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Cycling for the Environment, for Health, for Pleasure

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King William Road Bikeway

The Bicycle Institute of SA has represented the state's utility cyclists for over forty years. Being able to choose cycling and walking for transport is key to developing strong, connected, liveable and healthy communities that can adapt to challenges and capitalise on opportunities.

As an advocacy organisation whose aims are compatible with environmental, health and societal goals of all levels of government, we are delighted that the City of Unley is consulting on options for improving King William Road for cyclists, and pleased to provide our support and advice regarding the project. We acknowledge previous investment in this section of King William Road but, as your consultation mentions, there are deficiencies that have prevented the route achieving its full potential.

While both proposals have clearly involved much consideration, the Bicycle Institute's preference would be for the on-road separated bike lanes (Option 1), for reasons outlined below.

- Not all cyclists using King William Road originate from or are heading to the Mike Turtur Bikeway. Indeed, only about half of current usage originate from the Bikeway. Further south, King William Road provides north-south access through Unley compared to the north-east/south-west access provided by the Bikeway and, given the urban form in the area, the Bikeway cannot substitute as a north-south route. Directing all northbound cyclists onto a shared path is problematic, as we discuss below.
  We would not find acceptable the alternative that on-road cyclists are given no facilities. This would downgrade the level of service and safety currently provided, and we would suggest that downgrading traffic service is more acceptable, given that all levels of government have increasing cycling as a priority but no level of government has increasing driving as a priority.
- Off-road paths designated for shared use have their own issues with pedestrians, particularly when volumes of walkers and/or cyclists are high, tidal and/or concurrent; generally being a second-best result in these conditions. The separate project to widen the Mike Turtur Bikeway as far as Goodwood Road to 4m is aimed at addressing exactly these issues. Joining on-road cyclists to Bikeway cyclists results in a total demand twice as high as current Bikeway numbers. In these conditions, we feel that anything less than a 6m wide shared path would be inadequate. This is before pedestrian volumes are considered – noting that walking to work is more common closer to the City than farther away – or the impact of a bus stop or parking. And if 6m of path width were available, we would prefer the design to feature a separate footpath and two-way bicycle path, for the comfort of both pedestrians and cyclists.
  We further note that a matching (4m or 6m wide) shared path is not provided on Peacock Road, and that pedestrians waiting to cross King William Road would be in conflict with through cyclists. We observe that traffic signals are located in the existing footpath and query whether this would be relocated as part of the project – a not inconsiderable cost item. If not, it would form a further compromise.
- We understand that Adelaide City Council may be considering changing its Peacock Road bike lanes to buffered bike lanes (i.e. where cyclists are 'buffered' from traffic by car parking). This would match into on-road facilities in King William Road better than the shared path option.

However, we must also note that we have several concerns about the concept design which, as it stands, would prevent us from endorsing this draft. These are expanded upon with detailed design advice submitted over the following pages. This advice includes consideration of alternatives or options for achieving outcomes, several different priorities, and some points that would be detailed for the current design stage. We would be open to and appreciate the opportunity to work with the City of Unley in its decision-making around how some of these issues are addressed.

Overall, we see a great opportunity for the current project to deliver an excellent outcome to cyclists, pedestrians and the broader City of Unley community. Thank you for inviting us to help you achieve this vision.

Finally, just a word of advice that at its last AGM, the Bicycle Institute of South Australia voted to change its name to Bike Adelaide. We are currently working through the administrative details but hope to be in a position to launch our new branding by early next year. The new name has been adopted to better reflect BISA's identity to the cycling community and does not represent a change in our activities; we look forward to many more years of fruitful collaboration with the City of Unley.

Yours sincerely,

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Detailed Design Advice

Our design feedback is structured in terms of some broad operational aspects, then comments reflecting the northern and southern sections of the design, as reflected in cross-sections provided for sections A and B.

Operational aspects

1. Access to the north-east Park Lands path

A significant desire line exists between King William Rd and the Park Lands path on the north-east corner of the Greenhill Rd intersection. For northbound cyclists, this involves a right turn or two part north then east crossing. Neither manoeuvre is convenient.

In fact, an alternative is available. We urge that the use of this be encouraged, to improve convenience for cyclists and reduce demand on the subject section of King William Rd.

- A north-south path intersects the path some 110m east of King William Rd. This leads to a seagull island with cyclist refuge in Greenhill Rd and into Roberts St. Roberts St crosses Park Ln, providing access to King William Rd and the Mike Turtur Bikeway for southbound cyclists. However, the four-way intersection and then T-junction of Park Ln with King William Rd slows cyclists' travel. As such, and to also cater to northbound cyclists, the continuing route along Miller St/Young St, with a crossing of King William Rd into Trevelyan St, is our preferred option. This connects to the Mike Turtur Bikeway via a narrow path at what is currently a blind corner – which should be remedied by the Mike Turtur widening plan.
- A refuge crossing of King William Rd is needed, and widening of the Trevelyan path, which is about 1.5m wide and 20-25m long. Replacing the sleepers alongside the garden beds with a thinner edging product would help and the eastern threshold could be widened. Further path widening would require a more detailed examination.
- Signage indicating the route is required at both the path intersection in the Park Lands and on the Mike Turtur at Trevelyan St path.

The hook turn storage box provided for both Option 1 and Option 2 is a nice detail to assist north/eastbound cyclists to undertake a right hand turn, either into this path or Greenhill Rd more generally. We support its inclusion, however this location and size only allows for one hook-turning cyclist. We suggest that this be extended with an adjacent forward storage area.

2. Signal control

There is an obvious conflict between northbound through cyclists and westbound left-turning cars. Phasing to manage this is not shown. We understand that left-turns can occur when through movements are not allowed, at which point cyclists are held. However, the left-turn when through movements are allowed is more problematic. We would assume that phasing will hold cyclists while allowing left-turns and vice versa, depending on the most efficient phasing. The acceptability of this acknowledges that cyclists will get additional opportunities for through movements when trams run, but noting that a 10-minute tram frequency in both directions only occurs in peak and that trams coinciding reduces the through opportunities, hence left-turn needs cannot override a minimum level of service being provided for cyclists.

We would like to see a repeater bike light provided on the signals on the southern side of the intersection as bicycle lights are small and can be difficult to see, especially for queued cyclists.

For southbound cyclists, southbound traffic can lead to lengthy delays in being able to cross King William Rd to turn into the Mike Turtur Bikeway. We would like to see some examination of timing issues and whether changes to signal control could assist in reducing cyclist delays at this location.

Northern end: Section A

3. Southbound car lanes

The southbound car lanes at section A are very generous, and this is at a point some 50m from Greenhill Rd, where the lane widths are even wider still. We could assume that the large lane widths are related to the turning circles for cars turning right from Greenhill Rd, however we strongly query whether such wide lanes are required.

Road widths for double right turn lanes with a more acute angle appear to result in narrower departure lanes at Hampstead Rd/Muller Rd/Regency Rd. Compared to these arterial roads, King William Rd is not a through route, and we cannot see any justification for such wide lane widths. Indeed, Peacock Rd does not have similarly wide departure-side lane widths, despite having very similar angles and double right turn lanes into it from Greenhill Rd. Too generous lane widths have the effect of encouraging inappropriately high speeds and compromising the street design and amenity for other road users.

