Department of **Transport**

WALGA

Planning and Designing for Bike Riding in Western Australia

SHARED AND SEPARATED PATHS

Planning and Designing for Bike Riding in Western Australia

Shared and Separated Paths

Prepared by Department of Transport

Document control

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Amendment record

This document will be reviewed and developed as part of a suite of guidelines for the Planning and Designing for Bike Riding in Western Australia, to ensure its continuing relevance to the systems and process that it describes A record of contextual revisions is listed in the following table.

Revision Number	Revision Date	Description of Key Changes	Section / Page No.

CONTENTS

ABBREVIATIONS

AAA	All Ages and Abilities
ASD	Approach Sight Distance
DoT	The Department of Transport
LTCN	Long Term Cycling Network
MRWA	Main Roads WA
PSP	Principal Shared Path
PTA	Public Transport Authority
RTC	*Western Australian Road Traffic Code 2000*
SISD	Safe Intersection Sight Distance
SSD	Stopping Sight Distance
TMP	Traffic Management Plan
WABN Plan	*Western Australian Bicycle Network Plan 2014-2031* (and subsequent updates)
WALGA	Western Australian Local Government Association
WSUD	Water Sensitive Urban Design

1. INTRODUCTION

1.1 Purpose

This document has been developed to provide practitioners with guidance surrounding the planning and design of shared and separated paths in Western Australia (WA) to enable the safe and efficient movement of bicycle riders of all ages and abilities. It is intended to be a convenient and practical reference guide aimed at practitioners with varying levels of experience. It remains the responsibility of the practitioner to be suitably informed of the specifics and context of their project and how these guidelines are applied.

This guidance on shared and separated paths forms part of a suite of guidelines being developed by the Department of Transport (DoT) that will better inform planning and designing for bike riding in WA. The suite is intended to assist practitioners in delivering best practice, all ages and abilities (AAA) infrastructure and will include guidance pertaining to other forms of cycling infrastructure, such as safe active streets and protected bike lanes, wayfinding and local bike planning, as well as contextual guidance around design principles and infrastructure selection.

While this document covers the key requirements for designing shared and separated paths, it is important that practitioners exercise appropriate engineering judgement during the planning and design process. To enable this, the document directs the reader to relevant sections of the Western Australian *Road Traffic Code (RTC) 2000*, Main Roads WA (MRWA) technical standards, as well as relevant Austroads guidelines wherever possible.

1.2 Western Australian Cycling Network Hierarchy

The *Western Australian Cycling Network Hierarchy* consists of three key route types – primary, secondary and local, as shown in Figure 1.1. These are supported by a complementary network of road cycling routes and transport trails. Each route type is defined by the function it performs in the cycle network, rather than its built form.

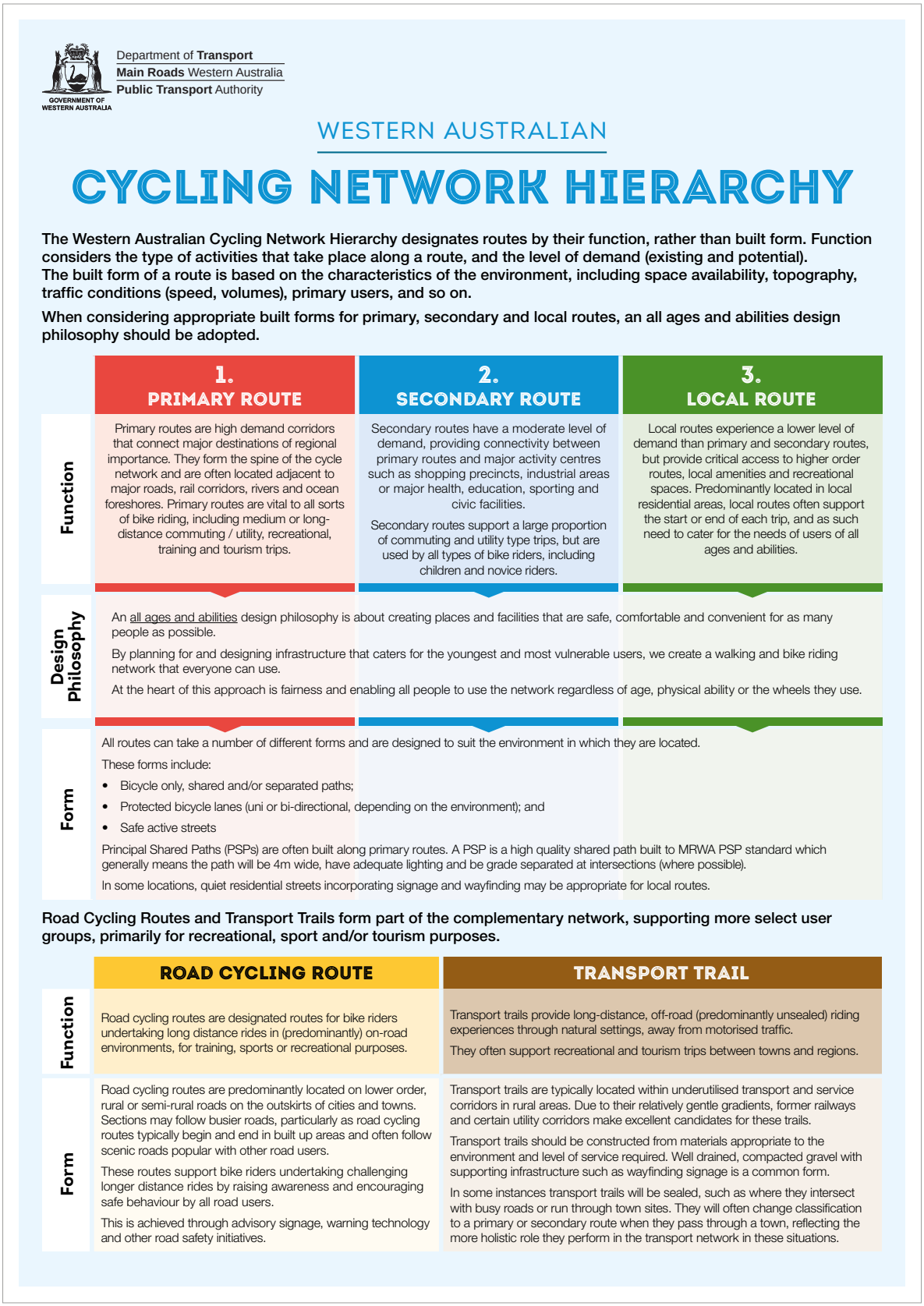


Figure 1.1 *Western Australian Cycling Network Hierarchy and key route types.*

Primary Route

Shared path along a rail corridor, catering for long-distance, uninterrupted journeys.

Secondary Route

Shared path within a recreational area, providing connections to primary and local routes.

Local Route

Shared path within a residential area, providing connections to secondary routes.

Figure 1.2 *The three key route types as defined in the Western Australian Cycling Network Hierarchy.*

The function considers the type of activities that take place along a route, and the level of existing and potential demand, while a routes' built form will be based on the physical characteristics of the location. As highlighted in Figure 1.2, shared and separated paths form an important component of primary, secondary and local routes.

In line with the *Western Australian Cycling Route Hierarchy*, all primary, secondary and local routes must be designed using an all ages and abilities design philosophy.

An all ages and abilities design philosophy is about creating places and facilities that are safe, comfortable and convenient for as many people as possible.

By planning and designing infrastructure that caters for the youngest and most vulnerable users, we create a walking and bike riding network that everyone can use.

At the heart of this approach is fairness and inclusivity by enabling all people to use the network regardless of age, physical ability or the wheels they use.

1.3 Standards and legislative requirements

This document it is not intended to be a traffic engineering manual. Instead, it provides principles and guidance for the planning and design of shared and separated paths. As such, practitioners should make reference to, and consider, all relevant traffic engineering standards and guidelines, including those mentioned below. This document will direct readers to the appropriate sections of relevant documents wherever possible.

It is imperative that all paths are designed in accordance with the *Western Australian RTC 2000*.

It is important to note that MRWA technical standards take precedence over all Australian Standards and Austroads guidance, as outlined in Figure 1.3. The supplements should be read in conjunction with the Austroads guidance as they contain state-specific information and guidance that can differ or expand on Austroads guidance.

Figure 1.3 *Order of precedence for relevant standards and guidelines.*

1.4 Definitions

Table 1.1 provides definitions for different types of path that can legally accommodate bike riding in WA.

Term	Definition (Additional information)
Bicycle path	A path set aside for the exclusive use of bicycle riders. (Sometimes referred to as a bicycle-only path).
Path	Any route intended for use by pedestrians or bicycle riders or both which is not part of a road and which may or may not be adjacent to a road. (Sometimes referred to as a footpath. Since April 2016, all bike riders irrespective of age are permitted to ride on footpaths in WA, unless signposted otherwise. This change has been significant in terms of expanding the path network available to bike riders. However, footpaths are narrower and typically support low speed, low volume bicycle riding and, although legal to ride on, they are a less preferred alternative to well-designed bicycle, shared or separated paths).
Separated path	A path signed for separated use on which bicycle riders and pedestrians are required to use separate designated areas. (Separated paths typically consist of two parallel paths, one exclusively for people riding and the other for people walking. The two paths are often constructed as a single pavement separated by a continuous white line. However, separation can also be achieved by landscaping, planters, cobblestones or through the use of contrasting surface treatments).
Shared path	An area that is open to the public that is designated for use by both bicycle riders and pedestrians. (As mentioned above, all bike riders are legally permitted to ride on paths and no compulsory signs or pavement markings are required to formally designate a shared path. Shared paths are specifically designed to accommodate the safe and efficient movement of pedestrians and bike riders concurrently).

Table 1.1 *Path definitions used in this document.*

It should be noted that for the purposes of this document, shared and separated paths are defined as being located outside of a road's kerb-to-kerb cross-section. Guidance relating to the design of on-road cycling infrastructure (such as protected bicycle lanes) will be provided in a future guidance document.

For further guidance surrounding definitions, practitioners should refer to the *Road Traffic Code 2000*: Part 1 Regulation 3 Terms & abbreviations.

2. GENERAL GUIDANCE

2.1 Considering all path users

While this document primarily focusses on accommodating the needs of people on bikes, it is important to acknowledge that shared and separated paths cater for a diverse range of users. The key requirements of "non-bike rider" user groups are outlined in Table 2.1.

Other user groups	Key considerations
Pedestrians	→ People walk for transport and recreation. People walking for transport (i.e. to work, school, the shops, etc.) tend to prefer routes which are direct. People walking for recreation tend to prefer routes which take in pleasant scenery including coastal and river foreshores, wetlands and bushland. → The average speed for pedestrians on shared paths is normally between 3 and 5 km/h. → Where there are high volumes of pedestrians and bike riders, it is best practice to provide separation (refer to Section 2.5 for guidance surrounding threshold volumes). → Separated paths should also be considered for locations that are popular with dog-walkers or families (including parents pushing prams). → Provision of shade, rest areas and wayfinding provide additional amenity for this user group. → Adequate lighting is very important, particularly in areas with poor passive surveillance.
Runners	→ Runners are typically capable of speeds between 7 and 14 km/h. → Often used at dawn and dusk, these users prefer paths that have good lighting or are clearly visible from adjacent roads. → Provision of shade, rest areas, drinking fountains and outdoor fitness equipment provide additional amenity for this user group.
People with disability	→ People with disability, including those with mobility, sensory or cognitive impairments, must be considered when designing shared and separated paths. → It is a legislative requirement that shared and separated paths are designed in accordance with *AS1428 Design for Access and Mobility*. For information regarding compliance with the *Disability Discrimination Act 1992* (DDA), refer to Section 3.7 to Section 3.11 of this guideline. → The placement of street furniture, signage, power/light poles, cable stays, bollards and holding rails can negatively impact the movement of people with disability.

Other user groups	Key considerations
Wheeled recreational devices	→ Wheeled recreational devices refer to in-line skates, roller-skates, skateboards, scooters and unicycles. → This group is classified within the pedestrian user group in accordance with the RTC, and therefore must comply with pedestrian laws. However, wheeled recreational device users are also permitted to use bicycle paths. → Small pavement defects within the path network can have serious consequences for this user group.
Other users	→ From time-to-time, maintenance and emergency services vehicles will require access to shared and separated paths. For this reason, it is important that shared and separated paths provide regular access points from the surrounding road network. → For more guidance on preventing unauthorised vehicle access to shared and separated paths, refer to Section 10.11.

Table 2.1 *Key considerations for other path users.*

2.2 Considering different trip types

People ride bikes for lots of different reasons and it is important to consider these when designing shared and separated paths.

Table 2.2 outlines the different types of trip undertaken by people riding bikes and their typical characteristics.

	Key considerations					
Trip type	**Description of trips**	**Typical time/day**	**Typical speeds**	**Typical distance**	**Group size**	**Type of bike**
Commute	Travelling to/ from work, school or university.	Normally Monday-Friday during peak hours.	Varies (depending on person and their type of bike).	Varies (but normally less than 25km).	Normally individual.	Diverse range of bikes (including e-bikes).
Delivery trips	Travelling to/ from a defined destination.	Varies.	Varies (depending on person, and their type of bike).	Normally quite short (less than 10km).	Normally individual.	Diverse range of bikes (including e-bikes).
Recreation	Low intensity exercise. Cycling for enjoyment.	Varies, but most popular outside of work hours or on weekends.	Varies (depending on person, and their type of bike).	Varies depending on age/fitness of person and whether they are with children.	Varies, but rarely in big groups.	Diverse range of bikes (including e-bikes).
Training	High intensity exercise. Cycling for sole purpose of cycling.	Varies, but most popular outside of work hours and/or on weekends.	Normally quite fast (>25km/h).	Long (normally more than 50km).	Varies, but normally in medium-to-large groups.	Normally high-performance road bikes.
Touring	Undertaking long distance, multi-day trips normally between towns or cities. May be combination of sealed roads/paths and unsealed trails.	Varies, but people normally undertake this type of cycling during weekends or while on holiday.	Normally quite slow (<20km/h).	Medium to long (normally more than 40km per day).	Normally individual, couple (or small group).	Varies, but often equipped with racks / pannier(s) to carry equipment to support their trip.
Utility	Travelling to/ from shops, cafés, pubs, sports training or visiting friends and family.	Varies.	Moderate (not usually in a hurry).	Normally quite short (less than 10km).	Normally individual (or small group).	Varies, but often equipped with pannier or basket to assist with carrying items such as shopping.

Table 2.2 *Types of trips undertaken by bike riders.*

When designing shared and separated paths, it is also important to consider the operating requirements of various unconventional types of bicycle including cargo bikes, recumbent bikes, hand-operated bikes and three-wheelers. As these bikes are typically longer and/or wider than regular bikes, careful consideration must be taken when installing treatments such as bollards or holding rails and end of trip and mid-trip facilities (refer to Section 4.7, 10.10 and 11.2 for more information).

		Typical Dimensions			
Type	**Diagram**	**Length**	**Width**	**Height**	**Special Features**
Standard bicycle		1800	600	1200	
Road bicycle		1800	600	1200	Narrow tyres, often with clipless pedal systems (cleats)
Electric bicycle		1800	600	1200	Heavier, faster acceleration
Child's bicycle		1500	500	600-900	Small size, lower top tube
Folding bicycle		1500	600	1200	Small size, lower top tube (at or below 500mm)
Tandem bicycle		2750	600	1200	Length, reduced manoeuvrability
Adult tricycle		1800	800	1200	Width, reduced manoeuvrability
Recumbent bicycle/tricycle		2000	750-1000	1300	Length, width, reduced manoeuvrability
Hand cycle		1800	800	1000	Length, width, height, reduced manoeuvrability
Cargo bicycle		2550	650	1300	Length, width, height, reduced manoeuvrability
Cargo tricycle		2100	870	1300	Length, width, height, reduced manoeuvrability, weight
Bicycle tag-along		2900	600	1200	Length, height, reduced manoeuvrability, weight
Bicycle and child trailer		3000	800	1200	Length, width, height, reduced manoeuvrability, weight
Bicycle and child seat		1800	600	1400	Height
Trishaw		2250	1220	1600	Length, width, height, reduced manoeuvrability, weight

Table 2.3 *When designing shared and separated paths, it is important to remember that bikes come in many shapes and sizes (image adapted from AS2890.3).*

2.3 Finding locations for shared and separated paths

Locations where shared and separated paths are typically suitable include:

- parallel to linear transport corridors such as major roads or railways;
- along rivers, lakes or coastal foreshores;
- within (or between) parks, sports grounds, and school/university campuses; and
- linking residential streets together.

When determining the most appropriate form of cycling infrastructure for a given corridor, it is important to recognise that shared and separated paths **are not** suitable for all situations.

Shared or separated paths may not be appropriate when:

- corridor space is limited due to power poles, tree roots, underground services (that are unable to be relocated) and street furniture;
- the corridor does not have sufficient setback from a property boundary; or
- the corridor is punctuated with a significant number of driveways (which increases the number of conflict points and therefore risk to path users).

In such circumstances, other types of infrastructure may be more appropriate, such as protected bicycle lanes or a safe active street.

Please refer to the *Planning and Designing for Bike Riding in Western Australia Contextual Guidance* document for more information on appropriate infrastructure selection.

2.4 Finding space for shared and separated paths

In some situations, space within the road corridor can be reassigned to accommodate shared and separated paths. Sometimes referred to as a 'road diet,' there are a number of techniques that can be used to create space for cycling and walking facilities, including:

- narrowing traffic lanes;
- restricting car parking;
- indenting car parking;
- utilising verge space;
- utilising median space;
- removing traffic lanes;
- undergrounding overhead powerlines;
- upgrading footpaths to shared path standard;
- making roads one-way; and
- closing roads to motorised traffic.

Figure 2.1 provides a visual representation of a 'road diet,' where a road space originally devoted to motorised traffic has been re-allocated to bicycle users and turning vehicles.

