0	-33.81501114	151.0027798	83R Macquarie Street, Parramatta
Bike Rack	2	0	-33.81354874	151.0035517	28–46 George Street, Parramatta
Bike Rack	2	0	-33.81498008	151.002948	198 Church Street, Parramatta
Bike Rack	6	0	-33.80877004	151.0053967	353D Church Street, Parramatta
Bike Rack	8	0	-33.78228344	151.0471566	1 Lloyds Avenue, Carlingford
Bike Rack	4	0	-33.77599098	151.0718211	32–34 Boronia Avenue, Epping
Bike Rack	6	3	-33.77267007	151.0806537	56 Rawson Street, Epping

Bike Rack	4	1	-33.77257113	151.081729	59 Beecroft Road, Epping
Bike Rack	12	5	-33.77287185	151.0817876	58 Beecroft Road, Epping
Bike Rack	8	0	-33.77292174	151.0819429	48 Beecroft Road, Epping
Bike Rack	2	0	-33.77407303	151.0812217	13–15 Bridge Street, Epping
Bike Rack	10	0	-33.77252687	151.0824645	48 Langston Place, Epping
Bike Rack	16	12	-33.77675931	151.117294	University Avenue, Macquarie Park
Bike Locker	4	0	-33.78413694	151.127444	35–41 Waterloo Road, Macquarie Park
Bike Rack	4	1	-33.8086268	150.9878318	
Bike Rack	6	0	-33.81589055	151.0119449	190A George Street, Parramatta
Bike Rack	2	0	-33.81500061	151.011134	190B George Street, Parramatta
Bike Rack	4	0	-33.81337218	151.0014956	9 George Street, Parramatta
Bike Rack	6	0	-33.81297391	151.0010726	4 George Street, Parramatta
Bike Rack	8	3	-33.80820058	150.988166	22 Railway Parade, Westmead
Bike Rack	4	0	-33.79703103	150.9849767	157 Briens Road, Northmead
Bike Rack	4	0	-33.79684214	150.9847568	Old Windsor Road, Northmead
Bike Rack	4	0	-33.79095518	150.9783586	Northwest Transitway, Constitution Hill
Bike Rack	4	0	-33.79098524	150.978476	204–206 Old Windsor Road, Constitution Hill
Bike Rack	4	1	-33.78680607	150.9519157	483 Wentworth Avenue, Toongabbie
Bike Locker	4	0	-33.80036736	150.9556202	229 Wentworth Avenue, Pendle Hill
Bike Rack	6	3	-33.80711936	150.9718299	7–14 The Kingsway, Wentworthville
Bike Rack	4	0	-33.81820535	151.0039409	126 Church Street, Parramatta
Bike Rack	2	0	-33.82304361	151.0105505	83 Marion Street, Harris Park

Bike Rack	2	0	-33.82252163	151.0103768	83 Marion Street, Harris Park
Bike Rack	20	0	-33.8503912	151.062954	6 Edwin Flack Avenue, Sydney Olympic Park
Bike Rack	2	0	-33.82244684	151.0097426	56 Marion Street, Harris Park
Bike Rack	2	0	-33.82251133	151.0097874	77 Marion Street, Harris Park
Bike Rack	16	0	-33.85064384	151.0626504	Edwin Flack Avenue, Sydney Olympic Park
Bike Rack	10	0	-33.8547188	151.0661486	Sarah Durack Avenue, Sydney Olympic Park
Bike Rack	10	0	-33.83903132	151.0718097	Marjorie Jackson Parkway, Sydney Olympic Park
Bike Rack	4	0	-33.84529782	151.0565752	302A Hill Road, Sydney Olympic Park
Bike Rack	2	0	-33.82286869	151.0633562	Ermington
Bike Rack	4	0	-33.82996457	151.0720373	Sydney Olympic Park
Bike Rack	8	0	-33.82497001	151.0762572	41–49 Hill Road, Sydney Olympic Park
Bike Rack	4	0	-33.82477671	151.077256	1 Footbridge Boulevard, Wentworth Point
Bike Rack	6	0	-33.81892322	151.0677943	Ermington
Bike Rack	2	0	-33.82210251	151.0657046	35 Trumper Street, Ermington
Bike Rack	2	0	-33.823111	151.0605444	2-10 Broadoaks Street, Ermington
Bike Rack	4	0	-33.823472	151.0556105	2-8 Broadoaks Street, Ermington
Bike Locker	6	1	-33.8177447	151.044138	1A Jean Street, Rydalmere
Bike Rack	4	0	-33.81751731	151.0438907	1A Jean Street, Rydalmere
Bike Rack	4	0	-33.82352781	151.0556393	Ermington
Bike Rack	4	0	-33.82053589	151.0466608	37–45 John Street, Rydalmere
Bike Rack	4	0	-33.81742809	151.0408608	1 Park Road, Rydalmere
Bike Rack	4	0	-33.8119755	151.0030101	6–8 Phillip Street, Parramatta
Bike Locker	10	0	-33.76464599	151.0150385	Barclay Road, North Rocks
Bike Rack	5	0	-33.7687093	151.0297566	340 North Rocks Road, North Rocks

