Department of Transport and Main Roads

Guideline

Physical separation devices for protected bicycle lanes and cycle tracks

July 2025

Queensland Government

Copyright

Licence

CC BY licence summary statement

In essence, you are free to copy, communicate and adapt this work, as long as you attribute the work to the State of Queensland (Department of Transport and Main Roads). To view a copy of this licence, visit: https://creativecommons.org/licenses/by/4.0/

Translating and interpreting assistance

The Queensland Government is committed to providing accessible services to Queenslanders from all cultural and linguistic backgrounds. If you have difficulty understanding this publication and need a translator, please call the Translating and Interpreting Service (TIS National) on 13 14 50 and ask them to telephone the Queensland Department of Transport and Main Roads on 13 74 68.

Disclaimer

While every care has been taken in preparing this publication, the State of Queensland accepts no responsibility for decisions or actions taken as a result of any data, information, statement or advice, expressed or implied, contained within. To the best of our knowledge, the content was correct at the time of publishing.

Feedback

Please send your feedback regarding this document to: tmr.techdocs@tmr.qld.gov.au

Contents

Tables

Figures

1 Purpose and scope of this guideline

This document has been prepared to provide guidance on preferred treatments and design characteristics of physical separation devices for protected bicycle lanes and cycle tracks.

The purpose and function of physical separation devices installed with an on-road bicycle lane is to deter motor vehicle encroachment into, and traversing of, the on-road bicycle lane. If a physical separator is impacted by a motor vehicle, it is performing its function to reduce overall injury risk. For example, in the absence of a physical separation device, a heavy vehicle encroachment into an on-road bicycle lane would likely result in a fatal or serious injury crash for any cyclist using the on-road bicycle lane at the time of the encroachment. If the physical separation device is damaged due to repeated motor vehicle impacts, a review of the road layout including analysis of the motor vehicle approach speed, approach angle and vehicle swept paths is required and the separation device revised accordingly.

Physical separators listed in this publication are only suitable for use with on-road bicycle lanes that are installed as per Figure C9-1 of Austroads *Guide to Traffic Management* (AGTM) Part 4, Section 4.6.3. Any installations at higher motor vehicle speed or volume locations require either physical segregation with a verge or the use of an appropriate Transport and Main Roads approved crash barrier with appropriate bicycle friendly design, as per the department's Accepted Road Safety Barrier Systems and Devices publication. Information on accepted products and suppliers available on the department's Approved products and suppliers webpage.

Section 5.1.3 of Austroads *Guide to Road Design* Part 6*,* addresses road system barriers but adjacent to off-road shared paths rather than for on-road bicycle lanes. Section 4.9 of Austroads *Guide to Road Design* Part 3 discusses separated bicycle lanes, protected bicycle lanes and supplementary treatments but does not provide specific safety design details about the separation treatment. Section 4.9.5 states '*Designers may also refer to road agency publications that may provide additional information, including local requirements and examples of treatments*'. Transport and Main Roads technical guideline *Selection and design of cycle tracks* also discuss separation treatments, including widths but does not provide guidance on separation device design considerations.

1.1 Background

Transport and Main Roads supports the implementation of on road separation between people riding bikes and motorists.

The degree and type of separation varies, with separation being provided through road pavement markings, vertical separation, physical barriers, and a combination of devices. This document provides a recommendation of preferred separation devices which are suitable for use alongside on road bicycle lanes..

1.2 Related documents

This guideline should be read in conjunction with the following:

- Austroads *Guide to Road Design:*
  - Part 3 *Geometric Design*
  - Part 6 *Roadside Design, Safety and Barriers*
  - Part 6A *Pedestrian and Cyclist Paths*

- Austroads *Cycling Aspects of Austroads Guides*
- Queensland *Manual of Uniform Traffic Control Devices:*
  - Part 2 *Traffic Control Devices for General Use*
  - Part 9 *Bicycle Facilities*
- Transport and Main Roads guideline *Selection and design of cycle tracks*.

1.3 Physical separation definition

An important distinction is between physical separators and visual or tactile delineators:

- Physical separators (Table 1.3(a)) are not intended to be traversed by motor vehicles, with the exception of traversable physical separators that are intended to be traversed at low speeds, while providing a continuous separation treatment along the entire length of the on-road bicycle lane.
- Visual or tactile delineators (Table 1.3(b)) are intended to provide either visual delineation or tactile feedback to on-road bicycle lane encroachment by motor vehicles and increase motor vehicle travel offset to the on-road bicycle lane. These devices do not provide physical separation.