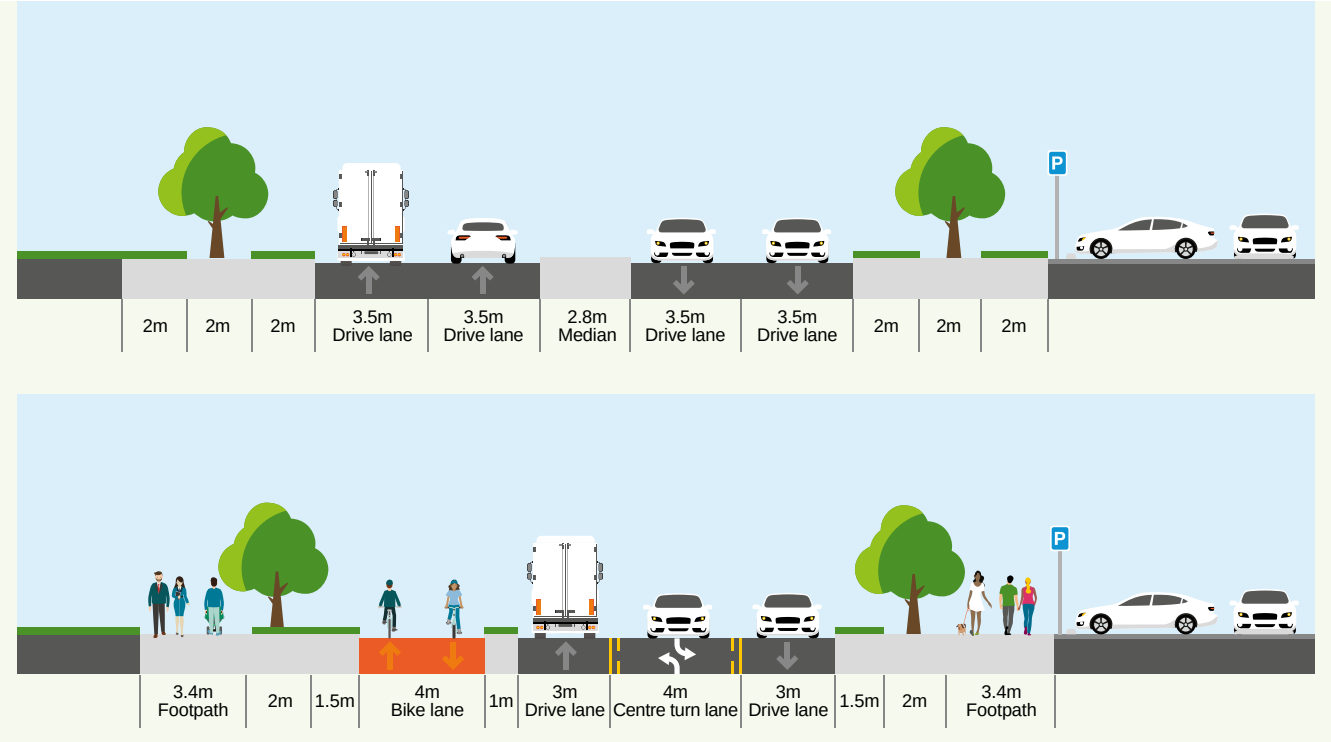


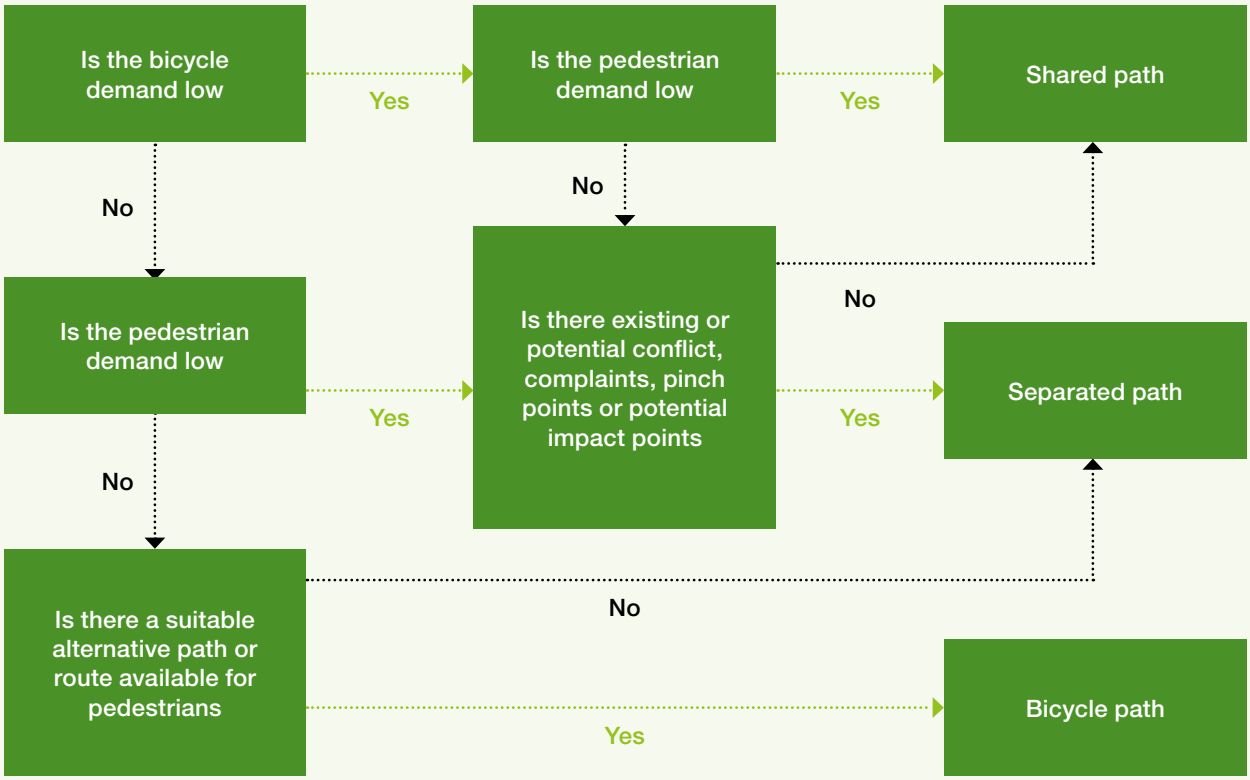
Figure 2.1 *'Road diet' principles can be used to re-allocate road space to cycling infrastructure.*

2.5 When to separate bike riders and pedestrians

Separated paths are strongly encouraged as they provide designated areas for people riding bikes and walking, rather than shared paths, particularly where there are high volumes of people walking and riding such as popular waterfront areas. Providing safe, separated areas for people riding and walking is an important factor in encouraging people to ride and walk more often.

Figure 2.2 provides designers with guidance to assist with determining the most appropriate type of path based on the level of demand. This figure is adapted from the *Austroads Guide to Road Design Part 6A*, which contains further guidance on the separation of people riding and walking.

For guidance on the preferred widths of shared and separated paths, refer to Section 3.2.



Level of Demand

The level of demand can be assessed generally on the basis of the peak periods of a typical day as follows:

- **Low demand:** infrequent use of path (less than 10 users per hour)
- **High demand:** regular use in both directions of travel (more than 50 users per hour)

These volumes are suggested in order to limit potential conflict between users, and will likely be significantly lower than the actual capacity of the path type chosen.

Figure 2.2 *Path type decision making framework (image adapted from Austroads Guide to Road Design Part 6A).*

50:50 Directional Split

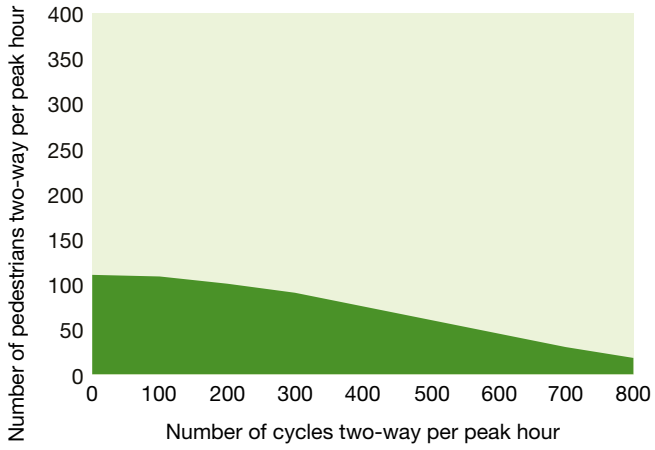


Figure 2.3 *Separation criteria for path with 50:50 directional split – typical of paths which are popular with recreational users (image adapted from Queensland Department of Transport and Main Roads 2015).*

75:25 Directional Split

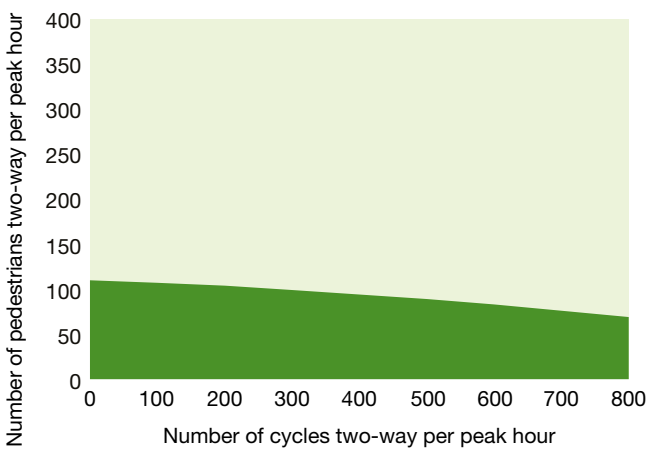


Figure 2.4 *Separation criteria for path with 75:25 directional split – typical of paths which are popular with commuters (image adapted from Queensland Department of Transport and Main Roads 2015).*

For further guidance surrounding when to separate pedestrians and bike riders, practitioners should refer to *Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 5 & Commentary C).

2.6 How to separate bike riders and pedestrians

Where a separated path is chosen, it is important to consider the most practical means of delineating or separating the parallel bicycle and pedestrian paths. Path separation can be achieved through a range of measures, including line marking, landscaping, planters, cobblestones, pavers and contrasting surface treatments.

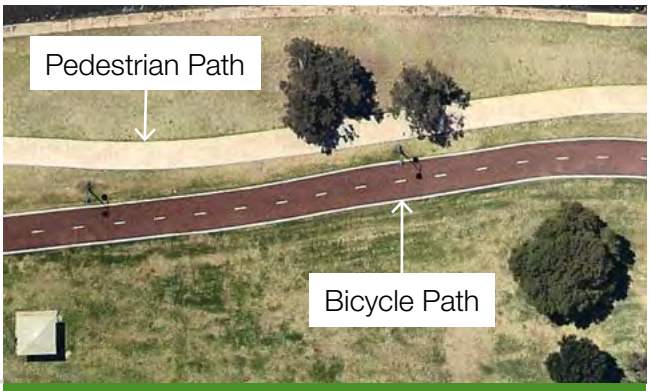
The preferred method of separation is dependent on local factors including available space and drainage, as well as construction and ongoing maintenance costs. Figure 2.5 provides a range of options for achieving safe and legible separation.

Distance between separated paths is an important component to consider. If the pedestrian path is positioned too far from the bicycle path, the bicycle path may be used as the pedestrian path and vice versa. Wayfinding and signage are always important components but become critical when separation between paths is significant.

For more information on signage and line marking separated paths, refer to Section 9.4.

Separation achieved by solid white edge line.

Separation achieved by kerbing and landscaped verge.



Separation achieved by trees and landscaping.

Separation achieved by pavers.

Separation achieved by planters.

Separation achieved by contrasting surface treatment.

Figure 2.5 *Some options for separating people riding and people walking.*

3. GEOMETRIC DESIGN

This section provides geometric design guidance for shared and separated paths, to ensure adequate space and visibility is provided for all users.

3.1 Operating envelope for bike riders

The operating envelope for bike riders in Figure 3.1 depicts the standard operating space required to accommodate a rider and should be used to design the appropriate path widths to allow for adequate clearance from fixed objects and potential hazards. The envelope is the minimum requirement and only provides for a small deviation for the rider's stability while travelling in a straight line. Path designs need to cater for riders of all ages and abilities and practitioners need to ensure that adequate width is provided for those riders that do not maintain a consistent straight line, particular when travelling uphill.

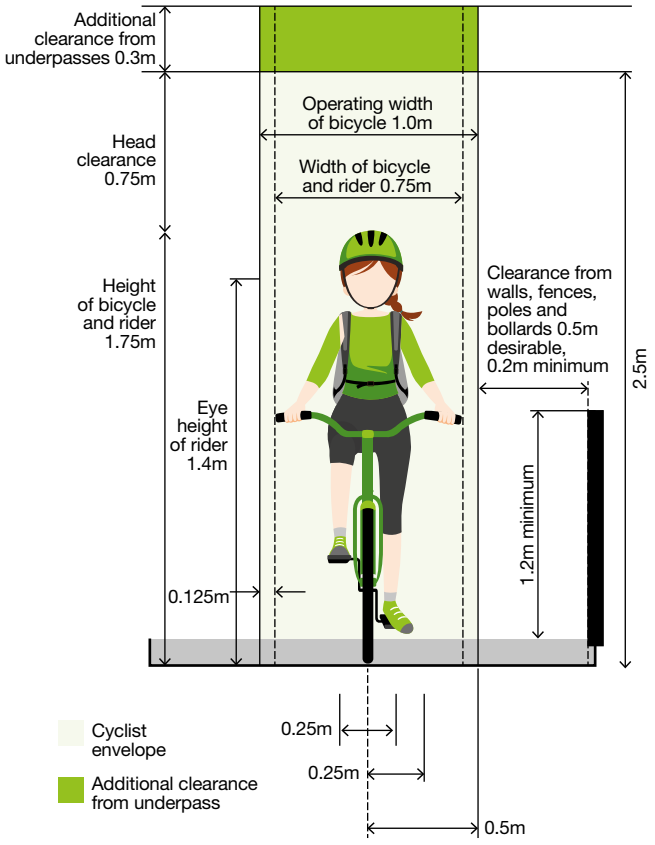


Figure 3.1 *A typical bike rider requires a 1.0m x 2.5m operating envelope.*

3.2 Path widths

The width of a path should correspond with its desired function, reflected by the route's classification in accordance with the *Western Australian Cycling Network Hierarchy* (refer to Section 1.2) as well as the expected number of people riding and walking on the path. Other factors to consider include the types of users and trip types (refer to Section 2.1 and Section 2.2) and catering for current needs and future growth.

Table 3.1 outlines the minimum and desirable (bi-directional) widths for all new shared and separated paths in WA. It should be noted that the widths stated below refer to the "usable path width" – i.e. the area of path which is free from obstructions.

Shared paths	
Minimum width	**Desirable width**
2.5m (local and secondary routes)	3.0m (local and secondary routes)
3.0m (primary route)	4.0m (primary route)
Separated paths	
Minimum width	**Desirable width**
4.0m*, where:	4.5m*+, where:
2.2m is provided for bike riders; and	2.5m+ is provided for bike riders; and
1.8m is provided for pedestrians	2.0m+ is provided for pedestrians

* Width does not include separation element (refer to Section 2.6)

Table 3.1 *Minimum and desirable path widths for shared and separated paths (Information sourced from Austroads Guide to Road Design: Part 6A and AS1428).*

Shared paths with a primary or secondary function will typically have greater width requirements than those along local routes.

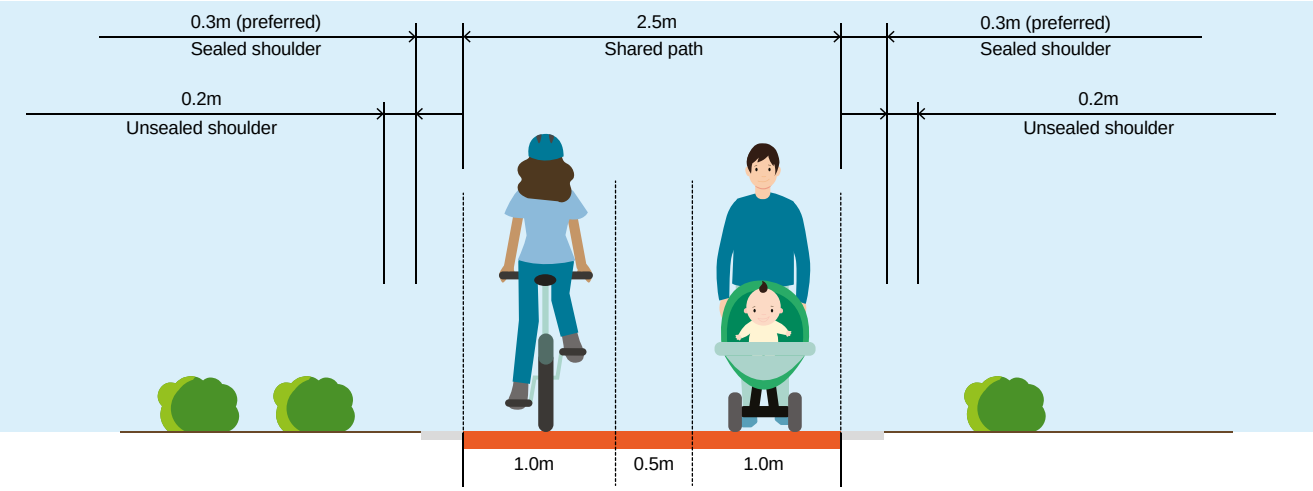
For separated paths, the appropriate width will typically be guided by site conditions, including the available space and the distance proposed between the pedestrian and bicycle paths.

In very constrained areas, the width of a shared path may be less than the minimum stipulated in Table 3.1, however this should be restricted to specific locations and is not acceptable along the whole length of a path.

For more guidance relating to clearances from batters and fixed objects, refer to Section 3.3. For guidance relating to fencing requirements, refer to Section 7.1.

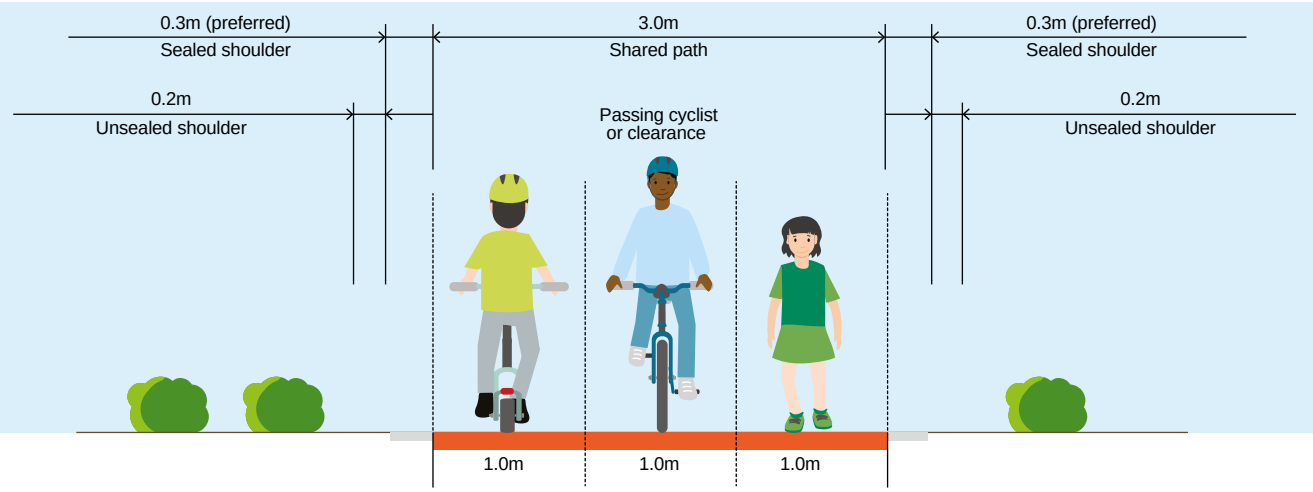
Table 3.2 provides additional guidance surrounding when to use different types/widths of path.

2.5m shared path



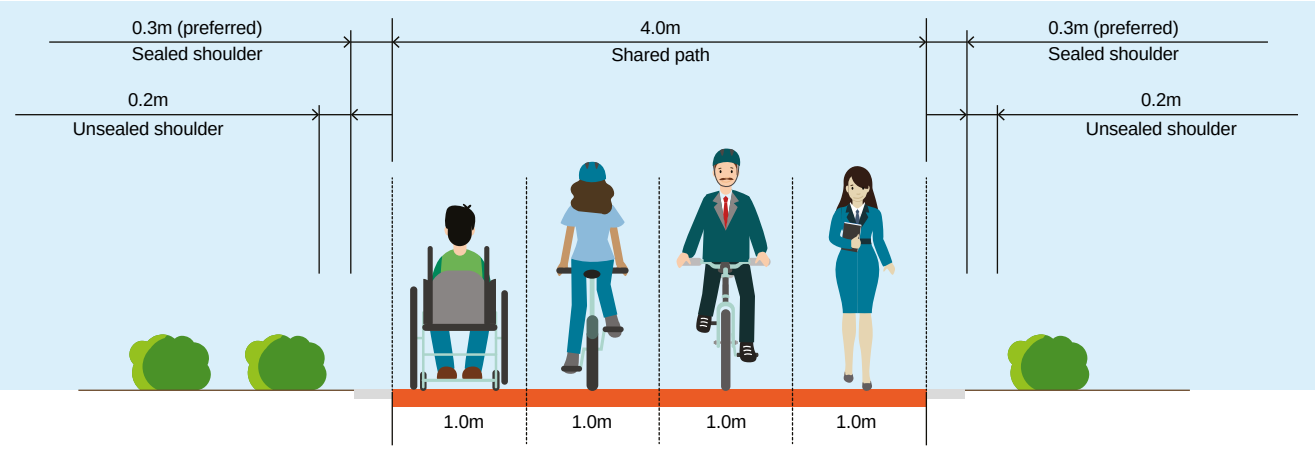
- Paths of this width provide only 0.5m of clearance when passings occur.
- If a passing and a meeting occur simultaneously, one of the users may be forced off the path.
- Paths of this width are only suitable for local and secondary routes, where volumes are low.

