Department of Transport and Main Roads

Technical Requirements

Cycling Infrastructure Program

Queensland Government

Contents

Introduction

The Cycling Infrastructure Program (CIP) funds cycling facilities that encourage more people of all ages and abilities to cycle more often. To increase cycling participation, facilities need to be comfortable, low-stress, convenient, direct, safe and competitive with other modes of travel. In order to achieve this, these technical requirements outline the desirable and minimum standards for cycling infrastructure projects funded through the CIP.

These technical requirements only relate to projects delivered through the CIP and are in line with Austroads guidance. However, to support the program intent, the CIP technical requirements generally seek a higher standard of provision because the CIP funds principal cycle networks and future cycling demand is expected to be high.

The technical requirements also exclude certain treatments and design values that are unlikely to support the program intent. They also incorporate a number of learnings and clarifications resulting from previous cycling infrastructure projects.

An eligibility requirement for all projects funded through the CIP is that the design must conform to these technical requirements.

Eligibility

Unless otherwise noted by these technical requirements, the CIP accepts treatments and design values set out for bicycle facilities in the reference documents listed in *Table 1*.

Designs incorporating treatments described in *Appendix A - Separation Devices on Bicycle Lanes* and *Appendix B – Cycle streets and bicycle advisory lanes* are specifically being targeted by the CIP. Additional assistance in the design and evaluation of these innovative treatments will be made available through the CIP.

Alternative standards, guidelines and innovative treatments not covered by the reference documents will be assessed on a case by case basis.

The following treatments are not eligible for funding by the CIP:

- Bicycle Awareness Zone treatments (with the exception of circumstances identified under the Bicycle Lanes section);
- Part-time bicycle lanes; and
- Construction of shared paths less than 2.5m wide (as a stand-alone treatment).

Table 1 - Reference documents

Austroads Guides to Road Design, Traffic Management and Road Safety	Available at www.austroads.com.au
Road Planning and Design Manual (RPDM)	Available at www.tmr.qld.gov.au.
Traffic and Road Use Management Manual (TRUM)	Available at www.tmr.qld.gov.au.
TMR Guidelines for road design on brownfield sites	Available at www.tmr.qld.gov.au.
TMR Design criteria for bridges and other structures	Available at www.tmr.qld.gov.au.
Queensland Manual of Uniform Traffic Control Devices (MUTCD), Part 9 Bicycle Facilities	Available at www.tmr.qld.gov.au.
TMR Traffic Control signs (TC signs)	Available at www.tmr.qld.gov.au.
TMR Traffic engineering Technical Notes	Available at www.tmr.qld.gov.au.
Australian Standard 3996 Access Covers and Grates	Available at www.saiglobal.com.
Australian Standard 1428 Design for Access and Mobility	Available at www.saiglobal.com.

Performance requirements

Facilities delivered through the CIP must be fit for purpose, direct, safe, attractive, and coherent. Facilities should also be transport-oriented allowing people using bicycles to comfortably access meaningful destinations. For further detail on these requirements, refer to *TMR Technical Note 128 Selection and Design of Cycle Tracks*.

Directness, comfort and coherence generally lead towards solutions within road corridors. This requires careful consideration of crossing and intersection treatments and physical separation from motorised traffic to maintain safety and attractiveness. Making a direct facility safer is often easier than making a safe facility more direct.

On-road facility requirements

Bicycle lanes

In some environments the attractiveness and perceived safety provided by a visually separated (e.g. line marking only) bicycle lane may not be enough to encourage new riders. Physical separation from motorised traffic assists in limiting perceived safety issues in road environments with higher traffic speeds and volumes. Physical separation can be achieved by:

- “hardening” a bicycle lane with a physical device, refer *Appendix A*;
- establishing a Cycle Track, refer *TMR Technical Note 128 Selection and Design of Cycle Tracks;* or
- establishing a path (incorporating priority crossings to maintain safety and directness).

CIP funding is specifically targeted at delivering a high proportion of projects that incorporate physical separation from motorised traffic. As such, projects which seek to achieve physical separation in the appropriate context will be more likely to secure CIP funding.

Bicycle lanes established under CIP shall conform to the widths specified in *Table 2*. Minimum width bicycle lanes should only be considered at localised constrictions such as drainage grates or where significant constraints restrict relocation of the kerb line.

Bicycle lane set out shall be based on the alignment of the adjacent traffic lane, not the kerb alignment.

Urban traffic lanes may need to be marked less than 3.5m wide in order to establish a bicycle lane. There is limited evidence to support wide traffic lanes in urban areas. Refer to the *RPDM* and *Guidelines for road design on brownfield sites* for further detail.

Table 2 –CIP Bicycle lane widths (Based on AGRD Part 3, Figure 4.18 and Figure 4.19)

Road speed limit	Minimum width for CIP projects	Desirable width for CIP projects
40km/h or less	Consider treatments in Appendix B	Consider treatments in Appendix B
50km/h	1.2m	2.0m (Physical separation possible consider Appendix A)
60km/h	1.5m	2.0m (Physical separation possible consider Appendix A)
70km/h	1.8m	2.0m (Physical separation possible consider Appendix A)
80km/h or higher	2.0m (Physical separation recommended refer Appendix A)	2.0m (Physical separation recommended refer Appendix A)

Bicycle Awareness Zone (BAZ) treatments do not provide separation for cyclists. The CIP will only consider funding BAZ treatments in exceptional circumstances where a road or bridge section is highly constrained and where traffic speeds and volumes are low. Refer *TRUM Volume 1 Part 10 Section 6.5-1* for more information.

