BIKE LANE DESIGN GUIDELINES

CITY OF MELBOURNE

A CONNECTED CITY

In a connected city, all people and goods can move to, from and within the city efficiently. Catering for growth and safeguarding prosperity will require planning for an efficient and sustainable transport network.

Acknowledgement of Traditional Owners

The City of Melbourne respectfully acknowledges the Traditional Owners of the land, the Boon Wurrung and Woiwurrung (Wurundjeri) people of the Kulin Nation and pays respect to their Elders, past and present.

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1. EXECUTIVE SUMMARY

Bicycle lane designs have been evolving rapidly in recent years, in response to increased participation rates and the realisation that there needs to be increased emphasis on improving the safety and experience of on-road bike riding for cyclists of all capabilities to better meet community needs and expectations, while increasing bicycle use.

When the City of Melbourne first began to implement on-road bicycle treatments in the 1990s there were limited guidelines available. Many of the treatments installed in the early years, are a legacy of the City having been the first to trial such solutions. Those treatments reflect the innovation and experimentation that underpinned the provision of on-road bicycle treatments at that time. Over the last three decades, the City has been involved in pioneering design work by testing a myriad of bicycle lane designs and being at the forefront in the development of various forms of separation between cyclists and other vehicles. The City has had to respond to multiple challenges including limited available road width and the need to cater for all road users within the finite road space that characterises the inner-city environment. The lessons-learnt over this period have provided the foundation for these bike lane design guidelines. The guidelines have also been informed by the findings of a review of existing published national and international bike lane design literature, as well as consultation undertaken with other municipalities across Australia, transport experts and agencies.

There are many details that are part of the design of safe and effective bike lanes. Where kerbside car parking exists, on-road bike lanes can be either placed to the left of parking (adjacent to the footpath) and be fully separated from traffic or they can be placed to right of on-street parking, thereby being adjacent to moving traffic. Features such as buffers can be physical or painted and provide additional offset space from moving traffic or parked cars along a street. These elements raise many design questions and a design guideline is therefore needed to simplify decision-making for planners and engineers. These bike lane guidelines set out the preferred City of Melbourne designs, for both mid-block and intersection situations, under a variety of conditions that take into account road geometry, the riding environment and usage conditions.

The guidelines cover the following on-road bike facilities:

1. **Kerbside Physically Separate**
2. **Double Chevron**
3. **Single Chevron on Parking Side of Bike Lane**
4. **Single Chevron on Traffic Side of Bike Lane**
5. **Simple Bike Lane**
6. **Shared Traffic-Bike Lane**
7. **Six alternate intersection treatments** (covering physically separated bike lanes/separation through traffic signal phasing/roundabouts)

2. ROLE OF THE GUIDELINES

Priority: Making Cycling Safer & More Attractive

Recent City of Melbourne research (report titled *'Bicycle User Confidence Study 2017'*) shows that physically separated bicycle lanes (those provided between the footpath and parked vehicles) offer higher levels of user confidence for cyclists. The proportion of people who are 'confident to ride' increases from 22% when a standard bike lane is provided (compared with conditions where there are no bike facilities) to as much as 83% if physical separation is installed. A broader review of national and international best practice has revealed key preferences in providing for on-road cycling, including:

- Full physical separation is preferred between cyclists and other road users to optimise cyclist safety. The separation is particularly relevant on busy arterial and connector roads and other environments where operating speeds are in excess of 30-40 kilometres per hour (km/h). However, at some busy locations, the provision of physical separation raises the issue of managing pedestrian movements – particularly associated with parking and delivery access.
- Extra effort is required to attract more people to take up cycling on a regular basis. It is important to make cycling more attractive for people of all levels and ages by eliminating risk and fear of collisions with vehicles.
- New solutions are needed to improve protection and priority for cyclists at intersections; specifically, to provide cyclists of all abilities the confidence of 'knowing-what-to-do' and 'where-to-go' safely and intuitively. Intersections are viewed as critical 'pinch points' for cyclists and it is important to implement treatments that increase cyclists' comfort in navigating them. In summary, it is necessary to reduce uncertainty and ambiguity at intersections by reinforcing priority for bicycles and making it visible.
- Local streets should be designed so that cyclists dominate visually and motorised traffic is tolerated as a guest. There is a need to develop designs and supporting traffic regulations / legislation that enable the implementation of bicycle priority street designs.

The preparation of these guidelines will assist the City of Melbourne in delivering bike facility designs that directly address the above aspirations.

3. DECISION SUPPORT TOOL FOR BIKE FACILITY SELECTION

In the City of Melbourne on-road bike lanes are located on both arterial roads as well as a wide range of local/collector streets. The arterial roads typically have multiple traffic lanes with comparatively high traffic volumes and speeds. Currently, bike facilities on many arterials provide little, if any, physical separation. Such facilities are not appropriate for cyclists with only basic competence levels, who often seek alternative routes away from arterials. However, the availability of an alternative route rarely eliminates the need for improved bike lane provision on arterial roads, as these often provide the most direct and convenient routes. Therefore, to attract less confident and inexperienced cyclists to arterial roads requires more effective mid-block separation and better protection at intersections.

However, the choice to provide one cycling facility type over another, such as a separated versus non-separated facility, needs to respond to the unique set of site characteristics that will exist for each design situation. The final decision cannot be fully obtained through the use of guidelines and the choice of a specific bike facility type will always be the responsibility of the designer. No guideline, warrant, or other selection tool can fully substitute for the experience and judgement of a qualified designer. For designers to properly exercise their judgement, any facility type selection tool must also be complemented by supplementary technical guidance – such as that presented in this report, which is specific for the conditions that are relevant in the City of Melbourne and for the six bike facility options under consideration.

Within this context, a 'Decision Support Tool for Bike Facility Selection' has been developed to enable initial determination of a suitable bike facility type – that responds to traffic volume, road geometry and operating speed characteristics. The 'tool' applies to urban bike lane facilities in the City of Melbourne and is intended as an aid during the planning process to provide a consistent basis for making decisions about appropriate mid-block treatments. However, the 'tool' does not specifically address intersection treatment options – which are covered separately in these guidelines.

The 'Decision Support Tool' shown at Table 1 provides guidance on the selection of a range of on-road bike facilities that could be deployed within a City of Melbourne context. It takes into consideration the available roadway width as well as traffic volumes and operating speed (85th percentile) allowing designers to identify a preferred type of cycling facility with relative ease. Designers will also need to take into consideration other site-specific characteristics when choosing the type of cycling facility appropriate for a given environment. Such characteristics include the number of cyclists using a route (or likely to be attracted to it), parking turnover, traffic capacity/congestion, road gradient, conflicts between cyclists / turning vehicles and vehicle types (particularly the presence of commercial vehicles). Ultimately, in making a final choice for the type of bicycle facility that may be appropriate at a given location, designers must also apply their own experience, skill and judgement to the particular issues under consideration – as well as take into account any practical budgetary constraints.

In all cases, the first preference is to achieve kerbside physically separated bike lanes. A second preference is the installation of double chevron treatments or, possibly, a shared Traffic-Bike Lane (created through the use of sharrows). Typically, the shared traffic-bike lane option would only apply where bike volumes are very high and vehicle volumes, speeds and queues are very low. The single chevron bike lane designs and the standard bike lane should only be considered in situations where insufficient road width is available for either the kerbside physically separated or double chevron designs and where a shared traffic-bike lane is not suitable.

Table 1: Decision Support Tool for Bike Facility Selection

BIKE FACILITY OPTION	ACTUAL MOTOR VEHICLE OPERATING SPEED 85TH PERCENTILE KM/H	ROAD WIDTH CONSIDERATIONS IN A SINGLE DIRECTION	MAXIMUM TRAFFIC VOLUME IN A SINGLE DIRECTION
Preferred Bike Facilities			
Kerbside Physically Separated (The first treatment to be considered)	Preferred treatment for all streets that have greater than 25 km/h	Minimum 4.9 metres (no parking) Minimum 7.8 metres (with parking)	More than 5,000 vehicles per day More than 500 vehicles per hour
Double Chevron	Best suited for streets below 50 km/h	Minimum 7.4 metres	5,000 vehicles per day or 400-500 vehicles per hour
Shared Traffic-Bike Lane	Preferred treatment for streets with speeds below 25 km/h, low volumes and queues	Generally, less than 7.4 metres (with parking) & suitable low traffic conditions	2,000 vehicles per day or 180 vehicles per hour
Less Desirable Bike Facilities: Should only be considered in situations where insufficient road width or traffic speeds/volumes prevents installation of above treatments			
Single Chevron on Parking Side of Bike Lane	Best suited for streets below 40 km/h	Minimum 7 metres	3,000 vehicles per day or 180-300 vehicles per hour
Single Chevron on Traffic Side of Bike Lane	Best suited for streets below 40 km/h	Minimum 6.8 metres	4,000 vehicles per day or 300-400 vehicles per hour
Simple Bike Lane	For consideration only up to 30 km/h	Minimum 6.4 metres (with parking)	2,500 vehicles per day or 180-240 vehicles per hour

4. CRASH ANALYSIS

The emerging preference to provide greater physical separation between cyclists and other road users, raises the matter of how effective physical separation can be in reducing cyclist crashes. Accordingly, a preliminary crash history assessment has been undertaken of both kerbside separated bike lanes and double chevron painted bike lanes (within the City of Melbourne). The 'before and after' findings are summarised in Table 2. The change in crash rate is calculated using data starting 5 years prior to the bike lane installation with the post period installation ending in December 2018. It is weighted by street segment lengths and change in bike volume. The assessment is only intended to provide an initial insight into the crash performance of each treatment separately. It is not comparing their respective merits and relative crash-reduction potential. In this regard, it is relevant to note that the treatments have been installed in different road environments and have attracted different levels of cycling activity.

In the absence of an identical baseline, the changes in 'cyclist crash rates' shown in Table 2 should only be interpreted separately for each bike lane treatment. The table reveals that both the double chevron bike lanes and kerbside separated bike lanes achieved significant crash rate reductions on roads with flat or uphill gradients. However, on steep downhill gradients there were increases in crash rates, particularly evident for the kerbside separated bike lanes (likely associated with numerous vehicle access points abutting these steep sections). Crash analysis was undertaken on the following street segments.

Table 2: Change in cyclist crash rate (%) by slope after lane installation

	FLAT, UPHILL OR GENTLE TO MODERATE DOWNHILL	VERY STEEP DOWNHILL[#] (SLOPE ≥ 7%)
Kerbside Separated	-41%	186%
Double Chevron*	-30%	6%

[#] May include immediately adjacent downhill segments of lesser slope, or immediately adjacent uphill segments with gentle slope (in direction of traffic flow).

* These results may be distorted by the very low number of crashes on flat / uphill segments, small sample size for very steep downhill segments which have not included busy city streets with off-street car parking conflicts and short data collection periods (due to recent installation dates).

It is not suggested that kerbside separated bike lanes should not be used on steep downhill sections. However, there is a need to find solutions which address the significant crash history associated with motorists turning across steep downhill bike lanes to/from off-street car parks.

Kerbside separated

- Swanston Street
  (Victoria Street to Grattan Street)
- La Trobe St
  (Spencer Street to Victoria Street)
- St Kilda Road (southbound)
  (Princes Bridge to Linlithgow Avenue)
- Elizabeth Street
  (Queensberry Street to Pelham Street)
- Elizabeth Street (northbound)
  (Victoria Street to Queensberry Street)
- Albert Street (eastbound)
  (Gisborne Street to Hoddle Street)
- Albert Street (westbound)
  (Powlett Street to Gisborne Street)
- Albert Street
  (Gisborne Street to Nicholson Street)

Chevron separated

- Clarendon Street
  (Wellington Parade to Victoria Parade)
- Swanston Street
  (Elgin Street to College Crescent)
- William Street
  (La Trobe Street to Franklin Street)
- Victoria Street
  (Peel Street to Errol Street)
- Cardigan Street
  (Victoria Street to Faraday Street)
- Commercial Road
  (Punt Road to St Kilda Road)
- Elizabeth Street (southbound)
  (Queensberry Street to Victoria Street)
- Albert Street (westbound)
  (Hoddle Street to Powlett Street)

5. DESIGN ENVELOPE

While it is not possible to identify all design situations in these guidelines, an appreciation of the basic geometric parameters applicable to cyclists as well as consideration of the cyclist operating envelope will assist in delivering appropriate designs for all components of bike lane facilities. Cyclist envelopes have been developed by Austroads and other agencies and been in use for many years. Figure 1 is an example of an Austroads envelope that provides minimum cyclist space requirements to aid designers. The 1.0-metre width of the Austroads envelope allows for the width of a bicycle and for some relatively minor variation in tracking. However, Austroads recognises that not all bicycle riders can steer a straight line and, when riding uphill, experienced riders work the bicycle from side to side while inexperienced riders may wobble.

To allow for these characteristics, Austroads suggests that the 1.0-metre envelope width should be increased to 1.5 metres.

Recent evidence from the USA and the UK indicates the preference by many of their transport agencies for adoption of a 1.5-metre cyclist envelope. A space envelope of 1.5 metres includes these elements:

- The static width occupied by the bicycle and rider when stationary – around 0.75 metres
- The dynamic width, which considers the fact that cyclists in motion deviate from a straight line, especially at low speeds. The dynamic width will vary with speeds: (a) above around 11 km/h, the amount of deviation is around 0.2 metres; and (b) at 5 km/h, the deviation is typically 0.8 metres.

A designer needs to ensure that in any given design, the dynamic width recognises:

- The essential manoeuvring space that allows for the balancing and related weaving required to keep a bicycle upright and moving forward – this accounts for the side-to-side 'wobbling' by cyclists
- The comfortable lateral clearance from obstacles to provide a buffer to kerbs, physical separators, posts and other obstacles
- The vertical 'pedal strike zone' – an additional clearance factor to protect cyclists riding close to a kerb or separator from striking a pedal on top of that kerb or separator and cause a crash.

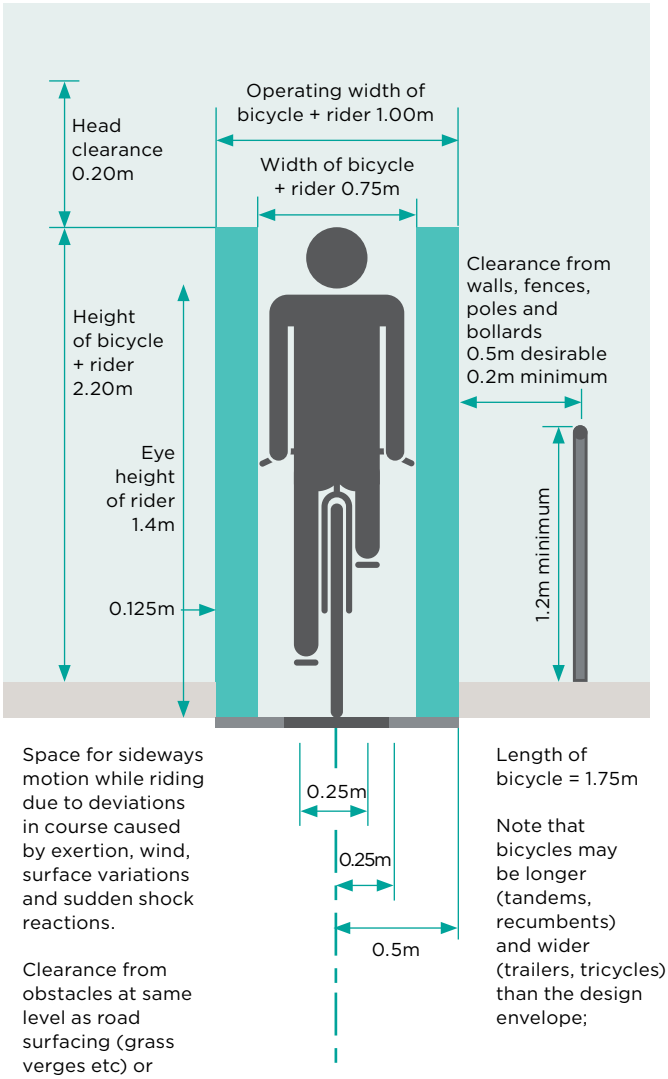


Figure 1: Cyclist Envelope

6. SELECTION OF MID-BLOCK ALTERNATIVES

Sections 7 to 12 of these guidelines discuss six potential mid-block bike facility design alternatives. The City will always consider, as the preferred first alternative, the installation of 'kerbside physically separated' bike lanes. In specific circumstances, 'double chevron' or 'shared traffic-bike lane ' treatments may also be suitable. Specifically, wherever sufficient road space is available (having regard for the geometric requirements for different bike facility designs, as outlined in these guidelines) a designer should only have the choice of using the following three options:

- Kerbside physically separated bike lanes – the preferred alternative, expected to be applied at the majority of locations.
- Double chevron painted bike lanes – it is expected that this option may apply in limited circumstances as follows:
  - some steep downhill streets;
  - where funding is inadequate; or
  - where parking turnover and traffic queues are low, such as local residential streets
- Shared traffic-bike lane (created through the use of sharrows) – typically this option may apply where bike volumes are very high and vehicle volumes, speeds and queues are very low.