Option 1 shows 3.6m (median-side) and 3.6m (kerb-side) lanes. These should be reduced, with spare space given to other road users. Peacock Rd appears to have a total width of some 6.0m, but a total width of up to 6.5m might be desirable/ feasible for King William Rd. In particular, some design improvements are limited to within a short distance of Greenhill Rd, where (as noted) the road width appears to be larger than section A would indicate.

4. Southbound (eastern) bicycle lane

We support a bicycle lane separated by a kerb from traffic, as per option 1, compared to a wider but painted separator in option 2. However, we note that for cyclists to be able to overtake within a separated facility, a minimum width between kerbs of 2.0m is required plus 0.2m clearance to upright kerbs (see attached Charette Design discussion paper prepared for Adelaide City Council's Frome Bikeway and related comments in the following section regarding separator profile.)

The separator should extend to the start of the car parking, with a break (and zebra markings across the bike lane) at the pedestrian refuge location.

At least the section of bike path from Greenhill Rd to the commencement of car parking south of Park Ln be should be coloured green. This will help to highlight the facility to drivers turning from Greenhill Rd and into/out of Park Ln. We suggest a 'Streetprint' form of product[1] over Park Ln itself, to preserve the green colouration in this high-scrub location.

BISA conducted trials of (essentially) mountable kerbing using the Sturt St facility some years ago. A low-profile yellow mountable kerb product placed 1-2m on the approach side of the yield line at side streets significantly increased car compliance with the yield requirement. We suggest use of this in Park Ln. (This product was not a 'speed hump' form of product and readily traversed by vehicles.)

5. Separator profile

This is a fine detail but has important implications and is not clear from the concept plans.

We strongly advise that 100mm high kerb separators be provided with a laid-back profile, as per (say) back-to-back kerb or median kerbing, rather than the upright profile typically provided for footpaths.

- The laid-back profile provides more 'comfort' to cyclists, who react to the presence and design of kerbing due to the dangers of a pedal striking the kerb ('pedal strike').
- ACC's experience with the first Frome Rd design was that drivers misjudged the upright kerb, even when this was arguably analogous to footpath kerbing, and ACC had to grind back kerbing to address

[1] As used on side streets along Goodwood Rd. A honeycomb or paver pattern would be adequate, but a floral/vine pattern would also deliver a degree of improved amenity and is a 'standard' Streetprint pattern.

complaints regarding striking of car undercarriages. With a minimum 0.3m wide separator, a car overhanging the kerb would not intrude into the bike lane.

With a laid-back kerb, a clearance of 0.1m could be acceptable.

An approach more compatible with addressing pedal strike would be to provide only the first and last sections of separator (i.e. eastern side: at Greenhill Rd, Park Ln; Park Ln, car parking; western side: bus loader and Greenhill Rd) at a height of 100mm. These sections are where traffic is most likely to intrude into the bike lane. In comparison, at intermediate sections of separator, traffic travelling parallel with these sections are unlikely to inadvertently mount it. These could be provided with a height of 50mm due to this lower separator role. This approach might be taken because a 50mm kerb height does not form a pedal strike hazard and no clearance is necessary, however such intermediate lengths need to be provided in reasonable lengths for overtaking to be feasible between narrower sections. A 50mm height separator should **not** have a laid-back profile.

A short section of 0.5m wide, 100mm high separator would be desirable between the left turn lane and through traffic lane on the northbound approach to Greenhill Rd. This is a location with a heavy left turn movement and cyclists waiting for a green light may 'prop' with a foot on the median separator. This is relevant where the bike lane is forward of the car yield line and about 6m (a car length) on the approach to this. In this section, an upright (footpath-style) kerb profile would ensure that any propping occurs further from the car lane.

6. Northbound (western) bike lane

The 2.5m protected bike lane width on the western side is welcomed.

Nonetheless, given possible width constraints, we could tolerate this being reduced to 2.4m if it is demonstrated this is the only way more pressing width priorities could be met, and subject to the separator having a laid-back profile or 50mm height.

Given that the footpath kerb will be replaced, we would also recommend that the replacement kerb have a laid-back profile. Similarly to the separator, the footpath kerb is likely be used by cyclists to prop on the approach to Greenhill Rd and we recommend upright kerb for the same short length.

The northern end of the bike lane should be coloured green in a similar way to the right turn bike box.

7. Western footpath

We applaud the widening of the western footpath from the existing 1.7m to 2.4m, for the comfort of pedestrians.

If possible, we would like to see it widened further, given the potential for some use of the footpath by cyclists who are not comfortable on-road (including children) and the potential for people to be waiting on the footpath to cross east. 2.5m is a desirable minimum width for a shared use path.

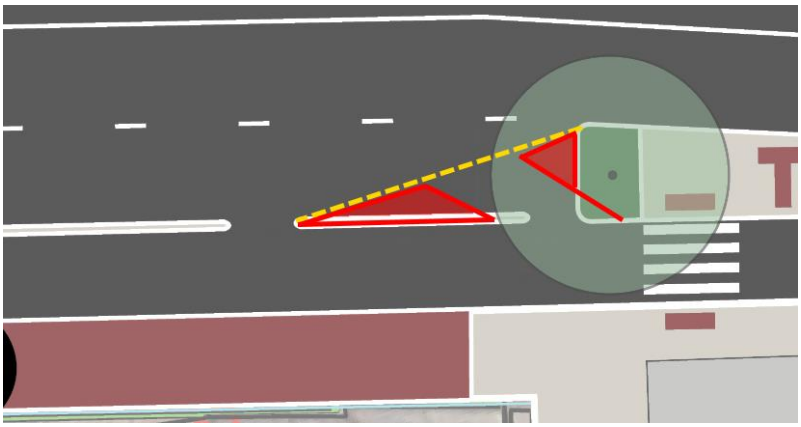
8. Right turn bike box

This is a useful feature, given that many cyclists access the Park Lands path to the north-east. However, it appears that the only way to enter the facility from the separated bike lane is through a gap in the separator at the forward storage area. Given that cyclists could be waiting two abreast over this gap, or flowing quickly in a through direction, such access would be difficult and the right turn box close to unusable.

Locating the gap further south to be level with the car holding line would assist in enabling access, particularly in conjunction with a wider bike lane – which is feasible with space recovered from the wide lanes on the eastern side of King William Rd. A 3m bike lane + 0.3m separator would cater for two abreast cycling generally but three abreast access at low speed, i.e. when cyclists are stopped and queued. 0.9m on

the right-hand side could then be line-marked as a right turn lane for cyclists, for a length of up to about 20m (it is narrow for longer distance travel, especially given the adjacent separator kerbing).

An additional minor improvement could be made by line-marking car guidance to enter the left-turn lane and design around this to create a protected area for cyclists, as shown in the following diagram.



This:

- enables cyclists to easily enter the left-turn lane and use this to reach the right turn box if traffic allows;
- provides a sheltered space for cyclists to wait outside of the stream of cyclists using the separated bike lane, if they need to wait for a break in traffic to enter the left-turn lane or through lane (as they prefer);
- angles cyclists so that they can conveniently see traffic but are also aligned for their forward movement;
- should be large enough to accommodate two cyclists side-by-side;
- has no impact on the effective length of the left-turn lane.