Bicycle lanes and on-street parking

Limitation of on-street parking on arterial roads improves safety, reduces motor vehicle congestion and permits separation of bicycles from moving traffic.

Locating parking adjacent to a separated bicycle lane (bicycles positioned kerbside) is an efficient method to protect cyclists from moving traffic. This also enables clearway operation to provide motor vehicle capacity when needed and parking off-peak while safely providing a safe full time facility for cyclists, for more detail refer *Austroads Guide to Road Design Part 3 figure 4.32*. Projects proposing this arrangement will be more likely to secure CIP funding.

The CIP will only accept projects proposing on-street kerbside car parking adjacent to a bicycle lane when the minimum dimensions set out *Table 3* are achieved. Typically, this can only be achieved with pavement marking of the parking bays as well as marking of the bicycle lane and the door zone. In some cases, this may require the narrowing of existing parking bays and adjacent traffic lanes.

Table 3 – Bicycle lanes and on-street parking dimensions

Parking bay width	Door zone buffer	Bicycle lane width
2.1m minimum	0.6m minimum	Refer Table 2 (above)

Where minimum widths cannot be achieved, on-street parking should be removed, indented or reconfigured to position cyclists kerbside. Projects considering parking rationalisation should consider demand, turnover and utilisation within the entire walkable catchment of the project site. *Table 4 - Relationship between length of time parked and distance walked* provides a general indication of walkable catchment related to parking duration. Construction costs related to indenting parking must be fit for purpose to attract CIP funding. Improvements to paths and crossings may be a justifiable ancillary project inclusion to promote walking from parking in nearby underutilised parking in side streets.

Table 4 - Relationship between length of time parked and distance walked[1]

Parking duration	Distance Walked (m)	Minutes Walked (at 1.2m/s)
less than ¼ hr	66	1
¼ hr to ½ hr	100	2
½ hr to 1 hr	121	2
1 hr to 2 hrs	150	3
3 hrs and over	183	4

Road drainage

Drain grates adjacent to bicycle facilities should comply with *Australian Standard 3996 Access Covers and Grates*. Works to update non-compliant gully grates should be considered as part of CIP projects.

Where bicycle lanes are retrofitted on streets with encroaching grates, use of desirable width bicycle lanes along the street will ensure that minimum bicycle lane widths are provided between the edge of grate and the bicycle lane marking. Grates should also be at the same crossfall as the adjacent pavement and not have additional fall to the inlet. Existing stormwater gullies could also be reconstructed to reduce grate interaction with the bicycle lane.

Where possible, new gullies in urban areas should be recessed into the kerb to allow the grate to line up with the lip of channel. This allows cyclists to follow the kerb line without interacting with potentially slippery steel grates.

[1] Derived from A Comprehensive Parking Survey of the St. Louis, Missouri Central Business District. St. Louis, Mo.: Missouri State Highway Department, 1950.

Off-road requirements

Paths

In order to achieve the program intent, key path design criteria are set out in *Table 5*.

Table 5 - Key path design criteria for Grant projects

Path design criteria	Minimum value	Desirable value	Rationale
Width (m)	2.5	3.0	3.0m wide paths have 50% greater capacity than 2.5m wide paths and generate fewer path user complaints.
Design speed on midblock level grade (km/h)	25	30	Appropriate for commuter use. Design speed should vary dependant on gradient and intersection priority.

A reduction in these design criteria values may be considered at localised constraints such as significant poles or structures. This must be explicitly documented as to why a better facility standard cannot be achieved, submitted to TMR and accepted through the design approval process to retain grants funding.

Provision of paths both sides of urban arterial and collector roads[2] may provide a case for reduced path widths, particularly when co-located with bicycle lanes.

Intersections of paths with paths should include 2.5 metre corner radii or a chamfer of equivalent size.[3]

Where an existing path is to be widened, longitudinal joints in paths should only be considered where a physical divider, such as a kerb, can be used to cover this joint.

Transverse joints shall be designed to be smooth, this is usually achieved through sawcut joints [4]or using a proprietary jointing system.

Where possible, pathways should be positioned so they are clear of the roots of established trees. In constrained locations where paths will be within the root zone of trees, pathway joint systems between slabs should be used to minimise any displacement of slabs that could form a hazard.

Where a significant number of pedestrians and cyclists are expected, a segregated path may be required to maintain an appropriate level of service[5]. TMR *Technical Note 128 Selection and Design of Cycle Tracks* provides additional guidance on segregated paths and path treatments at intersections with side streets.

Where a warning colour is used at an intersection with another path, crossings or driveway. Green surfacing shall only be used on a path designated BICYCLE ONLY. Green surfacing should not be used on shared paths to avoid any confusion regarding facility designation.

Shared path signage is not necessary as Queensland road rule 250 permits cyclists to ride on footpaths.

Paths intersecting with driveways should be constructed to provide a smooth joint between the two facilities using measures to control joint displacement such dowels or other proprietary devices. Where existing driveways do not meet the cross-fall requirements of proposed shared paths, they should be reconstructed to join smoothly to the pathway grade and cross-fall. Where driveways are being installed or reconstructed, the kerb crossing should not include a vertical lip at the invert.