3.0m shared path



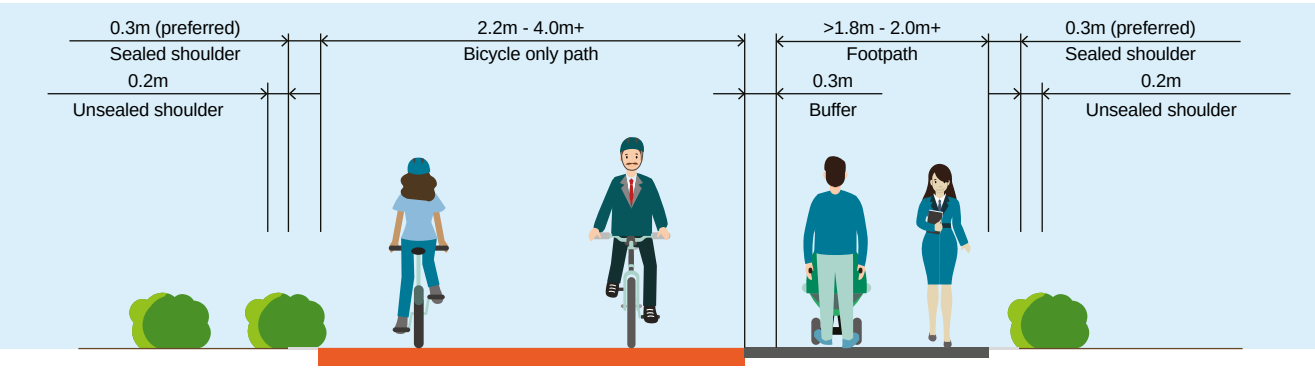
- Providing 1.0m of clearance, paths of this width allow both passings and meetings to occur simultaneously.
- This width is recommended for new local government shared paths (suitable for some primary and most secondary cycling routes), particularly those with a recreational function.

4.0m shared path



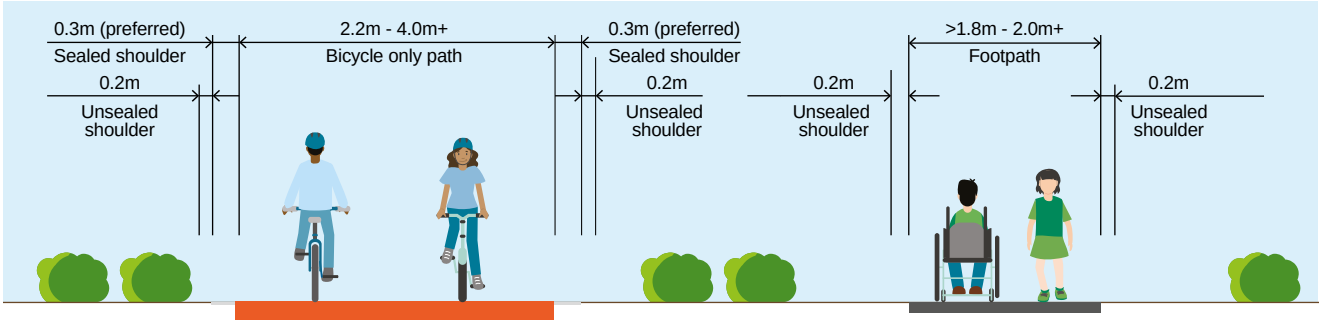
- Standard minimum width for all new principal shared paths (PSPs) built by State Government and preferred for other shared paths along primary routes.
- Allows for passing to occur in both directions.
- Creates a comfortable riding environment, making it attractive for people who wish to ride with family and friends.
- Note that in some situations, a separated path may be a more suitable use of available space.

Separated path with carriageways partitioned by 0.3m painted buffer



- This type of path is warranted where there are very high volumes of people riding and walking such as busy inner-city commuter routes or popular waterfront locations.
- Requires consideration of how best to separate bike riders and pedestrians (refer to Section 2.6).

Separated path with physical separation

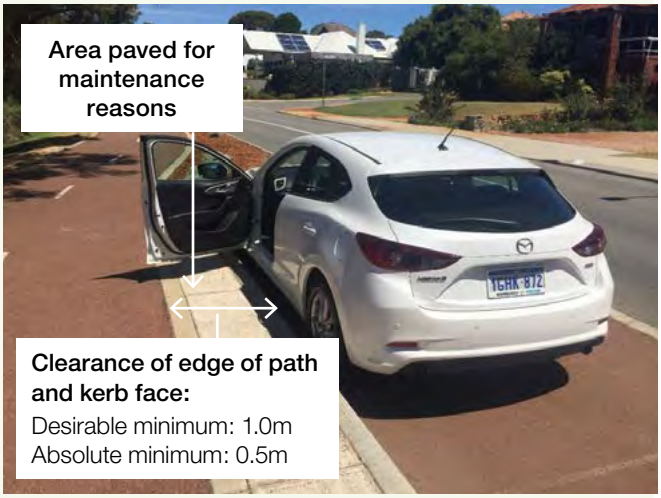


- Similar to above, this type of path is typically used in areas with high volumes of people riding and walking such as popular waterfront locations.
- Adequate space is required and separation allows for flexibility in the design approach.

Table 3.2 *General guidance around selection of the most appropriate path type/width.*

3.3 Setbacks and clearances

Table 3.3 outlines the recommended setbacks of paths from roads, parked vehicles, batter slopes and obstructions. Where setbacks from kerbs are required, it is recommended this area is covered in a contrasting material such as asphalt, concrete or pavement to minimise ongoing maintenance.

Situation and Guidance	Example
Setback from trafficable lanes	
→ The preferred location for a shared or separated path adjacent to the road is 1.0m from the kerb face (with a minimum of 0.5m). → This distance provides a buffer between path users and traffic and allows for road furniture and bins to be positioned at the kerb-line without impacting the movement of path users. → Wider clearances or physical barriers (including safety barriers or low-profile landscaping) may be appropriate where: – the kerbside lane is heavily trafficked; – the road has a speed limit of 60 km/h and above; or – children regularly use the path. → Road safety barriers should be considered for roads with speed limits above 70 km/h. Refer to section 7.2 for further information on safety barriers.	 *A minimum clearance of 0.5m is required between a shared path and an adjacent traffic lane.*
Setbacks from parallel parking	
→ Where a shared or separated path is located next to parallel parking, a 1.0m buffer zone is recommended. → The purpose of the buffer zone is to provide a safe area for people entering/exiting vehicles and to mitigate the risk of dooring.	 *A 1.0m buffer zone is recommended to prevent "dooring".*

Situation and Guidance	Example
Setbacks from right-angle parking	
→ Parking wheel stops may be required to prevent vehicles from overhanging onto shared or separated paths. → Where a wheel stop is installed, a 620mm – 900mm offset is required from the shared path to the kerb to prevent vehicle overhang. → Wheel stops should be designed with pedestrian movement around parked vehicles in mind.	 *Wheel stops used to prevent parked vehicles from overhanging onto shared path.*
Clearances from obstructions	
→ A 1.0m clearance is desirable between the edge of the path and any obstacle which is a potential hazard for a bike rider. → Where necessary, the absolute minimum of 0.5m clearance may be acceptable.	 *A minimum clearance of 0.5m is required between the edge of path and any obstruction e.g. lamp and signposts.*

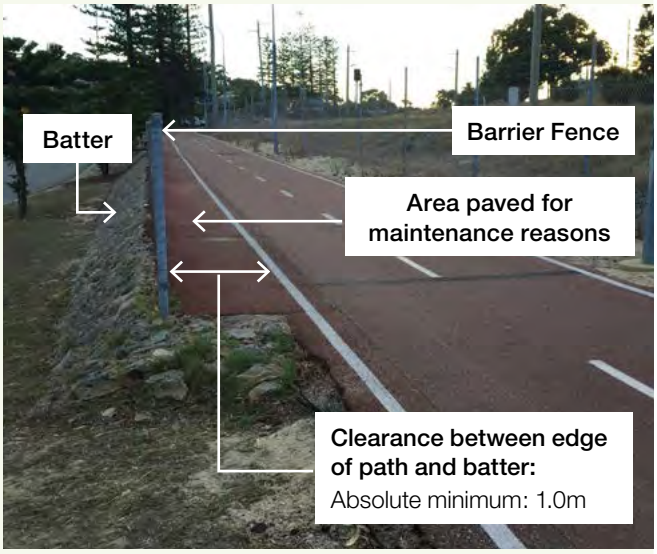
Situation and Guidance	Example
Clearances from batters	
→ A 1.0m minimum clearance is required for earthworks batters. → Additional clearance or a barrier fence is recommended where there is risk of serious injury to path users. Refer to Section 7.1 for more information.	 *A minimum clearance of 1.0m is required between the edge of path and batters.*
Vertical clearances from signage	
→ A 2.5m minimum clearance is required to any obstruction over the full width of the path. → The desirable sign height should be calculated from the top of the kerb or the surface level of the path. Refer to Section 3.1 for more information regarding the operating envelope for bike riders.	 *A minimum clearance of 2.5m is required to underside of the sign for the surface level of the path.*

Table 3.3 *Minimum setbacks and clearances (information sourced from MRWA's Supplement to Austroads Guide to Road Design: Part 6A).*

3.4 Design speeds

When designing shared and bicycle-only paths, it is important to recognise that many bike riders can maintain a relatively consistent speed over long distances. Speeds in excess of 35 km/h are not uncommon on flat paths, while speeds of over 50 km/h can be attained when travelling downhill. For this reason, it is recommended that all shared and bicycle-only paths are designed for a speed of at least 30 km/h. A higher or lower design speed may be adopted depending on the purpose and location of the path and other site-specific circumstances.

In constrained locations where sight visibility is reduced, such as approaches to underpasses, footbridges and shared zones, a lower design speed of 20 km/h should be adopted.

In these situations, it is important to utilise measures such as advisory pavement markings and contrasting surface materials to alert users to potential hazards. For further guidance refer to Section 9 pavement markings and Section 10 managing conflict and transition zones.

Figure 3.2 *Where space constraints result in substandard geometry, advisory measures are recommended to encourage appropriate behaviour by path users.*

Figure 3.3 *Entry point to shared zones, advisory measures are required to highlight the change of use/priority.*

For more information on bicycle operating speeds, practitioners should refer to Main Roads WA Supplement to *Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 5.2); and

***Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 5.2)**

3.5 Minimum curve radii

Typically, the desirable minimum radius for shared or separated paths is 10m. Exceptions to this include where topography or other physical elements restrict curve radii. In these situations, appropriate warning treatments and lighting are recommended. Sharp curves should be avoided near or at the bottom of steep downhill grades.

While banked curves can be beneficial for bicycle-only paths, superelevation should not exceed 2.5 percent for shared paths due to their adverse impact on mobility impaired users.

For intermediate values of superelevation, practitioners should refer to the horizontal curve equation found in *Austroads Guide to Road Design Part 3: Geometric Design* (Section 7.4).

3.6 Minimum horizontal curve lengths

For shared and bicycle-only paths, it is desirable to set minimum horizontal curve lengths as this encourages bike riders to remain on the correct side of the path as they corner, improving safety.

Figure 3.4 *Curved path example.*

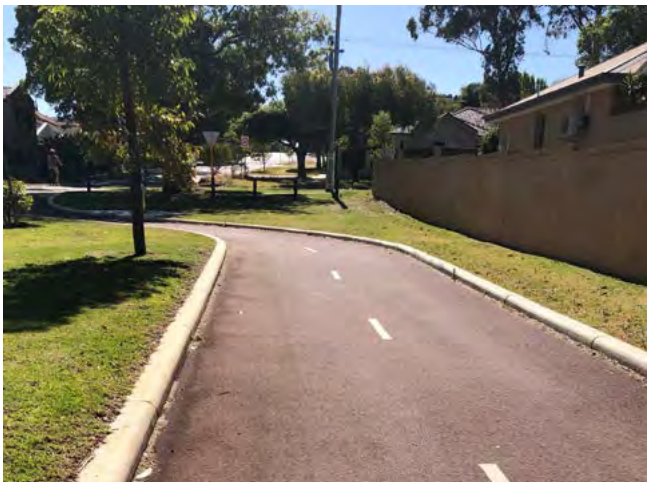


Figure 3.5 *Curved path example.*

Practitioners should resist the temptation to provide curves that are smaller than necessary (e.g. to create an artificially winding path for aesthetics or urban design reasons). It is much safer for path users if larger curves with greater sight distance are provided.

Figure 3.6 *Sharp 90° bends on paths should be avoided, as bike riders will not be able to remain on the correct side of the path as they corner.*

For more information pertaining to minimum horizontal curve lengths, practitioners should refer to Main Roads Supplement to *Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 5.3); and

***Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 5.3)**

3.7 Crossfall

In addition to being hazardous, the ponding of water on shared and separated paths can have negative impacts on amenity for path users. The primary risk associated with the ponding of water is that the surface can become slippery, increasing the likelihood of falls and injury. The accumulation of surface water can also create maintenance issues and result in users travelling on/off the paths to avoid puddles.

MRWA recommends a one-way crossfall of 2 per cent to effectively dispose of surface water on shared and separated paths, unless superelevation is required. *AS1428* specifies that a path's crossfall should not exceed 2.5 per cent (1 in 40) to ensure all users are able to safely use the path. For more guidance regarding drainage design, refer to Section 6.

For more information pertaining to crossfalls and drainage, practitioners should refer to Main Roads Supplement to *Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 5.6); and

***Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 5.6).**

3.8 Longitudinal gradients

To ensure people on bikes are not required to walk up steep grades or travel at unsafe speeds downhill, steep longitudinal grades should be avoided where possible, even at the expense of providing added curvature or travel distance.

Where possible, path grades should not exceed 5 per cent, however, in some circumstances this may not be achievable. In this situation a steep path is generally preferred to no path at all.

It is important that steep grades are not combined with sharp horizontal curvature (i.e. curves with <20m radius). If this cannot be achieved, adequate sight distances must be provided which take into account likely approach speeds (refer to Section 3.14).

To avoid the need for landings on shared paths it is necessary to restrict the maximum longitudinal gradient to 3 per cent.

***Figure 3.7** Zigzags positioned in appropriate locations could be used to overcome steep gradients (image courtesy of the Wanneroo Times).*

Shared and separated paths must also be designed in accordance with *AS1428* Design for Access and Mobility which states maximum gradients must not exceed 1:14, however it is recommended that gradients should not be steeper than 1:20. Refer to Section 3.10 for more information on ensuring compliance with the *Disability Discrimination Act 1992.*

For maximum grades of bicycle-only paths, practitioners should refer to Main Roads Supplement to *Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 5.4); and

***Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 5.4).**

3.9 Landings

Landings are provided to ensure that a level rest area is provided on steep grades to make the path more accessible for path users with impaired mobility. Where it is appropriate to provide landings, they should comply with *MRWA Supplement to Austroads Guide to Road Design – Part 6A* and *AS1428* in accordance with the *Disability Discrimination Act 1992*.

Landings are not required for bicycle-only paths.

If landings are unable to be incorporated in a shared path, a separate pedestrian-only path with landings could be provided as an alternative option. The landing should have no vertical curves and include handrails that comply with Main Roads Supplement to *Austroads Guide to Road Design – Part 6A* and *AS1428.1*. Signage and/or pavement markings are required to clearly indicate that wheelchair access is via the pedestrian path.

Piano key markings should be applied at all landings where bicycle riders have access. Where the approach sight distance (ASD) is less than 20m on a downhill approach to the initial landing then the addition of a 'BUMP' warning pavement marking should be used.

Refer to MRWA standard drawings 201131-0071-2 and 201131-0070-3 for details on the use of "BUMP" and "piano key" pavement markings on landings.

Figure 3.8 *Examples of 'BUMP' and piano key pavement markings.*

For more information pertaining to the design of landings, practitioners should refer to Main Roads Supplement to *Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 5.4); and

***Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 5.4).**

3.10 Switchback ramps

Switchback ramps are not preferred but if they are required to ascend or descend from different surface levels or gradients where space is constrained, curvilinear ramps are recommended.

Dependent on the height difference, switchback ramps can ascend to the required elevation in two or more runs, effectively reducing the overall footprint of the ramp where space limits the installation of longer ramps. The addition of rest points in ramps effectively breaks up the long spans making them easier for people with disability to use.

The following guidance applies to switchback ramps:

- Ramps should always be curvilinear as bikes turn on a curve;
- Ramps typically turn 180 degrees in the opposite direction;
- Ramps are required to have a maximum slope of 1:12; and
- Ramp lengths are restricted to 9m maximum before there is a requirement to introduce rest platforms.

Figure 3.9 *Example of the preferred curvilinear switchback.*

Figure 3.10 *Example of rectilinear switchback.*

For more information on path intersection design and path-path intersections, practitioners should refer to Main Roads WA Supplement to the *Austroads Guide to Road Design Part 6A: Paths for Walking and Cycling* (Section 6); and

***Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 6); and**

***Cycling Aspects of Austroads Guides*: (Section 7.7).**

For more information on regulatory control, practitioners should refer to *MRWA Policy and Application Guidelines: Signage and Pavement Marking on Paths* (Section 7).

3.11 Disability access requirements

Practitioners delivering shared and separated path infrastructure have a legal responsibility to meet their obligations under the *Disability Discrimination Act 1992* (DDA). The DDA ensures that shared and separated paths are designed in accordance with *AS1428 Design for Access and Mobility*. Where there are suitable alternatives for pedestrians, bicycle paths are not required to meet the DDA requirements listed in this section.

Generally, the standards prescribed in this guideline meet or exceed the minimum requirements of *AS1428* regarding the following:

- Path widths
- Street furniture
- Vertical clearances
- Surfaces.

Additionally, practitioners must ensure the following elements are included when delivering a path project:

- **Grates/covers:** Grates should be sized and aligned to prevent walking sticks/canes, wheels and other mobility aids from falling through.
- **Ramps and landings:** Ramp gradients should be between 1:14 and 1:20. Landing intervals are required every 9.0m to 15.0m, dependent on the gradient. It is essential that all ramps are lipless.
- **Kerb ramps:** MRWA states that the maximum gradient for kerb ramps is 1:10 with an absolute maximum of 1:8 according to *AS1428* (across a maximum length of 1.52m). Kerb ramp landings must be installed at the top and base of ramps with a maximum gradient of 1:40. Preferred minimum width is 1.5m (absolute minimum 1.33m).
- **Warning and Directional Tile Ground Surface Indicators (TGSIs):** TGSIs should be installed where local governments determine they are necessary (in consultation with representatives from the vision impaired community).
- **Guidance signs:** Ideally signs should be placed in a position that does not interfere or cause a hazard to bike riders or pedestrians. Signs should be offset a minimum of 0.6m from the edge of the path and mounted 2.0m from the ground to the underside of the sign. Where the sign is perpendicular to the path and within 0.6m of the edge of the path, the sign height is increased to 2.5m. Refer to Section 3.3 (Table 3.3) for more information on vertical clearance from signage and refer to Section 9 for more information regarding signage requirements for shared and separated paths. NOTE: Pavement markings are preferred over signs as the control device.

For further guidance regarding compliance with the *Disability Discrimination Act 1992*, practitioners should refer to *AS1428*. For further guidance regarding the installation of TGSIs, practitioners should refer to MRWA's Technical Specification 606.

For more information on guidance signs, practitioners should refer to refer to MRWA's *Sign Specification 601* and MRWA's Standard Contract Drawing No. 9548-0106.

3.12 Sight distances

Appropriate sight distances are essential for safety on shared and separated paths. Sight distances provide path users with the opportunity to stop or take evasive action in order to avoid a collision with another path user or obstacle. Locations where available sight distances need to be assessed include:

- at the intersections of roads or other paths;
- across the inside of horizontal curves;
- in sag curves (e.g. where a path passes under a road) and over vertical crest curves;
- at entries and exits to underpasses;
- at the top and bottom of stairs; and
- below overhead obstructions.

To ensure people on bikes can avoid head-on collisions, shared and separated paths must be designed to provide a sight distance of at least double their stopping sight distance for a rider to perceive, react and stop safely.