Table 1.3(a) Physical separators

Name	Description	Purpose and function
Physical separator – kerb Refer to Standard Drawing 1033	Kerb shaped physical structure	Not intended to be traversed by motor vehicles
Physical separator – bollard Refer to MRTS14 (Clauses 10.2.2 and 10.2.3)	Bollard or guide post shaped physical structure	Not intended to be traversed by motor vehicles
Traversable separator Refer to Section 2.4 of Queensland MUTCD Part 13 (AS 1742.13)	Speed hump shaped physical structure	Intended to be traversed by motor vehicles at low speeds to access driveways or kerbside parking bays (or other kerbside land uses)
Dividing strip Refer to TORUM Schedule 5	"*An area or structure that divides a road lengthways, but does not include a nature strip, bicycle path, footpath or shared path.*"	To provide physical separation – median
Traffic island Refer to TORUM Schedule 5	"*A structure on a road to direct traffic, but does not include a road marking or painted island.*"	To provide physical separation – splitter island

Table 1.3(b) Visual or Tactile delineators

Name	Description	Purpose and function
Tactile delineator	Low-profile device, not a physical structure (including Audio Tactile Line Marking)	Intended to provide tactile feedback to motor vehicle encroachment and to increase offset from the on-road bicycle lane
Pavement marked delineator (also known as: bicycle lane safety strips or painted island) Refer to TORUM Schedule 5, AS 1742.9 s2.3.2 & s2.4.3, AS 1742.2 s5.6.5	Stripes or chevron road pavement markings	Intended to provide visual delineation only and increase offset from the on-road bicycle lane

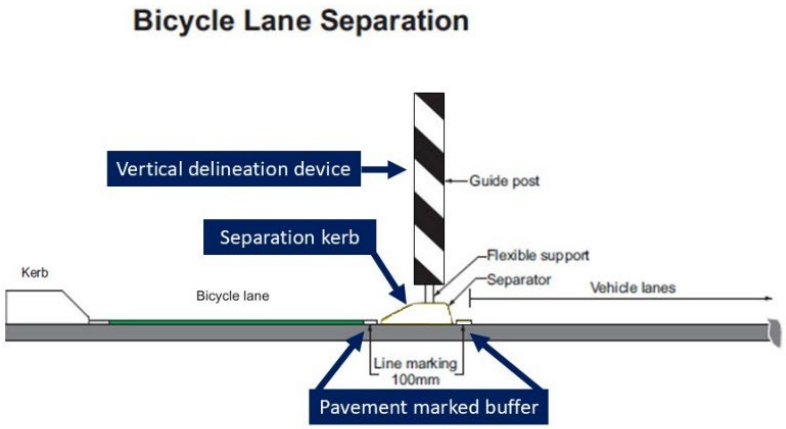
2 Preferred separation device

2.1 Device configuration

The preferred separation device configuration is a **vertical delineation device on a separation kerb, within a pavement marked buffer**. The pavement marked buffer shall be with 150 mm wide white outline pavement markings either side per Queensland MUTCD Part 2. The design aspects of the preferred separation device are detailed in Figure 2.1(a) and Table 2.1.

Further information is also provided on dimensions, shape, colour, surface finish and so on in the checklist in Appendix A. The *Physical separation devices product information and acceptance checklist* is to be used as an aid for the selection of separation devices. Please note that devices may be used if they can be demonstrated to be non-hazardous, fit for the purpose of the application and are agreed for use by the Transport and Main Roads project RPEQ.

Figure 2.1(a) – Key features of preferred treatment – kerbside parking prohibited with semi-mountable kerb



NOTE: In locations with kerbside parking / stopping restrctions or prohibitions, yellow ‘no stopping’ lines are to be installed along the separator immediately adjacent the bicycle lane.

Permanent separators, regardless of material, shall be white, light grey, or similar contrasting colour (for example, black on light concrete).

Permanent vertical delineators used with permanent separators shall be black and white, or similar contrasting colour (for example, black on light concrete) similar to those shown in Section 4.5.7 of Queensland MUTCD Part 2.

Vertical delineators shall feature a slope similar to that of the D4-2-2 sign (*Bidirectional hazard marker*). The direction of the downwards slope indicates the direction to which road users in a general traffic lane may pass. Where a separator with vertical delineation is placed between bicycle only allocation and general traffic allocation, the vertical delineator shall slope in only one direction. Where the separator with vertical delineation is placed between a shared left turn lane and a general traffic lane, the vertical delineator shall slope in both directions with chevron markings.

In locations where driveway access (or similar) is required and a vertical delineator on a separation kerb cannot be installed, then a traversable separator must be installed, but only for short sections. Only in situations where the installation of both a vertical delineator on a separation kerb or a traversable separator is not possible, then a bicycle safety strip preferably with a tactile delineator will be used, but only for short sections (<20 m).

Where a bicycle safety strip (preferably with a tactile delineator) is applied, if Raised Reflective Pavement Markers (RRPMs) are used in conjunction they shall be installed in accordance with Section 5.9 of Queensland MUTCD Part 2. Section 5.6 of Queensland MUTCD Part 2 discusses marking splayed approaches to obstructions with RRPMs, especially where street lighting is below standard or absent. Whilst separators are narrow such that they do not have diagonal or chevron markings on approach, it may be necessary to supplement the outline markings with RRPMs. Care is needed to ensure that designers understand the role outline markings may play in replacing edge line delineation in some situations. Where this occurs on the left side of a general traffic lane (as is usually the case), the correct colour RRPM must be used (left hand edge line vs median island outline).

