ROAD DESIGN NOTE

# Accessible central island platform stops (CIPS) for trams in mixed traffic

## 1. Purpose

This Road Design Note (RDN) provides guidelines for the design of road infrastructure associated with accessible tram stops located centrally within an undivided road. There are two types of CIPS:

Type 1: where other vehicles are not permitted to drive on the tram tracks at the tram stop, i.e. segregated CIPS, where fencing is installed between the tram tracks and traffic lane, such as installed on Flinders Street at Swanston Street intersection, Melbourne, and Melbourne University.

Type 2: where other vehicles are permitted to drive on the tram tracks at the tram stop, i.e. non-segregated CIPS where fencing, between the tram tracks and traffic lane, cannot be installed, such as High St, Westgarth.

This RDN provides guidelines for Type 2 CIPS to address the following pedestrian safety and operational issues:

- tram doors being inadvertently opened on the traffic side of the tram,
- pedestrians crossing traffic lanes to board on the wrong side of tram,
- confusion for motorists in relation to giving way to pedestrians,
- consistency of giving way at CIPS compared to other types of stops already in operation.
- more reliable tram journeys, particularly during peak times.

Accessible tram stops provide a platform and associated ramps/pedestrian facilities that comply with the requirements of the *Disability Discrimination Act 1992, Disability Standards for Accessible Public Transport 2002 (DSAPT)* and referenced Australian Standards.

## 2. Scope

This RDN is applicable for central island platform stops (CIPS) for trams:

- where posted speed limits are 60 km/h or less.
- at intersections and mid-block between intersections.

This RDN provides guidelines on:

- types of routes where CIPS would be appropriate.
- road safety barrier requirements.
- traffic lane realignment and narrowing as a result of installing a CIPS.
- pedestrian operated signals, signing, line marking and street lighting requirements.
- intersection sight line requirements.
- access and storage requirements.

## 3. Tram route selection

CIPS could be considered on undivided roads where the following factors apply:

- are priority tram routes under the SmartRoads network operating plans
- located within strip shopping centres
- have 4 traffic lanes (2 each way) with limited road reservation width.
- have a posted speed limit ≤60 km/h and where the operating speeds are ≤60 km/h
- carry low volume of commercial vehicles (<5%)
- where off-street parking is available for residents or where parking can be removed adjacent to CIPS and vehicular access to driveways can be provided.
- where clearways can be implemented
- have alternative and parallel routes nearby to accommodate traffic diverted from

implementation of CIPS (refer to SmartRoads network operating plans)

- optimisation of existing tram stops is planned.

## 4. Road safety barriers

Road safety barrier requirements are dependent on the following factors:

- posted speed limit
- tram stop patronage and road conditions
- platform level relative to adjacent road pavement
- presence of other shielding features

Appendix A provides details of road safety barrier requirements for different speed zones.

Appendix B provides details of an acceptable layout for pedestrian operated signals, road safety barriers and platform terminations.

## 5. Traffic lane width

Wherever possible, traffic lane widths should be left unaltered with the platform fitted into the available cross section.

Where encroachment of the platform into traffic lanes is necessary, changes to lane arrangements shall consider:

- traffic lane width requirements. Refer to Austroads Guide to Road Design (AGRD) Part 3: Geometric Design and VicRoads Supplement to AGRD Part 3.
- lane alignment. Any lateral shifts in traffic lanes adjacent to platforms shall include appropriate changes to the lane alignment on both the approach and departure sides of the platform. These changes can be achieved by adopting:
  - horizontal geometry as defined in AGRD Part 3: Geometric Design and *VicRoads Supplement to AGRD Part 3* based on a speed equal to the speed limit plus 10 km/h, or
  - tapers based on merge taper lengths defined in AGRD Part 3: Geometric Design and *VicRoads Supplement to AGRD Part 3*. Lateral rates of movement of 0.6 m/s should be adopted where possible.
- pavement width requirements for turning movements at intersections. Refer *Design Vehicles and Turning Path Templates* (Austroads, 2006) and applicable VicRoads Region for advice on appropriate design vehicles, and combinations of design vehicles.
- method of removal of redundant line marking. The extent and method of redundant line marking removal on arterial roads is subject to the approval of VicRoads whilst local roads are subject to the approval of Council. Placement of asphalt overlays for the full width of pavement to cover redundant line marking may be required where substantial shifts in lane lines are required.

Appendix C provides details of the principles to be applied in developing proposals that require changes to traffic lane widths and/or alignments and issues that must be addressed.

