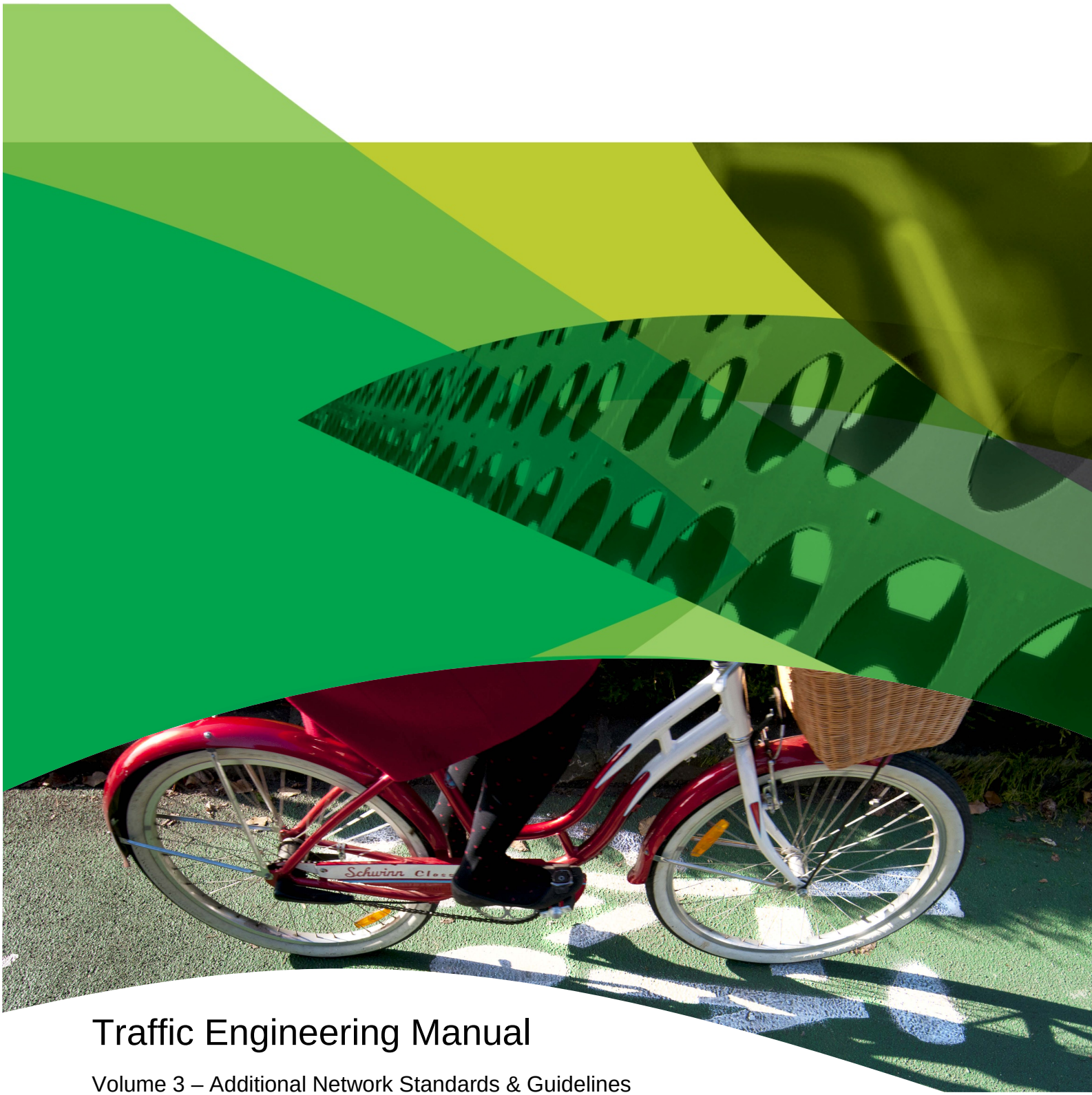


Traffic Engineering Manual

Volume 3 – Additional Network Standards & Guidelines

Design Guidance for strategically important cycling corridors

Edition 1, December 2016

vicroads.vic.gov.au

Table of Contents

1. Introduction

This document, the *Design Guidance for strategically important cycling corridors*, aims to assist practitioners in finding standards and guidelines relating to the implementation and design of strategically important cycling corridors.

This is a working document whereby practitioners are encouraged to provide feedback on this document via tem@roads.vic.gov.au or (03) 9854 2417 to ensure any learnings or improvements can be promptly considered.

2. How to Use this Guide

This document provides guidance to practitioners on selecting the best practice treatments in the delivery of cycling infrastructure to support the development of strategically important cycling corridors.

This document consists of the following parts:

Background

This section details the principles behind the strategically important cycling corridors and the relationship with other types of bicycle infrastructure.

Development Process

This section assists practitioners to determine what appropriate infrastructure is required on a Strategically Important Cycling Corridor and the process where desirable outcomes cannot be met.

Design Parameters for strategically important cycling corridors

This section contains guidance on selecting the best practices for strategically important cycling corridors based on the desirable design parameters specified in Austroads, Australian Standards and VicRoads documents.

Further guidance is also provided in this section for topics not covered in Austroads, Australian Standards and VicRoads documents. The additional guidance aims to enhance the quality of cycling infrastructure provided on strategically important cycling corridors.

General Bicycle Topics

This section contains references to bicycle related topics, not limited only to strategically important cycling corridors.

Topics include general references regarding off-road paths, on-road infrastructure, bicycle parking and treatments for high and low speed environments.

Where a reference to a VicRoads Supplement is made, the VicRoads Supplement shall be read in conjunction with the relevant parent document.

3. Background

Strategically important cycling corridors are a subset of the Principal Bicycle Network (PBN) and are intended to provide:

- a long-term vision for a network of safe, direct and high quality cycling corridors connecting activity centres, public transport hubs and other key locations
- a step-change in cycling facilities to encourage cycling of all ages and abilities – using a combination of **high quality** a) off-road paths, b) on-road separated bike lanes and c) traffic-calmed local streets
- a focused planning and investment effort along these key corridors.

The Principal Bicycle Network (PBN) sets out proposed and existing cycle routes that help people cycle for transport to work, school, shops and services. The PBN makes use of many local roads and

off-road paths, as well as arterial roads. The PBN also includes routes that people use to cycle for recreation, where they also perform a transport function.

The relationship among the PBN, Bicycle Priority Routes (BPR) and strategically important cycling corridors is represented by the diagram in Figure 1.

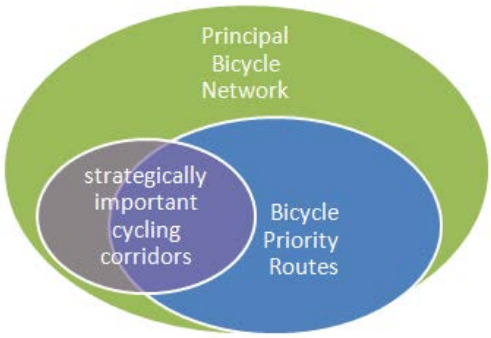


Figure 1: Relationship among the different bicycle network classifications

To inform the development of strategically important cycling corridors, a set of network principles are typically used. These principles are typically based on current transport planning practice and existing transport guidance. Three main sources are the *New Zealand Cycle Network Planning Guide* (2004), *Cycling Aspects of Austroads Guides* (2014) and the VicRoads *SmartRoads* criteria.

Table 1: Typical network principles used to develop strategically important cycling corridors

Principles	Application
Takes a **corridor approach** linking into a **connected network**	• Must end at another corridor, significant intersection or major destination • Can extend outside of the Central Subregion to provide guidance to future plans
Maximises connections to key **destinations**	• Greater than two connections through identified higher order destinations in *Plan Melbourne* • Choice of routes with higher order adjoining land uses
Provides a **safe** cycling environment	• Avoid high speed roads, when an off-road facility cannot be provided within the road corridor • Select corridors with lower exposure rating for crashes
Provides **attractive** routes for cyclists of all abilities	• Preference for corridors that can deliver one of the three types of facilities that have increased cycling in Melbourne • Consider topography
Provides **direct** routes that minimises delays and turns	• Start by drawing lines 'as the crow flies' between destinations • Minimise delays and turns when allocating corridors to the Principal Bicycle Network
Provides **sufficient** supply of corridors to meet future needs in an **efficient** manner	• Preference for corridors where investment required is lower • Can the corridor spacing provide enough capacity? • Approximate network density CBD ≈ 400m, major employment areas ≈ 1000m, remainder of Melbourne ≥ 1.6km
Builds on existing **planned** networks	• Allocate corridors onto Principal Bicycle Network links • Choose Bicycle Priority Routes over Principal Bicycle Network routes where they existed • Need a clear and strong rationale to add new links to PBN

For information on the strategic importance of a cycling corridor in Victoria, advice can be sort from Active Transport Victoria via activetransport@ecodev.vic.gov.au or calling (03) 8392 6533.

4. Development Process

Identification of the potential pipeline of strategically important cycling corridors is the first step in a long process of developing and implementing improved bicycle facilities. The development of specific proposals along the priority corridors must happen before any implementation can occur. During this development process, it is critical that both councils and the community support the proposed facility prior to securing funding. Without the support, only limited improvements to the cycling network are likely to be achieved.

A corridor study will be completed for each selected corridor, including identifying acceptable works at each location along the corridor as well as possible timing and costs of those works for delivering the improvements. This would form a key input into a business case to Government for funding consideration. These business cases may seek funding for construction of bicycle lanes, intersection treatments and paths development and/or funding for further design development for major infrastructure (e.g. bridges). These works may be scheduled over a number of years, depending upon the complexity and costs of the proposals. This planning work will generally be led by VicRoads and should involve:

- investigation of the full corridor across all council areas
- confirm a preferred option alignment, including investigation of alternative local road options (for corridors that are identified as not 100% defined)
- development of concepts for the preferred options
- identify key connections to the corridor to ensure the highest level of access onto corridor is provided
- where corridors are at capacity, create ideas to increase capacity via improvements on parallel routes (e.g. to improve an off-road path where land is limited and widening is not possible, investment could consider improvements to parallel on-road facilities to move faster cyclists off the shared path and creating more room for slower cyclists)
- consider a higher level of improvements rather than what was identified during the prioritisation process
- identify specific design solutions via a consistent design standard and develop a way finding strategy
- councils are encouraged to work with VicRoads to contribute to the development of the planning proposals for strategic corridors in their area. This may help to fast track the development of these corridors and provide better information into the review of this targeted investment plan
- in addition, funding contributions from councils, for sections of strategically important cycling corridors that utilise local roads, will be important to create effective cycling corridors for their local communities.

During the development of concepts for the preferred route, Figure 3 should be used to help select the appropriate solution. Melbourne has led Australia in developing and implementing different types of bicycle facilities. Drawing on this experience, three types of facilities (see Figure 2) have been identified that have attracted higher numbers of cyclists and have a higher proportion of females to males. This gender split can be used as an indicator of these facilities being perceived as safe. These three types of cycling facilities are considered the desired standard for facilities on strategically important cycling corridors. It is however recognised that this standard may not be achieved in the short to medium term on some corridors.

Local streets, Napier Street, Fitzroy

Off-road paths, Capital City Trail, Fitzroy North

Separated lanes, Swanston Street, Melbourne CBD

Figure 2: Types of facilities that provide for all abilities and have supported growth in cycling in Melbourne

Preferred Cycling Treatments Flowchart

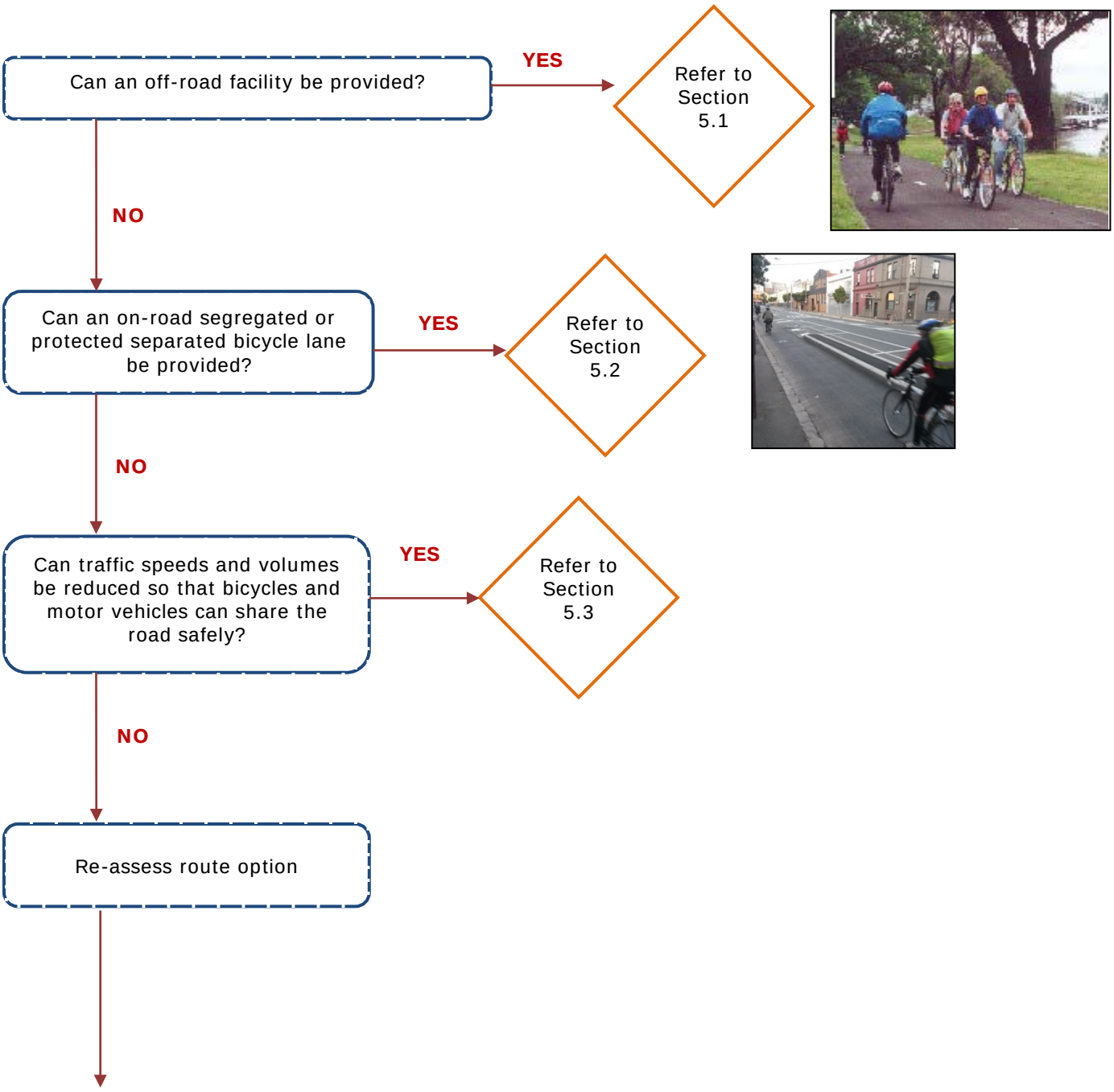


Figure 3: Preferred Cycling Treatments Flowchart

Type of Bicycle Facility Required

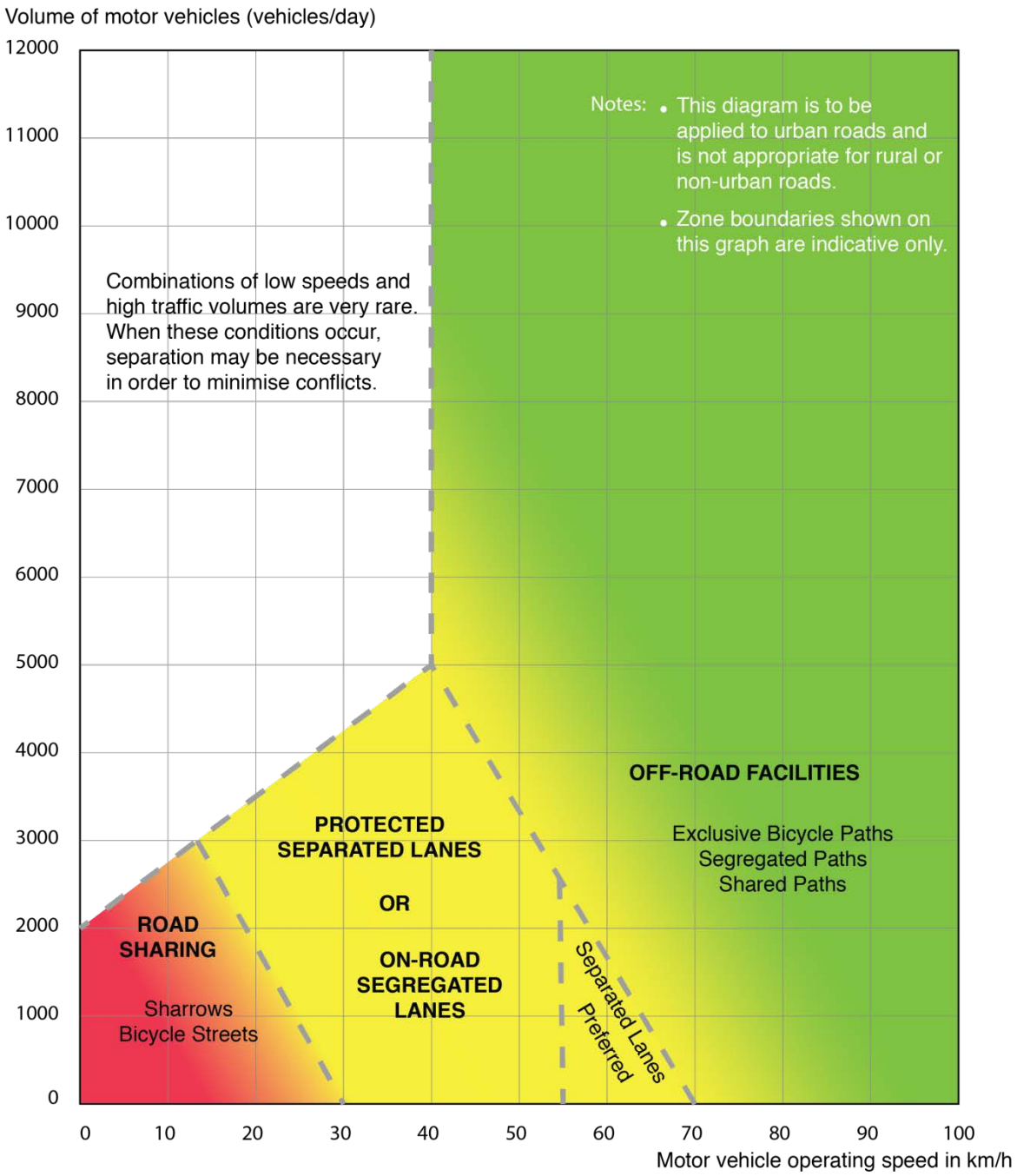
Source: Section 2.7 of the Cycling Aspects of Austroads Guides (2014)

When considering the type of bicycle facility, such as bicycle lanes or shared use paths, two guiding principles are to separate cyclists from motor vehicles and provide a high level of priority for cyclists across driveways and through intersections (see Section 4.6.5 of Austroads Guide to Traffic Management Part 4).

Figure 3 provides guidance for the selection of an appropriate type of bicycle facility. It relates the degree of separation required for cyclists to the speed and volume of general traffic. It should, however, be noted that jurisdictional policy and implementation strategies may also influence the selection of particular facilities.

A key message of Figure 3 is that the separation of cyclists from motor vehicles is not always required on local and collector roads that have traffic volumes less than approximately 3,000 vehicles per day and operating speeds equal to or less than 30 km/h. In these circumstances, it may be considered acceptable that cyclists share the road with motor vehicles.

It should be noted that the zone boundaries shown in Figure 3 among different types of treatments are indicative only, for example, protected separated bicycle lanes may be used on roads with an operating speed lower than 30 km/h if it is deemed more desirable to separate cyclists and motorists rather than having road sharing. However, providing a 'lower' level of facility than what is specified in Figure 3 is not recommended.



Adapted from Cycling Aspects of Austroads Guides Figure 2.2

Figure 4: Bicycle facilities based on volume and operating speeds of motor vehicles

5. Design Parameters for strategically important cycling corridors

General

The intention of this Section is to guide practitioners in selecting a cycling treatment that provides the best outcome for cyclists. The focus will be on key design elements that directly affect the development and implementation of bicycle infrastructure on strategically important cycling corridors – for topics not covered here, refer to Section 6 - General Bicycle Topics in this document.

When selecting a treatment or design parameter to be used on a strategically important cycling corridor, practitioners should aim to choose the most 'desirable' recommendation. These recommended treatments or design parameters will be specified under each topic. Where this is not achievable, practitioners should choose the next best treatment or design parameter; otherwise the decision making process outlined in Section 4 of this document should be repeated.

Where it is determined that design parameters cannot be met, practitioners should consider the application of context sensitive design principles. Context sensitive design is an approach that provides flexibility to utilise design parameters that are beyond the normal design domain to satisfy competing project objectives.

The application of context sensitive design generally includes:

- Consideration of alternative options
- Determination of design parameters beyond the normal design domain that may be applied.
- Consideration of improvements to other design parameters.
- Assessment of associated risks.
- Documentation of the decision making process.
- Seeking the relevant approval for the use of those particular design parameters.

For details regarding context sensitive design, practitioners can refer to VicRoads' guideline *Context Sensitive Design - Application of Design Domain and Design Exceptions*.

The guidance contained in this Section in most cases is an abridged version of the material found in the parent document, which is identified under each topic heading. Detailed or additional guidance can be found in the parent document under those relevant sections or clauses and should be read in conjunction with the guidance in this document.

Where there is a difference between the guidance in this document and in the parent (source) document, the guidance in this document takes precedence.

Section 5.1 – Off-Road Paths (shared / exclusive)

5.1.1 Description

Off-road paths allow cyclists to ride on a separate path that is not shared with motor vehicles – in many cases the path is remote from a road. This separate facility virtually eliminates the risk of collision between motorists and bicycle riders and as such is the preferred treatment on strategically important cycling corridors.

In general, the following considerations should be taken into account when off-road paths are to be provided. Further details can be found in the sections below and in the parent cycling related Australian Standards and Austroads documents (noted in each section).

- Whether full separation is required between pedestrians and cyclists on the off-road path, the preference is for a fully separate path. However, this decision may be influenced by user volumes, sight distance along the corridor, crash history (if available) and land availability (refer to Section 5.1.2).
- Width of the path to adequately cater for the volume and types of bicycle riders (refer to Section 5.1.4 below).
- The design of the separated path should provide adequate separation between bicycles and pedestrians (e.g. median or barrier).
- The amount of land required for the off- road path.
- The cost of installation and maintenance.
- Signage to highlight to users where they should ride and road crossing points.
- Whether the path should be designed as a two-way facility or one-way facility.

For guidance on separated bicycle paths or lanes adjacent to the road or within the road reserve, refer to Section 5.2 of this document.