Table 2.1 – Preferred separation device design attributes

Preferred safety design features	Function	Considerations
Separation kerb	Provides a safe mounting for vertical delineators and a tactile deterrent to vehicle encroachment. To optimise safety outcomes, the preferred separation device must have the following characteristics: • conspicuous through use of contrasting colours and inclusion of fluorescent and retroreflective elements • slip-resistant wet pendulum >65 BPN • semi-mountable on the bicycle side, not incorporating a vertical lip (refer to Transport and Main Roads Standard Drawing 1033); a barrier profile may be appropriate on the motor vehicle side to reduce motor vehicle encroachment • continuous treatments are preferred compared to short sections of discrete devices; they should be sufficiently long that they are legible on approach (for example, install the kerbs on the approach to corner of conflict zone such that they reinforce to motorists the desired travel path in their own lane).	• Breaks in the device should be included to remove a 'debris trap' and overland flow / road drainage should not be significantly affected. • Drainage gaps shall incorporate sloped ends no steeper than 1 in 4 on the leading edge. • Avoid short sections of separation kerb as it may appear unexpectedly to people riding bikes. • Regular monitoring and clearing of debris build-up in the bicycle lane and near the device is required. • The vertical height of the device makes it difficult for vehicles to mount it at reasonable speed and/or comfort and is therefore only suitable where there is no demand for vehicles to cross the device (for example, to access car parking or driveways). • Where access to driveways needs to be maintained, fully-mountable separation kerbs may be used in these sections only (as illustrated in Figure 2.1(b).

Preferred safety design features	Function	Considerations
Vertical delineation device	Improves conspicuity, reduces the likelihood of bicycle wheel strikes and complements the vehicle encroachment deterrent provided by the separation kerb. Improves visibility and raises awareness of the separation kerb to pedestrians crossing the road, reducing the trip and fall risk. Section 4.5.5 of Queensland MUTCD Part 2 does not require delineation of the separators, however, mentions that several signs may be used. The use of signing as delineation on separators is intentionally optional, unless an engineering assessment identifies site-specific need – for this application the relevant needs could include: the likelihood of bicycle wheel strikes, the likelihood of vehicle encroachment, and the likelihood of pedestrian slip, trips and falls on the device.	• These are effective in improving the legibility and visibility of the installed physical separation kerb. • These are very effective in improving safety of people riding bikes. They are more effective when installed with other devices (for example, separation kerb) rather than directly into the road surface. • The height should be the equivalent of a road edge guide post. • The device should be installed at the front face of the treatment and at regular intervals. • Additional / more frequently spaced devices may be required based on site characteristics such as horizontal alignment or where there is a lack of or limited street lighting. • Larger gaps in spacing may be considered where there is a need for vehicles to cross the device. • A disadvantage of this device is the potential for impact damage and associated frequent maintenance / replacement costs.
Pavement marked buffer around the separation kerb	Improves delineation and provides the required offset to vehicles and bicycles from the separation device.	Refer to offset requirements to travel lanes specified in the *Road Planning and Design Manual* and Austroads guides.

Figure 2.1(b) – Example of traversable (mountable) separation for driveway access

2.2 Site design considerations

Site design aspects to be considered when installing bicycle lane separation devices include:

- bicycle lane width and the potential for the device to hinder passing or overtaking within the bicycle lane
- the type of people riding bikes likely to use the bicycle lane:
  - groups or individuals
  - children or adults, and
  - level of experience
- the likelihood of motor vehicle encroachment, especially at:
  - feeder bicycle lanes to advanced storage areas or advanced stop boxes
  - horizontal curves

  - weaving situations, and
  - intersection auxiliary lanes
- traffic volumes and proportion of heavy vehicles / buses
- locations where there is high vehicle or pedestrian demand across / through the bicycle lane:
  - strong desire line of people walking along or across the bicycle lane
  - kerbside bus stops (consider bus frequency)
  - kerbside car parking (consider turnover rates and if it is reconfigurable), and
  - driveways at high vehicle trip generators.