Field inlets and/or cross drainage may need to be considered to prevent paths being submerged during rainfall and reduce collection of debris on the path and ongoing maintenance.

[2] Refer to Table C1 2, Austroads Guide to Road Design Part 6A: Paths for Walking and Cycling (2017)
[3] Refer section 6.4, Austroads Guide to Road Design Part 6A: Paths for Walking and Cycling (2017)
[4] Figure C 4, Austroads Guide to Road Design Part 6A: Paths for Walking and Cycling (2017)
[5] Refer TMR Technical Note 133 Guidance on the widths of shared paths and separated bicycle paths

Transitions between on-road and off-road facilities

Where the cycle route connects from a roadway corridor into a parkland or off-road corridor, transition kerb ramps should be considered. These ramps should also be considered for locations where the bicycle lane may be restricted by a narrow bridge or intersection. The additional off-road option allows bicycle riders to choose which facility they use based on their confidence and the traffic level at the time. For further detail refer TMR *Technical Note 108 Mid-block bicycle lane termination treatments.*

Objects adjacent to paths

A 1.0 metre clearance should be provided from the edge of cycle-able surface of any bikeway or shared pathway to any potentially hazardous object adjacent to a path.

Fencing, balustrades and vegetation shall be placed to ensure unobstructed sight lines are available.

Selection of vegetation adjacent to paths should consider the effects of leaf, seed and other plant debris on path slip resistance and maintenance. Planting of vegetation adjacent to paths must ensure clearances and sight lines are easily maintained as the planting matures.

Designing to minimise the extent of fencing is recommended. Landscaping or low shrubbery is a desirable alternative to fencing in many situations.

Fencing is intended to protect path users from hazards however it does not necessarily need to follow the edge of path. For example, fencing the headwall and wings of a culvert protects path users from the hazard while maximising clearance to the path.

Fencing incorporating vertical bars is not considered smooth as rubrails are only partially effective at preventing adult cyclists or children from engaging with the vertical elements of the fence. Fence types with openings of 25mm or less are considered to have smooth features. Smaller apertures are more desirable and may be required if anti-climb features are required. The smoothest side of fence products should face towards the path such as in Figure 1.

Figure 1 - Closely spaced mesh fencing

Fencing with continuous smooth profiles can eliminate the offset top rail requirement on bicycle path as pedals will not be caught on the tightly spaced horizontal wire. This should also have the benefit of reducing the cost of the fencing. This modified weldmesh can also be formed with the edges rolled at the top and bottom to further increase strength and remove the need for top or bottom rails.

There is often a need for fencing of pathways across bridges, particularly where pathways pass close to the back of w-beam guardrail. If w-beam is located within 1.0 metre of the path edge it should be treated to minimise path user collision severity. Fencing needs to be designed to ensure it does not interfere with guardrail effectiveness in the event of a motor vehicle collision. The path should diverge away from the guardrail as soon as practicable to minimise the amount of path with clearance constraints and the need for fencing.

Path Terminal Treatments

Path terminal treatments should not be used as slow points or force cyclists to dismount to safely navigate through the treatment.

Terminal barrier treatments that limit motor vehicle access should only be considered if there is infrastructure along the pathway, such as light weight bridges, that could be damaged by unauthorised access by a motor vehicle.

Protection of structures from unauthorised motor vehicle access should be managed by load limit signage.

TMR *Technical Note 131 Shared path and bicycle path termination treatments* provides further guidance on safe vehicle restriction treatments for bicycle paths and shared paths.

Appendix A – Separation Devices on Bicycle Lanes

In 2015 TMR commissioned a study into the feasibility of retrofitting separation onto existing on-road bicycle lanes. The study: examined available separation devices, undertook crash analysis and observational studies of the operation of existing on-road separation treatments. This fact sheet provides a summary of the key findings of this research.

Best Performing Separation Device Configuration:

Vertical device within a pavement marked buffer

- Vertical delineation devices on a separation kerb, optimally within a pavement marked buffer:
  - Separation kerb provides a safe mounting for the vertical delineators and a tactile deterrent to vehicle encroachment;
  - Vertical delineation devices improve conspicuity, reduce the likelihood of bicycle wheel strikes hazards and complement the vehicle encroachment deterrent provided by the separation kerb; and
  - Pavement marked buffer around the separation kerb improves delineation and increases the offset to vehicles and bicycles.

Desirable characteristics:

- Provide breaks in separation kerb to reduce cyclist 'trap' hazard and allow drainage;
- Generally seek to avoid short sections of separation kerb;
- Conspicuous (through use of contrasting colours and inclusion of retro reflective elements); and
- Slip resistant, semi-mountable (fully mountable at driveways).