Bike Locker	18	6	-33.81886479	151.004872	21 Wentworth Street, Parramatta
Total	**489**	**68**			

Table 2 Bicycle parking facilities in Parramatta

The recently installed Opal card accessible bicycle sheds at Parramatta Transport Interchange (see Figure 55) offers a high quality facility that corresponds to cyclists' need for free, secure and conveniently located parking. This facility is well used and appears significantly more popular than individual lockers or facilities that require payment.

Figure 55 Parramatta train station bicycle parking shed

Missing bicycle parking facilities

The Saddle Survey also recorded instances in which bicycle parking was required. This was generally based on the underlying characteristics of the area, such as proximity to a public transport interchange, a busy set of shops or a concentration of high density residential or employment. Areas in which bicycles were parked informally (e.g. tree, fence) were also identified as areas that may require formalised bicycle parking (e.g. hoop). Table 3 documents the instances in which missing bicycle parking was recorded.

Reason parking is required	Latitude	Longitude	Address
Bikes are informally parked.	-33.8140618	151.0052823	2 Horwood Place, Parramatta
Bikes are informally parked.	-33.81453973	151.0094139	30–32 Charles Street, Parramatta
Near large employment and retail area. Bikes are informally parked.	-33.81749837	151.0034175	150-152 Church Street, Parramatta
Near public transport, and a large employment and retail area. Bikes are informally parked.	-33.81780474	151.0043693	1–3 Fitzwilliam Street, Parramatta
Near shops/retail/food and entertainment.	-33.81425563	151.003179	215–217 Church Street, Parramatta
Near shops/retail/food and entertainment.	-33.79742338	151.0257635	42 Belmore Street E, Oatlands
Near shops/retail/food and entertainment.	-33.7972267	151.0256333	43A Belmore Street E, Oatlands
Near shops/retail/food and entertainment.	-33.7842288	151.0285805	134A Felton Road, Carlingford
Near shops/retail/food and entertainment.	-33.78315462	151.0464401	312A Pennant Hills Road, Carlingford
Bikes are informally parked.	-33.772361	151.0822061	9 Cambridge Street, Epping
Bikes are informally parked.	-33.77227125	151.082418	9 Cambridge Street, Epping
Bikes are informally parked.	-33.77229104	151.0825356	9 Cambridge Street, Epping
Near public transport, and a large employment and retail area. Bikes are informally parked as the existing bike parking at capacity.	-33.77281026	151.0817416	Beecroft Road, Epping
Bikes are informally parked as the existing bike parking at capacity.	-33.77257674	151.0824103	48 Langston Place, Epping
Near public transport, and a large employment area. Bikes are informally parked and parked incorrectly.	-33.80822355	150.9881915	22 Railway Parade, Westmead

Bikes are informally parked.	-33.80664082	150.9721993	79 Wentworth Avenue, Wentworthville
Near public transport and a retail area. Bikes are informally parked.	-33.78738471	150.9508578	Cornelia Road, Toongabbie
Near public transport and retail area.	-33.78757444	150.9506669	9–21 Aurelia Street, Toongabbie
Near public transport and retail area.	-33.78774264	150.9504915	2–10 The Portico, Toongabbie
Near public transport and retail area.	-33.78800672	150.9501498	24–26 Aurelia Street, Toongabbie
Near public transport and retail area.	-33.78800502	150.9498601	15 Aurelia Street, Toongabbie
Near public transport and retail area.	-33.78693712	150.9516945	479–495 Wentworth Avenue, Toongabbie
Near public transport.	-33.80167541	150.9571518	221A Wentworth Avenue, Pendle Hill
Near public transport. Bikes are informally parked.	-33.80643841	150.9719877	83 Wentworth Avenue, Wentworthville
Near public transport.	-33.80722133	150.9717898	9 The Kingsway, Wentworthville
Near public transport.	-33.80678358	150.9723004	79–93 Wentworth Avenue, Wentworthville
Near a bike route, public transport, and a retail area.	-33.82244332	151.0081273	51 Marion Street, Harris Park
Near a bike route, public transport, and a retail area.	-33.82240576	151.0092792	59 Marion Street, Harris Park
Bikes are informally parked.	-33.81193773	151.0068963	George Khattar Lane, Parramatta
Bikes are informally parked.	-33.8140228	151.0051016	68 George Street, Parramatta
Bikes are informally parked.	-33.81428308	151.0054298	69 George Street, Parramatta
Near large employment and retail area, public transport, and a bike route.	-33.81828276	151.0036861	139 Church Street, Parramatta
Near large employment and retail area, public transport, and a bike route.	-33.81857344	151.0038715	124 Church Street, Parramatta
Near shops/retail/food and entertainment.	-33.76845603	151.0292193	North Rocks Road, North Rocks
Near shops/retail/food and entertainment.	-33.76847518	151.0289976	North Rocks
Near shops/retail/food and entertainment.	-33.79228456	151.0078828	James Ruse Drive, North Parramatta