The remaining alternatives, including 'single chevron' bike lanes (either on the parking or traffic side) and 'simple' bike lanes, should only be installed when there are significant space limitations and where the street is not suitable for conversion to a shared traffic-bike lane.

7. KERBSIDE PHYSICALLY SEPARATED

Kerbside physically separated treatments involve the provision of bike lanes between the kerb and parked vehicles. They have been used for many years around the world and are increasingly becoming a preferred treatment in many Australian cities.

The full physical separation from moving traffic provides the safest riding environment for cyclists. Kerbside physically separated bike lanes also offer the virtual elimination of 'car dooring' risks (depending on the separator design adopted between the bike lane and the parking on its right side).

The ability to implement 'full separation' treatments is often constrained by the practical costs of implementation and other considerations with respect to property access and management of pedestrian movements associated with on-street parking / deliveries / servicing. There have been issues with respect to the management of conflict between cyclists and other road users, particularly in areas where there are numerous driveways, laneways and small streets intersecting the bike lane.
In these circumstances, reciprocal visibility can be affected (due to parked vehicles) and there can be significant crash potential between cyclists and motorists moving across the bike lane – particularly where cyclist speeds are comparatively high (downhill sections).

Caution should be exercised when considering kerbside physically separated treatments in areas that are characterised by a high frequency of vehicle movements across the bike lane into driveways, laneways or side streets. In these circumstances, designers may need to consider the adoption of 'double chevron' bike lane options – which provide for improved reciprocal driver-cyclist visibility.

Existing use in the City of Melbourne

In the City of Melbourne, the extent of kerbside physically separated bike lane treatments is limited, as a proportion of the entire bike network. They have already been installed in Swanston Street and La Trobe Street as well as, over much shorter distances in a few other streets. In these locations, the width adopted for the bike lane varies between 1.8 metres to 2.2 metres. The separation from parking lanes has typically been in the form of a 1.0-metre wide physical island.

Kerbside physically separated bike lanes appear to have achieved greater safety and comfort for many bike riders – though, anecdotally, these treatments have largely attracted experienced and confident riders and failed to attract a significant number of inexperienced and novice riders, particularly the young and elderly riders. Their limited attractiveness for 'less experienced' cyclists is possibly a reflection of their location on busy commuter routes and, potentially, a feeling of vulnerability by some of those riders who may not be comfortable sharing a confined and comparatively narrow space with fast moving commuters.

Accordingly, the future application of kerbside physically separated bike lanes needs to take into consideration the circumstances when it may be appropriate to implement bike lanes that are wider than 2.2 metres. Wider lanes would be useful on existing busy routes, as well as any route where significant growth is anticipated in the number of cyclists. In addition, a key objective is to attract cyclists of all abilities to ride on fully protected bike lanes. Therefore, on such routes where there is a desire to attract less-confident and less-experienced bike riders, it may be appropriate to explore wider bike lane widths to provide greater comfort and manoeuvring space – thereby increasing the willingness of novice riders to ride and mix with streams of experienced riders.

Design Considerations

Kerbside separated bike lanes are the preferred bike lane design in the City of Melbourne. Accordingly, detailed guidelines have been prepared to cover a wide range of likely design situations and enable the widest possible implementation of those physically separated bike facilities. Tables of suggested dimensions for the design elements of kerb separated bike lanes (under a range of road width scenarios) are provided in Appendix A. The tables cover situations where the adjacent traffic lanes are either unconstrained (to their right side) or with kerb constraints (barrier or semi-mountable).

A summary of the range of suggested dimensions for each of the four road environments under consideration is shown in Table 3. The range of dimensions that could be applied is also shown in Figure 2. An alternate option with a wide physical separator island (applicable for short distances) for areas of high pedestrian activity is shown in Figure 3.

Table 3: Summary of Dimensions for Various Design Elements of Kerbside Physically Separated Bike Lane

ENVIRONMENT TYPE	DIMENSIONS FOR VARIOUS DESIGN ELEMENTS OF KERBSIDE PHYSICALLY SEPARATED BIKE LANE (METRES)			
	BIKE LANE	PHYSICAL SEPARATOR ISLAND	PARKING LANE	TRAFFIC LANE
Without a physical kerb on the right side of the adjacent traffic lane	1.8 to 3.0 typical (up to 4.0 in high volume areas)	0.8 to 1.0 typical (up to 2.0 in frequent use areas)	2.2	2.9 to 3.0
With a barrier kerb on the right side of the adjacent traffic lane	1.8 to 3.0 typical (up to 4.0 in high volume areas)	0.8 to 1.0 typical (up to 2.0 in frequent use areas)	2.2	3.6
With a semi-mountable kerb on the right side of the adjacent traffic lane	1.8 to 3.0 typical (up to 4.0 in high volume areas)	0.8 to 1.0 typical (up to 2.0 in frequent use areas)	2.2	3.2 to 3.5
Without on-street parking	1.8 to 3.0 typical (up to 4.0 in high volume areas or may be reduced to 1.0 for short distances on intersection approaches)	0.3	Not Applicable	2.8 to 3.0

Notes:

1. A bike lane width in excess of 3.0 metres to be considered on routes with existing high demand and/or significant anticipated growth.
2. In areas of high parking and/or pedestrian activity, such as high-volume set-down/pick-up zones, bus stops and/or areas where there is frequent use by disabled motorists, consideration may be given to increasing the width of the physical separator island to 2.0 metres.
3. Increased separator island width may be achieved by localised reduction of the kerbside bike lane to 1.2 metres which would encourage lower cyclist speeds and discourage overtaking in the vicinity of the high pedestrian activity area.

The photograph is used for illustration purposes only. The actual treatment may be applied to different street cross sections, including undivided two-way streets, one-way streets, divided streets and streets with trams. The range of dimensions provided below covers those multiple potential applications.

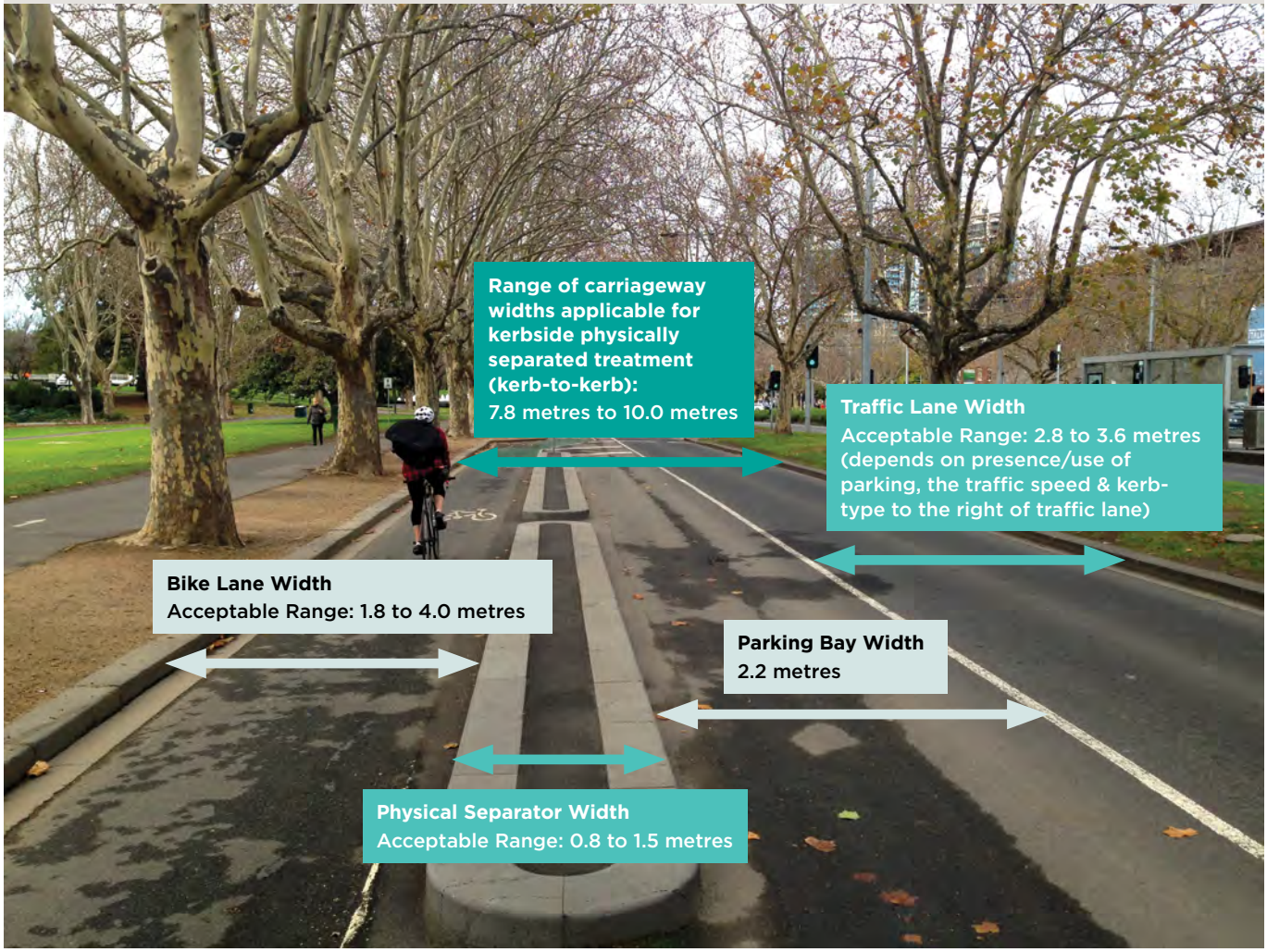


Figure 2: Kerbside Physically Separated Bike Lane Treatment in St Kilda Road, Melbourne – Range of Dimensions for Possible Adoption

The photograph is used for illustration purposes only. The actual treatment may be applied to different street cross sections, including undivided two-way streets, one-way streets, divided streets and streets with trams. The range of dimensions provided below covers those multiple potential applications.

Alternate Option with Localised Wide Physical Separator

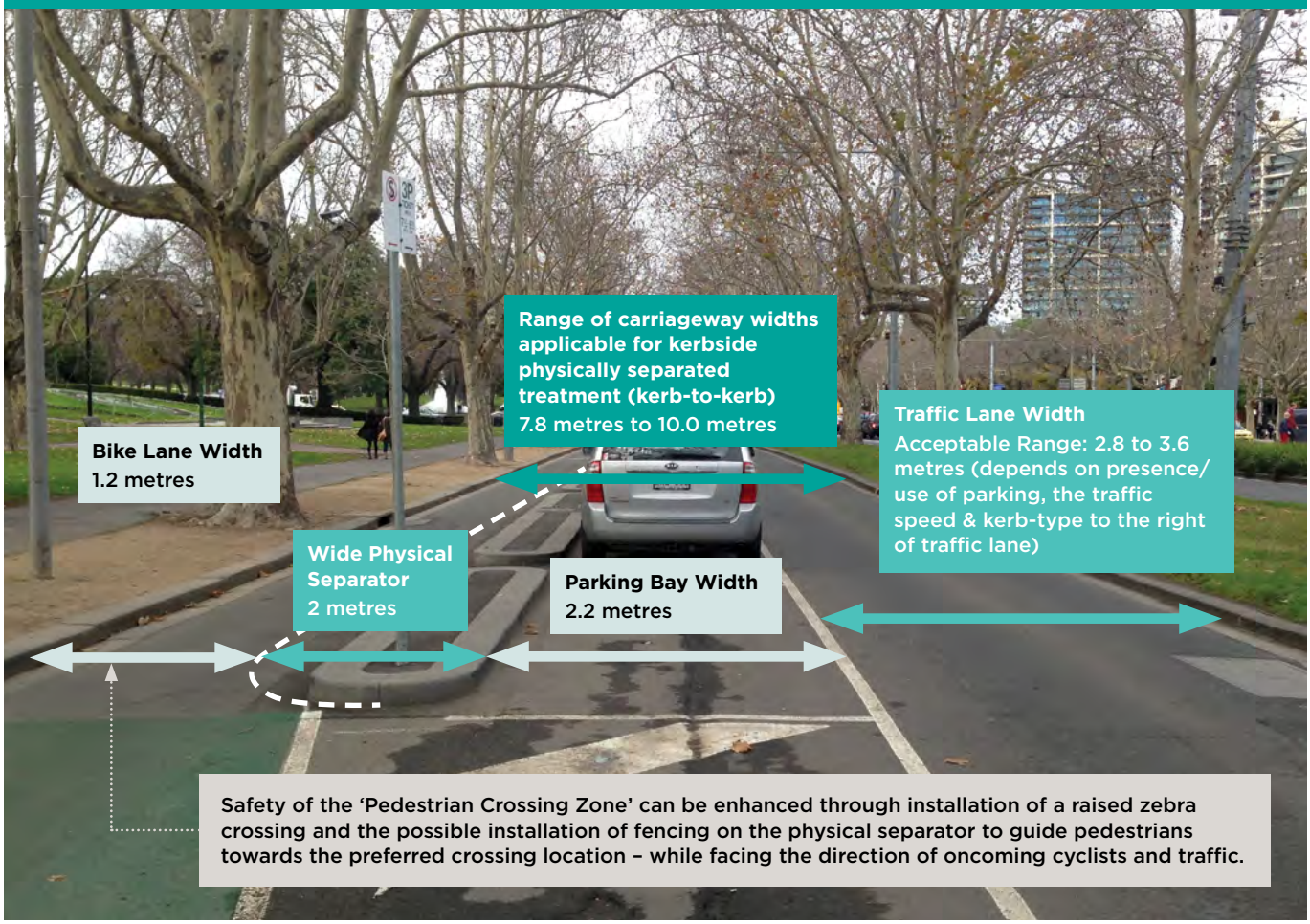


Figure 3: Kerbside Physically Separated Bike Lane Treatment in St Kilda Road, Melbourne – Alternate Dimensions with Wider Physical Separator

7.1 Materials and Cost Mitigation

When constructing physical separator islands, the City of Melbourne has historically used:

- Bluestone kerbing when bike lanes are located within the Hoddle Grid precinct and along some prominent boulevards. This is intended to match the bluestone kerb and channel (e.g. La Trobe Street and St Kilda Road southbound); and
- Pre-cast concreate kerbing (exposed aggregate) when bike lanes are located outside the Hoddle Grid precinct (e.g. Albert Street and Elizabeth Street North).