Mountable separation kerb for driveway access

Separation kerb with vertical device

Historic Practice:

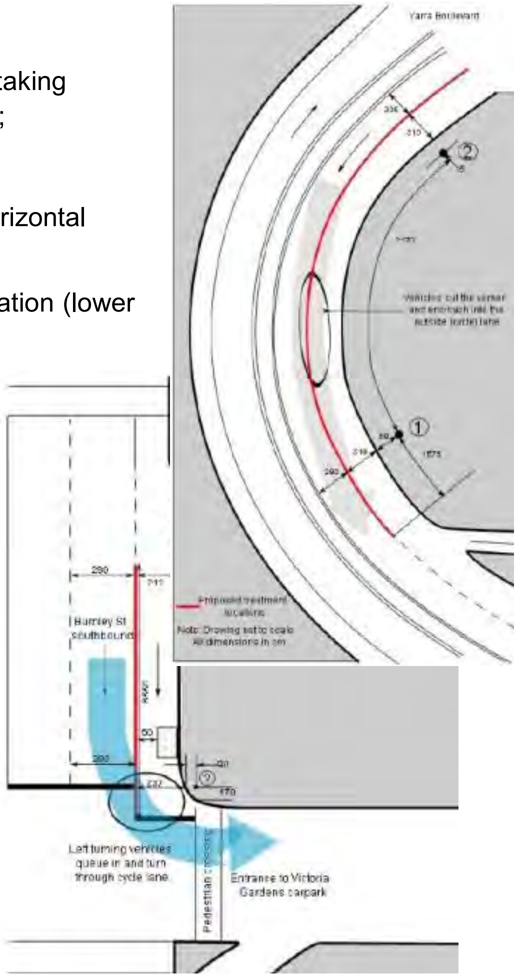
Use of concrete barrier kerbs or 'wheel stops' are common on historical separation treatments.

These are appropriate only if the risk of vehicle encroachment into the bicycle lane is greater than the risk of cyclists and motor vehicle crashes with the device. Risk assessment and exercising engineering judgement and will be required on a site by site basis.

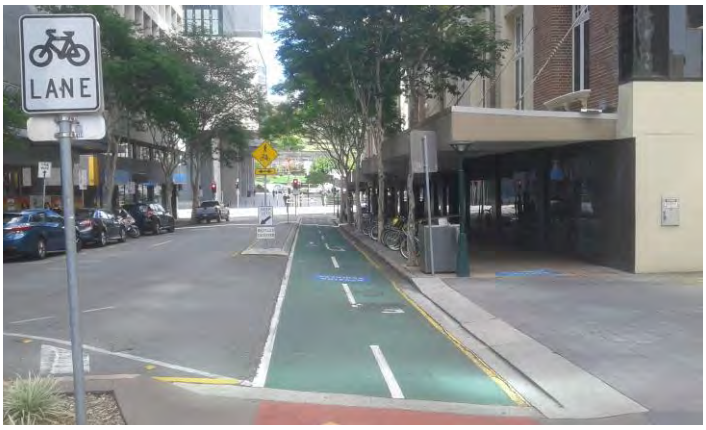
If used, they must incorporate colour contrast, retro reflection, a pavement marked buffer and vertical delineation devices. They must also have a semi mountable profile facing on the bicycle lane side with ramped ends at the drainage cuts combined with increased width at the entry and distinct delineation on the ends.

Site Considerations:

- Bicycle lane width of 1.8m minimum (2m desirable) to allow for passing/overtaking (AGRDPt3) and additional width required on uphill sections and turns/curves;
- Existing facilities are used, or could be used, by less experienced cyclists;
- Where vehicle encroachment on cycling space is most common including horizontal curves, weaving situations, and intersection auxiliary lanes (images right);
- Where traffic volumes and proportion of heavy vehicles/buses warrant separation (lower vehicle thresholders where there are higher proportions of trucks/buses):
    - o ≥ 8,000 vehicles per day at 50kph,
    - o ≥ 5,000 vehicles per day at 60kph,
    - o ≥ 2,500 vehicles per day at 70kph, and
    - o Any volume of vehicles per day at ≥ 80kph.
- Careful design consideration needed where there is high vehicle demand across/through the location from:
    - o Kerbside bus stops (bus frequency) and car parking (consider turnover rates and if it is reconfigurable);
    - o Driveways at high vehicle trip generators.
- Design to account for operational risks including:
    - o Regular bicycle pelotons or bicycle platoons formed at intersections, and
    - o Strong pedestrian desire line along or across the bicycle lane.



Examples:



Tank St, Brisbane (right) provides a direct connection in the cycle network between the Kurilpa Bridge and Roma Street Parklands filling a key inner-city ‘missing link’.

It is two-way, 2.2m wide cycle track, delineated by a 1.2m wide raised concrete median island and green bicycle lane surface treatment.

It has high bicycle traffic of 1000 bicycles on a weekday and 500 on the weekend.

Maryborough Street, Bundaberg (left) is a two-way, 2.8m wide cycle track delineated by a raised concrete kerb and parking.

At times, a high number of students stand and walk within the cycle track in order to access car parking, school buses, or cross the street.

It is heavily used by school aged cyclists during the week.

Appendix B – Cycle streets and bicycle advisory lanes

In 2015 TMR commissioned a study into the feasibility of retrofitting improved bicycle advisory treatments. The study: reviewed retrofit bicycle advisory treatments in Australia and overseas and then recommended bicycle advisory treatments for use in pilots on Queensland roads. This fact sheet provides a summary of the recommended treatments of this research.

Bicycle advisory lanes and Cycling Streets

These advisory treatments are both low cost retrofitted ways of encouraging safer road user interactions where vehicles and bicycle riders are required to mix in the same space. An important consideration is the number of vehicle passing movements that are expected to occur.