Bikes are informally parked.	-33.81232104	151.0039851	29-31 Phillip Street, Parramatta

Table 3 Required bicycle parking facilities

It should be noted this survey only included publicly accessible bicycle parking that was encountered during the five day Saddle Survey. No attempt was made to record private bicycle parking in residential or commercial developments.

4. Implications for the future of cycling in Parramatta

4.1. General recommendations

The following includes some pertinent reflections from the survey team that offer general guidance regarding methods to enhance the bicycle network:

- Drainage grates were often found to have the grill bars parallel to the direction of travel, presenting an unreasonable road safety risks for cyclists, who may either have their wheel trapped, or attempt an urgent manoeuvre to avoid the grill, potentially placing themselves in the path of a motorist. It was evident to the survey team that some drainage grates had been replaced with a more bicycle friendly configuration. Others may have simply been turned 90 degrees (when the grate is perfectly square).
- Bicycle symbols without accompanying line marking should not be used when the maximum speed limit is above 40km/h due to the speed differential between bicyclists and motorists at higher speeds.
- Bicycle symbols should only be used to indicate where bicyclists should travel. 'Watch for Bicycle' vertical signs should be used when seeking to alert motorists to the presence of cyc lists.
- Kerbside car parking bays should be 2.0m in width, to increase the available width for a bicycle lane. Avoid placing bicycle symbols in areas that can also be used to park cars.
- Signage: See end of Section 3.2 for general signage principles.
- Bike lanterns should be used at all controlled intersections connecting two pieces of declared shared path.
- On ground markings for all shared paths, to clearly differentiate between shared paths and footpaths. These can function to indicate where pedestrians and cyclists should be, to help avoid conflict.
- When shared paths cross driveways, there needs to be signage to both exiting/entering motorists and cyclists to increase awareness and provide clarity on who has priority.
- All publications highlighting bicycle routes should clearly indicate what type of infrastructure (e.g. shared path, on street bike lane, informal bike route) exists. In instances in which no dedicated bicycle infrastructure is available but still forms part of the bicycle network, an *informal route* should be listed (e.g. dashed line rather than solid line). As the network takes form, it is expected informal bicycle routes will become formalised bicycle routes through the development of dedicated bicycle infrastructure.

5. Next steps

The results of the Saddle Survey will be used as a key input into the development of the proposed bicycle network for Parramatta. In addition to the findings of the Saddle Survey, a number of other datasets will be used to inform the proposed bicycle network. This includes the Bicycle Use Propensity Index, Crash data, results from community consultation held as part of the Bike Plan (e.g. CrowdSpot) as well as future residential and commercial development in Parramatta.

The proposed network plan will be the next deliverable in the development of the Bike Plan and will be presented to stakeholders at a meeting on the 10th of February 2017.

6. Appendix 1 Route Maps

The maps shown below indicate the routes taken during each of the five days of the Saddle Survey. In addition to these routes, additional detail was gathered on foot within the Parramatta CBD.

