Beulah Road Bicycle Boulevard Norwood
Design Options and Traffic Impact

Client //	City of Norwood Payneham & St Peters
Office //	SA
Reference //	15A1266000
Date //	14/01/16

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Norwood

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Issue: A 14/01/16

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Quality Record

Issue	Date	Description	Prepared By	Checked By	Approved By	Signed
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1. Introduction

Further to the recent Elected Member's workshop, this report provides details of the background to the Beulah Road Bicycle Boulevard, including a review of the revised roundabout layouts, the preferred option design and the traffic and transport impact assessment.

2. Project Background

The recommendation for the development of a Bicycle Boulevard along Beulah Road was endorsed as part of the City of Norwood Payneham & St Peters (Council) City Wide Cycling Plan (Cycling Plan). The route was identified to form part of a network of Bicycle Boulevards supported by the Department of Planning Transport and Infrastructure (DPTI) as an approach that would improve safety and accessibility for cyclists and encourage a greater proportion of the population to cycle for work, education, social and leisure purposes. Specifically Beulah Road forms part of the proposed Norwood - Magill Bikeway proposed from Adelaide CBD to the foot of the Adelaide Hills.

The Cycling Plan identified Beulah Road as the most popular cycling route within the Council area, generating the most consultation feedback for requests for the cycling environment to be improved. As a result of this, Council has supported the development of Bicycle Boulevard design options for Beulah Road, which should take account of the following considerations:

- Treatments should minimise the loss of on-street car parking and ensure existing access to properties is maintained. Where any loss of on-street car parking is identified as part of a proposed design, the impacts of this on the surrounding properties, along with possible alternative solutions, needs to be clearly articulated;
- Treatments should have the dual benefit of improving pedestrian accessibility and safety;
- Build upon the excellent local connectivity offered by Beulah Road to The Parade District Centre;
- Consideration needs to be given to the nature and frequency of larger vehicles utilising Beulah Road to access local businesses (including the Norwood Place Shopping Centre) for deliveries etc.;
- Recommended treatments shall remove existing substandard bicycle lane markings to be replaced with appropriate line markings (which may include sharrows);
- Provide consistency in the "look and feel" of the Bicycle Boulevard, integrated with work being undertaken along Beulah Road in the City of Burnside and within Kent Town;
- An integrated and holistic approach to amenity, landscaping and public realm improvements in accordance with the *Streets for People Compendium;* and
- Design solutions should clearly detail the likely impact on the local area and adjoining streets to assist the Council in making an informed decision on the benefits and impacts of the proposal/s.

As an initial stage of the Norwood to Magill Bikeway, DPTI has upgraded the arterial road crossings at Fullarton Road and Portrush Road and has implemented alterations to the roundabouts along Beulah Road to reduce the speeds at which vehicles can enter and exit the roundabouts. DPTI is also currently developing a cyclist based directional signage strategy which includes Beulah Road and extends from the Parklands to Magill, which is expected to be implemented shortly.

3. Roundabout Design Review

3.1 Background

As part of the initial stage of the Beulah Road Bicycle Boulevard, DPTI implemented design changes to the 4 roundabouts along Beulah Road. The roundabouts had been identified as encouraging high vehicle speeds and the Sydenham Road roundabout in particular had a poor crash record for cyclists. The amendments, completed in early 2015 changed the roundabout from the traditional "tangential" design to the lower speed "radial" design. The "radial" design results in vehicles facing the central island when approaching the roundabout give way line rather than being directed on to the circulating carriageway. The design changes were achieved through enlarged central median islands and extended kerb-build outs.

Detailed traffic data in the form of 12 hour turning movement surveys and video at 2 of the roundabouts was collected by DPTI prior to the roundabout changes. A follow up program of post opening surveys is planned to be completed by DPTI in mid-2016, which will cover a similar scope. No mid-block traffic speed data has been obtained for Beulah Road following the changes to the roundabouts. Although changes to the mid-block speeds are not anticipated as a result of the roundabout changes, it is recommended that Council obtains updated data to supplement the 2013 surveys to both assist with the DPTI roundabout review and potentially as pre-implementation surveys in anticipation of the Bicycle Boulevard being implemented.

3.2 Design Review

In relation to the operation of the revised roundabout design, the following observations have been made with regard to traffic movements:

- Based on site inspections completed in October 2015, it appears the converted roundabouts have a significant impact on car speeds with cars slowing considerably on approach;
- Judging by tyre marks on the white painted kerb extensions and splitter islands, drivers have been slow to get used to the much narrower entry and exit points and entry alignment;
- There appears to be some damage to the new kerbing due to tyre/wheel impacts at a number of the intersections, notably George Street;
- Large vehicles appeared to require more space by using the central island apron and/or the kerb extensions as trafficable area, evidenced by tyre marks and limited observations; and
- Bicycles and pedestrians did not appear to be impeded and are assumed to be benefitting from slower speeds and wider splitter islands. Vehicles were regularly observed giving way to pedestrians when approaching the roundabouts as shown in Figure 3.1 below.

Figure 3.1: Vehicle and Pedestrian Operation on Beulah Road at Edward Street

However as evidenced above and on Figure 3.2 below, there is a need to enhance the road markings treatment to assist and legitimise bikes to merge with general traffic well in advance of the current merge point. This is considered further in relation to the design options for the Bicycle Boulevard.

Figure 3.2: Bicycle Positioning on Beulah Road

As indicated in Figure 3.2, existing cyclists are departing from the bike lane well before the road marking terminates in order to position themselves safely to enter the roundabouts. Exiting the bike lane as it terminates could result in cyclists being forced to wait for vehicles to pass or being cut off as vehicles turn on to the roundabout next to a cyclist.

Adjustments to this road marking have been identified as part of the Bicycle Boulevard design, which should assist in improving the positioning of cyclists and raising driver awareness of cyclists likely location within the roadway when approaching the roundabouts. This is in accordance with the recently released Queensland Transport & Main Roads Technical Note (TN 136, pages 13 and 15 attached as Appendix A) "Providing for Cyclists at Roundabouts". It also follows long standing approaches adopted in Victoria for safely accommodating cyclists on Bicycle Boulevard style

streets that advise cyclists and drivers on the correct positioning on the approach to a roundabout. This is shown from Pigdon Street in the City of Yarra, Victoria, on Figure 3.3.

Figure 3.3: City of Yarra Bicycle Boulevard Roundabout Markings

The QTMR Technical Note also recommends that such treatments could be supported by reductions in regulatory speed limits (TN136, page 18), although this is not currently identified as part of the Beulah Road Bicycle Boulevard scheme design.

As part of the changes to the roundabout designs on Beulah Road, it is considered that it would have been beneficial to provide educational signs and media attention to warn drivers of the "changed traffic conditions" and the need to further slow down due to the design changes. Although the revised roundabouts have now been in place for some months, such educational signage may still be pertinent. It is however considered essential that educational and informative signage is provided as part of the Bicycle Boulevard implementation program.

3.3 Further Reading and References

In additional to the QTMR Technical Note, Western Australia has also recently announced the development of a series of Bicycle Boulevards. The WA Department of Transport website provides background education and media programs and comprehensive information on Bicycle Boulevards within fact sheets, designs and animations. The website also includes concept designs for the current demonstration projects being developed in Bayswater and Mount Hawthorn. The website link is: http://www.transport.wa.gov.au/activetransport/safe-active-streets-program.asp.

There has also been some media coverage of the project: http://www.theage.com.au/wa-news/perths-bicycle-boulevards--where-cyclists-get-priority-over-cars-20151024-gkhn02.html.

WA will be hosting a national workshop to compare the recent Bicycle Boulevard programs, including the varying design concepts adopted in each jurisdiction and any before / after data that has been collected. It is recommended that Beulah Road should form part of that workshop and that data for formal monitoring and evaluation of the roundabouts is obtained and is put in place for the wider Bicycle Boulevard scheme once implemented. QTMR is seeking to complete a trial and monitoring of one of their schemes off the back of their recent Bicycle Boulevard design guide (TN136).

The full Technical Note 136 (Providing for Cyclists at Roundabouts) can be found at the following website address: http://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Technical-Notes/Technical-Notes-Index.aspx.

4. Initial Bicycle Boulevard Design Options

4.1 Potential Treatments

The Cycling Plan identified a number of potential treatments that could be considered for Beulah Road, noting that many of them would require the removal of on-street parking spaces. Initial options considered included:

- Mid-block kerb build-outs with landscaping as per Cycling Plan;
- Gateway treatments as per Cycling Plan;
- Threshold treatments and distinctive pavement;
- Slow points or two-way driveway links;
- Raised intersection tables;
- Road humps or raised mid-block tables;
- Removal of white lines delineating parking and centre lines;
- Pedestrian crossing requirements, particularly in relation to Norwood Primary School;
- Median treatments for Osmond Terrace;
- The use of on-road pavement markings with bicycle logos, arrows and directional sharrows;
- Landscaping opportunities; and
- Signage.

As one of the Council objectives was to minimise the loss of on-street car parking as a result of the Bicycle Boulevard, traffic management options that involved build-outs and other roadway narrowings, such as those referenced in Photo 45 of the Cycling Plan (reproduced below as Figure 4.1) have not been considered further. Whilst these would assist with speed management and streetscape amenity, the loss of at least 4 car parking spaces per treatment would not meet one of the Council's primary objectives.

Figure 4.1: Bicycle Boulevard Treatment from City-wide Cycling Plan

4.2 Considered Treatments

Treatments that have therefore been considered for the preferred option include:

- Gateway treatment and signage at Portrush Road entrance;
- Gateway signage at Fullarton Road entrance;
- Raised intersection tables that highlight the location of the intersection and grade to the existing kerb and gutter (as per Rundle Street example in Figure 4.2 below);
- Raised mid-block tables that grade to the existing kerb and gutter and therefore maintain parking and access (as per Figure 4.3 example below);
- Pedestrian Crossing adjacent to Norwood Primary School and Oval access;
- Threshold treatments which provide a continuous footpath treatment across the entry in to a road;
- Osmond Terrace median upgrades, including pedestrian and cyclist connections; and
- On-road pavement markings with bicycle logos, arrows and directional sharrows.