Bicycle advisory lanes

While bicycle lanes are always preferred to allow vehicles to pass bicycle riders at any time, bicycle advisory lanes are a low cost retrofit treatment to carry a bicycle route through a mixed traffic environment. For example, in a 12.5m kerb to kerb cross section, two general purpose lanes, two bicycle lanes and marked parking bays on one side is preferred, see figure 6. Bicycle advisory lanes are more suitable on roads with <4000 vehicles per day. They are possible on roads with >4000vpd, however, there are less passing opportunities for vehicle drivers who must wait for a safe time to overtake, whereas exclusive bicycle lanes allow passing at any time.

Where there isn't space for bicycle lanes, or where vehicle parking is retained on both sides, bicycle advisory lanes are appropriate. Broken lines delineate a road shoulder to encourage bicycle riders to use the left of the road. These treatments are designed to encourage vehicles to overtake bicycle riders only when safe to do so. That is, when there are no on-coming vehicles. Bicycle advisory lanes are applicable on collector roads with speed limits ≤50km (posted 40 preferred), that do not have space for exclusive bicycle lanes.

This design is intended to replace bicycle awareness zones. Existing bicycle awareness zones that are marked on the edge line encourage riders to position themselves on the edge line, in the 'door zone' of parked cars. This positioning can give motor vehicle drivers the impression that it is safe to overtake, even when there is an oncoming vehicle. Bicycle advisory lanes are easy to retrofit and can work with existing car parking or on roads with no car parking.

Bicycle advisory lane design considerations:

- Suitable on collector roads with speed limits ≤50km/h (posted 40 preferred), that do not have space for exclusive bicycle lanes.
- 3.0m central traffic lane provided between the broken edge lines of the two bicycle advisory lanes.
- 2.0m bicycle advisory lanes marked with broken edge line and yellow bicycle stencil placed on green patch. Green surface treatment may be used to highlight the complete length of the bicycle advisory lane, this is not mandatory.
- Minimum 0.5m chevron buffers must be marked beside parking bays to highlight the 'door zone'.
- Importantly, a dividing line must not be marked. A central shared traffic lane encourages lower vehicle speed, and the preferred vehicle driver behaviour of waiting to overtake bicycle riders after an oncoming vehicle has passed, instead of squeezing through too close to the bicycle rider.
- Broken edge lines result in vehicle lateral tracking towards the centre of the road, away from bicycle riders.
- Broken edge lines provide clear operating space for bicycle riders that can be shared by vehicles.
- Broken edge line is 1m long, with 1m long gap and is 150mm wide.
- There are variations for uphill or downhill grades >2%, see figures 4 and 5.
- Easy to retrofit, can work with existing car parking or on roads with no car parking. Parking can be located one side or both sides. If parking is marked on one side where >2% gradient, locate parking on uphill side.

The figures below show a range of cross section options. Contact CyclePedTech@tmr.qld.gov.au for more information.

Figure 1. Concept example of bicycle advisory lanes (from Perth, WA).