Proposals to remove any existing traffic lanes shall be clearly identified at the concept design stage. Approvals for removal of existing traffic lanes shall be obtained from the relevant VicRoads Regional Director.

Proposals for changes to traffic lane widths and/or alignments are subject to the approval of VicRoads

## 6. Pedestrian operated signals, signing, line marking and street lighting

Pedestrian operated signals shall comply with the requirements of VicRoads Traffic Engineering Manual (TEM) Volume 1 – Traffic Management.

Note: Where new pedestrian operated signals are proposed it is recommended that a *SCRIM* test be carried out to ensure that sufficient friction exists on approach to the crossing. Values defined in *AGRD Part 3: Geometric Design* and *VicRoads Supplement to AGRD Part 3*.

A signing and line marking strategy has not been developed at this stage, therefore all signs and linemarking shall comply with the requirements of *VicRoads' TEM Volume 2 - Signs and Markings*. For consistency purposes the relevant authority should be consulted.

For the purpose of street lighting, roads adjacent to CIPS shall be lit to a minimum of V3 standard. Particular attention should be paid to ensure appropriate lighting of lane re-alignments, the nose of the tram platform, lane narrowing, pedestrian crossings and bollards. Lighting shall also comply with *Disability Discrimination Act 1992, Disability Standards for Accessible Public Transport 2002 (DSAPT)*

## 7. Intersection sight line requirements

Sight line requirements at intersections and mid-block locations are defined in AGRD Part 4A: Unsignalised and Signalised Intersections and VicRoads Supplement to AGRD Part 4.

Platform stops and associated pedestrian railing, shelters, etc. shall not reduce sight distances below desirable SISD requirements, unless agreed otherwise with the relevant VicRoads Region.

## 8. Drainage requirements

The effect of CIPS on the existing drainage system should be checked. For drainage purposes, CIPS should be considered as traffic islands and comply with the requirements of AGRD Part 5: Drainage Design – Section 2 and applicable *VicRoads Supplement to AGRD Part 5 and RDG Part 7 – Drainage*.

## 9. Approval process

Road safety audits shall be carried out at the concept, detail design and pre-opening stages.

Approval from Public Transport Victoria, Yarra Trams, VicRoads and agreement from the relevant municipality is required for concept designs before proceeding to detail design.

VicRoads approvals shall be obtained from the relevant VicRoads Region.

## References

Austroads guide to road design (AGRD)

VicRoads supplements to AGRD

Supersedes: Nil

Traffic Engineering Manual

Road Design Note 03-03 Accessible tram stops in safety zones.

**Approved by**

Daniel Cassar

Manager Road Standards and Traffic

## Contact

For further information please contact:

**VicRoads Technical Services**
60 Denmark St, Kew Vic 3101
Email: technicalconsulting@roads.vic.gov.au

**Road Design Notes are subject to periodic review and may be superseded.**

## Appendices

APPENDIX A: Road safety barrier requirements

APPENDIX B: Layout for pedestrian operated signals, safety barriers & platform terminations

APPENDIX C: Development of proposals to modify traffic lanes.

**Road Design Note 03-05 – Revision Summary**

| Issue | Approved | Date | Amendment |
|---|---|---|---|
| 03-05 | Mgr RS&T | JAN 2016 | First Edition |

# Appendix A - Road safety barrier requirements

Road safety barrier requirements will vary depending on site conditions and the design of the platform. Three categories of road safety barrier treatment are available. These are:

## Category 1 - Full Length Barriers

This category requires road safety barriers for the full length of the platform including protection of the end facing approaching traffic.

This type of treatment is not applicable for CIPS.

## Category 2 - Barriers at Approach End and Departure End

This category only requires road safety barrier protection for the end of the platform facing approaching traffic. Refer to section A1 below for details of crash cushion requirements.

This type of treatment may be applicable to the approach end of a CIPS located in a ≤ 60 km/h speed zone immediately downstream of a section of roadway with an operating speed > 60 km/h.

## Category 3 – Crashworthy Bollard Array at Approach End, Departure End and Pedestrian Crossings

This category requires protection of the platform end facing approaching traffic by an array of crashworthy bollards. An alternative to a bollard array may be considered for sites where bollards are inconsistent with urban design objectives, and these objectives warrant the omission of bollards. Refer Section A2 for details.

Category 2 barriers shall be adopted for all other sites, except where Category 3 barriers are acceptable as described in Section A2 below.