Figure 5: Example of Shared Path between Box Hill and Ringwood, Box Hill

5.1.2 Choice of Appropriate Type of Path

Source: Section 7.3 of Cycling Aspects of Austroads Guides (2014), Section 3 of Austroads Guide to Road Design Part 3 (2016), VicRoads Guidance on Treating Bicycle Car Dooring Collisions

Where an off-road bicycle or pedestrian facility is to be provided, usually this involves the mixing of pedestrians and cyclists along the off-road path. There are three main types of paths that can be provided:

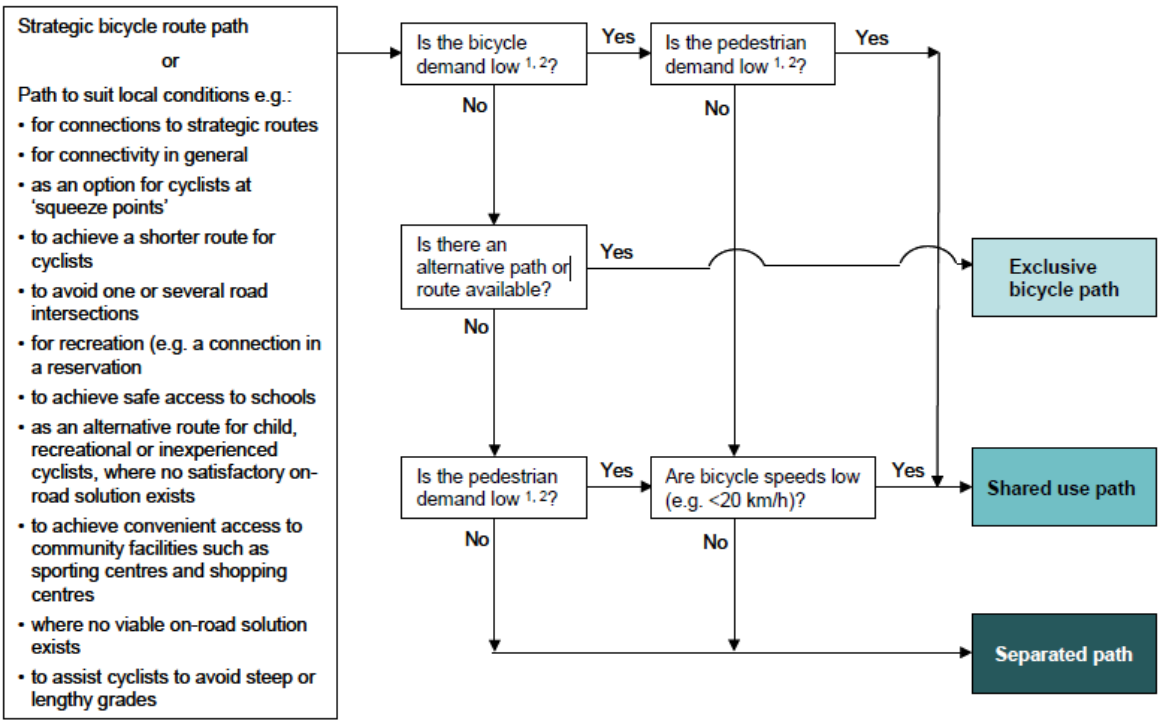
- Shared use path – a wide path where pedestrians and cyclists both use the same path.
- Segregated path – the pedestrian path is adjoining to the bicycle path, usually separated by linemarking or visually through the use of different coloured pavements.

- Separated path – where the path for cyclists is physically separated from the path for pedestrians, e.g. by a barrier or median. The bicycle path component may also be known as an 'exclusive bicycle path'.

On strategically important cycling corridors, a separated path (exclusive bicycle path) is the desired treatment as:

- Where there is an adjacent pedestrian path, it virtually eliminates the conflict between pedestrians and cyclists as they are physically separated.
- Allows cyclists to have uninterrupted and safe travel at a relatively high constant speed (30 km/h or above).

Where there are difficulties in providing a separated exclusive bicycle path, Figure 5 below provides guidance regarding other path type options. Note that 'separated path' in the chart below also includes a 'segregated path'. Practitioners should be aware that there may be other issues, constraints and practices that will have a bearing on the decision-making process.



1 The level of demand can be assessed generally on the basis of the peak periods of a typical day as follows:
a. Low demand: Infrequent use of path (say less than 10 users per hour)
b. High demand: Regular use in both directions of travel (say more than 50 users per hour).

2 These path volumes are suggested in order to limit the incidence of conflict between users, and are significantly lower than the capacity of the principal path types.

Figure 6: Guide to the choice of path treatment for cyclists (source: Section 7.3 of Cycling Aspects of Austroads Guides (2014))

Further notes to Figure 5 above:

- Where the volume of pedestrians and/or cyclists is large or there is the potential for conflicts between the two modes, there may be a need to separate the path between cyclists and pedestrians, and at other associated locations where pedestrians and cyclists are adjacent to one another. It is recommended that where there are more than 50 cyclists per hour, separated (or at the very least segregated) paths should be provided.

- A segregated path also provides a level of separation; however, as there is no physical separation, there is still a chance of a collision between a pedestrian and cyclist in the event a cyclist encroaches onto the pedestrian path.
- Where there is a large differential speed between the two modes, there is an increased risk of injury to pedestrians in the event of a collision between a pedestrian and cyclist.
- Path width and the need to provide a separate footpath should be determined on future demand estimates. Recommended design parameters can be found in Section 5.1.4 (d) where:
    - o 'Desirable widths' should be used where the volume of cyclists is 1000 or less an hour during peak times.
    - o Where the volume of cyclists is greater, a width beyond the 'desired width' should be used.
    - o A greater width should also be used where there is a safety or operational benefit.
    - o Where there are geometric or other restrictions preventing the 'desired width' from being used, then the 'minimum width' may be used.
- Further guidance can be found in Austroads Guide to Road Design Part 6A Sections 3.4 and 3.5.

5.1.3 Bicycle Speed and Horizontal Alignment

a) Bicycle Operating Speed

Source: Section 7.5.2 of Cycling Aspects of Austroads Guides (2014)

Recommended design operating speed for a shared / bicycle path: 30 km/h

b) Horizontal Alignment (curves)

Source: Section 7.5.3 of Cycling Aspects of Austroads Guides (2014)

The minimum horizontal radii shown in Table 2 should be used where a flat surface is used and it is not possible or desirable to provide superelevation. The desired radius is shown in yellow.

Table 2: Minimum radii of horizontal curves without superelevation

Design Speed (km/h)	Minimum radius (m)
20	10
30	**25**
40	50
50	94

c) Crossfall (non-curves)

Source: Section 7.5.6 of Cycling Aspects of Austroads Guides (2014)

To maintain comfort for people bicycling with more than two wheels or with a trailer and for effective disposal of surface water, a bicycle path crossfall of 2 percent is generally sufficient.

Steeper cross slopes of up to 8 percent are acceptable for limited distances in retrofit conditions[1].

5.1.4 Path Width

Source: Section 7.5.4 of Cycling Aspects of Austroads Guides (2014)

a) Exclusive Bicycle Paths (two way)

Path widths for strategically important cycling corridors **must** meet Major Path standards (marked in yellow).

1 MassDOT Separated Bike Lane Planning & Design Guide, Chapter 4, Section 3.3.1
https://www.massdot.state.ma.us/highway/DoingBusinessWithUs/ManualsPublicationsForms/SeparatedBikeLanePlanningDesignGuide.aspx

Table 3: Exclusive bicycle path (two way) widths

	Path Width (m)	
	Local access path	**Major path**
Desirable width (minimum)	2.5	3.0
Minimum width – typical maximum	2.5[(1)]-3.0[(2)]	2.5[(1)]-4.5[(2)]

1. A lesser width should only be adopted where cyclist volumes and operational speeds will remain low.

2. A greater width may be required where the number of cyclists is very high (refer to Section 5.1.2).

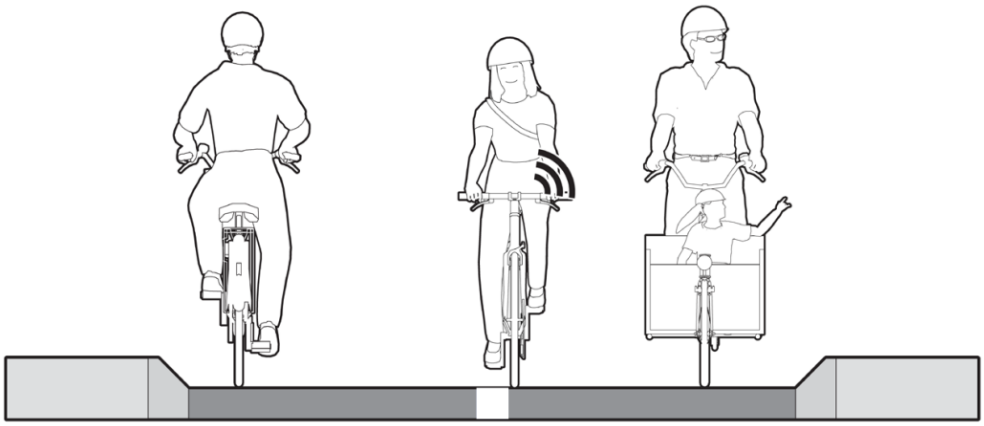


Figure 7: A desirable minimum width of 3.0 m allows passing movements to be comfortable undertaken (two-way path)[2]

Figure 8: Example of separated pedestrian and cyclist path

b) Shared Paths

Strategically important cycling corridor shared paths **must** meet 'commuter path' standards (marked in yellow). Where pedestrian volumes are higher, the recreational path width should be considered or

[2] Image source: MassDOT Separated Bike Lane Planning & Design Guide, Chapter 3, Section 3.3.2 https://www.massdot.state.ma.us/highway/DoingBusinessWithUs/ManualsPublicationsForms/SeparatedBikeLanePlanningDesignGuide.aspx

a separated path be considered instead to eliminate the risk of collision between pedestrians and cyclists (see (c) below).

Table 4: Shared path widths

	Path Width (m)		
	Local Access path	**Commuter path**	**Recreational path**
Desirable width (minimum)	2.5	3.0	3.5
Minimum width – typical maximum	2.5[(1)]-3.0[(2)]	2.5[(1)]-4.5[(2)]	3.0[(1)]-4.0[(2)]

1. A lesser width should only be adopted where cyclist volumes and operational speeds will remain low.
2. A greater width may be required where the numbers of cyclists and pedestrians are very high (refer to Section 5.1.2) or there is a high probability of conflict between users (e.g. people walking dogs, roller bladders and skaters etc.).

c) Separated Paths - two-way path

Strategically important cycling corridor two-way separated paths **must** meet the desirable minimum width (marked in yellow). This width allows passing movements in both directions. It should be noted that these types of paths provide physical separation between pedestrians and cyclists.

Table 5: Separated paths - two-way path

	Path Width (m)		
	Bicycle path	**Footpath**	**Physical separator between bicycle path and footpath**
Desirable width (minimum)	2.5	1.5	1.0
Minimum width	2.0	1.2	0.5

d) Separated Paths - one-way path

Strategically important cycling corridor one-way separated paths **must** meet the desirable minimum width (marked in yellow). This width allows passing movements. It should be noted that these types of paths provide physical separation between pedestrians and cyclists.

Table 6: Separated paths - one-way path

	Path width (m)		
	Bicycle path	**Footpath**	**Physical separator between bicycle path and footpath**
Desirable width (minimum)	1.5	1.5	1.0
Minimum width	1.2	1.2	0.5

5.1.5 Intersection Treatments

a) Pram Ramps

Source: Australian Standards AS 1742.9

Path priority crossing treatments allow off-road paths to continue across a road. These types of crossings typically include a raised platform and pavement markings to increase the conspicuity of the crossings and to encourage motorists to slow down and give way to people crossing the road way as show in Figure 8.

Path priority crossing treatments are only suitable for local roads that carry very low volumes of traffic (e.g. less than 2000 vehicles per day for collector roads and 800 vehicles per day for local streets). Where higher traffic volumes are expected, consideration towards signalised intersections should be given.

Figure 9: Example of pram ramps - Ames Street, Carlton North

b) Signalised Road Intersections

Source: Section 5.3.9 of Cycling Aspects of Austroads Guides (2014)

Signalised intersections are often associated with traffic routes and are therefore utilised by commuter cyclists. Wherever practicable, traffic routes and signalised intersections should provide the space and operational conditions to support cycling as a viable mode of transport. The needs of cyclists should be considered in relation to detection, signal phasing and timing, and road space. Off-road paths are often provided for non-commuter cyclists (e.g. the young and novice cyclists) and these paths often have to be incorporated into the functional layouts of signalised intersections. Traffic management considerations for cyclists at intersections are also provided in the Austroads Guide to Traffic Management Part 6.

The operation of traffic signals to accommodate cyclists is discussed in the Austroads Guide to Traffic Management Part 9 and traffic signal displays for cyclists in the Austroads Guide to Traffic Management Part 10.

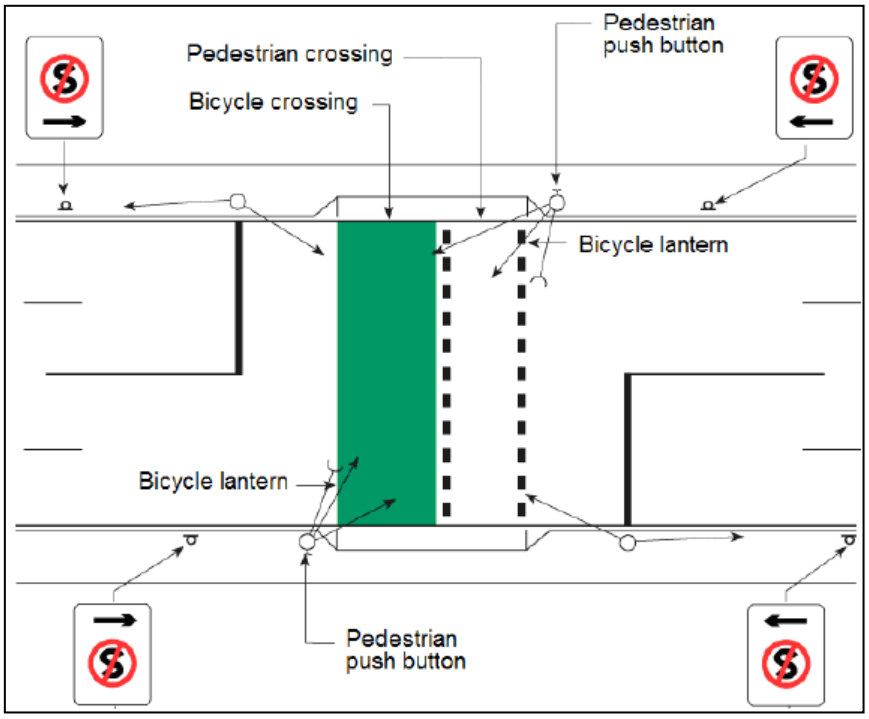


Figure 10: Example of signalised pedestrian / bicycle crossing

c) Path Terminal Treatments

Source: Section 7.8 of Cycling Aspects of Austroads Guides (2014)

A path terminal treatment may be required where a shared path or bicycle path intersects with a road and applies to recreational and commuter paths that cross a road from a reservation, or to paths that follow a major road and cross side streets. Guidance on the use and design of path terminal treatments is provided in Section 10 of Austroads Guide to Road Design Part 6A (2009).
Path terminal treatments for off-road, shared paths and bicycle paths are generally provided to:

- restrict illegal access by drivers of motor vehicles to road reserves and parkland to prevent damage to paths and other assets and prevent illegal waste dumping.
- advise cyclists that there is a road ahead and slow cyclists down before they cross the road.

The objective of a path terminal treatment is to prevent illegal vehicle access with a design and/or device that maintains a safer operating environment for cyclists. The Austroads Guide to Road Design Part 6A provides examples and guidelines for the design of the treatments that include separation of entry and exit, bollards or staggered fences.

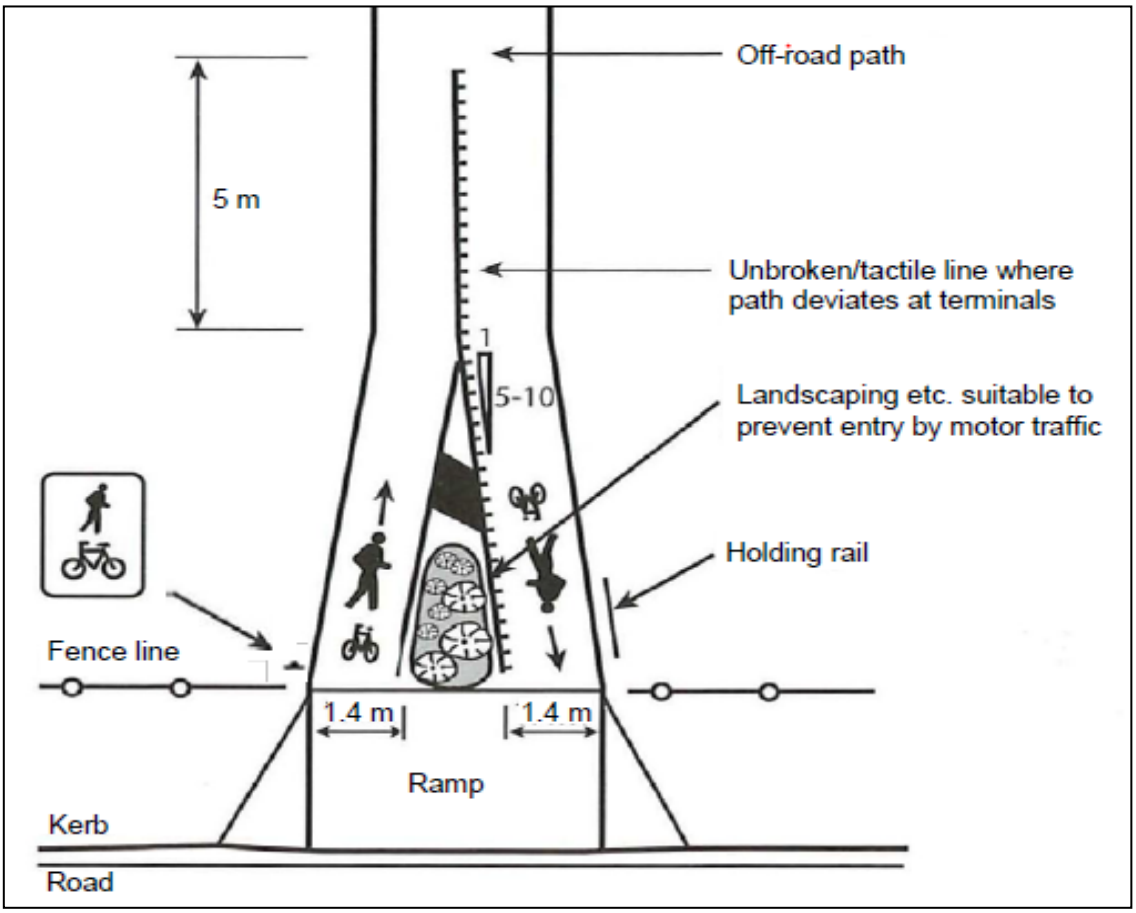


Figure 11: Off-road path terminal treatments - separate entry/exit terminal

Figure 12: Off-road path terminal treatments – bollard treatment

Figure 13: Off-road path terminal treatments – staggered fence treatment

d) At side roads

Source: Section 9.6.3 of Austroads Guide to Road Design Part 4 (2009) and Section 7.6.6 of Cycling Aspects of Austroads Guides (2014)

There are three types of treatments available for the design of path crossings of side streets, a design where the path approach is bent-out (i.e. is deviated away from the major road), a design where the approach is straight, and a treatment where a one-way bicycle path is deviated to become an on-road bicycle lane. These crossings are also covered in Section 9.6.3 of the Austroads Guide to Road Design Part 4. The first two types of treatment may be applied to bicycle paths or separated paths.