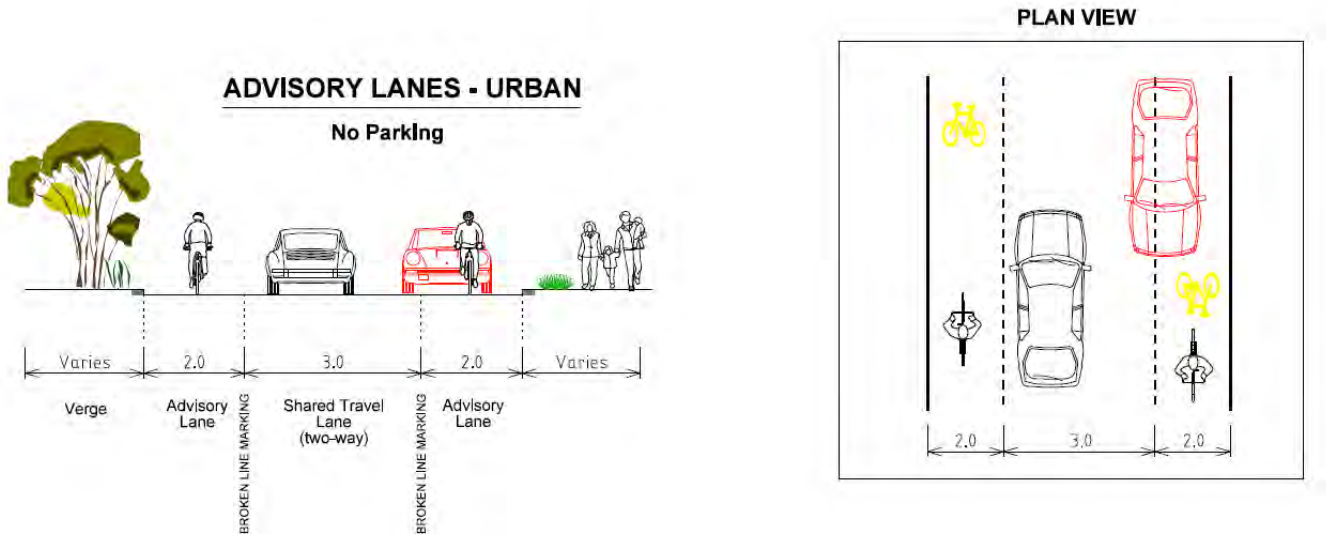


Figure 2. 7m kerb to kerb space with no vehicle parking

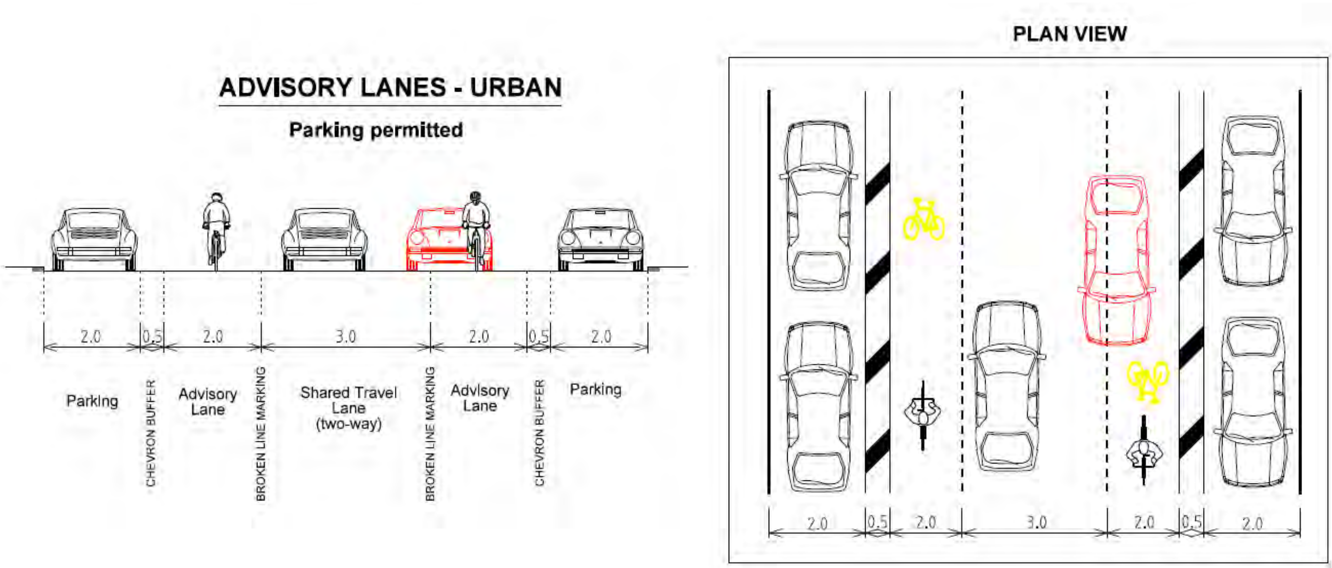


Figure 3. 12m kerb to kerb space with vehicle parking both sides

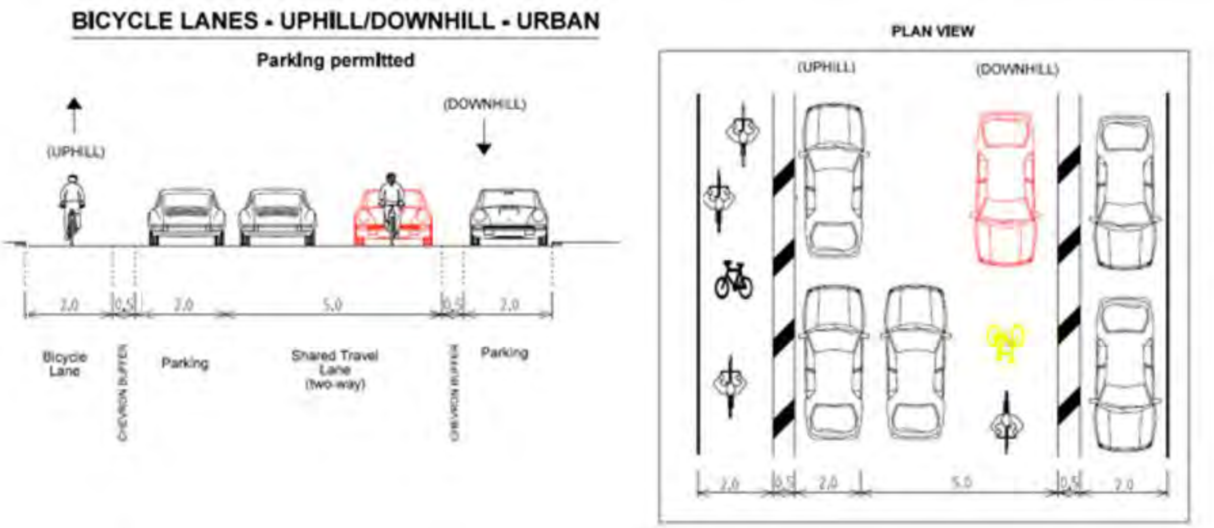


Figure 4. 12m kerb to kerb with parking both sides with a gradient >2%, kerbside bicycle lane for uphill side preferred.