## A.1 Crash Cushion Requirements

The length and width of crash cushions can vary to account for variations in the design impact speed and the width of hazard requiring protection. Crash cushions shall be selected based on the following criteria:

- Design impact speed. Where site constraints permit, crash cushions shall provide for a design impact speed equal to the speed limit plus 10 km/h. Where the site is constrained and the length required to meet this requirement is not available, a design impact speed equal to the speed limit may be adopted.
- Width of Hazard Protected. Where the platform access ramp faces approaching traffic and site constraints permit the use of a crash cushion that maximises the width of platform protected, then such a crash cushion shall be adopted. Where the platform access ramp faces approaching traffic and site constraints are not compatible with the use of a wide crash cushion, a narrow crash cushion located at the foot of the ramp may be selected.

**Notes:**

- Accepted crash cushions are shown in Road Design Note 06-04
- Crashworthy bollards have been successfully crash tested to at least Test Level 0 (+ 10 km/h) as defined in AS/NZS 3845:1999

## A.2 Site Conditions where Category 3 Barriers May be Acceptable

Crashworthy bollards may be used where **all** of the following conditions are met:

- The speed limit is 60 km/h or less at all times.
- Actual traffic operating speeds at the platform site are consistent with the applicable speed limit.
- The site is constrained and/or urban design considerations are of such high priority that an accepted crash cushion cannot be accommodated or is not considered appropriate.

An example of an acceptable crashworthy bollard is the "Omni Stop" bollard (code 2211), supplied by Saferoads Pty Ltd. This is a proprietary product. The foundation of these rigid steel bollards include a cartridge which allows the bollard to partially deflect on impact which makes them less hazardous to errant vehicles than simple rigid bollards. While these bollards have been successfully crash tested, their crash performance, both from a vehicle occupant and vehicle damage point of view, is inferior to that of accepted crash cushions.

Alternatives to "Omni Stop" bollards may be considered where these alternatives have been successfully crash tested in accordance with AS/NZS 3845:2015.

Acceptable configurations of crashworthy bollards for the protection of platform ends are shown in Appendix B.

## Bollard Alternative

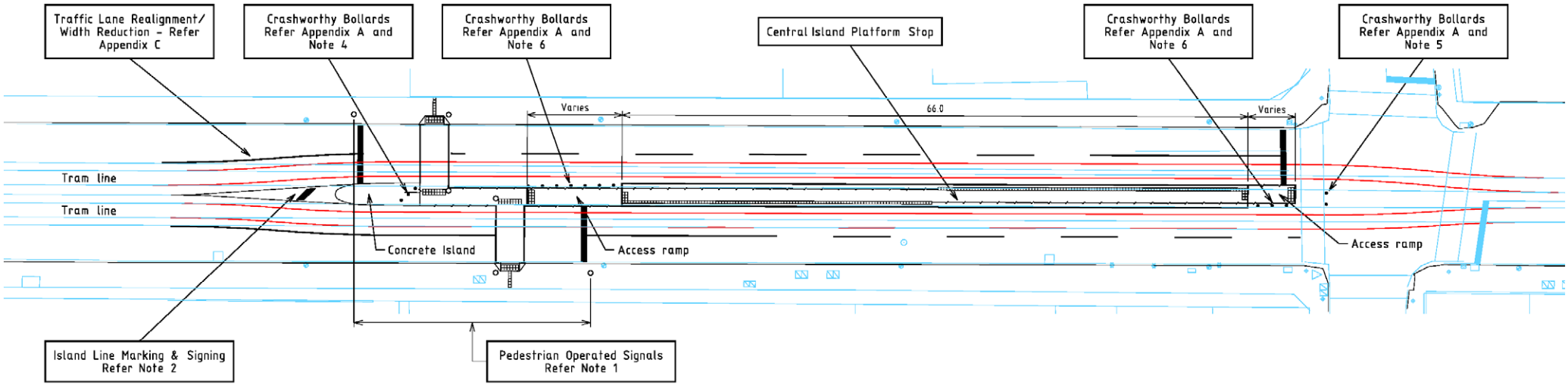
At sites that would otherwise be suitable for Category 3 barriers, where bollards are undesirable due to urban design objectives, replacement of bollards with a raised traffic island located between the platform and approaching traffic may be considered.

The minimum requirements for the traffic island are as follow:

- The width of the island is no less than the maximum width of the platform.
- The length of island where the width requirement of above is met is no less than 10m.
- Barrier kerb as shown on standard drawing SD2001E, or accepted equivalent, shall be used. Mountable or semi mountable kerb is not acceptable.
- Offsets to traffic lanes shall be as per normal traffic island requirements defined in AGRD Part 4A: Unsignalised and Signalised Intersections.