The cost of these treatments is significant and it is suggested that alternate materials and treatments could be considered in order to improve the timelines of the installation of kerbside separated bike lanes being rolled out across the municipality in order to provide a more comprehensive and safe network which encourages more people to cycle.

The table below summarises the indicative cost of various materials which could be used to construct a kerbside physically separated bike lane. The estimated cost comparison was undertaken on the recently installed kerbside bike lane in Albert Street, between Gisborne and Nicholson Streets, which used pre-cast concrete kerbs. As such, all other kerbing options have been indexed against the pre-cast concrete kerb option. The costs include all project management, traffic management and construction costs associated with the City of Melbourne's standard contractor.

MATERIAL	INDEX: APPROXIMATE COST TO CONSTRUCT KERBSIDE SEPARATED BIKE LANE
Bluestone Kerbing and asphalt infill	1.35
Pre-cast concrete Kerbing and asphalt infill	**1.00**
Cast in-situ concrete Kerbing and asphalt infill	0.80
Concrete spike-down kerbing: (ie: Swanston St North installed in 2007)	0.60 - 0.70
Rubber kerbing with rubber infill	0.60

The above table indicates that the use of rubber kerbing with rubber infill would enable more than twice as many kerbside separated bike lanes to be constructed in comparison to a scenario where only a bluestone kerbing profile was installed.

The photo to the top right illustrates a potential profile of the rubber kerbing separator islands. The rubber infill could be coloured to be similar to the existing asphalt infills used on existing separator islands.

These rubber treatments are durable enough to last for up to 10 years and could ultimately be upgraded in the future when funds are available.

Alternatively, spike-down concrete kerbing treatments could be prioritised in order to provide a treatment at a significantly lower cost than the bluestone or pre-cast concrete options.

In addition to considering the use of alternative kerbing materials, the following design alternatives could be considered to improve cost efficiency associated with the future roll-out of kerbside separated bike lanes.

Example of rubber kerbing with rubber infill

Recommended Alternate Treatment:
Short sections of physical islands:

- This could involve the installation of 2 metre long sections of separator islands which would enable parking signs/posts to be installed, while visually informing all road users of the bike lane's width and layout.
- Extensive gaps, in the order of 10-15 metres, could be provided between the islands and would be painted with chevron line marking to highlight the edge of the parking bays and bike lane to all road users.
- This design would significantly reduce the quantity of kerbing and infill to be constructed in order to significantly reduce costs by 60-80 percent in comparison to existing designs which have been constructed with long islands and short gaps.
- This style of design would be most suitable on streets where peak period Clearways are not provided and where parking bay widths are generous (ie: at least 2.4m wide). On streets where Clearways do exist, the long gaps in the separator islands would lead to taxis and other motorists advantageously illegally parking in the bike lane to avoid blocking the traffic lanes when attempting to park for short periods of time. This illegal parking commonly occurs along the majority of Albert Street where the separator islands are purely chevron painted treatments.

Less Desirable Option: Chevron painted separator islands with 300mm wide plastic kerbs:

- This treatment has been trialled on a short section of Albert Street, adjacent to an area providing all-day ticket parking spaces. These spaces are generally occupied by local workers driving single occupancy cars and therefore do not require passengers to exit on the bike lane side.
- The use of this treatment in other streets which experience higher parking turnover rates and vehicles occupancy rates could lead to potential safety issues, particularly when used by delivery drivers, children, parents with prams, disabled passengers who will have a narrower and less protected flat area to manoeuvre within between the parking lane and the bike lane.
- The narrow 300mm wide separator kerb adjacent to the parking lane may also act as a potential trip hazard for passengers alighting from vehicles.
- Therefore, these treatments would likely only be recommended in streets which provide all-day parking or have excessive width which enables the establishment of wide parking bays or wide painted separator islands between the parking lane and bike lane.

Less Desirable Option: Continuous chevron painted separator islands with flex bollards (e.g: majority of Albert St):

- This treatment is generally considered undesirable for future roll-out due to on-going complaints and maintenance issues associated with damage to the flex bollards and significant complaints from the community about the poor visual aesthetic of the design which requires the installation of vertical bollards at regular spacing.
- Albert Street's peak period Clearways also leads to common occurrences of deliberate or ignorant illegal parking behaviour by motorists who park within the bike lane to avoid blocking the traffic lane. While most of these issues would not occur on streets where full-time parking is provided, some of these illegal parking behaviours would still prevail.

The use of alternate kerbing materials and modifying the existing lengths and spacing of physical islands when designing kerbside separated bike lanes in order to reduce the cost of each project should be considered when applying these guidelines. This would enable an increased roll-out of this form of bike lane facility across the municipality.

8. DOUBLE CHEVRON

Overview

The use of double chevron treatments simultaneously addresses two key safety issues for bike riders – by providing appropriate levels of separation between cyclists and parked cars as well as moving traffic. The difficult riding conditions that are often encountered by cyclists when riding in the narrow space between parked vehicles and moving traffic is responsible for many crashes and near misses.

Whether there is a marked bike lane or not, there are many reasons why a cyclist may need to move into the adjacent traffic lane – where drivers don't necessarily expect cyclists, particularly if there is a simple bike lane in place. Factors that push cyclists into the traffic lane (which do not necessarily affect car drivers) include road surface conditions or debris on the road. Double chevron treatments can significantly reduce unexpected conflicts between bikes and motor vehicles.

Existing Use in the City of Melbourne

There are several instances where double chevron treatments have been used in the City of Melbourne. This design has been adopted in preference to kerbside separated bike lane treatments where budgetary constraints existed or on roads with any combination of the following:

- low parking turnover steep downhill gradients
- high vehicle volumes turning across the bike lane to access off-street carparks or laneways
- low levels of traffic queues extending back from intersections

Design Considerations

Double chevron bike lanes are the second preferred option in the City of Melbourne after kerbside physically separated bike lanes. Table 4 provides guidance on the circumstances appropriate for installation of a double chevron bike lane treatment.

Table 4: Double Chevron Bike Lane – Key Considerations & Guidance

CONSIDERATIONS	GUIDANCE
Where to install double chevron bike lanes	This design option may be pursued where constraints prevent or complicate the installation of kerbside physically separated bike lanes. These constraints include heritage overlays in the planning scheme (which may not allow removal or modification to existing street features such as wide bluestone pitcher channels) or budgetary considerations. Best suited to streets with low parking turnover and short traffic queues at intersections. May be combined with kerbside physically separated bike lanes on the approach to intersections to separate and prioritise cyclists at locations where traffic queues are an issue. More cost-effective treatment than kerbside physically separated bike lanes. More intuitive treatment for all road users because parking is maintained directly adjacent to the footpath and can be accessed more easily by pedestrians (e.g. local residents and visitors to area). Installation of building construction zones within the kerbside parking lane (adjacent to the site) do not require the relocation or significant re-design of the bike lane. Maintains option for future transition to a 'shared traffic-bike lane ' street if bike volumes increase and traffic volumes/speeds reduce.
Cyclist Volume	Generally appropriate for cyclist volumes up to 120 cyclists per hour per direction. Greater cyclist volumes require wider lanes which may be vulnerable to traffic use.
Traffic Volume & Composition	Should not exceed 480 vehicles per hour per direction. However, short queue lengths are more critical to ensure queued vehicles do not extend back from intersections and obstruct the bike lane. The street should also preferably have low volumes of commercial vehicles, because large trucks can intimidate less confident cyclists and commercial vehicles often undertake higher levels of parking manoeuvres which obstruct cyclists.
Geometry	Double chevron bike lane can be delivered with a wide range of dimensions that respond to changing road widths, vehicle speeds and environments. Table 5 provides a summary of the potential variation in key design parameters.
Speed	Street should preferably be characterised by a speed environment with 85th percentile vehicle operating speeds of less than 40 km/h in each direction. Operating speeds of up to 50 km/h may be considered in exceptionally favourable circumstances (excellent reciprocal visibility, straight/flat alignments, generous chevron separator width).

Figure 4 is an example of a double chevron treatment that was installed in Clarendon Street, East Melbourne. The speed limit on this street is 50km/h. The traffic lane width is 2.9 metres. It is now considered that the width of traffic lanes can be reduced on straight road alignment. Table 5 summarises the dimensions that may apply to double chevron bike lanes and the adjacent traffic lanes under various speed limit conditions. The range of dimensions that could be applied is also shown in Figure 5.

Decisions to increase bike lane and/or chevron dimensions will be dictated by the number of cyclists using a route and the nature of adjacent parking manoeuvres as well as the traffic characteristics in the adjacent traffic lane. Justification to increase the bike lane width up to 4.0 metres will exist on routes with existing high demand and/or significant anticipated growth.

Where the adopted bike lane width is in excess of 2.0 metres, consideration must be given to the incorporation of appropriate traffic management treatments to prevent vehicles using the bike lane as a traffic lane.

When space is insufficient for double chevron installations and treatment is limited to single chevron separation, it is important to determine whether to provide separation from parked cars or moving traffic. This aspect is discussed in more detail in the sections that follow.

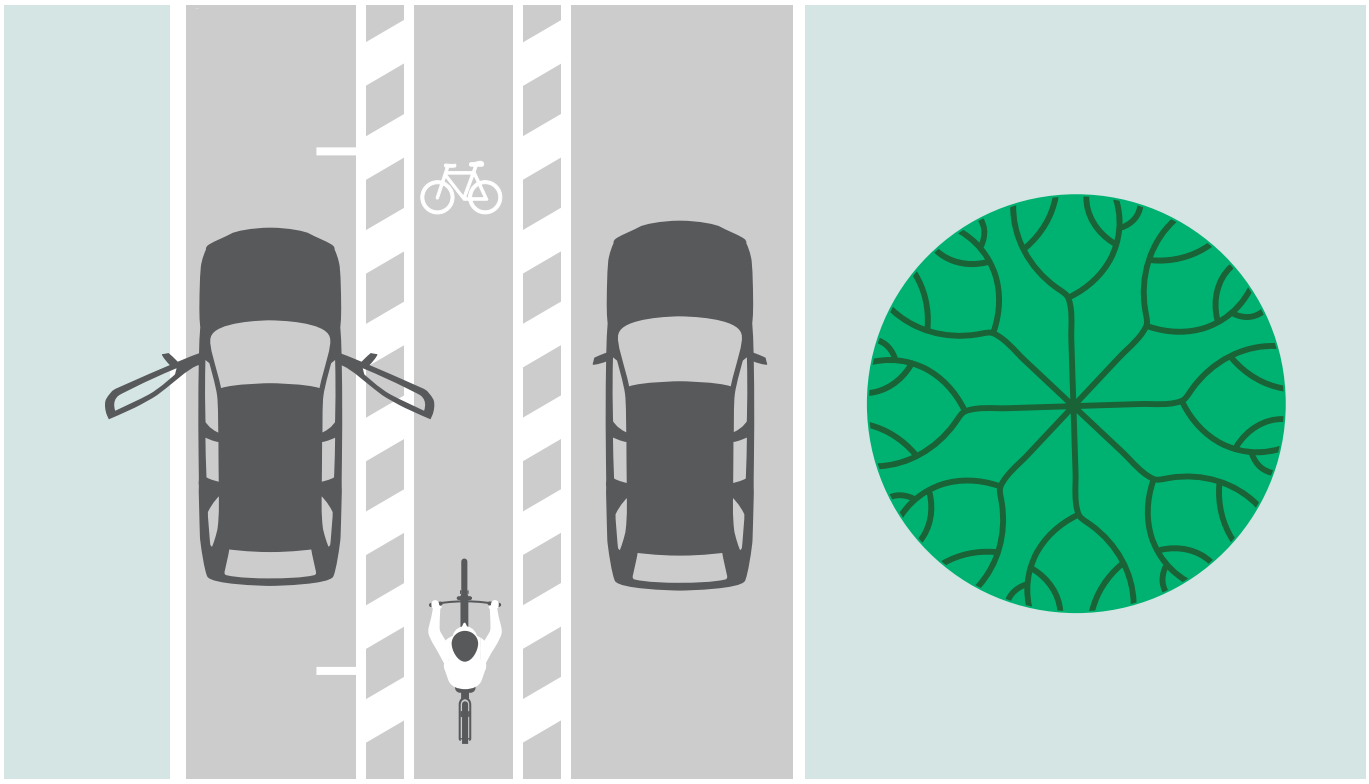


Figure 4: Example of Double Chevron Treatment

Table 5: Summary of Dimensions for Various Design Elements of Double Chevron Bike Lane

ENVIRONMENT TYPE	DIMENSIONS FOR DESIGN ELEMENTS OF DOUBLE CHEVRON BIKE LANE (METRES)			
	BIKE LANE	CHEVRON	PARKING LANE	TRAFFIC LANE
40km/h speed limit	1.5 to 4.0	0.6 to 1.2	2.2	2.5
50km/h speed limit	1.5 to 4.0	0.6 to 1.2	2.2	2.6
60km/h speed limit	1.5 to 4.0	0.6 to 1.2	2.2	2.7

The photograph is used for illustration purposes only. The actual treatment may be applied to different street cross sections, including undivided two-way streets, one-way streets, divided streets and streets with trams. The range of dimensions provided below covers those multiple potential applications.

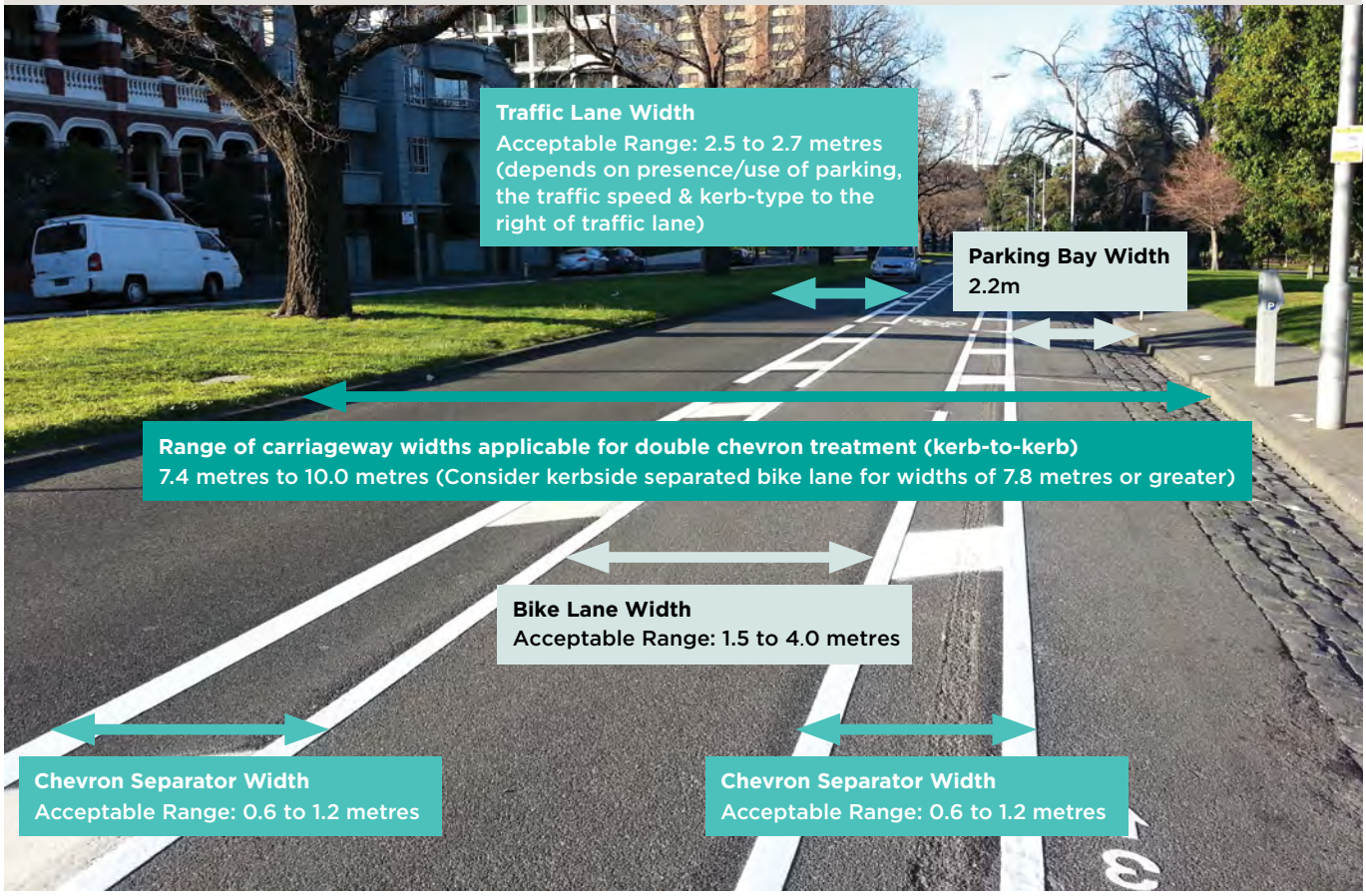


Figure 5: Double Chevron Bike Lane Treatment in Clarendon Street, East Melbourne – Range of Dimensions for Possible Adoption

Double chevron separated bike lanes work well in streets which exhibit low levels of parking turnover and when the street does not experience long traffic queues at intersections, particularly within the short left turn or left/through traffic lanes provided in the shadow of the on-street parking lane on the immediate approach to the intersection.