Figure 4.2: Raised Intersection Table at Rundle Street, Kent Town

Figure 4.3: Example of Raised Table Treatment with On-street Parking and Access Maintained

5. Preferred Option

5.1 General Treatments

The preferred option includes a combination of the treatments identified above and is summarised below and in Appendix B, along with photomontages. Inset plans are provided as part of the main plans showing additional detail of the key features and locations.

Along the length of the route the following is recommended:

- Removal of the existing centre line, bicycle lane and car parking lane line markings;
- Introduction of sharrow pavement markings at 45m intervals along Beulah Road;
- Introduction of sharrow pavement markings at the entry in to each of the roundabouts; and
- Distinctive pavement treatments for each roundabout side road entry to Beulah Road, which could include the use of pavers or imprinted bitumen or concrete.

Figure 5.1 below shows an example of the sharrow markings from the Outer Harbor Greenway in Croydon.

Figure 5.1: Sharrow Bicycle Pavement Markings

5.2 Specific Treatments

Location specific treatments, working from west to east are recommended as follows:

- Fullarton Road gateway signage and distinctive pavement;

- Short bike lane transition for improved roadway integration from the existing shared path on to the Bicycle Boulevard;
- Raised intersection table and distinctive pavement at Edmund Street;
- Raised intersection table and distinctive pavement at Runge Place and Charlotte Place;
- Mid-block raised table and distinctive pavement between Charlotte Place and Sydenham Road;
- Mid-block raised table and distinctive pavement between Sydenham Road and Woods Street;
- Raised intersection table and distinctive pavement at Woods Street;
- Wombat crossing adjacent to Norwood Primary School and Norwood Oval, resulting in the net loss of approximately 3 parking spaces following kerb reinstatement of redundant crossover;
- Raised threshold treatment entering Beulah Road (west) from Osmond Terrace;
- Kerb build-outs on Osmond Terrace to assist pedestrian crossing movements;
- Distinctive pavement and bicycle lane treatment on Osmond Terrace;
- Osmond Terrace median upgrade incorporating pedestrian and cyclist routes, surface paving, trees and landscaping;
- Raised threshold treatment entering Beulah Road (east) from Osmond Terrace;
- Mid-block raised table and distinctive pavement between Osmond Terrace and Edward Street;
- Mid-block raised table and distinctive pavement between Edward Street and George Street;
- Mid-block raised table and distinctive pavement between George Street and Queen Street;
- Mid-block raised table and distinctive pavement between Queen Street and Portrush Road;
- Eastbound bike lane between Queen Street and Portrush Road to enable cyclists to safely access the Portrush Road crossing; and
- Portrush Road gateway treatment including build-outs, signage, distinctive pavement and resulting in the loss of 1 parking space.

5.3 Signage

As noted above, DPTI is currently implementing a cycle signage strategy for Beulah Road as part of the wider Norwood - Magill Bikeway. The signage is anticipated to be similar to that used on the Outer Harbor Greenway as shown in Figure 5.1 above and will include travel distances and travel times by bicycle.

The signage will be provided at key locations along Beulah Road where route selection occurs or a specific destination is signed. It is anticipated that the DPTI signage will focus on wider destinations and adjoining suburbs and could include Adelaide CBD, Magill, Magill UniSA campus and Norton Summit.

This directional route signage is proposed to be supported by feature signage along Beulah Road. This will provide feature gateway signage and a similar theme at each of the local streets. This could provide an opportunity for more localised signage to the local streets and potentially the access routes to popular venues on The Parade and Magill Road. Local destinations that could be signed include The Parade Shopping Centre, including specific shops, Norwood Oval, local schools and the local street names.

5.4 Landscape

As part of improving the amenity of Beulah Road for residents, local users and commuters, a number of opportunities have been taken to enhance the landscape.

Around the proposed raised intersection tables, landscaped build outs have been incorporated within the areas adjacent to the intersection where parking is not permitted. These are proposed to be planted with low level vegetation to maintain appropriate sight distances.

Small landscape areas have been included adjacent to the Wombat crossing entry points near to Norwood Primary School and this has been extended towards Plane Tree Lane adjacent to which parking should also be restricted in accordance with recommended standards and guidelines.

A comprehensive landscape scheme has been developed for Osmond Terrace median that incorporates a number enhancements, including:

- Wider are more clearly defined pedestrian and cyclist crossing routes
- Pedestrian build outs on Osmond Terrace to reduce the crossing width
- Additional trees within the median; and
- A paved section of median with landscape beds

Gateway treatments including distinctive paving on the roadway, landscaping and signage have been developed for the Fullarton Road and Portrush Road entries to Beulah Road.

The landscape report is included as Appendix C.

6. Impact Assessment

6.1 Introduction

The proposed Bicycle Boulevard has been developed to achieve a lower speed environment within Beulah Road to enable cyclists and motor vehicles to safely share the available roadway. The potential impacts and benefits of the street functions are considered below.

6.2 Cyclists

Existing cyclist volumes on Beulah Road have been recorded at 179 in the AM peak period (7am to 9am) approaching the Fullarton Road intersection and 101 cyclists on Beulah Road, Beulah Park crossing the Portrush Road intersection for the same time period. Slightly lower numbers are recorded for the PM peak period (4 to 6pm) in each location. Cycling participation numbers and trends will continue to be monitored, with the next bike count to occur in mid- March 2016.

The revised street environment within Beulah Road is anticipated to encourage increased use of the route by cyclists for commuting, education, social and leisure purposes. The general reduction in traffic speeds, resulting in a lower speed difference between the majority of vehicles and cyclists is expected to provide a safer environment for less confident cyclists. As well as the major use as a commuting route to Adelaide CBD, it is anticipated that the route could encourage more local cycling access to The Parade, Magill Road, Norwood Primary School and local businesses in the area.

The overall level of increase in cycling activity will also be dependent on the completion of safe cycling connections along the whole of the proposed Norwood-Magill Bikeway, of which Beulah Road will form part.

6.3 Parking

Minimising the loss of on-street parking was a key objective of the Bicycle Boulevard due to the overall pressure on parking in this area from a number of sources. A summary of the results of parking occupancy surveys undertaken on Tuesday 23 June 2015, Thursday 25 June 2015 and Saturday 04 July 2015 on Beulah Road is included as Appendix D.

The preferred option is anticipated to result in the loss of up to 4 parking spaces, as follows:

- 1 parking space on the north side associated with the Portrush Road gateway treatment;
- 3 parking spaces around the proposed Wombat crossing adjacent to Norwood Primary School and Norwood Oval.

The parking spaces between Portrush Road and Queen Street recorded the lowest parking occupancy of all sections of Beulah Road, with an average occupancy of 43% and a peak occupancy of 50% on weekdays/Saturdays. The removal of one space is not therefore considered to impact on the amenity or availability of parking.

The parking spaces adjacent to Norwood Primary School are more heavily used. An average occupancy of 95% was recorded on the north side, peaking at 100% at school pick up time. During the surveys much of the south side parking was not available due to footpath works. The south side survey results are not therefore representative at only 45% average occupancy and this is likely to have increased the demand for parking on the north side. The surveys are not

therefore representative of typically conditions, although observations indicate that parking demand is generally high in this area and 80 to 90% occupancy is likely during weekday daytime periods.

The provision of the pedestrian crossing on Beulah Road may therefore have some impact on parking availability for this section, with a potential net reduction of 3 spaces. During the daytime much of this parking is understood to be occupied by school staff for whom there may be opportunities to utilise the Greek Church car park, with whom the school already has an agreement. The proposed crossing will provide a safe crossing point for school parents who currently park in the Greek Church car park. In addition, the crossing is expected to assist in encouraging increasing levels of walking and cycling to Norwood Primary School from the local residential areas and will assist pedestrian access and safety to Norwood Oval, the Greek Church and St Bartholomew's Church.

6.4 Vehicle Speeds and Journey Times

The existing speed environment on Beulah Road indicates average speeds around 43-45 km/h and 85th percentile speeds of around 50 km/h, which is the current speed limit. These speeds are heavily influenced by the existing spacing of the roundabouts and the closed median on Osmond Terrace.

The proposed Bicycle Boulevard treatments seek to achieve a desirable 85th percentile speed environment of 30 km/h and a maximum of 40 km/h. This target speed environment is intended to be achieved by the proposed design treatments and the sharing of the carriageway between motorists and cyclists, with no proposals to change the regulated speed limit along Beulah Road.

An assessment of the travel times between Portrush Road and Osmond Terrace and Osmond Terrance and Fullarton Road has been completed based on vehicles accelerating up to 30, 40 and 50 km/h from the various intersections and then decelerating to observe the relevant traffic controls at the next intersection. The table below shows the estimated travel times for each speed environment.

Table 6.1: Travel Time Variations with Different Speed Environments

Route Section	Travel Time based on Top Speed (secs)		
	30 km/h	40 km/h	50 km/h
Portrush Road to Osmond Terrace	106 seconds	92 seconds	80 seconds
Osmond Terrace to Fullarton Road	95 seconds	78 seconds	65 seconds

The above travel times reflect free flow conditions on Beulah Road and do not include additional delays that could be expected to influence total travel times for all speed environments as a result of;

- waiting for a gap to exit onto Fullarton Road or Portrush Road;
- queuing at Fullarton Road or Portrush Road;
- waiting for vehicles parking/unparking or otherwise manoeuvring on Beulah Road; and
- giving way to vehicles at the intermediate roundabouts.

The section between Portrush Road and Osmond Terrace could increase travel times by up to a maximum of 26 seconds with a reduction in the speed environment from 50km/h to 30km/h. The actual increase in travel time will be less of an impact on this section due to the proximity of the roundabouts. As a result of the roundabouts, a speed of 50km/h is not typically achieved for very long on each section and this is reflected in current speeds with only around 15% of vehicles recorded reaching mid-block speeds of 50 km/h.