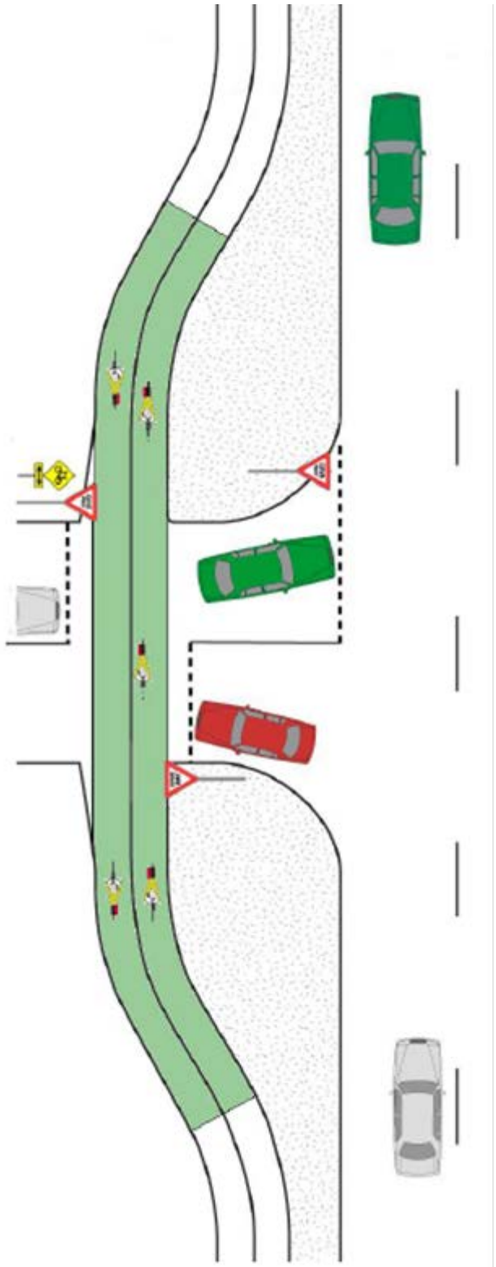
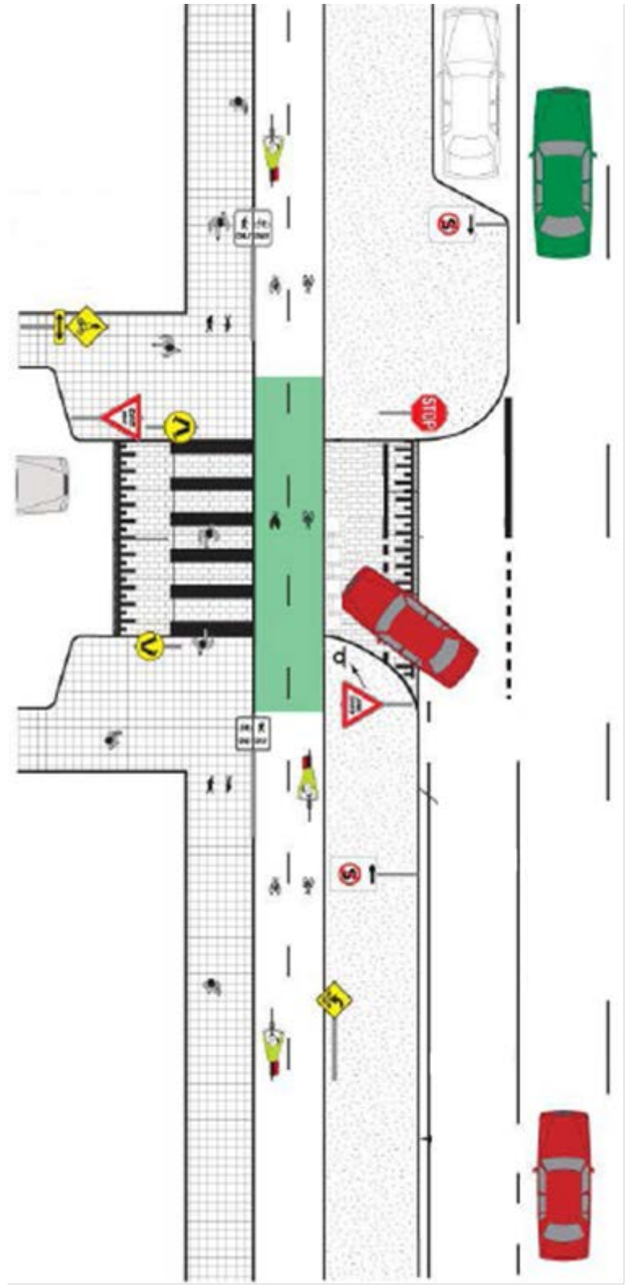
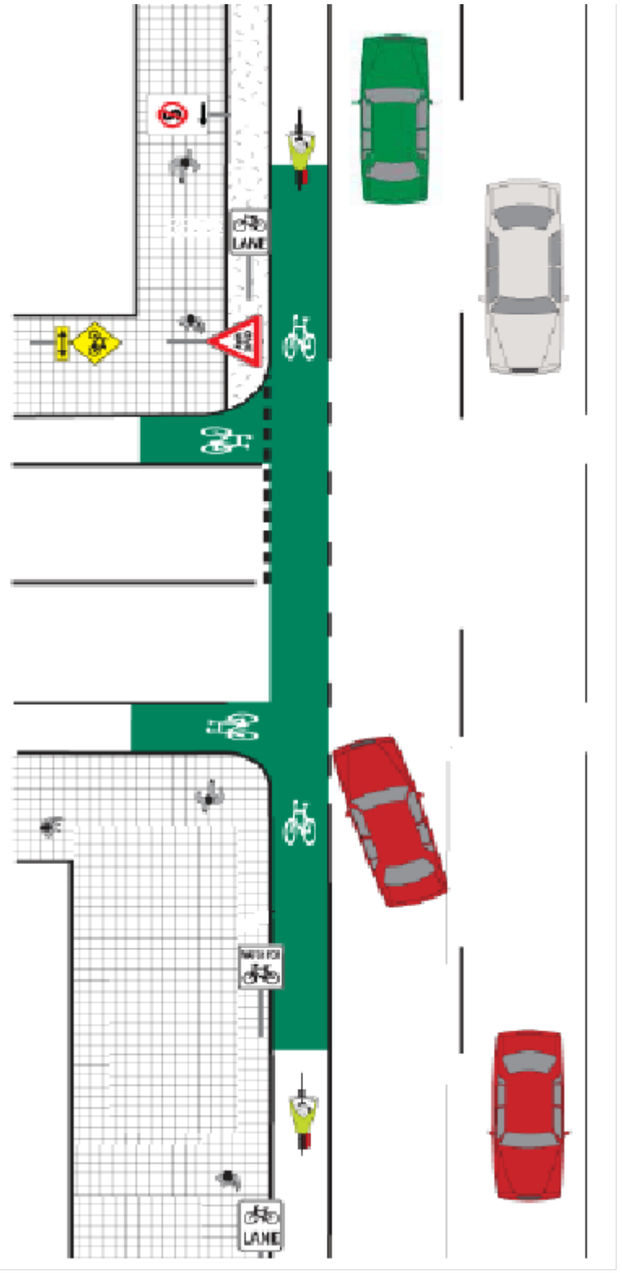
Bent-out treatment	Straight crossings	One-way bicycle path crossing (bent-in side road)
		

Figure 14: Types of crossings of side roads (Adapted from Section 7.6.6 of Cycling Aspects of Austroads Guides (2014))

e) Mid-block Crossing

Source: Section 7.6.4 of Cycling Aspects of Austroads Guides (2014)

An example of a mid-block off-road bicycle path crossing is shown in Figure 14.

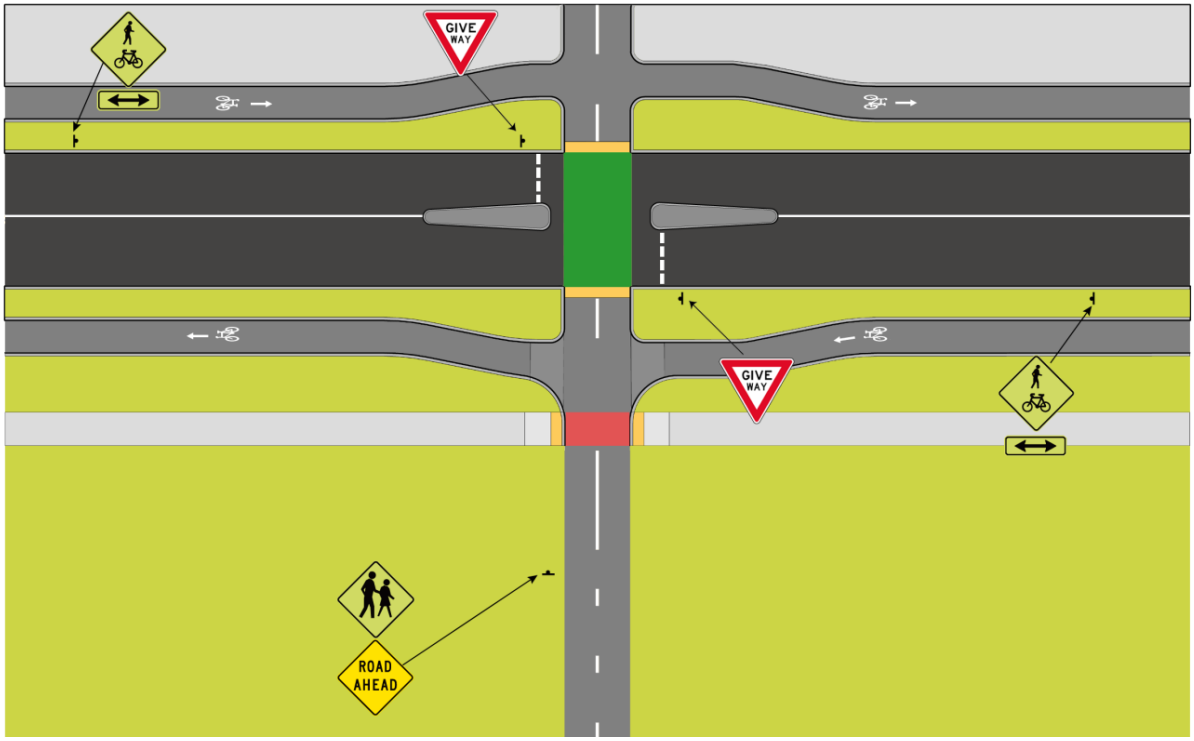


Figure 15: Mid-block off-road bicycle path crossing. Adapted from Massachusetts Department of Transportation Separated Bike Lane Planning & Design Guide [3].

f) Driveway Crossings

Where the off-road bicycle path crosses a driveway, the design should clearly communicate that cyclists have the right-of-way.

For low volume residential driveways, the location of the path crossing should be clearly visible to motorists – vegetation and roadside furniture should be removed as not to cause a safety hazard. A higher level of treatment is usually not required unless an engineering assessment indicates a need.

At crossings (both controlled and uncontrolled) of high volume residential or commercial driveways, or any industrial driveway, a higher level of treatment may be required. These treatments include:

- Raised bicycle path crossing
- Installation of road humps on the driveway approach to the crossing
- The bicycle path painted green across the conflict point
- Bicycle warning signs

[3] Adapted from MassDOT Separated Bike Lane Planning & Design Guide, Chapter 4, Section 4.5 https://www.massdot.state.ma.us/highway/DoingBusinessWithUs/ManualsPublicationsForms/SeparatedBikeLanePlanningDesignGuide.aspx

Section 5.2 – On-Road Bicycle Lanes

5.2.1 Description

This section briefly describes various types of bicycle lane treatments and provides guidance on the use and the width of the treatments. Further details can be found in Section 4.4 of the Cycling Aspects of Austroads Guides (2014); however the type of treatments listed in this Section for use on strategically important cycling corridors focus on separating cyclists from motor vehicles wherever possible.

a) Separated Bicycle Lanes

Source: Section 4.4.3 of the Cycling Aspects of Austroads Guides (2014)

The provision of a separated bicycle lane aims to improve the safety for cyclists by providing (physical) separation from other motor traffic whilst maintaining directness of travel and priority at intersections. Separated bicycle lanes are also referred to as:

- protected separated bicycle lanes
- kerb separated bicycle lanes.

Protected Separated Bicycle Lanes

Source: Section 4.4.3 of Cycling Aspects of Austroads Guides (2014) and Section 4.8.5 of Australian Guide to Road Design Part 3 (2016)

A protected separated bicycle lane:

- is usually considered where a substantial length of road is being widened or duplicated and where there are few driveways and intersections
- generally provides a higher level of service for cyclists (compared to unprotected on-road bicycle lanes) and has been shown to promote increased patronage on cycling routes
- is an option to be considered where a full width off-road path with suitably high levels of directness and priority for cyclists at intersections cannot be achieved within the existing road reservation.
- may be applied in urban areas where parking is prevalent
- is characterised by a raised separation strip to physically prevent vehicular access to the bicycle lane and provide clearances for the opening of car doors.

The raised separator generally requires breaks in the kerb to maintain the free drainage of the road (in a retrofit situation) or otherwise a specific drainage system needs to be installed. Frequent maintenance of these bicycle lanes is required to ensure that they do not accumulate debris and litter that would normally be collected by a street sweeper in routine road maintenance. This is important because cyclists using this type of facility are unable to readily deviate around debris (as they could when using a conventional bicycle lane) such as glass, stones, and other objects that could puncture a tyre.

Figure 16: On-road one-way separated bicycle path on St Kilda Road near Linlithgow Avenue

Protected bicycle lanes are typically one-way, travelling in the same direction as the adjacent traffic lanes; however they may be two-way where:

- Origins and destinations are on the same side of the road and as such, road crossings can be avoided.
- There is no choice other than for a treatment within the road reserve in a length generally consisting of paths and where the need for road crossings by cyclists can be avoided.
- Relatively few driveway crossings exist, particularly where the route is used by children.
- Parking demand is low in the area of the treatment, and as a consequence would be removed.
- The road is wide such that parking is retained adjacent to (but outside of) the bicycle lane area. In this instance, the facility is regarded as appropriate only where the parking is long-term.

Figure 17: Example of protected two way lanes - Fitzroy Street, St Kilda

Kerb Separated Path

Source: Section 4.4.3 of Cycling Aspects of Austroads Guides (2014)

The treatment is raised above the traffic lanes and is usually situated alongside semi-mountable kerb and channel, unless a flush treatment is required for drainage considerations in which case a 600 mm wide flush kerb or edge strip may be used.

Kerb separated path are appropriate in constrained locations where a buffer between a bicycle lane and a roadway cannot be provided, or only a narrow buffer can be provided. Because of the narrow buffer, raised bicycles lanes are generally not recommended for two-way operation or to be adjacent to on-street parking, unless provisions are made to ensure the safety of cyclists adjacent to the traffic or parking lane.

At certain locations, the separation may need to be increased by 1.0 m from the back of kerb to provide clearance from car doors where kerbside parking is likely to occur.

Figure 18: Kerb separated bicycle lane

Figure 19: Two way kerb bicycle path on Beaconsfield Parade

b) Contra-flow Exclusive Bicycle Lane

Source: Section 4.4.2 of Cycling Aspects of Austroads Guides (2014)

A contra-flow bicycle lane is an exclusive bicycle lane that enables cyclists to travel in both directions in a one-way street. Contra-flow bicycle lanes:

- should be considered as an acceptable treatment in urban environments where sufficient road widths exist to provide a safer treatment
- should have a width appropriate to the situation (refer to 'bicycle lane widths'); absolute minimum = 1.5 m; desirable = 1.8 m
- should be physically separated from motor traffic where used in speed zones ≥ 60 km/h by a raised traffic island (preferable) or a safety strip that is desirably 1 m wide (0.6 m minimum)
- without physical separation from the adjacent traffic lane (e.g. a raised island), may generally be appropriate only in speed zones up to 50 km/h

- may be placed between parked cars and the kerb where bicycle access is important. Although this is not ideal, it may be satisfactory where cyclists do not need to frequently leave or join the facility over its length and cycling speeds are low. In such cases, it is imperative to provide a 1.0 m separator (preferably a raised island) to allow for vehicle overhang or opening car doors.

Figure 20: Example of contra-flow lane - Lennox Street, City of Yarra

5.2.2 Bicycle Lane Widths

Source: Section 7.5.4 of Cycling Aspects of Austroads Guides (2014)

The tables in this section describe the recommended width of separated bicycle lanes. Recommended widths are shown in yellow.

a) One-way Bicycle Lanes

Table 7: Separated paths - one-way path[4]

	Bicycle lane width (m)
Desirable minimum width	1.5
Minimum width – typical maximum	1.2 – 2.5

[4] Section 7.5.4 of Cycling Aspects of the Austroads Guides (2014).

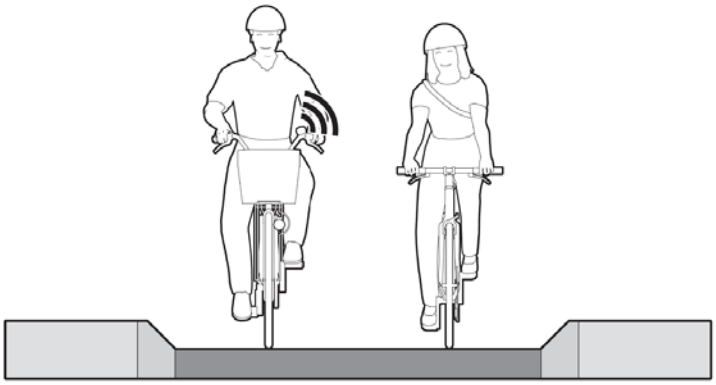


Figure 21: A desirable minimum width of 1.5 m allows passing movements to be undertaken[5]

b) Separated Paths - two-way path

Table 8: Separated paths - two-way path[6]

	Bicycle lane width (m)
Desirable minimum width	3.0
Minimum width – typical maximum	2.5(1)- 4.0(2)

1. A lesser width should only be adopted where cyclist volumes and operational speeds will remain low

2. A greater width may be required where the number of cyclists is very high

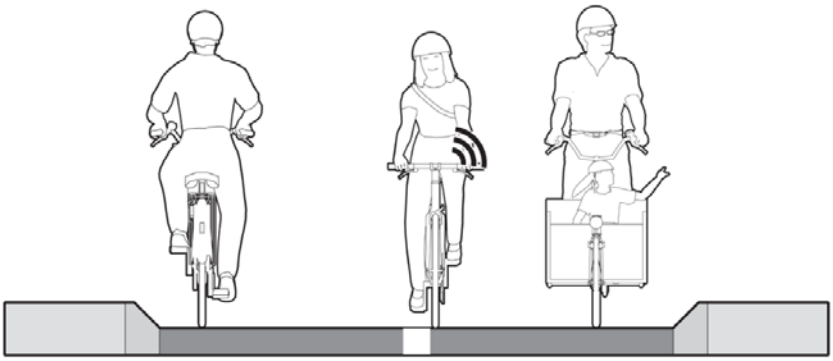


Figure 22: A desirable minimum width of 3.0 m allows passing movements to be undertaken[5]

5.2.3 Bicycle Lane Elevation

a) Separated Bicycle Path

Separated bicycle paths may be raised against the adjacent roadway to provide a vertical separation between cyclists and motor vehicles. This is especially the case for kerb bicycle lanes where in some cases, a wide physical barrier between the roadway and bicycle path may not be feasible (see Figure 17). Consideration may also be given to provide a difference of level between the bicycle lane and adjacent footpath to discourage encroachment from pedestrians.

[5] Image source: MassDOT Separated Bike Lane Planning & Design Guide, Chapter 3, Section 3.3.2 https://www.massdot.state.ma.us/highway/DoingBusinessWithUs/ManualsPublicationsForms/SeparatedBikeLanePlanningDesignGuide.aspx

[6] Section 7.5.4 of Cycling Aspects of the Austroads Guides (2014).

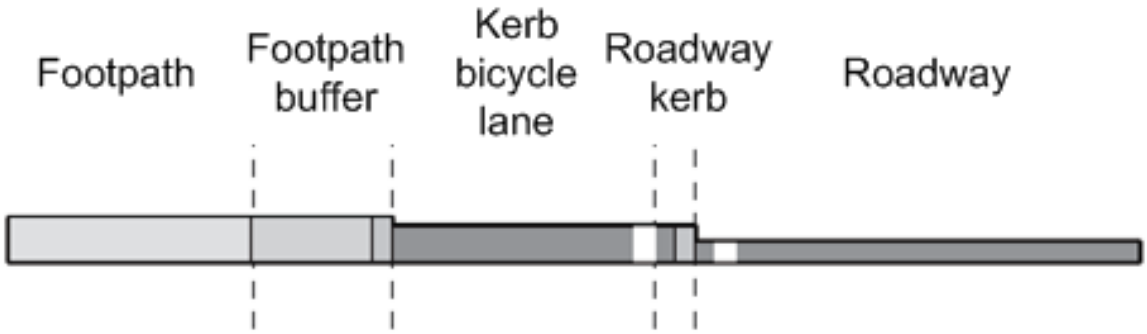


Figure 23: Example cross section of a raised kerb bicycle lane showing the bicycle lane on a higher level than the roadway but lower than the footpath[7]

Other considerations for raised kerb bicycle lanes include:

- Where this treatment has priority movements across an intersection, a ramp up/down is required where the path is to be at road level. A ramp is not required if the bicycle lane is provided on a raised crossing or the roadway is placed on a raised platform which is the same level as the raised kerb bicycle lane.
- Where this treatment rejoins the road as an exclusive bicycle lane prior to major intersections, this should be accommodated by means of a ramp up/down to the road pavement surface with a grade no steeper than 10% to transition the level difference.
- Refer to Section 5.2.4 of this document for arrangements at intersections

5.2.4 Intersection Treatments

Source: Sections 5.3 and 5.4 of Cycling Aspects of Austroads Guides (2014)

The crossing of a separate bicycle path across a road intersection poses safety issues for cyclists, namely the risk of collision between cyclists and motorists due to motorists not being aware of cyclists. Therefore, the design of road crossings at intersections needs to provide a safe riding environment, of which can be achieved through continuing the separation of cyclists and motorists through the intersection.

As shown in Figure 23, the approach to the conflict point comprises three zones[8]:

- Recognition zone – the approaching cyclist and motorist have an opportunity to see each other and evaluate their respective approach speeds.
- Decision zone – the cyclist or motorist identifies who is likely to arrive at the intersection first and adjust their speed to give way or stop if necessary.
- Stop zone – space for the motorist or cyclist to stop if needed.

[7] Image source: MassDOT Separated Bike Lane Planning & Design Guide, Chapter 3, Section 3.3.2 https://www.massdot.state.ma.us/highway/DoingBusinessWithUs/ManualsPublicationsForms/SeparatedBikeLanePlanningDesignGuide.aspx

[8] MassDOT Separated Bike Lane Planning & Design Guide, Chapter 4, Section 4.2.4 https://www.massdot.state.ma.us/highway/DoingBusinessWithUs/ManualsPublicationsForms/SeparatedBikeLanePlanningDesignGuide.aspx

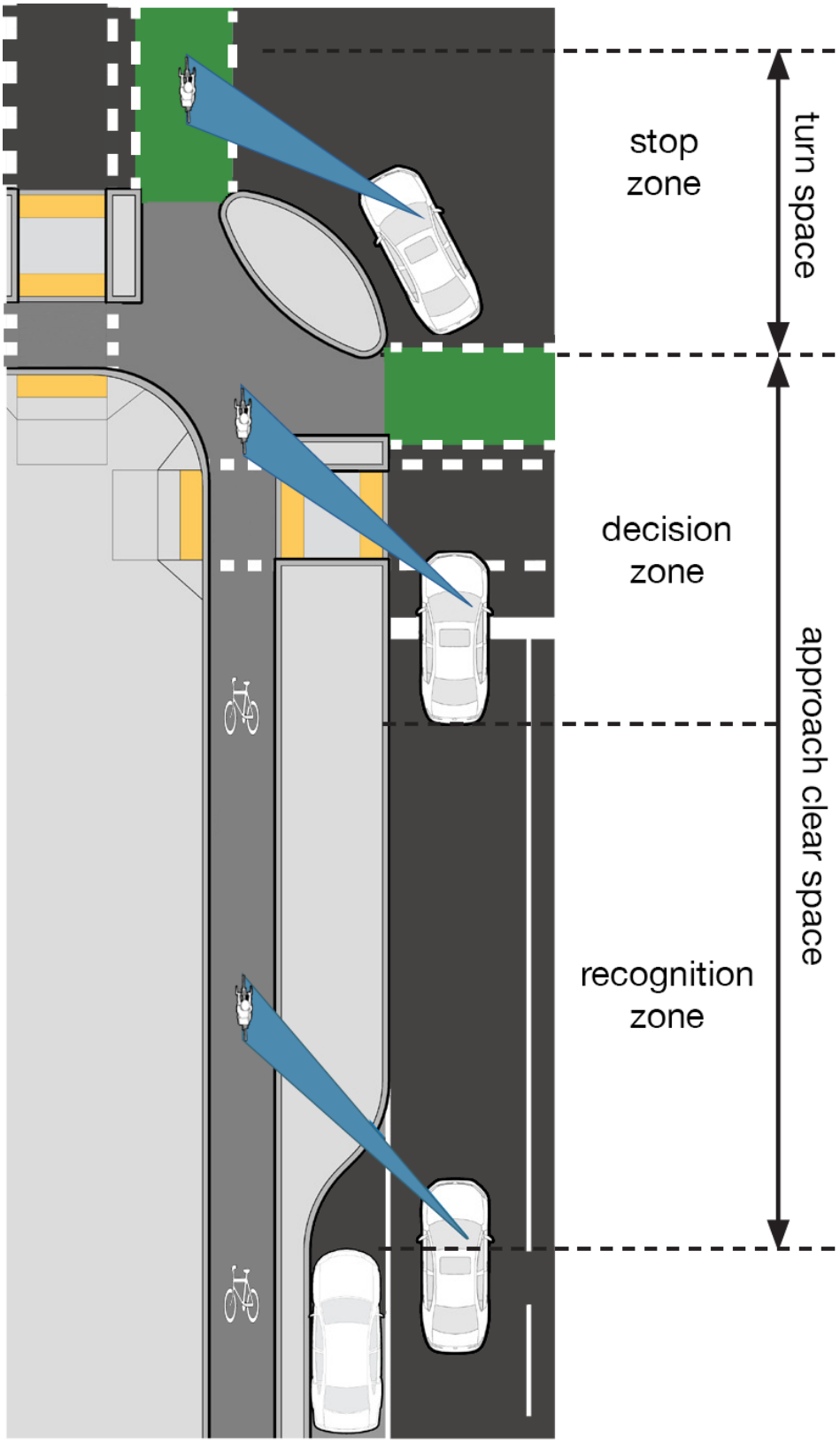


Figure 24: Approach to the conflict point at an intersection. Adapted from Massachusetts Department of Transportation Separated Bike Lane Planning & Design Guide[9]

[9] Image source: MassDOT Separated Bike Lane Planning & Design Guide, Chapter 4, Section 4.2.4 https://www.massdot.state.ma.us/highway/DoingBusinessWithUs/ManualsPublicationsForms/SeparatedBikeLanePlanningDesignGuide.aspx

a) Separated Path Crossing

Source: Section 5.3.9 of Cycling Aspects of Austroads Guides (2014)

Figure 24 shows an example of a multi-lane road intersection with off-road bicycle paths on one road and a shared path on the other road in a constrained road reservation. In this case, the various paths adjoin and cross parallel to the intersecting roads. This example shows two-way bicycle paths on both sides of one road and shared paths on both sides of the intersecting road. For this type of treatment, it is desirable to have separate detection and lanterns for cyclists and pedestrians (refer to Austroads Guide to Traffic Management Part 9 (2014) and Austroads Guide to Traffic Management Part 10 (2016)).