Figure 3.11 *Example of clear sightlines at road crossing.*

Figure 3.13 *Example of clear sightlines at bottom of stairs.*

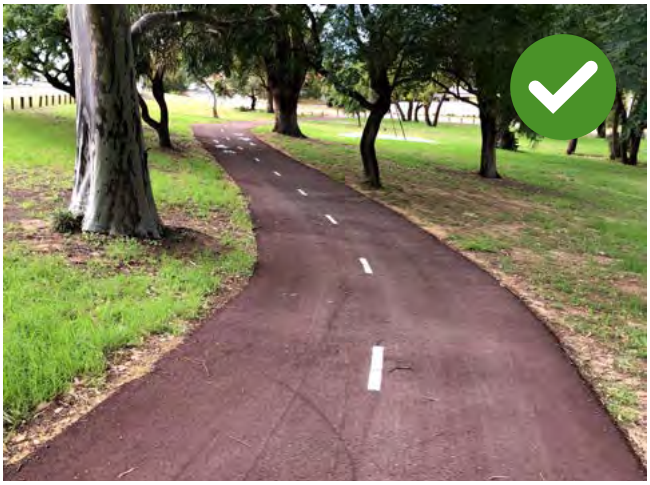


Figure 3.12 *Example of clear sightlines across the inside of horizontal curves.*

Figure 3.14 *Example of clear sightlines below an overhead obstruction.*

3.13 Stopping Sight Distances (SSD)

Shared and separated paths should be designed with adequate SSD on vertical curves, horizontal curves and at intersections.

Figure 3.15 *Example of clear sightlines at path to path intersection and across curve.*

Figure 3.16 *Example of poor sightlines at path to path intersection.*

For more information on calculating SSD, practitioners should refer to MRWA's Supplement to the *Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 5.7); and

***Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 5.7)**

3.14 Approach Sight Distances (ASD)

Shared and separated paths should be aligned to intersect roads at 90 degrees. Where the ASD for people on bikes is restricted, warning signs and/or measures to reduce the approach speed should be provided (refer to Section 10).

Figure 3.17 *Examples of clear sightlines on approach to road crossing.*

Figure 3.18 *Examples of path intersecting at 90 degrees.*

3.15 Safe Intersection Sight Distances (SISD)

SISD checks are particularly important where walls run parallel to the major leg at an intersection. In these situations, it may be necessary to provide splays in the path away from the wall to achieve SISD.

For more information on calculating ASD and SISD, practitioners should refer to *Austroads Guide to Road Design: Part 4A Unsignalised and Signalised Intersections* (Section 3); and

MRWA's Supplement to the *Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 5.7); and

***Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 5.7).**

4. INTERSECTION DESIGN

4.1 Intersections with other paths

Where paths intersect with other paths, they must be designed to ensure that all users can clearly understand who has right-of-way.

The following guidance applies to intersections between paths:

- All path-path intersections should intersect at 90 degrees where possible.
- When two shared or separated paths cross, they should form two staggered T-junctions, rather than a single four-way intersection (refer to Figure 4.1). Caution should be applied as minimum stagger distances may apply where there is a proven record of conflict or specific safety concerns.
- Where a shared or separated path meets a path of lesser importance (such as a local footpath), the higher order path should maintain priority, with the minor path forming a T-intersection (refer to Figure 4.2).
- Where a shared or separated path along a local or secondary route meets a path along a primary route, the primary route should maintain priority, based on its function within the cycling hierarchy.
- Where both paths have similar volumes and function within the cycling hierarchy, priority should be assigned to the route that is most constrained (e.g. one path may have a steep upgrade on the approach or departure).
- Other geometric factors (such as sight lines) may also influence the assignment of priority at path-path intersections. Where visibility is limited due to the presence of an obstruction that can removed (e.g. landscaping), attempts should be made to remove the obstruction.
- Intersections should not be located on longitudinal grades greater than 3 per cent. Where a path joins another path that has landings in accordance with *AS1428.1*, the intersection should be located at the landing, with the length of the landing increased to match the width of the connecting path.

Figure 4.1 *Preferred staggered configuration when two paths of equal importance meet.*

Figure 4.2 *Preferred intersection configuration where a high-order path meets a lower-order path.*

Consideration should be given to the method used to connect paths. Sharp right-angle turns are not appropriate and should be avoided, unless there is no other alternative due to constraints at the site location.

The following guidance applies to path connections:

- The path should contain corner splays with a minimum radius of 2.5m.
- The path intersection should have a turn radius of ≥5m to ensure a rider undertaking a turn movement can maintain an upright position through the turn.
- At busy intersections, the path should be widened to limit the potential for conflict between through moving and turning riders.

Figure 4.3 *Examples of good path intersection connection with corner splays and turn radius.*

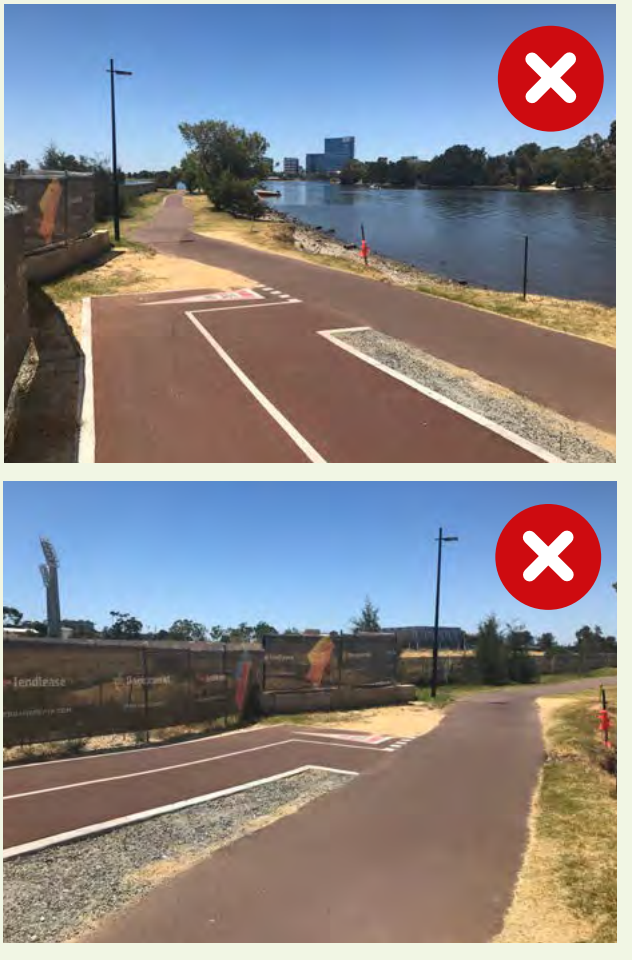


Figure 4.4 *Examples of poor path intersection connections with no corner splays and sharp turn.*

4.2 Where paths cross driveways

Type 1 (non-indented, priority): In accordance with regulations 57 and 58 of the RTC, where a shared or separated path crosses a driveway, the path should continue through the driveway, reinforcing the legal priority of path users. A diagrammatic representation of this is provided in Figure 4.5.

Where a path crosses a driveway, which experiences significant traffic volumes (such as a shopping centre, service station, multi-storey car park), an alternative treatment may be more appropriate (refer to Sections 4.6 to 4.8).

Where retrofitting a path across existing driveways, this design may require the adjustment of levels and drainage to suit local conditions.

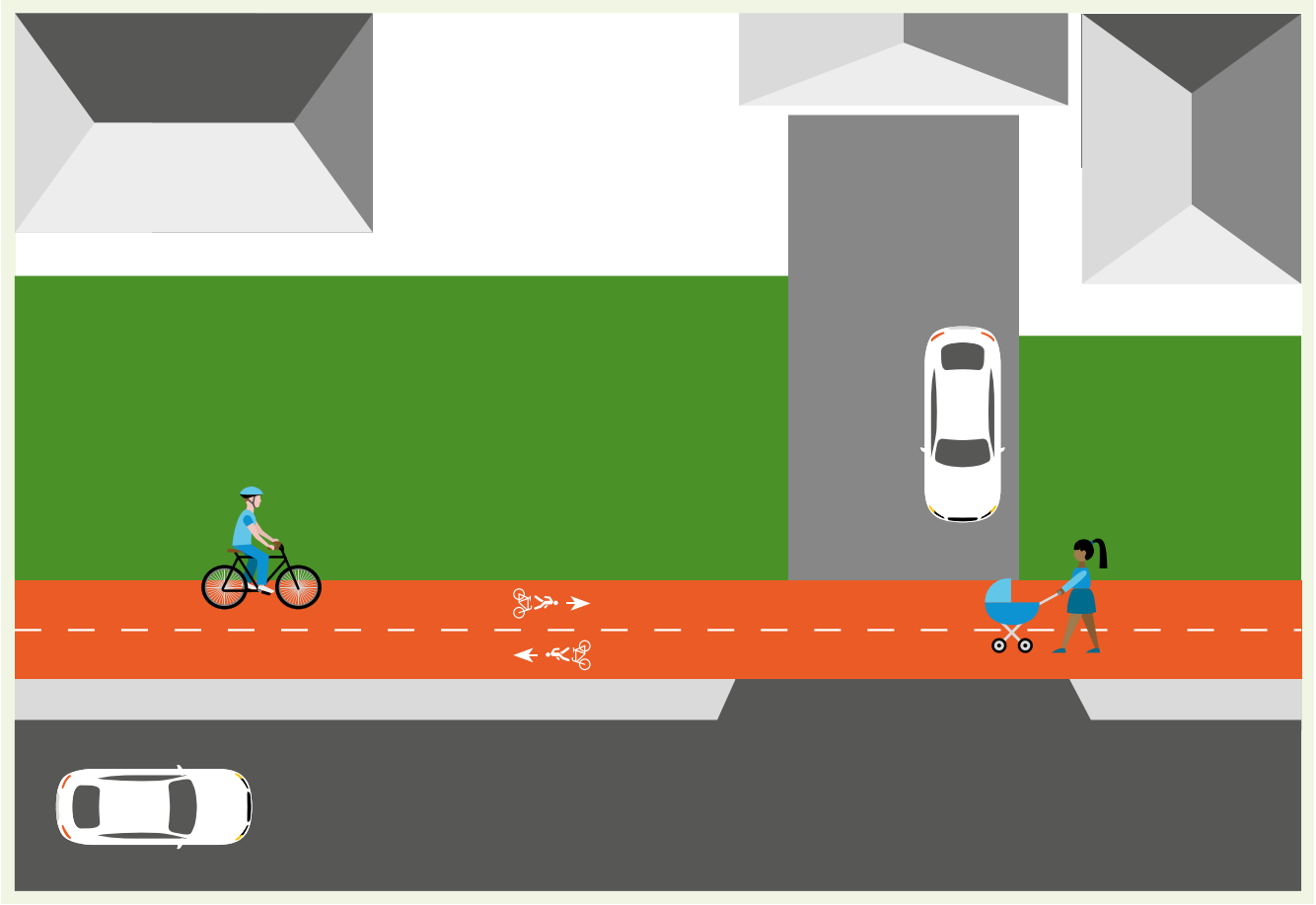


Figure 4.5 *Intersection type 1 (non-indented, priority) – suitable only for driveways.*

For more details regarding the design, funding and approval of crossovers, practitioners should refer to the *WALGA Guidelines and Specifications for Residential Crossovers*; and

Main Roads WA Supplement to *Austroads Guide to Road Design – Part 8* (Additional Road Design – Driveways).

4.3 Intersections with minor roads

One of the major drawbacks of shared and separated paths is the lack of priority when crossing minor roads, which has the potential to significantly increase journey times when compared to parallel on-road routes. Where shared or separated paths cross minor roads, intersections should be designed in a manner that ensures:

- both motorists and path users are aware of the existence of the crossing and the priority that applies;
- the location and design of the crossing, and the priority adopted, does not put road and path users at risk when turning; and
- safe use by all path users.

Type 2 intersection (indented, priority): Providing priority for path users across minor roads where safe to do so is encouraged. The treatment shown in Figure 4.6 combines give-way signage with a raised plateau to legally (and visually) assign priority to path users.

The minimum 6.0m indentation to the roadway is required to allow for cars to enter the major road without obstructing the shared path and for cars to stop after entering the minor road without impeding through movements on the major road they have just exited. The indentation also helps improve sight lines and awareness between road and path users. This treatment may be suitable when:

- traffic volumes on the side road are low;
- speeds on both the major road and side road are low; or
- there are low numbers of heavy vehicles (particularly semi-trailers) given their potential to straddle the crossing point.

Practitioners should not use this type of indented priority if the crossing is located on a downhill grade or adequate sightlines cannot be achieved.

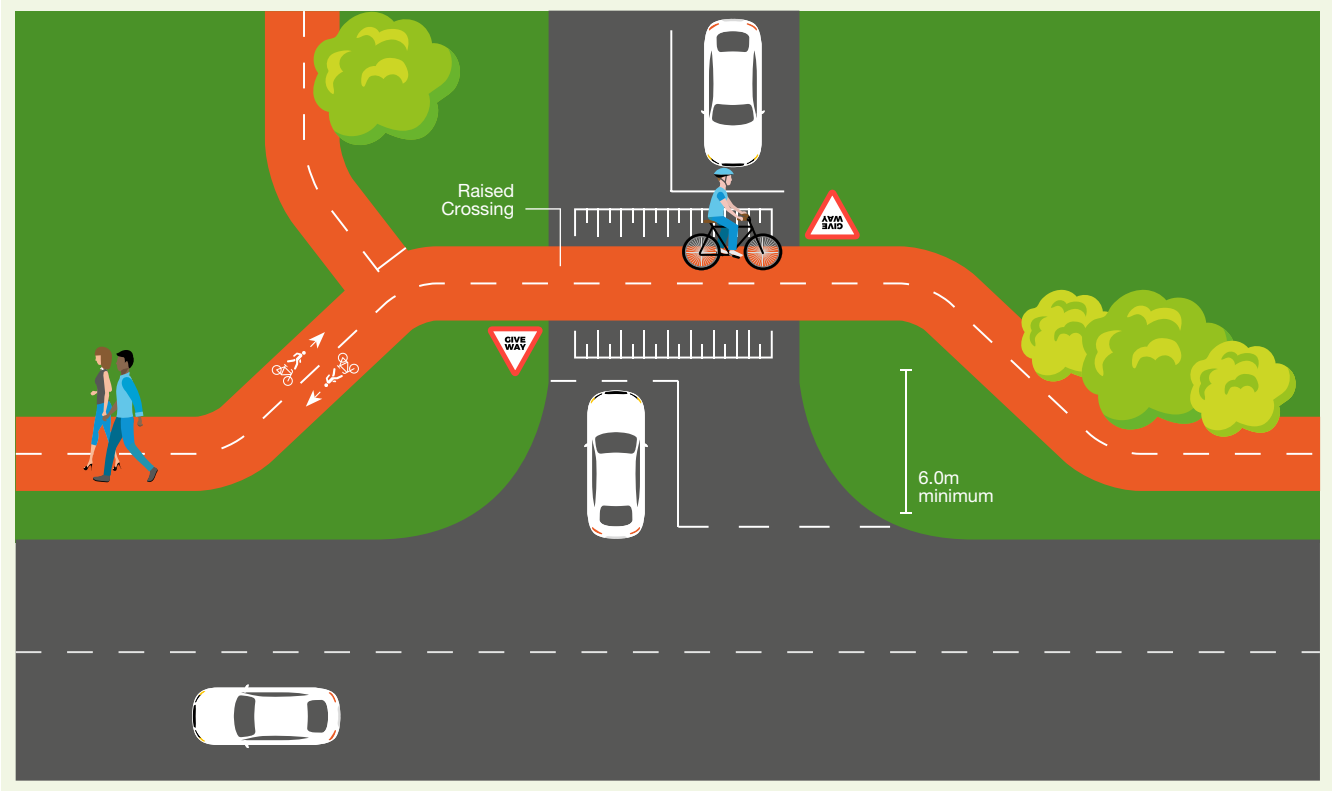


Figure 4.6 *Intersection type 2 (indented, priority) – only for minor roads where sufficient sightlines and storage space is available.*

Refer to *Cycling Aspects of Austroads Guides 2017*, Figure 7.10: Bicycle path crossing bent-out at side road, page 114.

Type 3 intersection (indented, non-priority intersection): Where sufficient space is available, shared or separated paths can be indented away from the parallel road at its intersection with the local access road (refer to Figure 4.7).

The principal reason for indentation is to allow storage space for vehicles turning into the local road as well as to improve sightlines between turning vehicles and path users. Indentation should be achieved using smooth curves (e.g. 30m radius) as the use of tight curves can introduce manoeuvres that require the bike rider's attention at a point where their focus should be on the intersection.

If the crossing distance is wide or traffic volumes and approach/turning speeds are higher (>3000 vehicles per day and/or >30 km/h), a median refuge may need to be provided. *MRWA's Supplement to Austroads Part 4A* recommends a minimum length of 3.0m for refuges (absolute minimum of 2.0m). For more information on refuges, refer to Section 4.6.

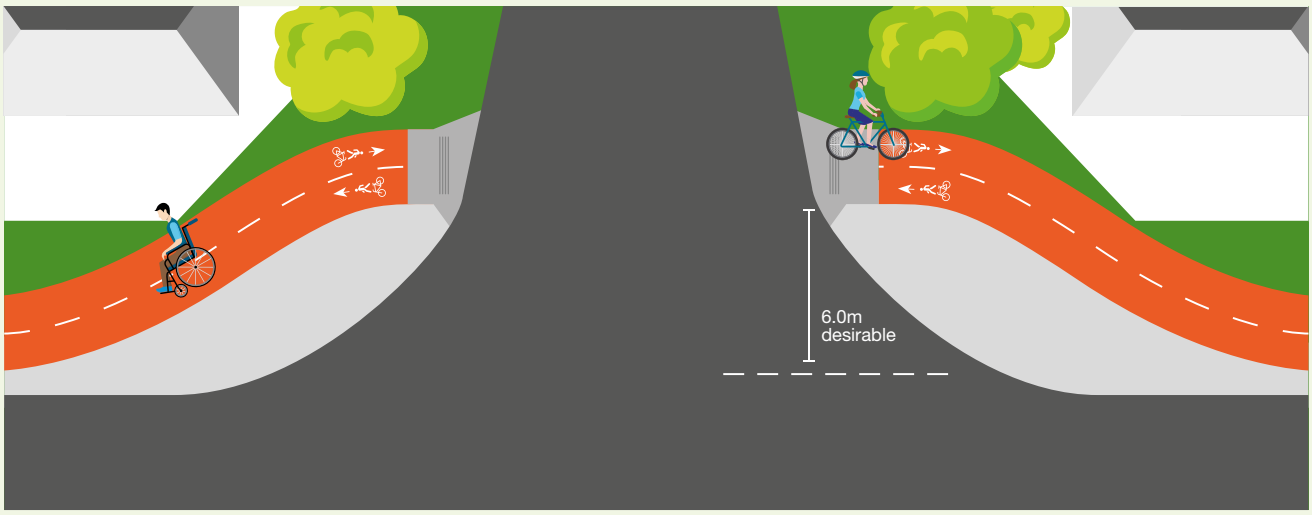


Figure 4.7 *Intersection type 3 (indented, non-priority) – suitable for higher volume roads.*

Type 4 intersection (non-indented, non-priority): Figure 4.8 provides a typical intersection treatment where a shared or separated path crosses a minor road. This type of intersection is only recommended for situations where traffic volumes are low and where it is not possible provide indentation (see Type 3).