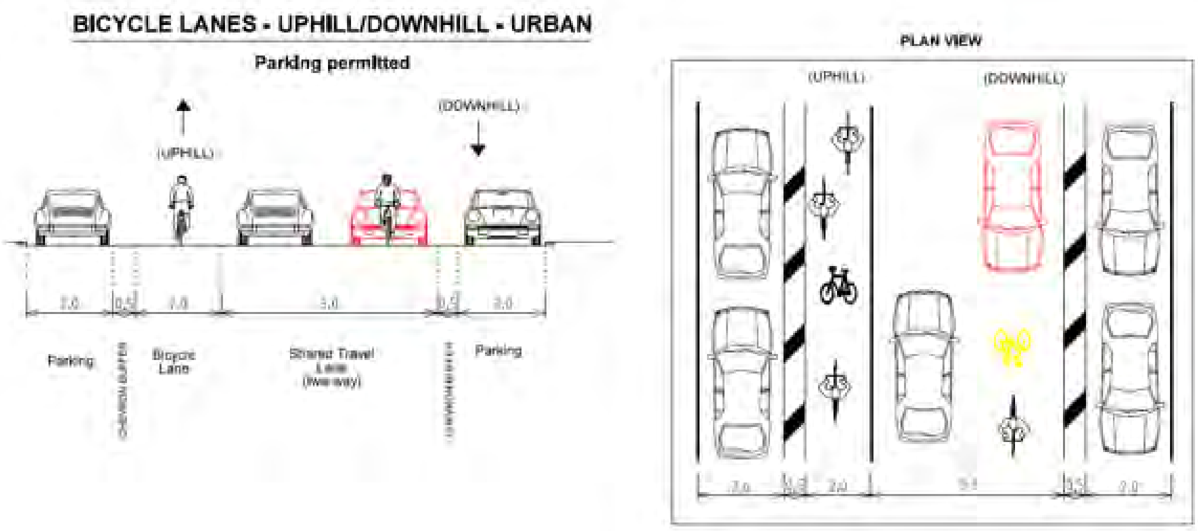


Figure 5. 12m kerb to kerb with parking both sides with a gradient >2%, exclusive bicycle lane for uphill side.

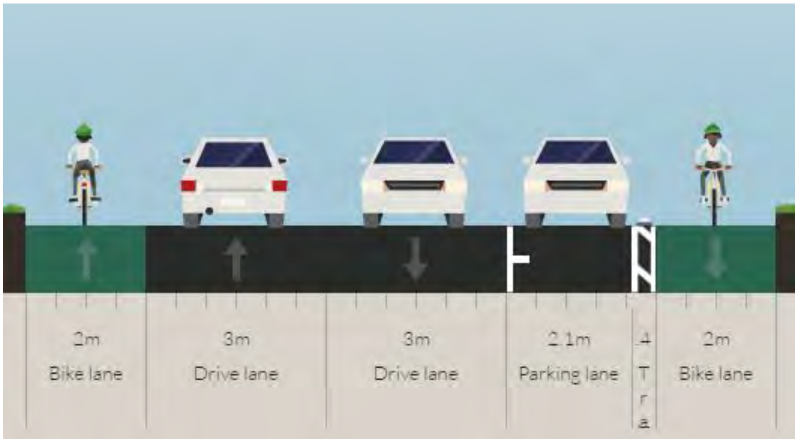


Figure 6. Preferred cross section for collector roads with 12.5m cross section: two traffic lanes, kerbside bicycle lanes and marked parking bays on one side. This allows exclusive bicycle space and no delayed overtaking of bicycle riders.

Cycle streets

A Cycle Street is designed as a mixed traffic environment that encourages bicycle riders to use the centre of the road. These treatments are designed for low speed, low volume roads. A cycle street is a local access road that forms part of the main bicycle route. It can also be considered as a bicycle path with limited vehicle access.

Figure 7. Example from The Netherlands where red asphalt is used to highlight the cycle street.

Cycle street design considerations:

- A shared 3.0-3.5m wide asphalt lane with yellow advisory bike stencils. Narrow profile encourages safe ‘equitable’ speed and discourages overtaking of bicycle riders.
- ‘Overrun areas’ at edges are ≥0.75m wide constructed with a tactile surface such as audio-tactile rumble strips, stamped concrete or similar.
- Suitable on low speed activity centre roads or local access roads that form part of a key bicycle connection.
- Variations can be designed for one lane or two lanes with a mountable median.
- Easy to retrofit, no need to remove parking.
- Designed in conjunction with LATM measures such as road closures, slow points and humps to reinforce low speeds and low volumes of vehicles.
- Clearly designated parking using indented 2.0m marked parking bays with landscaping placed in line with parking to delineate these areas. Parking can be located one side or both sides.

Figure 8. Example from Dutch CROW Manual for bicycle traffic (2007).

