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Cycle Notes

No. 15 - June 2005

Providing for Cyclists at Roundabouts

Welcome to CYCLE NOTES No. 15. The purpose of CYCLE NOTES is to provide information on the design of bicycle facilities for engineers and planners.

CYCLE NOTES should be read in conjunction with:

- AUSTROADS Guide to Traffic Engineering Practice, Part 14 – Bicycles.
- Australian Standard 1742.9, Manual of Uniform Traffic Control Devices, Part 9 Bicycle Facilities.
- VicRoads Traffic Engineering Manual Volumes 1 and 2

Introduction

The purpose of this edition of *Cycle Notes* is to provide guidance on the provision for cyclists at roundabouts in Victoria.

In particular, this edition of Cycle Notes addresses entry speeds for motor vehicles entering roundabouts and the provision for cyclists travelling through roundabouts.

General

Well designed roundabouts are a safe and efficient form of intersection control for motor vehicles. Roundabouts have been used extensively in the United Kingdom and in Australia since the 1980's.

In particular, roundabouts have a relatively low crash rate in comparison to other types of intersections for motor vehicles and, when crashes do occur, they are often less severe than those that occur at other types of intersections.

Types of Roundabouts

Small, single lane roundabouts are commonly used at intersections along local and collector roads. They are often used to improve road safety and as a traffic calming device.

On arterial roads and highways, large multi-lane roundabouts are typically used to improve road safety and capacity.

The type of roundabout used depends upon its purpose, its design capacity and the volume of traffic that will use the roundabout.

Roundabouts on Local and Collector Roads

Local and collector roads typically carry relatively low numbers of vehicles and operate at a speed limit of 50 km/h or less. Roundabouts on these roads tend to be single lane roundabouts with a diameter of less than 25 metres as shown in Figure 1.

Figure 1 - Single lane roundabout on a local road

Roundabouts on Arterial Roads and Highways

Arterial roads and highways typically carry higher numbers of vehicles and operate at speed limits of up to 100 km/h. Roundabouts on these roads tend to be multi-lane roundabouts with a diameter of more than 25 metres as shown in Figure 2.

Figure 2 - Multi-lane roundabout on an arterial road

Cyclists at Roundabouts

Many cyclists find roundabouts intimidating, especially multi-lane roundabouts that carry large traffic volumes.

This is because cyclist safety at roundabouts largely relies on motorists seeing and giving way to cyclists as they travel past entrances as shown in Figure 3.

Cyclists can also feel vulnerable when they ride through roundabouts and when they attempt to make a right hand turn. This is especially difficult at multi-lane roundabouts where cyclists must give way to vehicles that are exiting the roundabout.

Figure 3 - Cyclist safety reflies on drivers giving way to cyclists as they travel past entrances to the roundabout

Conflict Points for Cyclists

Single lane roundabouts

Just like motorists, cyclists may enter a single lane roundabout and take the first exit, travel straight through the roundabout, turn right or make a 'U' – turn.

The main conflict point for cyclists using single lane roundabouts occur each time the cyclist travels past an entry leg of the roundabout as shown in Figure 4.

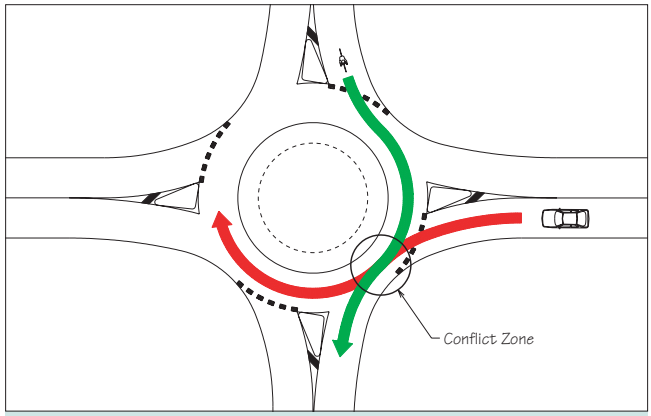

Figure 4 - Conflict point for single lane roundabouts

Multi-Lane Roundabouts

At multi-lane roundabouts, cyclists who are turning right may use the left traffic lane or the right traffic lane. Cyclists who use the left lane are required to give way to other vehicles that are exiting the roundabout.