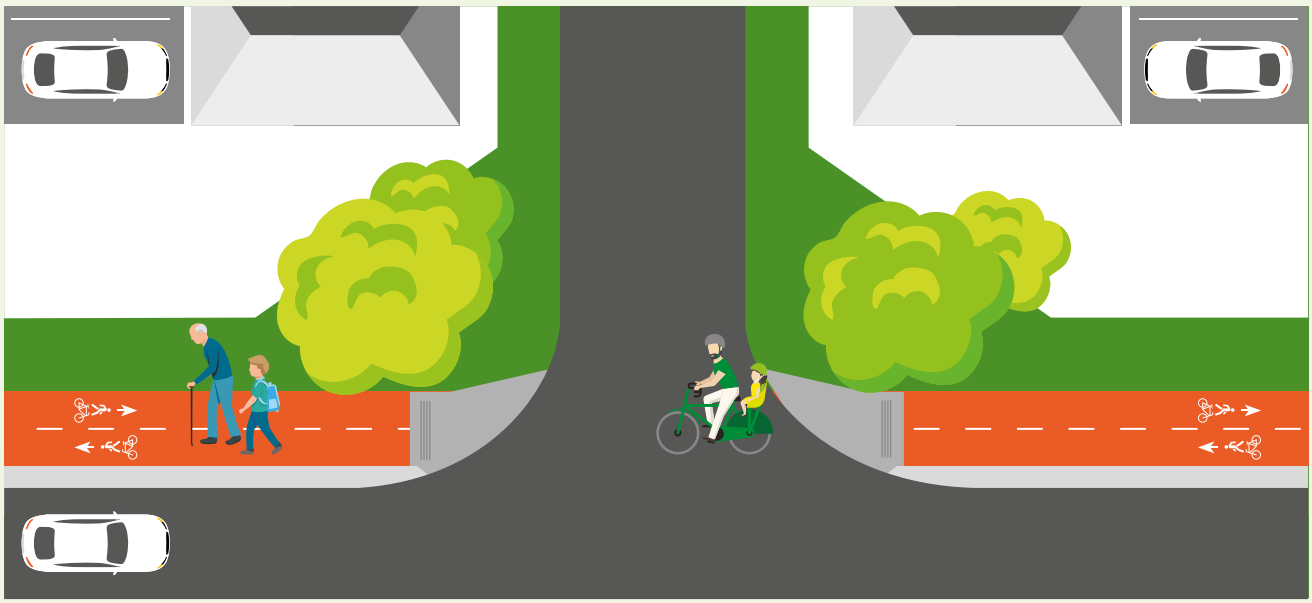


Figure 4.8 *Intersection type 4 (non-indented, non-priority) – suitable for local access roads.*

For more information pertaining to intersections with minor roads, practitioners should refer to *Cycling Aspects of Austroads Guides* (Section 7.6).

4.4 Intersections with major roads

Where shared paths cross with busy multi-lane roads, more sophisticated crossing measures are required. Refer to Table 4.1 for crossing options for when shared and separated paths intersect with major roads.

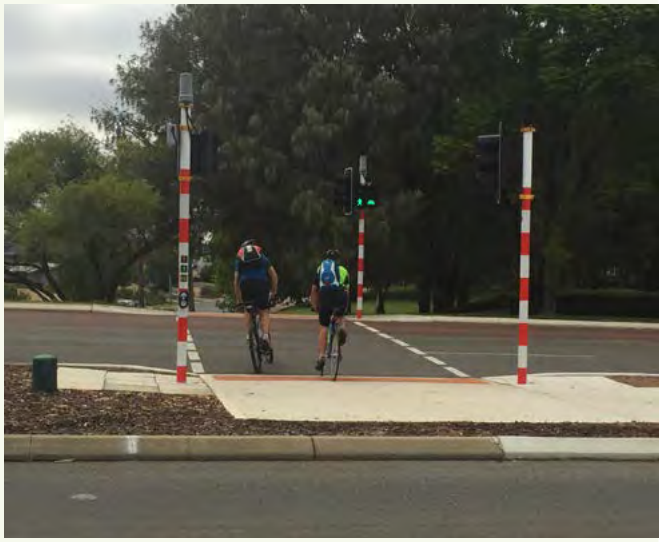
Control and Key Considerations	Example
Wide median refuge	
→ In locations that have high traffic volumes, wide median refuges are recommended to enable a staged crossing by path users. → To accommodate a bicycle, it is desirable that a refuge be at least 3.0m long (2.0m at an absolute minimum). → The median should maintain the same width as the path (at a minimum). → Where demand is concentrated at certain periods of the day (e.g. near schools), a wider and/or longer storage area may be necessary. → Additional space for refuges can be created through localised lane narrowing.	 *Wide refuge*
Signalised crossings	
→ Where shared or separated paths intersect with higher volume roads, it may be preferable to install signals. → In WA, the planning, design and coordination of all traffic signals is the responsibility of MRWA. → At signalised intersections along shared paths, the bicycle movement typically operates parallel to the pedestrian movement. → Under recent changes to the RTC (December 2020) bicycle riders no longer need to dismount at a signalised crossing, so long as they enter from a connecting path at a speed of 10km/hr or under, keep to the left and give way to pedestrians on the crossing.	 *Signalised intersection*

Table 4.1 *Options for when shared and separated paths intersect with major roads.**(Continued next page.)*

Situation and Key Considerations	Example
Underpasses	
→ Applicable in situations which have high posted speeds, high volumes of motorised traffic, multiple lanes, a railway, or to provide path continuity. Underpasses are provided to increase the overall safety of bike riders and pedestrians. → It is important to provide adequate sight-distances at the entry and exit points. → Allow visibility along the length of the underpass. → Other considerations for underpass design include drainage, security, lighting and vandalism.	 *Underpass*
Overpasses	
→ Overpasses may be provided to achieve a safer crossing of roads which have high speeds/volumes and/or multiple lanes. → *AS5100* & *AS1428* provide information on handrailing for bicycle and pedestrian bridges. → Additional information pertaining to railing height specifications at overpasses is provided in Section 7.	 *Overpass*

Table 4.1 *Options for when shared and separated paths intersect with major roads.*

Please note it is recommended that practitioners consult with;

→ DoT and MRWA when considering signals, underpasses or overpasses for shared and separated paths; and

→ PTA when working in and around the PTA Rail Reserve.

For more information on when grade separation is required, practitioners should refer to *Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings* (Section 8.2)

4.5 Intersections with roundabouts

While roundabouts are becoming increasingly popular with road designers due to the increased capacity for traffic movements, they can be hazardous for bike riders and pedestrians. On bicycle routes, the approaches should be designed to cater for the lowest practicable approach speed with single lane entries and exits.

Where shared and separated paths intersect at roundabouts, it is recommended that adequately sized refuges (refer to Section 4.6) are provided with unobstructed sightlines to enable path users to safely stage their crossings, as shown in Figure 4.9 and Figure 4.10.

During design, practitioners should consider the sight distance requirements of bike riders and turning motorists (refer to Section 3.12).

Figure 4.9 *Major roundabout example – sufficiently sized refuges allow path users to safely stagger their crossings on the approaches to roundabouts.*

Figure 4.10 *Minor roundabout example – sufficiently sized refuges allow path users to safely stagger their crossings on the approaches to roundabouts.*

For more information on how to cater for cyclists at roundabouts, practitioners should refer to *Cycling Aspects of Austroads Guides* (Section 5.5).

4.6 Cut throughs and kerb ramps

Where road crossing treatments are required for cyclist and pedestrian access, the preferred option is a 'cut-through' treatment (where the crossing is maintained at road level) rather than a raised island treatment.

MRWA's Supplement to Austroads Part 4A recommends a minimum island length of 3.0m for refuges (with an absolute minimum of 2.0m). The refuge "gap" should be at least as wide as the adjoining paths, with an absolute minimum of 2.5m. Where high volumes of people riding or walking are expected to cross simultaneously, it is recommended that additional storage space is provided.

If a cut-through cannot be graded such that it is self-cleaning, an appropriate maintenance regime must be established (refer to Section 11).

When designing kerb ramps, landings must be installed at the top and base of ramps no less than the width of the path, they should always be flush with the road surface and not create a lip that causes a trip hazard for people walking or a potential loss of control for bicycle riders.

There are two different installation methods available, outlined in MRWA's Standard Drawing 9831-5649 Type A & B. To ensure DDA compliance, tile paving should be installed in accordance with *AS1428.4* and MRWA's Standard Drawings 200931-0089, 200931-0090 and 200931-0091.

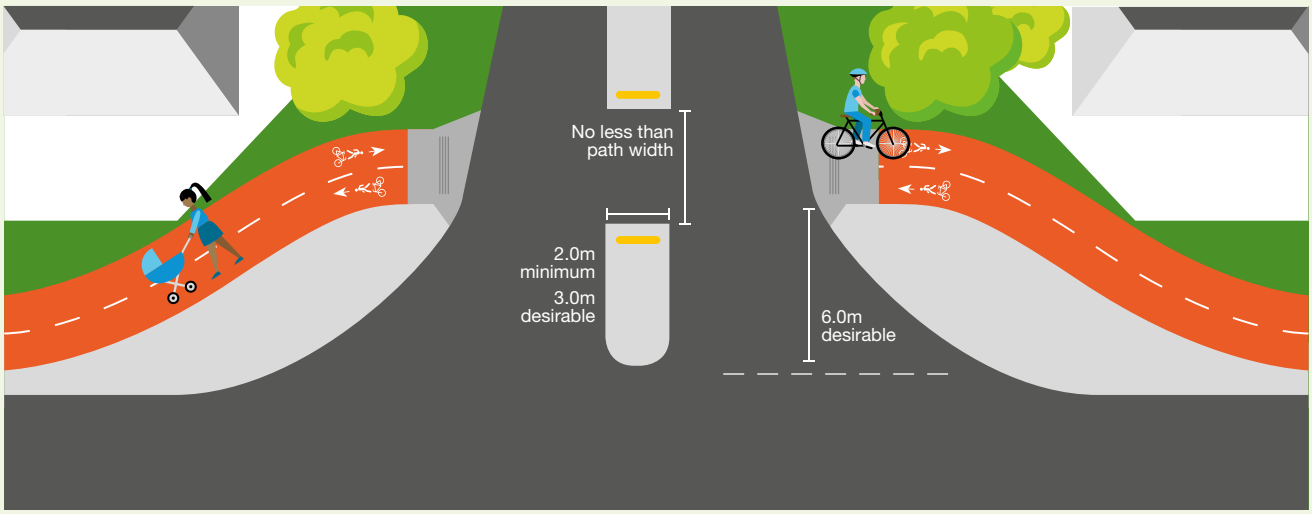


Figure 4.11 *Preferred cut-through geometry.*

For more information pertaining to cut throughs in medians, practitioners should refer to MRWA's *Supplement to Austroads Guide to Road Design: Part 4A Unsignalised and signalised intersection* (Section 6); and

***Austroads Guide to Road Design: 4A Unsignalised and signalised intersection* (Section 6).**

For more information pertaining to kerb ramps (level changes), practitioners should refer to MRWA's *Supplement to Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 5.8).; and

***Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 5.8).**

4.7 Holding rails

There are a variety of functions that can be performed by the U-shaped rails, sometimes known as U-rails, shown in Figure 4.12 Within these guidelines these rails are classified as holding rails and they should be installed to highlight an intersection and to assist with the stability of the rider while they wait for a gap in the traffic stream to cross the carriageway.

Holding rails should be considered for use at:

- staged crossing with an appropriate safe setback distance from the road, without creating a hazard to through movement along the path;
- isolated mid-block, uncontrolled crossings with medians and verges with sufficient width so that a rail does not intrude into the existing perpendicular path; and
- crossing points where there are high volumes of people riding or the road has high traffic volumes/speeds.

When using these rails as holding rails, they should be positioned to ensure riders can easily see the approaching traffic. This improves the safety and time spent at the intersection while stabilising the rider as they move off to cross or enter the intersecting carriageway.

Holding rails must be placed on the left side of the path within easy reach of rider to ensure they can stop when appropriate and without having to dismount or lose their balance, especially when using clipless pedal systems (i.e. cleats).

In general, these rails should **never** be:

- used at signalised intersections;
- installed in the middle of a path (as they may cause a hazard for people using the path); or
- installed where riders are required to dismount.
- For further guidance on bollards and U-rails refer to Section 10 managing conflict and transition zones.

Figure 4.12 *Holding Rails – must be placed on the left side of the path within easy reach of rider.*

For more information on holding rails practitioners should refer to *Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 7.4).

5. PAVEMENT DESIGN

5.1 Surface materials

A smooth, skid resistant surface is required to enable bicycles to be used effectively, comfortably and safely. In WA, shared and separated paths are typically constructed from asphalt (either red or black) or concrete.

While all three materials have advantages and disadvantages, which are summarised in Table 5.1, **red asphalt is the preferred surface treatment for all shared and bicycle-only paths in WA**. In addition to providing a smooth attractive surface, the use of red asphalt helps visually differentiate shared and separated paths from the road network. The colouration also acts as a form of passive wayfinding, directing pedestrians and bike riders to safe routes.

Please note coloured surfacing and/or coarser materials can be used as alternative pavement materials for different environment conditions. For further guidance, refer to Section 10.

Figure 5.1 *Red asphalt is the preferred surface treatment for all "cycling-focussed" paths in Western Australia.*

Concrete paths should only be used where asphalt is unavailable or where specific environmental or site conditions do not support its use. Examples of this may include wet or saline areas (as asphalt is typically more susceptible to water damage). Concrete may also be preferred in locations where asphalt is difficult to obtain, particularly in smaller regional towns.

Figure 5.2 *Example of a concrete shared path.*

Where concrete is chosen, it is important that contractors adhere to the specifications outlined in MRWA's Supplement to *Austroads Guide to Road Design: Part 6A* (Appendix C Path Construction and Maintenance).

Advantages	Disadvantages	DoT guidance
Red asphalt		
→ Provides uniformity with the vast majority of existing high-quality shared and separated paths throughout WA. → Can be installed on a variety of ground conditions including soils with high clay proportions which may move due to weather and seasonal conditions. → Although the surface may deteriorate over time, damage tends to be localised and relatively inexpensive to repair. → Provides passive wayfinding. → Does not require expansion joints, allowing for a smoother ride.	→ Can be more expensive than concrete or black asphalt. → May be difficult to source in regional areas. → Constrained locations may restrict paving machinery access. → If designed incorrectly, can be prone to "bleeding" in very hot climates. → Can result in localised tree root penetration.	→ Strongly preferred for all shared and bicycle-only paths. → Must be used for primary routes except where environmental conditions do not allow.
Black asphalt		
→ May be easier to source than red asphalt. → Can be installed on a variety of ground conditions including soils with high clay proportions which may move due to weather and seasonal conditions. → Although the surface may deteriorate over time, damage tends to be localised and relatively inexpensive to repair. → Does not require expansion joints, allowing for a smoother ride.	→ Can radiate a lot of heat (particularly in hot summer sun). → As it can "look like a road", it does not offer the same passive wayfinding of red asphalt. → Constrained locations may restrict paving machinery access. → If designed incorrectly, can be prone to "bleeding" in very hot climates. → Can result in localised tree root penetration.	→ Only to be used when red asphalt is unavailable.
Concrete		
→ May be the cheapest material to source. → Can typically be constructed by local government officers (without engaging specialist asphalting contractor). → Often the most suitable pavement material for paths located in wet or saline areas. → Can radiate less heat in hot climates. → Can be coloured to create visual cues.	→ Prone to uplifting by tree roots. This is more noticeable in concrete as the entire slab will be affected. → Prone to experiencing a greater extent of failure, often requiring a longer section of the path to be replaced. → Lighter colour can result in increased glare. → Concrete joints can lead to poor ride quality.	→ Only to be used when red asphalt is unavailable or shown to be unsuitable for environmental or engineering reasons. → If concrete is required, it should be coloured red by mixing a colouring agent into the concrete (non-negotiable for primary routes). Painting after construction is substandard.

Table 5.1 *Advantages and disadvantages of different types of pavement materials.*

5.2 Pavement construction

Shared paths do not experience the same level of vehicular loading as roads. In areas where vehicles frequently cross or gain access to a path, the pavement should be strengthened to support their usage.

All shared paths should be constructed in accordance with MRWA's Supplement to *Austroads Guide to Road Design: Part 6A* (Appendix C Path Construction and Maintenance).

Asphalt paths: Asphalt paths should be constructed according to the following specifications (shown in Figure 5.3):

- Sub-base 150mm minimum;
- Prime coat; and
- 5/7mm dense graded laterite asphalt 25mm minimum thickness.

If the shared path will also be used for access by others (such as emergency services), with special vehicle requirements, the pavement design may need further assessment.

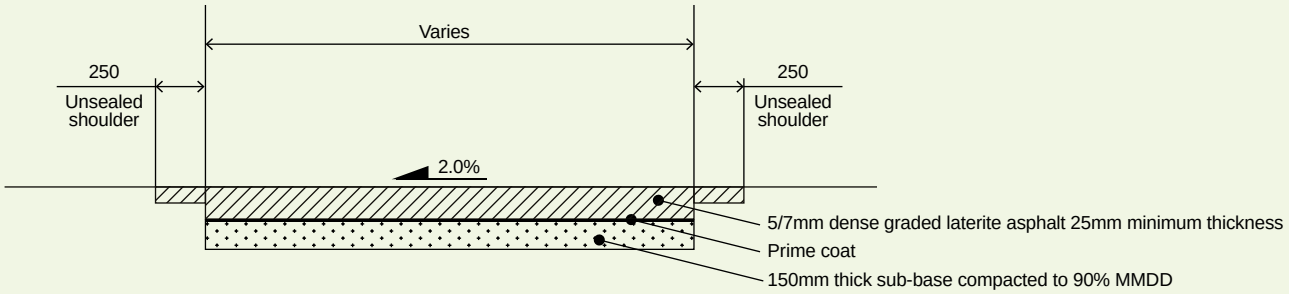
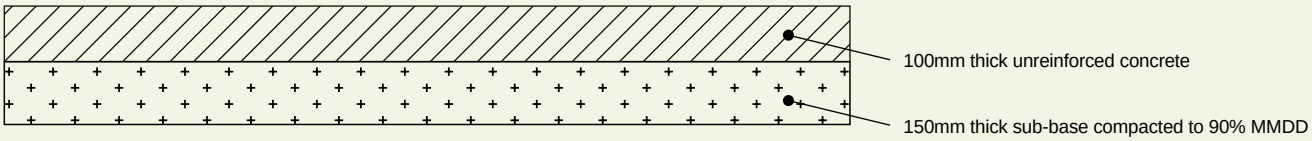


Figure 5.3 *Typical pavement cross-section for asphalt paths.*

Concrete paths: Concrete paths should be constructed at a minimum with the following specifications (shown in Figure 5.4):

- Sub-base 150mm minimum thick crushed limestone; and
- 100mm thick N25 unreinforced concrete.

Concrete should be coloured red by mixing a colouring agent into the concrete as painting after construction is substandard.



Concrete Footpath Typical Cross Section (N.T.S.)

Specification:

1. Surface to be wood floated with broom finish to Type U4.
2. Smooth picture frame to be applied to path edges only and not contraction/expansion joints.
3. Contraction joints to be installed at 3m centres and of keyed type.
4. Expansion joints to be installed at 12m centres and at all changes in direction.
5. Expansion and isolation joints shall be filled with grey polyurethane (mastic) sealant.
6. Footpath must be the same width as the existing footpath but not less that 2.0m wide.

Figure 5.4 *Typical pavement cross-section for concrete paths.*

Isolation joints should be installed at the junction between the concrete slab and pits and access chambers and where the slab abuts fixed structures such as walls and kerbs. The joint shall be 10mm wide closed cell expanded polyethylene.

If a path will be crossed by commercial vehicles the slab thickness will be increased to 150mm and SL 82 reinforcement installed centrally and should not be continuous across contraction joints. Contraction joints in commercial crossovers can be extended to 4.0m centres.

Expansion and Isolation joints shall be filled with grey polyurethane sealant. This is a Lock Joint product that seals adjacent path slabs to minimise unevenness between the slabs.

For further guidance regarding the pavement specifications, practitioners should refer to MRWA's Supplement to *Austroads Guide to Road Design: Part 6A* (Appendix C Path Construction and Maintenance).

Kerbing

The main applications of kerbing along shared and separated paths include:

- providing separation between path users and motorised traffic;
- reducing maintenance of shoulders (i.e. preventing edge-break);
- assisting with drainage; and
- improving the aesthetic values of the path (normally by creating a boundary between the path and adjoining landscaping).

Please note clearances to kerbs should be a minimum of 0.3m from the edge line to prevent pedal strikes.

Barrier kerb used to separate path users from traffic.

Mountable kerb used in driveway location.

Flush edge kerb used to provide a boundary between path and landscaping.

***Figure 5.5** Situations in which kerbing may be appropriate for shared and separated paths.*

For more information regarding the design, manufacturing and placement of kerbs, practitioners should refer to MRWA's *Roadside Items, Design of Kerbing* available on the MRWA website.