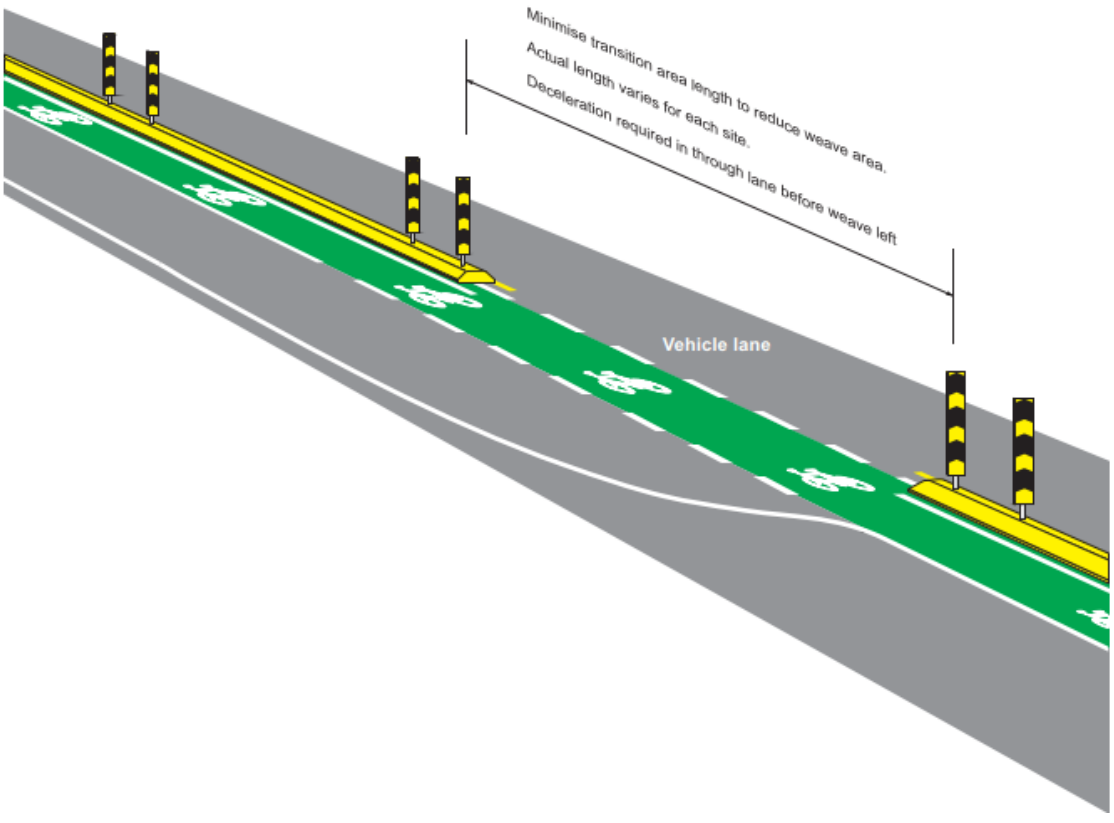
Guidance on these issues can be found in:

- Section 4.8 of Austroads *Guide to Road Design* Part 3, and
- Transport and Main Roads guideline *Selection and Design of Cycle Tracks*.

2.3 Retrofit bicycle lane in a left turn lane

Where a retrofit bicycle lane in a left turn lane treatment is to be installed, it is preferable to install separator kerb along the lane line as illustrated in Figure 2.3 to minimise the road length where vehicles merge with cyclists. Refer to Queensland MUTCD, Q-Series W6 Q05 for more detailed information.

Figure 2.3 Retrofit bicycle lane in a left turn lane – lane separation details



3 Historical applications

Figure 3 – Example of historical concrete barrier kerbs

Use of concrete barrier kerbs or ‘wheel stops’ are common on historical separation treatments, as shown in Figure 3. These treatments are appropriate only if the risk of vehicle encroachment into the bicycle lane is greater than the risk of crashes by people riding bikes and motor vehicles with the device. If used, they must incorporate colour contrast, retroreflection, a pavement marked buffer and vertical delineation devices similar to that detailed in Table 2.1. They must also have a semi-mountable profile facing on the bicycle lane side with ramped ends at the drainage cuts combined with increased width at the entry and distinct delineation on the ends.

4 Background

There is currently limited design guidance, however, on how to best implement these separation treatments and to ensure new hazards are not created for people riding bikes. A number of incidents have been reported (refer to Section 4.1) that emphasise the importance of ensuring separation treatments are not hazards in their own right.

While separation devices increase the lateral separation between people riding bikes and motorists, research confirms that some devices and/or treatments are more effective than others. Some examples of successful implementations of these devices is discussed below.

4.1 Case studies

4.1.1 David Low Way, Bli Bli, North Coast District

Transport and Main Roads’ North Coast District was subject to a personal injury claim in December 2016.

As part of a roundabout construction, a developer installed a small concrete island which was struck by a person riding a bicycle.

The images following show a concrete island separating the bicycle lane from the road. There are 2 gaps in the concrete for driveways accessing David Low Way across the bicycle lane. The last photo in Figure 4.1.1 shows the same treatment at the other legs of the roundabout. This continuous separation treatment design was adjusted due to the driveways on the approach to this leg of the roundabout where the incident occurred.

The smaller concrete island was hit by a person riding a bicycle who was injured, and subsequently made a personal injury claim against Transport and Main Roads. The concrete island has now been removed.

Lessons learnt: Smaller non-continuous sections of separation devices can be hazardous, particularly when installing next to minimum-width bicycle lanes. It is preferable to not install short sections of separation; however, if these are to be installed, further delineation of the potential hazard should be incorporated into the design.

Figure 4.1.1 – David Low Way: Showing concrete islands separating the bicycle lane from the road

Source: Google Street View.

4.1.2 Captain Cook Highway, Cairns, Far North Queensland region

A bicycle lane separation treatment was funded by the *Safer Roads Sooner* program on the Captain Cook Highway in Cairns. It sought to provide a physical separation between people riding bikes and vehicles on a road with high traffic volumes and speeds and a high proportion of heavy vehicles. The business case drew upon a Coroner's findings into a death that had occurred at this location.