The main conflict points for cyclists using multi lane roundabouts occur each time the cyclist travels past an entry leg of the roundabout and when right turning cyclists travel past the exit legs of the roundabout as shown in Figure 5.

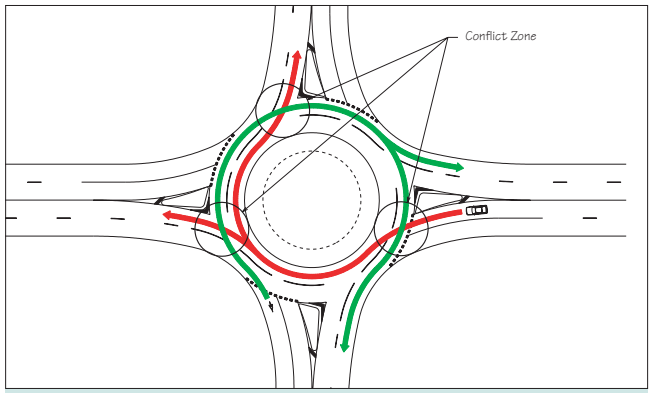

Figure 5 - Conflict points for multi-lane roundabouts

Cyclist Safety at Roundabouts

A recent study of cyclist crashes at roundabouts in Victoria showed that there were a total of 391 reported crashes involving cyclists between 1 January 1999 and 31 December 2003. Of these, 236 (60%) occurred when a driver entering the roundabout failed to give way to a cyclist who was traveling within the roundabout. This result is repeated in studies undertaken in New South Wales (70%, Robinson, 1998) and the United Kingdom (50%, Layfield and Maycock, 1986).

Similar studies have shown that:

(a) 18% of crashes at roundabouts and 6% of crashes at signalised intersections in New South Wales involved a cyclist (Robinson 1998, Allot and Lomax, 1993).

(b) 7.3% of crashes at roundabouts in France involved a bicycle compared to 3.7% at all other cross roads (Aphand, Noelle and Guichet, 1991)

(c) 17% of bicycle crashes at roundabouts occurred when cyclists were struck by a motor vehicle exiting the roundabout (Jordan 1986),

These studies confirm that drivers do not see, are not conscious of, or misjudge the speed that cyclists are travelling around the roundabout (Austroads, 1999 and Traffic Advisory Leaflet 9/97 (UK)).

Increasing Cyclist Safety at Roundabouts

Reducing Entry Speeds

As 60% of crashes at roundabouts involve an entering vehicle failing to give way to a cyclist, the key to increasing cyclist safety at roundabouts is to reduce the speed at which drivers enter the roundabout. It is also important to reduce the speed of drivers as they exit the roundabout.

Conventional Roundabout Design

As indicated in Figure 6, conventional roundabout design results in drivers entering and exiting the roundabout at an angle that is tangential to the central island. This design allows drivers to enter, travel through and exit the roundabout at up to 50 km/h.

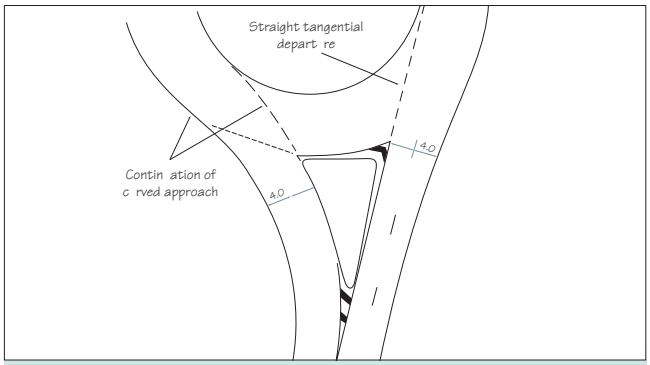

Figure 6 - Conventional design for roundabout entry and exits

"European" Roundabout Design

As indicated in Figure 7, the focus of European roundabout design is to require drivers to enter and exit roundabouts at angles that are closer to perpendicular to the central island.