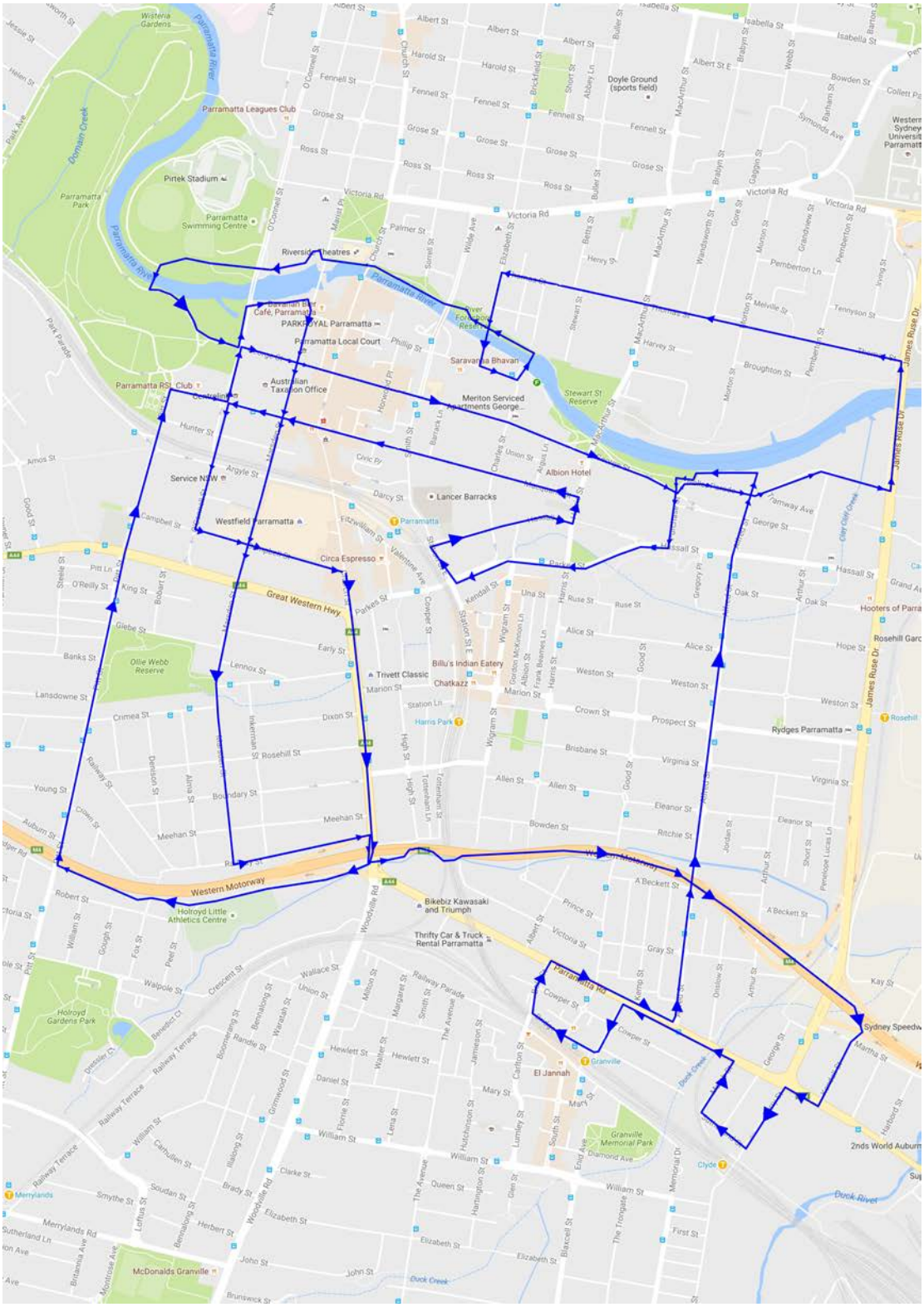

Figure A 1 Day 1 Route

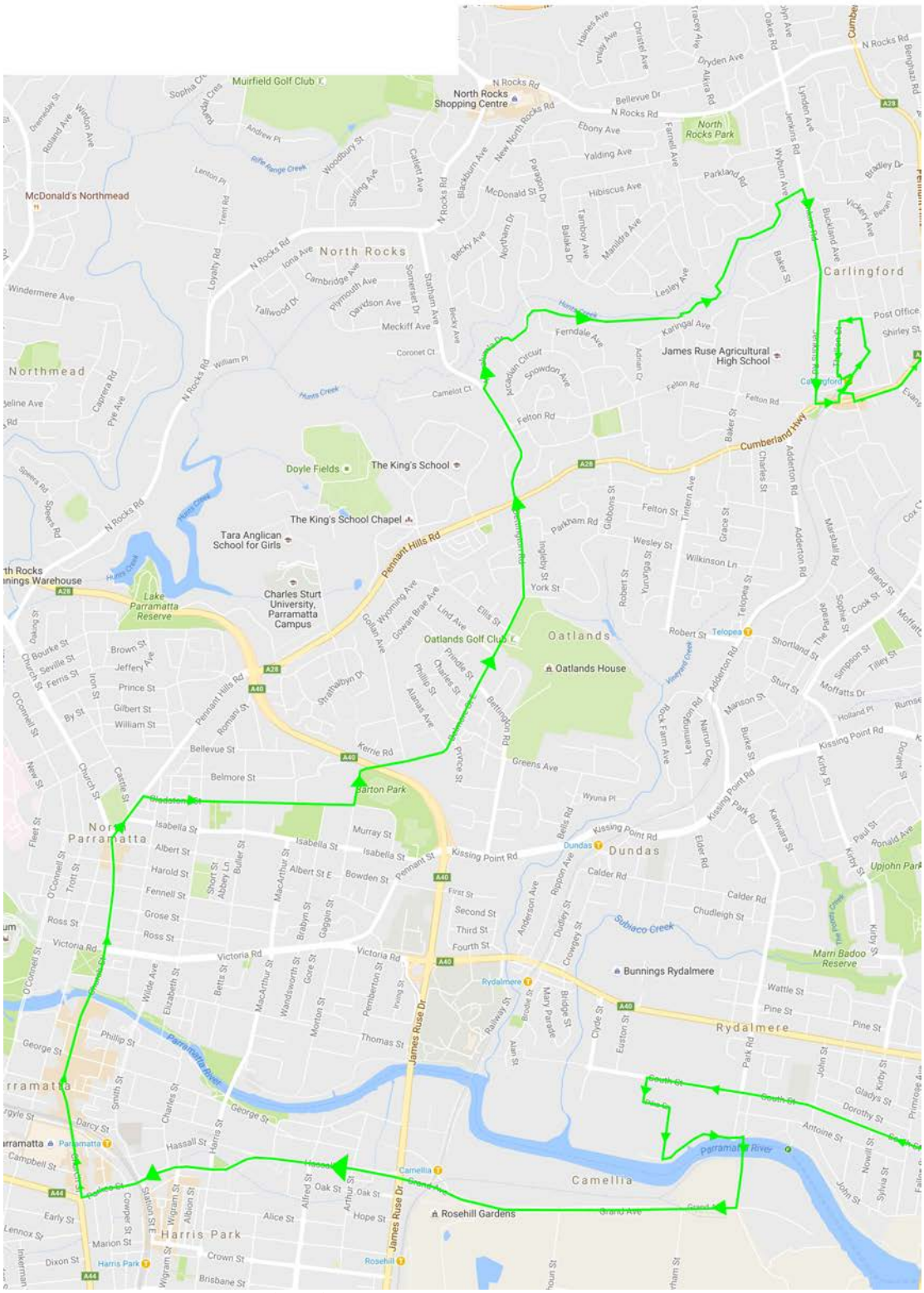

Figure A 2 Day 2 Route (Left)