The narrow lane widths would make it challenging for cyclists to travel through a queue of cars to reach the right turn box. However, this treatment is still desirable to enable cyclists who might wish to enter traffic e.g. to use the through and right lane, cross the road or perform a U-turn.

9. Northbound travel lane

We note that the northbound travel lane adjacent to the left turn lane is 2.9m wide. 3.0m is generally considered the minimum acceptable for bus use.

Southern end: Section B

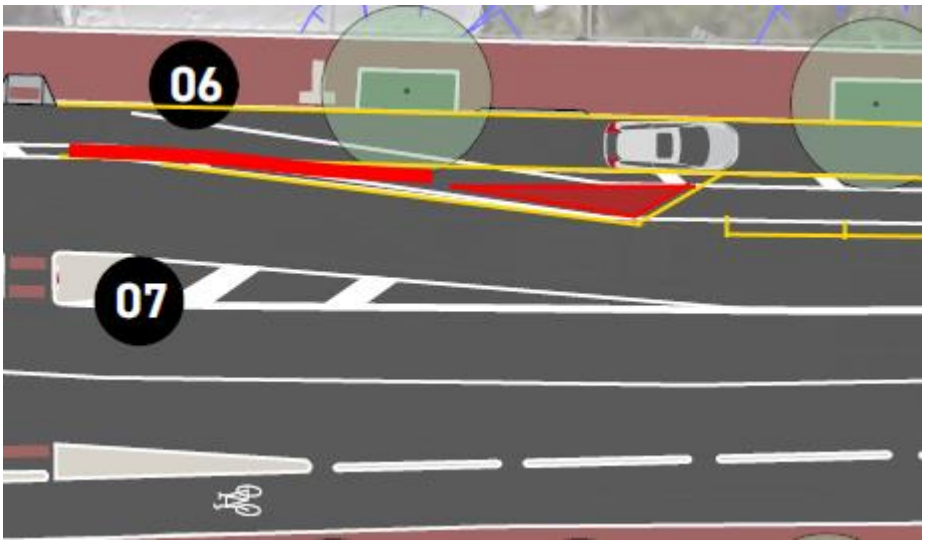
10. Southbound bicycle lane

A bicycle lane provided between moving traffic and parking does not represent a separated facility and therefore does not match the type of facility provided further north or the Mike Turtur Bikeway.

We strongly recommend reversing the location of the parking and bike lane, to create a buffered bike lane. An example of a buffered bike lane from Melbourne follows. A buffered bike lane is also planned for Payneham Rd as part of the O.G. Rd intersection upgrade.

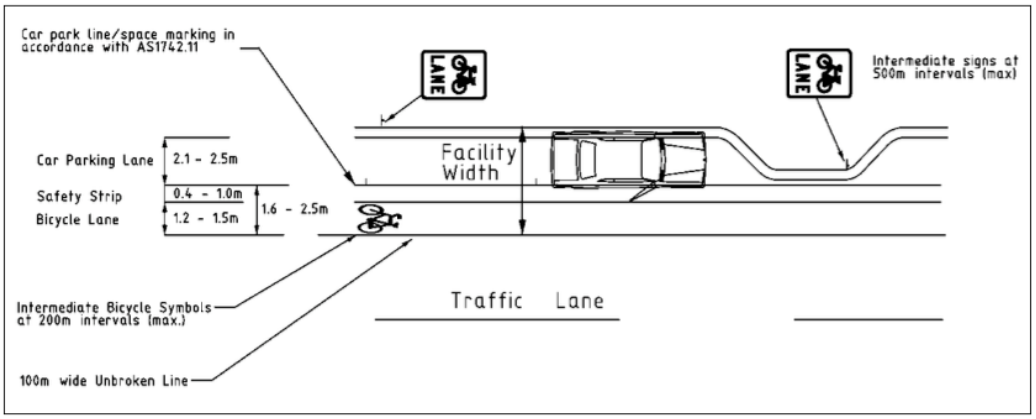
As parking provides clearance to moving traffic, only a painted buffer to car parking is required. It is desirable but not entirely necessary that the bike lane be coloured green. If it is not, then we recommended a 'strongly' painted buffer as shown in the Melbourne example, featuring solar LED cateyes on the carparking edge to emphasise its presence.

The general transition from the separated bike lane further north to the buffered bike lane is shown indicatively below. (Advice about widths follow this.) This points to the loss of a parallel car parking space, however the kerb protuberances provided in the car parking further south could be removed to make up for this loss in parking. A proposed section of kerbing (red triangular area) could host a small street tree and would help to reinforce the different street environment. We suggest that the pedestrian refuge island (07) could feature landscaping, for the same reason.



From Austroads, a buffer ('safety strip') between parallel parking and a general bicycle lane should be 0.4-1.0m wide, as follows.

Figure 4.3: Typical bicycle/car parking lanes layout (parallel parking)



Source: Austroads (2010b) Figure 4.27.

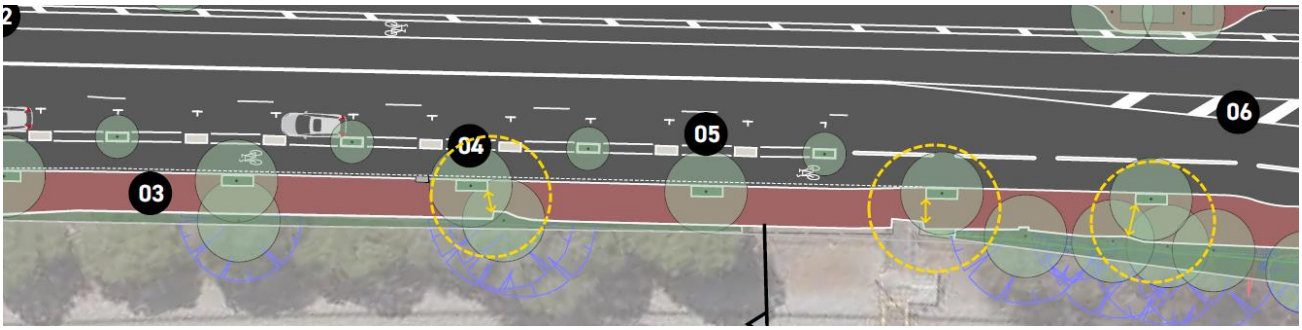
To cater for demand in King William Rd, the buffered bike lane should be 2.0m to allow for overtaking. In this case, the painted buffer would provide space that could be considered to include the clearance to the footpath kerb and to the cars, when it is used by overtaking cyclists. While this would put such cyclists within the door zone, car doors opening into bicycle traffic would be rarer for a buffered bike lane than a unbuffered bike lane as the vehicle occupancy of around 1.1 people/car in Adelaide means that only some 1 in 10 cars have a passenger. Nonetheless, 2.0m + 0.4m buffer does not allow for any variability in parking. (A greater width is desirable and possibly achievable in some locations, around other road feature transitions.)

Option 1 shows a 1.4m bike lane plus 0.5m buffer i.e. allocated space of only 1.9m. We have identified two alternatives to achieve the required separated bike lane width.

a) Western footpath

The footpath width is some 3.3m – which is greater than the 2.4m footpath further north. Given that the project will change what is currently a shared use path to a footpath, this is one of the rare cases where we would advocate for a reduction in footpath width in favour of the space required for the buffered bike lane.