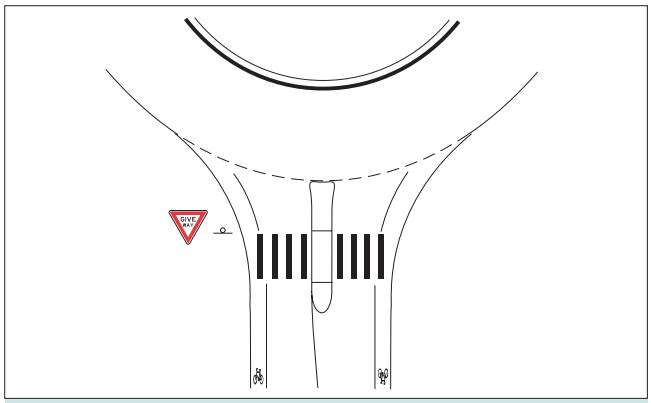

Figure 7 - European design for roundabout entry and exits

This design also uses a larger central island, single lane entry and exits of minimum width and minimal flaring of entry and exits. The design could also include a wide splitter island, kerb outstands and zebra crossings to provide additional clues to drivers and to provide a safer crossing point for pedestrians. However, the needs of trucks and buses must also be considered.

These features result in drivers entering, traveling through and exiting roundabouts at much lower speeds. This results in a safer roundabout for cyclists and pedestrians.

Application of the European Design

It should be noted that the European design provides less traffic capacity than the conventional design and is not necessarily suitable for all locations. However it should be considered at intersections that carry high numbers of cyclists and/or pedestrians.

On-Road Bicycle Lanes within Roundabouts

As for mid-block situations, on-road bicycle lanes on the approaches and through roundabouts provide cyclists with a dedicated space in which to ride and increased separation from motor vehicles.

On-road bicycle lanes are appropriate at medium sized, single lane roundabouts and two lane urban roundabouts as shown in Figure 8, particularly on those legs that have high numbers of cyclists.

It is also important to consider the use of a green surface treatment for the bicycle lanes as outlined in *Cycle Notes 14 – Coloured Surface Treatments for Bicycle Lanes*.

Figure 8 - On-road bicycle lanes on the approach to a roundabout

Off-Road Bicycle Paths at Roundabouts

Off-road bicycle paths are appropriate at two lane rural and three lane urban roundabouts that carry high numbers of motor vehicles at higher speeds. At these locations it is important to provide cyclists with a safer alternative that separates them from motor vehicles.

For further information on the provision of off-road bicycle paths at roundabouts, please refer to Section 5.5.2.4 of Austroads' Guide to Traffic Engineering, Part 14 – Bicycles.

Cyclist Warning Signs

In addition to slowing drivers down before they enter roundabouts, the provision of signs that request drivers to "Watch for Cyclists" should also be considered on the approaches to roundabouts.

Sign G9 – 57 (shown in Figure 9) is the standard design for these signs.

Figure 9 - "Watch for Bicycles" sign

Providing for Cyclists at Small Single Lane Roundabouts

Introduction

As indicated above, small single lane roundabouts are commonly used on local and collector roads to improve road safety and as a traffic calming device as shown in Figure 10.

Typically, small single lane roundabouts are suitable for low volume roads and in speed zones of 60 km/h or less.

Figure 10 - Small single lane roundabout on local roads in Balwyn

Cyclists at small, single lane roundabouts

For roundabouts of this type, most experienced cyclists are comfortable riding in the centre of the approach and the circulating lane of the roundabout. With the slower speed environment, they are also confident that drivers entering the roundabout will give way to them as they ride past the entry legs.

For these reasons, it is usually considered unnecessary to provide on-road bicycle lanes through the roundabout or an off-road bicycle path around the roundabout. Instead, it is expected that experienced cyclists will mix with other traffic through the roundabout and cyclists under 12 years of age may use the footpath.

Typical layout for a small, single lane roundabout

Figure 11 shows a typical layout for a single lane roundabout that is on local roads with a speed limit of 50 km/h or less. This type of layout is appropriate for roundabouts that carry low volumes of traffic and low volumes of cyclists.

On roads that carry high numbers of cyclists, where it is considered desirable to slow traffic down or where there is a crash history involving cyclists, elements of the European design could be included to reduce the speed of traffic using the roundabout. It is also suggested that "Watch for Cyclists" signs could be erected on the approaches to the roundabout. It is also very important to provide safe crossing points for pedestrians at these roundabouts. As such, consideration should be given to providing zebra crossings as shown or signalised crossings.