Reducing the speed environment to 40km/h, which is not significantly below the current average mid-block speed recorded of around 44 km/h would be expected to increase travel time by a maximum of 12 seconds between Portrush Road and Osmond Terrace. Overall given current speeds and the likelihood of additional delays, it could be expected that on average vehicles would incur around 10 seconds additional travel time and that most vehicles would incur less than 20 seconds additional travel time.

The section between Osmond Terrace and Fullarton Road could increase travel times by up to a maximum of 30 seconds with a reduction in the speed environment from 50km/h to 30km/h. This is due to the longer distances either side of the Sydenham Road roundabout. Reducing the speed environment to 40km/h from 50km/h would increase travel time by up to a maximum of 13 seconds. As with the section east of Osmond Terrace, current average speeds are around 44 km/h and around 15% of vehicles exceed 50 km/h. Most vehicles would therefore be expected to incur less than 20 seconds additional travel time and on average around 10 seconds additional travel time.

The anticipated increases in journey times as a result of the changed speed environment along Beulah Road are not expected to result in significant diversion of traffic. This is discussed further below in consideration of the traffic volumes on Beulah Road.

6.5 Traffic Volumes

Current traffic volumes range from around 4,600 vehicles per day between Queen Street and George Street to 2,200 vehicles per day west of Osmond Terrace. Given that Beulah Road does not provide a complete through route from Portrush Road to Fullarton Road, it is anticipated that much of the traffic will be seeking to access the local area. Some through traffic seeking to avoid congested intersections is expected to route between Portrush Road and Osmond Terrace and Osmond Terrace/Sydenham Road to Fullarton Road.

The anticipated change in traffic speeds and journey times noted above is not in itself expected to change the attraction of the route in comparison to existing, and likely congested, alternatives.

The recent changes to the roundabout speed environments and the introduction of the raised tables may however result in a change in the overall perception of the route as a travel option. Some reduction in traffic volumes may occur as a result of this perception, although as the alternatives are likely to remain congested, this reduction is expected to be small and most likely less than 5% of traffic volumes, or approximately 15 vehicles in the peak period.

Locally the adjacent alternatives to Beulah Road would be Magill Road and The Parade or for local streets, Dover Street to the north and William Street to the south. Apart from the Dover Street option, all of the other alternative routes would require vehicles to travel through and additional arterial road intersection or make an additional right turning movement at a congested arterial road intersection on Portrush Road. The potential impact on these routes is therefore expected to reduce over time as Beulah Road, even with the recommended treatments and speed environment changes, remains the most attractive and time efficient route.

6.6 Sydenham Road signal changes

The presence of a left turn arrow on the traffic signals at Sydenham Road and Magill Road has been identified as a potential encouragement for traffic to use Sydenham Road and Beulah Road as an alternative to continuing on Magill Road and turning on to Fullarton Road.

Observations at the traffic signals have indicated that during the left turn arrow phase, very few vehicles turned left. This is primarily due to the left hand lane being a shared ahead and left turn lane, with vehicles wishing to travel straight ahead holding up left turners. The left turn arrow phase is also relatively short and typically less than 15 seconds.

However, the left turn proportion is much higher in the AM peak hour (29% of westbound traffic) when compared to the 12 hour, 7am to 7pm, period (15% of total traffic). This indicates that there may be some rat-running traffic avoiding the traffic signals at Magill Road and Fullarton Road, although a proportion of this traffic is likely to be accessing the commercial properties in this area of Norwood, including along Beulah Road. The proposed Bicycle Boulevard treatments may discourage some of this traffic from using Beulah Road and remaining on Magill Road or considering the use of routes such as Chapel Street. Further investigation, including registration matching surveys, would be required to more accurately estimate the traffic that may be affected.

6.7 Pedestrian Amenity

The proposed Bicycle Boulevard measures along Beulah Road would be expected to result in a general reduction in vehicle speeds, supporting the vehicle speed reductions that have been achieved with the changes to the roundabout design. The lower vehicle speeds on approach to and, to a lesser extent, exit from the roundabouts, together with the improved pedestrian median refuges, will have enabled pedestrians to feel safer when crossing Beulah Road. The roundabouts are anticipated to provide the majority of crossing activity along Beulah Road, linking to The Parade and Magill Road.

Lower vehicle speeds in the mid-block sections would assist pedestrians that wish to cross mid-block, creating a general improvement of the amenity and social value of the street. However, this crossing demand is generally anticipated to remain low as there are few mid-block pedestrian access routes and destinations.

The proposed pedestrian crossing adjacent to Norwood Primary School and along the Osmond Terrace footpaths will improve the pedestrian safety and amenity for these routes where the pedestrian demand along Beulah Road is generally highest. The pedestrian crossing adjacent to the school will also assist with pedestrian access to Norwood Oval, St Bartholomew's Anglican Church and the Greek Church. The proposed pedestrian crossing has also been included as a recommendation of the City wide Schools Traffic and Parking Review, on which community consultation has recently taken place.

The proposed landscape treatments at the Portrush Road gateway, Osmond Terrace median and on the verges adjacent to the intersection raised tables will also create an improved amenity and ambience for the adjoining sections of footpath.

6.8 Residential Amenity

The extended raised tables have been identified as a mid-block treatment to assist with vehicle speed management in preference to traditional road humps or speed cushions. As well as being able to provide a design format that maintains kerb side parking, the profile of the raised areas creates significantly less vehicle noise than shorter road humps. The road surface level is raised by 100mm with entry and exit gradients of 1 in 15, which provides a smoother transition from the adjacent road surface, resulting in less severe braking by vehicles on approach. The raised tables are also a minimum of 6m long, which means that vehicles will have both wheels on the raised

table at the same time. This reduces the vertical bouncing of the vehicle, which occurs with road humps where each set of wheels crosses the entirety of the road hump separately.

This combination of less severe braking on approach and the reduced vertical bouncing results in significantly lower noise impacts than occurs with traditional road humps and speed cushions.

7. Summary

The proposed Beulah Road Bicycle Boulevard forms part of the wider Council and DPTI projects to create an identified cycling network within local streets that encourages more of the population to consider cycling for commuting, education, leisure and social purposes. The proposed treatments for the section of Beulah Road between Portrush Road and Fullarton Road complement the recent work completed by DPTI, Council and the City of Burnside Council upgrading the Beulah Road roundabouts to achieve lower vehicle speeds, Rundle Street raised table and bike lane upgrades, Fullarton Road and Portrush Road crossing provision and bicycle treatments on Beulah Road and Cuthero Terrace within the City of Burnside.

The review of the recently implemented roundabout design has identified the following points:

- There is typically significant kerb impact on the build-outs, including damage to some kerbs at George Street and Queen Street, as drivers adjust to the revised layout;
- Observations indicate that drivers are approaching and travelling through the roundabouts at reduced speeds; and
- The existing bike lane markings do not position cyclists appropriately on approach to the roundabouts and cyclists are generally moving from the bike lanes well before they terminate. This will be addressed with the Bicycle Boulevard designs.

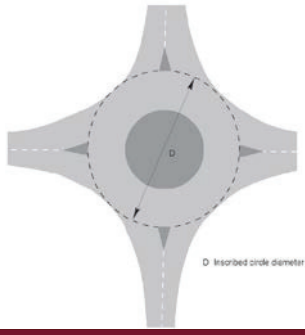
The preferred treatments identified for the Beulah Road Bicycle Boulevard to support the wider Norwood-Magill Bikeway are anticipated to achieve the following:

- A local street that is likely to encourage increased levels of cycling;
- Improved bicycle pavement markings and signage that assist cyclist safety and navigation;
- An improved street environment and amenity, particularly around Osmond Terrace median;
- A reduction in the general speed environment along Beulah Road to between 30 and 40 km/h with no regulatory speed limit changes introduced, but resulting in journey time increases below 20 seconds for the majority of vehicles;
- An improved environment for local pedestrians to support access to and from The Parade and Magill Road;
- The loss of only 4 parking spaces, 3 of which are associated with safety improvements for pedestrians around Norwood Primary School, resulting in minimal impact on parking; and
- Minimal impact on traffic and parking outside Beulah Road as a result of the limited changes in travel times and lack of attractive alternative routes.

Appendix A

Excerpt from Queensland Transport and Main Roads Technical Note 136 (Providing for Cyclists at Roundabouts)

5 Basic Geometric Groups

B1 - Single Lane Approaches (Tangential geometry)	
	
Guidelines	
• As per *Road Planning and Design Manual*[27]	
Consider bicycle treatments where	• Combined AADT of all approaches exceeds 6000, and • Approach speed limit exceeds 40 km/h.
Avoid	• In urban areas near schools. • Locations frequented by the elderly or people with disabilities. • Elliptical central islands.
Advantages	• Low angle of incidence reduces motor vehicle collision severity. • 5 m wide approach lanes can allow cyclists to queue jump during congested periods.
Disadvantages	• Limited motor vehicle speed control at crossing conflict points, speeds greater than 50 km/h result in high probability of a fatal crash if a vulnerable road user is involved. • 5 metre lane width flare at entry can be difficult for cyclists to claim the lane. • Late motor vehicle deceleration can prohibit cyclist integration on approach. • Entering driver attention may be focused on vehicles about to enter on the adjacent approach if they expect high speed potentially conflicting vehicles, cyclists present on the circulation lane may be overlooked when driver attention is focused elsewhere. • Drivers may misjudge cyclist speed or perceive there is enough road width available to push past.
Other Considerations	• Early acceleration allowed by generous exit geometry allows drivers to quickly attain their desired speed but reinforces driver expectation that the intersection is over, just when path users are about to cross. • This expectation might increase the probability of rear end crashes associated with a downstream priority crossing and reduce driver likelihood of giving way.
Possible Retrofit Treatments	• Refer Table 4.2 for suggested treatments by context. • Apply selected facilities from the “Awareness Toolbox”. • Apply selected facilities from the “Speed management Toolbox”. • Apply selected facilities from the “Transition Toolbox”. • Apply selected facilities from the “Conflict Management Toolbox”. • Bicycle lanes should be terminated on approach at a point where equitable car-bicycle speeds are achieved.
Additional References	• Austroads *Guide to Road Design* Part 4B. • Austroads *Guide to Traffic Management* Part 6.