Where long queues do form in the short left turn or left/through traffic lanes on the approaches to intersections, the mid-block double chevron bike lane provided adjacent to the parking bays can become obstructed by vehicle queues which creates discomfort and complications for cyclists.

The photo below left illustrates an example where the traffic queue has just extended beyond the length of the left turn lane and vehicles have commenced obstructing the bike lane. Any further propagation of this vehicle queue would completely block the bike lane and creates a safety issue for cyclists where they have to choose to either sit behind the traffic queue or 'weave' between the traffic lanes.

In circumstances such as this, consideration should be given to:

- Removing on-street parking spaces to enable the establishment of a longer left turn lane; and/or
- Installing intermittent physical separator islands either side of the double chevron bike lane to prevent motorists from driving along, or queuing within, the bike lane. This is illustrated in the photo below right, which indicates that up to one parking space will generally need to be removed for each treatment. Such treatments should be considered on the approaches to intersections, driveways, off-street car park entrances or in circumstances where motorists drive illegally along the double chevron bike lane.

9. SINGLE CHEVRON ON PARKING SIDE OF BIKE LANE

Overview

The use of a single chevron separation on the 'parking side' of a bike lane has been developed in recent years in response to the high incidence of crashes involving car doors being opened into the path of bike riders (known as 'car-dooring'). Such crashes occur as bike lanes often overlap the door zone (the space taken by the open door of a parked vehicle) and car-dooring is therefore a serious hazard wherever cyclists ride beside parked cars. VicRoads has reported that in Victoria car-dooring is one of the biggest risks to bike riders. The bike rider may swerve out further into the road or collide with the car door, often with serious consequences. Between July 2011 and June 2016, there were 771 car doorings involving bike riders. Of these two were fatalities and 177 were serious injuries.

VicRoads also reported that the proportion of car dooring crashes involving bike riders is much higher in the Melbourne CBD and surrounding inner city area. This is likely associated with the prevalence of short-stay parking restrictions and associated high visitation and turnover of parking spaces across the central city. In view of these factors, it is important to pursue bike lane designs that keep bike riders out of the car-dooring zone.

Existing Use in the City of Melbourne

A number of 'single chevron on parking side' installations exist in the City of Melbourne. This design suits streets with a high turnover of on-street parking and/or modest vehicle speeds. However, this treatment should only be considered in situations where there is insufficient road width to allow the installation of either a kerbside separated bike lane or a double chevron separated bike lane, and where the traffic volumes, speeds and queues are too high to enable a 'shared traffic-bike lane ' street to be established.

All future bike lane installations in the City of Melbourne should ensure that cyclists are given adequate space to ride without the risk of being car-doored. The car dooring zone is typically 0.8 to 1 metre from the edge of a car. The single chevron should cover the majority of this width to provide for safe cycling.

Design Considerations

Table 6 provides guidance on the circumstances appropriate for installation of a single chevron on the 'parking side' of a bike lane (rather than on the traffic side). On many streets within the inner city there is greater emphasis on protecting cyclists from potential car-dooring crashes rather than crashes with moving vehicles. This has partly arisen as both the posted and operating speed limits across many parts of central Melbourne have been decreasing in recent years thus gradually reducing the potential for adverse interaction between cyclists and moving traffic. In this context, and where high turnover of parking spaces is present, a reduction in the exposure of cyclists to car-dooring crashes is preferable. The chevron separator should ideally be wide enough to cover at least 80% of the 0.8-1.0 metre door-opening space (based on a vehicle parked correctly in a parking bay). The width of the bike lane should also be sufficiently generous to enable bike riders to remain within the bike lane, when approaching open car doors, and not have to merge into the adjacent traffic lane (where there is a risk of side-swipe collisions with moving vehicles). If the available carriageway width (after allowance for the adjacent traffic lane) is 2.7 metres or greater – a double chevron should be installed, comprising a 1.5 metre wide bike lane and two chevrons of 0.6 metres each.

Table 6: Single Chevron on the Parking Side of Bike Lane – Key Considerations & Guidance

CONSIDERATIONS	GUIDANCE
Where to install single chevron on parking side of bike lanes	The installation of single chevron bike lanes on the 'parking side' should occur on streets with high turnover of on-street parking (such as shopping streets and streets within activity centres). This design option is generally preferable to single chevron bike lanes on the 'traffic side' when the vehicle volume and operating speeds are comparatively modest (30-40 km/h) and/or the proportion of commercial vehicles is low.
Cyclist Volume	Appropriate for cyclist volumes up to 120 cyclists per hour per direction.
Traffic Volume & Composition	Should not exceed 240 vehicles per hour per direction. Street should preferably have less than 2% commercial vehicles.
Geometry	Bike lane width range is 1.5 metres to 1.8 metres. Chevron Width range is 0.6 to 0.8 metres. Traffic lane adjacent to bike lane is 2.7 metres desirable minimum width (for typically 40 km/h or less). Lane width to be increased up to 2.9 metres where higher speeds prevail.
Speed	Street should preferably be characterised by a speed environment with 85th percentile vehicle operating speeds of less than 40 km/h in each direction.

The photograph is used for illustration purposes only. The actual treatment may be applied to different street cross sections, including undivided two-way streets, one-way streets, divided streets and streets with trams. The range of dimensions provided below covers those multiple potential applications.

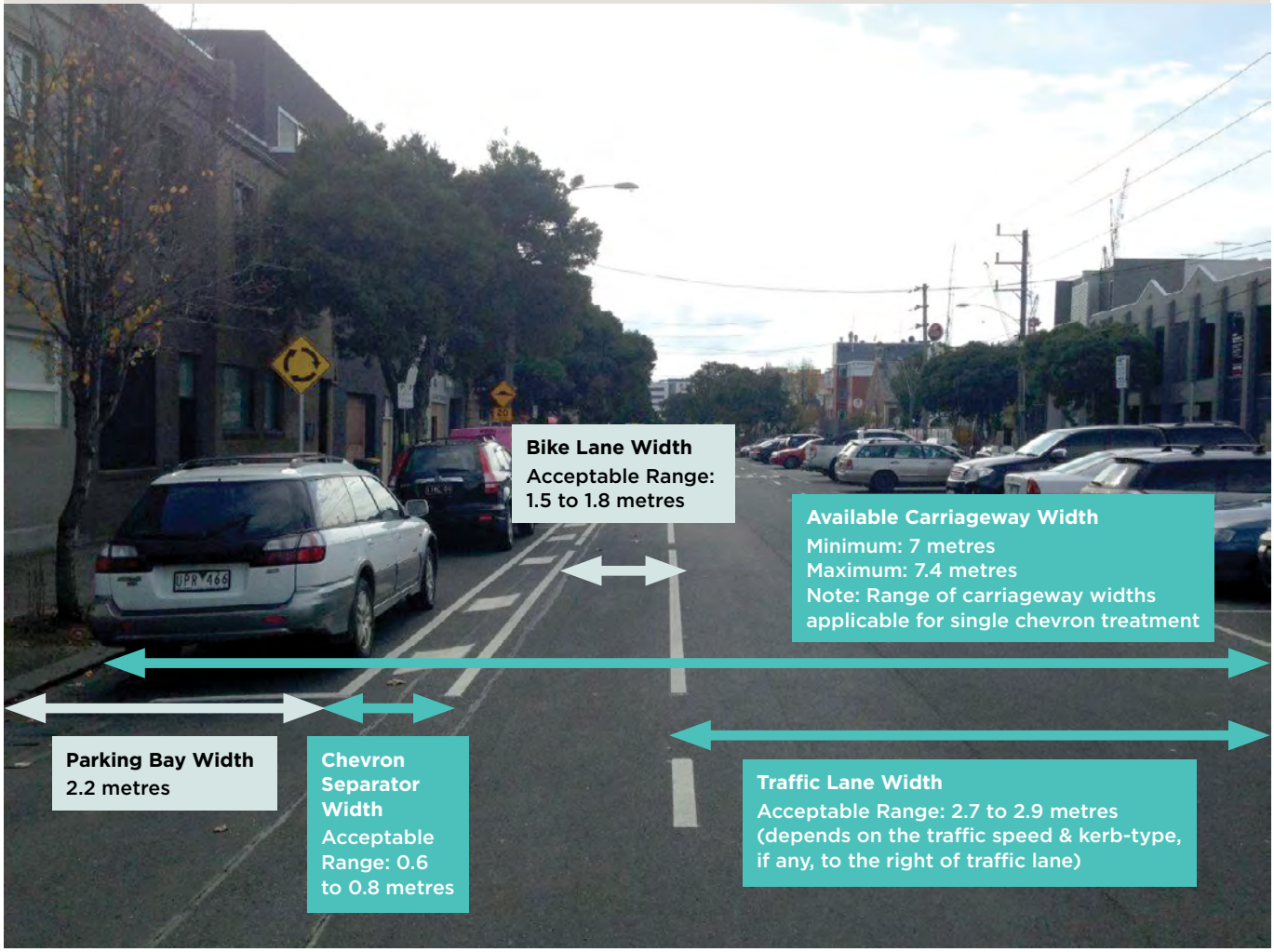


Figure 6: Single Chevron Bike Lane Treatment on Parking Side in William Street, Melbourne – Range of Dimensions for Possible Adoption

10. SINGLE CHEVRON ON TRAFFIC SIDE OF BIKE LANE

Overview

The Australian Government Department of Infrastructure and Regional Development released an information sheet in July 2015 titled "Australian cycling safety: casualties, crash types and participation levels". The information sheet presents an analysis of cycling safety in Australia, including the types of crash that result in cyclist injuries.

A total of 19,420 multi-vehicle crashes (a bicycle plus at least one other vehicle) were assessed between 2008 and 2013. Side swipe crashes accounted for 14% of all multi-vehicle crashes that involved bicycles. This comparatively high proportion of side-swipe crashes suggests that the provision of a wider buffer between bike riders and vehicles would be beneficial. It is relevant to note that across Australia, side-swipe crashes are twice as frequent as car-dooring collisions (7% of the total).

There are many standard bike lanes, in the City of Melbourne, where cyclists are potentially more exposed to moving traffic rather than car-dooring from vehicles in adjacent parking spaces. This 'exposure' may arise out of a combination of vehicle types, operating speed and the overall traffic volume on a particular route.

When cyclists' exposure to traffic occurs on a street where there is, concurrently, very low parking turnover (and associated few episodes of 'car door openings') consideration should be given to the provision of a single chevron on the traffic side. In these situations, the provision of a single chevron on the 'traffic side' of the bike lane could offer better protection to bike riders than a chevron on the parking side.

Existing Use in the City of Melbourne

A number of ‘single chevron on parking side’ installations exist in the City of Melbourne. This design is better suited to streets with very low turnover of on-street parking (such as all day residential parking) and/or when vehicle volume and operating speeds are relatively high (40-60km/h). However, in common with the ‘single chevron on parking side’ treatment, this treatment should only be considered in situations where there is insufficient road width to allow the installation of either a kerbside separated bike lane or a double chevron separated bike lane, and where the traffic volumes, speeds and queues are too high to enable a ‘shared traffic-bike lane ’ street to be established.

An example where this treatment has been installed is Macaulay Road, North Melbourne (between Dryburgh Street and Boundary Road).

The installation of single chevron treatments requires consideration of the street environment to determine whether it is better to provide separation from parked cars or moving traffic.

At times, the ‘single chevron on traffic side’ design has been installed as a cost effective upgrade of a bike lane facility – that is an existing ‘simple bike lane’ design (single white line). In these situations, there may be circumstances where on part or most of a street segment there may be equal or greater justification to install a ‘single chevron on parking side’ design rather than the traffic side. However, even in such instances, the ‘single chevron on traffic side’ design has been adopted as a practical and more cost-effective interim measure. Placing the chevron on the traffic side in the first instance avoids the cost and road ‘scarring’ associated with having to grind out the existing bike lane line marking to provide a chevron separator on the parking side of the bike lane. The position of the chevron can then be ‘flipped’ to the parking side when a road-profile asphalt re-sheet occurs.

Design Considerations

Table 7 provides guidance on the circumstances appropriate for installation of a single chevron on the 'traffic lane side' of a bike lane (rather than on the parking side). Generally, the installation of such bike lane treatments is preferable on streets where there is an identified need to provide greater separation between cyclists and moving traffic rather than between cyclists and parked vehicles. If the available carriageway width (after allowance for the adjacent traffic lane) is 2.7 metres or greater – a double chevron should be installed, comprising a 1.5 metre wide bike lane and two chevrons of 0.6 metres each.

Table 7: Single Chevron on the Traffic Lane Side of Bike Lane – Key Considerations & Guidance

CONSIDERATIONS	GUIDANCE
Where to install single chevron on traffic side of bike lanes	The installation of single chevron bike lanes on the 'traffic lane side' should occur on streets with very low turnover of on-street parking (such as all-day parking). This design option is generally preferable to single chevron bike lanes on the 'parking side' when the vehicle volume is high and operating speeds medium to high (40 km/h or above). It is also appropriate where the proportion of commercial vehicles is high.
Cyclist Volume	Appropriate for cyclist volumes up to 120 cyclists per hour per direction.
Traffic Volume & Composition	Should not exceed 240 vehicles per hour per direction. Suitable for streets with more than 2% commercial vehicles and/or formal bus services.
Geometry	Bike lane width range is 1.5 metres to 1.8 metres Chevron Width range is 0.6 to 0.8 metres Traffic lane adjacent to bike lane is 2.5 metres desirable minimum width – up to 2.7 metres depending on local considerations
Speed	Street should preferably be characterised by a speed environment with 85th percentile vehicle operating speeds of less than 40 km/h in each direction. Operating speeds of up to 50 km/h may be considered in exceptionally favourable circumstances (excellent reciprocal visibility, straight/flat alignments, generous chevron separator width).