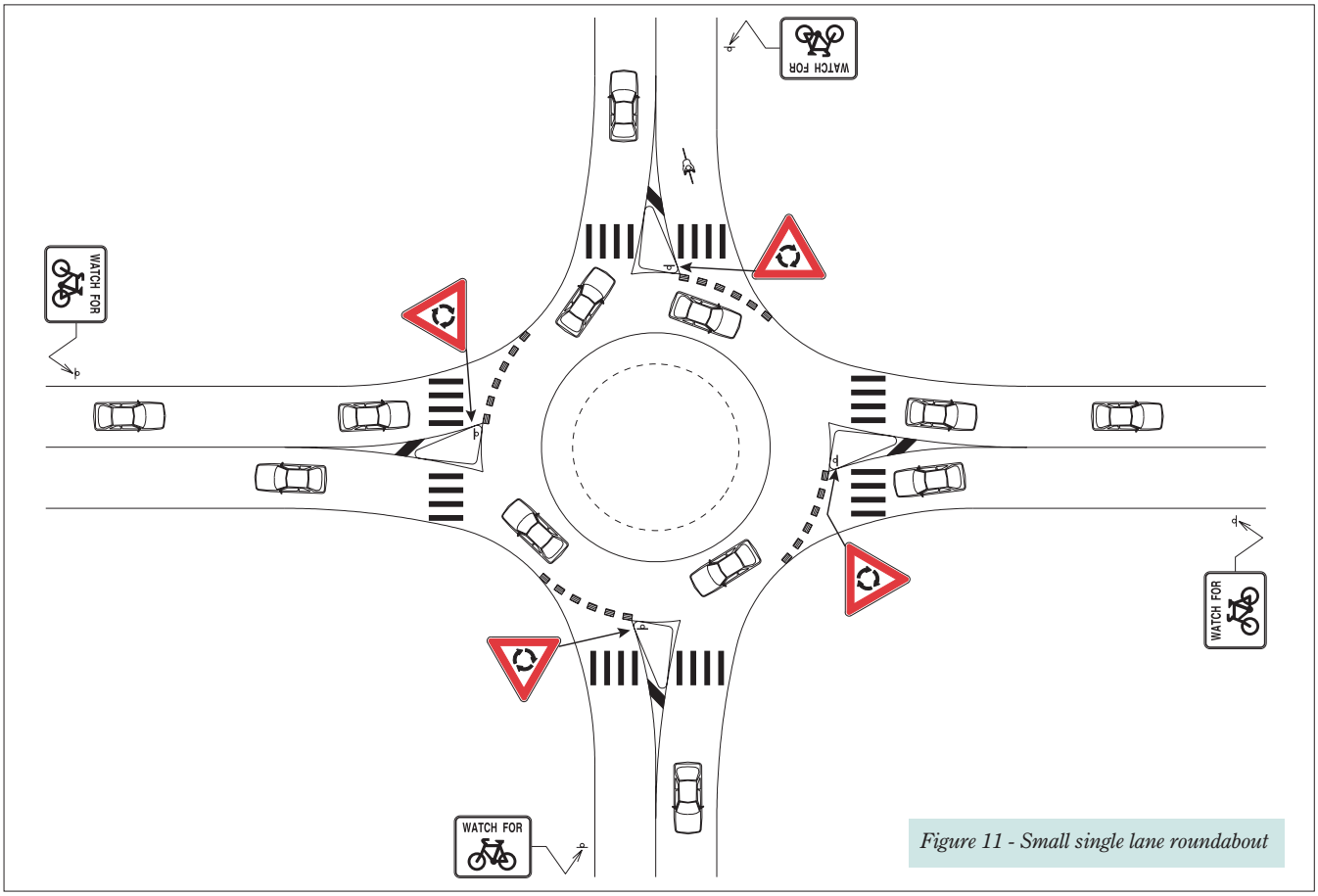

Figure 11 - Small single lane roundabout

Providing for Cyclists at Larger Single Lane Roundabouts

Introduction

Large, single lane roundabouts are commonly used on collector and arterial roads that carry higher traffic volumes, where each leg carries similar volumes of traffic and where traffic signals are considered undesirable. An example of a large, single lane roundabout is shown in Figure 12.

In addition, these roundabouts often operate in speed zones of between 50 km/h and 70 km/h.

Figure 12 - Large, single lane roundabout on a busy collector road in Viewbank

Cyclists at large, single lane roundabouts

As for small, single lane roundabouts, most experienced cyclists are comfortable riding in the centre of the approach and the circulating lane of large, single lane roundabouts.