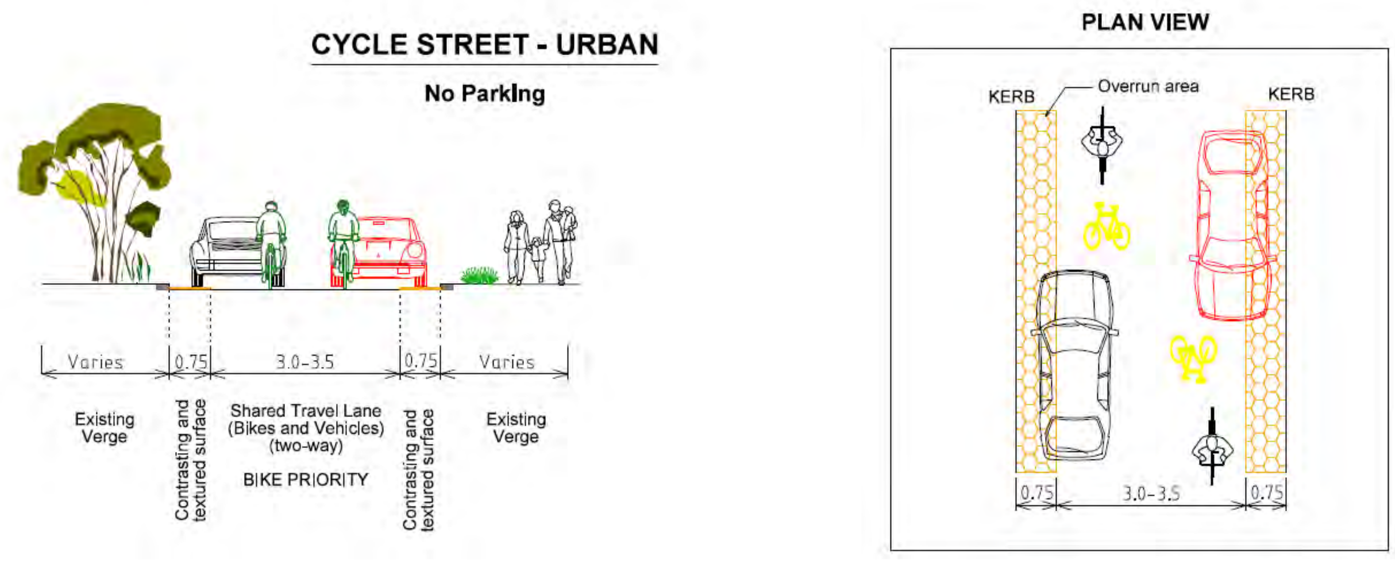


Figure 9. 4.5m to 5m kerb to kerb space with no vehicle parking

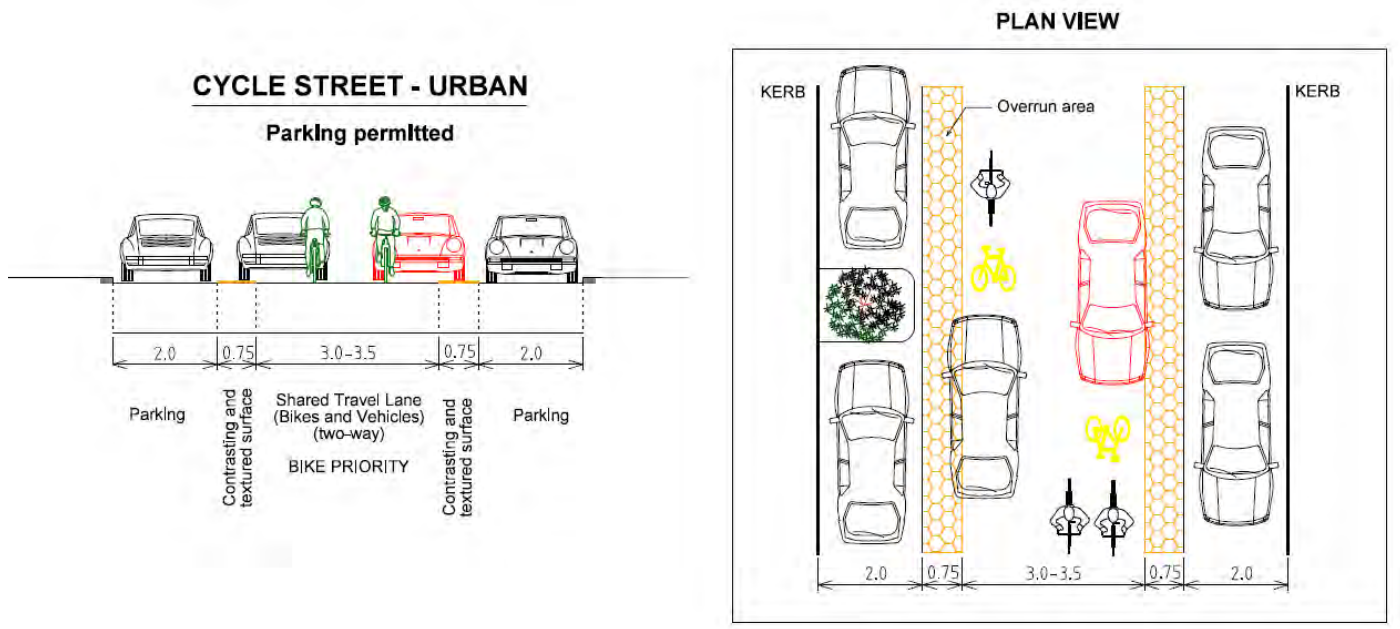


Figure 10. 8.5m to 9m kerb to kerb space with vehicle parking both sides

Document control sheet

Contact for enquiries and proposed changes

If you have any questions regarding this document or if you have a suggestion for improvements, please contact:
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Version history

Version no.	Date	Changed by	Nature of amendment
0.1	14/06/17	Mark McDonald	Initial draft
0.2	15/06/17	Robyn Davies	Review
0.3	20/06/17	Adam Rogers	Review
1.0	21/06/17	Mark McDonald	Final

Document sign off

The following officers have **approved** this document.

Name: Jon Douglas

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Position: Director, Cycling Programs

Signature: ______ Date: 21/6/17