The range of dimensions that could be applied for a *'Single Chevron on the Traffic Lane Side of Bike Lane'* design is shown in Figure 7.

The photograph is used for illustration purposes only. The actual treatment may be applied to different street cross sections, including undivided two-way streets, one-way streets, divided streets and streets with trams. The range of dimensions provided below covers those multiple potential applications.

Figure 7: Single Chevron Bike Lane Treatment on Traffic Side in Queensbridge Street, Southbank – Range of Dimensions for Possible Adoption

11. SIMPLE BIKE LANE

Overview

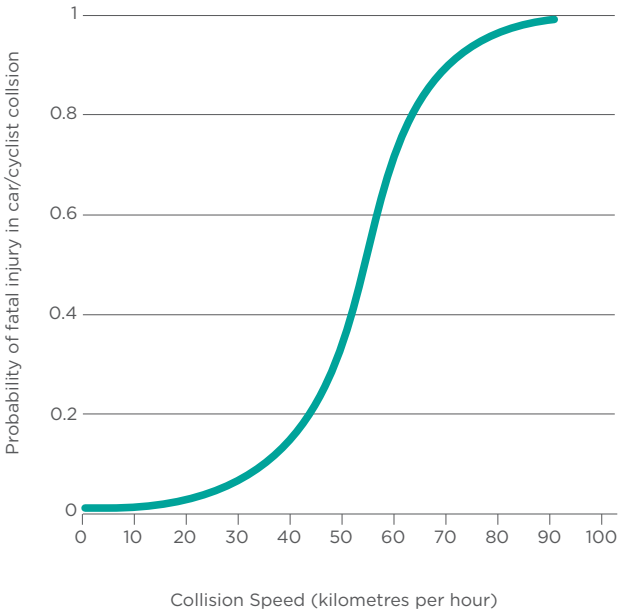
The simple bike lane treatment is a traditional design where separation between bike riders and adjacent vehicles is simply provided by a single continuous white line. No other protection is offered to cyclists.

Simple bike lane treatments are widespread across metropolitan Melbourne. Their popularity is partly a reflection of their ease-of-installation and the ability to implement the treatment without, in many instances, reducing traffic capacity. In fact, many simple bike lanes terminate before reaching an intersection, forcing cyclists to merge with general traffic and navigate their way, unassisted, across an intersection.

When considering any future role for simple bike lanes, it is relevant to note that unprotected road users such as cyclists and pedestrians are particularly vulnerable when involved in crashes with motorised vehicles. At an impact speed of 60 km/h the cyclist/pedestrian has little chance of surviving a crash, whereas at an impact speed of 40 km/h there is around an 80% chance of survival for the cyclist/pedestrian. At 30 km/h the chance of survival is well over 90%.

Thus, the use of simple bike lanes should be avoided on roads with traffic operating speeds that are above 30 km/h, as the risk of severe trauma for cyclists and pedestrians is significant. Instead, in such situations, it is desirable to provide greater separation and/or introduce measures to reduce impact speeds to, ideally, much less than 30 km/h.

Crash Severity & Collision Speed



Existing Use in the City of Melbourne

The simple bike lane treatment has been in use for decades across the City of Melbourne due to its relative ease of implementation across numerous road geometry, traffic volume and speed environments.

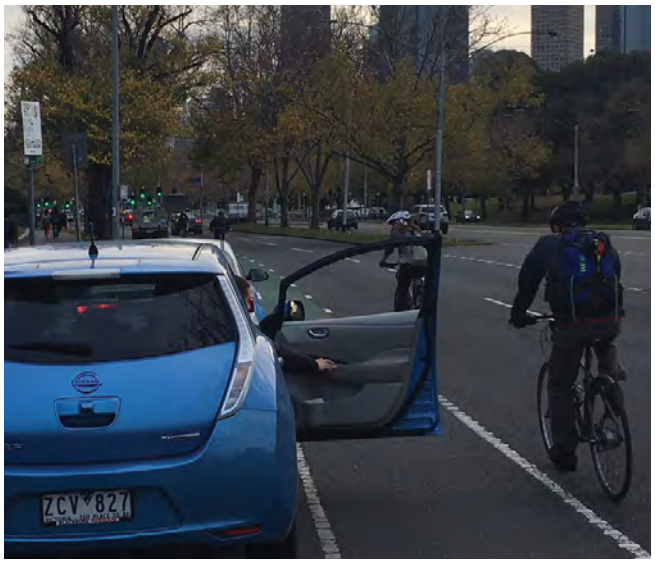
From the late 1980s, there was widespread deployment of simple bike lanes in the municipality, as awareness grew of the need to reallocate road space and provide safer riding conditions in support of the growing number of cyclists. However, most of the early bike lane installations focussed on the provision of absolute minimum bike lane widths at mid-block locations and little or no provisions at intersections – in order to not compromise overall traffic capacity on a route.

Since those early installations, evidence has materialised on the shortcomings of simple bike lanes – particularly with respect to their general inadequacy at protecting bike riders from both 'car-dooring' crashes with parked vehicles and 'side-swipe' crashes with moving vehicles.

City of Melbourne research indicates that most cyclists (78%) do not feel comfortable riding in simple bike lane. These treatments no longer meet community expectations for a quality bike lane. The use of simple bike lanes should not be considered for new installations and existing treatments should be investigated for upgrading.

Existing simple bike lane treatments should only be maintained in exceptional circumstances and need to be carefully assessed in terms of their ongoing appropriateness and relevance, particularly their safety performance.

Ideally, local residential streets should be calmed with devices aimed at reducing vehicle volumes and speeds to enable the establishment of a 'shared traffic-bike lane' street, rather than requiring the provision of a simple bike lane.



Design Considerations

It is recommended that use of the simple bike lane design be discontinued in the City of Melbourne – due to the established high risk of both 'car dooring' and 'side swipe' collisions. Retention of existing simple bike lane installations (some of which are 1.5 metres wide) or limited new installations should only be considered in exceptional circumstances, where the benefit of installing a simple bike lane treatment is deemed to outweigh the total absence of a bike facility. It is noted that existing 1.5-metre wide 'simple bike lane' designs in the City of Melbourne have poor car-dooring crash histories. The preferred strategy is to progressively replace all simple bike lane treatments across the City of Melbourne with other bike lane designs that provide greater visual and physical separation between cyclists and vehicles. Table 8 provides guidance on the rare circumstances where a simple bike lane treatment may be still considered in the City of Melbourne.

Table 8: Simple Bike Lane – Key Considerations & Guidance

CONSIDERATIONS	GUIDANCE
Where to install simple bike lanes	The installation of simple bike lanes is a 'last resort' due to lack of space for better forms of bike lanes (chevron separated or physically separated). The candidate street should be characterised by low operating speed (under 30 km/h) and low traffic volume.
Cyclist Volume	Appropriate for low cyclist volumes (less than 20 cyclist per hour per direction).
Traffic Volume & Composition	Should not exceed 240 vehicles per hour per direction. Street must have less than 2% commercial vehicles.
Geometry	Absolute minimum bike lane width is 1.8 metres (new installations).
Speed	Street must be a slow-speed environment with 85th percentile vehicle operating speeds of less than 30 km/h in each direction. It is highly undesirable to place cyclists in a bike lane next to motorists travelling over 30km/h as it may lead to increased conflict potential due to the high speed differential.

12. SHARED TRAFFIC-BIKE LANE

Overview

In many countries including Australia, there is currently no legislative framework in place to allow formal designation of shared road environments and/or prioritisation of bicycles over other vehicles. Accordingly, most attempts in Melbourne to create/indicate a shared traffic-bike lane for bicycles and other vehicles have involved the use of 'sharrows' (share-lane markings). Sharrows are pavement markings that show a bicycle symbol with two chevrons on top (as shown in the photo to right). However, it would be preferred if these treatments legally encouraged cyclists to ride in the centre of the traffic lane by requiring motorists to travel behind cyclists and be banned from overtaking cyclists on such streets.

Shared traffic-bike lane streets typically occur in situations where a road is too narrow to fit a bike lane and too narrow for cars and bikes to ride side-by-side. Therefore, the car and bike must share the lane. In view of the vulnerability of cyclists, if involved in crashes with vehicles travelling over 30 km/h, it is preferable to only establish shared traffic-bike lanes in situations with low traffic volumes and low operating speeds. The general concept is that cyclists can integrate relatively safely with traffic travelling at, or below, 25 km/h and that segregated bike lanes should be installed along roads with higher operating speeds.

'Shared traffic-bike lane' streets should be designed so that they appeal to and attract casual, risk-averse, inexperienced as well as younger and elderly cyclists who would not generally be willing to ride on most streets within the traffic lane.

Around the world, attempts to formalise shared traffic-bike lanes (and concurrently define either equal or higher priority for bike riders over vehicles) have mainly taken place in North America and some European countries. The design approaches explored in these countries are largely applied in low-volume and low-speed streets that are optimised for bicycle travel through treatments such as traffic calming, signage and pavement markings, and intersection treatments prioritised for bikes. In Germany, a bike priority street concept was introduced into their 'Highway Code' in the late 1990s – it is called 'Fahrradstraße' (cycle street). The cycle street is, legally, a public road with mixed traffic and is designed to favour cyclists.

In these countries, sharrows help 'legitimise' the presence of cyclists by reminding road users of the possible presence of bicycles on the road and where a cyclist has the right to ride. The intention of sharrows is to encourage cyclists to position themselves in the centre of a traffic lane and 'claim the lane'. Under the Victorian Road Rules cyclists are allowed to ride in the middle of a traffic lane (effectively claiming the lane) in situations where the traffic lane is too narrow and there is not enough space for another vehicle to overtake a bicycle safely within the lane.

However, there is currently no Australian or state/territory-level guidance on the use of sharrows for the purposes of establishing 'shared traffic-bike lane ' streets.

Within this context, sharrows have been used for many years across inner Melbourne in a wide range of traffic situations; the most common of which include:

- On narrow local streets where no bike lanes are marked; and
- In the centre of lanes on the approaches to roundabouts (often used where a bicycle lane terminates prior to the intersection and cyclists are required to merge into the main traffic lane).

Use of sharrows has been promoted as a means of achieving several outcomes:

- Encourage riders to 'claim the lane' in slow speed environments (and in so doing improve their visibility to motorists and reduce the risk of car dooring collisions with parked vehicles);
- Encourage car drivers to be more tolerant of the presence of cyclists, reducing the likelihood of intimidatory interactions; and
- Assist bicycle riders with wayfinding by designating a 'preferred' or 'superior' route.

Existing Use in the City of Melbourne

In the City of Melbourne, the creation of shared traffic-bike lanes, through the use of sharrows, has usually occurred where other types of bike facility cannot be implemented, due to insufficient space, and in areas where separation between vehicles and cyclists has been difficult to achieve, such as the approaches to roundabouts. Therefore, shared traffic-bike lanes in Melbourne have been implemented to:

- Help define local bicycle routes;
- Establish important linkages between established formal bike routes; and
- Provide a practical solution to assist cyclists at squeeze points (such as roundabouts) along routes where existing formal bike lanes already exist.

Design Considerations

Table 9 provides guidance on the creation of shared traffic-bike lanes in the City of Melbourne.

Table 9: Shared Traffic-Bike Lane – Key Considerations & Guidance

CONSIDERATIONS	GUIDANCE
Where to create a Shared Traffic-Bike Lane	This treatment may be the optimal design, when installed in streets with very low traffic volumes and speeds, and high bike volumes. This assumes a future scenario where increased education results in motorists understanding and not overtaking cyclists on roads with 'sharrows'. The candidate street should be characterised by low operating speed (under 25 km/h), low traffic volume and short queuing at intersections (if necessary, some on-street parking could be removed on the approach to intersections to enable a formal kerbside bike lane to be established). Under these conditions and in certain streets, a shared traffic-bike lane would be preferable to a simple bike lane design, and may be preferable to any other style of bike lane design. While 'sharrows' are the only 'traffic control item', under current legislation, that can be used to highlight a shared traffic-bike lane , the rights and responsibilities of both cyclists and motorists is unclear and subject to interpretation in the context of the surrounding road environment. Use of 'sharrows' on roundabout approaches should not be used when operating speeds are above 30 km/h and/or when traffic volume are in excess of 180 vehicles per hour per direction. Where space is available and pedestrians will not be impacted, investigations should be undertaken to determine the suitability of replacing sharrows on the approaches to roundabouts with separated bike lane designs through the roundabout.
Cyclist Volume	Appropriate for a wide range of cyclist volumes. However low cyclist volumes (less than 10 cyclist per hour per direction) in 'very low' traffic volume streets (less than 30 vehicles per hour per direction) may not warrant the establishment of a shared traffic-bike lane .
Traffic Volume & Composition	Should not exceed 180 vehicles per hour per direction (and less than 2,000 vehicles per day). Street must have low levels of commercial vehicles as such vehicles are often intimidating to cyclists and are seeking to travel at higher speeds. Shared traffic-bike lane must not be established on a formal bus route.
Geometry	Appropriate where carriageway in a single direction is less than 4.6 metres. Street should be preferably flat (steep uphill sections will create a potentially large and undesirable speed differential between cyclists and motorists).
Speed	Street must be a slow-speed environment with 85th percentile vehicle operating speeds of less than 25 km/h in each direction. It is highly undesirable to mix cyclists and motorists travelling over 25km/h as it may lead to increased conflict potential due to the speed differential.

In summary, 'shared traffic-bike lane ' streets may be the optimal street design for cyclists if the street exhibits very low vehicle speeds, volumes and queues. In such circumstances, cyclists will be encouraged to ride in the centre of the traffic lane without feeling intimidated by motor vehicles attempting to travel at higher speeds than the cyclist. This design may therefore be preferable to establishing formal kerbside separated or chevron separated bike lanes as cyclists can occupy the entire width of the traffic lane which may be preferably for streets with very high cycling volumes. This design may also increase sight lines between cyclists and motorists at conflict points such as driveways, off-street car parks and intersections.

Alternatively, 'shared traffic-bike lane' streets may also be considered:

- On narrow carriageways where the installation of the preferred forms of bike lane designs is not feasible due to insufficient road width; and
- On the approaches to low-speed / low-volume single lane roundabouts on local roads.

In all instances, shared traffic-bike lanes are to be identified through the use of sharrows markings.

Where streets with low traffic volumes have operating speeds in excess of 25 km/h, but are otherwise considered suitable candidates for the creation of a shared traffic-bike lane , traffic calming measures should be introduced to reduce the speed differential between cyclists and motorists and provide cyclists the necessary confidence and safety in sharing the road with general traffic.

The City of Melbourne will use the 'sharrow' pavement symbol as shown in Figure 8. Sharrows are to be in long-life white paint and placed in prominent positions, to highlight to all road users that cyclists can claim and ride in the centre of the lane.

Sharrow designs and dimensions are to comply with Australian Standard AS 1742.9 (Manual of uniform traffic control devices Part 9: Bicycle facilities).