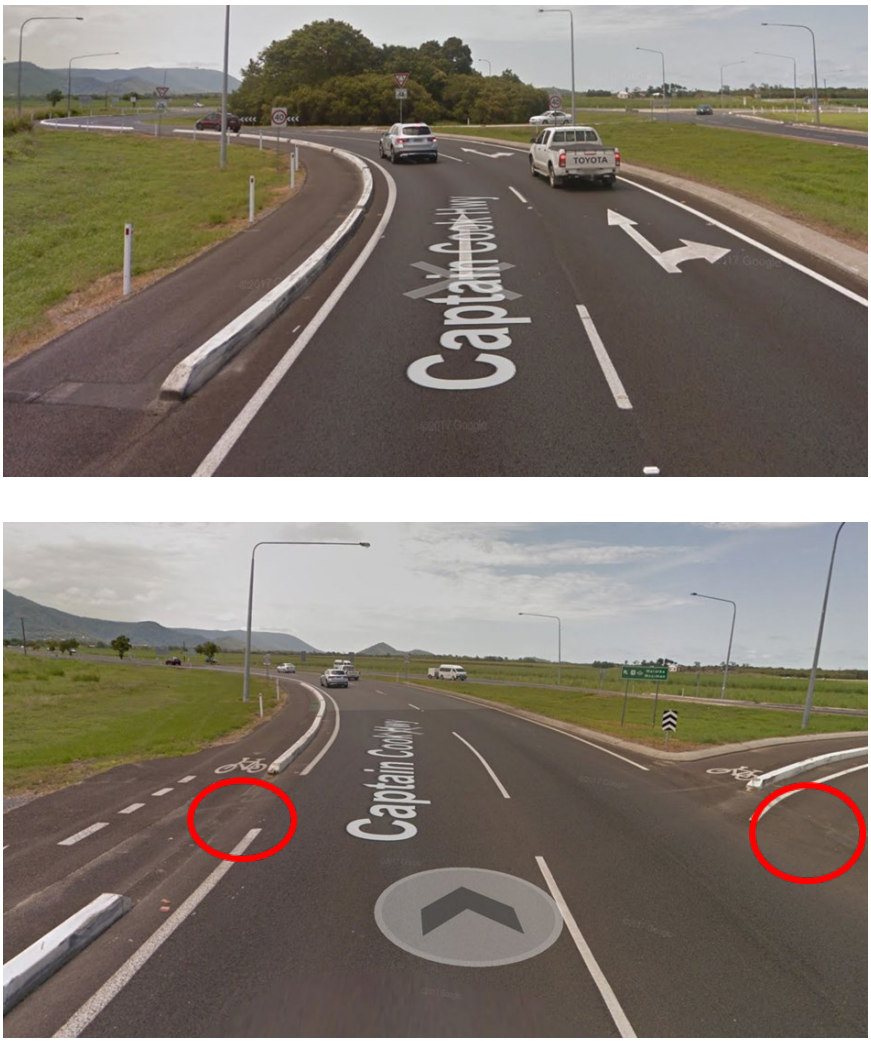
The initial treatment (2009) used a low-height plastic kerb and is shown in Figure 4.1.2(a).

Figure 4.1.2(a) – Captain Cook Highway: 2009 separation treatment (plastic kerb with vertical delineators)

At all locations, and specifically at the Captain Cook Highway, there have been maintenance issues with vehicles striking the kerb (the pinning mechanisms failed on repeated occasions) and the delineator posts were frequently damaged.

Considering the maintenance issues and the need to further discourage heavy vehicles from entering the bicycle lane, the Far North Queensland region submitted a Safer Roads Sooner funding case to replace it with a concrete, back to back barrier kerb, which is still in place (Figure 4.1.2(b)).

Figure 4.1.2(b) – Captain Cook Highway: current separation treatment (concrete kerb)



Design changes included amending the bicycle lane openings to assist in smooth bicycle flow paths and 300 mm vertical delineation devices were installed; however, as per the 2009 project, these were also struck by heavy vehicles' rear wheels and became a maintenance issue (see Figure 4.1.2(b), the circles indicate where the devices were previously installed).

While this has been considerably more effective in achieving the primary goal of preventing vehicles from entering the bicycle lane, there are design elements that could be improved to make it more 'cycle friendly', notably the steep leading edges at the drainage breaks, the entering / exiting alignment, the width at the entry and improved delineation of the end (which would benefit both people riding bikes and drivers).

The challenge at the Captain Cook Highway roundabouts is to keep vehicles out of the bicycle lane but ensure any new risks for people riding bikes are not introduced. The barrier kerb on the traffic side appears to have effectively reduced the 'hit by truck' risk but has introduced other hazards that should be able to be mitigated with some design modifications.

4.1.3 Brisbane City Council examples for other devices and applications (including driveway access control devices)

Brisbane City Council has used this plastic kerb with vertical delineators treatment at the separated cycle facility in George Street (Figure 4.1.3(a)), and Transport and Main Roads has installed it on Gympie Road at Kedron Park Road southbound (Figure 4.1.3(b)).