When considering this alternative, it must be recognised that a traffic island will not provide the same level of protection from errant vehicle impacts as the bollard arrays shown in Appendix B. The approval process for such a proposal must consider the risks associated with omission of bollards and conclude that the treatment proposed is appropriate for the site.

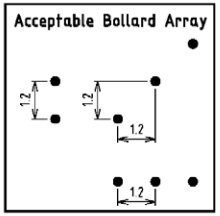
# Appendix B –
# Layout for pedestrian operated signals, safety barriers and platform terminations




CIPS with Pedestrian Operated Signals and Category 3 Barriers

**Notes**

1. Pedestrian Operated Signals as per Section 4 of VicRoads Traffic Engineering Manual Volume 1 – Traffic Management shall be provided so that signalised controlled crossings are available at each end of CIPS.
2. Island line marking and signing as per Section 18.2 and Figure 18.6 of VicRoads Traffic Engineering Manual Volume 2 – Signs and Markings shall be provided on approaches, except for departure side stops at intersections.
3. Acceptable road safety barrier products are listed in Road Design Note 06-04.
4. Bollards should be aligned to maximise the width of platform protected. An angled array of bollards is preferred to minimise the likelihood of striking more than one bollard simultaneously.
5. A line of bollards perpendicular to the direction of approaching traffic is only acceptable where site constraints prevent the use of an angled array as described in Note 4 above. Bollards should be aligned to maximise the width of platform protected.
6. Where the access ramp is located on the approach side of the platform and the ramp is separated from the pedestrian crossing such that it is not shielded by bollards at the intersection or signal poles, then bollards should be provided between the crossing and the access ramp railing to maximise the protection provided to the platform.
7. Bollards should be a conspicuous colour to ensure they are highly visible to motorists and include a delineator as defined in Section 23.2 of VicRoads Traffice Engineering Manual Volume 2 – Signs and Markings.



# APPENDIX C – Development of proposals to modify traffic lanes

In most cases, it will not be possible to accommodate a CIPS without encroaching on the adjacent traffic lane(s). Where encroachment is necessary, three options are available. These are:

**Option 1** Maintain the existing lane configuration and reduce the width of one or more lanes.

**Option 2** Remove one lane and modify the width of the remaining lanes.

**Option 3** Widen the pavement on the outside of the carriageway and realign lanes around the CIPS.

Proposals for individual sites may combine two or more of these options. As each site may have unique constraints, it is not possible to be prescriptive in this design note about which option should be adopted, however principles which should be applied in developing proposals are as follows:

## C.1 Lane Widths

Minimum lane widths are as follows:

| | |
|---|---|
| Through Lanes: | 3.3m adjacent to CIPS; 3.0m elsewhere |
| Turning Lanes: | To be based on design vehicle. |
| Bicycle Lanes: | 1.2m |

Desirable traffic lane widths as shown in Section 4.2.5 of Austroads Guide to Road Design Part 3: Geometric Design and *VicRoads Supplement to AGRD Part 3*.

Lane widths less than those shown above, or greater than shown in Section 4.2.5 of Austroads Guide to Road Design Part 3: Geometric Design and *VicRoads Supplement to AGRD Part 3* may be considered where the widths proposed are consistent with those on the existing road either side of the stop. Lane width proposals shall consider the proportion of commercial vehicles, buses and bicycles in the existing traffic mix and ensure that lane widths are appropriate.

Where a single traffic lane is provided past a CIPS, the minimum pavement width required between the platform and the outer face of kerb is 5.0m to allow vehicles to pass a vehicle that may have broken down.

Locations where desirable lane widths cannon be achieved will be assess buy the relevant authorities on a case by case basis.

Emergency Services should be consulted regarding any changes to the road network as their needs will need to be considered.

## C.2 Alignment Shifts/Lane Merges

Changes in lane alignments based on diverge tapers with a rate of lateral shift of 1.0 m/s is generally acceptable.

Where lane merges are required, merge tapers based on a rate of lateral shift of 0.6 m/s are required.

Taper details, including sight distance requirements are defined in Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections and VicRoads Supplement to AGRD Part 4C.

For platforms at intersections, it is not acceptable to shift the alignment of lanes on one side of an intersection without either:

A. Providing the same shift in alignment on the downstream side of the intersection before transitioning back to the original alignment, or

B. Providing clear delineation of lane alignments through the intersection.

Option (a) is generally preferable to Option (b). Approach sight distance appropriate to the speed limit is essential for either option.