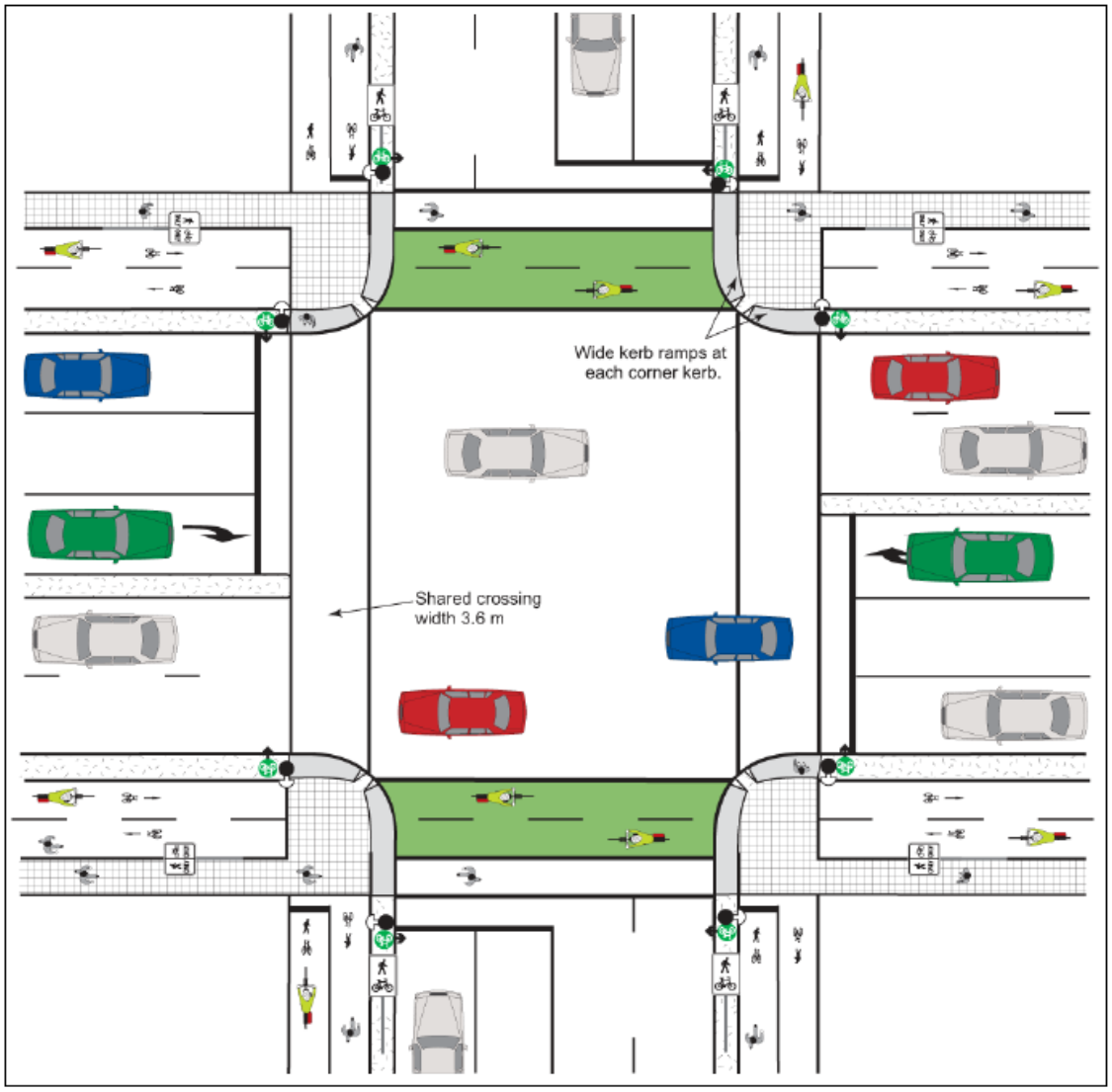


Figure 25: Shared path and two-way bicycle path at a signalised intersection

Figure 25 shows how protected two-way bicycle lanes can be provided at and on the approach to the signalised intersection.

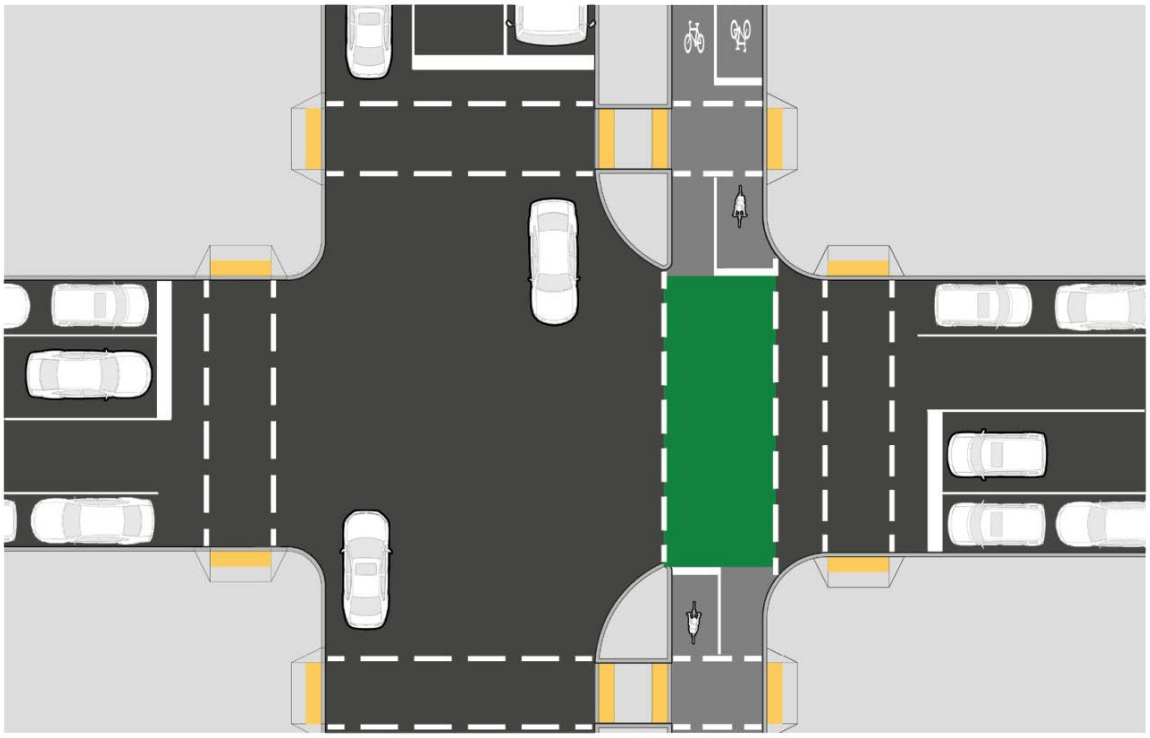
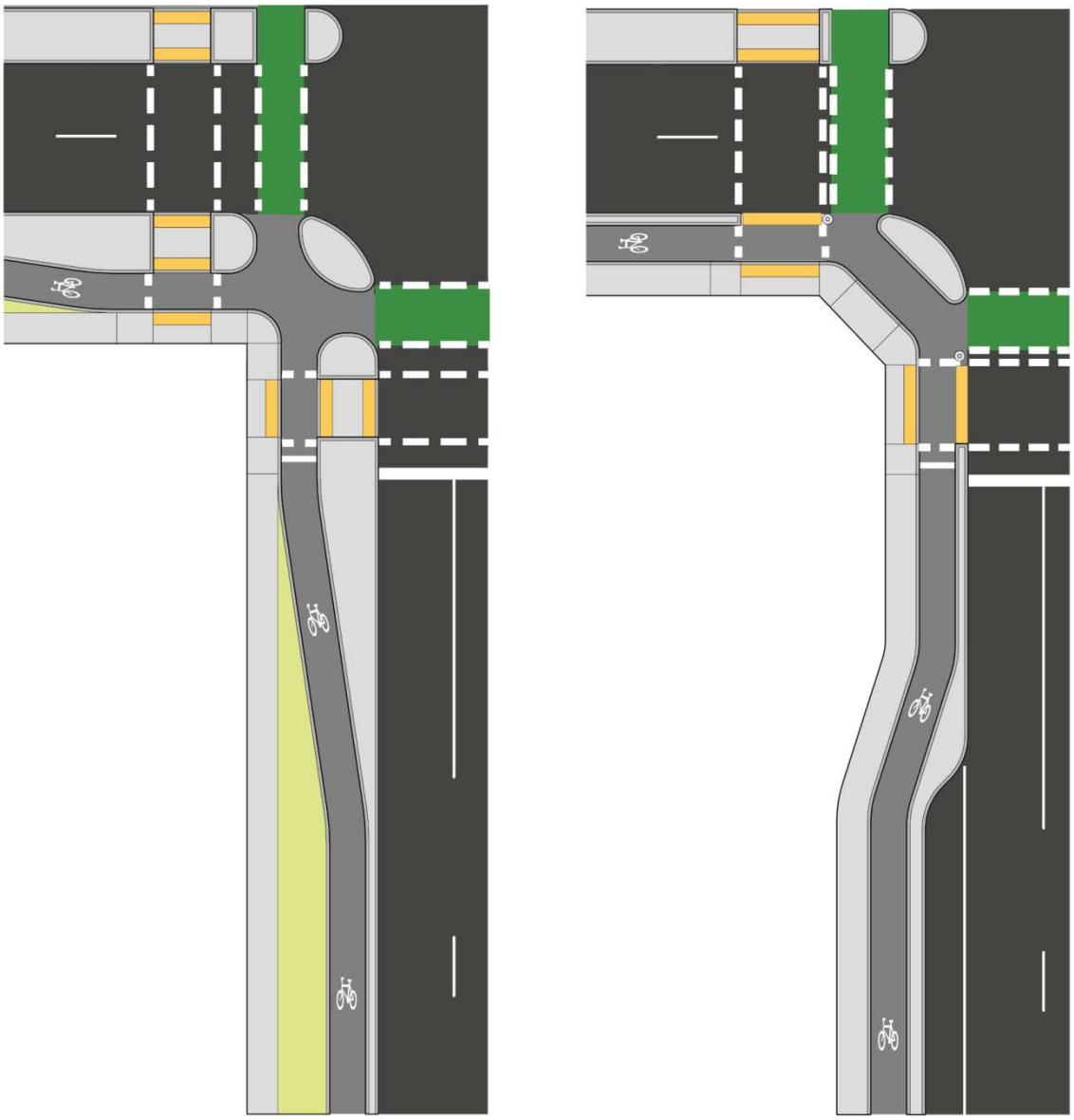


Figure 26: Protected two-way bicycle lane crossing an intersection. Adapted from Massachusetts Department of Transportation Separated Bike Lane Planning & Design Guide[10]

[10] MassDOT Separated Bike Lane Planning & Design Guide, Chapter 4, Section 4.2.5 https://www.massdot.state.ma.us/highway/DoingBusinessWithUs/ManualsPublicationsForms/SeparatedBikeLanePlanningDesignGuide.aspx

b) Kerb Bicycle Lanes

Figure 26 shows possible arrangements for kerb bicycle lanes at and on the approach to the signalised intersection. It should be noted that the 'bend-out' option provides the greatest amount of sight distance (and thus reaction time) between turning vehicles and approaching cyclists. The 'bend-in' option may be used where there are space restrictions at the intersection.



Bend-out example ***Bend-in constrained example***

Figure 27: Protected bicycle lanes at an intersection. Adapted from Massachusetts Department of Transportation Separated Bike Lane Planning & Design Guide[11]

[11] MassDOT Separated Bike Lane Planning & Design Guide, Chapter 4, Section 4.3.2 https://www.massdot.state.ma.us/highway/DoingBusinessWithUs/ManualsPublicationsForms/SeparatedBikeLanePlanningDesignGuide.aspx

c) Right Turns from Protected Bicycle Lane to On-Road Bicycle Lane

Source: Section 5.3.9 of Cycling Aspects of Austroads Guides (2014)

The treatment shown in Figure 27 is similar to that used at large signalised intersections to assist bicycle hook turns between a separated path and a bicycle lane on the intersecting road. Up to four bicycles can be accommodated in this area while waiting for a green right-turn arrow. If the cyclist volume is high, green pavement surfacing should be considered on both the holding area and the bicycle crossing.

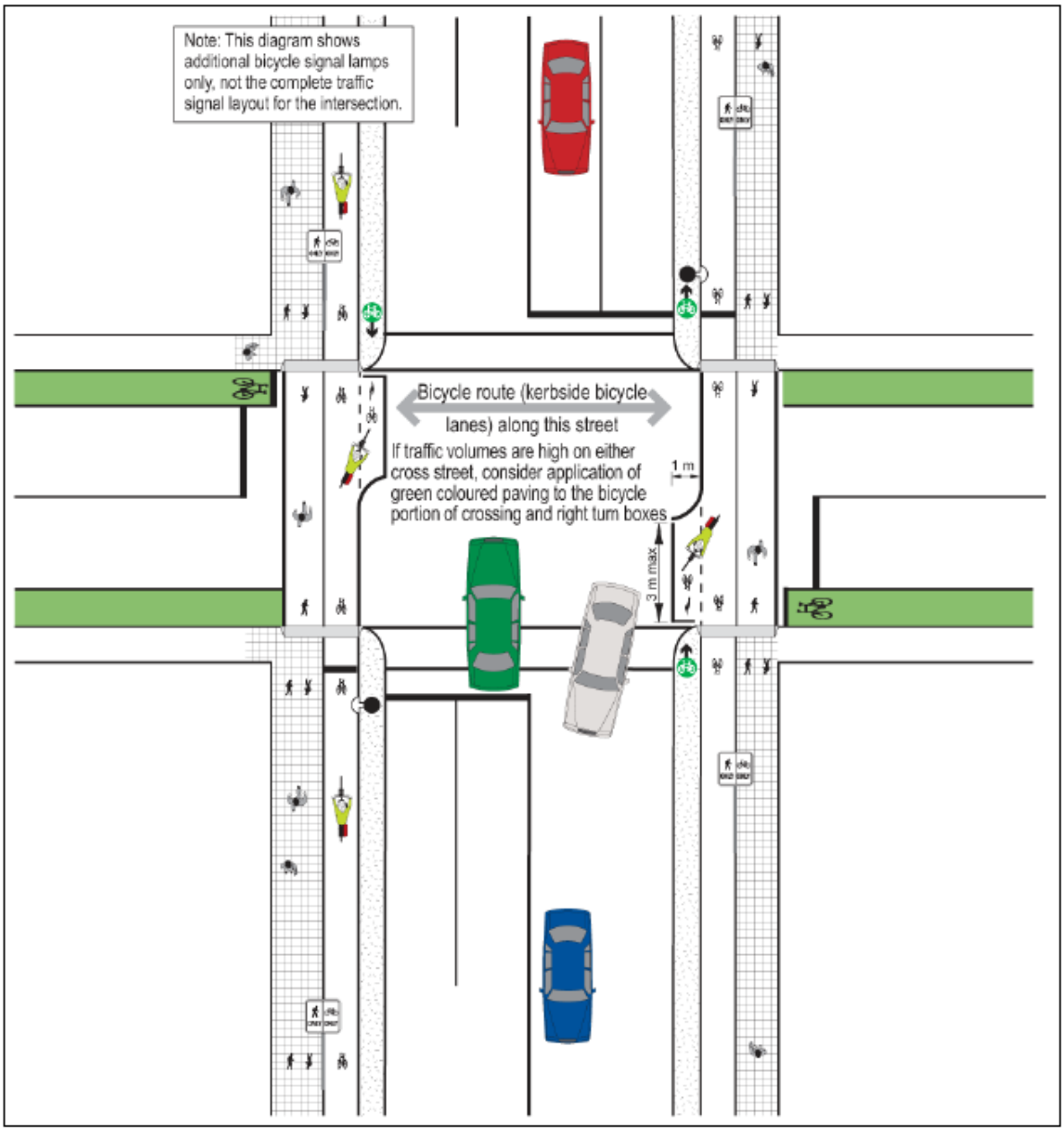


Figure 28: Right turn from an off-road bicycle path to an on-road bicycle lane

d) Driveway Crossings

Where the separated bicycle lane crosses a driveway, the design should clearly communicate that cyclists have the right-of-way.

For low volume residential driveways, the location of the bicycle lane crossing should be clearly visible to motorists – vegetation and roadside furniture should be removed as not to cause a road safety hazard. A higher level of treatment is usually not required unless an engineering assessment indicates a need.

At crossings (both controlled and uncontrolled) of high volume residential or commercial driveways, or any industrial driveway, a higher level of treatment may be required. These treatments include:

- Raised bicycle lane crossing
- Installation of road humps on the driveway approach to the crossing
- The bicycle lane painted green across the conflict point
- Bicycle warning signs

Where the bicycle lane is adjacent to a road (e.g. kerb bicycle lane) and parking is allowed parallel to the bicycle lane, parking should be restricted in advance of the driveway to achieve adequate approach sight distance. A clear line of sight should be provided between motorists exiting and entering the driveway and approaching bicycles. Sight lines should be examined before major reconstruction projects to identify strategies to further improve visibility while balancing on street parking availability (e.g. relocating streetscape elements, lengthening curb extensions, etc.)[12].

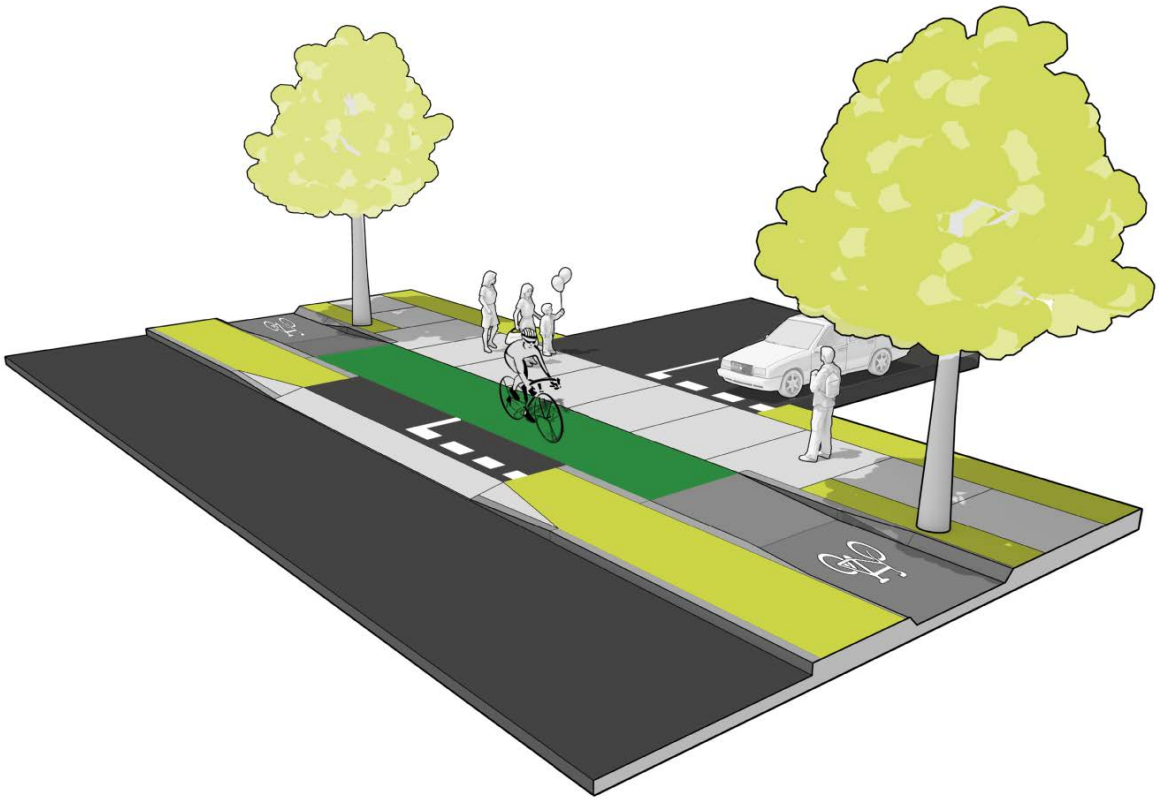


Figure 29: Example of side street / wide driveway bicycle path crossing. Adapted from Massachusetts Department of Transportation Separated Bike Lane Planning & Design Guide

[12] MassDOT Separated Bike Lane Planning & Design Guide, Chapter 4, Section 4.3.5 https://www.massdot.state.ma.us/highway/DoingBusinessWithUs/ManualsPublicationsForms/SeparatedBikeLanePlanningDesignGuide.aspx

e) Transition from Protected Separated Bicycle Lane to Road Sharing or Bicycle Lane

The figures below show the transition from a protected separated bicycle lane to road sharing or a bicycle lane. Other treatments, such as road humps, may be used to slow motorist operating speeds.