Figure 4.1.3(a) – George Street, Brisbane (plastic kerb with vertical delineators)

Figure 4.1.3(b) – Gympie Road at Kedron Park Road southbound, Kedron Park (plastic kerb with vertical delineators)

Lessons learnt: The plastic kerb was not suitable for the high traffic and truck volumes (and in particular, the B-double sugarcane hauling trucks) experienced at the Captain Cook Highway roundabouts. A more robust treatment was necessary to keep vehicles out of the bicycle lane. Further improvements could still be considered to reduce risks to people riding bikes by introducing a semi-mountable profile on the side of people riding bikes with ramped ends at the drainage cuts, combined with increased width at the entry and distinct delineation on the ends, colour contrast, retroreflection, and a pavement marked buffer and vertical delineation devices. In addition, a rail / post for people riding bikes could be included to assist people riding bikes checking for turning vehicles from behind at GIVE WAY locations.

4.2 Separation device audit

The following table details separation devices currently in place and the findings of the assessment of their suitability as separation treatments for on-road bicycle lanes. This assessment informed the definition of the preferred bicycle lane separation treatment outlined in Section 2.

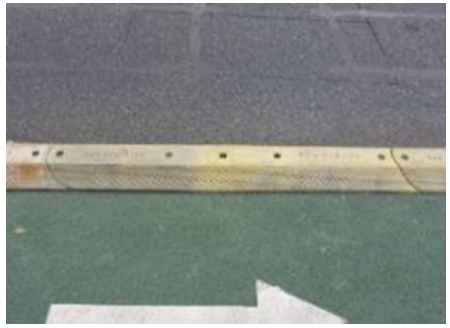
Table 4.2 – Types of separation devices and suitability audit

Device	Examples		Assessment findings
Pavement marked delineator Painted buffer (various line marking arrangement and widths) including bicycle lane safety strips or painted island	 Painted 1 m chevron traffic island with rumble bars (Chinderah Bay Road)	 Painted 2 m chevron traffic island with raised reflective pavement markers (RRPMs) at bend (Bennetts Road)	• Provision of RRPMs also assisted with this improved perception of safety. • Limited effectiveness in reducing vehicle encroachment.

<table>
<tr><th>Device</th><th colspan="2">Examples</th><th>Assessment findings</th></tr>
<tr><td rowspan="2">Discrete high-profile devices
armadillos
wheel stops
half wheels
moulded rubber</td><td> 
Low visibility of older concrete devices</td><td> 
Low abruptness discrete concrete (Helensvale Road)</td><td rowspan="2">Concrete devices were noted as having poor visibility in low light and at night.
All concrete device options, regardless of the angle of the leading and trailing edges, were noted as introducing risk to all road users.
Separation between devices varied but did not appear to reduce or eliminate the build-up of debris compared to continuous installations.
There was a lower perception of comfort when driving or riding next to these treatments. Concrete devices, particularly the leading edges, introduced a risk that may have been more significant than that which was being addressed via the installation.
The device, when installed with treatments to address these issues (that is, vertical delineation devices and pavement marked buffers around separation kerbs), provides improved sense of separation compared to being installed by itself.</td></tr>
<tr><td> 
Rounded discrete rubber (Somerset Drive)</td><td> 
High abruptness discrete concrete (Somerset Drive)</td></tr>
</table>

<table>
<tr><th>Device</th><th colspan="2">Examples</th><th>Assessment findings</th></tr>
<tr>
<td rowspan="3">Discrete low / medium profile separators – tactile delineators
audio tactile line markings (ATLMs)
retroreflective pavement markers
Riley kerb
low profile rumble bars</td>
<td> 
Vehicle encroachment over ATLM (Bennetts Road)</td>
<td> 
Low profile rubber rumble bar with RRPM (Chinderah Bay Road)</td>
<td rowspan="3">Studies found that a significant proportion of vehicles travel over the ATLM devices and into the adjacent bicycle lane.
Typically, the ATLM device is not an effective deterrent for motorists travelling at low speeds (approx. 60 km/h) and does not reinforce or increase separation between vehicles and people riding bikes.
Some versions of rumble bars have a relatively high edge and could potentially destabilise people riding bikes, should they meet the device.
In some instances (for example, low-profile longitudinal humps), the low vertical profile could be almost indistinguishable in look or function to surface paint. These devices may prove ineffective as a deterrent to motorists given the very low profile. Additionally, people riding bikes may not be able to distinguish the device as being slightly raised and may inadvertently ride over it, not expecting there to be a difference in level or surface texture.
Overall, these devices had a limited effect in reducing the number of vehicle encroachments into an adjacent bicycle lane and were not conspicuous enough.</td>
</tr>
<tr>
<td> 
Low profile longitudinal humps (Bridge Street, Mackay)</td>
<td> 
High profile rumble bar (creating a medium profile separator)</td>
</tr>
</table>