6 Treatment Details

6.1 Awareness Toolbox

A1 - Bicycle awareness zone	
 *River Street, Mackay, QLD (Edited Photo: Mark McDonald)*	
Guidelines	
• As per *TRUM Volume 1 Part 10, Section 6.5-1*	
Where to Use	• On approaches and within the circulation of roundabouts with mixed traffic. • At the transition zones on approaches to roundabouts. • Symbol must be located in the centre of the lane.
Avoid	• As a standalone treatment. • Locating the symbol near the left hand edge.
Advantages	• Reminds drivers of cyclist presence in queue and circulation. • Does not increase entering lane width assisting control of motor vehicle entering speed.
Disadvantages	• Pavement markings may be obscured by queued vehicles. • May not be appealing to “interested but concerned” user groups.
Other considerations	• People do not see what they are not looking for, treatments to raise driver awareness and expectations should support safety. • Symbols located in the centre of the lane may receive less wheel wear and last longer.
Additional References	• Austroads *Guide to Traffic Management* Part 6.

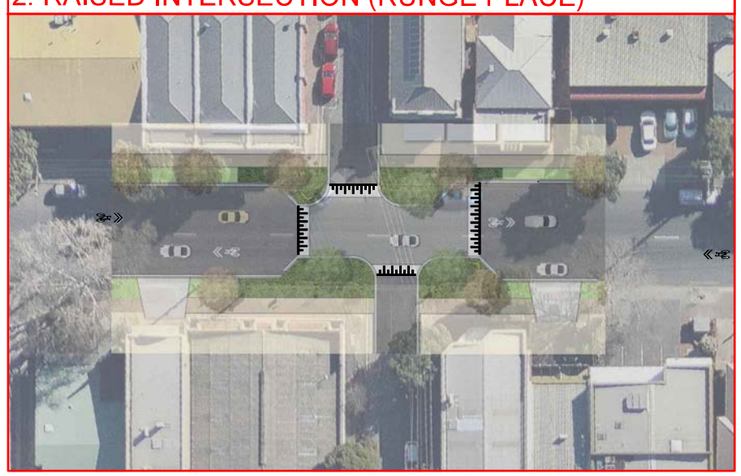
Appendix B

A3 Plans and Montages

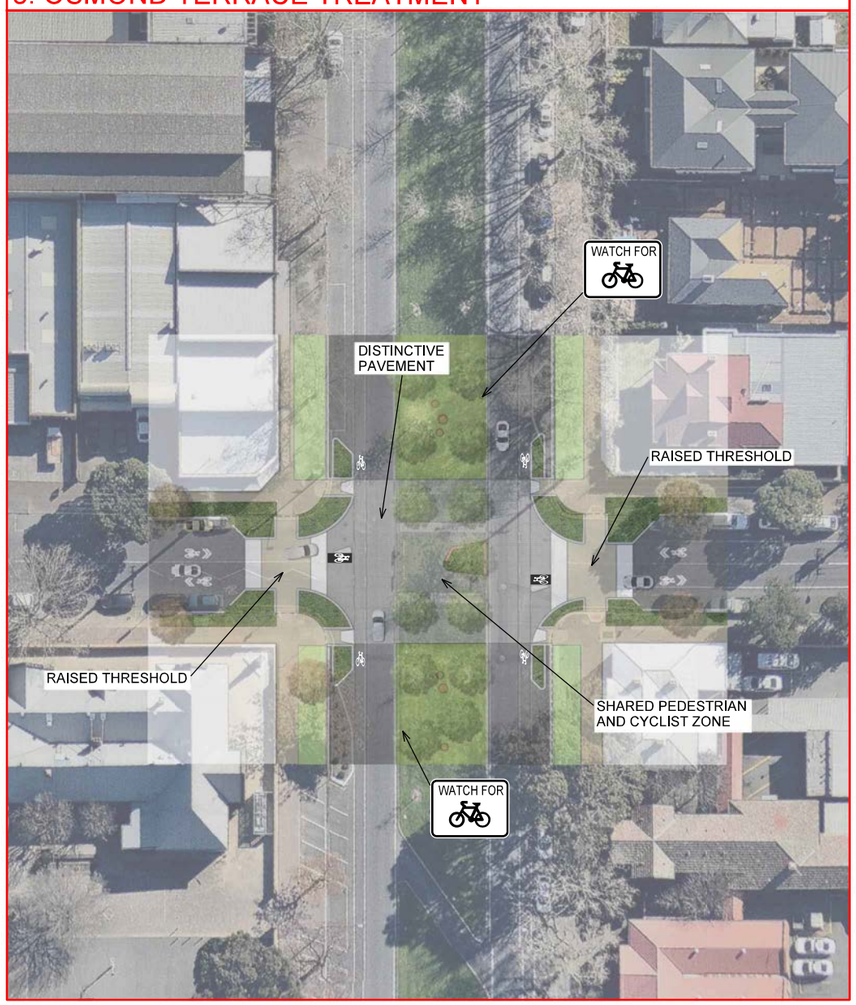
PROPOSED BICYCLE BOULEVARD, BEULAH ROAD

1. FULLARTON ROAD GATEWAY TREATMENT

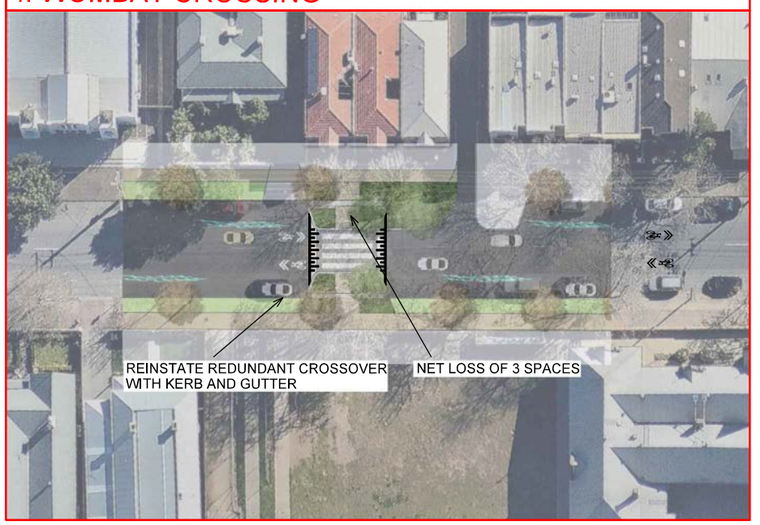
2. RAISED INTERSECTION (RUNGE PLACE)



3. OSMOND TERRACE TREATMENT



4. WOMBAT CROSSING



PRELIMINARY PLAN
FOR CONSULTATION PURPOSES

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GTA consultants
www.gta.com.au