This would reduce the footpath width to below 3.0m. However, there are a few locations where tree placement would create 'squeeze points' along the footpath, as shown following. Relocating tree plantings could offset the footpath narrowing by increasing the usable width.



As noted for section A, the western separated bike lane could be reduced from 2.5m to 2.4m as long as the kerb to the footpath and the separator both have laid-back rather than upright profiles.

b) Car parking and western footpath

We query whether car parking is required on this side of King William Rd. If it were removed, it would be possible to reduce the separator width from 0.8m to as little as 0.3m. However, this would come at the expense of tree plantings in these separators, which we believe offer high amenity value to the project. To enable a footpath width of 3.0m to be retained, we could tolerate a general separator width of 0.5m widening to 0.8m where trees are planted in the separator, as long as the planted separators are not protected by 100mm high kerbing (which would reduce effective bike lane width) but provided as either flush landscaping areas or protected with only 50mm high kerbing. In this case, part of the bike lane clearance would be provided by the landscaping. Only narrow-trunked trees should be used and we suggest that the five proposed separator trees be reduced to three (i.e. the second and fourth proposed trees be replaced with low-level landscaping), in order to preserve clearances.

In this case, the 2.5m western separated bike lane should **not** be reduced to 2.4m as the extra width is used as part of required clearances.

Planted separators should support trees and ground covers only. (There is a tendency for plantings in similar landscaping areas to comprise strappy plants that overflow the landscaping and reduce effective bike facility width.)

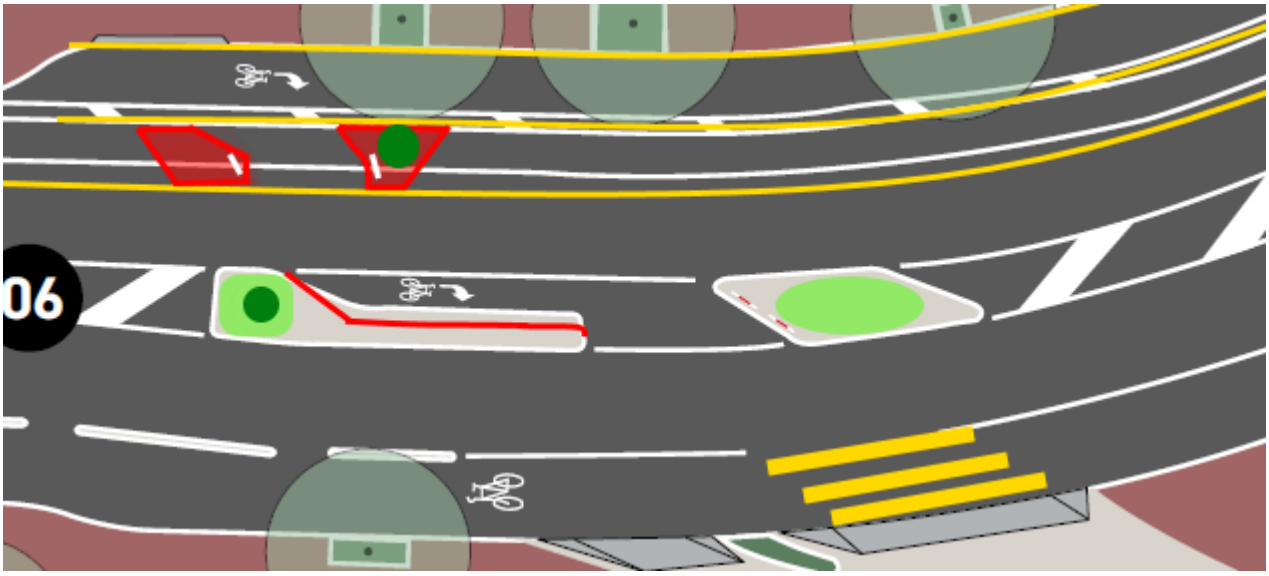
11. Bicycle refuge, Mike Turtur Bikeway crossing

This bicycle refuge is based on a bicycle lane rather than buffered bike lane, hence requires redesign. A general concept follows, with the following features:

- Cyclists turning right into the Bikeway are given a protected area in which to conveniently pull off the separated path to its right, rather than needing to pull into a bay on the left and then cross both cyclists and traffic. This allows for ease of access into the refuge, but also (short) holding rails if they need to wait to give way to traffic. As the traffic is one-way in regard to cyclist yielding and sightlines, the southern kerb extension could feature a small tree.
- The central refuge is wide, presumably to cater for likely demand. However, the actual bike 'lane' section of this is relatively narrow. This could be widened to enable cyclists to locate further from southbound through traffic. A rail located in the nose of this northern section of refuge would assist

cyclists waiting here, increasing the capacity of the refuge. The refuge is wide enough to present low-level landscaping opportunities (light green), including a small tree on the northern end (dark green) given that cyclists are not travelling from the right of southbound through traffic and this would not impede required sightlines.

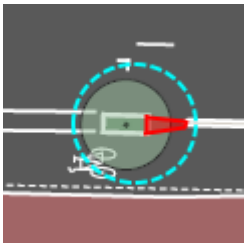
- The width of the refuge is not shown. There may be some opportunity/desirability to reduce the width slightly to provide width to other priorities, however this should be carefully considered.
- We suggest that the area on the west shown with indicative 'zebra' line-marking should be treated to highlight this as a crossing point to through cyclists. This could be using green Streetprint, as previously mentioned, without necessarily providing priority. A section where cyclists exit the Mike Turtur into the separated bike lane is also advisable (this, in particular, could be a decorative pattern that simply highlights the location rather than attempts to manage it.) And similarly for the southbound separated bike lane where cyclists slow to turn off into the crossing to the Mike Turtur.



As previously noted, an issue regarding the utility of the refuge is the timing of cars arriving at the refuge compared to bikes. We would like to see some examination of the opportunities around signal control management of this.

12. Western bike lane

As a fine detail, we would like to see the separator prior to the southernmost tree planting 'guide' cyclists appropriately.