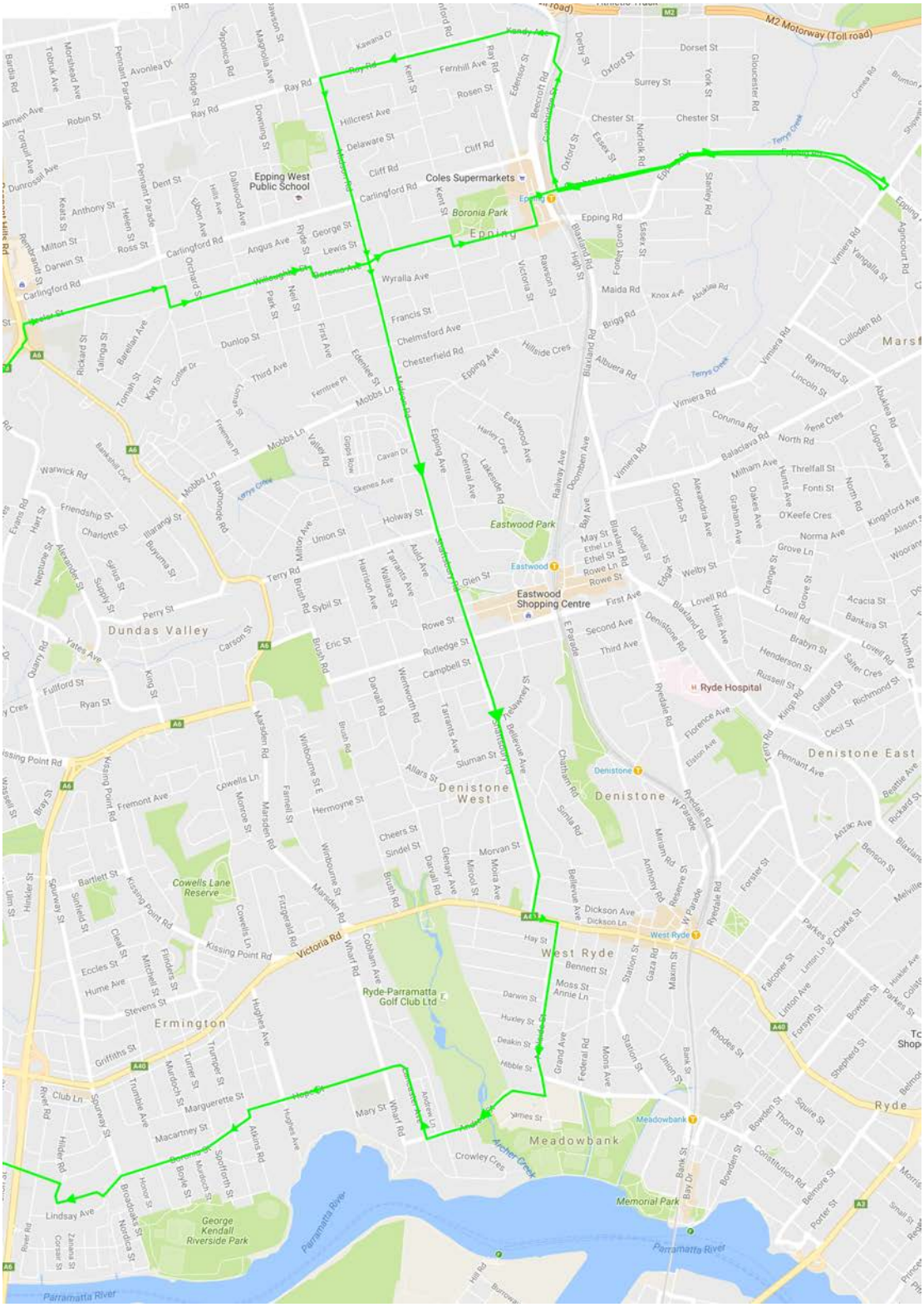

Figure A 3 Day 2 Route (Right)