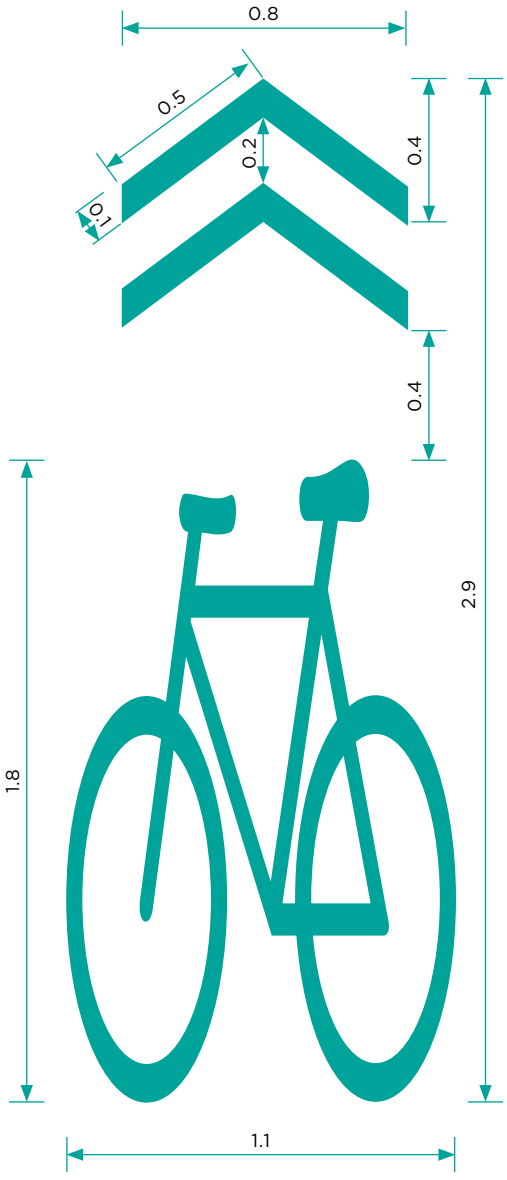


Figure 8: Indicative Layout Sharrows Pavement Marking

13. INTERSECTION TREATMENTS

The City of Melbourne has historically prioritised upgrading bike lanes at mid-block locations, but has rarely extended these upgraded facilities through to intersections.

The traffic capacity of the street network is primarily governed by the number of stand-up traffic lanes provided on the approaches to intersections. Therefore, removing a traffic lane to enable the installation of a protected bike lane on the approach to an intersection can result in a significant reduction in traffic capacity along the entire street.

This reluctance to significantly reduce traffic capacities has led to an existing situation where the design of most bike lanes on the approaches to intersections in Melbourne is suboptimal and acts as a deterrent to attracting increased cycling usage. This situation is evident on many of Melbourne's busiest bike routes, where the following intersection arrangements prevail:

Non-physically separated kerbside bike lane

This treatment is often of sub-standard width (less than 1.5 metres wide such as in La Trobe Street). This style of bike lane results in cyclists feeling 'squeezed' between the kerb and the moving traffic lane. Also, left turning motorists may drive into the kerbside bike lane prior to the intersection, which could potentially result in a side-swipe collision or an obstruction to the bike lane.

Bike lane provided between the left turn lane and the through traffic lanes

Examples of this treatment are found in Canning Street, Carlton, on its approaches to Elgin Street and along Queensberry Street, North Melbourne. This style of bike lane results in conflicts between cyclists and left turning motorists prior to the intersection. There is also the potential that long queues of left turning motorists may extend back and block the bicycle lane, or left turning motorists may inappropriately turn from the bike lane, rather than moving over to the kerbside left turn lane.

No bike lane

This example is found in Albert Street, East Melbourne; Queensbridge Street, Southbank; and Lloyd St, Kensington. The elimination of the bike lane on the approaches to intersections is likely seen as intimidatory by novice and less confident cyclists. The absence of a defined bike lane may also contribute to cyclists engaging in a variety of movement patterns, while attempting to negotiate the intersection, which may confuse motorists and give rise to safety issues. Some cyclists wait behind the queue of left turning motorists, experiencing delays and inhaling vehicle exhaust fumes. Other cyclists ride in the narrow space between the left turn lane and the through traffic lane, where no formal space is provided often riding along the white painted line separating the two traffic lanes. This results in 'near misses' between cyclists and moving traffic.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In addition, roundabouts in Melbourne generally lack and formal separation for cyclists on the entry points.

In order to address these issues, the preferred treatment on the approaches to intersections is for the provision of either physical separation or separation through traffic signal phasing – thereby improving cyclist priority and safety. These treatments may result in a traffic-capacity reduction and possibly longer queues and delays for motorists. Six variations of intersection treatments have been identified for potential implementation within the City of Melbourne. The six treatments cover physically separated bike lanes; separation through traffic signal phasing and a treatment for roundabouts allows for separated bike lanes. The choice of how a particular intersection is treated needs to be taken in the context of the midblock bike lane options presented in previous chapters and consideration of whether there are any issues in the transition from midblock to intersection treatments that may influence the choice of either. The various intersection treatment options are presented in the sections that follow.

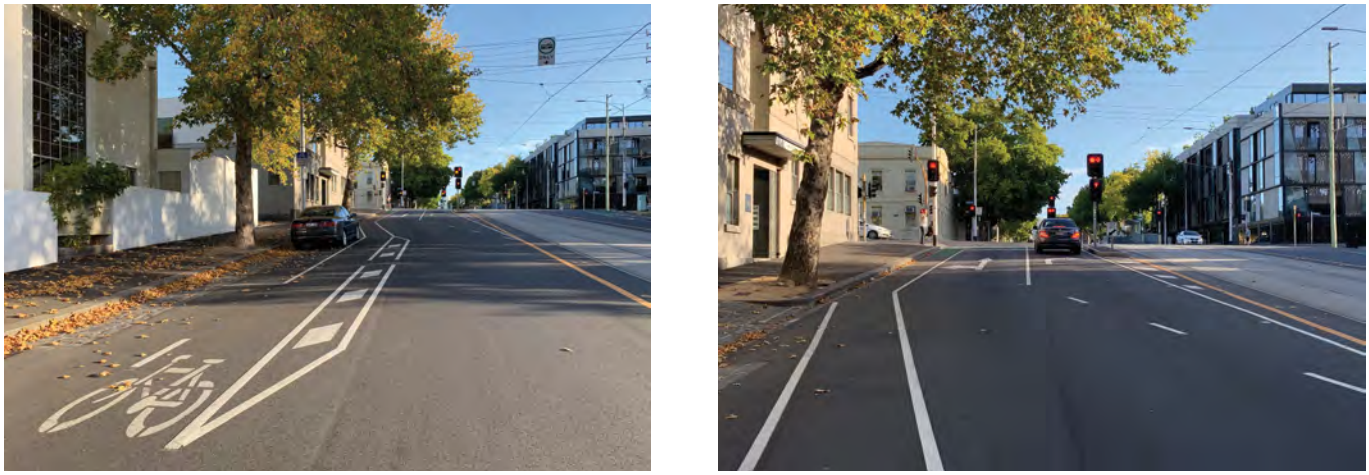


Figure 9: Example of non-physically separated kerbside bike lane – transition from mid-block treatment (top image) to intersection treatment (bottom Image)(Queensberry St, North Melbourne)

Figure 10: Example of Bike lane between left turn and through traffic lane – transition from mid-block treatment (top image) to intersection treatment (bottom Image)(Queensberry St, North Melbourne)

Figure 11: Example of 'No-bike-Lane' (Lloyd St, Kensington)

Figure 12: Example of 'No-bike-Lane' (Queensbridge St, Southbank)

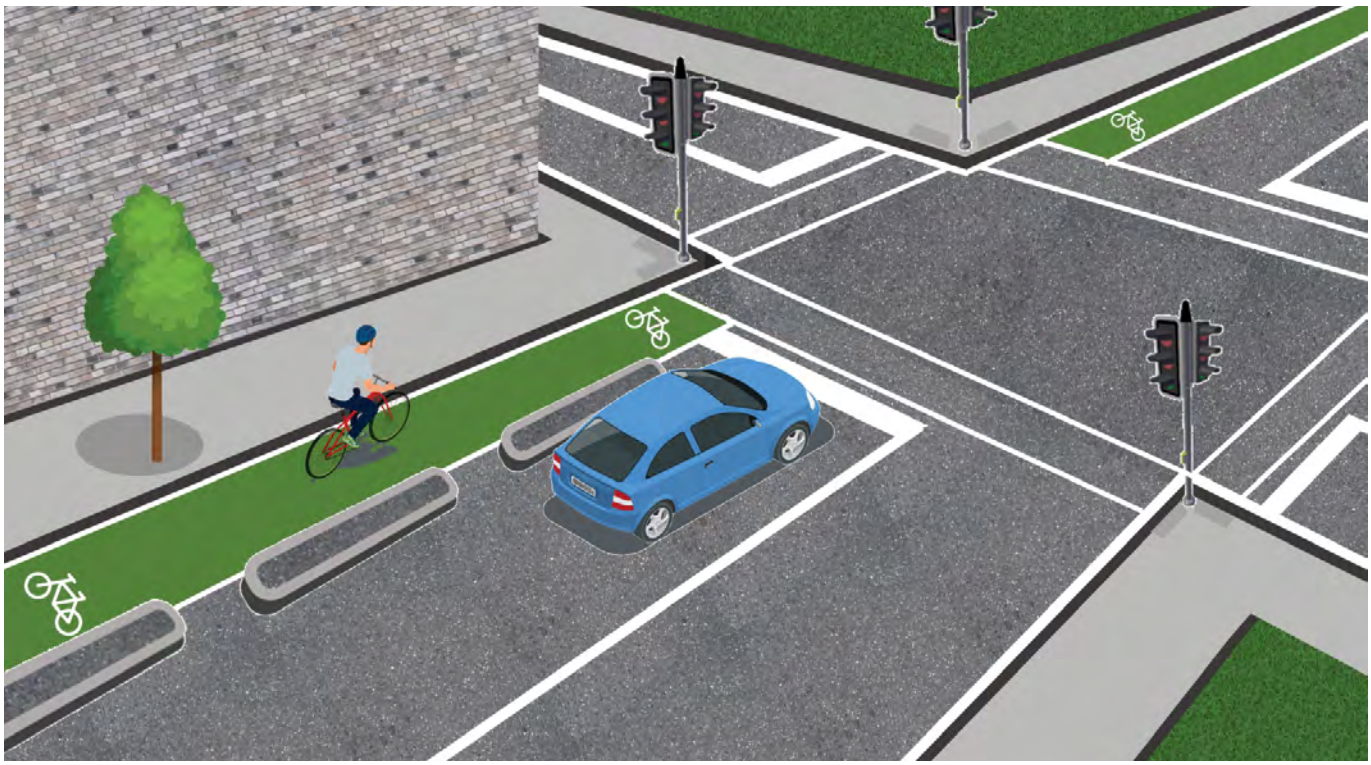
13.1 Narrow Separation

13.1.1 Narrow Separation In Low Pedestrian Activity Areas

Overview

This intersection treatment provides a physical barrier between a bike lane and traffic lane. Physical separation continues (as a minimum) to the stop line and recommences on the intersection departure. The design eliminates traffic queue interference with the bike lane, as cyclists are able to proceed unimpeded from their mid-block bike lane to the intersection stop line. However, there is no protection for cyclists when crossing the intersection. Various forms of separation have been used in municipalities across metropolitan Melbourne.

A preferred profile for the narrow separator kerbing incorporates a semi-mountable profile on the bike lane side, which increases the effective width of the bicycle lane, and a barrier profile on the traffic lane side to provide strong separation from vehicles.



Application within the City of Melbourne

This form of intersection separation has been rarely used within the City of Melbourne. An example exists in Moray Street, Southbank, at its intersection with City Road (as shown in the image to the right). However, this separation kerb can generally be narrower (ie: 300mm wide) on the approaches to intersections as there is no risk of 'car dooring' collisions and no need for passengers accessing adjacent car parking spaces to be able to stand on a wider separation island. As discussed above, the profile of the separator kerb should also be semi-mountable on the bike lane side.

Further implementation of this 'narrow separation' treatment (300mm wide kerb) on the approach to intersections is proposed for intersections along Albert Street, East Melbourne.

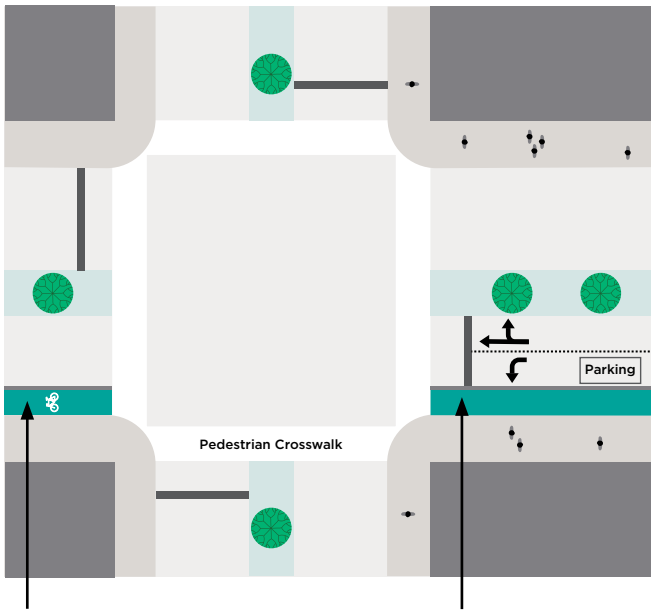
It is considered to be a treatment with significant potential for future application within the municipality. It could likely be implemented widely across many bike routes in Melbourne – in many cases without possibly impacting on the number of traffic lanes (at locations where intersection traffic capacity may be a relevant consideration). The treatment also allows retention of existing pedestrian and cyclist desire lines across the intersection. However, the treatment is unlikely to enhance bike safety when cyclist ride through the intersection as there is no inherent protection from left-turning motorists.

Design Considerations

Figure 13 shows conceptually a narrow separation bike lane treatment at an intersection. The treatment effectively prevents vehicles from mixing with cyclists on the approach to the stop line. It is suitable for approaches that feature any number of traffic lanes at the stop line. The arrangement does not impact on the cyclist and pedestrian desire crossing lines at the intersection. However, it is not considered suitable for busy pedestrian environments – where additional footpath space may be desirable. At those locations, consideration should be made for bike lane deviation and allow for footpath widening. This option is discussed in section 12.1.2. In considering the relative merits of each option, reference can be made to the following:

ITEM	STANDARD NARROW SEPARATION	DEVIATION FOR FOOTPATH WIDENING
Pedestrian Crowding	✗	✓
Crossing Desire Lines	✓	✓
Cyclist Safety	✓	✓
Traffic Capacity	✓	✗

Left turning vehicles have insufficient space to position themselves at the ideal angle to optimise visibility with cyclists. Vehicles are positioned virtually parallel to the cyclists' direction of travel – forcing drivers to 'check-behind-their-backs' before turning left. Various forms of kerbing can be used for the separation kerb, including cast-in-situ, spike-down prefabricated (concrete or plastic). Suggested dimensions for bike lane, traffic lane and physical separator widths are provided in Appendix B.



Bike Lane Width:
Absolute minimum 1.0 metres
Desirable 2.2 metres or greater

Physical Barrier Between Bike Lane & Traffic Lane (Typically 0.3 metres)

Note: The physical kerb barrier between the bike lane and traffic lane should be set-back a sufficient distance from the pedestrian crosswalk line to avoid creating a pedestrian trip hazard. This set-back distance will typically be in the range of 1.2 to 3.0 metres.

Figure 13: Indicative Conceptual Layout – Narrow Separation at Intersection

13.1.2 Narrow Separation In High Pedestrian Activity Areas with Deviation For Footpath Widening

Overview

This treatment is a variation of the 'Narrow Separation' treatment. It is a design that is ideally deployed where the stop line can be reduced by one traffic lane and/or where there is significant pedestrian demand at the intersection or a need to address issues between left-turn vehicles and cyclists. In these situations, a footpath extension enhances pedestrian storage capacity and amenity but also requires a deviation in the path of the bike lane. In common with the 'Narrow Separation' treatment, vehicles at the stop line are positioned immediately adjacent to cyclists – separated only by a narrow kerb.