6. DRAINAGE

Shared and separated paths should be constructed with adequate crossfall (refer to Section 3.7) to prevent the ponding of surface water during or following rain events. The provision of adequate drainage not only enhances safety for path users but can also improve pavement longevity.

Water Sensitive Urban Design (WSUD) is an important aspect of water management that can contribute to sustainability and liveability. It is important that WSUD is considered as part of any infrastructure design or construction project as it can lead to good environmental management. Incorporating natural water drainage into the landscape will provide benefits to the aesthetics and add ecological value to the path construction.

When terrain is flat, it may simply be adequate to elevate the path above the natural surface level of the adjacent land to ensure that water can freely shed off the path by the crossfall. The typical cross section for drainage and crossfall requirements in flat terrain is shown in Figure 6.1.

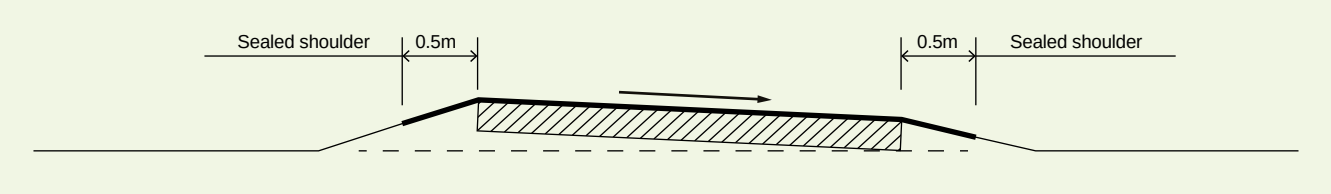


Figure 6.1 *Drainage and crossfall requirements for elevated path in flat terrain (image courtesy of Austroads Guide to Road Design: Part 6A (Figure 5.14)).*

Where a path is located at the base of a slope or constructed within sloping terrain, remedial works should be undertaken to prevent water and debris flowing across the path. The path drainage must be sufficient as to prevent erosion, scouring or ponding which could potentially result in damage to the path.

The preferred solution for situations where a path is to be built in a location where existing terrain exceeds recommended crossfall is shown in Figure 6.2. In this situation, an open drain is provided on the high side of the path to cut off water and carry it to a discharge point, possibly via pits and lateral pipes. In this case, any water that falls onto the path itself is shed to the low side.

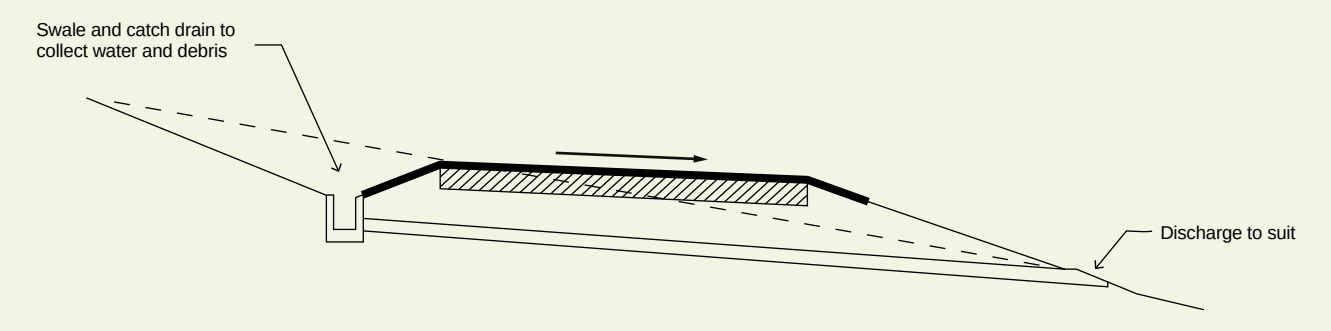


Figure 6.2 *Drainage and crossfall requirements for path where existing terrain exceeds path crossfall – preferred (image courtesy of Austroads Guide to Road Design: Part 6A (Figure 5.14)).*

For further guidance regarding crossfall and drainage requirements, practitioners should refer to *Austroads Guide to Road Design: Part 6A* (Section 5.6).

Paths that follow watercourses need to satisfy the requirements of the responsible drainage authority.

Soak wells and underground infiltration systems or storage tanks shall be designed in accordance with the *Stormwater Management Manual for Western Australia: Department of Water and Environmental Regulation, 2007*.

Additional drainage considerations for shared and separated paths include:

- Wherever practicable, locate drainage pit lids outside of the path. If this is not possible, cast iron covers should be filled with a concrete in-fill to create a flush surface finish.
- Ensure pit covers are “bike rider friendly” (i.e. with grid-patterned grates).
- Ensure pit covers do not create hazardous grooves or upstands.
- Ensure that side entry pits do not protrude into abutting paths.

Figure 6.3 *Examples of good and bad drainage applications.*

For more information on swales and catch drains, practitioners should refer to *Austroads Guide to Road Design Part 5B: Drainage, Open Channels, Culverts and Floodways* (Austroads 2013b).

7. FENCING AND SAFETY BARRIERS

7.1 Fencing and handrails

Fences may be necessary where:

- there is a steep batter/vertical drop located near the path;
- access to a busy road needs to be restricted;
- a path crosses a bridge or culvert; or
- a path is located adjacent to a hazard.

Fences separating paths from hazards should be a minimum of 1.2m tall and should be used only where the severity of the hazard is considered low. A higher fence, greater than or equal to 1.4m, should be adopted where path users need to be protected from more severe hazards, such as a high vertical drop or in locations where there is a risk of a bike rider being vaulted off their bicycle if they collide with the fence, such as on a sharp curve following a steep downhill grade.

For more information on fencing requirements practitioners should refer to *Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 5.5); and

***Cycling Aspects of Austroads Guides* (Section 7.5)**

It should be noted that in situations where a shared or separated path's batter slope is steeper than 1:3 and greater than 1.5m in height, a fence is always required.

A key issue to avoid is bicycle handlebars 'snagging' on vertical supporting elements of fences and handrails. A 'bike safe' handrail, which curves inwards to protect people on bikes, is recommended. Where handrails are provided in accordance with *AS1428* the sealed width of shared paths must be widened by 0.5m on both sides to maintain the trafficable width for bike riders. An edge line must be provided 0.5m offset from the handrails to delineate the trafficable width.

For more information regarding fencing and handrails, practitioners should refer to *Austroads Guide to Road Design: Part 6A Paths for Walking and Cycling* (Section 5.5).

7.2 Safety barriers

Safety barriers should be provided where there is an increased possibility of errant vehicles coming into contact with path users.

Safety barriers may be appropriate in locations where:

- a path is located within an intermediate or high-speed road (i.e. 70 km/h or greater);
- a heavily trafficked path is located less than 4.0m from an adjacent heavily trafficked road; or
- there are expected to be large numbers of bystanders congregated adjacent to the road beyond the usable path width (e.g. near schools, sporting facilities or entertainment precincts).

A 1.0m minimum clearance is required from the shared path edge line to the posts of safety barrier system. Where possible, a smooth-running rail should be provided at the back of the supports to minimise the risks of riders becoming snagged on the posts.

For more information regarding the design and installation of road safety barriers, practitioners should refer to MRWA's *Supplement to Austroads Guide to Road Design: Part 6A* (Section 5.5) and

***Austroads Guide to Road Design: Part 6 Roadside Design, Safety and Barriers* (Section 5.1.3)**

Figure 7.1 *Fence and handrail examples.*

Figure 7.2 *Safety barrier separating shared path from high-speed road.*

8. LIGHTING

Lighting of paths is important to enable bike riders and people walking to perceive hazards, such as uneven surfaces or obstacles, as well as to assist with orientation and wayfinding and improving the sense of personal safety for users.

Where path lighting along the entire path is not justified, consideration should be given to the adequate lighting of at-grade crossing points, curves, path to path intersections and perceived hazards. All lighting systems should be provided in accordance with *AS1158*.

It is important to acknowledge that many lights mounted on bicycles are only powerful enough to make other path users aware of their existence (rather than illuminating the path itself). An example of a path with good lighting is shown in Figure 8.1.

It is recommended that adequate lighting is provided along primary and secondary cycling routes, as many riders have no alternative but to ride during the hours of darkness.

Street lighting on roads parallel to paths may sometimes be sufficient to illuminate a path, however, limits to light spill and blockage by trees needs to be considered in these situations.

Lighting for paths should be designed on the basis that if one source fails, a second source will continue to provide reasonable lighting.

Path lighting columns and bollards should not be placed within a path wherever possible. Ideally these should be setback from the edge of the path and clear of the riding surface. For more guidance relating to clearances from batters and fixed objects, refer to Section 3.3

Lighting for shared paths must not spill and glare into residences in accordance with the requirements of AS 4282 Control of the obtrusive effects of outdoor lighting.

Bollard lighting is recommended in situations where pole lighting will be obstructed by trees or to prevent light pollution into adjacent residences (refer to Figure 8.2). Bollard lighting should be directional to prevent glare and positioned below the rider's eye height.

Figure 8.1 *Adequate lighting is recommended along all Primary and Secondary cycling routes.*

Mains Powered.

Solar Powered.

Figure 8.2 *Example of shared path bollard lighting systems.*

All underpasses and their approaches must be lit. Where there is a greater concern for personal safety/security, a higher level of lighting may be required. Day time lighting of underpasses should be considered as many bicycle riders wear sunglasses.

To cater for future lighting requirements, conduits and other preparatory works should be installed during path construction to minimise the cost and disruption to path users in the future.

For more information regarding the lighting design guideline, practitioners should refer to MRWA's *Roadside Items, Lighting Design Guideline for Roadway and Public Spaces*, available on the MRWA website.

Please note all lighting installation must be installed in accordance with these guidelines.

For more information regarding lighting of shared and separated paths, practitioners should refer to *Australian/New Zealand Standard: Lighting for roads and public spaces, (Part 3.1): Pedestrian area (Category P) lighting — Performance and design requirements (AS1158.3.1:2020)*

9. SIGNS AND PAVEMENT MARKINGS

The provision of signs and pavement markings for shared and separated paths in WA shall be in accordance with MRWA's *Policy and Application Guidelines: Signage and Pavement Marking on Paths*, relevant Australian Standards and wherever practical, Austroads Guidelines.

It is important to note that MRWA has developed a number of signs, complementary to the Australian Standard, to provide for additional signage requirements not included in the Standard.

These signs are listed in the MRWA Index of Signs, available on the MRWA website. Non-standard signs shall not be used without prior approval from MRWA.

Figure 9.1 *Directional signage installed outside of the path envelope.*

9.1 Application process

Approval for all signs and pavement markings on all paths in WA is required from the Commissioner of MRWA, or duly delegated officers or organisations. The Commissioner has subsequently delegated this task to the Manager Traffic Management Services in accordance with the provisions of Regulation 297(2) of the *Road Traffic Code 2000*.

Applications for approval to erect, establish, display, alter or remove signs and pavement markings shall be submitted in writing to the relevant Traffic Services Branch for paths in the Metropolitan region or the relevant MRWA Regional Office. The application should include the relevant contact information and a plan detailing the existing signs and pavement markings and the proposed changes.

9.2 Installation and maintenance

Signs and pavement markings shall be installed in accordance with MRWA's Specifications 601 and 604, MRWA's standard drawings, and relevant Australian Standards.

It is worth noting that the use of pavement marking is the preferred type of control device. Pavement markings minimise the negative impacts and clutter to the streetscape, as well as remove potential hazards. Signs should only be used where a particular safety issue has been identified that provides justification that the use of a sign will be more effective than a pavement marking.

Table 9.1 provides a list of all minimum signing and pavement marking requirements relevant to shared and separated paths. Refer to Section 1.2 for definitions of the *Western Australian Cycling Network Hierarchy* for path type.

Path Type	Regulatory sign/ Pavement marking for path designation	Pavement marking – regulatory control (give way or stop)	Pavement markings – separation lines	Pavement markings - edge lines
Path located on a Local Route	Only required for separated paths/bicycle paths	Recommended	Optional	Optional
Path located on a Secondary Route		Recommended	Recommended	Recommended
Path located on a Primary Route, including Principal Shared Paths (PSPs)		Required	Required	Required
All other paths		N/A	N/A	N/A

Table 9.1 *Minimum Signing and Pavement Marking Requirements courtesy of MRWA's Policy and Application Guidelines: Signage and Pavement Marking on Paths.*

9.3 Designating shared and separated paths

In WA, signs and pavement markings are no longer required to formally designate a path as a shared path. As outlined in Section 2, all paths can be used by both people on bikes and people walking unless signage specifically states that bicycle riding is prohibited. Signs and pavement markings may still be used on certain paths where it is deemed necessary to "legitimise" bike riding.

For separated paths, there is a legal requirement under the RTC (Part 1 Regulation 3 separate footpath) to use pavement markings or signs to formally designate the extent of the separated path sections. When designating separated paths, pavement markings are preferred over signs. Wayfinding and signage are important components but become critical when separation between paths is significant.

The locations at which signs and/or pavement markings are *required* to designate a separated and/or bicycle-only path include:

- the beginning of the path;
- Immediately following road crossings and path connections; and
- the end of the path.

Please note the above stipulates the minimum requirements for signage and pavement markings, there may be a need for additional pavement marking and signage in other locations along the path in certain circumstances.

Figure 9.2 *R8-3 sign used to formally designate the pedestrian-only and bicycle-only components of a separated path.*

9.4 Line marking

- **Centre lines (broken separation lines)** are recommended for shared and separated paths. Refer to Table 9.1 for the minimum signing and pavement marking requirements. These lines separate two-way traffic, facilitate overtaking and encourage users to remain on the left-hand side of the path. Centre lines should be continuous through intersections and should be used to reinforce the priority route.
- **Edge lines** should be installed on sections of path where the lines have been identified as required in Table 9.1. These lines comprise of a continuous line installed to separate the lane from the shoulder. Edge lines should either taper before they intersect with another path or continue around the intersection connecting into the line marking from the intersecting path if the intersecting path is at least 2.5m wide.
- **Unbroken separation lines** should be installed on sections of path where the lines have been identified as required in Table 9.1. These lines are recommended for paths where the sight distance is less than 40m, the path terminates at an intersection of another path, or contains STOP or GIVE WAY controls. They can also be used where there is evidence of path users traveling in opposite directions regularly crossing a broken separation line.
- **Give Way lines** should be used to regulate the movement of bicycle riders and to clearly define the priority at an intersection. They may be installed without installing a corresponding Give Way pavement marking and/or sign.

For more information on the requirements for line marking, practitioners should refer to MRWA's *Policy and Application Guidelines: Signage and Pavement Marking on Paths*.

Figure 9.3 *Centre line example.*

Figure 9.4 *Centre line example on concrete.*

Figure 9.5 *Edge line example.*

Figure 9.6 *Unbroken separation line example.*

Figure 9.7 *Give Way line examples.*

For more information on the Pavement Marking / Signage Warrants for Regulatory Control, practitioners should refer to MRWA's *Policy and Application Guidelines: Signage and Pavement Marking on Paths*.

For further details surrounding the thickness/spacing of separation, edge, STOP and GIVE WAY lines, practitioners should refer to Main Roads WA standard drawing 9931-0198-9.

9.5 Contrasting colours

It is important to ensure that the correct lining colour is used to contrast with the pavement material. While white line marking is preferred for asphalt paths and green line marking is preferred for concrete paths, this will be dependent on the finished pavement material colour. It is also important to note that the colour of the lining will need to be adapted as the pavement material colour alters and becomes darker or lighter due to environmental conditions throughout its life cycle.

A visual inspection of the pavement material colour should be performed before determining the appropriate line marking colour required to provide enough contrast. The general rule is that on light coloured surfaces where the contrast of white line markings is reduced then green line markings should be used.

Examples of lining marking colour contrasts are shown in Figure 9.8.

Figure 9.8 *Line marking example.*

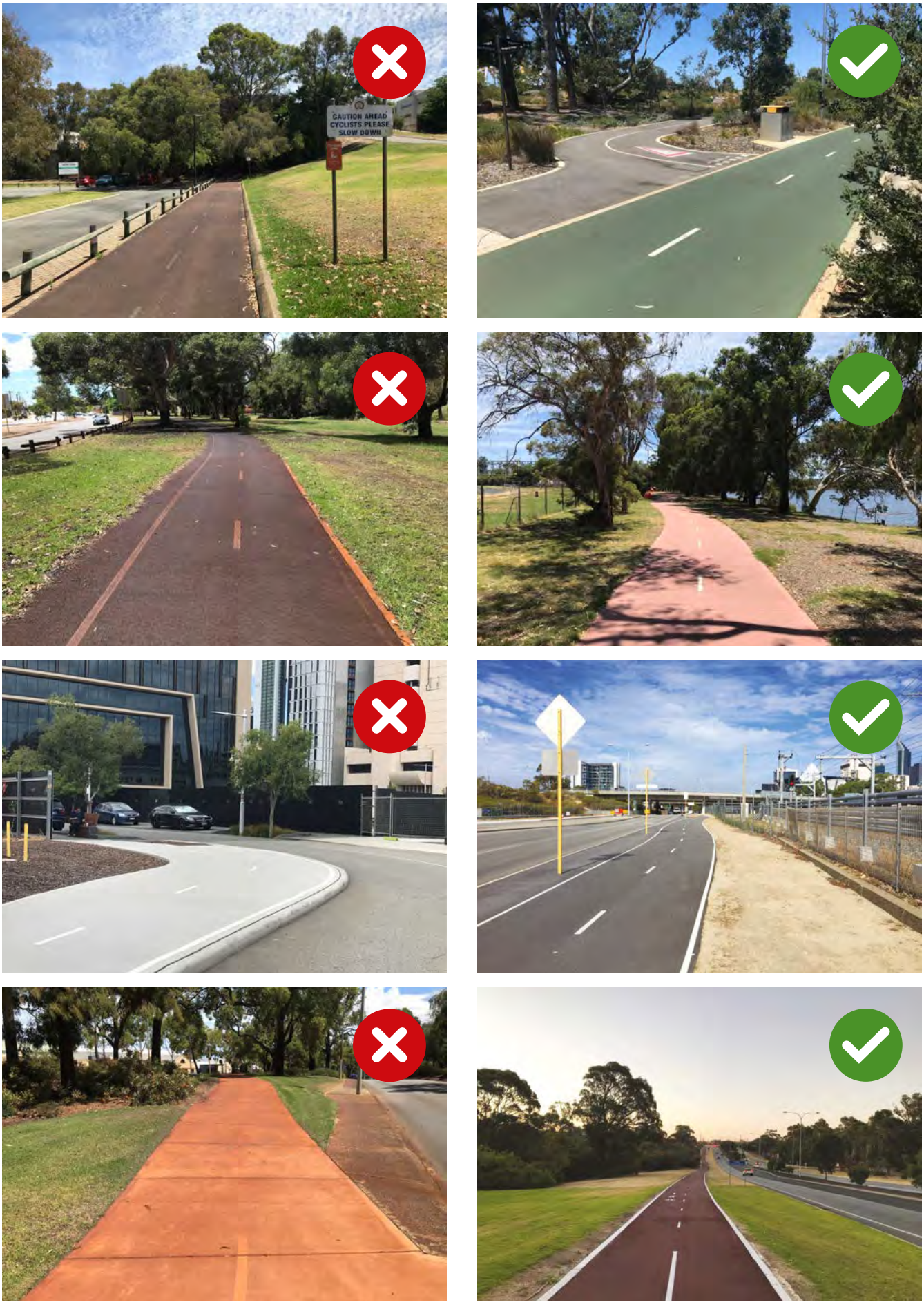


Figure 9.9 *Line marking examples.*

9.6 Yellow diagonal markings

In locations where maintenance and service vehicles frequently cross shared or separated paths, yellow diagonal markings can be installed to highlight the conflict between motorists and path users. These markings are used to highlight to drivers crossing the path that they should not block the flow of the path, thus reducing conflict and preventing vehicles from blocking the path.

The yellow diagonal pavement marking should be adapted and installed as 300mm diagonal lines running in the one direction only at a 45-degree angle with a 600mm spacing between the lines.