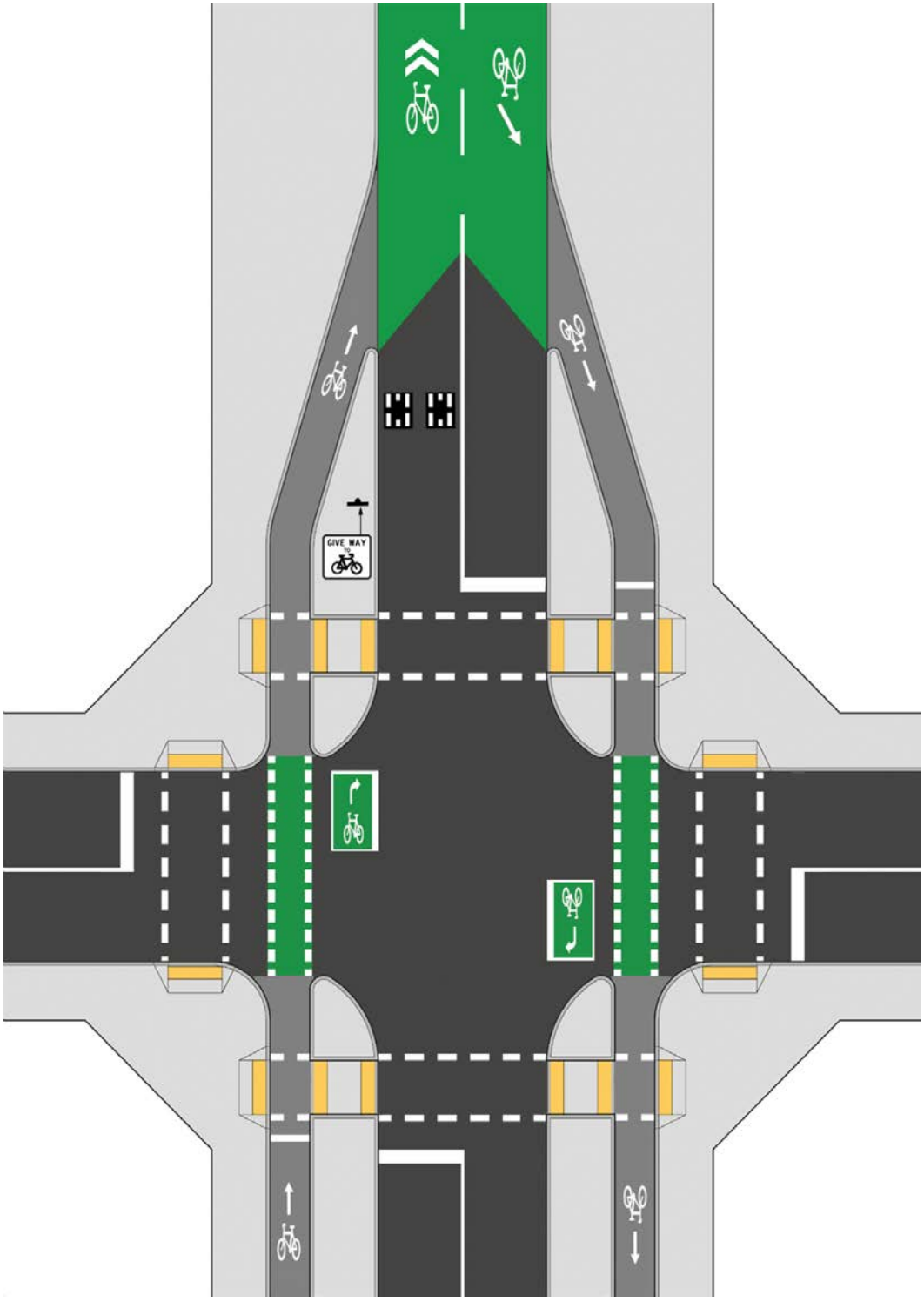


Figure 30: Transition from protected separated bicycle lane to road sharing. Adapted from Massachusetts Department of Transportation Separated Bike Lane Planning & Design Guide [13]

[13] Adapted from MassDOT Separated Bike Lane Planning & Design Guide, Chapter 4, Section 4.5 https://www.massdot.state.ma.us/highway/DoingBusinessWithUs/ManualsPublicationsForms/SeparatedBikeLanePlanningDesignGuide.aspx

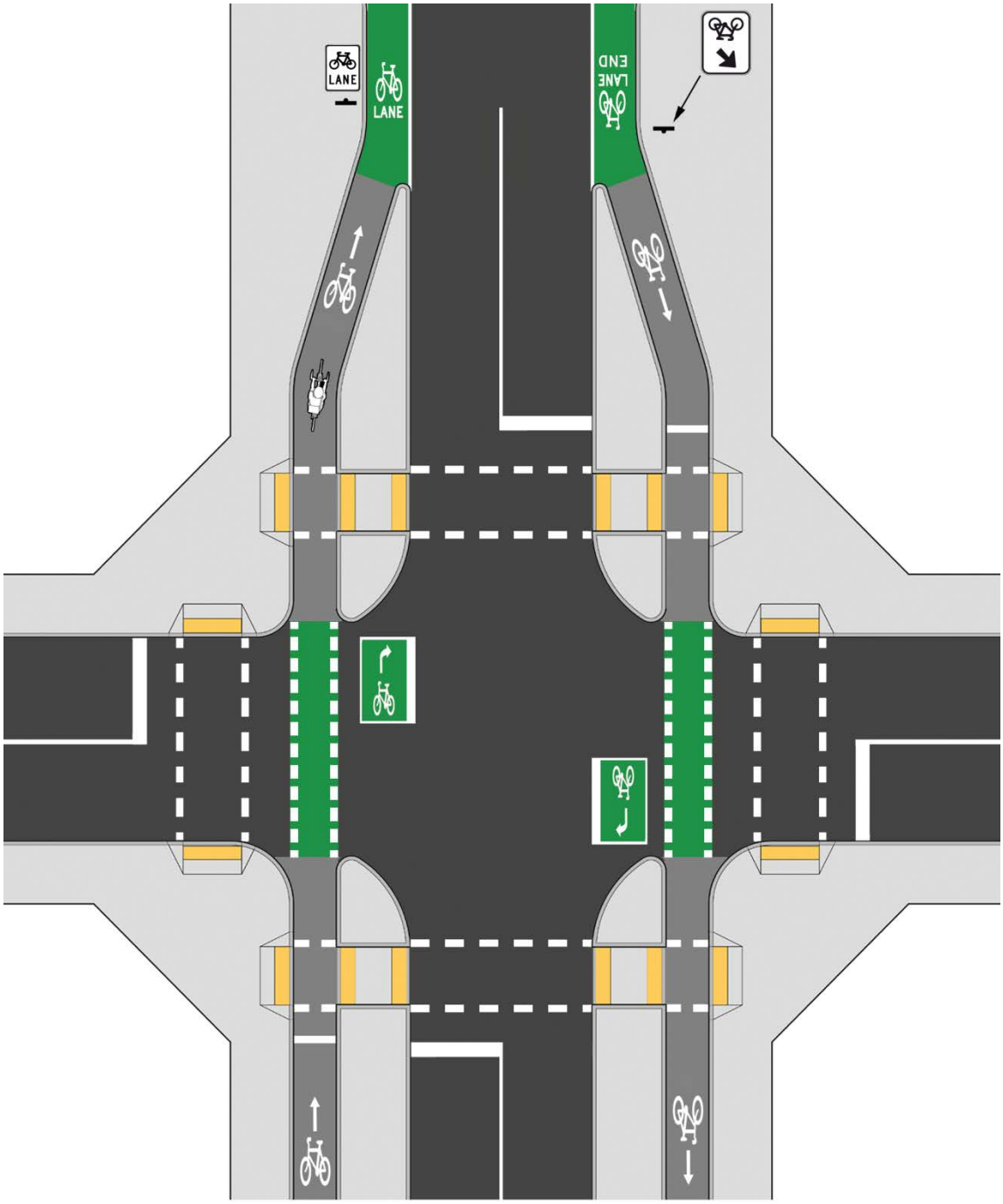


Figure 31: Transition from protected separated bicycle lane to a bicycle lane. Adapted from Massachusetts Department of Transportation Separated Bike Lane Planning & Design Guide [14]

[14] Adapted from MassDOT Separated Bike Lane Planning & Design Guide, Chapter 4, Section 4.5 https://www.massdot.state.ma.us/highway/DoingBusinessWithUs/ManualsPublicationsForms/SeparatedBikeLanePlanningDesignGuide.aspx

f) Transition from One-way Protected Separated Bicycle Lane to Two-way Protected Separated Bicycle Lane

The figures below show the transition from a one-way protected separated bicycle lane to two-way protected separated bicycle lane. Traffic signal phasing which includes bicycle movements should be considered in these treatments to provide head starts for cyclists.

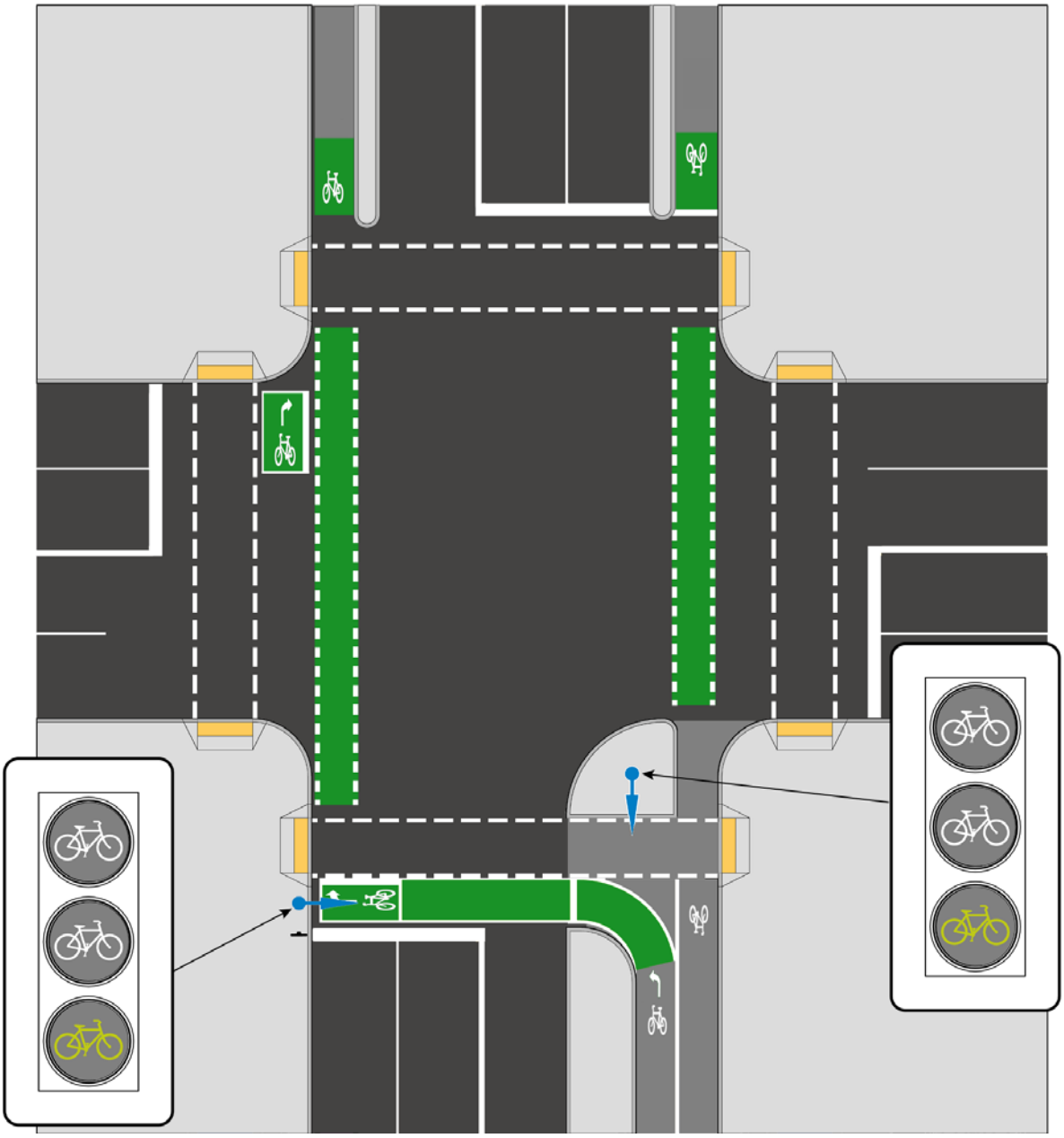


Figure 32: Transition from a one-way protected separated bicycle lane to two-way protected separated bicycle lane.[15]

[15] Adapted from MassDOT Separated Bike Lane Planning & Design Guide, Chapter 4, Section 4.5 https://www.massdot.state.ma.us/highway/DoingBusinessWithUs/ManualsPublicationsForms/SeparatedBikeLanePlanningDesignGuide.aspx

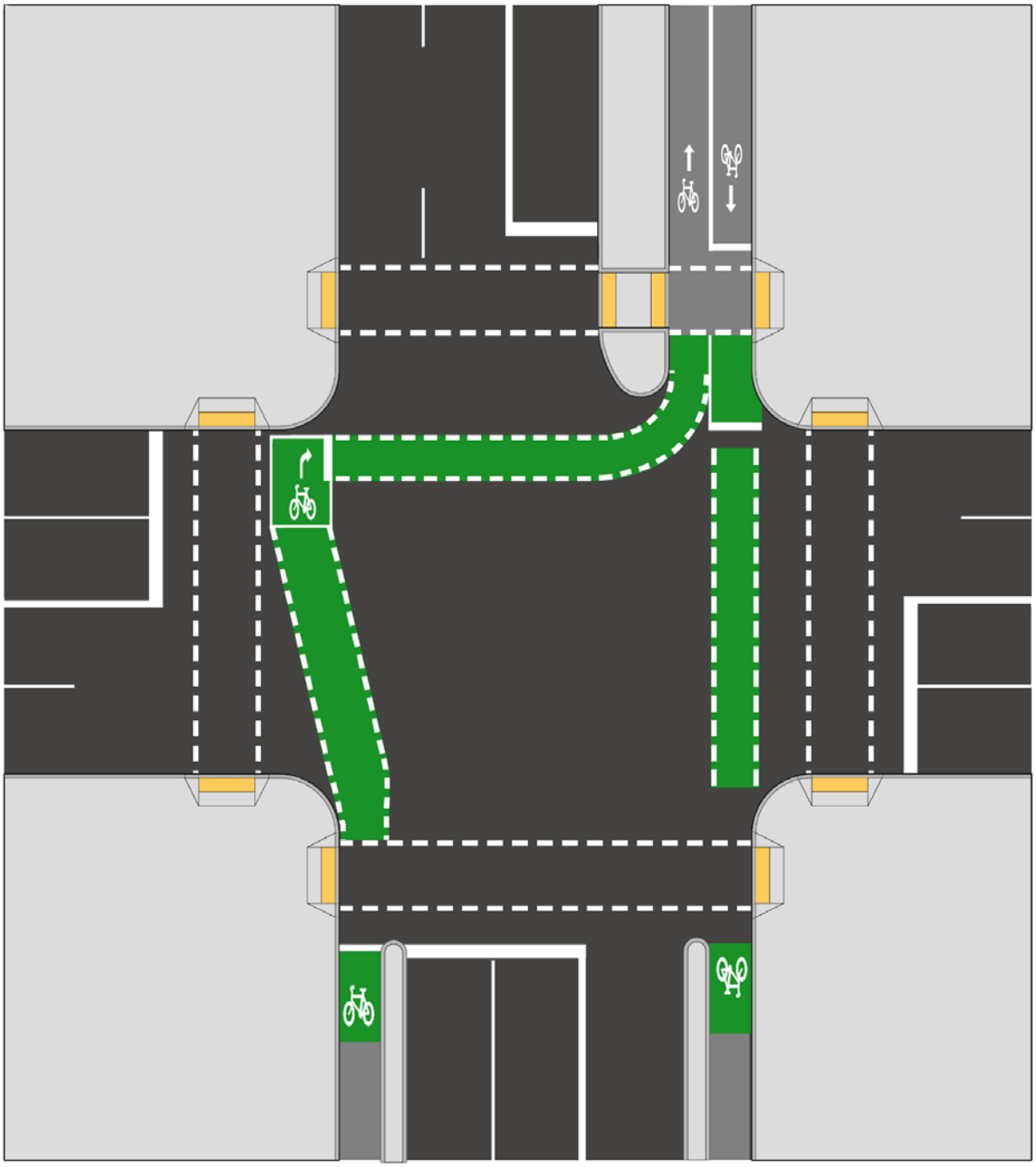


Figure 33: Transition from a one-way protected separated bicycle lane to two-way protected separated bicycle lane. Adapted from Massachusetts Department of Transportation Separated Bike Lane Planning & Design Guide [16]

[16] Adapted from MassDOT Separated Bike Lane Planning & Design Guide, Chapter 4, Section 4.5 https://www.massdot.state.ma.us/highway/DoingBusinessWithUs/ManualsPublicationsForms/SeparatedBikeLanePlanningDesignGuide.aspx

5.2.5 Pavement Markings

Green coloured pavement surfaces may be used to enhance the delineation of areas of pavement that are used for bicycle lanes. The recommended Australian Standard colour for bicycle facility surfacing is Emerald Green G13 (refer to Section 6.6 of Austroads Guide to Traffic Management Part 10 (2016)).

For protected bicycle lanes, the use of green surfacing for bicycle lanes is generally used in the following situations:

- Areas where the paths of motor vehicles and bicycles cross or weave, typically on the approaches and departures of intersections at the tapers to left-turn lanes and added lanes (diverge and merge areas)
- Within particularly complex intersections, or very wide intersections, where enhanced delineation of the bicycle lane is essential.

Figure 34: Example of green coloured pavement surfacing

Section 5.3 – Bicycle and Motor Vehicle Road Sharing

5.3.1 Description

Where separation of cyclists from the road is not possible, treatments where cyclists and motorists share the same length of road can be considered. However, road sharing increases the level of risk to cyclists compared to off-road or separate facilities due to the differential speed between cyclists and motor vehicles.

Practitioners need to be aware of the following:

- Road sharing may only be used on low speed roads where the speed differential is lower between bicycles and vehicles.
- Although signage and pavement markings have the ability to raise the awareness of cyclists, there is still the possibility of a collision between a vehicle and cyclist.
- Motorists may become frustrated by cyclists blocking lanes and the perceived additional travel time.

Figure 35: Example of road sharing on Napier Street, Fitzroy

5.3.2 The Safe System

The Safe System is a road safety philosophy that requires roads to be designed and managed so that fatality and serious injury are avoidable. The basic principles are:

1. Humans are fallible, and will inevitably make mistakes when driving, riding or walking.
2. Despite this, road trauma should not be accepted as inevitable. No one should be killed or seriously injured on our roads.
3. So, to prevent serious trauma, the road system must be forgiving, so that the forces of collisions do not exceed the limits that the human body can tolerate[17].

The Safe System is divided into four core interrelated components:

- Safer roads
- Safer speeds
- Safer vehicles
- Safer people

The Safe System principles are embedded in the Victorian Towards Zero Safety Strategy.

Research undertaken for the Safe System has shown the risk of fatality for a cyclist in a crash with motor vehicles decreases to 10% when the motor vehicle is travelling at 30 km/h[18]. As such, where road sharing is to occur, the operating speed of motor vehicles should be below 40 km/h.

The volume of motor vehicles on roads where sharing is to occur, should be in accordance with Figure 3 in this document.

5.3.3 Treatment Types

a) Bicycle Streets

Source: VicRoads Guidance on Treating Bicycle Car Dooring Collisions

Bicycle streets are roads where bicycles are given priority over motor vehicles. Bicycle riders are encouraged to ride in the general traffic lane whereby other vehicles are expected to share the traffic lane with bicycle riders.

[17] Safe System Solutions Pty Ltd, “Safe System Auditing”, http://www.safesystemsolutions.com.au/safe-system-assessments.html

[18] Wramborg P, A New Approach to a Safe and Sustainable Traffic Planning and Street Design for Urban Areas, Road Safety on Four Continents Conference, Warsaw, 2005.

This treatment is most appropriate on undivided two lane roads where the operating speed is 30 km/h or lower and traffic volumes are low. The intention is to enhance the road environment to make cycling safer for all type of riders regardless of their level experience or confidence. Bicycle streets are to be clearly signed and line marked and may be used in combination with other treatments to provide a continuous safe riding environment.

The lower operating speed also reduces the risk of injuries for crossing pedestrians.

NOTE: VicRoads is currently investigating whether the Victorian Road Rules sufficiently allows cyclists to ride in the middle of the lane ('claiming the lane'). Some stakeholders perceive that there is a degree of ambiguity in the Road Rules regarding this issue. Practitioners wishing to use this treatment should seek legal advice to manage this risk.

Potential locations for bicycle streets include:

- On undivided two lane local roads where the approach operating speed is less than 40 km/h.
- Roads with a low volume of traffic.
- Roads with a substantial number of inexperienced bicycle riders.
- Local areas with a high number of cyclists.
- Where off-road bicycle facilities are not practicable.
- Roads with narrow width.

Where such a treatment is to be considered, the following should be taken into account:

- Reducing the operating speed on the bicycle street route (to below 40 km/h), whether through the use of:
    - Traffic calming measures, such as:
        - Slow points.
        - Road humps or raised platforms (mid-block and/or at intersections).
        - Increasing approach deflection to roundabouts.
        - Larger roundabout central island.
    - Reduced speed limits.
- Signs are required to highlight to all road users that bicycles have priority over motor vehicles and may be present in the centre of the lane.
- Physical treatments to raise the prominence of crossing pedestrians – such as raised crossing platforms and/or kerb extensions. Other treatments, such as the traffic calming measures mentioned above, assist in reducing the road's operating speed thus reducing the risk of injury to pedestrians.
- Community acceptance and understanding of lane sharing.
- Cyclist confidence and safety in sharing the lane with general traffic.
- Mixing cyclists and motorists may lead to conflict if differential speeds are high, making this treatment more appropriate on low-speed roads.

The design of bicycle streets should allow the following[19]:

- Bicycles riders have space to ride two abreast, motor vehicles give way to bicycles allowing safe overtaking.
- Vehicles give way to bicycles at intersections.
- At the terminus of the bicycle street:
    - An off-road transition is to be provided where riders are to continue on an off-road path.
    - Spacious median refuges where bicycles are to cross an intersection.
    - Where riders are to continue on an on-road bicycle lane, a clear and gradual transition arrangement is required to ensure cyclists are able to make the transition safely and that other vehicles are still aware of the continuing presence of cyclists.

Figure 35 shows a schematic drawing of a bicycle street.