## C.3 Providing for Cyclists

The safety of cyclists travelling past platform stops is a key issue that must be considered when developing a proposal for a CIPS that require reductions in lane widths or changes in lane configuration. Short sections of roadway with reduced cross section width can be potentially hazardous for cyclists by creating "squeeze points" when the road space available to them is significantly less than that on the adjoining sections of road.

Platform proposals that require changes to lane widths/configurations must ensure that provision for cyclists appropriate to the route is included. On routes that are also a bicycle priority route as part of SmartRoads Network Operating Plans, consideration should be given to providing an on-road bicycle lane or a wide kerbside lane to ensure bicycles are still given priority past CIPS. Refer to VicRoads Cycle Notes No. 7, August 2000, and No. 13, July 2004 for further guidance on this issue.

Provision for cyclists must consider not only the cross section width available but the suitability of the pavement surface for bicycles. Examples of pavement surfaces that may not be suitable for cyclists may include bluestone kerb and channel

with wide bluestone channels or depressed grated pits.

Where the platform proposal will effectively force cyclists to traverse unsuitable pavement surfaces they were previously able to avoid, modification of this unsuitable surface to make it traversable for cyclists shall be included in the platform works.

## C.4 Lane Removal – Assessment of Proposals

The retention of the existing lane configuration is a highly desirable objective, even if lane widths need to be reduced. Where this is not possible, VicRoads shall be advised prior to concept designs being submitted for approval to enable an assessment of the effect of changing the lane configuration on the operation of the affected road(s) to be carried out. VicRoads may conduct its own assessment of traffic impacts and/or provide direction on the traffic assessment required to be carried out by others prior to submission of concept designs for approval.

Where a number of stops are expected to have a similar effect on lane configurations along a route these should all be advised to VicRoads at the same time to enable the route effects and individual site effects to be considered concurrently.

The feasibility of relocating stops or optimisation of stops to avoid changes to lane configurations at critical intersections or mid-block locations should be investigated to enable an assessment of all available options to be completed.

## C.5 Parking

Where lane realignment or removal impacts on existing parking capacity, the number of parking spaces affected should be identified and shown on any proposals submitted to the relevant municipality for agreement. The relevant municipality shall be consulted on the feasibility of modifying existing parking arrangements before any proposals are submitted for approval. Where changes to the road layout will have an impact on existing parking arrangements, the relevant municipality should be invited to submit proposals for mitigation measures, including the feasibility of modifying adjacent parking areas for additional capacity, which should be considered as part of the platform works.

Parking is not allowed adjacent to CIPS or within the 20m approach to CIPS, unless there is a sign which permits parking.

## C.6 CIPS Length

Consideration should be given to providing 33m long dual sided loading CIPS where sufficient road space is available. Where the minimum platform width for dual sided loading is unable to be provided, a longer CIPS is to be considered to handle loading/unloading from two trams at the same time. A longer CIPS enables two trams to stop staggered to each other with minimal or no overlap of the trams. Appendix B provides details of a 66m long CIPS which accommodates trams stopping at each end with signalised controlled crossings for pedestrian access but there are many in operation which are longer. Also consideration must be given to the type of tram utilizing the stop i.e possible new 45m long trams. Allowing for pedestrian operated signals on the approach to the CIPS and the 20m no parking restriction, a significant number of parking spaces are affected. Consideration should be given to providing shorter (and narrower) CIPS where patronage is expected to be lower and conditions permit to minimise the number of parking spaces being affected.

## C.7 Local Access

The effects of any changes to existing traffic lanes on points of access to adjoining properties and side road intersections having restricted turning movement shall be identified and shown on any proposals submitted to the responsible road authority for approval. Restricting any turning movement can be a concern to Local Government. Changes to existing traffic lanes may affect local access in a number of ways, examples of which include the following:

- Commercial vehicle access. Reduced lane widths may force larger vehicles to occupy more than one lane in order to turn into or from a point of access. Proposals must demonstrate that existing access conditions can be maintained – i.e. design vehicles currently able to access a property must continue to have viable access.
- Access in merge areas. If lane merges are required, points of access within merge areas may be more hazardous than those within single or dual lane sections of road due to the increased demands on drivers in these areas. Merge areas should be located clear of points of local access if possible.

- Sight Lines to Access Points. Changes to lane alignments may change sight lines available to vehicles exiting points of local access, particularly if parking is permitted near the approach side of the access point. Sight lines available to points of local access must be appropriate to the speed environment.

## C.8 Bus Stops

Bus service operators and the responsible road authority shall be consulted on all proposals where existing bus stops may be affected by CIPS and associated roadwork to ensure that bus operations are not adversely affected.