Figure 9.10 *Yellow diagonal markings used to designate area where vehicles cross path.*

9.7 Pavement markings

All pavement markings need to be in a contrasting colour to the surface material to ensure that they are visible and effective for all likely conditions. Pavement markings should be inspected at regular intervals and maintained to the standards required for reflectiveness and skid resistance.

All regulatory pavement markings (including line work and pavement stencils) should be installed in accordance with:

***Australian Standards: Manual of uniform traffic control devices, Part 3: Traffic control for works on roads – AS1742.3*;**

***MRWA's Specification 604: Pavement Markings*; and**

MRWA's *Policy and Application Guidelines: Signage and Pavement Marking on Paths – Appendix A*.

Table 9.2 below provides a list of all approved pavement markings relevant to shared and separated paths. While many of the below drawings reference PSPs delivered by State Government, the drawings remain relevant to application across shared paths in WA.

MRWA Drawing Numbers	Description
200331-0164	Signs & Line Marking for Pedestrian Zebra Crossing
200531-0008	Shared Path – Typical Bollard & Pavement Marking Detail
200531-0009	Shared Path – Typical Intersection Pavement Marking Details
200731-0038	Principal Shared Path – Directional Pavement Markings
200731-0072	Pavement Marking Messages for PSPs
200831-0001	Give Way Pavement Marking for PSPs
200831-0005	T-Junction Pavement Marking for PSPs
201031-0180	Keep Clear Pavement Marking – For use with PSPs
201131-0018	Local Bicycle Routes – Typical Route Pavement Marking
201131-0055	Local Bicycle Routes – Typical Pavement Marking Configurations
201131-0070	BUMP Pavement Marking for PSPs
201131-0071	Pavement Marking for Landings on Shared Paths & PSP's
201131-0075	Keep Left Pavement Marking
201131-0087	Typical Pavement Markings & Signs Layout for PSPs
201831-0017	Diagonal Pavement Markings
201231-0009	Stop Pavement Marking for PSPs
201231-0010	Side Junction Pavement Marking for PSPs
201231-0015	Stop Ahead Pavement Marking for PSPs
201231-0016	Give Way Ahead Pavement Marking for PSPs
201231-0023	Interface with Pedestrian Zebra Crossing for PSP's
201231-0024	Treatment for Areas with High Pedestrian Usage for PSPs
201331-0058	Pavement Marking for PSPs – Bicycle Path Only, End Bicycle Path Only
201331-0059	Pavement Marking for PSPs – Pedestrian Path Only and End Pedestrian Path Only
201331-0060	Pavement Marking for PSPs – No Bicycles
201331-0070	Shared Path – Typical Signing Pavement Marking Details for Mid-Block
201431-0010	Pavement Marking for PSPs – Curved T-Junction – Left and Right
201431-0040	Shared Zone Pavement Marking
201531-0086	Pedestrian/Bike Rider at Junction – Warning Sign Pavement Marking

Table 9.2 *List of Main Roads WA pavement marking drawings.*

9.8 Directional signage

Directional signs are provided as a navigational aid to bike riders, often referred to as wayfinding.

Directional signs should maintain a degree of standardisation which allow people encountering the signs for the first time to immediately recognise them. Moreover, their design should ensure that they cannot be misread by motor vehicle drivers in situations where this could create a hazard.

For more information regarding directional signage, practitioners should refer to *MRWA's Technical Guideline – Bicycle Directional Signs Part C*, available on the MRWA website.

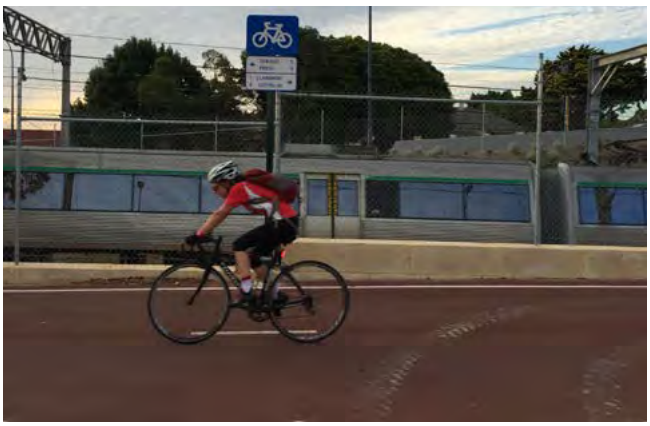


Figure 9.11 *Example of a MR-GC-16 bicycle route marker with a MR-GC-18C supplementary plate.*

Figure 9.12 *Example of a MR-GC-16 bicycle route marker with a MR-GC-18C supplementary plate.*

Bicycle directional signs need to convey clear and concise information to assist riders to find their way around the network and guide riders to their destinations while making full use of cycle infrastructure. Directional signage can display destinations, directions and distances.

Destinations include the following:

- Major regional centres and nearby suburbs;
- Shopping complexes;
- Recreational centres and swimming pools;
- Train stations;
- Parks and recreational areas;
- Tourist destinations;
- University and TAFE campuses; and
- Other bicycle paths within the greater network.

Directions to destinations are essential to ensure that walkers and riders are directed via routes that minimise the length of travel and travel time to the destination.

Distances to destinations provide useful information to people riding and walking and should be shown on the supplementary plates where possible. Distances to destinations less than 0.5 km are to be shown to the nearest 0.1 km. Distances between 0.5 km and 10 km are to be shown to the nearest 0.5 km. Distances over 10 km are to be shown to the nearest kilometre.

Figure 9.13 *Example of wayfinding time to destination.*

Figure 9.14 *Example of wayfinding directional.*

Table 9.3 below provides a list of all drawings relevant to bicycle network directional signage.

MRWA Drawing Numbers	Description
9548-0106	Location Details for One Post Signs
200731-0024	Bicycle Route Marker – MR-GC-16
200731-0025	Bicycle Route Marker Supplementary Plate – MR-GC-17A: One Direction, one line of text
200731-0026	Bicycle Route Marker Supplementary Plate – MR-GC-17B: One Direction, two lines of text
200731-0027	Bicycle Route Marker Supplementary Plate – MR-GC-18A: Two Directions, two lines of text
200731-0028	Bicycle Route Marker Supplementary Plate – MR-GC-18B: Two Directions, three lines of text
200731-0029	Bicycle Route Marker Supplementary Plate – MR-GC-18C: Two Directions, four lines of text
200731-0030	Bicycle Route Marker Supplementary Plate – MR-GC-18D: Two Directions, five lines of text
200731-0031	Bicycle Route Marker Supplementary Plate – MR-GC-18E: Two Directions, six lines of text
200731-0061	Local Bicycle Route Number Marker – MR-GC-19
200731-0062	Bicycle Route Marker for Use on Local Bicycle Routes Only – MR-GC-20
200731-0032	Street Name Tag for Bicycle Directional Signs – MR-GS-11
200731-0038	Principal Shared Path Directional Pavement Markings

Table 9.3 *List of MRWA directional signage drawings.*

10. MANAGING CONFLICT AND TRANSITION ZONES

10.1 Managing areas with high pedestrian activity

As outlined in Section 2.5, separated paths tend to be more appropriate in areas with high volumes of people riding and people walking.

Conflict between users often occurs in situations where high numbers of people join, leave or cross a shared path. This typically occurs around train stations, shopping precincts, recreational areas and other points of interest. To help prevent this type of conflict, consideration should be given to providing grade separation, or rerouting the shared path around the area (while ensuring access is maintained). Where space or budgetary constraints prevent this from occurring, various advisory treatments can be implemented to help manage the potential conflict. Engineering judgement should be used to determine the most appropriate treatment/s.

10.2 Managing transitions between separated paths and shared paths

The transition between separated paths and shared paths should be considered carefully as this will be determined by the volume of users. There are several treatment options that could be considered and various advisory treatments that can be implemented to help manage the transition from a separated path into a shared path.

Engineering judgement should be used in all cases to determine the most appropriate treatment. Refer to Sections 10.6 to 10.8 for examples of treatments that may be appropriate for use.

10.3 Managing interfaces with bus stops

Shared or separated paths are often located along roads that are used by bus routes. In order to minimise potential conflict with boarding or alighting bus passengers it is recommended that paths deviate behind bus shelters and hardstand areas (shown in Figure 10.1). The deviation should provide adequate space for the shelter and passengers waiting outside of the shelter.

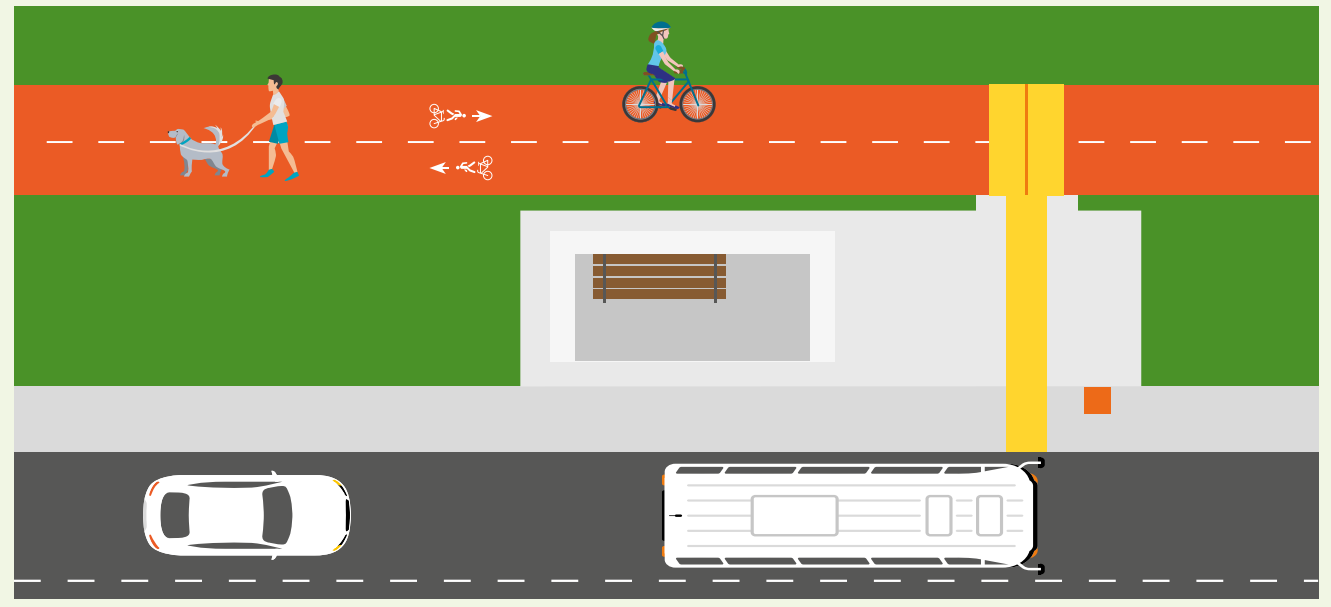


Figure 10.1 *In order to minimise conflict with passengers, it is preferable that shared and separated paths deviate behind bus shelters.*

Where this is not achievable due to space constraints, advisory measures (such as signage or pavement markings) are recommended to encourage appropriate behaviour by people riding and walking on the path and anyone waiting at the bus stop (shown in Figure 10.2). Consideration should be given to the location of bus stop signage, to ensure it is not placed in a position that obstructs or restricts users of shared and separated paths.

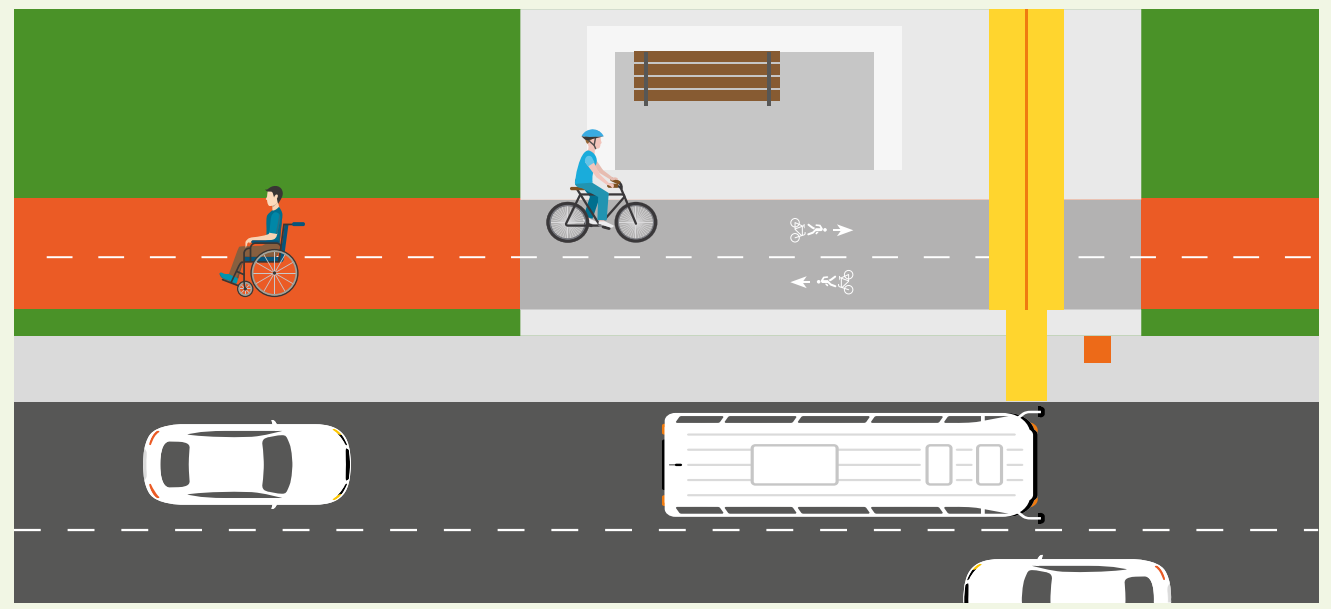


Figure 10.2 *Shared path in front of bus shelter – acceptable in situations where both boarding/alighting and path volumes are low (or where no other option is available).*

For more information regarding bus stop design, practitioners should refer to the *Public Transport Authority's Bus Stop Design Guidelines (2019)*.

10.4 Managing path obstructions

When objects such as power poles conflict with shared or separated paths, it is preferable to remove or relocate them to an alternative location. If this is not possible, 1.0m of clearance (0.5m absolute minimum) should be provided between the edge of the path and the obstruction. Alternatively, and noting that this the least desirable option in this situation, the object may be treated as a bollard, whereby the same pavement markings as outlined in Section 10.12 are applied.

Figure 10.3 *Path deviation around obstruction.*

Figure 10.4 *Obstruction treated as bollard.*

10.5 Managing transitions between on and off-road cycling infrastructure

Shared and separated paths normally only form one component of a town or city's cycling network. To ensure that shared and separated paths integrate with on-road cycling infrastructure, it is important that users can safely transition between the two. Preferred layouts for the four types of transition are provided in Figure 10.5, and are termed as follows:

- Transition type 1: on-road lane to off-road path (same side);
- Transition type 2: off-road path on-road lane (opposite side);
- Transition type 3: off-road path to on-road lane (same side); and
- Transition type 4: on-road lane to off-road path (opposite side).

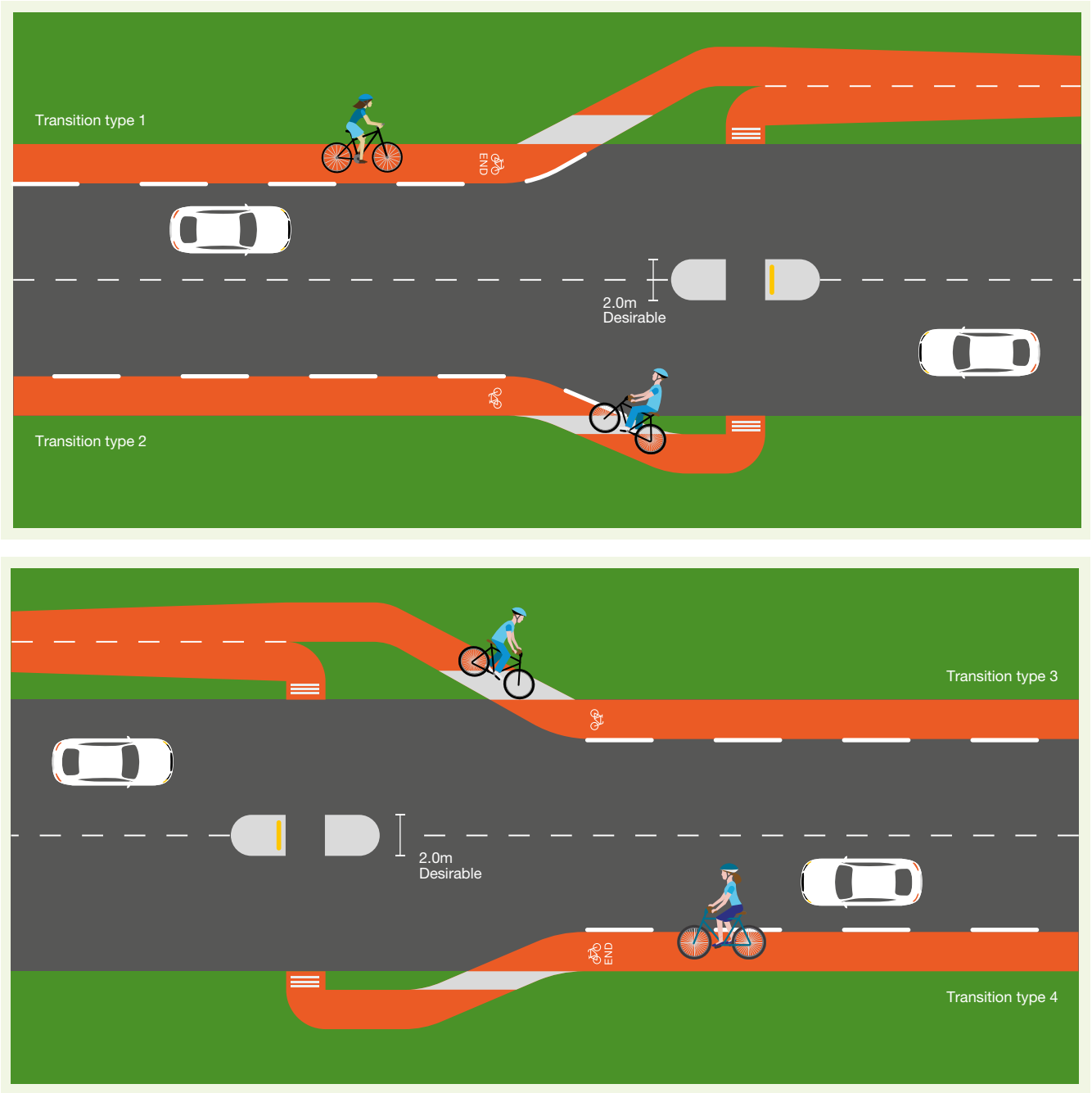


Figure 10.5 *Transitions between on-road and off-road cycling infrastructure (indicative only).*

Transition ramps should be angled at a maximum of 20 degrees so that riders can leave and enter the general traffic stream safely and conveniently. The entry ramp from the path to the road should be angled to enable riders to view the approaching traffic.

Figure 10.6 *Transition ramps from Shared paths to on-road cycle facilities.*

For more guidance regarding on transition ramps, practitioners should refer to *Austroads Guide to Road Design – Part 3*.

10.6 Pavement markings and signage

Pavement markings are considered a "passive" means of encouraging bike riders to slow down when approaching conflict zones or areas of high pedestrian activity. Unlike posted signage, pavement markings tend to be more easily recognised by people riding bikes (who tend to be looking downwards). Other disadvantages with signs include increased visual clutter and the potential to create additional obstacles (if installed on new poles). Although relatively cheap to implement, the effectiveness of advisory signs and pavement markings is limited.

Figure 10.7 *Examples of pavement markings used to promote slower cycling in areas of high pedestrian activity.*

10.7 Alternative pavement materials and colours

Alternative pavement materials and colours can also be used to highlight areas with high levels of pedestrian activity. Coloured surfacing and/or coarser pavement materials can help alert bike riders to a change in conditions, encouraging riders to reduce their speed and take more care as they pass through these spaces. Rumble strips constructed using thermoplastic line marking should closely resemble those found in highway situations and contain skid resistant materials.