With the slower speed environment, they are also confident that drivers entering the roundabout will give way to them as they ride past the entry legs. However, on roads that carry higher volumes of traffic at higher speeds, consideration should be given to providing on-road bicycle lanes through the roundabout to provide greater separation for more experienced cyclists. At these roundabouts, less experienced cyclists are likely to use the footpath.

Typical layout for a large, single lane roundabout

Figure 13 shows a typical layout for a large, single lane roundabout on a collector or arterial road with a speed limit of between 50 km/h and 70 km/h. This type of layout is appropriate for roundabouts that carry higher volumes of traffic and higher volumes of cyclists. This design incorporates bicycle lanes through the roundabout and "Watch for Cyclists" signs on the approaches.

On roads that carry high numbers of cyclists, where it is considered desirable to slow traffic down or where there is a crash history involving cyclists, elements of the European design could be included to reduce the speed of traffic using the roundabout. It is also very important to provide safe crossing points for pedestrians at these roundabouts. As such, consideration should be given to providing zebra crossings as shown or signalised crossings.

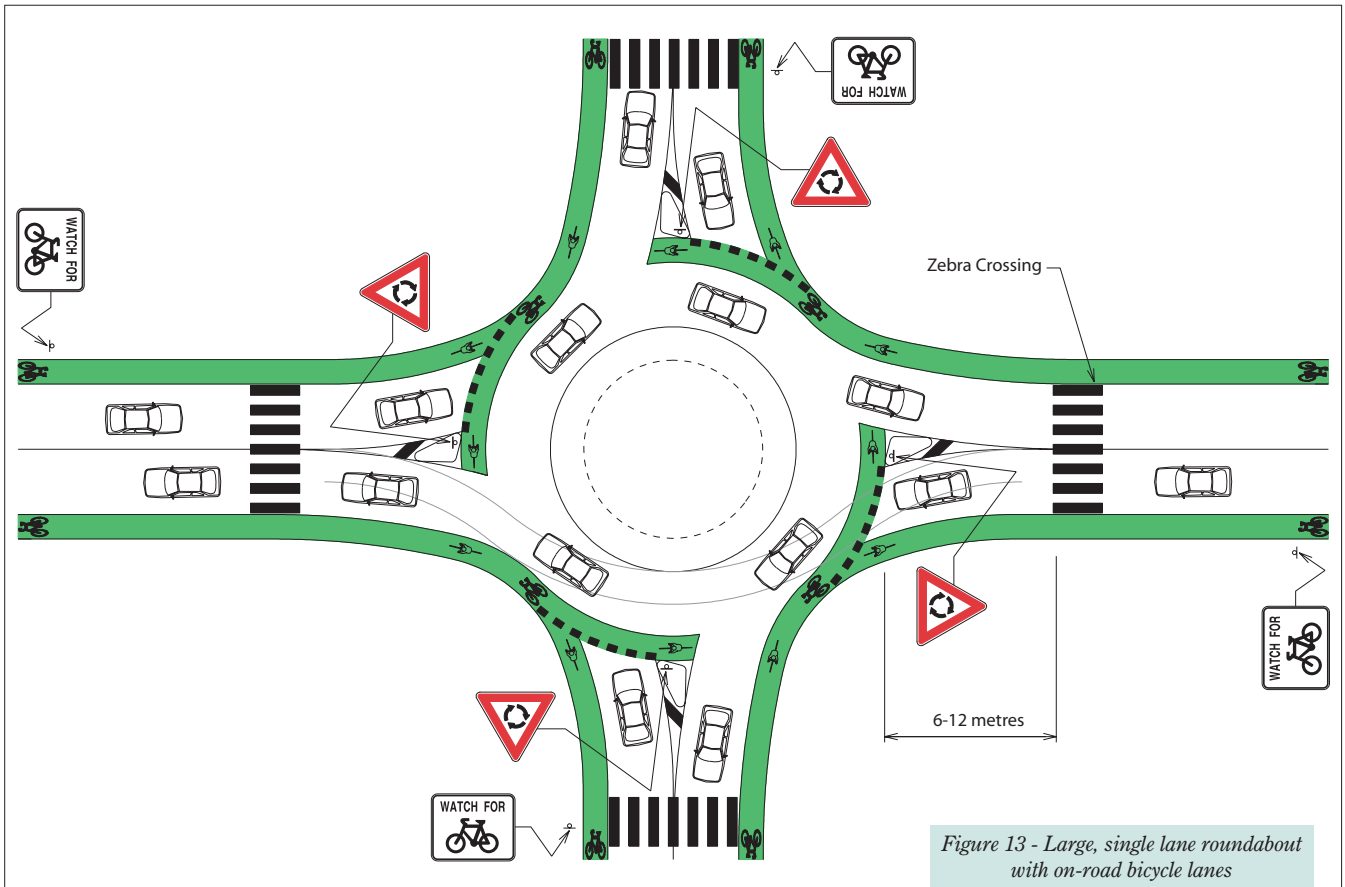

Figure 13 - Large, single lane roundabout with on-road bicycle lanes

Providing for Cyclists at Two-Lane Urban and Single Lane Rural Roundabouts

Introduction

As indicated above, two-lane urban and single lane rural roundabouts are commonly used on arterial roads and highways that carry high traffic volumes, where each leg carries similar volumes of traffic and where traffic signals are considered undesirable. An example of a two-lane urban roundabout is shown in Figure 14.