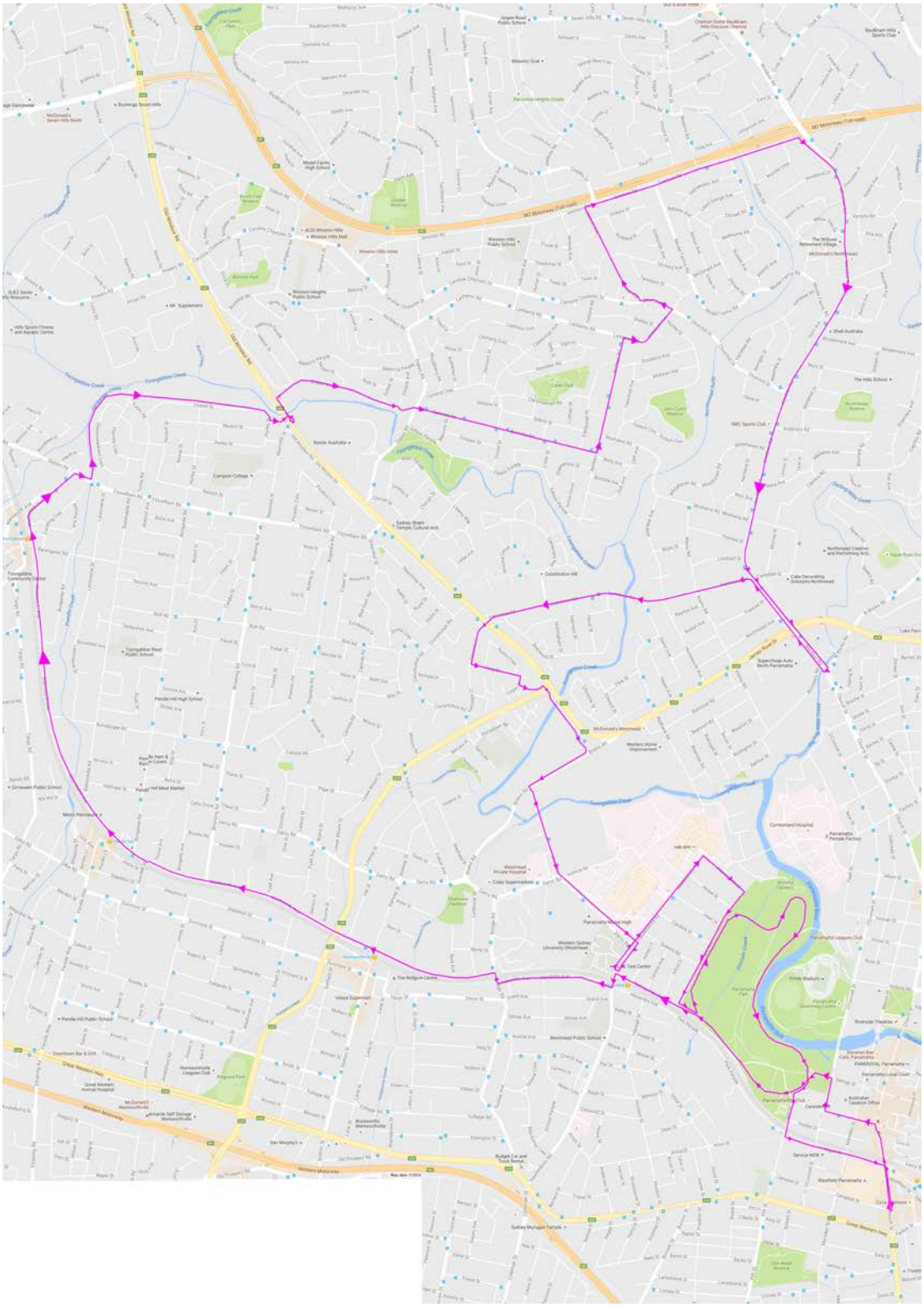

Figure A 4 Day 3 Route