[19] Western Australia Department of Transport (2015), "Bike Boulevard Pilot Project Part of the Safe Active Streets Program"

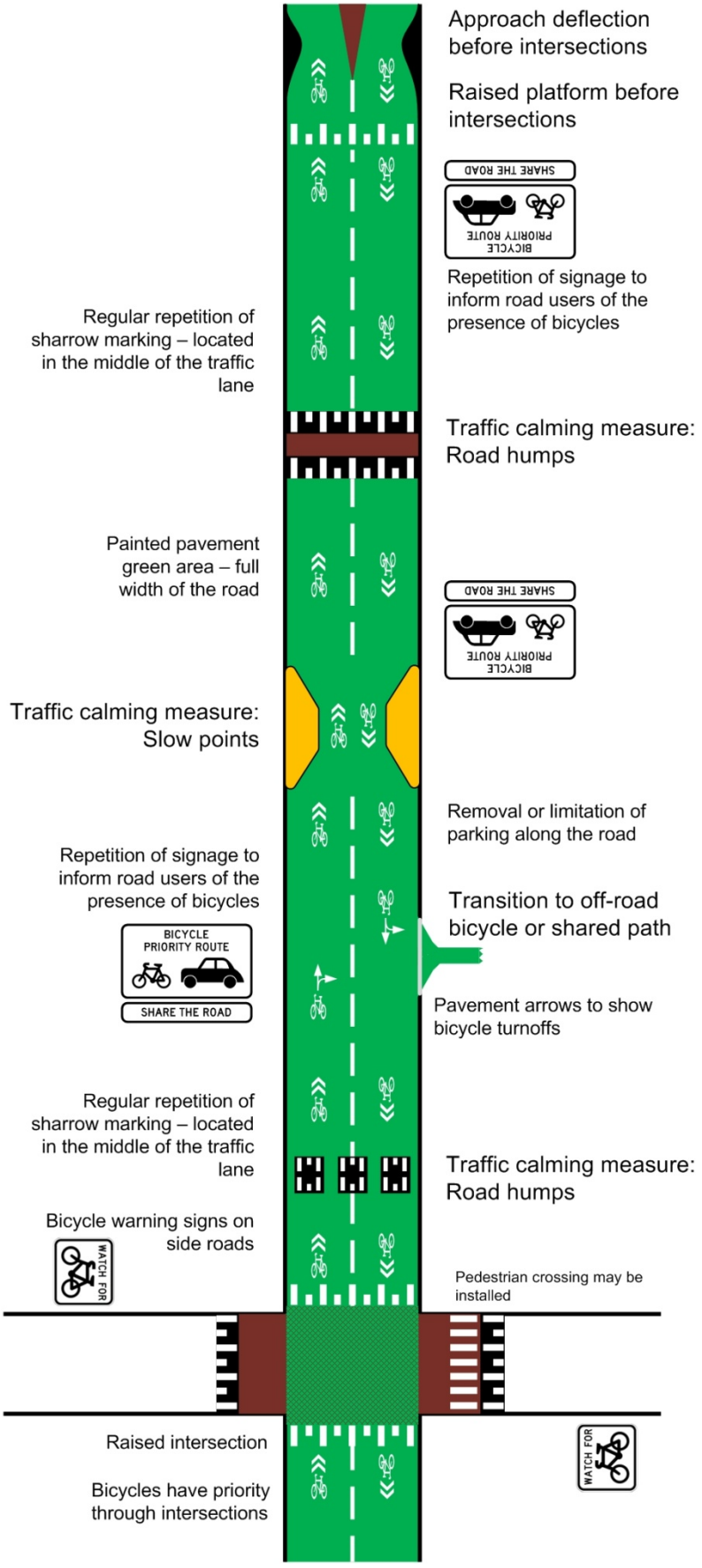


Figure 36: Example of a bicycle street

b) Lane Sharing at Individual Intersections (Sharrows)

Source: VicRoads Guidance on Bicycle and Pedestrian Treatments at Roundabouts, VicRoads Guidance on Treating Bicycle Car Dooring Collisions

Sharrows are pavement markings consisting of a bicycle symbol and two chevron markings and may be used on the approach to an intersection where a bicycle lane or similar facility terminates prior to the intersection, and cyclists are required to merge into the main traffic lane. The intention of sharrows is to position cyclists into the centre of the traffic lane at individual intersections and encourage them to mix with through traffic. This is sometimes referred to as "claiming the lane".

NOTE: VicRoads is currently investigating whether the Victorian Road Rules sufficiently allows cyclists to ride in the middle of the lane ('claiming the lane'). Some stakeholders perceive that there is a degree of ambiguity in the Road Rules regarding this issue. Practitioners wishing to use this treatment should seek legal advice to manage this risk.

Potential locations for positioning cyclists into the centre of the traffic lane (through the use of sharrows) include:

- Intersections (e.g. single lane roundabouts) on local or collector roads or where the approach speed limit is equal to or less than 60 km/h with operating speeds closer to the intersection at less than 40 km/h.
- Roads with a low volume of through traffic.
- Where cyclist segregation is not practicable.
- Roads with narrow width.

Where such a treatment is to be considered, the following should be taken into account:

- Reducing the operating speed on the approach and through the intersection (to less than 40 km/h), whether through the use of:
    - Traffic calming measures to reduce the speed differential between cyclists and motorists, such as:
        - Increasing approach deflection.
        - Narrowing of lanes.
        - Larger circulating roundabout.
    - Reduced speed limits – refer to the VicRoads Speed Zoning Guidelines.
- Locating sharrow markings in prominent positions, to highlight to all road users that cyclists can claim the lane and ride in the centre of the lane.
- Signs may be required to highlight to all road users that bicycles are allowed to ride in the centre of the lane.
- Community acceptance and understanding of lane sharing.
- Cyclist confidence and safety in sharing the lane with general traffic.
- This treatment is more appropriate on low-speed roads as mixing cyclists and motorists may lead to conflict if the differential speed is high.

Figure 37: Example of sharrows at Asling & Martin Street roundabout, Brighton

c) Raised Platforms

Source: Austroads Guide to Traffic Management Part 8 (2008)

This treatment involves placing a raised platform along a road and/or on the approach to an intersection. The intention is to reduce vehicle approach speeds, so that in the event of a collision between a cyclist or pedestrian and a motor vehicle, the vehicle operating speed is low (30 km/h or below) and the likelihood of cyclist or pedestrian serious injury is reduced. The design of the raised platform will need to slow vehicles to the desirable speed while also being traversable by heavy vehicles.

There are two main types of raised platforms for use on the approach to the roundabout:

- Speed cushion.
- Fully raised platforms (including flat top road humps) (refer to Section 5.3.4 (c)).

Speed Cushion

Speed cushions are a type of raised platform that are spaced in smaller sections across the road rather than occupying the entire roadway. The speed cushion is designed to be more favourable to cyclists, buses and larger vehicles.

Speed cushions are usually made of moulded rubber segments (see Figure 37) however there are concrete and asphalt variations.

Figure 38: Example of a speed cushion

Potential locations for speed cushions include:

- Where it is desirable to raise the profile of cyclists along a road and/or at the intersection.
- At intersections with a high history of crashes between vehicles and cyclists and/or pedestrians.

Where such a treatment is to be considered, the following should be taken into account:

- Ensuring adequate lighting for driver awareness.
- Colour contrast to improve conspicuity of the cushions.
- Adequate signage and linemarking.

5.3.4 Intersection Treatments

a) Head-start and Expanded Storage Areas

Source: Section 5.3.5 of Cycling Aspects of Austroads Guides (2014)

These storage areas are provided to position cyclists in a highly visible location while they are waiting to proceed through the intersection, thereby improving safety. Figure 13 shows four combinations of head-start and expanded storage areas at signalised intersections. The required length of the head-start area (LHS) varies depending on the number of bicycles that need to be stored.

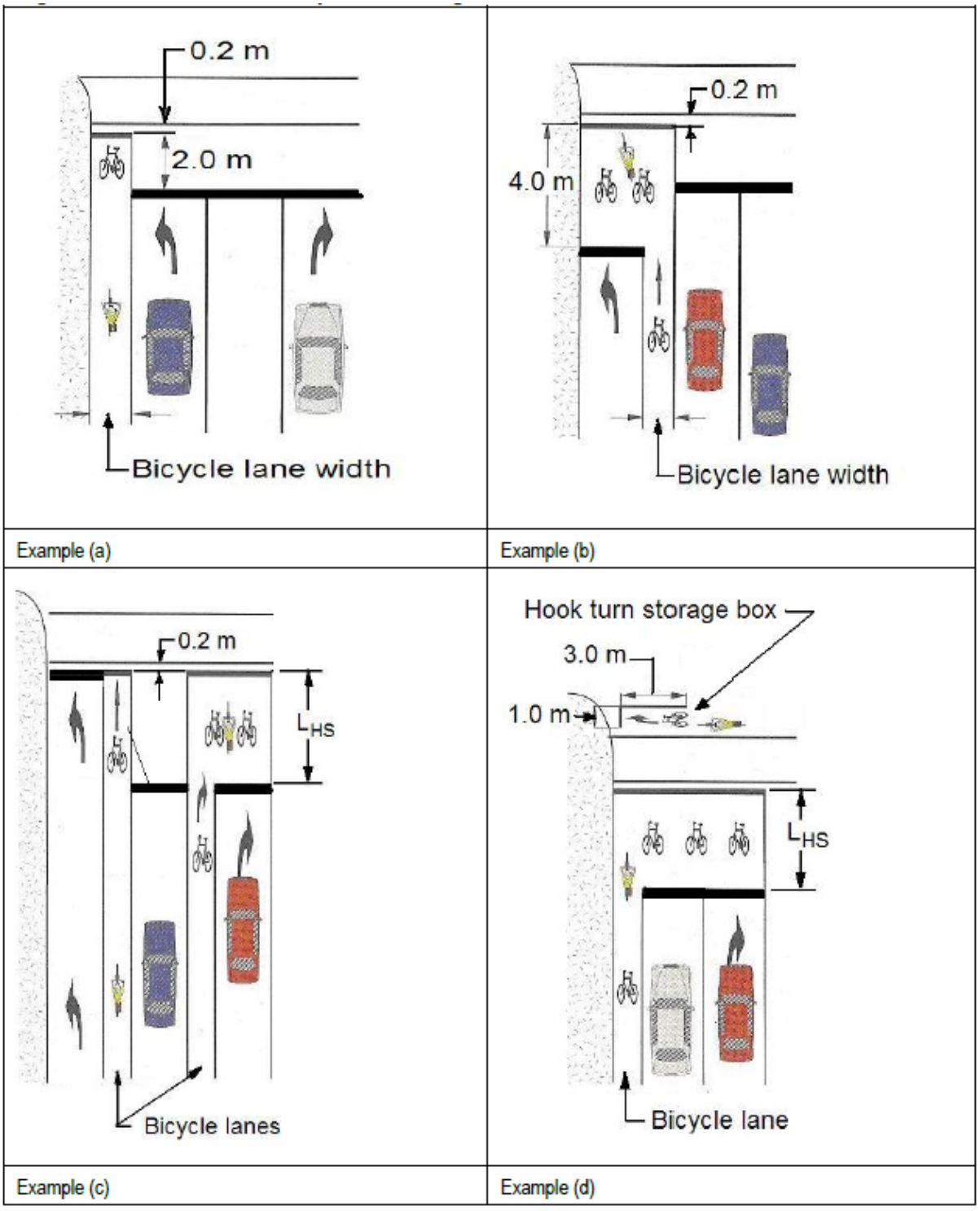


Figure 39: Examples of Head Starts & Expanded Storage Areas

Table 9: Bicycle treatments at intersections

Example	Purpose	Comment
(a)	The purpose is to store a cyclist in advance of a motor vehicle driver in the adjacent left-turn lane or through lane so that the cyclist can be easily seen by a stationary driver at the stop line. This is particularly important where the vehicle is a van or truck in which case the cyclist would otherwise be hidden from view below the left-hand side window.	This treatment: reduces the potential for conflict between cyclists and traffic using the left lane is suitable where cyclist numbers are relatively low allows cyclists to pass on the left side of a queue of vehicles waiting to turn left has an area that is only as wide as the bicycle lane on the approach has a bicycle stop line that is located 0.2 m in advance of the pedestrian crosswalk line and 2.0 m (i.e. storage length for one bicycle) beyond the motor vehicle stop line may be placed to the left of a left-turn lane, a through lane, or a combined through and left-turn lane.
(b)	This treatment locates the bicycle lane between the left-turn lane and through lane and as a consequence provides additional storage width and length.	Cyclists travelling straight ahead travel to the right of queued or moving left-turning vehicles. Left-turning vehicles are required to change lanes across the bicycle lane at the start of the left-turn lane. Cyclists intending to turn left should desirably share the left-turn lane with motor vehicles. However, it is likely that some left-turning cyclists will use the bicycle lane to pass the queue and access the storage box.
(c)	This illustration includes two treatments that provide a head start for through cyclists and right-turning cyclists (with expanded storage).	The first treatment is a bicycle lane for cyclists travelling straight through the intersection. In this case left-turning cyclists are expected to share the left-turn lane with motor vehicles. The second treatment is a right-turn expanded storage area for high volumes of bicycle turning traffic. These treatments: are rarely used and are not intended for use in higher speed zones (> 60 km/h) because of the difficulty and conflict associated with cyclists crossing traffic lanes to access the right-turn bicycle lane may be appropriate in lower-speed zones (≤ 60 km/h) where bicycle volumes are high and the turn is made into a single-lane mixed function road that does not have marked bicycle lanes (e.g. inner city areas). Where bicycle lanes are provided in the intersecting road and bicycle turning volumes are not high, it is more acceptable to install a head-start storage area only in the right-turn bicycle lane. In this instance it is also necessary to include additional turning lines within the intersection to guide right-turning cyclists and delineate the cyclists' path for drivers.
(d)	This example also shows two treatments that provide storage expanded across	The first treatment is a hook turn storage area, provided to accommodate cyclists in a safer position while they are waiting for a green traffic signal phase for the

	two traffic lanes and a formalised hook-turn treatment.	intersecting road, and can be used generally throughout the road system. The second treatment, an expanded storage area shared by left-turning, through and right-turning cyclists is suitable only for lower speed areas (e.g. 50 km/h).

b) Left-turn and Through / Left-turn Treatments

Source: Section 5.3.7 of Cycling Aspects of Austroads Guides (2014)

The treatment is illustrated in Figure 14 where a bicycle lane provides separation for cyclists through the diverge area on the approach to the intersection and at the stop line. The bicycle lane provides an offset to the island nose and the side of the island is parallel to the adjacent traffic lane. Generally, cyclists share the left-turn lane with motor vehicles; however, where the volume of left-turning cyclists is high it may be appropriate to provide a bicycle lane within the left-turning roadway. If a significant number of cyclists turn left at a CHL treatment, then provision of a bicycle lane adjacent to the kerb within the left-turn roadway should be considered.

It should be noted that this treatment is not considered ideal due to the risk of collision between cyclists and motorists (where motorists turn across the path of cyclists), however this risk can be mitigated if the (motor vehicle) operating speed prior and at the treatment is low (around 30 km/h).

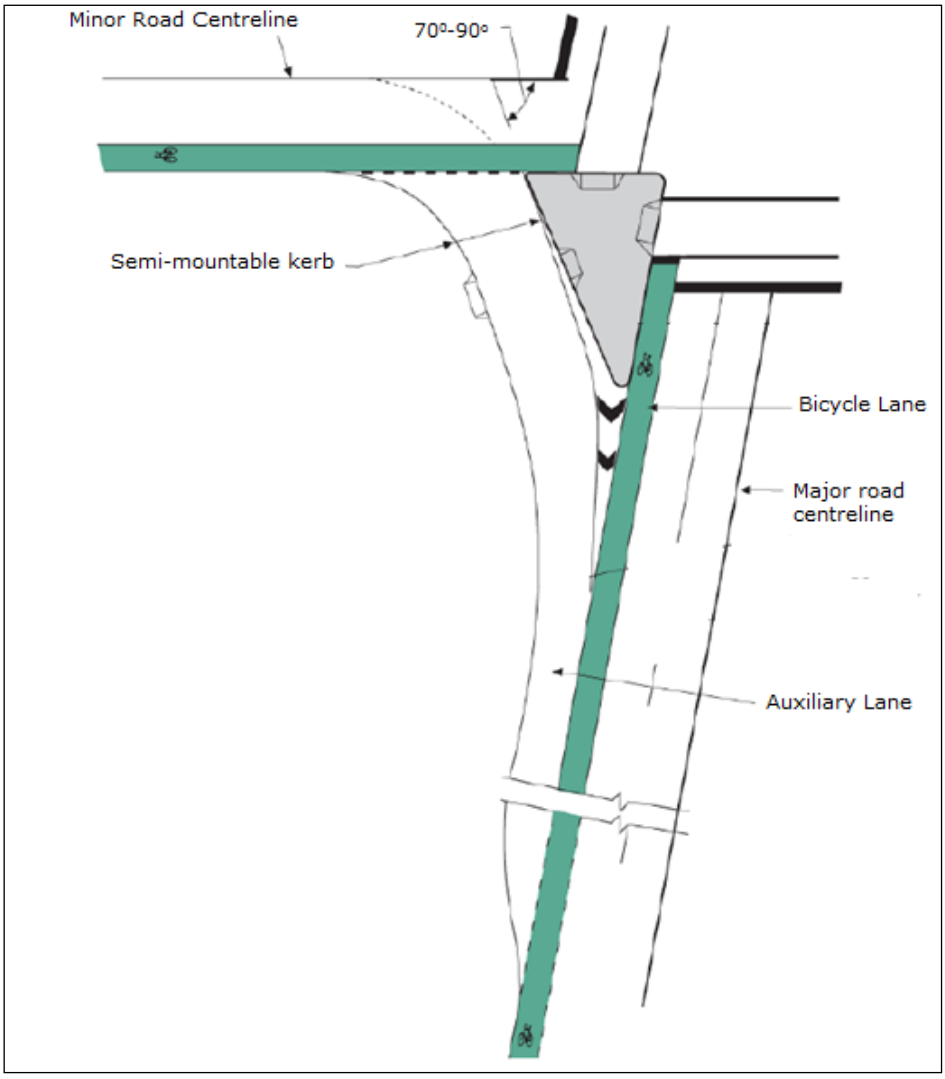


Figure 40: Provision for cyclists at a signalised CHL treatment in a low-speed environment

Where there is no left turn slip lane, the vehicle left turn lane may be either 'combined' with the bicycle lane or the bicycle lane crosses the left turn lane before the stop line.

Either of the treatments in (a) and (b) are not considered ideal due to the risk of collision between cyclists and motorists (a separate or segregated facility is preferred), however this risk can be mitigated if the (motor vehicle) operating speed prior and at the treatment is low (around 30 km/h) (this can be achieved with treatments such as raised platforms, see (c)).

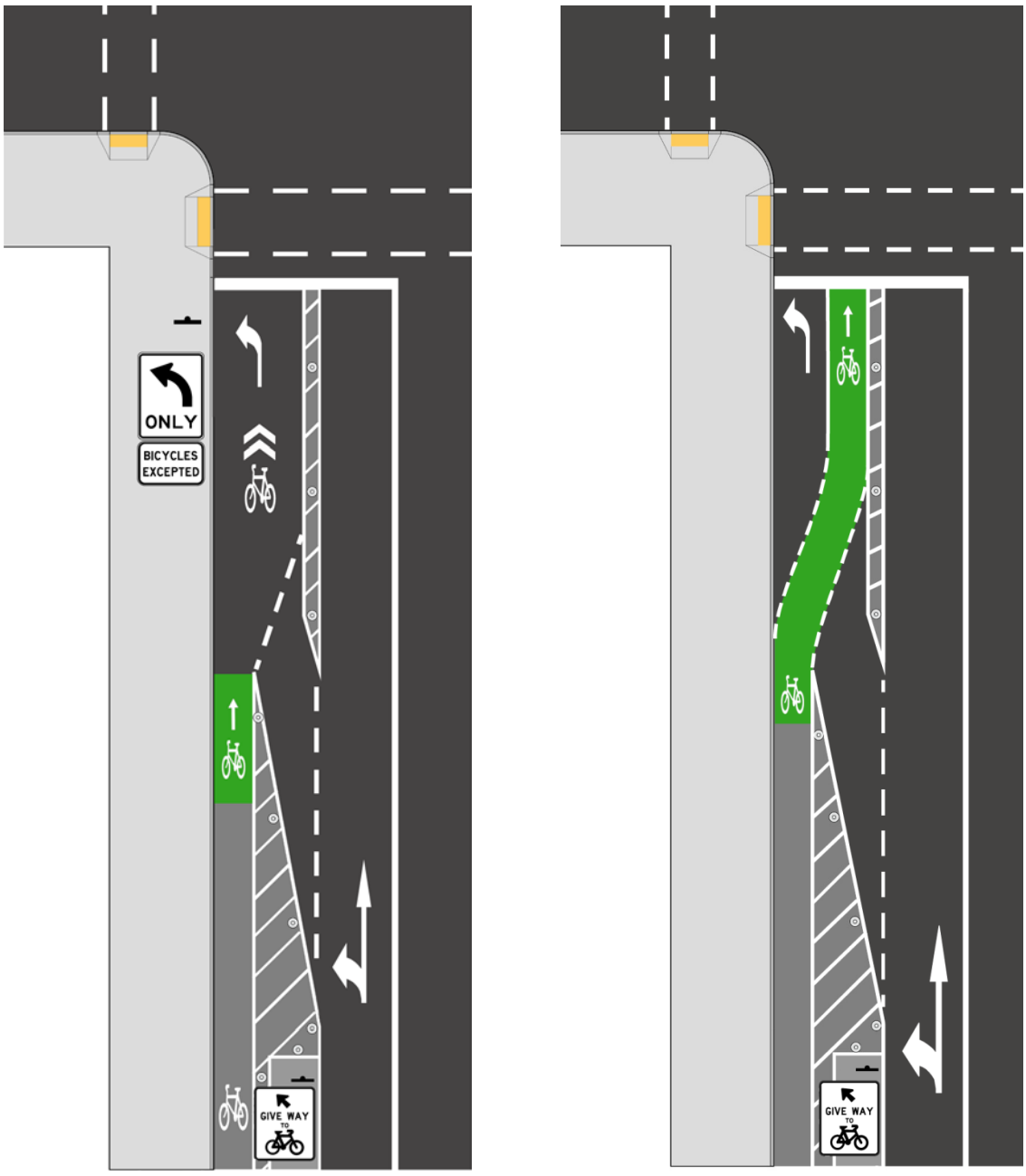


Figure 41: Shared left turn and bicycle lane treatments. Adapted from Massachusetts Department of Transportation Separated Bike Lane Planning & Design Guide[20]

[20] Adapted from MassDOT Separated Bike Lane Planning & Design Guide, Chapter 4, Section 4.3.3 https://www.massdot.state.ma.us/highway/DoingBusinessWithUs/ManualsPublicationsForms/SeparatedBikeLanePlanningDesignGuide.aspx

c) Raised Platforms

The approach to intersections may be raised for a certain distance as a way to reduce operating speeds at intersections.

One type of raised platforms is flat top road humps. These road humps are a version of the speed hump where the top of the raised platform section is a flat surface instead of being entirely curved. The length of these humps are usually less than 6 metres and vehicles experience a definite rise and fall when traversing the platform.

An alternative type of raised platform is where the platform is of greater length (more than 6 m) and the platform extends to the holding line at the intersection. This type of platform may be more desirable in locations where the vertical deflection (and changes in grade) is to be less severe than road humps.

Fully raised platforms with gradients of 1:15 to 1:20 are generally considered as cyclist friendly.

Potential locations for fully raised platforms include:

- Where vehicle speeds before or through the intersection are unacceptably high.
- Where the presence of crossing cyclists or pedestrians may be unexpected, especially on side roads leading to the strategically important cycling corridors route.
- At intersections with a high history of crashes between vehicles and cyclists and/or pedestrians.