Figure 14 - Two lane, urban roundabout on a busy arterial road in Lalor

In addition, these roundabouts often operate on roads with speed limits of between 60 km/h and 100 km/h.

Cyclists at two-lane urban and single lane rural roundabouts

Most cyclists are not comfortable riding through two-lane, urban roundabouts. In particular, cyclists find it very difficult to turn right at two-lane urban roundabouts.

As a result, on roads that carry high numbers of cyclists, consideration should be given to providing on-road bicycle lanes through the roundabout to provide greater separation for more experienced cyclists. Consideration should also be given to providing an off-road bicycle path around the roundabout for less experienced cyclists to use.

Typical layout for a two-lane urban roundabout

Figure 15 shows a typical layout for a two-lane urban roundabout on an arterial road with a speed limit of between 50 km/h and 70 km/h. This type of layout is appropriate for roundabouts that carry higher volumes of traffic and higher volumes of cyclists. This design incorporates bicycle lanes through the roundabout and "Watch for Cyclists" signs on the approaches.

Subject to capacity considerations and where it is considered desirable to slow traffic down or where there is a crash history involving cyclists, elements of the European design could be included to reduce the speed of traffic using the roundabout. It is also very important to provide safe crossing points for pedestrians at these roundabouts. As such, consideration should be given to providing zebra crossings as shown or signalised crossings.