BEULAH ROAD BIKE BOULEVARD
FULLARTON ROAD - OSMOND TERRACE

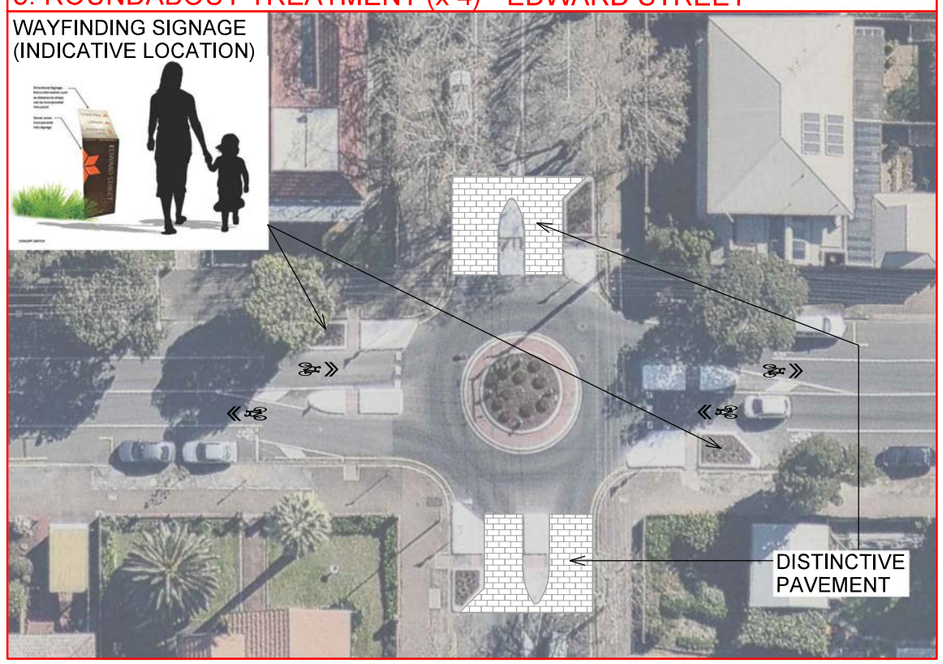
BEULAH ROAD, NORWOOD
NORWOOD, PAYNEHAM & ST PETERS

DATE	SCALE	INSET SCALE
14 JANUARY '16	1:2250 @ A3	1:750 @ A3
DESIGNER: R. FRIMPONG	DRAWING NO.: SKETCH 01 OF 02	

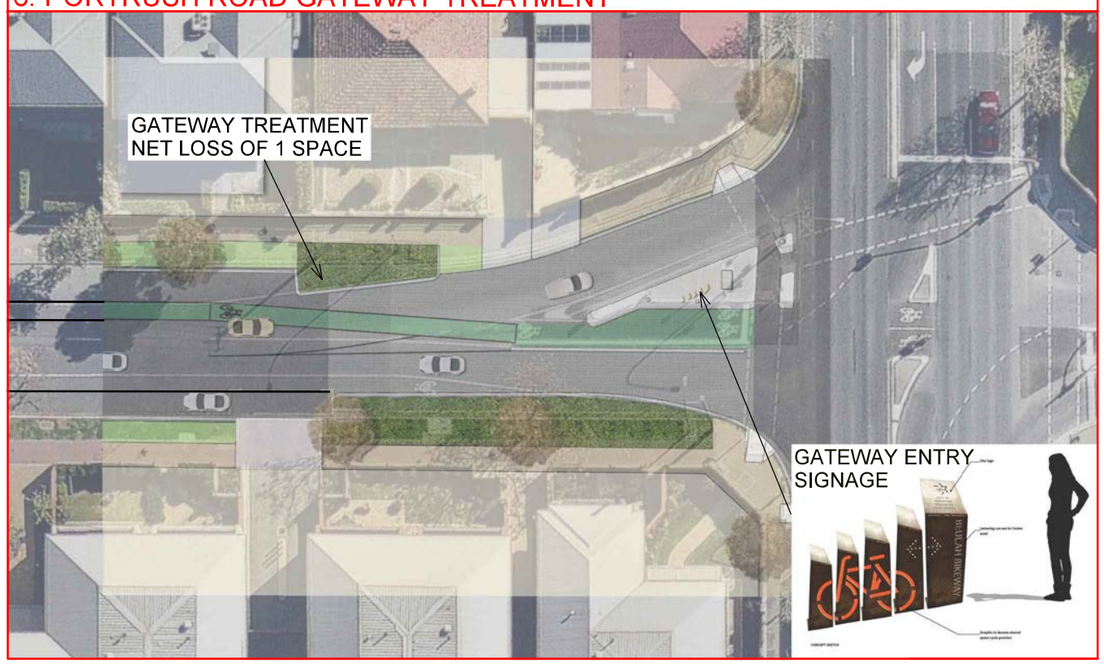
PLOTTED BY : Richard.Frimpong ON 14/01/2016 AT 1:18:43 PM

PROPOSED BICYCLE BOULEVARD, BEULAH ROAD

5. ROUNDABOUT TREATMENT (x 4) - EDWARD STREET



6. PORTRUSH ROAD GATEWAY TREATMENT

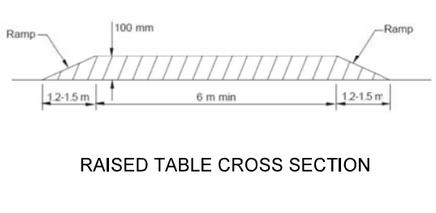


N

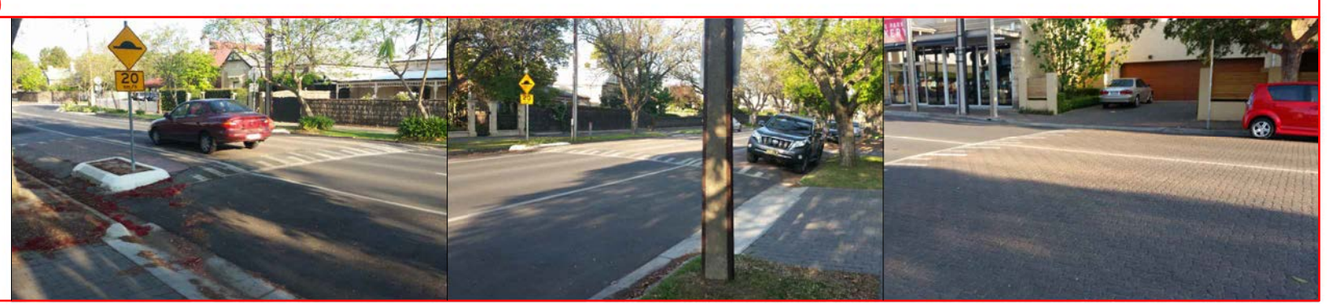
PRELIMINARY PLAN

FOR CONSULTATION PURPOSES

7. MID-BLOCK RAISED TABLE (x 6)



RAISED TABLE CROSS SECTION



GTA consultants
www.gta.com.au

BEULAH ROAD BIKE BOULEVARD
OSMOND TERRACE - PORTRUSH ROAD

BEULAH ROAD, NORWOOD
NORWOOD, PAYNEHAM & ST PETERS

DATE	SCALE	INSET SCALE
14 JANUARY '16	1:2250 @ A3	1:500 @ A3
DESIGNER: R. FRIMPONG	DRAWING NO.: SKETCH 02 OF 02	

PLOTTED BY : RichardFrimpong ON 14/01/2016 AT 1:19:07 PM


Knight Frank
CHARLOTTE PLACE

Appendix C

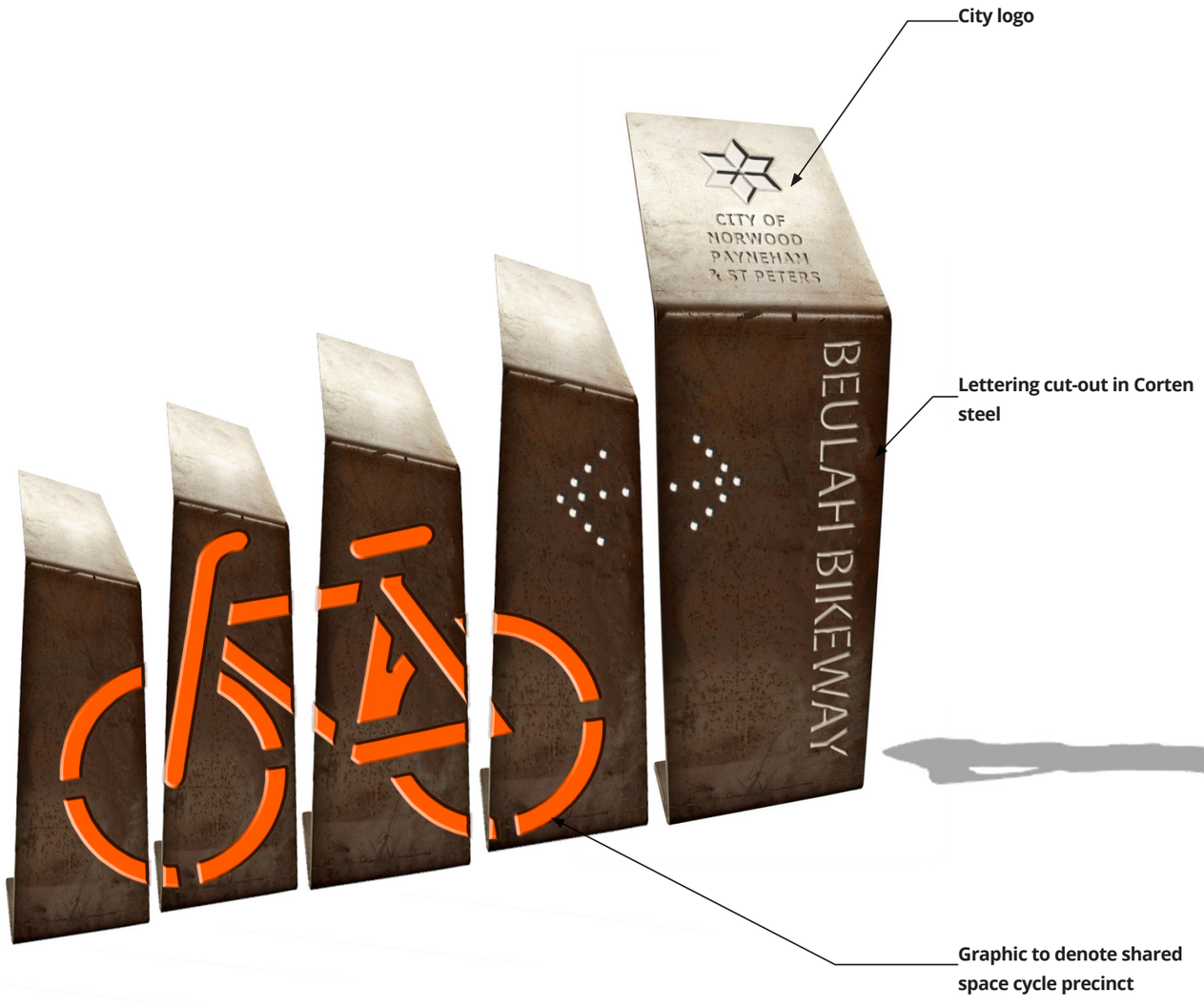
Landscape Report

Beulah Road Bikeway
Landscape Concept

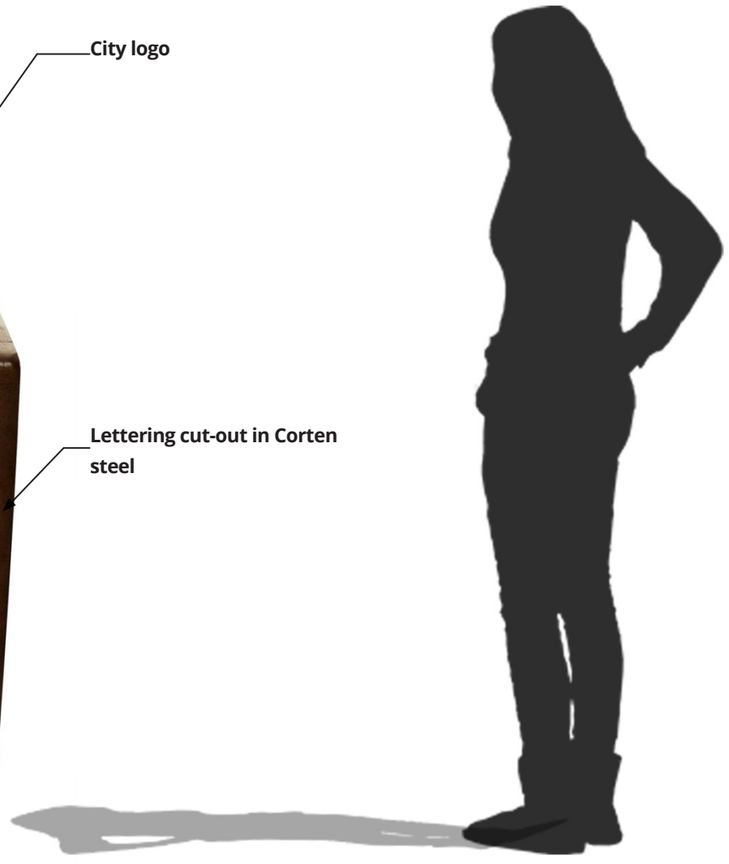
Prepared for: City of Norwood, Payneham & St Peters
Reference: 15035
Date: January 2016

ASPECT Studios™
ASPECT Studios Pty Ltd ABN 11 120 219 561

Gateway Signage



CONCEPT SKETCH



Vision

To create an Entry statement located at the Portrush Road and Fullarton Road ends of Beulah Road.