Figure 10.8 *Examples of alternative pavement materials & colours used in areas with high pedestrian activity.*

10.8 Path deflection and narrowing

Path deflection can be used to reduce forward visibility, therefore reducing opportunity for conflict. The example shown in Figure 10.9 below demonstrates the use of path deflection to slow cyclists in an area of high pedestrian activity. Here, pedestrians entering/exiting the City West train station are provided with priority across the shared path (in order to prevent queueing occurring at the level-crossing area). The effectiveness of this particular treatment is considered modest.

Figure 10.9 *Example of path deflection pedestrian crossing (note the extensive use of warning signage and pavement markings to further reinforce).*

In some situations, path narrowing can be used to create a sense of discomfort for bike riders, similar to that experienced by motorists through Local Area Traffic Management (LATM) schemes. Physical narrowing of paths can be achieved through the use of buildouts to reduce effective widths. Narrowing can be achieved by planting vegetation or by using different surface materials or textures towards the edges of the path. It should be noted that this technique can sometimes promote additional conflict by forcing bike riders and people walking into closer proximity with one another, and therefore should be used with caution.

10.9 Rumble strips

Transverse rumble strips are commonly used on highways to alert motorists to a change of speed limit or an approaching intersection. Similar treatments can be applied on shared and separated paths as a semi-passive means of alerting bike riders that they are approaching an intersection or pedestrian crossing point. Figure 10.10 and Figure 10.11 show examples of two different materials used to create a rumble strip effect.

Figure 10.10 *Rumble strip treatment using brick pavers.*

Figure 10.11 *Rumble strip treatment using thermoplastic line marking.*

The effectiveness of rumble strips in reducing the possibility for conflict is thought to be somewhat limited, as over time, these treatments become pre-meditated (or disregarded) by riders familiar with the area.

It is recommended that rumble strips are used in conjunction with other conflict reduction treatments such as signage or pavement markings. Although brick pavers have a greater aesthetic quality than pavement markings, they are intended to create a level of discomfort for riders to ensure a reduction in speed. However, they can become a hazard in wet conditions due to the lack of skid resistance.

10.10 Bollards and u-rails

Bollards and U-rails should not be used as a conflict management tool on shared or separated paths. Most bike riders require forward-motion to maintain an upright position. Because of this, closely spaced u-rails and bollards can cause people to lose balance, especially when using clipless pedal systems (i.e. cleats). In addition to being difficult to navigate, these treatments can be hard to see on bends or curves and in poorly lit areas. Bollards and u-rails also restrict access for emergency response vehicles.

For these reasons, treatments like those shown in Figure 10.12 and Figure 10.13 are **not** supported as conflict management tools on shared paths. For guidance on the correct installation of u-rails refer to Section 10.12. More information on bollards is provided below.

Figure 10.12 *U-rails not supported as a conflict management treatment on shared paths.*

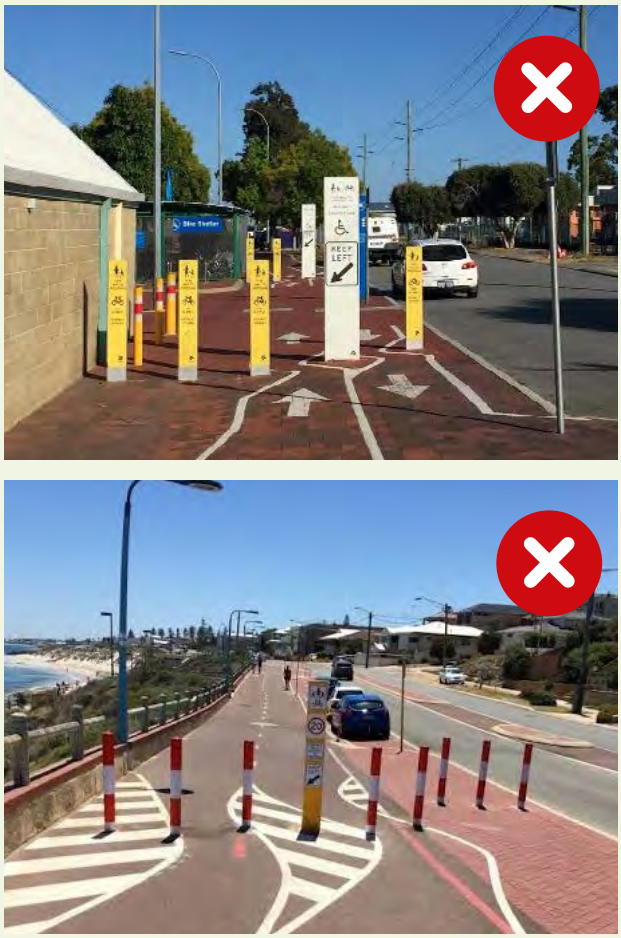


Figure 10.13 *The use of bollards is not supported as a conflict management treatment on shared paths.*

10.11 Preventing unauthorised vehicle access

The use of bollards on shared paths can be hazardous to bike riders and as such, their use should be limited to situations when there is clear evidence of unauthorised motor vehicle access, or where future motor vehicle access may result in damage to structures. In such cases, a risk analysis should be completed and if bollards are proposed, they should be placed on side entries only and not within a free-flowing path.

Retractable/removable bollards should be installed wherever emergency vehicle access may be required. Retractable bollards should be designed so that nothing protrudes above path level when lowered. For safety, bollard installation must meet MRWA standards, that stipulate white and red reflective tape and median pavement markings which direct bike riders away from the bollard (as shown in Figure 10.14).

Figure 10.14 *Preferred entry bollard treatment for preventing unauthorised vehicle access.*

For more information regarding unauthorised vehicle access, practitioners should refer to MRWA's Supplement to *Austroads Guide to Road Design: Part 6A* (Section 7.5);

***Austroads Guide to Road Design: Part 6A* (Section 7.5); and**

MRWA drawing 200531-0008.

11. PATH AMENITY AND MAINTENANCE

11.1 Natural landscaping – trees and shrubs

In WA's hot climate, the presence of trees and shrubs can significantly improve the amenity of shared and separated paths and should be considered as part of the design process. In addition to providing valuable shade, certain species of trees and shrubs can also attract birdlife and other native fauna, providing a more enjoyable walking or bike riding experience.

Path reserves can hold significant ecological value and can be designed and maintained to support biodiversity, provide critical wildlife habitat and corridors and foster a strong sense of place.

Most local governments have existing policies, such as Urban Forest Strategies and Greening Plans, that prioritise native vegetation and provide guidance on tree and shrub selection, planting and maintenance.

Figure 11.1 *Shared path bordered by shaded landscaping.*

Figure 11.2 *Shared path meandering through native bushland.*

While not always possible, the loss of trees should be minimised when retrofitting or widening paths, with options for replanting explored to increase the amenity of the area over the longer term. In circumstances where the removal of trees is required, community consultation may be necessary, however this will depend on the local planning policies and planting guidelines as well as the local context.

Practitioners are encouraged to consider alternative engineering approaches that retain trees and maintain adequate path widths. Figure 11.3 shows a path that has been deviated around an established tree, while Figure 11.4 shows a path that has been split into two 1.4m paths to avoid a tree.

Figure 11.3 *Path "deviation" around established tree.*

Figure 11.4 *Path "split" around established tree.*

It is recommended that local governments seek the opinion of a qualified arborist to establish structural root and root protection zones during the path design process. The advice from the arborist should be incorporated into the engineering drawings and initiated during construction.

While planting trees near a path increases path amenity, it also has the potential to cause maintenance issues.

When planting trees near shared or separated paths, consideration should be given to:

- Setbacks – trees should be placed at least 1.0m from the edge of the path, with vegetation at least 500mm from the edge of the path to reduce the hazard risk for path users;
- Plant species – deciduous vegetation and trees should be used in areas where setback distances can be increased to ensure that safety hazards and path damage is minimised;
- Trees located near shared and separated paths can sometimes create a visual barrier or obstruction, so it is important to check that sightlines and vertical clearances are maintained.
- Vegetation and ground covers with spikes or thorns should also be avoided alongside paths to avoid injury and excessive maintenance;
- Trees should be planted away from the edge of paths to minimise the likelihood of roots causing damage and cracking of the path surface;
- Overhanging leaves and branches should be maintained at a safe height of 2.5m or above (refer to Cyclist Envelope Section 3.1);
- Soft vegetation can be planted closer to the edge of the shared path, ensuring that ample room is provided for growth;
- Root barriers should be considered where trees are being installed close to the path;
- Path heights should be raised where possible to preserve existing tree roots and minimise the damage and to retain the shade canopy; and
- Sprinkler system watering times should be set to limit the impact of water on the path creating an unnecessary hazard for bike riders.

11.2 End-of-trip and mid-trip facilities

The provision of end-of-trip and mid-trip facilities on shared and separated paths, such as bicycle parking, bicycle maintenance stands, water stations and rest areas, add to the riding experience and support a safe, appealing environment that attracts a more diverse range of users. The development of amenities and destinations adjacent to the path, such as bicycle skills tracks, natural planting also add to the overall user experience. Mid and end-of-trip facilities should reflect the specific climate and terrain of the area and emphasise the unique surrounding cultural and natural landscapes.

The installation of mid-trips facilities are essential to support healthy, active and safe communities as well as providing a solution to manage heat stress, the importance of these facilities should not be underestimated.

Bicycle parking

Bicycle parking needs to be convenient if it is to be effective. Parking should be easy to find, easy to use, and as close to destinations and points of interest as possible. Racks/stands should be grouped in small clusters in a variety of locations and not placed in areas where personal security is a concern, or where they create a trip hazard.

Racks/stands should be designed using sturdy materials. Sufficient space around each rack/stand should be provided to ensure access is not restricted. Racks/stands that only support the front wheel of the bicycle should be avoided, as these provide insufficient support for the bicycle and may cause unnecessary damage when parked. For more information on bicycle parking practitioners should refer to AS 2890.3:2015, Parking facilities: Part 3: bicycle parking.

Figure 11.5 *Examples of bicycle parking facilities.*

Bicycle maintenance stations

Bicycle maintenance stations allow bicycle riders convenient, free access to a range of tools required to safely maintain their bike. They should be easy to find, with enough space to ensure that the user can move around the stand easily. These facilities should not be placed in areas where security is a concern, or where they create a hazard to other users.

The stand should be sturdy and be bolted down or incorporated into the path structure. These facilities should be regularly maintained to ensure that all tools and equipment are present and working correctly.

Figure 11.6 *Examples of bicycle maintenance stations.*

Water stations

Water stations allow people to remain hydrated and limit heat stress. They should be placed along the route adjacent to the path and visible to path users, with enough surrounding space to allow people to stop safely without causing an obstruction. They also provide an opportunity for social interaction, which increases the enjoyment of users.

Figure 11.7 *Examples of water stations.*

Rest areas

Rest areas allow people to take a break when travelling and can provide shelter for the climate as well as the opportunity to provide information on local amenities, destinations and travel time and distances for users. They should be placed along the route adjacent to the path and visible to path users, with enough surrounding space to allow people to stop safely without causing an obstruction. They can be placed to capitalise on specific features and points of interest along the route and provide additional rest locations if the route contains steep gradients.

Figure 11.8 *Examples of rest areas.*

Art and interpretative signage

Public art and interpretation can significantly enhance peoples' engagement with and enjoyment of paths, which form an important part of the local community. Interpretation can take many forms, including displays, signs, interactive media, guided walks, asphalt art, and so on.

Planning and implementation of art and interpretation should be done collaboratively with local artists and heritage experts who can guide the design, fabrication, curation and installation of works. Displays can be co-delivered with local community groups and organisations, such as local schools.

Figure 11.9 *Example of artwork on Turquoise Way Trail, Jurien Bay.*

Figure 11.10 *Example of artwork on Leake St, Bayswater.*

Theme A: Splashing in the creek and muddy play

Theme B: Connection with nature

Theme C: Sport with mates

Theme D: Fun in Forry

Theme E: Creativity and colour

Figure 11.11 *Examples of the City of Kalamunda and Town Team Movement engagement with the Forrestfield community to create design ideas for art treatments to install on future shared paths to encourage active transport.*

For more information on this treatment, practitioners should refer to MRWA's Technical Note: Decorative Pavement Markings

Skills building facilities

Combining the development of shared and separated paths with skills tracks can enhance the use and enjoyment of the path users. Skills tracks provide essential opportunities for young riders to practice their riding skills in a highly visible and safe setting. This is an ideal way to teach young riders road safety skills with an emphasis on fun in an active environment that will build their motivation, confidence and skills for riding for more everyday trips.

Figure 11.12 *Example of Skills Track.*

11.3 Maintenance regimes

Like all infrastructure, shared and separated paths require ongoing maintenance to ensure they remain safe and continue to provide an adequate level of service to their users. When planning or designing shared and separated paths, it is important to consider their whole-of-life cost. Funding for ongoing maintenance should ideally be secured at the project development stage. Maintenance regimes for shared and separated paths should typically consider the following remedial actions:

- Repair of surface damage (including potholes, grooves, and upstands);
- Regular sweeping to remove leaves, branches, broken glass and other debris;
- Cleaning of drainage channels and culverts;
- Pruning of encroaching trees and other vegetation;
- The repair/replacement of damaged or missing signs or faded pavement markings; and
- The maintenance of ancillary items such as lighting, drinking fountains, and bicycle maintenance stations.

Figure 11.13 *In general, paths that are kept in good condition will be more popular than those which are allowed to deteriorate.*

When it comes to surface damage, it is important that defects do not exceed the tolerances outlined in Table 11.1. Narrow grooves (such as those between concrete slabs or manhole covers) can easily trap narrow bike wheels, while small upstands can be especially hazardous for users of scooters, skateboards and rollerblades.

Width of groove	Height of upstand
Parallel to direction of travel	
< 12mm	< 10mm
Perpendicular to direction of travel	
–	< 20mm

Table 11.1 *Tolerances for grooves and upstands on shared and separated paths (information sourced from Austroads Guide to Road Design: Part 6A).*

11.4 Working on or near paths

When conducting works on or near shared and separated paths, practitioners must consider the requirements of all users specified in Section 2.1 (not just people on bikes and people walking). It is important to consider the needs of people with impaired mobility, especially those who use wheelchairs, mobility scooters and hand-operated bicycles, who may not be able to dismount to negotiate roadworks.

When planning works on or near paths, a Traffic Management Plan (TMP) should be prepared. The TMP specifies how safety will be managed for road and path users, as well as the crew carrying out the works. TMPs should clearly show the temporary signage that will be used during detours, as well as how path users will be kept separated from plant and equipment.

When detours are required, users should be provided with a safe, accessible alternative that provides a similar level of service to the original path. It is generally preferable to minimise the distance of detour. Where possible, the width of any temporary path should be the same as the width of the original path. Horizontal and vertical clearances should strive to meet the specifications outlined in Section 3.3 of this guideline.

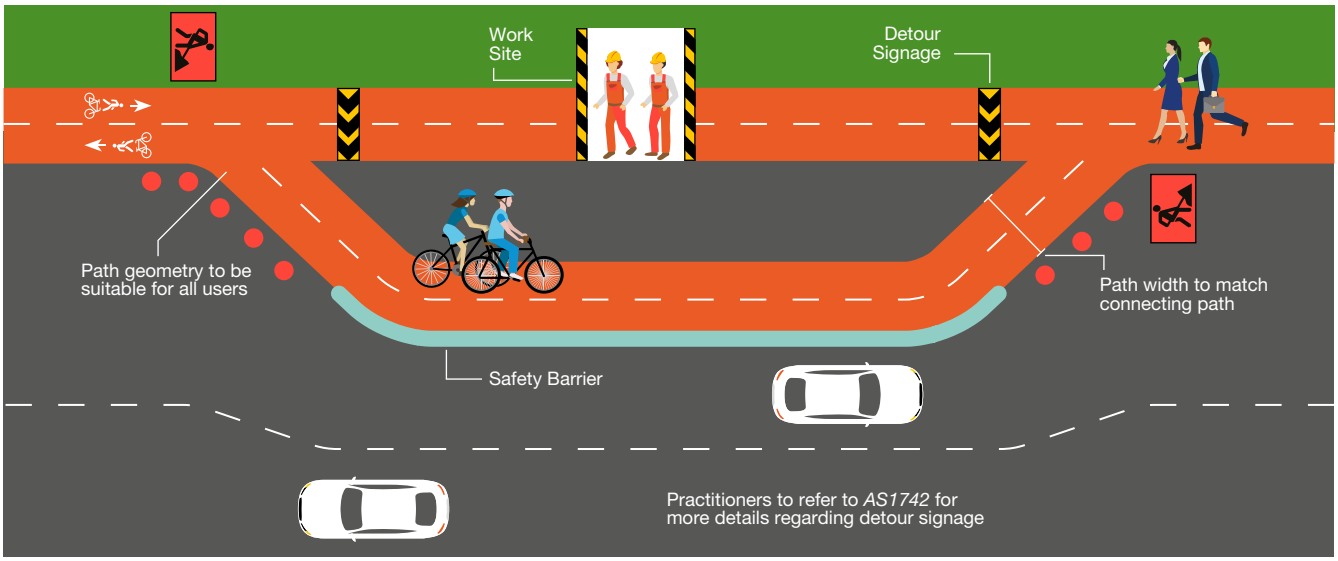


Figure 11.14 *Example of a TMP used for a shared path diversion (image courtesy of Austroads Guide to Road Design: Part 6A).*

Fencing and barricades should be used in all situations where a hazard (such as excavations) is adjacent to a path facility. Temporary fencing shall not be installed on a path without providing adequate pathway width and lateral clearance.

Temporary hoses or cables that run along the path should be placed at right angles to the path. All cables should be protected by a smoothly ramped solid cover treatment. After the roadworks are completed, paths should be returned to their pre-construction condition or better. When undertaking works on paths, temporary signage should be installed in accordance with *AS1742*. Signs shall not be installed across paths.

Warning signs and devices are to be provided for path users to warn them of upcoming works. An advanced public notice of the works should be provided at least a week before the commencement of works (refer to Figure 11.15).

Wayfinding signage may be required in situations where detours go by multiple streets or paths. Detours shall be clearly signed and marked on the alternative route as well as physical and electronic maps where detours are substantial.

Figure 11.15 *Advanced public notice of detours of shared path closure.*

For more guidance pertaining to works on or near shared paths, practitioners should refer to MRWA's guidelines on the provisions for all path users at roadwork sites in built-up areas.

12. REFERENCES

AS1158 – Lighting for Roads and Public Spaces

AS1428 – Design for access and mobility

AS1742 – Manual of uniform traffic control devices

AS2890.3 – Parking Facilities for Bicycle Parking

Austroads Guide to Road Design Part 3: Geometric Design

Austroads Guide to Road Design Part 4: Intersections and Crossings

Austroads Guide to Road Design Part 5B: Drainage, Open Channels, Culverts and Flood-ways

Austroads Guide to Road Design Part 6A: Paths for walking and cycling

Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings

Cycling Aspects of Austroads

Disability Discrimination Act 1992. 17.2

Planning and Designing for Pedestrians: Guidelines

Main Roads WA's Guidelines on the provisions for all path users at roadwork sites in built-up areas

Main Roads WA Supplement to Austroads Guide to Road Design – Part 8 (Additional Road Design – Driveways).

Main Roads WA Policy and Application Guidelines: Signage and Pavement Marking on Paths

Main Roads WA Specification 604

Main Roads WA Supplement to Austroads Guide to Road Design – Part 4A

Main Roads WA Supplement to Austroads Guide to Road Design – Part 6A

Main Roads WA Technical Guideline – Bicycle Directional Signs – Part C

Public Transport Authority's Bus Stop Design Guidelines (2019)

Queensland Department of Transport and Main Roads 2015 Road planning and design manual: edition 2: volume 3: supplement to Austroads Guide to Road Design Part 6A: Pedestrian and Cyclist Paths

Vic Roads Cycle Notes 21, 2013

WA Road Traffic Code 2000

Western Australia Cycling Route Hierarchy

Western Australian Local Government Association Guidelines and Specifications for Residential Crossovers

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