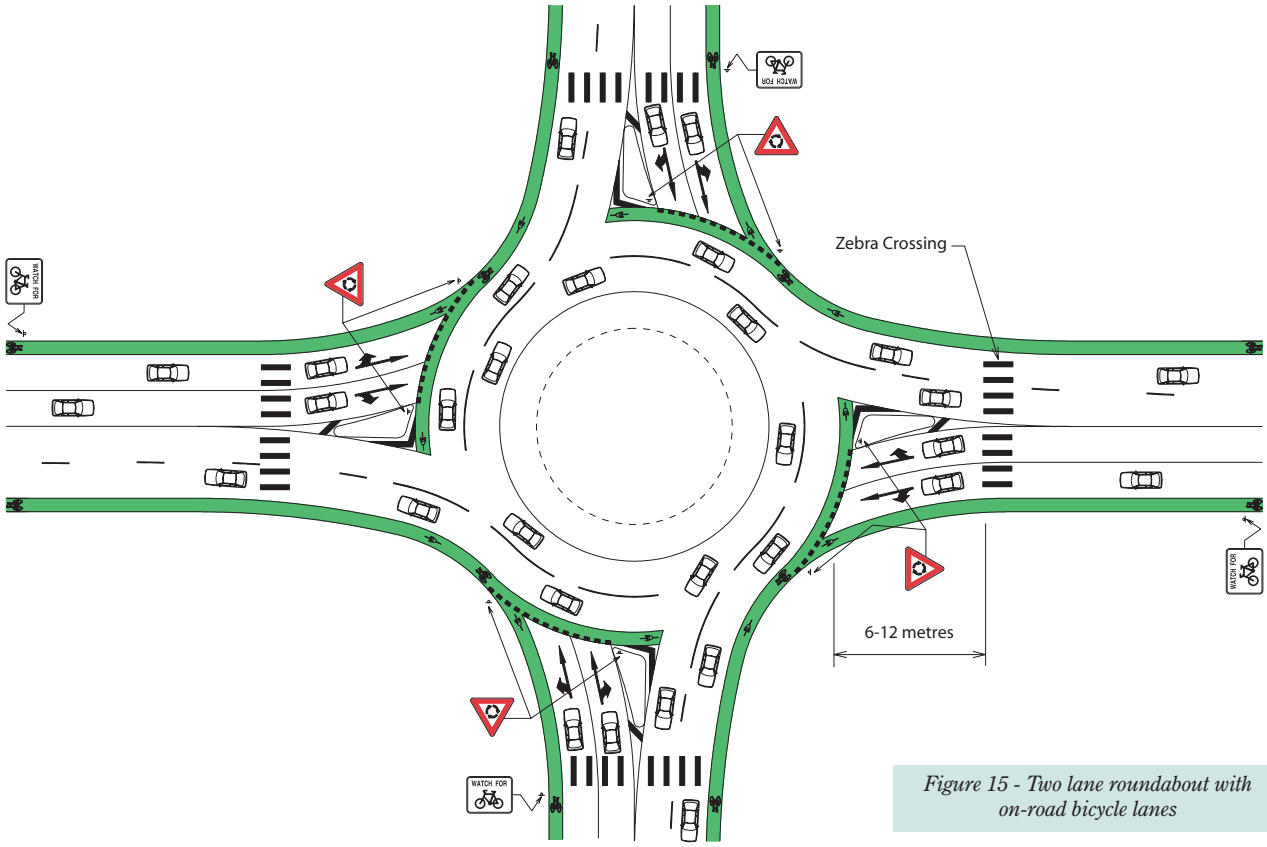

Figure 15 - Two lane roundabout with on-road bicycle lanes

Providing for Cyclists at Three-Lane Urban and Two-Lane Rural Roundabouts

Introduction

Three lane roundabouts are not common, but have been used on arterial roads that carry high traffic volumes, where each leg carries similar volumes of traffic and where traffic signals are considered undesirable. An example of a three-lane roundabout is shown in Figure 16.

Two lane rural roundabouts are often used in semi-rural areas where there are lower traffic volumes and the speed limit on the intersecting roads is between 80 km/h and 100km/h.

Figure 16 - Three lane roundabout with pedestrian crossing on Fitzsimons Lane and Porter Street in Templestowe

Cyclists at three lane roundabouts

As for two-lane, urban roundabouts, most cyclists are not comfortable riding through two-lane rural and three-lane urban roundabouts and will often avoid these sites.

In particular, cyclists find it very difficult and intimidating to travel through these roundabouts and almost impossible to turn right. For these reasons, it is recommended that an off-road, shared use path be provided around these roundabouts for cyclists to use. It is also recommended that controlled (signalised , "zebra" or grade separated) crossings be provided on critical approaches to increase cyclist (and pedestrian) safety.

Typical layout for a three lane, urban roundabout

Figure 17 shows a typical layout for a three lane urban roundabout on an arterial road with a speed limit of between 50 km/h and 70 km/h. This type of layout is appropriate for roundabouts that carry higher volumes of traffic and higher volumes of cyclists. This design incorporates off-road bicycle paths around the roundabout and controlled crossing points on critical approaches.

Even though an off-road bicycle path has been provided around this type of roundabout, it is still considered important to control the speed of traffic through the roundabout through the use of appropriate entry and deflection curves. This is because more experienced cyclists are unlikely to use the off-road paths and will continue to cycle through the roundabout with other vehicles. It is also appropriate for motor vehicle safety.