Bikeway Design Charrette – design discussion paper

Fay Patterson, BE, MAITPM
15 November 2016

Key points

1. Cyclists vary enormously in speed, unlike motor vehicles, which are confined to a speed limit. A critical feature of a separated bike lane is that, unlike on an on-road bike lane, cyclists are physically confined to the bike lane. They cannot move over into the traffic lane to overtake a slower cyclist.
2. A cyclist's riding space (or 'design envelope') is about 1 metre wide: 600mm of physical width + 200mm of "wobble" space on either side. Two of these together is needed to allow overtaking = 1.8m to 2.0m due to the overlap of "wobble" space, though where these wobble overlaps are permitted, passing may be unnerving. (Some guidelines suggest a wider physical width + narrower wobble space, though they end up at the same 1m design envelope.) Widths wider than 2.0m provide more comfort to cyclists, but do not increase capacity if less than a 1m increment.
3. Effective width is determined by the nature of the boundaries of a bike lane. If it is bounded by a kerb that is more than 5cm high, there is a danger of the cyclist's pedal hitting the kerb. In practice, cyclists will cycle about 20cm from the edge to avoid this, so a 2m bike lane with high kerbs on either side is effectively only 1.6m wide – not wide enough to allow overtaking. The effective width is also reduced if part of the bike lane is a gutter that has a different surface from the rest of the bike lane. In Adelaide, standard gutters are 0.45m wide.
4. There are no clear Australian standards to say how wide separated bike lanes should be. There are guidelines provided by Austroads Guides, which supersede Austroads' Guide to Engineering Practice (GTEP) but are sometimes vaguer. These address all aspects of providing for bikes. More recently, the Queensland Department of Transport and Main Roads (TMR) has issued guidance about separated bikeways. There is also a range of guidelines originating from other countries. While GTEP suggests a 1.8m-2m width is needed for overtaking, recommendations regarding width vary enormously and typically do not address capacity per se. Qld TMR's guidance is confusing, with 2m quoted in the text as comfortably allowing for overtaking but 2.5m+ shown in a table. Research underpinning Qld TMR's guidance implies that the 2.5m may reflect Qld practice re: gutters and clearances, but also quotes international research confirming that at about 2m effective width, cyclists will self-discipline to allow passing. It also notes that the model developed (which is based on two-way situations) doesn't apply to situations narrower than 2.5m as it assumes overtaking is possible (2.5m two-way is the same as 2m one-way plus additional clearance because passing involves oncoming cyclists); and that it shouldn't be used to determine design widths.
5. As with car traffic, mid-block profile is not necessarily the key determinant of capacity. Where signals are frequent, capacity at intersections and traffic signal phasing will be the key determinants – but lack of mid-block passing opportunities would frustrate many cyclists and exacerbate capacity constraints at intersections.

Introduction

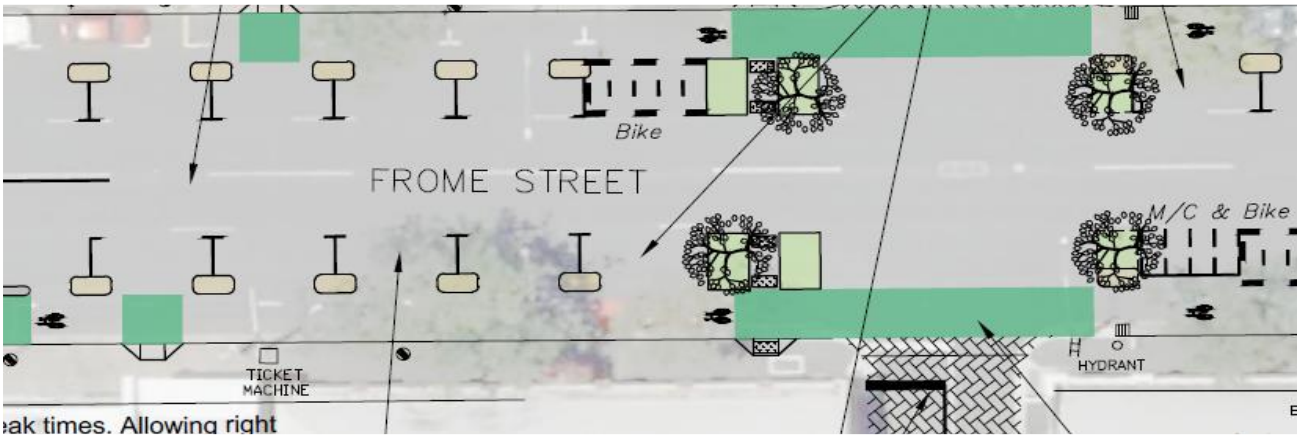
The Adelaide City Council plans to provide a north-south and east-west separated bike lanes crossing the City. It plans to replace existing separated bike lanes that have been constructed on Regent/ Frome Streets between Carrington Street and Pirie Street. The new bike lanes will be narrower, to enable two lanes of peak hour traffic in each direction as opposed to the one lane of traffic and one parking lane that currently exists.

As part of the consultation for the project, the ACC ran a Bikeways Design Charrette, in which attendees were asked to assess several "typologies" (basic layouts) for future bikeways and suggest any typologies not already covered. These boiled down to three configurations for a one-way bikeway on both sides of the street:

1. At road level, separated from the footpath by the existing kerb and separated from the car lane by a new kerbed separator
2. At footpath level, separated from the footpath by paint or a tactile surface and separated from the car lane by a new kerb
3. At mid-level, separated from the footpath by a half-height kerb and from the car lane by another half-height kerb.

A fourth typology, a two-way bikeway on one side of the street, was strongly opposed for reasons of safety and convenience.

The existing Frome Bikeway falls into the first typology, more or less as shown in this image from the original design concept:



This concept showed a separator between the bike lane and parking, which widened out next to side streets to accommodate trees. One complaint about the existing Frome Bikeway is that this did not occur and the landscaping areas were not constructed to allow trees to be planted at a later date.

The major consideration is, of course, that Councillors want to retain two through traffic lanes in each direction in peak hour, which means widening the car parking lane to a traffic lane width.

Designs presented by ACC in the Charrette to help inform discussion took as a starting point a new bikeway width of 2.0m. The existing bikeway width is 2.7m. So is 2.0m enough? This is not a straight-forward question, and nor is whether or not the bikeway would in fact be 2.0m wide, even under the ACC assumptions. The adequacy of 2.0m is the main subject of this paper.

1) Design guidance

There is no Australian Standard for separated bikeways. An "Australian Standard" is a document in a particular series prepared by Standards Australia. Standards Australia is basically a publishing house that commissions a group of experts to put together a national standard in response to an identified need, and knows the appropriate processes to develop a Standard to gain industry acceptance. Formal Australian Standards have standard formats and a numbering system starting with an AS designation for 'Australian Standard', e.g. *AS2890.1:2004 Off-street parking*.

For traffic engineering in Australia, Australian Standards for certain things exist – such as bike parking – but the guidance relied upon by practitioners is given in other documents prepared by Austroads. Austroads is an organisation comprising representatives from Australia and New Zealand at local, state/ territory and commonwealth levels, to promote safety and uniformity in the Australasian road systems.

Austroads has produced three guides for the planning, design and traffic management of the road system: the *Guide to Road Design*, the *Guide to Traffic Management* and the *Guide to Road Safety*. These *Guides* are an update and replacement for a previous series called the *Guide to Traffic Engineering Practice*. Part 14 of this covered cycling and was generally referred to as GTEP14. (NB This was published by Standards Australia, but was not in itself an "Australian Standard".)

Each of the *Guides* has several parts. To make the cycling information more accessible, Austroads has summarised these bits in a document called *Cycling Aspects of Austroads Guides.* All of the *Guides* are available for pdf download at no cost.

The Austroads *Guides* are guidelines to be interpreted, not standards to be adhered to. (In particular, as Austroads members tend to come from state government level, they're better at arterial roads and treatments tend to focus on these, so some guidelines should be "interpreted" for use on local streets.) However, Australian legislation that permits authorised people to (and stops unauthorised people from) changing public roads can require that certain guidelines be followed. In SA, the legislation references a DPTI document, which for cycling requires compliance with the Austroads *Guides*.

Currently, the Austroads *Guides* aren't very thorough in terms of separated or exclusive bike lanes – the treatment underpinning the Frome Bikeway. ("Bikeway" is a label applied to identify a route, not a type of treatment.) For this reason, Queensland's Dept of Transport and Main Roads (TMR) has developed its own guidelines: *Separated Cycleways Guideline* (January 2014). This is expanded upon somewhat by *Technical Note 128, Selection and Design of Cycle Tracks* (2015), and both of these reference the Traffic and Road Use Management (TRUM) manual *Technical Note: Calculating the Widths of Shared Paths and Separated Bicycle Paths,* which seems to be basically the same as TMR's *Technical Note 133 Guidance on the widths of shared paths and separated bicycle paths* (November 2014). All except the TRUM Technical Note are easily and freely available.