<table>
<tr><th>Device</th><th colspan="2">Examples</th><th>Assessment findings</th></tr>
<tr>
<td rowspan="2">Bollard or guide post vertical physical separators
flexible guide posts
lane divider flap
traffic cones
low impact smart bollard
plastic flexible bollards</td>
<td> 
Damaged delineation post (Tweed Valley Way)</td>
<td> 
Plastic bollard device (Grey St)</td>
<td rowspan="2">Guide posts can be prone to regular and major damage depending on their location, proximity to the edge of traffic, and fixing / mounting type. Guide posts installed on top of concrete barriers or as an integrated component of a separation kerb are better alternatives based on consideration of the following:
They appear less prone to initial damage compared to isolated guide post installations.
When damaged, any remnant part of the guide post fixed to the surface (including the mounting plate) will not be located at-grade, itself becoming an unintended hazard for people riding bikes.
When damaged, there appears an improved chance that some parts of the device mount may be contained within the longitudinal separator.
Plastic bollard devices are retrofittable and relatively cheap, short enough to not catch on the handlebars of people riding bikes and are reflective; however, they can be more prone to vandalism and regular damage by collision.</td>
</tr>
<tr>
<td> 
Damaged (leaning) bi-directional guide posts (George Street)</td>
<td> 
Delineation post on top of concrete barrier (Helensvale Road)</td>
</tr>
</table>

<table>
<tr><th>Device</th><th>Examples</th><th>Assessment findings</th></tr>
<tr>
<td>Physical separator kerbs
caterpillar safe cycle kerb (new product and as yet untested)
rubber separation kerb
rubber lane maker
pre-cast concrete</td>
<td> 
Caterpillar kerb
 
Rubber separation kerb (George St)
 
Pre-cast concrete (Maryborough Street – 20+ years old)</td>
<td>The rubber devices were robust and generally did not suffer catastrophic failure. Longer-term issues including UV degradation, device separation and cracking are common within an approximate 4 to 6-year post-installation period, depending on site exposure and traffic characteristics.
The continuous concrete kerb device is very robust; however, as these treatments age, their visibility becomes limited, particularly in low light or darkness. The dimension of the vertical face from the road surface is higher than the rubber device. The profile of the concrete kerb is likely required to reduce edges chipping off. There is the potential for the more significant edge dimension to destabilise people riding bikes if they were involved in an acute collision with the device.
Skid resistance needs to be verified.</td>
</tr>
</table>

Device	Examples		Assessment findings
Safety barriers (>150 mm height) • pre-cast concrete • water filled	 Pre-cast concrete with safety fencing	 Water filled safety barriers	• Concrete barriers >150 mm high are typical installations on higher speed road environments, designed to redirect out-of-control vehicles. In this situation, a higher level of separation is preferable. • The devices are installed as interconnected modules which make them difficult to locate within an existing road cross-section in a retrofit situation. • They are also less likely to conform to medium-high radius turns, given their fixed characteristics. • Water-filled barriers are typical installations in temporary road works situations and are designed to be used as containment fences or as delineation devices. Similar to the pre-cast concrete barriers, these devices are installed as interconnected modules. Their width would make them difficult to locate within an existing road cross-section in a retrofit situation. The devices can be connected to form medium radius curves, unlike concrete barriers. • A smaller form of device with a lower risk profile is preferred for retrofit situations and lower speed and traffic volume situations.

Device	Examples		Assessment findings
Planter boxes • plastic / rubber • pre-cast concrete • raised gardens	 Plastic / rubber planter box	 Pre-cast concrete planter box	• Planter boxes are large non-frangible devices where the mass and scale of the treatment could represent a hazard to motorists and people riding bikes on roads that have posted speed limits of 60 km/h or higher. • The size (width) typical of planter boxes would also make it difficult to locate them within an existing road cross-section in a retrofit situation. • The available research does not specifically reference planter boxes. The research is clear that any form of separation would deliver perceived and objective benefits to / for people riding bikes; therefore, a smaller form of a separation device that has a lower risk profile is preferred. FEMA 430 Section 4.4.2 discusses the use of crash-rated bollards concealed in planters. • Advantages of these treatments is that they are much more aesthetically pleasing and can be preferable when installed as part of an overall streetscaping / greening / calming project for a particular precinct.

5 Further information

For further information on this guideline, please contact:

Transport and Main Roads – Engineering & Technology Branch

Email: CyclePedTech@tmr.qld.gov.au

Appendix A: Physical separation devices product information & acceptance checklist

A1 Introduction

Appendix A contains a checklist to assist in the selection of on-road bicycle lane Physical Separation Devices (PSD), appropriate for use for permanent installations at an on-road bicycle lane to form physical separation between bicycle riders, Personal Mobility Device (PMD) riders and on road vehicles in adjacent traffic lanes.

A2 Governing manuals and associated specifications and guidelines

- Queensland *Manual of Uniform Traffic Control Devices* (MUTCD) Part 9.
- *Queensland Guide to Traffic Management* (QGTM) Part 10.
- Transport and Main Roads guideline *Selections and Design of Cycle Tracks*
- Transport and Main Roads Standard Drawing 1033 *Kerb and Channel – Profiles*.
- Transport and Main Roads Technical Specification MRTS14 *Road Furniture* (Clauses 10.2.2 and 10.2.3).
- Austroads *Guide to Road Design* Part 6A (AGRD06A) Table 5.9.
- Austroads *Guide to Traffic Management* Part 4 (AGTM04), Section 4.6.3, Figure C9-1.