A series of repeated corten 'totems' which draw people into the precinct. A visual cue for motorists to slow down and share the road with cyclists.

DRAFT

Wayfinding Signage

CONCEPT SKETCH

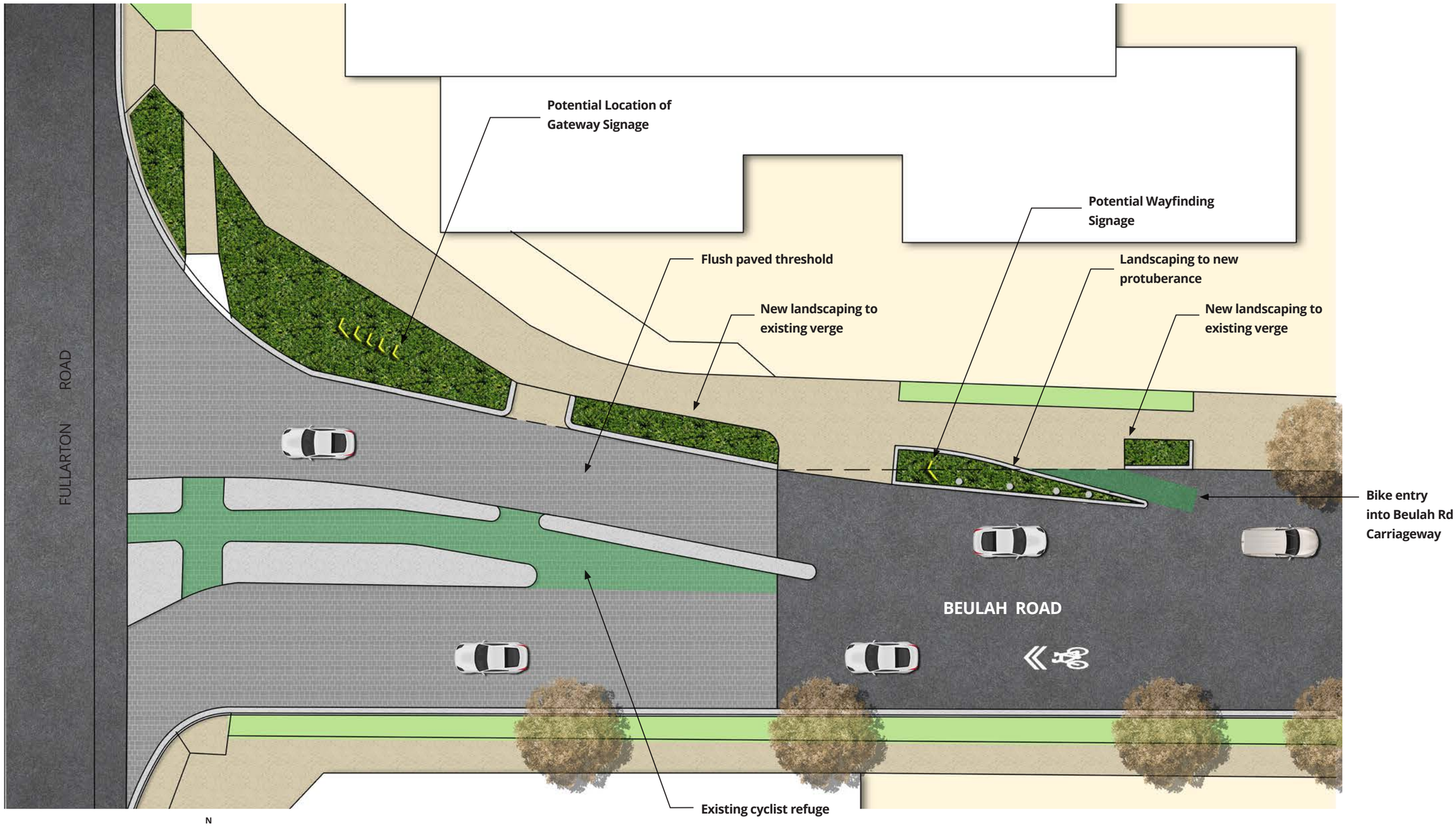
Vision

Creation of a suite of signage in-keeping with the character of the precinct. Intermediate wayfinding signage at key points along the precinct to direct cyclists and pedestrians to shopping precincts.

Wayfinding can also be incorporated into seating elements at meeting points/ gathering nodes along Beulah Road

DRAFT

Fullarton Road



PLAN | SCALE 1:200 @ A3

DRAFT

Typical Threshold Treatment

PLAN | SCALE 1:200 @ A3

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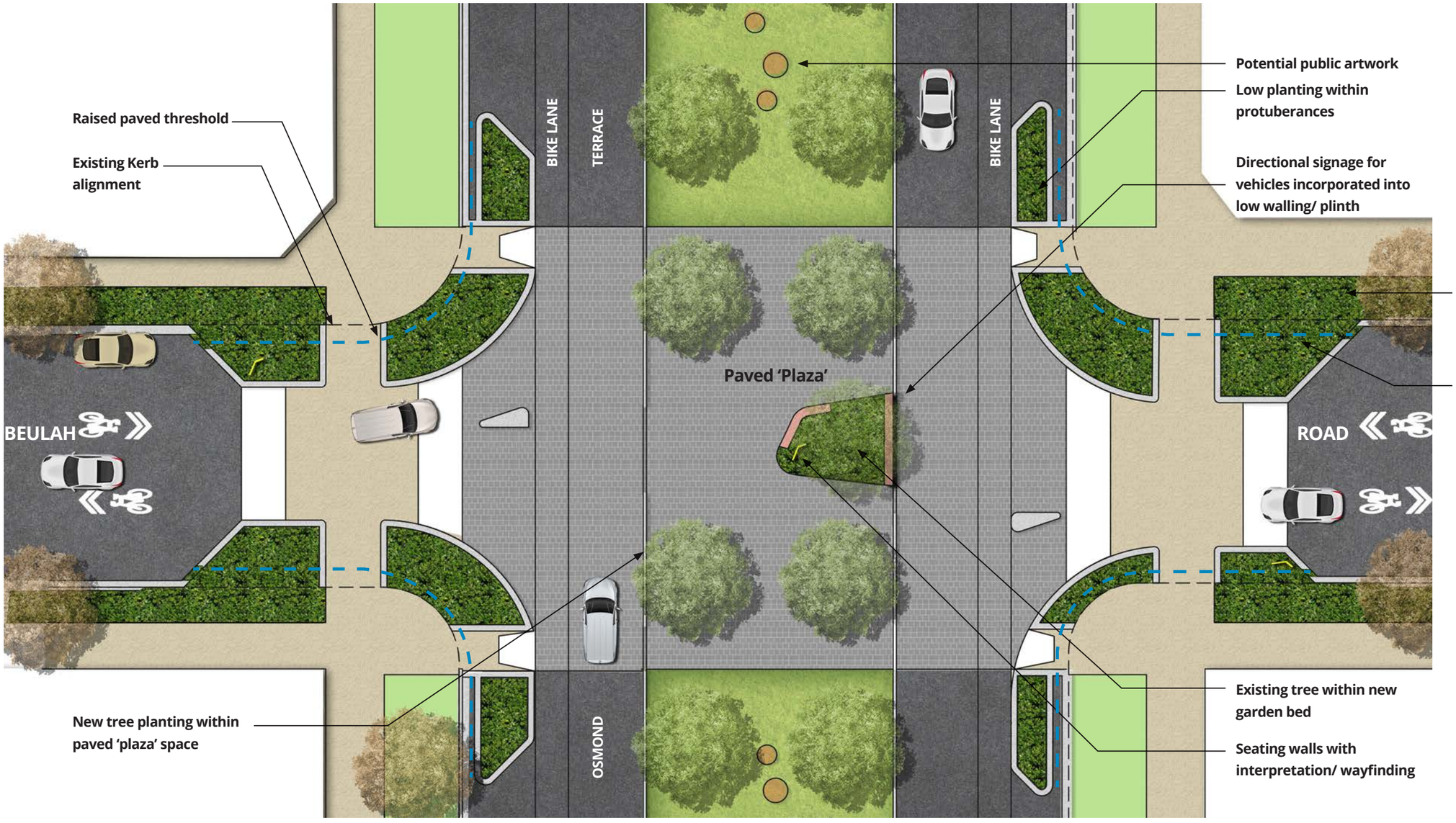
DRAFT