Where such a treatment is to be considered, the following should be taken into account:

- The approach speed to the intersection – vehicles should be able to cross the raised platform safely.
- The design of the raised platform needs to accommodate heavy vehicles (e.g. buses).
- Where crossing pedestrians do not have priority across the raised platform at the intersection, the design of the crossing may need to highlight this.
- Although the raised platform has the ability to assist in slowing down vehicles, there is still the possibility of a collision (at speed) between a vehicle and cyclist.
- Appropriate drainage to reduce vehicle and pedestrian slip hazards.

Refer to Figures 41 and 42 for examples of raised platforms.

Figure 42: Flat top speed hump followed by sharrows on Pearson Street, Brunswick West.

Image Source: Google Maps

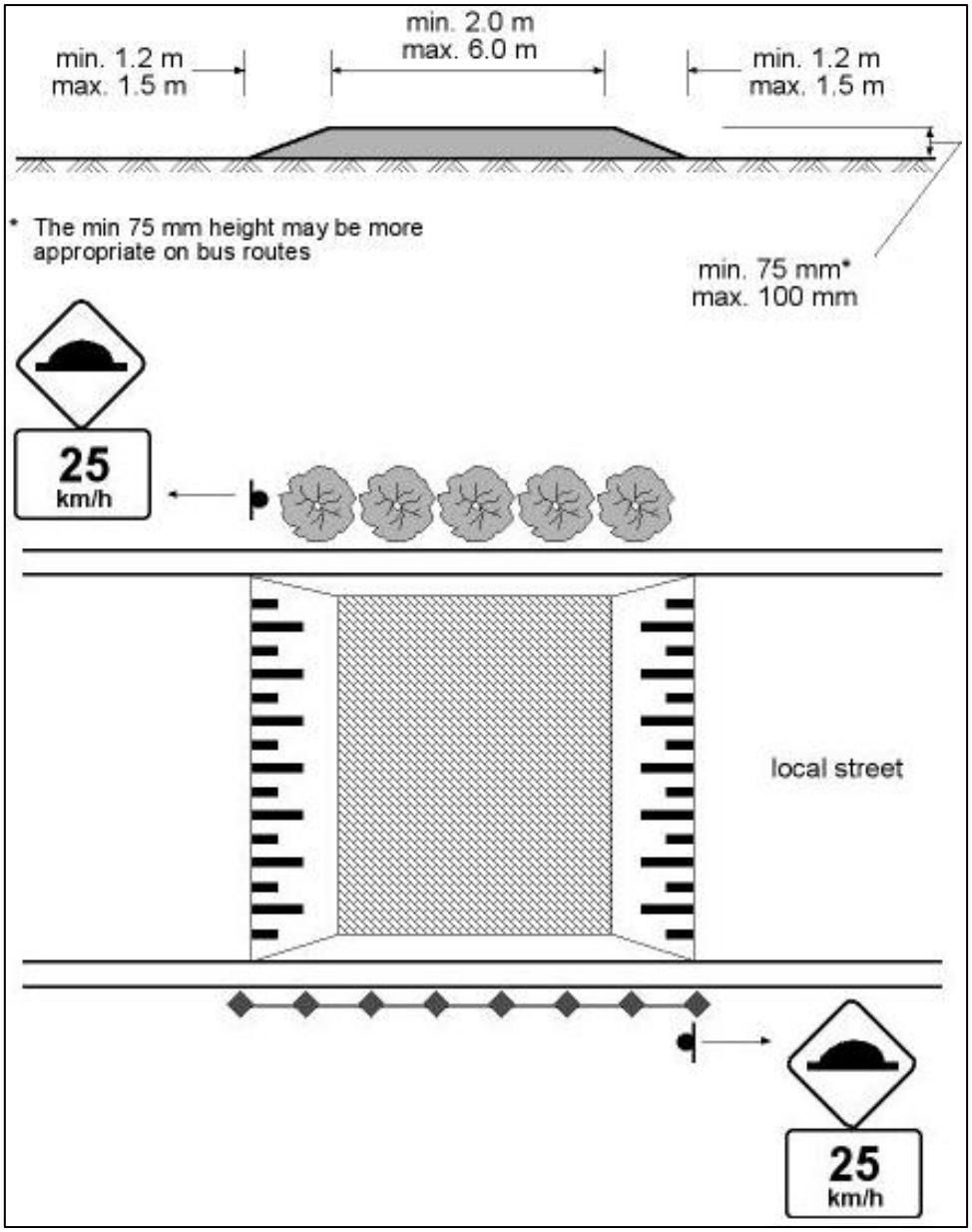


Figure 43: Typical dimensions of a flat top road hump. Source: Austroads[21]

[21] Austroads, 2008, "Guide to Traffic Management Part 8: Local Area Traffic Management" pp 79 Figure 7.7

d) Left-turn Bypass Treatment

Source: Section 5.3.7 of Cycling Aspects of Austroads Guides (2014)

Left-turn access through signals may be provided for cyclists where a major bicycle route turns left through a signalised intersection as shown in Figure 43. This treatment has a bicycle lane in the intersecting road. Where there is no bicycle lane in the intersecting road the bypass should be designed as a free-flow arrangement where the bicycle lane is directed into an off-road path parallel to the intersecting road to join it with a protected transition (kerb extension).

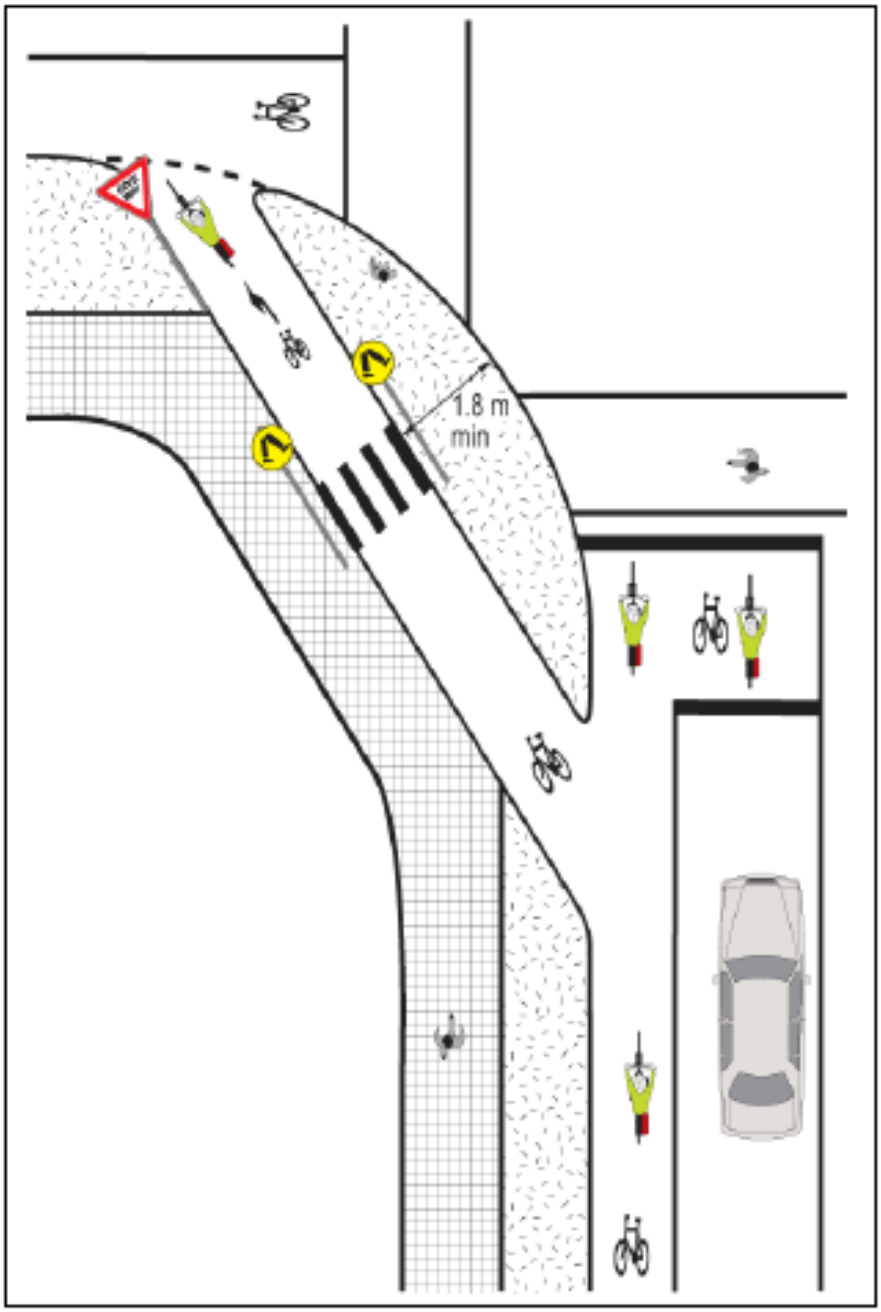


Figure 44: Bicycle lane left-turn bypass at a signalised intersection

e) Refuge within an Unsignalised Intersection

Source: Section 5.4.4 of the Cycling Aspects of Austroads Guides (2014)

A refuge may be placed within an intersection to accommodate the crossing movements of both pedestrians from footpaths and cyclists from bicycle lanes in the side roads while restricting motorists to a 'left-turn in/left-turn out' arrangement. Such a treatment is shown in Figure 12.

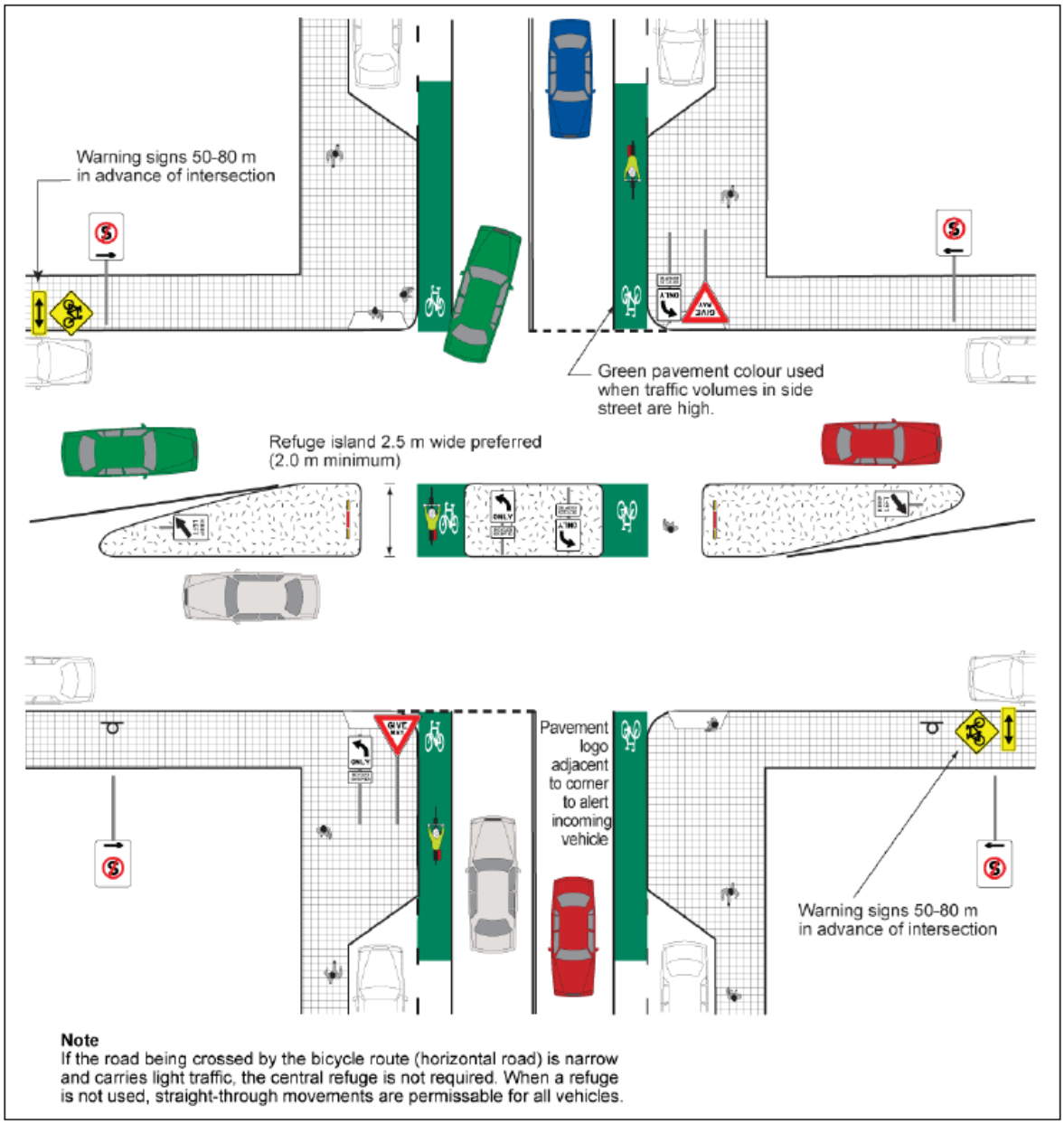


Figure 45: Refuge within an intersection for pedestrians and cyclists in bicycle lanes

5.3.5 Cyclist Monitoring and Surveying

Source: Appendix C of the Cycling Aspects of Austroads Guides (2014)

Data collection is an important tool for strategically important cycling corridors to assist in areas such as cost benefit analysis for new works, gauging the impact and effectiveness of routes over a period of time and determining where further improvements to the network should occur. There are a number of monitoring devices (including commercial products) that can be used to collect useful information such as cyclist volumes, average speeds and journey lengths.

a) Bicycle Detection

Inductive loop detectors are commonly used to detect vehicles but can also be used to detect bicycles. The loops, which are buried just below the surface of the road or cycle way record metallic objects passing over due to a change in the inductance. Bicycles have a lower metal content than vehicles. Bicycle inductive loop detectors therefore need to be more sensitive to produce acceptable results.

Piezo-detectors can also be used to detect bicycles. Piezo materials change electrical characteristics when subjected to mechanical deformation caused by pressure. The deformation can cause a change in resistance (piezo-resistive) or the generation of a charge (piezoelectric). The piezo-resistive sensor can detect a bicycle at low to zero speeds, whilst the piezoelectric sensor is not effective at very low speeds.

As with the detection of pedestrians, microwave, infra-red, ultrasonic and laser detection methods can also be used to detect bicycles. Again, these types of sensors may not provide the required accuracy due to difficulties in distinguishing between closely spaced bicycles.

b) Other Methods

Global positioning system (GPS) – GPS receivers and loggers can currently be installed in vehicles to record route, speed and travel time information.

Video – further development of video capture and data processing technology should enable accurate automatic recording of bicycle flow, speed, congestion, route and origin-destination data.

Other methods are discussed in Appendix C of the Cycling Aspects of Austroads Guides (2014).

6. General Bicycle Topics

This section lists other general topics relating to bicycles (e.g. traffic signals, pavement markings, provision of off-road paths, signs, etc.) and provides references to where particular aspects of these topics can be located in the Austroads Guide to Traffic Management, Australian Standards relating to traffic management (AS), and Additional Network Standards and Guidelines (ANSG) from VicRoads. Particular aspects of traffic practice are given under the general topic headings.

Note references to Austroads Guide to Road Design is generally contained within the Cycling Aspects of Austroads Guides document.

All VicRoads Supplements shall be read in conjunction with the relevant parent document.

A. LOCAL ROADS (LOW SPEED ROADS)	
Topic	**Relevant Clause or Section**
A1. General / Miscellaneous	
Bicycle Facilities	Austroads Guide to Traffic Management Part 10 Section 8.5.5
Pedestrian and Bicycle Surveys	Austroads Guide to Traffic Management Part 3 Appendix E
Bicycle planning for activity centres	Austroads Guide to Traffic Management Part 7 Section 2.3.2
Cycling implications for Traffic Management Practice	Austroads Guide to Traffic Management Part 7 Section 3.8.4
Categories of Cyclists	Austroads Guide to Traffic Management Part 4 Appendix B
Provision for bicycles at work sites	AS 1742.3 Clause 2.3.7, 4.14.4
Bicycle treatments at level crossings	AS 1742.7 Clause 6.6
Bicycle provisions on arterial and local roads - Bicycle provisions mid-block	AS 1742.9 Clause 2.4
Bicycle loop at an intersection	VicRoads Supplement to Austroads Guide to Traffic Management Part 10 Section 8.5.5
Cycling event complies with the Road Rules	VicRoads Supplement to Austroads Guide to Traffic Management Part 9 Attachment A
A2. Network Planning	
Purpose of a Bicycle Network	Austroads Guide to Traffic Management Part 4 Section 4.6.1
Cycle networks	Austroads Guide to Traffic Management Part 7 Section 2.3.5
Bicycle in Activity Centres	Austroads Guide to Traffic Management Part 7 Section 3.8.3
A3. Parking	
Bicycle Parking Provision Rates	Austroads Guide to Traffic Management Part 11 3.2.1 & Commentary 2, C 2.2
General requirements of Bicycles parking facilities	Austroads Guide to Traffic Management Part 11 Section 6.8.5
Provision for Bicycles	Austroads Guide to Traffic Management Part 11 Section 7.8.5
Location of Bicycle Parking Facilities	Austroads Guide to Traffic Management Part 11 Appendix C 9.1
Type of Bicycle Parking Facilities	Austroads Guide to Traffic Management Part 11 Appendix C9.2
Bicycle Parking Provision Rates	Austroads Guide to Traffic Management Part 11 3.2.1 & Commentary 2, C 2.2
A4. Interchanges and Intersections	
Provision of cyclists at freeway interchange	Austroads Guide to Traffic Management Part 6 Section 6.4.4
Provision of bicycle lane at intersections	Austroads Guide to Traffic Management Part 6 Section 2.2.2
Road User Considerations - bicycles at intersections	Austroads Guide to Traffic Management Part 6 Section 3.4
Road Space Allocation and Lane Management for cyclists (roundabouts)	Austroads Guide to Traffic Management Part 6 Section 4.4.2

Local Road Approaches to Signalised Intersections	Austroads Guide to Traffic Management Part 6 Section 5.3.3
Cycling road crossing facilities	Austroads Guide to Traffic Management Part 6 Section 8
Bicycle Path Terminal Treatments at Road Crossings	Austroads Guide to Traffic Management Part 6 Section 8.2.2
Crossings at Signalised Facilities	Austroads Guide to Traffic Management Part 6 Section 8.2.3
Road Crossings by Off-road Bicycle Paths in Rural and Outer Urban Areas	Austroads Guide to Traffic Management Part 6 Section 8.2.4
Intersections of Paths with Paths	Austroads Guide to Traffic Management Part 6 Section 8.3
Bicycle provisions on arterial and local roads - Bicycle lane treatments at intersections	AS 1742.9 Clause 2.5
Head-start and Expanded Storage Areas	Cycling Aspects of Austroads Guides Section 5.3.5
Hook Turn Storage Boxes and Hook Turn Restrictions	Cycling Aspects of Austroads Guides Section 5.3.6
Left-turn Treatments	Cycling Aspects of Austroads Guides Section 5.3.7
Bypass of T-intersection	Cycling Aspects of Austroads Guides Section 5.3.8
Crossings at Signalised Intersections	Cycling Aspects of Austroads Guides Section 5.3.9
Signalised Mid-block Crossings	Cycling Aspects of Austroads Guides Section 5.3.10
Unsignalised Road Intersections	Cycling Aspects of Austroads Guides Section 5.4
Basic and Channelised Intersections	Cycling Aspects of Austroads Guides Section 5.4.2
Channelised Left-turn Treatment	Cycling Aspects of Austroads Guides Section 5.4.3
Refuge within an Unsignalised Intersection	Cycling Aspects of Austroads Guides Section 5.4.4
Roundabouts	Cycling Aspects of Austroads Guides Section 5.5
Bicycle Paths and Shared Paths at Roundabouts	Cycling Aspects of Austroads Guides Section 5.5.5
At-grade Treatment at Interchanges	Cycling Aspects of Austroads Guides Section 5.6.2
Grade Separation of Ramps for Cyclists	Cycling Aspects of Austroads Guides Section 5.6.3
Alternative Routes	Cycling Aspects of Austroads Guides Section 5.6.4
A5. Local area traffic management	
Catering for Cyclists and Pedestrians	Austroads Guide to Traffic Management Part 8 Section 8.12
Providing for Bicycles in LATM	Austroads Guide to Traffic Management Part 8 Section 8.12.1
Providing for Pedestrians in LATM	Austroads Guide to Traffic Management Part 8 Section 8.12.2
Vertical deflection devices and their effect on cyclists	Austroads Guide to Traffic Management Part 8 Section 7.2
Horizontal deflection devices and their effect on cyclists	Austroads Guide to Traffic Management Part 8 Section 7.3
Bicycle facilities in LATM areas	Austroads Guide to Traffic Management Part 8 Section 7.5.11
Bicycle two way riding on one way streets	AS 1742.13 Clause 2.9
Bicycle excepted signage - at local area traffic management sites	AS 1742.13 Clause 4.2.12

A6. Traffic Signals	
Bicycle signal displays and layouts	AS 1742.14 Clause 2.5, 3.6
Arrangement of bicycle signal aspects	AS 1742.14 Section 3
Signal face locations at intersections - bicycle aspects	AS 1742.14 Clause 4.2.4
Bicycle signal lantern mounting height	AS 1742.14 Clause 5.2
Cyclist push buttons	AS 1742.14 Clause 5.7
Yellow time for bicycle phase	VicRoads Supplement to Austroads Guide to Traffic Management Part 9 Appendix H.4
Bicycle Detection	Austroads Guide to Traffic Management Part 9
Signal timing and phasing treatments for cyclists	Austroads Guide to Traffic Management Part 9
Loop detectors and push-button detection	Austroads Guide to Traffic Management Part 9
Cyclist setting at mid-block signalised crossing or intersection signalised crossings	Austroads Guide to Traffic Management Part 9
Bicycle Aspects	Austroads Guide to Traffic Management Part 10 Section 8.1.4
Bicycle Signals	Austroads Guide to Traffic Management Part 10 Section 8.3.7
A7. Signs	
No hook turns by bicycles	AS 1742.2 Clause 2.8.8
Additional Victorian bicycle regulatory signs	VicRoads Supplement to AS 1742.9 Clause 2.2
Additional Victorian bicycle warning signs	VicRoads Supplement to AS 1742.9 Clause 2.2
Bicycle lane - signing and marking	VicRoads Supplement to AS 1742.9 Clause 2.4.4 (b)
Bicycle provisions on arterial and local roads - Signs	AS 1742.9 Clause 2.2
Index of bicycle related signs	AS 1742.1 Section 2, 3, 4
Shared bus and bicycle lane signs	VicRoads Supplement to AS 1742.12 Clause 5.2
Exception plates with regulatory signs to allow bicycle exemption	VicRoads Supplement to AS 1742.2 Clause 2.8.10 (b)
Bicycle direction signs	VicRoads Supplement to AS 1742.9 Clause 5.4
Navigational aids for cyclists - Direction signs	AS 1742.9 Clause 5.4
Navigational aids for cyclists - Location of signs	AS 1742.9 Clause 5.6
Exception plates with regulatory signs to allow bicycle exemption	Austroads Guide to Traffic Management Part 10 Section 8.8.8
A8. Pavement Markings	
Bicycle lane lines at intersections	VicRoads Supplement to AS 1742.2 Clause 5.4.4
Navigational aids for cyclists - Bicycle symbol	AS 1742.9 Clause 5.2
Parking adjacent to Barrier lines	VicRoads Supplement to Austroads Guide to Traffic Management Part 11 Section 7.6
Bicycle lane lines	VicRoads Supplement to AS 1742.2 Clause 5.3.1
Sharrow pavement markings	VicRoads Supplement to AS 1742.9 Clause 2.3
Bicycle provisions on arterial and local roads - Pavement markings	AS 1742.9 Clause 2.3
Continuity Lines through traffic	Austroads Guide to Traffic Management Part 10 Section 6.3.6
Edge lines (Bicycle Lane)	Austroads Guide to Traffic Management Part 10 Section 6.3.7, 6.3.8
Coloured Pavement of Bicycle Lane	Austroads Guide to Traffic Management Part 10 Section 6.6