A3 Acceptance of new products as suitable for use in Queensland

This document refers to:

- Kerb physical separators – kerb shaped (refer to Standard Drawing 1033) physical structure, not intended to be traversed by motor vehicles.
- Bollard (vertical delineators) physical separators – rigid or flexible posts (refer to MRTS14 *Road Furniture* Clauses 10.2.2 or 10.2.3), not intended to be traversed by motor vehicles.
- Traversable separators – speed hump shaped (refer to Queensland MUTCD Part 13) physical structure, intended to be traversed by motor vehicles to access driveways or kerbside furniture, kerbside parking bays and kerbside land uses.

Unless specified otherwise, all the attributes specified in this document apply to all these devices.

NOTE: Low profile (<50 mm) tactile delineator or audio tactile type products, (that provide tactile feedback to motor vehicle encroachment and increase offset to the on-road bicycle lane,) are not physical separation devices.

These products are only suitable for use with on-road bicycle lanes that are installed as per AGTM04 Part 4, Section 4.6.3, Figure C9-1. Any installations at higher motor vehicle speed or volume locations require either physical segregation with a verge or the use of an appropriate department approved crash barrier with appropriate bicycle friendly design, as per the department's Accepted Road Safety Barrier Systems and Devices publication. Information on accepted products and suppliers available on the department's Approved products and suppliers webpage.

A4 Physical separation devices product information & acceptance checklist

Complete shaded boxes only.

A4.1 Dimension & shape

Sample of Product Received	Y/N

Dimension	Requirement	Product (mm and R)	Pass
Kerb Length	[No set min & max limits]		Y/N
Kerb Width	[Max 500 mm]		Y/N
Kerb Height	[Min 90 mm, max 150 mm] As per Standard Drawing 1033.		Y/N
Kerb vertical step on bicycle lane side	[Max 20 mm] As per Table 5.9 of AGRD06A.		Y/N
Kerb profile – kerbside parking locations	Semi-mountable or mountable kerb profile on bicycle lane side and barrier kerb profile on parking side, as per Standard Drawing 1033.		Y/N
Kerb profile – kerbside parking prohibited locations (general traffic lane)	Semi-mountable kerb profile on both sides, as per Standard Drawing 1033.		Y/N
Traversable separator profile	Watts design or Flat-top design as per Section 2.4 of Queensland MUTCD Part 13.		Y/N
Traversable separator height	[Min 90 mm, max 150 mm]		Y/N

Traversable separator height	[Min 90 mm, max 150 mm]		Y/N

Bollard	Dimension and shape compliant with MRTS14 (Clauses 10.2.2 or 10.2.3).		Y/N

A4.2 Colour

Product Colour	Variability in product colour to provide luminance contrast specified in AS 1428.4.1 to be achieved against typical road pavements (concrete or asphalt). Conspicuous through use of contrasting colours and inclusion of fluorescent and retroreflective elements. Specify: Embedded (E) or Coating (C).		Y/N

A4.3 Product type

Material type	Major material component and generic classification only (e.g. rubber, plastic, polymer, fibre polymer, metal, ceramic or concrete).		Y/N

Kerb	Provision of non-hazardous mounting for bollards (vertical delineators).		Y/N

Bollard	Compliant with MRTS14 (Clauses 10.2.2 or 10.2.3).		Y/N

A4.4 Surface finish

Kerb and **traversable separator**	Slip-resistant wet pendulum test of >65 SRV (or equivalent >65 BPN) on all traversable and/or potentially traversable surfaces. Testing as per Test Method Q704 in the department's *Materials Testing Manual*. Tested in accordance with AS 4663 linked to the specific product being registered. Tests results confirming the product is in accordance the test is required. If the manufacturing process has changed, a new test is required. Specify if slip resistance is either: Embedded (E) or Coating (C). Product is free of sharp edges, burrs, discolouration or other defects which may affect appearance and/or serviceability.		Y/N

Bollard	Surface finish compliant with MRTS14 (Clauses 10.2.2 or 10.2.3).		Y/N

A4.5 Retro-reflective properties

Requirement	Y/N	Pass
Is the retro-reflective element(s) of the product currently on the department's accepted retro-reflective sheeting products list? If not, then a concurrent application will be required for the retro-reflective sheeting.		Y/N
Have the retroreflective elements of the products been tested for compliance with Table 2.3 of AS/NZS 1906.1?		Y/N
Is the product marked with at least (refer to Clause 2.11 of AS/NZS 1906.1): • the manufactures identification logo or symbol; and • product identification code.		Y/N

A4.6 General

Requirement	Y/N	Pass
Can be securely fastened?		Y/N
AS 3996 load class rating		Y/N
If impacted it shall not leave behind any protruding elements in the pavement or become an impaling hazard and shall not constitute a catch, snare, puncture or destabilisation hazard in a damaged state.		Y/N
Designed to remain stable under reasonably expected conditions: • wind conditions and air turbulence from passing traffic for bollards, .or • motor vehicle traversing for traversable separators (driveways, and so on).		Y/N

A4.7 Additional testing

Requirement	Y/N	Warranty Period	Pass
Is there either: a) a warranty period of ≥ 5 years, or b) an equivalent weathering test results from a NATA approved lab.			Y/N
Minimum guarantee of product durability including UV resistance of 5 years.			Y/N