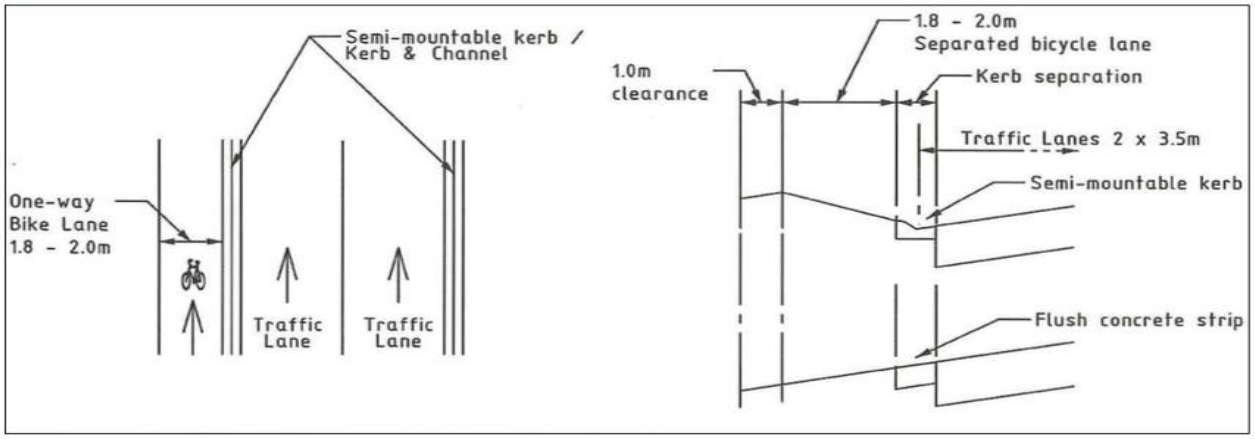
The Qld TMR guidance is more or less best-practice in Australia at the present time and its advice has been accepted (though not endorsed) by DPTI. Qld TMR calls separated bike lanes 'cycle tracks'.

2) Capacity and width

Cycling Aspects of Austroads Guides is silent on how capacity is related to width (though more information may be available in the Guides it references). In Section 4.4.3 (regarding separated bicycle lanes – the formal name for the treatment, and including kerb separated bike lanes and protected bike lanes), the information provided is basically:

- Figure 4.6 shows a 'typical' cross-section for a one-way bike lane of 1.8m to 2.0m. This is at footpath level and also shows a 1m flush concrete strip to provide clearance to the footpath, to reduce conflict with pedestrians.

Figure 4.6: Location and typical cross-section of kerb separated bicycle lane



Note: A one-way crossfall should be applied where a flush concrete strip is used so that drainage does not accumulate on the bicycle path.
Source: Austroads (2010b) Figure 4.20.

- Figure 4.7 shows a 'typical' cross-section between two kerbs, being 2.0m in width.

Figure 4.7: Kerb separated bicycle lane

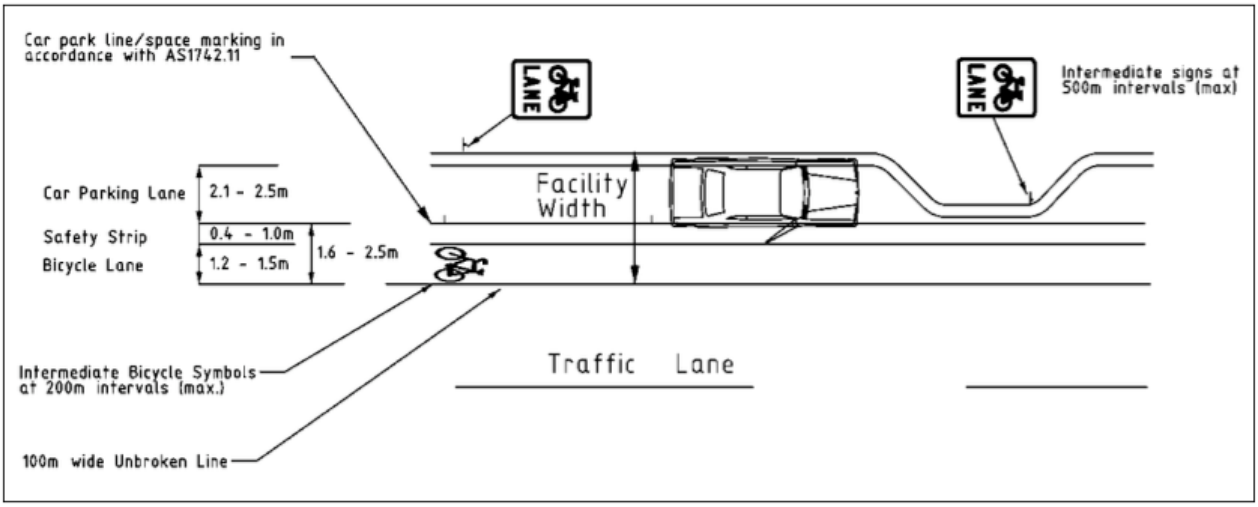
Source: Austroads (2010b) Figure 4.21.

So 1.8m to 2.0m is 'typical', but there is no indication of the capacity this will cater for. Also, what about things that might erode this width?

Section 4.3.2 (exclusive bicycle lanes) notes that it is desirable for the channel (quoted as typically 0.4m in width) not to be included as part of the measured bicycle lane width due to potential safety concerns related to the join between roadway and channel, but also because of the risk of pedal strike. (This is where a cyclist riding close to the kerb hitts the pedal on the kerb. In the worst case, this could throw a cyclist off.)

Figure 4.3, "Typical bicycle/car parking lanes layout (parallel parking)", (see below) shows the safety strip continuing past the gutter edge where parking is absent beside a kerb build out, indicating a required clearance of 0.8m to 1.2m to the face of kerb – although this is not shown in Figure 4.4 regarding angle parking. Hence there is some indication of kerbs and channel (gutter) being relevant to width, but this is far from being authoritative.

Figure 4.3: Typical bicycle/car parking lanes layout (parallel parking)



Source: Austroads (2010b) Figure 4.27.

The (now superseded) GTEP14 contains better information linking width and capacity – and kerbs:

- Section 6.3.3: The capacity of a 1.5m path in one direction is about 150 cyclists/ hour; this is sufficient for a single stream of cyclists. Opportunities for passing require additional path width (the path needs to be a minimum of 1.8m-2.0m) or passing using the other side of the path [in the case of a two-way path].
- Section 4.2.4: Capacity for bike paths can be applied to bike lanes. Surface conditions and edge clearances to kerb need to be considered in the assessment of capacity of bike lanes.
- Figure 3-1 Bicycle operating space: To the basic bicycle design envelope, a minimum 0.2m clearance must be provided to a kerb. [The basic bicycle design envelope is 1.0m, incorporating the rider/bicycle (0.8m) and essential manoeuvring ("wobble") space clearances on either side (0.1m). This is the same in the *Cycling Aspects of Austroads Guides*.]
- Figure 4-4 Vehicle positions on road carriageway associated with Exclusive Bicycle Lanes: This is consistent with Figure 3-1, showing a cyclist at 0.2m from a kerb but 0m where no kerb (but presumably a smooth, clean surface) is provided. With no kerb, two cyclists travelling abreast or

one passing the other in the same direction take up 2.0m i.e. double the design envelope for a single cyclist.