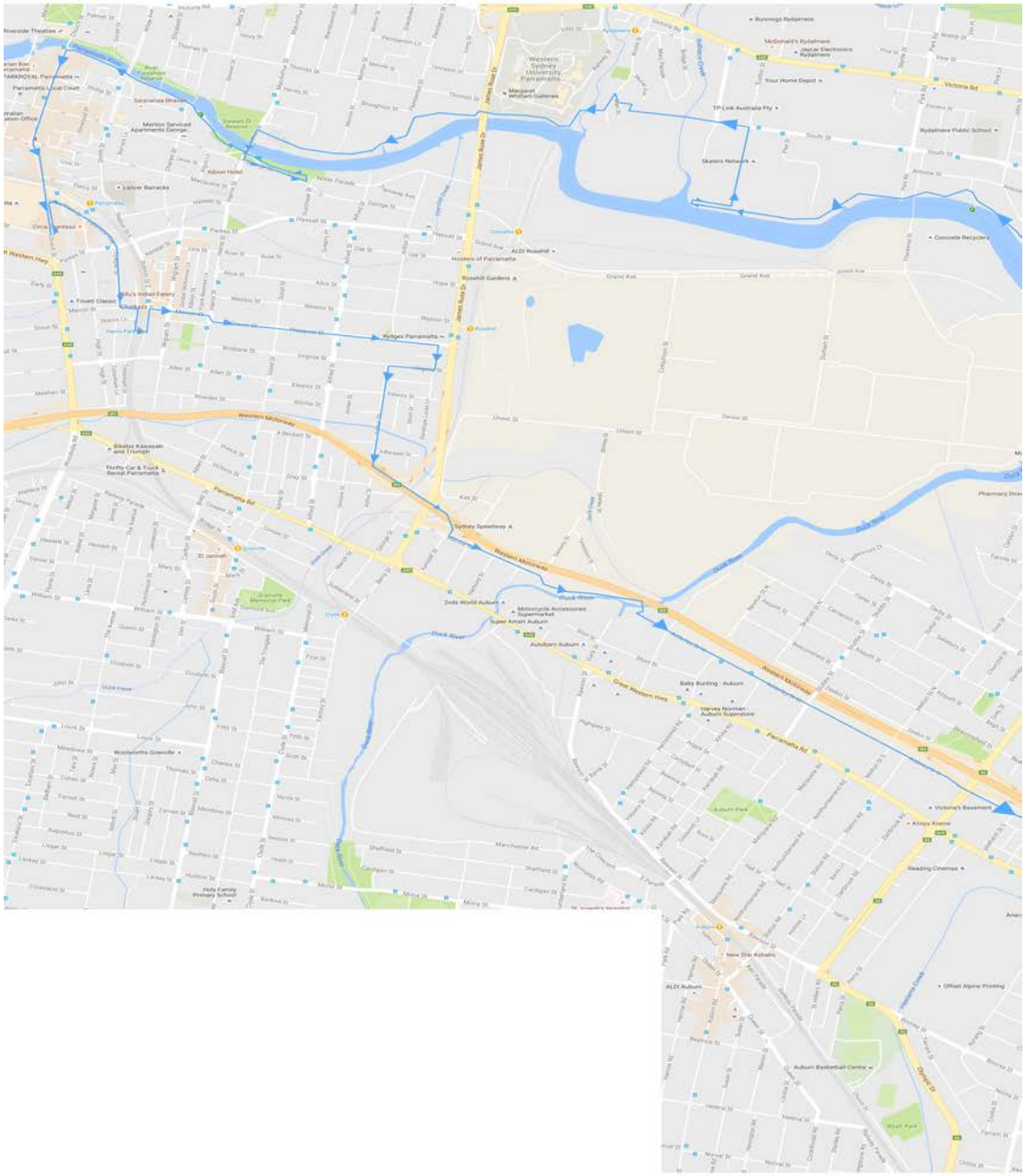

Figure A 5 Day 4 Route (Left)