Threshold Treatment - Perspective View

DRAFT

Osmond Terrace

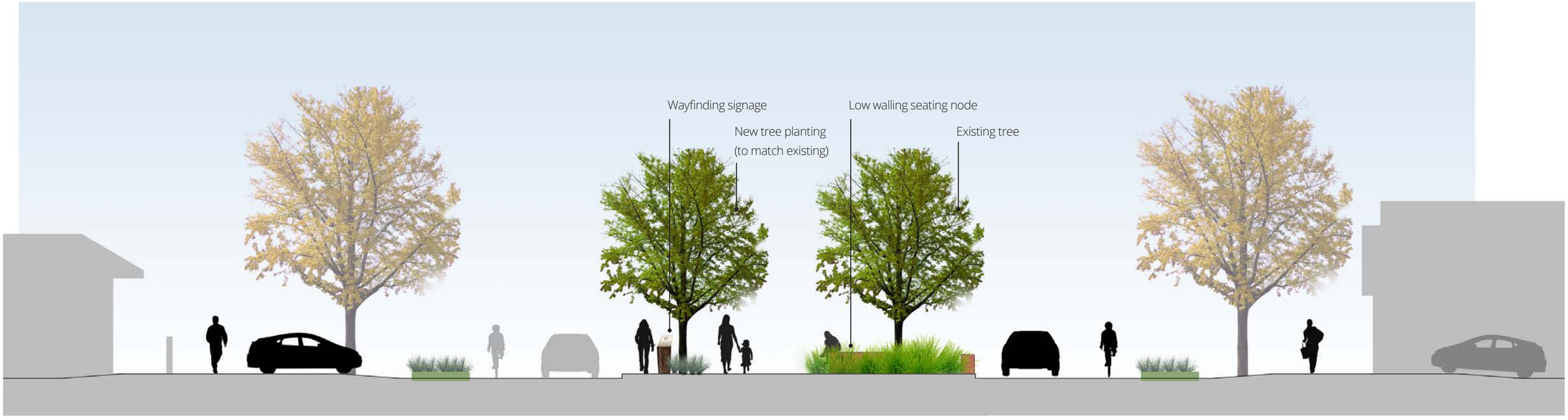


PLAN | SCALE 1:200 @ A3

N

DRAFT

Osmond Terrace - 'Plaza'



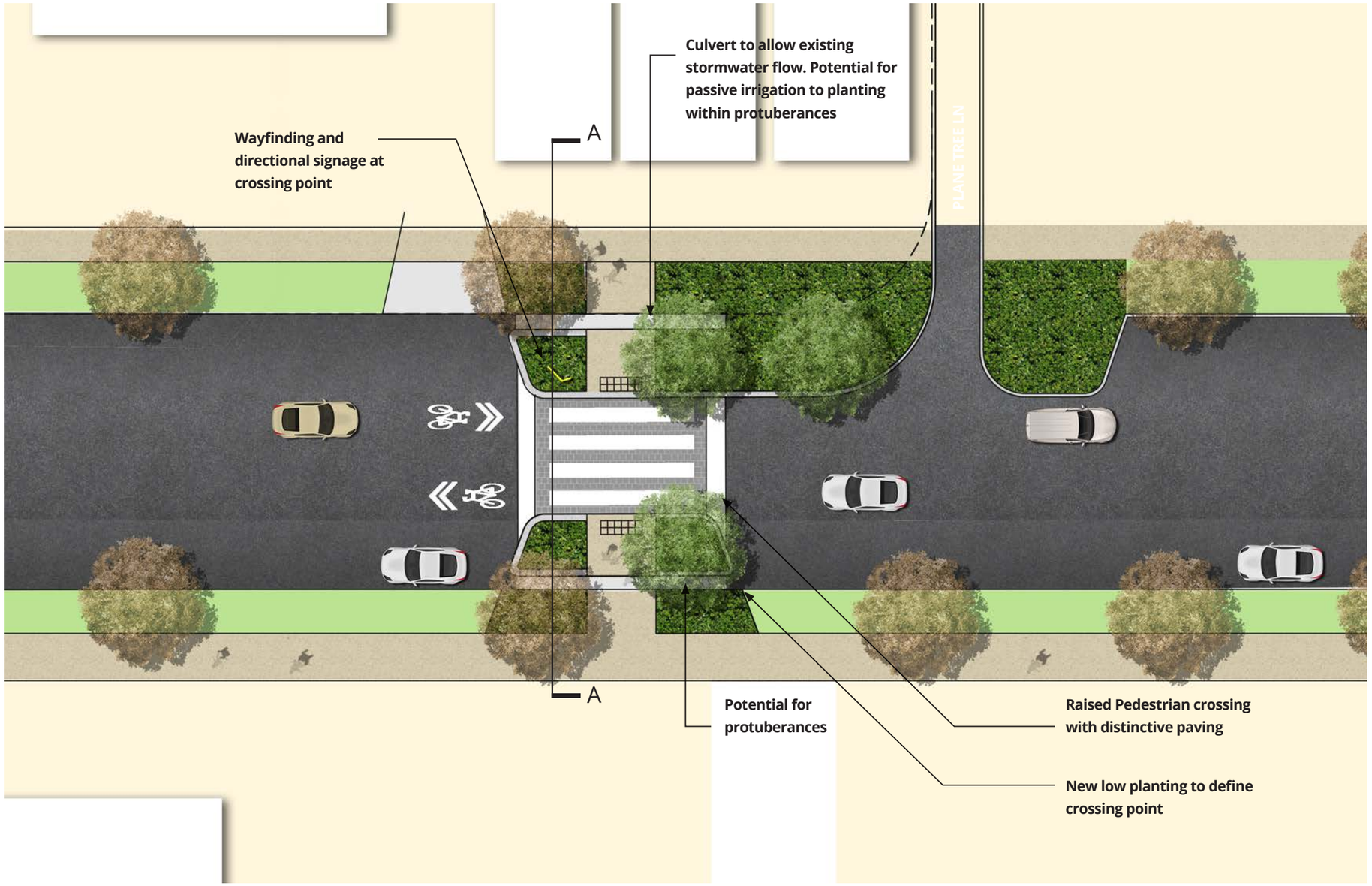
LONG SECTION THROUGH OSMOND TERRACE MEDIAN | N.T.S.

DRAFT

Osmond Terrace - Perspective View

DRAFT

Pedestrian Crossing Point



PLAN | SCALE 1:200 @ A3

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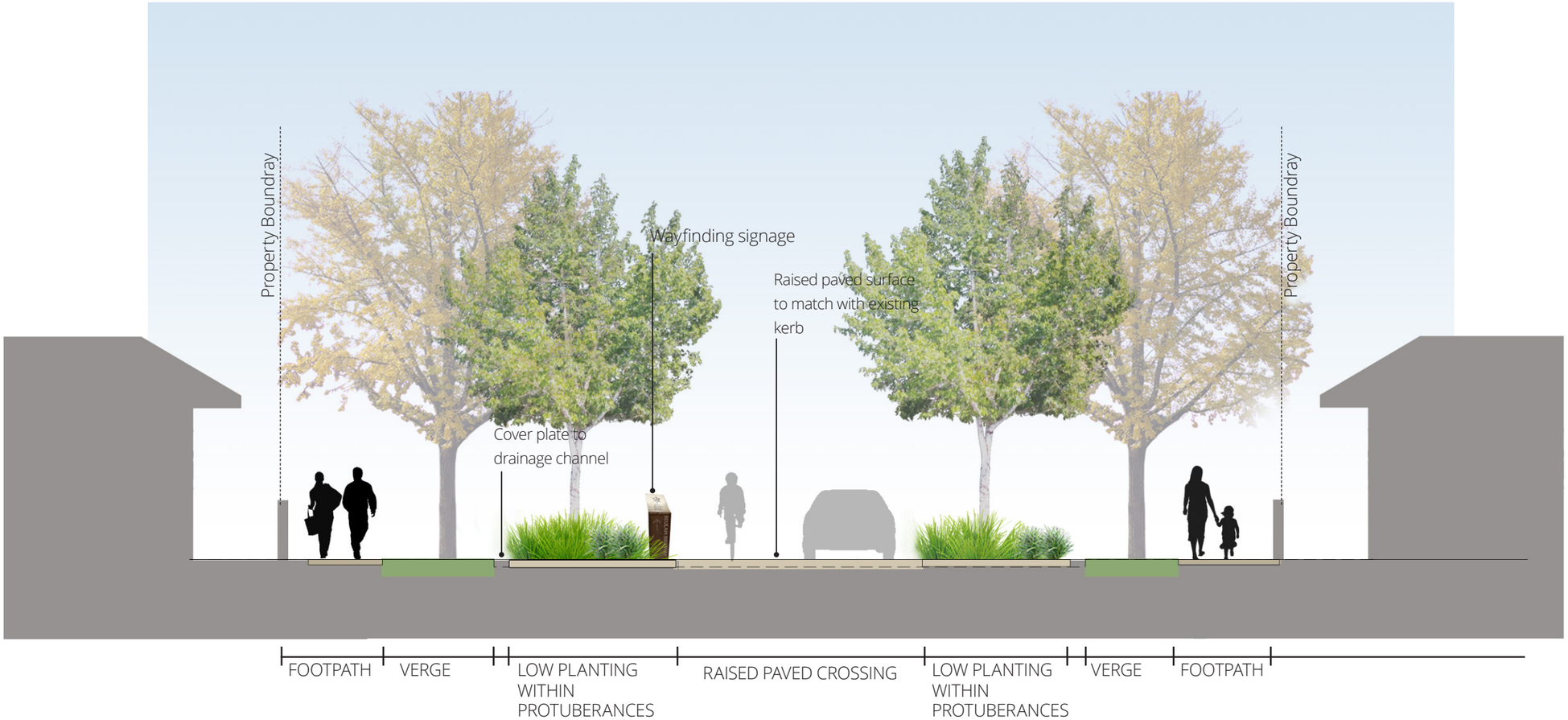
DRAFT