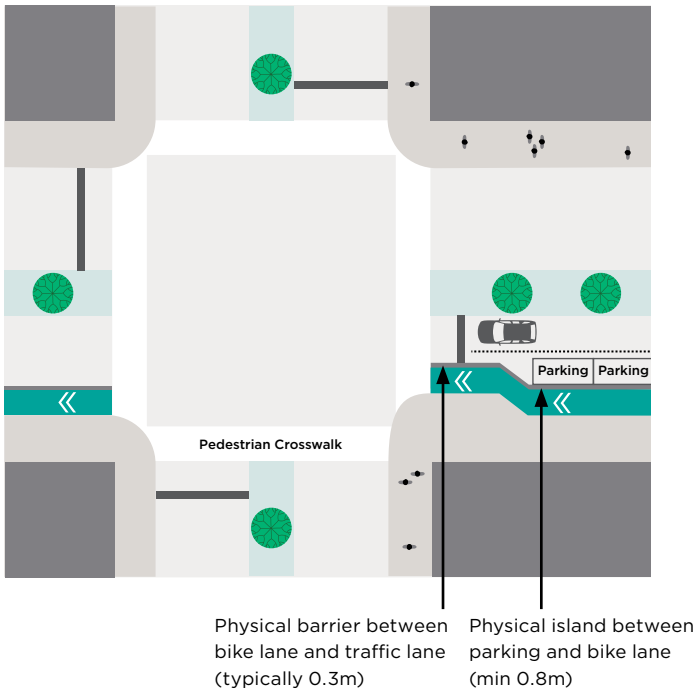


Figure 14: Indicative Conceptual Layout – Deviation for Footpath Widening at Intersection

Application within the City of Melbourne

This form of intersection separation has not been used within the City of Melbourne. It is considered to be a treatment with significant potential for future application in busy pedestrian precincts. It could likely be implemented widely across many bike routes in through Melbourne's activity centres.

Design Considerations

Figure 14 shows conceptually the 'deviation for footpath widening' treatment at an intersection. The range of dimensions for the bike lane and kerb separator and 'set back' guidance are the same as per the 'standard narrow separation' treatment. The 'deviation' treatment prevents vehicles from mixing with cyclists on the approach to the stop line, reduces the number of traffic lanes by one and provides additional pedestrian storage. This treatment is suitable for approaches that feature any number of traffic lanes at the stop line.

The arrangement impacts on the cyclist desire line at the intersection.

Various forms of kerbing can be used for the separation kerb, including cast-in-situ, spike-down prefabricated (concrete or plastic).

13.2 Bike Safety Priority Treatments

13.2.1 Full Protection Across Intersection

Overview

Efforts to provide improved protection for cyclists from left-turning vehicles, both at the stop-line and whilst crossing a signalised intersection have been the focus of designers in recent years. Currently, most intersections in Australia, provide for cyclists and vehicles travelling in the same direction in the same traffic signal phase (both proceed at the same time). Under this arrangement there is little protection for cyclists from left-turning vehicles.

Across Australia and globally, transport agencies have been developing designs to force left-turning vehicles to position themselves more at right angles to the parallel flow of cyclists which they are crossing. A design that has received favourable review internationally involves provision of a single approach lane shared by all turning movements and forcing left-turners into a wider turning circle before crossing the path of cyclists. More specifically, this is achieved through the inclusion of traffic islands within and, possibly, on the intersection approach. When turning, the traffic islands guide left-turners to position themselves at right angles to cyclists– thus optimising visibility. These physical traffic islands within the intersection not only promote the desired positioning of left-turning vehicles but also provide enhanced protection to cyclists from turning motorists.

A painted green pavement treatment is used to highlight the cyclist travel path across the junction, thereby further highlighting the presence and enhancing the safety of bike riders.

Application within the City of Melbourne

This form of intersection separation has not been used within the City of Melbourne. It is considered to be a treatment with significant potential for future application and could likely be implemented widely across many bike intersections in Melbourne – especially at locations where only one traffic lane is required at the stop line. The treatment also allows retention of existing pedestrian and cyclist desire lines across the intersection.

The treatment is considered particularly suitable at locations where there are known issues between cyclists and left-turn vehicles. An alternate 'partial protection' treatment is discussed in section 13 – which applies to situations where multiple traffic lanes are required at the stop line. In considering the relative merits of each option, reference can be made to the following table:

ITEM	INTERSECTION WITH FULL PROTECTION	INTERSECTION WITH PARTIAL PROTECTION
Pedestrian Crowding	✓	X
Crossing Desire Lines	✓	X
Cyclist Safety	✓	-
Traffic Capacity	X	✓

Design Considerations

Figure 15 shows conceptually the type of bike lane treatment that provides 'full protection' for cyclists proceeding through an intersection. This treatment is suitable for approaches that only require a single traffic lane.

In such situations, left-turning vehicles at the stop line can be separated from cyclists by a wide traffic island – which positions them laterally 2 to 3 metres to the right of cyclists. The island, in combination with a smaller island located within the intersection (also shown in Figure 16) for a partially protected intersection forces left-turning traffic into executing a wide arc.

This arrangement has no impact on cyclist and pedestrian desire lines across the intersection, as each is able to cross along their preferred trajectory – no deviation is required.

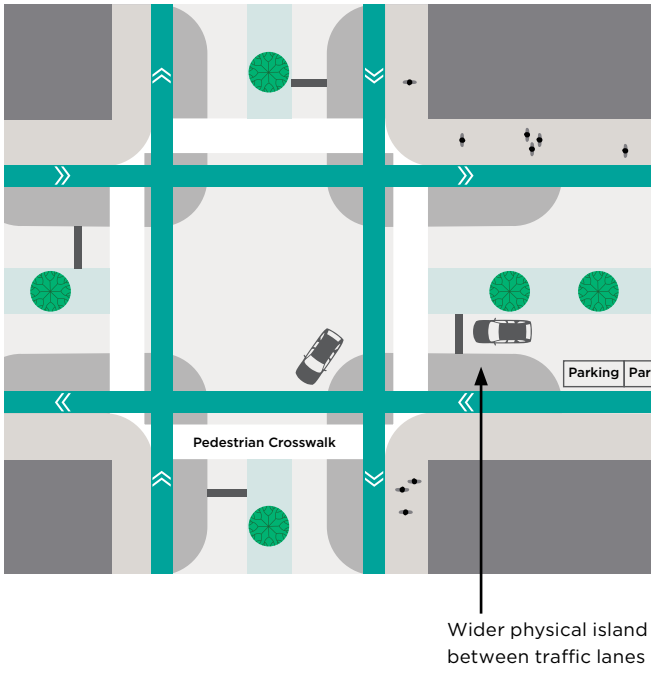


Figure 15: Indicative Conceptual Layout – Full Protection at Intersection

13.2.2 Partial Protection Across Intersection

Overview

This intersection treatment is a variation of the 'Full Protection' treatment. It is a design that can be deployed where two or more traffic lanes are required at the stop line or where there is a single traffic lane but no on-street parking on the intersection approach. In these situations, left-turning vehicles at the stop line are positioned immediately adjacent to cyclists – separated only by a narrow kerb.

The treatment is characterised by the inability to establish a wide traffic island in the space adjacent to the bike lane at the stop line (unlike the "Full Protection" treatment). As such, there is a reduced ability to force left-turning vehicles to line up at right angles to cyclists.

Furthermore, cyclists and pedestrians are likely to be shifted off their preferred crossing desire line.

Application within the City of Melbourne

This form of intersection separation has not been used within the City of Melbourne. Initial implementation is proposed for the intersection of proposed for Albert Street and Lansdowne Street, East Melbourne. It is considered to be a treatment with significant potential for future more widespread application within the City of Melbourne. It could likely be implemented across many bike routes in Melbourne where cyclist and pedestrian volumes at intersections are modest (and thus the deviation from preferred desire lines across the intersection is not as critical.

Figure 16: Indicative Concept Treatment: Partial Protection across Intersection

Design Considerations

Figure 17 shows conceptually the type of bike lane treatment that provides 'partial protection' for cyclists proceeding through an intersection. This treatment is suitable for approaches that feature two or more traffic lanes at the stop line.

This arrangement impacts on the cyclist and pedestrian desire crossing lines at the intersection. In each case, some deviation is introduced to the preferred trajectory.

Left turning vehicles have limited space, when turning, to position themselves at an appropriate angle to optimise visibility with cyclists.

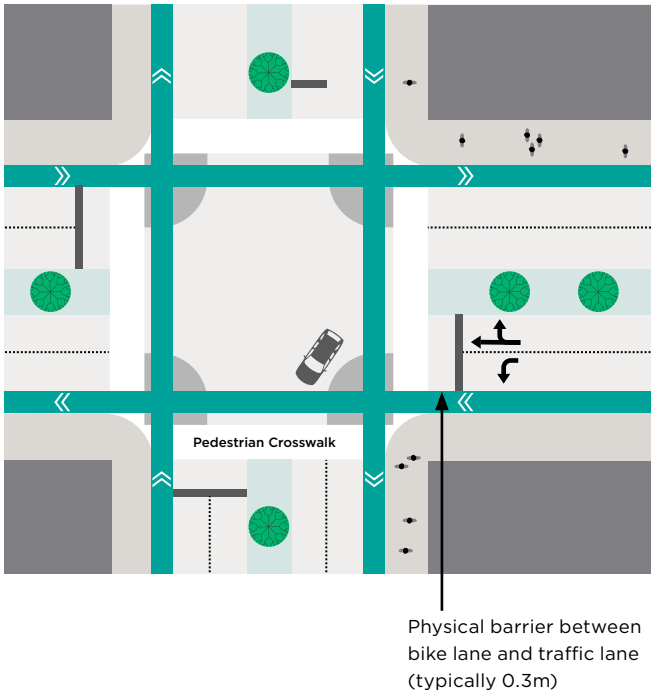


Figure 17: Indicative Conceptual Layout – Partial Protection at Intersection

13.3 Traffic Signal Priority/ Phasing Separation

Overview

Exclusive traffic signal phases that cater principally for bicycles are typically not required at signalised intersections. Therefore, in the majority of cases, cyclists navigate through intersections by obeying the same traffic signal displays that govern other vehicle movements. However, there are many situations that can arise that lead to hazardous interactions between cyclists and other vehicles – particularly with left turning vehicles cutting across bike riders proceeding straight and with right-turning cyclists attempting to position themselves on the right side of the carriageway and having to weave across multiple lanes of faster moving traffic.

In an attempt to address these issues, transport agencies are increasingly considering solutions that use traffic signal phasing techniques to optimise safety, eliminate conflicts and prioritise bike movements. These techniques, often referred to as 'phasing separation', are particularly useful in assisting cyclists turning left or right.

The introduction of a separate signal phase, for the exclusive use of bicycles, enables riders to travel through or turn at an intersection within their own allocated time. Importantly, traffic signal phase separation can operate independently of physical separation – either on the approach or through the intersection.

Application within the City of Melbourne

There are only a few instances where 'phase separation' has been deployed at signalised intersections in Melbourne. The wider implementation of priority for bicycles through special traffic signal phasing is an intersection treatment option that is considered appropriate in Melbourne. Phasing separation solutions may be particularly useful for cyclists at locations where there is no bike lane on the 'departure' side of an intersection. The provision of a priority/ advanced-activation priority signal phase for cyclists would enable riders to 'establish themselves' on the departure side of an intersection without having to merge/ negotiate in narrow spaces with vehicles. Traffic signal timing and phases should therefore be reviewed across the City to promote safer intersections and accommodate a wider range of bike riders.

Design Considerations

A significant reduction in potential conflicts at intersections can be achieved by removing the occurrence of turning vehicles crossing the bicycle route or through vehicles adversely interacting with turning cyclists – during the same traffic signal phase cycle. This can be achieved by fully controlling vehicle turning phases or providing a separate bicycle phase. However, the addition of new signal phases could potentially lead to increased delays for all vehicles (cyclists and motorists). These impacts would need to be considered on a site-by-site basis. Increased delays for cyclists can lead to higher rates of non-compliance, which is an undesirable outcome.

13.4 Roundabouts

Overview

Historically, many roundabouts across inner Melbourne have been designed with little explicit consideration for needs of cyclists and pedestrians. In such situations, cyclists have often found themselves having to share space with vehicles when entering roundabouts and being exposed to relatively fast-moving traffic both at the entrance and whilst circulating within the roundabout. Some roundabout designs can cause considerable confusion and hazard to cyclists who may be uncertain on how to navigate through them. Such circumstances are not conducive to supporting increased levels of cycling.

In 2017 Austroads released a research report into bicycle safety at roundabouts which found that not only does the design of roundabouts contribute to bicycle crashes but also that the majority of the crashes occurred on urban local road roundabouts, with most (63%) of these located on local roads with a 50 km/h speed limit or less.

The majority of the crashes occurred on the circulating lane involving a motor vehicle, about to undertake a turning or straight through movement, entering the circulating lane and colliding with a cyclist already on the circulating lane. Austroads noted that the current roundabout design guidance documentation has a focus on the higher speed arterial road roundabout, with speeds in the order of 50 km/h. Specific guidance on geometric methods to achieve entry and circulating speeds of less than 30 km/h are not contained in the existing guides.

As a result of the research, Austroads has suggested that the existing design principles, found in published guidelines, should be amended. In all situations where bicycles and motor vehicles share the road space, the design speed of the roundabout should be no more than the target speed of less than 30 km/h. Where the target speed cannot be achieved consideration should be given to providing a separate facility for cyclists – located away from the circulating lanes.

Until recently, there were no design alternatives that provided any special priority and/or separation for cyclists at roundabouts. However, in 2018 a new roundabout design (a Victorian-first) was introduced at two existing roundabouts in Moray Street, South Melbourne.

The remodelled geometric designs in Moray Street (at the Dorcas Street and Coventry Street intersections) provide for both a raised zebra crossing and a new dedicated bike path running parallel at each pedestrian crossing. In doing so, pedestrians and cyclists have right-of-way over motorists and vehicles are slowed and stopped in the process by the introduction of raised pavements in the crossing zone. Give-way signage faces motorists both entering and exiting the roundabout – formalising the need by motorists to yield to cyclists in all circumstances.

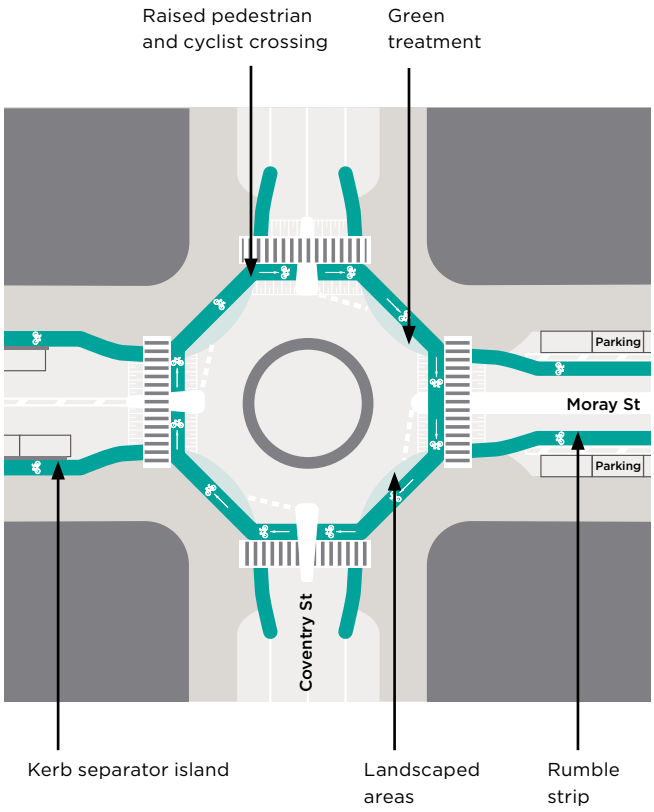
Application within the City of Melbourne

No roundabout treatments in the City of Melbourne include the bicycle priority treatments recently adopted in Moray Street, South Melbourne. Many roundabouts in Melbourne have no bike lane treatments. Some roundabouts along bike routes have sharrow markings at the entrance points. The Moray Street design should be used as a starting point to develop similar bike-prioritised roundabout designs in the City of Melbourne. However, this style of design requires significant space and may not be feasible at many of the City's intersections.