Figure A 6 Day 4 Route (Right)

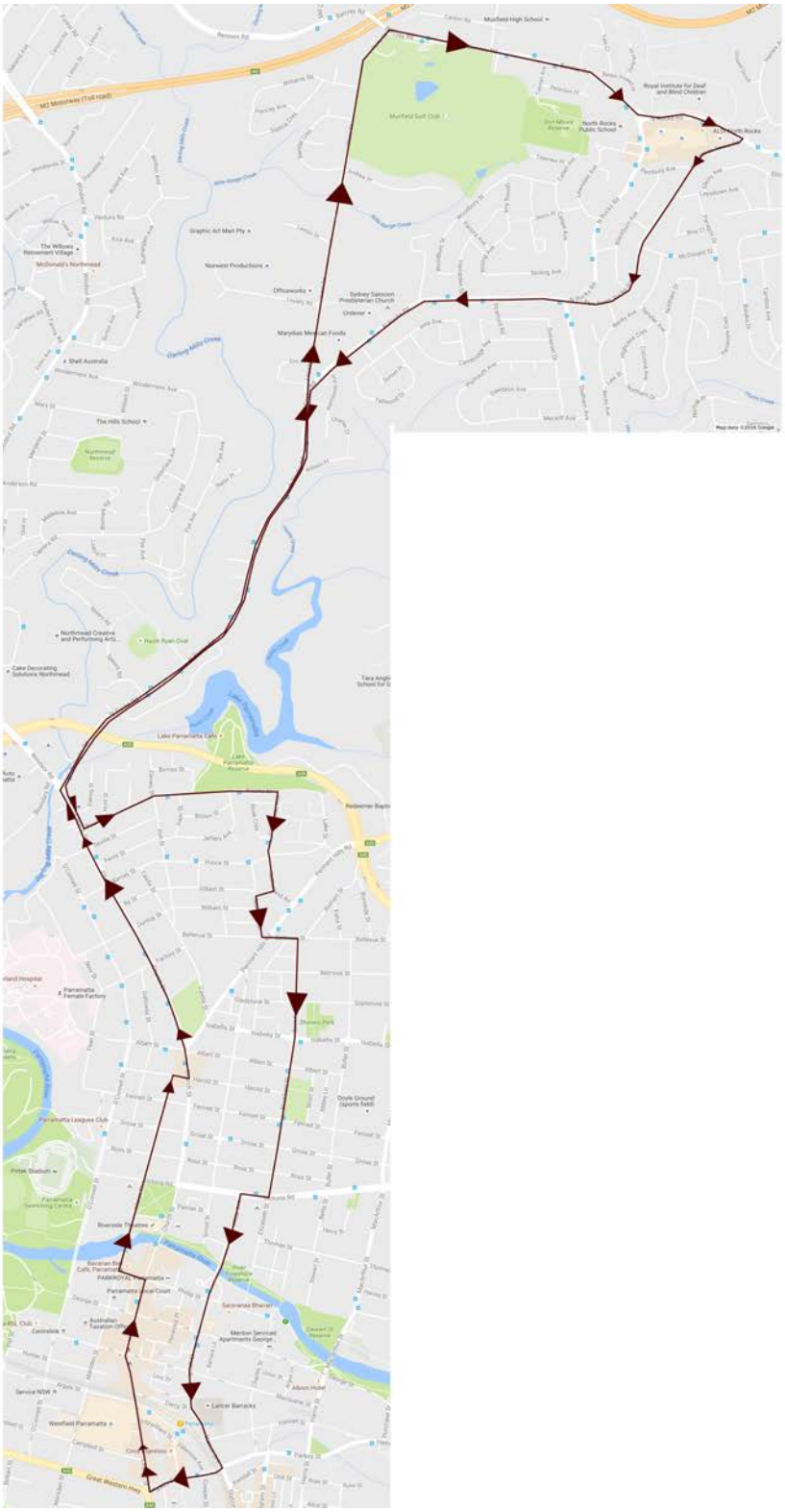

Figure A 7 Day 5 Route

7. References

Austroads. (2015). *Bicycle Wayfinding*. Retrieved from Sydney:
CROW. (2007). *Design Manual for Bicycle Traffic*. Ede: CROW.
Heinen, E., Maat, K., & van Wee, B. (2011). Day-to-Day Choice to Commute or Not by Bicycle. *Transportation Research Record*(2230), 9-18. doi:10.3141/2230-02
Hudson, M. (1982). *Bicycle Planning: Policy and Practice*: Architectural Press.