Pedestrian Crossing Point



SECTION A : A | SCALE 1:100 @ A3

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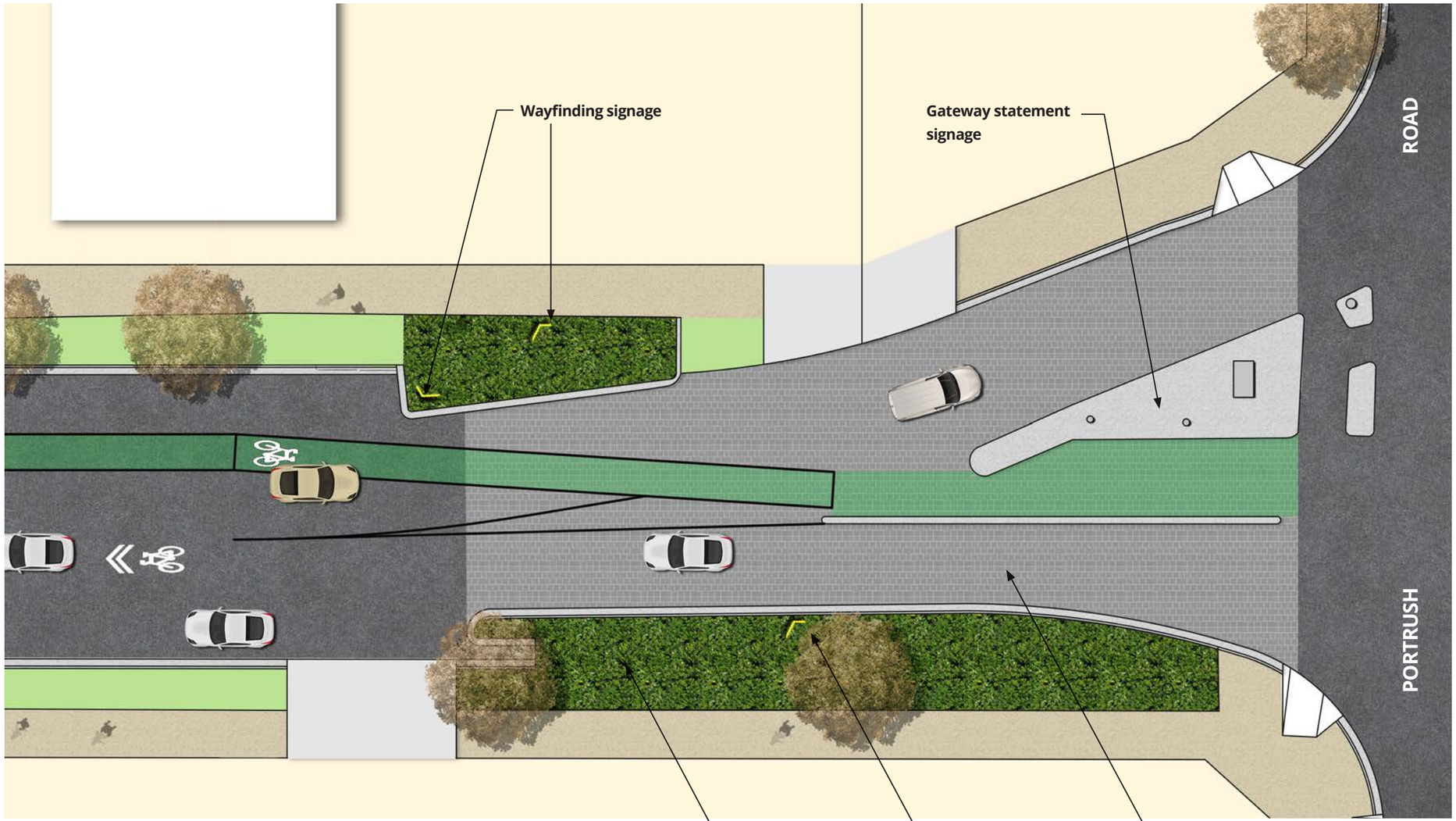
Portrush Road



PLAN | SCALE 1:200 @ A3

DRAFT

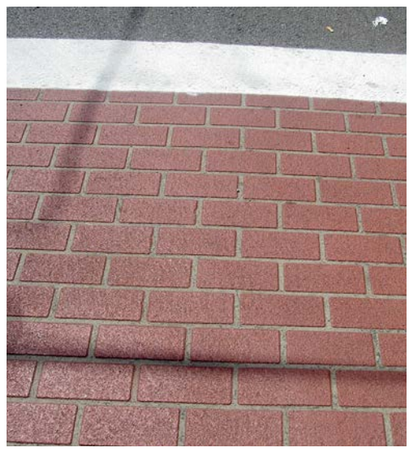
Precedent Images - Surface Treatments

TACTILE INDICATORS

TACTILE INDICATORS

TACTILE INDICATORS

IMPRINTED CONCRETE THRESHOLD TREATMENT



'PATTERN PAVE' THRESHOLD TREATMENT

TACTILE INDICATORS

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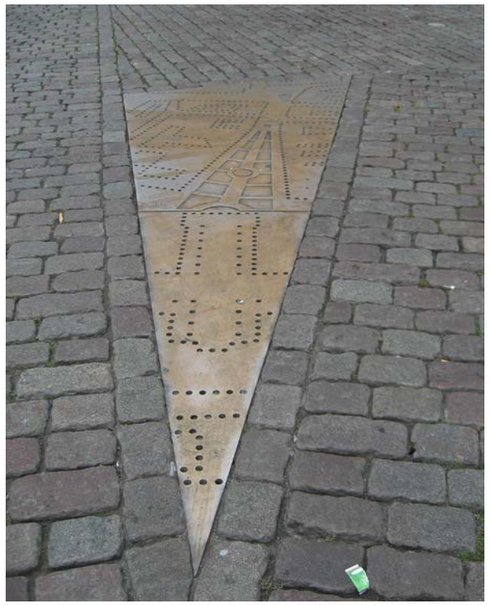
Precedent Images - Signage and wayfinding

TOTEM WAYFINDING SIGNAGE



SIGNAGE INTEGRATED INTO SURFACE

TACTILE INDICATORS

PAINTED SURFACE TREATMENT

DRAFT

Appendix D

Parking Survey Summaries

Section 1 - Portrush to Queen																
		Tues AM			Tues Lunch			Tues PM			Thurs Night			Saturday			Avg Weekday
	Spaces	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	% Occupied
North side	14	6	8	43%	7	7	50%	7	7	50%	1	13	7%	6	8	43%	48%
South side	16	4	12	25%	6	10	38%	7	9	44%	0	16	0%	7	9	44%	35%
Total	30	10	20	33%	13	17	43%	14	16	47%	1	29	3%	13	17	43%	41%

Section 2 - Queen to George																
		Tues AM			Tues Lunch			Tues PM			Thurs Night			Saturday			Avg Weekday
	Spaces	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	% Occupied
North side	20	7	13	35%	15	5	75%	13	7	65%	6	14	30%	17	3	85%	58%
South side	20	12	8	60%	18	2	90%	17	3	85%	6	14	30%	19	1	95%	78%
Total	40	19	21	48%	33	7	83%	30	10	75%	12	28	30%	36	4	90%	68%

Section 3 - George to Edward																
		Tues AM			Tues Lunch			Tues PM			Thurs Night			Saturday			Avg Weekday
	Spaces	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	% Occupied
North side	16	8	8	50%	11	5	69%	13	3	81%	3	13	19%	14	2	88%	67%
South side	19	13	6	68%	15	4	79%	14	5	74%	8	11	42%	17	2	89%	74%
Total	35	21	14	60%	26	9	74%	27	8	77%	11	24	31%	31	4	89%	70%

Section 4 - Edward to Osmond																
		Tues AM			Tues Lunch			Tues PM			Thurs Night			Saturday			Avg Weekday
	Spaces	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	% Occupied
North side	20	16	4	80%	17	3	85%	16	4	80%	10	10	50%	19	1	95%	82%
South side	15	14	1	93%	12	3	80%	13	2	87%	12	3	80%	14	1	93%	87%
Total	35	30	5	86%	29	6	83%	29	6	83%	22	13	63%	33	2	94%	84%

Section 5 - Osmond to Woods																
		Tues AM			Tues Lunch			Tues PM			Thurs Night			Saturday			Avg Weekday
	Spaces	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	% Occupied
North side	19	18	1	95%	17	2	89%	19	0	100%	10	9	53%	18	1	95%	95%
South side	23	11	12	48%	10	13	43%	10	13	43%	5	18	22%	8	15	35%	45%
Total	42	29	13	69%	27	15	64%	29	13	69%	15	27	36%	26	16	62%	67%

Section 6 - Woods to Sydneham																
		Tues AM			Tues Lunch			Tues PM			Thurs Night			Saturday			Avg Weekday
	Spaces	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	% Occupied
North side	17	14	3	82%	13	4	76%	14	3	82%	9	8	53%	15	2	88%	80%
South side	20	18	2	90%	17	3	85%	14	6	70%	10	10	50%	17	3	85%	82%
Total	37	32	5	86%	30	7	81%	28	9	76%	19	18	51%	32	5	86%	81%

Section 7 - Sydneham to Runge																
		Tues AM			Tues Lunch			Tues PM			Thurs Night			Saturday			Avg Weekday
	Spaces	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	% Occupied
North side	17	14	3	82%	16	1	94%	9	8	53%	1	16	6%	14	3	82%	76%
South side	18	14	4	78%	12	6	67%	9	9	50%	2	16	11%	17	1	94%	65%
Total	35	28	7	80%	28	7	80%	18	17	51%	3	32	9%	31	4	89%	70%

Section 8 - Runge to Fullarton																
		Tues AM			Tues Lunch			Tues PM			Thurs Night			Saturday			Avg Weekday
	Spaces	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	Occupied	Avail	% Occ.	% Occupied
North side	10	7	3	70%	4	6	40%	8	2	80%	5	5	50%	4	6	40%	63%
South side	18	16	2	89%	15	3	83%	15	3	83%	2	16	11%	6	12	33%	85%
Total	28	23	5	82%	19	9	68%	23	5	82%	7	21	25%	10	18	36%	77%

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