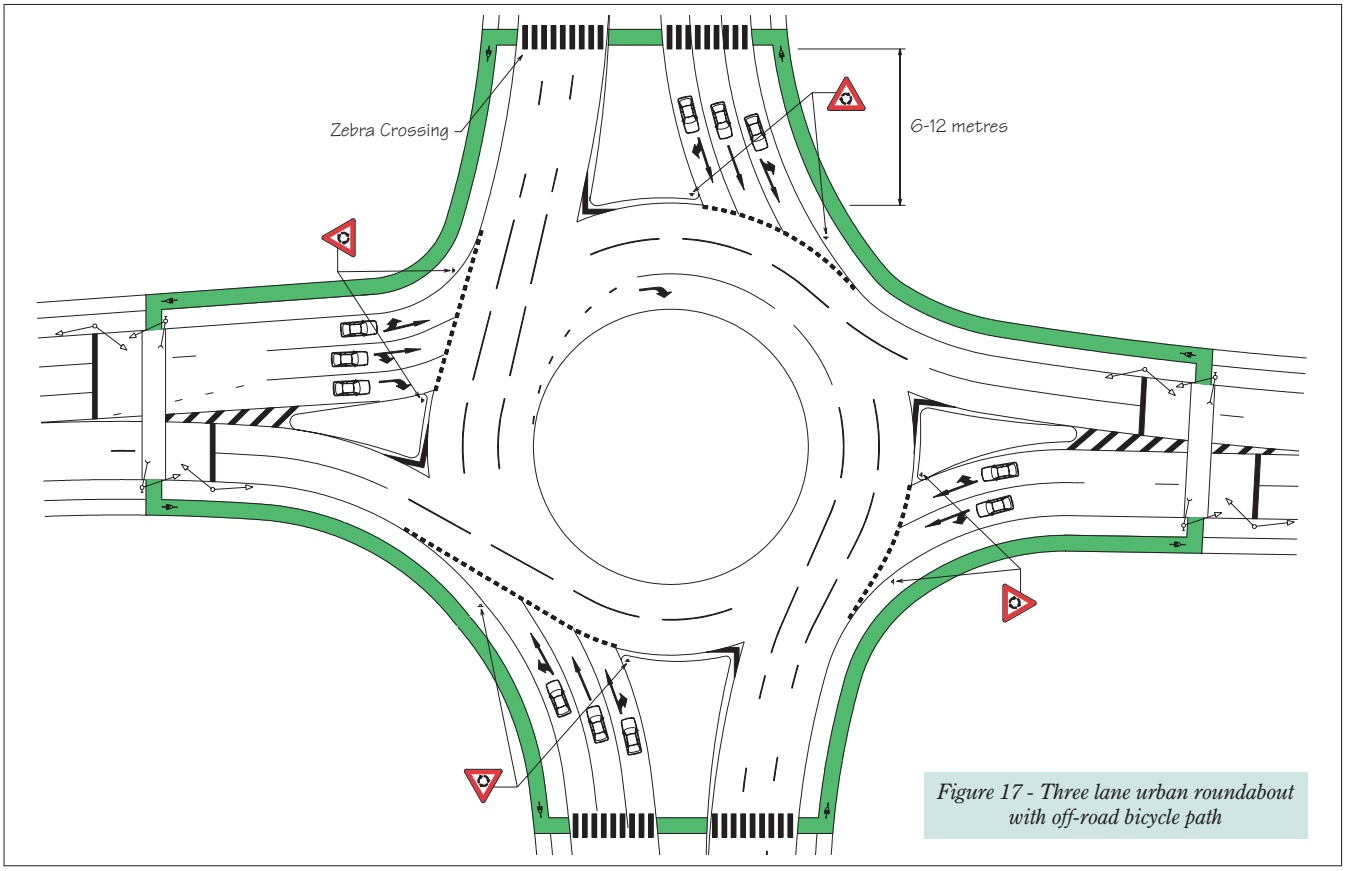

Figure 17 - Three lane urban roundabout with off-road bicycle path

Providing for Pedestrians at Roundabouts

Introduction

In addition to providing for cyclists at roundabouts, it is also important to provide for pedestrians at roundabouts.

Reducing the entry speeds of vehicles at roundabouts not only assists cyclists but also makes roundabouts safer for pedestrians.

Similarly, the provision of zebra crossings and signalised crossings at roundabouts not only assist pedestrians but also increase safety for cyclists.

Pedestrian Crossings

As indicated in Figures 11, 13, 15 and 17, it is important to consider the provision of zebra crossings and signalised crossings at roundabouts.

Particular attention also needs to be paid to the location of the crossings to ensure that the crossings are located from 6 – 12 metres from the holding line of the roundabout.

In built up areas, it is suggested that crossings could be located at the holding line or no more than 6 metres from the holding line to minimise the distance that pedestrians must walk to cross the road.

Figure 18 – Bicycle lane and pedestrian crossing at roundabout on Faraday Street and Cardigan Streets, Carlton

Figure 19 – Pedestrian crossing within 6 metres of roundabout on Faraday Street and Cardigan Streets, Carlton

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For further information on the design of roundabouts please refer to:

Austroads' Guide to Engineering Practice – Roundabouts, Part 6.

Previous editions of Cycle Notes can be downloaded from the VicRoads web site at: www.vicroads.vic.gov.au

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