A9. Public Transport Locations	
Bicycle provisions at bus stops	VicRoads Supplement to AS 1742.12 Additional Information - Buses
Providing for cyclist at bus stops	VicRoads Supplement to AS 1742.9 Attachment B
Providing for cyclists at kerbside bus stops	VicRoads Supplement to AS 1742.9 Attachment B
Providing for cyclists at bus stops using an off-road bicycle path	VicRoads Supplement to AS 1742.9 Attachment B
Providing for cyclists at kerb outstand bus stops	VicRoads Supplement to AS 1742.9 Attachment B

B. URBAN ARTERIALS	
Topic	**Relevant Clause or Section**
B1. General / Miscellaneous	
Bicycle Facilities	Austroads Guide to Traffic Management Part 10 Section 8.5.5
Pedestrian and bicycle surveys	Austroads Guide to Traffic Management Part 3 Appendix E
Bicycle planning for activity centres	Austroads Guide to Traffic Management Part 7 Section 2.3.2
Cycling implications for Traffic Management Practice	Austroads Guide to Traffic Management Part 7 Section 3.8.4
Categories of cyclists	Austroads Guide to Traffic Management Part 4 Appendix B
Provision for bicycles at work sites	AS 1742.3 Clause 2.3.7, 4.14.4
Bicycle treatments at level crossings	AS 1742.7 Clause 6.6
Bicycle provisions on arterial and local roads - Bicycle provisions mid-block	AS 1742.9 Clause 2.4
Bicycle loop at an intersection	VicRoads Supplement to Austroads Guide to Traffic Management Part 10 Section 8.5.5
Cycling event complies with the Road Rules	VicRoads Supplement to Austroads Guide to Traffic Management Part 9 Attachment A
Bicycle Facilities	Austroads Guide to Traffic Management Part 10 Section 8.5.5
Pedestrian and bicycle surveys	Austroads Guide to Traffic Management Part 3 Appendix E
Bicycle planning for activity centres	Austroads Guide to Traffic Management Part 7 Section 2.3.2
Cycling implications for Traffic Management Practice	Austroads Guide to Traffic Management Part 7 Section 3.8.4
B2. Network Planning	
Purpose of a Bicycle Network	Austroads Guide to Traffic Management Part 4 Section 3.6
Cycle networks	Austroads Guide to Traffic Management Part 7 Section 2.3.5
Bicycle in Activity Centres	Austroads Guide to Traffic Management Part 7 Section 3.8.3

B3. Parking	
Bicycle Parking Provision Rates	Austroads Guide to Traffic Management Part 11 Section 3.2.1 & Appendix C2.2
General requirements of Bicycles parking facilities	Austroads Guide to Traffic Management Part 11 Section 6.8.5
Provision for Bicycles	Austroads Guide to Traffic Management Part 11 Section 7.8.5
Location of Bicycle Parking Facilities	Austroads Guide to Traffic Management Part 11 Appendix C 9.1
Type of Bicycle Parking Facilities	Austroads Guide to Traffic Management Part 11 Appendix C9.2
Bicycle Parking Provision Rates	Austroads Guide to Traffic Management Part 11 3.2.1 & Appendix C2.2
B4. Interchanges and Intersections	
Provision of cyclists at freeway interchange	Austroads Guide to Traffic Management Part 6 Section 6.4.4
Road User Considerations - bicycles at intersections	Austroads Guide to Traffic Management Part 6 Section 3.4 Cycling Aspects of Austroads Guides Section 5.3.4
Road Space Allocation and Lane Management for cyclists (roundabouts)	Austroads Guide to Traffic Management Part 6 Section 4.4.2
Cycling road crossing facilities	Austroads Guide to Traffic Management Part 6 Section 8
Local Road Approaches to Signalised Intersections	Austroads Guide to Traffic Management Part 6 Section 5.3.3
Bicycle Path Terminal Treatments at Road Crossings	Austroads Guide to Traffic Management Part 6 Section 8.2.2
Crossings at Signalised Facilities	Austroads Guide to Traffic Management Part 6 Section 8.2.3
Road Crossings by Off-road Bicycle Paths in Rural and Outer Urban Areas	Austroads Guide to Traffic Management Part 6 Section 8.2.4
Intersections of Paths with Paths	Austroads Guide to Traffic Management Part 6 Section 8.3
Bicycle provisions on arterial and local roads - Bicycle lane treatments at intersections	AS 1742.9 Clause 2.5
Head-start and Expanded Storage Areas	Cycling Aspects of Austroads Guides Section 5.3.5
Hook Turn Storage Boxes and Hook Turn Restrictions	Cycling Aspects of Austroads Guides Section 5.3.6
Left-turn Treatments	Cycling Aspects of Austroads Guides Section 5.3.7
Bypass of T-intersection	Cycling Aspects of Austroads Guides Section 5.3.8
Crossings at Signalised Intersections	Cycling Aspects of Austroads Guides Section 5.3.9
Signalised Mid-block Crossings	Cycling Aspects of Austroads Guides Section 5.3.10
Unsignalised Road Intersections	Cycling Aspects of Austroads Guides Section 5.4
Basic and Channelised Intersections	Cycling Aspects of Austroads Guides Section 5.4.2
Channelised Left-turn Treatment	Cycling Aspects of Austroads Guides Section 5.4.3
Refuge within an Unsignalised Intersection	Cycling Aspects of Austroads Guides Section 5.4.4
Roundabouts	Cycling Aspects of Austroads Guides Section 5.5
Bicycle Paths and Shared Paths at Roundabouts	Cycling Aspects of Austroads Guides Section 5.5.5
At-grade Treatment at Interchanges	Cycling Aspects of Austroads Guides Section 5.6.2
Grade Separation of Ramps for Cyclists	Cycling Aspects of Austroads Guides Section 5.6.3

Alternative Routes	Cycling Aspects of Austroads Guides Section 5.6.4
B5. Traffic Signals	
Bicycle signal displays and layouts	AS 1742.14 Clause 2.5, 3.6
Arrangement of bicycle signal aspects	AS 1742.14 Section 3
Signal face locations at intersections - bicycle aspects	AS 1742.14 Clause 4.2.4
Bicycle signal lantern mounting height	AS 1742.14 Clause 5.2
Cyclist push buttons	AS 1742.14 Clause 5.7
Yellow time for bicycle phase	VicRoads Supplement to Austroads Guide to Traffic Management Part 9 Appendix H.4
Bicycle Detection	Austroads Guide to Traffic Management Part 9
Signal timing and phasing treatments for cyclists	Austroads Guide to Traffic Management Part 9
Loop detectors and push-button detection	Austroads Guide to Traffic Management Part 9
Cyclist setting at mid-block signalised crossing or intersection signalised crossings	Austroads Guide to Traffic Management Part 9
Bicycle Aspects	Austroads Guide to Traffic Management Part 10
Bicycle Signals	Austroads Guide to Traffic Management Part 10
B6. Signs	
Bicycle lane lines at intersections	VicRoads Supplement to AS 1742.2 Clause 5.4.4
No hook turns by bicycles	AS 1742.2 Clause 2.8.8
Additional Victorian bicycle regulatory signs	VicRoads Supplement to AS 1742.9 Clause 2.2
Additional Victorian bicycle warning signs	VicRoads Supplement to AS 1742.9 Clause 2.2
Bicycle lane - signing and marking	VicRoads Supplement to AS 1742.9 Clause 2.4.4 (b)
Bicycle provisions on arterial and local roads - Signs	AS 1742.9 Clause 2.2
Index of bicycle related signs	AS 1742.1 Section 2, 3, 4
Shared bus and bicycle lane signs	VicRoads Supplement to AS 1742.12 Clause 5.2
Exception plates with regulatory signs to allow bicycle exemption	VicRoads Supplement to AS 1742.2 Clause 2.8.10 (b)
Bicycle direction signs	VicRoads Supplement to AS 1742.9 Clause 5.4
Navigational aids for cyclists - Direction signs	AS 1742.9 Clause 5.4
Navigational aids for cyclists - Location of signs	AS 1742.9 Clause 5.6
B7. Pavement Markings	
Navigational aids for cyclists - Bicycle symbol	AS 1742.9 Clause 5.2
Parking Adjacent to Barrier lines	VicRoads Supplement to Austroads Guide to Traffic Management Part 11 Section 7.6
Bicycle lane lines	VicRoads Supplement to AS 1742.2 Clause 5.3.1
Sharrow pavement markings	VicRoads Supplement to AS 1742.9 Clause 2.3
Bicycle provisions on arterial and local roads - Pavement markings	AS 1742.9 Clause 2.3
Continuity Lines through traffic	Austroads Guide to Traffic Management Part 10 Section 6.3.6
Edge lines (Bicycle Lane)	Austroads Guide to Traffic Management Part 10 Section 6.3.7, 6.3.8
Coloured Pavement of Bicycle Lane	Austroads Guide to Traffic Management Part 10 Section 6.6
B8. Public Transport Locations	
Bicycle provisions at bus stops	VicRoads Supplement to AS 1742.12 Additional Information - Buses

Providing for cyclist at Bus Stops	VicRoads Supplement to AS 1742.9 Attachment B
Providing for cyclists at kerbside bus stops	VicRoads Supplement to AS 1742.9 Attachment B
Providing for cyclists at bus stops using an off-road bicycle path	VicRoads Supplement to AS 1742.9 Attachment B
Providing for cyclists at kerb outstand bus stops	VicRoads Supplement to AS 1742.9 Attachment B
B9. Mid-block treatments	
Types of On-road Bicycle Facilities	Cycling Aspects of Austroads Guides Section 4.1.1
Key Design Criteria and Considerations	Cycling Aspects of Austroads Guides Section 4.2
Road Geometry	Cycling Aspects of Austroads Guides Section 4.2.1
Gradients	Cycling Aspects of Austroads Guides Section 4.2.2
Cross-section and Clearances	Cycling Aspects of Austroads Guides Section 4.2.3
Types of Bicycle Lane Treatments	Cycling Aspects of Austroads Guides Section 4.4
Bicycle/Car Parking Lanes	Cycling Aspects of Austroads Guides Section 4.4.1
Contra-flow Bicycle Lanes	Cycling Aspects of Austroads Guides Section 4.4.2
Separated Bicycle Lanes	Cycling Aspects of Austroads Guides Section 4.4.3
'Peak Period' Bicycle Lanes	Cycling Aspects of Austroads Guides Section 4.4.4
Protected Two-way Lanes	Cycling Aspects of Austroads Guides Section 4.4.5
Finding Space for Bicycle Lane Treatments	Cycling Aspects of Austroads Guides Section 4.5
Supplementary Road Treatments	Cycling Aspects of Austroads Guides Section 4.6
Curves and Turns	Cycling Aspects of Austroads Guides Section 4.6.1
Lane Channelisation	Cycling Aspects of Austroads Guides Section 4.6.2

C. OFF ROAD BICYCLE FACILITIES	
Topic	**Relevant Clause or Section**
C1. General	
Types of Path	Cycling Aspects of Austroads Guides Section 7.2
Choice of Appropriate Type of Path	Cycling Aspects of Austroads Guides Section 7.3
Location of Paths for Cycling	Cycling Aspects of Austroads Guides Section 7.4
Path Design Criteria for Bicycles	Cycling Aspects of Austroads Guides Section 7.5
Bicycle Operating Speed	Cycling Aspects of Austroads Guides Section 7.5.2
Horizontal Alignment	Cycling Aspects of Austroads Guides Section 7.5.3
Width	Cycling Aspects of Austroads Guides Section 7.5.4
Vertical Alignment	Cycling Aspects of Austroads Guides Section 7.5.5
Crossfall and Drainage	Cycling Aspects of Austroads Guides Section 7.5.6
Clearances, Batters and Fences	Cycling Aspects of Austroads Guides Section 7.5.7
Sight Distance	Cycling Aspects of Austroads Guides Section 7.5.8
Path Crossings of Roads	Cycling Aspects of Austroads Guides Section 7.6
Grade Separated Bicycle Path Crossing	Cycling Aspects of Austroads Guides Section 7.6.2
Signalised Bicycle Path Crossing	Cycling Aspects of Austroads Guides Section 7.6.3
Unsignalised Bicycle Path Crossing	Cycling Aspects of Austroads Guides Section 7.6.4
Path Approach Design Criteria	Cycling Aspects of Austroads Guides Section 7.6.5
Types of Crossings of Side Roads	Cycling Aspects of Austroads Guides Section 7.6.6
Intersections of Paths with Paths	Cycling Aspects of Austroads Guides Section 7.7
Considerations	Cycling Aspects of Austroads Guides Section 7.7.1
Design of Intersections of Paths with Paths	Cycling Aspects of Austroads Guides Section 7.7.2
Path Terminal Treatments	Cycling Aspects of Austroads Guides Section 7.8
Fences and Road Safety Barriers	Cycling Aspects of Austroads Guides Section 7.9
Fences	Cycling Aspects of Austroads Guides Section 7.9.1
Road Safety Barriers	Cycling Aspects of Austroads Guides Section 7.9.2

Road and Path Lighting	Cycling Aspects of Austroads Guides Section 7.10
Construction and Maintenance Considerations at Cycling Facilities	Cycling Aspects of Austroads Guides Section 10
C2. Pavement Markings	
Bicycle path and footpath provisions - Pavement markings	AS 1742.9 Clause 3.3
C3. Signs	
Bicycle path and footpath provisions - shared and separate path signage	VicRoads Supplement to AS 1742.9 Clause 3.2 (d), (e), (f)
Bicycle path and footpath provisions - Signs	AS 1742.9 Clause 3.2
C4. Parking	
End of Trip Parking Facilities	Cycling Aspects of Austroads Guides Section 11
Bicycle parking facilities – classification of parking security measures	AS 2890.3 Clause 1.5 Cycling Aspects of Austroads Guides Section 11.6
Bicycle parking facilities - general information	AS 2890.3 Clause 2.1 Cycling Aspects of Austroads Guides Section 11.1
Bicycle parking facilities - parking area requirements	AS 2890.3 Clause 2.2
Bicycle parking facilities - floor slopes	AS 2890.3 Clause 2.3
Bicycle parking facilities - protection from vehicular encroachment	AS 2890.3 Clause 2.4
Bicycle parking facilities - location and clearances	AS 2890.3 Clause 2.5
Bicycle parking facilities - access to parking	AS 2890.3 Clause 2.6
Bicycle parking facilities - signage	AS 2890.3 Clause 2.7
Bicycle parking facilities - lighting	AS 2890.3 Clause 2.8
Bicycle parking facilities - weather protection	AS 2890.3 Clause 2.9
Bicycle parking facilities – maintenance	AS 2890.3 Clause 2.10
Bicycle parking facilities - bicycle spacing envelope	AS 2890.3 Clause 3.3
Typical forms of bicycle parking	AS 2890.3 Clause Appendix B Cycling Aspects of Austroads Guides Section 11.2
Bicycle Parking Provision Rates	Austroads Guide to Traffic Management Part 11 Section 3.2.1 & Appendix C2.2
General requirements of Bicycles parking facilities	Austroads Guide to Traffic Management Part 11 Section 6.8.5
Provision for Bicycles	Austroads Guide to Traffic Management Part 11 Section 7.8.5
Location of Bicycle Parking Facilities	Austroads Guide to Traffic Management Part 11 Appendix C 9.1
Type of Bicycle Parking Facilities	Austroads Guide to Traffic Management Part 11 Appendix C9.2 Cycling Aspects of Austroads Guides Section 11.4

D. HIGH SPEED ROADS	
Topic	**Relevant Clause or Section**
D1. General	
Bicycle facilities	Austroads Guide to Traffic Management Part 10 Section 8.5.5
Pedestrian and bicycle surveys	Austroads Guide to Traffic Management Part 3

	Appendix E
Bicycle planning for activity centres	Austroads Guide to Traffic Management Part 7 Section 2.3.2
Cycling implications for Traffic Management Practice	Austroads Guide to Traffic Management Part 7 Section 3.8.4
Categories of cyclists	Austroads Guide to Traffic Management Part 4 Appendix B
Provision for bicycles at work sites	AS 1742.3 Clause 2.3.7, 4.14.4
Bicycle treatments at level crossings	AS 1742.7 Clause 6.6
Bicycle provisions on arterial and local roads - Bicycle provisions mid-block	AS 1742.9 Clause 2.4
Bicycle loop at an intersection	VicRoads Supplement to Austroads Guide to Traffic Management Part 10 Section 8.5.5
Cycling event complies with the Road Rules	VicRoads Supplement to Austroads Guide to Traffic Management Part 9 Attachment A
D2. Pavement Markings	
Continuity Lines through traffic	Austroads Guide to Traffic Management Part 10 Section 6.3.6
Edge lines (Bicycle Lane)	Austroads Guide to Traffic Management Part 10 Section 6.3.7, 6.3.8
Coloured Pavement of bicycle lane	Austroads Guide to Traffic Management Part 10 Section 6.6
Navigational aids for cyclists - bicycle symbol	AS 1742.9 Clause 5.2
Parking Adjacent to Barrier lines	VicRoads Supplement to Austroads Guide to Traffic Management Part 11 Section 7.6
D3. Signs	
Profile bicycle line	VicRoads Supplement to AS 1742.2 Clause 5.2.8
Signing to allow bicycles on freeways	VicRoads Supplement to AS 1742.2 Clause 3.4.3 (a)
Bicycle provisions on freeways - Application of signs to freeway interchanges	AS 1742.9 Clause 4.3
D4. Interchanges and Intersections	
Provision of cyclists at freeway interchange	Austroads Guide to Traffic Management Part 6 Section 6.4.4
Road User Considerations - bicycles at intersections	Austroads Guide to Traffic Management Part 6 Section 3.4
Road Space Allocation and Lane Management for cyclists (roundabouts)	Austroads Guide to Traffic Management Part 6 Section 4.4.2
Local Road Approaches to Signalised Intersections	Austroads Guide to Traffic Management Part 6 Section 5.3.3
Cycling road crossing facilities	Austroads Guide to Traffic Management Part 6 Section 8
Bicycle Path Terminal Treatments at Road Crossings	Austroads Guide to Traffic Management Part 6 Section 8.2.2
Crossings at Signalised Facilities	Austroads Guide to Traffic Management Part 6 Section 8.2.3
Road Crossings by Off-road Bicycle Paths in Rural and Outer Urban Areas	Austroads Guide to Traffic Management Part 6 Section 8.2.4
Intersections of Paths with Paths	Austroads Guide to Traffic Management Part 6 Section 8.3
Bicycle provisions on arterial and local roads - Bicycle lane treatments at intersections	AS 1742.9 Clause 2.5

Cyclists at Traffic Signals	Cycling Aspects of Austroads Guides Section 9.5
Traffic Signal Displays for Cyclists	Cycling Aspects of Austroads Guides Section 9.5.1
Bicycle Detection	Cycling Aspects of Austroads Guides Section 9.5.2
Treatments for Cyclists at Traffic Signals	Cycling Aspects of Austroads Guides Section 9.5.3

E. PLANNING AND TRAFFIC MANAGEMENT FOR CYCLING	
Topic	**Relevant Clause or Section**
Bicycle Strategies and Strategic Bicycle Plans	Cycling Aspects of Austroads Guides Section 2.2
National Cycling Strategy	Cycling Aspects of Austroads Guides Section 2.2.1
Local Strategic Bicycle Plan	Cycling Aspects of Austroads Guides Section 2.2.3
Integrated and Multi-modal Planning	Cycling Aspects of Austroads Guides Section 2.3
Bicycle Network Management	Cycling Aspects of Austroads Guides Section 2.4
Purpose of a Bicycle Network	Cycling Aspects of Austroads Guides Section 2.4.2
Functions of a Bicycle Network	Cycling Aspects of Austroads Guides Section 2.4.3
Objectives of a Bicycle Network	Cycling Aspects of Austroads Guides Section 2.4.4
Network and Route Mapping	Cycling Aspects of Austroads Guides Section 2.4.5
Categories of Cyclists and their Network Requirements	Cycling Aspects of Austroads Guides Section 2.4.6
Bicycle Programs	Cycling Aspects of Austroads Guides Section 2.5
Behavioural Aspects Programs	Cycling Aspects of Austroads Guides Section 2.5.1
Traffic Studies and Bicycle Surveys	Cycling Aspects of Austroads Guides Section 2.6
Type of Bicycle Facility Required	Cycling Aspects of Austroads Guides Section 2.7
Combining Bicycle Travel with Public Transport	Cycling Aspects of Austroads Guides Section 2.8
Local Area Traffic Management	Cycling Aspects of Austroads Guides Section 2.9
Traffic Management in Activity Centres	Cycling Aspects of Austroads Guides Section 2.10
Planning Context for Cycling in Activity Centres	Cycling Aspects of Austroads Guides Section 2.10.1
Bicycles in Activity Centres	Cycling Aspects of Austroads Guides Section 2.10.2
Cycling Implications for Traffic Management Practice in Activity Centres	Cycling Aspects of Austroads Guides Section 2.10.3
Traffic Impacts of Developments	Cycling Aspects of Austroads Guides Section 2.11
Bicycle Rider Requirements	Cycling Aspects of Austroads Guides Section 3
Space to Ride	Cycling Aspects of Austroads Guides Section 3.2
Smooth Surface	Cycling Aspects of Austroads Guides Section 3.3
Speed Maintenance	Cycling Aspects of Austroads Guides Section 3.4
Sight Lines	Cycling Aspects of Austroads Guides Section 3.5
Connectivity	Cycling Aspects of Austroads Guides Section 3.6
Information	Cycling Aspects of Austroads Guides Section 3.7

Document Information

Title:	Design Guidance for strategically important cycling corridors – Edition 1
Department:	Traffic Engineering
Directorate:	VicRoads Network Design Services
Approved by:	Jeremy Burdan Manager – Traffic Engineering
Date of Approval:	December 2016

Amendment Record

Edition / Revision	Pages(s)	Issue Date	Amendment Description
Edition 1	63	December 2016	First Edition

For enquiries regarding this supplement, please contact the VicRoads – Traffic Engineering team via tem@roads.vic.gov.au or 9854 2417.