Design Considerations

The design adopted for the Moray Street roundabouts is shown conceptually in Figure 18. Further assessment is required in order to determine the long-term impact of the design and to fine-tune preferred dimensions and alignment of the various design components.

Where space for such treatments is not available, consideration should be made for the adoption of speed-reduction techniques to slow motorised traffic to under 30 km/h on the approach and entry to roundabouts. This would provide a safer operating environment for cyclists.



- Cars to give way to cyclists and pedestrians
- 40km/hr speed reduction

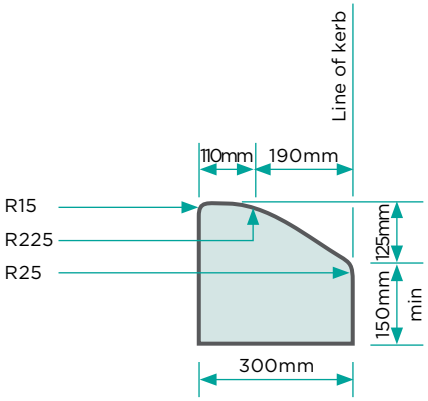
Figure 18: Plan View of Roundabout at Moray Street / Coventry Street, South Melbourne

14. KERB PROFILES

Barrier & Semi-mountable Kerbs

The City of Melbourne mostly uses barrier kerbs when installing physically separated bike lanes either in mid-block locations or at intersections. Semi-mountable kerb profiles are rarely used within Melbourne but are more common in other municipalities. There are 'Engineering Standard Drawings' that provide detailed information on kerb types. These drawings cover cast-in-site, precast and bluestone kerb and channel – for both barrier (Figure 19) and semi-mountable (Figure 20) kerb types. The preferred combination for future applications is to adopt a semi-mountable profile on the bike lane side (which reduces potential for 'pedal-strike') and a barrier profile on the traffic lane side (which provides strong separation from vehicles) – as shown on the images.

Semi-mountable Kerb (standard VicRoads profile Used by other municipalities*)



Semi-mountable Kerb (City of Melbourne profile)*

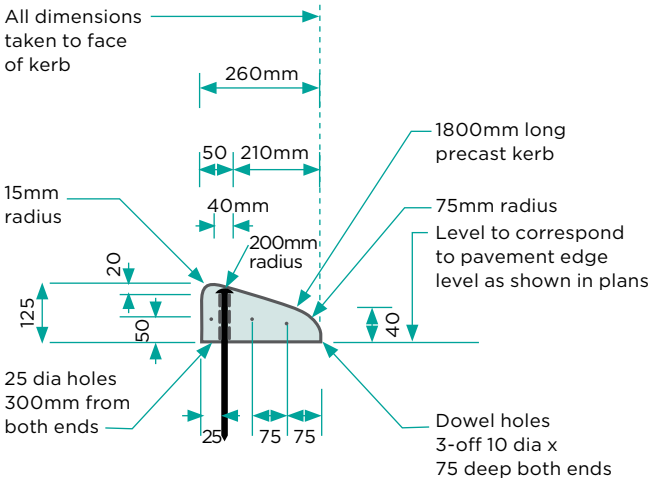
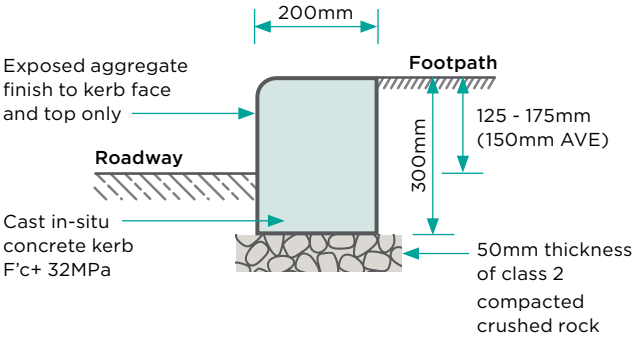


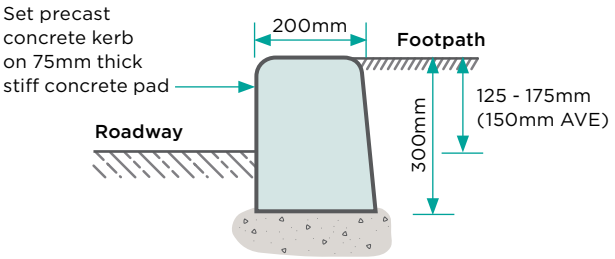
Figure 20: Semi-mountable Kerb Details

*Drawings not to scale

Cast-in-situ Kerb*



Pre-cast Kerb*



Bluestone Kerb*

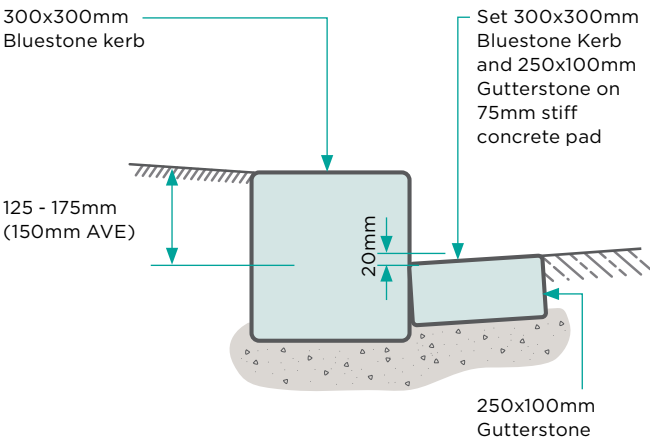


Figure 19: Barrier Kerb Details

Barrier Kerb

Semi-mountable/Barrier Kerb

Semi-mountable/Kerb

Application within the City of Melbourne

The City of Melbourne predominantly uses barrier kerbs to create a safe environment between cyclists and vehicles as well as cyclists and pedestrians. The usefulness of different types of kerbs in providing separation between modes has been the focus of both researchers and practitioners. Right angled kerbs can pose risks to cyclists due to their height but are viewed as providing optimum separation from vehicles and pedestrians. Sloped and levelled kerb types are more forgiving for cyclists but allow road users to move onto each other's infrastructure, creating a potential risk of collision.

Future kerb types to be used for bicycle infrastructure in Melbourne should be considered on a case-by-case basis, taking into consideration the level, type and speed of traffic and the pedestrian activity in the vicinity of the bike lane. These aspects will inform the choice of kerb type most suitable for the circumstances. It is relevant to note, when considering kerb types for kerbside physically separated bike lanes, that in areas of high parking activity (where pedestrians are frequently using the separator between the parking lane and the bike lane) the adoption of a semi-mountable kerb may require construction of a wider separator island – as the flat surface on the top of the separator needs to be in the range of 0.8 to 1.0 metre to cater for prams and wheelchairs.

Kerbside Bike Lane raised to Footpath level

This style of design should only be installed when physical street furniture queues can be installed between the bike lane and the footpath to inform cyclists and pedestrians of the division between these two areas. Contrasting pavement materials should highlight the bike lane and footpath.

This will be critical to ensuring that pedestrians do not walk in the bike lane, and that cyclists do not ride along the footpath.

Alternative designs which provide a minimal vertical separation between the bike lane and footpath should also be considered.

APPENDIX A – KERB SEPARATED BIKE LANE DIMENSIONS

Table 10: Kerb Separated Bike Lanes without Physical Kerb on the Right Side of the Adjacent Traffic Lane

TOTAL ROAD WIDTH IN ONE DIRECTION (BIKE LANE, SEPARATOR, PARKING & TRAFFIC LANE)(METRES)	BIKE LANE (METRES)	PHYSICAL SEPARATOR ISLAND(METRES)	PARKING (METRES)	TRAFFIC LANE (METRES)
7.70	1.80	0.80	2.20	2.90
7.75	1.80	**0.85**	2.20	2.90
7.85	**1.90**	0.85	2.20	2.90
7.95	**2.00**	0.85	2.20	2.90
8.05	**2.10**	0.85	2.20	2.90
8.15	**2.20**	0.85	2.20	2.90
8.25	2.20	0.85	2.20	**3.00**
8.30	2.20	**0.90**	2.20	3.00
8.40	2.20	**1.00**	2.20	3.00
8.50	**2.30**	1.00	2.20	3.00
8.60	**2.40**	1.00	2.20	3.00
8.70	**2.50**	1.00	2.20	3.00
8.80	**2.60**	1.00	2.20	3.00
8.90	**2.70**	1.00	2.20	3.00
9.00	**2.80**	1.00	2.20	3.00
9.10	**2.90**	1.00	2.20	3.00
9.20	**3.00**	1.00	2.20	3.00

Table 11: Kerb Separated Bike Lanes with a Vertical (Non-Mountable) Kerb on the Right Side of the Adjacent Traffic Lane

TOTAL ROAD WIDTH IN ONE DIRECTION (BIKE LANE, SEPARATOR, PARKING & TRAFFIC LANE) (METRES)	BIKE LANE (METRES)	PHYSICAL SEPARATOR ISLAND (METRES)	PARKING (METRES)	TRAFFIC LANE (METRES)
8.40	1.80	0.80	2.20	3.60
8.45	1.80	**0.85**	2.20	3.60
8.55	**1.90**	0.85	2.20	3.60
8.65	**2.00**	0.85	2.20	3.60
8.75	**2.10**	0.85	2.20	3.60
8.85	**2.20**	0.85	2.20	3.60
8.90	2.20	**0.90**	2.20	**3.60**
9.00	2.20	**1.00**	2.20	3.60
9.10	**2.30**	1.00	2.20	3.60
9.20	**2.40**	1.00	2.20	3.60
9.30	**2.50**	1.00	2.20	3.60
9.40	**2.60**	1.00	2.20	3.60
9.50	**2.70**	1.00	2.20	3.60
9.60	**2.80**	1.00	2.20	3.60
9.70	**2.90**	1.00	2.20	3.60
9.80	**3.00**	1.00	2.20	3.60

Note: A narrower traffic lane of approximately 3.2 to 3.3 metres may be appropriate on streets where there is a very low traffic carrying function or very low parking turnover rates. Therefore, the increased time required for parking manoeuvres within a narrow traffic lane which obstructs through traffic flow is an acceptable outcome. A relatively low and champhered barrier kerb on the right hand side of the traffic lane is preferable to ensure that parking manoeuvres can actually occur.

For example, the southbound carriageway of Elizabeth Street, between Flinders Lane and Flinders Street includes a 2.3 metre wide parking lane and a 3.2 metre wide traffic lane adjacent to a 100mm high champhered barrier kerb which allows vehicles to mount the relatively wide tram separation island when undertaking parking manoeuvres.

Table 12: Kerb Separated Bike Lanes with a Semi-Mountable Kerb on the Right Side of the Adjacent Traffic Lane

TOTAL ROAD WIDTH IN ONE DIRECTION (BIKE LANE, SEPARATOR, PARKING & TRAFFIC LANE) (METRES)	BIKE LANE (METRES)	PHYSICAL SEPARATOR ISLAND (METRES)	PARKING (METRES)	TRAFFIC LANE (METRES)
8.00	1.80	0.80	2.20	3.20
8.05	1.80	**0.85**	2.20	3.20
8.15	**1.90**	0.85	2.20	3.20
8.25	**2.00**	0.85	2.20	3.20
8.35	**2.10**	0.85	2.20	3.20
8.45	**2.20**	0.85	2.20	3.20
8.55	2.20	0.85	2.20	**3.30**
8.60	2.20	**0.90**	2.20	3.30
8.70	2.20	**1.00**	2.20	3.30
8.80	2.20	1.00	2.20	**3.40**
8.90	**2.30**	1.00	2.20	3.40
9.00	**2.40**	1.00	2.20	3.40
9.10	**2.50**	1.00	2.20	3.40
9.20	2.50	1.00	2.20	**3.50**
9.30	**2.60**	1.00	2.20	3.50
9.40	**2.70**	1.00	2.20	3.50
9.50	**2.80**	1.00	2.20	3.50
9.60	**2.90**	1.00	2.20	3.50
9.70	**3.00**	1.00	2.20	3.50

Table 13: Kerb Separated Bike Lanes Without On-Street Parking

TOTAL ROAD WIDTH IN ONE DIRECTION (BIKE LANE, SEPARATOR, PARKING & TRAFFIC LANE) (METRES)	BIKE LANE (METRES)	PHYSICAL SEPARATOR ISLAND (METRES)	TRAFFIC LANE (METRES)
4.90	1.80	0.30	2.80
5.00	**1.90**	0.30	2.80
5.10	**2.00**	0.30	2.80
5.20	2.00	0.30	**2.90**
5.30	**2.10**	0.30	2.90
5.40	**2.20**	0.30	2.90
5.50	2.20	0.30	**3.00**
5.60	**2.30**	0.30	3.00
5.70	**2.40**	0.30	3.00
5.80	**2.50**	0.30	3.00
5.90	**2.60**	0.30	3.00
6.00	**2.70**	0.30	3.00
6.10	**2.80**	0.30	3.00
6.20	**2.90**	0.30	3.00
6.30	**3.00**	0.30	3.00

APPENDIX B – BIKE LANE DIMENSIONS AT STOP LINES

Table 14: Kerb Separated Bike Lanes at Stop Lines (Appropriate only for Short Distances on Intersection Approaches)

TOTAL ROAD WIDTH IN ONE DIRECTION (BIKE LANE, SEPARATOR, PARKING & TRAFFIC LANE) (METRES)	BIKE LANE (METRES)	PHYSICAL SEPARATOR ISLAND (METRES)	TRAFFIC LANE (METRES)
4.10	1.00	0.30	2.80
4.20	**1.10**	0.30	2.80
4.30	**1.20**	0.30	2.80
4.40	**1.30**	0.30	2.80
4.50	**1.40**	0.30	2.80
4.60	**1.50**	0.30	2.80
4.70	**1.60**	0.30	2.80
4.80	**1.70**	0.30	2.80
4.90	**1.80**	0.30	2.80

Note: For bike lanes in excess of 1.8 metres adopt dimensions as per Table 13.

How to contact us

Online:
melbourne.vic.gov.au

In person:
Melbourne Town Hall - Administration Building
120 Swanston Street, Melbourne
7.30am to 5pm, Monday to Friday
(Public holidays excluded)

Telephone:
03 9658 9658
7.30am to 6pm, Monday to Friday
(Public holidays excluded)

Fax:
03 9654 4854

In writing:
City of Melbourne
GPO Box 1603
Melbourne VIC 3001
Australia

Interpreter services
We cater for people of all backgrounds
Please call 03 9280 0726

03 9280 0717	廣東話
03 9280 0719	Bahasa Indonesia
03 9280 0720	Italiano
03 9280 0721	普通话
03 9280 0722	Soomaali
03 9280 0723	Español
03 9280 0725	Việt Ngữ
03 9280 0726	عربي
03 9280 0726	한국어
03 9280 0726	हिंदी
03 9280 0726	All other languages

National Relay Service:
If you are deaf, hearing impaired or speech-impaired,
call us via the National Relay Service: Teletypewriter (TTY)
users phone 1300 555 727 then ask for 03 9658 9658
9am to 5pm, Monday to Friday (Public holidays excluded)

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