- The Appendix notes a process for determining path width for non-standard bikes, based on outer and inner turning radii and additional clearances. If the sum of the measured distances is greater than the path width, than the path needs to be widened. This would seem to apply more for curved paths or where these non-standard bikes might be passing other bikes. (Cargo bikes and trikes are typically wider than a standard bike but wobble less.)

The two figures are reproduced in the Appendix of this paper.

TMR's *Separated Cycleways Guideline* recommends in Section 3.4.1 a minimum cycle track width of 2.0m. A 2.0m wide one-way cycle track allows comfortable overtaking and allows bicycle riders to ride side by side. It then gives quite definitive width/capacity guidance:

Table 2: One-way cycle track dimensions (on each side of the road)

Peak hour Volume - (bicycle riders/hour)	Width (m)	Separator (without parking)	Separator (with parking)
0 – 150	2.0 m – 2.5 m	0 m – 1.0 m+	0.75 m – 1.5 m+
150 – 500	2.5 m – 3.5 m	0 m – 1.0 m+	0.75 m – 1.5 m+
>500	3.5 m – 4.5 m	0 m – 1.0 m+	0.75 m – 1.5 m+

This does not mention whether, or to what extent, the form of the separator (earlier defined as "a median, kerb, verge or buffer planting") might affect required width, and hence how authoritative the width requirements of Table 2 actually are.

Nor is it at all obvious where Table 2 came from. Research undertaken on 10 two-way shared paths and 2 two-way cycle-only paths in Queensland is the proximate base[1], and a model based on a threshold of 12 delayed passages per hour. Looking at the research underlying this[2], Norwegian guidance would allow a segregated cycle path of 1.5m-2.0m for volumes of over 300 cyclists/hour – with the higher width relating to high pedestrian volumes on the adjacent footpath rather than cyclist volumes. Under Dutch guidance, for a path accommodating more than 150 cyclists an hour, the recommended bicycle path width is 3.5m-4.0m. (The Queensland reviewers noted that this appears generous.)

In assessing bicycle only paths, the research took as its starting point a 2.5m path, based on Austroads guidance. They then calculated a capacity of 670 to 880 cyclists/ hour for one-way bike-only travel, depending on the acceptability level for delay; and noting that their model could not be applied to bike lanes of a width lower than 2.5m. (NB The researchers also note that Nørrebrogade in Copenhagen has two 2.5m wide one-way cycle tracks. These were conservatively calculated to have a capacity of 2,200 cyclists/hour – 'close to capacity'.)

Of particular note:

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1 TN133 Guidance on the widths of shared paths and separated bicycle paths, Technical Note, Transport and Main Roads, November 2014.

2 Bicycle and Pedestrian Capacity Model: North Brisbane Cycleway Investigation Model Validation and Implementation Draft Report, SKM, 5 February 2010.

- The fundamental proposal underlying the research is that the bicycle design envelope is 1.0m and paths are multiples of this. Hence 2.0m would give two lanes of travel, 2.5m would give more comfort but very little additional capacity, and 3.0m would be required to give three lanes of travel and hence a step-increase in capacity.
- In the Frome Street situation, the relatively frequent intersections and side streets would give a different flow profile to the Queensland paths, and hence different results. In particular, the fundamental assumptions of the model (Poisson distribution with random cyclist arrival times) would not apply.
- The Queensland paths researched various kerb arrangements, but none were one-way bicycle paths, and the kerb arrangements – and clearances – were not considered in the research.

From Appendix B1.04 Cycle track cross sections of the *Separated Cycleways Guideline*, the cycle track width is measured to face of kerb (where relevant); the width in Table 2 is not in addition to any clearance to kerbs (or buffer planting, or an awkwardly-cambered gutter). The impact of kerbs is mentioned in advice about different cycle track types:

- Section 3.4.4.1 dual kerb cycle track: This recommends kerb heights for a dual kerb cycle track of 50mm (absolute minimum) to 100mm (desirable), but also to minimise the kerb height on the footpath side to reduce risk of pedal strike (i.e. where the pedal hits the kerb). No clearance is suggested to avoid pedal strike, and as a standard pedal height is about 50mm above ground level, only the 50mm kerb height could avoid this.
- Section 3.4.4.2 median-separated cycle track: This also recommends minimising kerb height to reduce risk of pedal strike, but no heights or clearances are given.
- Section 3.4.4.3 cycle track at footpath level: With no kerb to the footpath, there is no risk of pedal strike, however a minimum 0.5m planting strip is recommended to separate the cycle track from the footpath to prevent pedestrian intrusion onto the cycle track.

In Queensland, the standard kerb height is 150mm. In South Australia it is typically 100mm-140mm. Greater height is likely to be associated with greater clearance to kerb by riders as pedal strike issues increase with kerb height. (A high kerb is provided over the Montefiore Bridge, at Morphett Street, demonstrating the physical "feel" of this kerb height.) A 100mm kerb height is required for buses to kneel to or use their ramps for the use of people with disabilities.

The original Frome Bikeway retained the standard kerb between the bikeway and the footpath, and added a median separator with the same kerb height.

From all of this:

- The one-way 2.0m bike lanes shown between kerbs in the *Cycling Aspects of Austroads Guides* would have a capacity equivalent to a single stream of cyclists, i.e. up to 150 cyclists/hour, because these function as 1.6m bicycle lanes with 0.2m clearance to the (high, upright) kerb on either side – ignoring any impact from the gutters. The capacity would be about the same as a 1.5m one-way bicycle path with no kerbs on either side.
- The one-way 1.8m-2.0m bike lanes shown at footpath level in the *Cycling Aspects of Austroads Guides* begin to allow for overtaking, especially if cyclists stray into the flush separator strip.

These would have roughly double the capacity of the 2.0m bike lanes between kerbs noted above.

- The one-way bike lane widths shown in Table 2 of the *Separated Cycleways Guideline* do not address kerb clearances, but a kerb on one side is envisaged for all configurations except that of a bicycle path at footpath level. Assuming a 0.2m clearance to kerbs, this gives an effective width of 1.8m-2.3m. The actual clearance experienced in Queensland conditions may be greater (the development of GTEP14 was spearheaded by South Australia), and the approach may be allowing for a gutter on one side, hence the effective width may be less than this. Still, from presented research, an effective 1.8m would not allow for comfortable overtaking. This may be why a design that is stated as allowing for comfortable overtaking and side-by-side riding (2.0m) is also presented as having the same capacity as a single stream of cyclists: the lower width could be approaching the single stream situation, under Queensland conditions.
- More generally, the width/capacity correlations shown in Table 2 do not appear to be supportable as proscriptive guidance in the South Australian situation.

3) BISA's position re: bikeway width

ACC's background information started with a concept of a 2.0m bikeway width, as per the *Cycling Aspects of Austroads Guides.*

BISA's position re: bikeway width, which was also expressed/endorsed by other participants in the Design Charrette, is:

- 2.0m is only acceptable if it is understood as being the effective (= usable), not nominal (= total) width. So where a kerb is provided with a height of over 50mm, an additional clearance is required to prevent pedal strike on that side. We assume that a kerb of 50mm or less would not require an additional clearance. A chamfered or semi-mountable design would further reduce the need for clearance to a low kerb, while still providing guidance to child cyclists and pedestrians. (Note that for a high kerb design such as the existing Frome Bikeway design, a 2.0m effective width + clearances would require the nominal bikeway width to be a minimum of 2.4m and up to 2.65m if the gutter is not considered to be rideable.)
- It is desirable for motor vehicle occupants to unload from vehicles onto a pavement that is at the same height as the bikeway, with kerbing being located at the front and/or rear of the parking space rather than obliging unloading occupants to balance on a separator. This kerbing is where a tree would be planted. The separator is a nominal 1.0m wide in the existing Frome Street section; further north, it would reduce to 0.8m.
  When no cars are parked – such as at peak hour, when the parking is used as a traffic lane – the space between the kerb and bikeway is not only at the same level as the bike lane, it is empty and not intruded upon by car doors, etc. While spacing of trees and other landscaping details were not covered during the charrette, trees spaced at one per two car parking spaces and no intermediate kerbing would be acceptable if the bikeway is at a higher level to the roadway. This would give a distance of about 10m between the landscaping areas, which is similar to other streets. So where the bikeway is higher than the roadway and assuming a 2.0m effective width

out of peak periods, this means that the effective bikeway width during peak periods would be 2.7m-2.9m (assuming, as per the *Separated Cycleways Guideline*, that no buffer to the roadway is required for a speed limit below 60km/h, but still excluding the 100mm width of the top of kerb.) We feel that this is a generous assumption and an effective bikeway width of 2.3m-2.5m is more reasonable. We also believe that these 10m sections could be used by cyclists to overtake other cyclists if they found the 2.0m too narrow to be comfortable. We note that the Queensland research found average overtaking lengths on shared paths of 10m.
The regular tree placings would moderate faster cyclists' speeds, which is reasonably appropriate given the frequency of side streets and intersections.

- It is desirable for a bikeway that is at a higher level than the roadway to be carried at that level over side streets, for safety reasons. Depending on where trees are planted, these areas could also form passing areas.

Adding this to the preceding examination of width and capacity, the peak hour capacity of a well-treated bikeway with an effective width of 2.0m would be verging on identical to the existing bikeway, despite the larger nominal width of the latter of 2.7m between kerbs.

Even outside of peak periods, the narrower width is likely not to represent a major reduction in capacity due to the effect of intersections and as 2.0m is the minimum effective width that will allow two 'lanes' of cyclist travel.

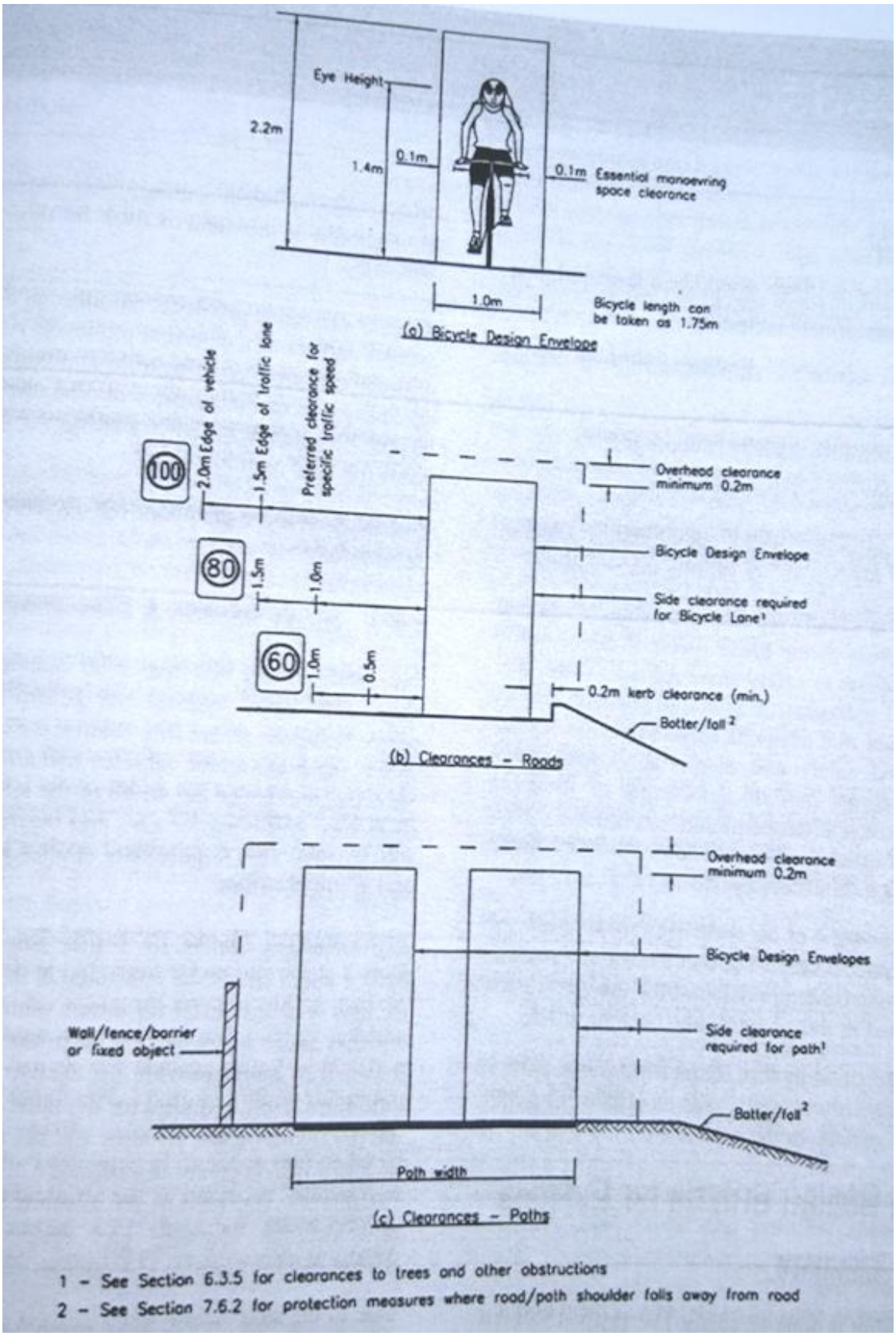
However, this would be less comfortable and possibly affect the ability to easily pass non-standard bikes having a larger design envelope than for a standard cyclist.

Another proviso is regarding child cyclists: their design envelope is related to bike handling skills and could be larger than that of adult cyclists, despite their smaller physical size.

Against this, with a passenger occupancy of around 1.1, the likelihood of parked cars needing to open car doors into the area allowed for them is relatively low and even outside of peak periods, careful cyclists could use the door zone to pass occasional non-standard cyclist types – or simply follow these and wait to accelerate off more rapidly at a side street or intersection location, which is something that could perhaps be taken into consideration in further design work.

Appendix

GTEP Part 14, Figure 3.1



GTEP Part 14, Figure 4.4