ROAD DESIGN NOTE

Easy Access Stops (EAS) – Trafficable Platforms for Trams in Mixed Traffic

1. Purpose

This Road Design Note (RDN) provides guidelines for the design of road infrastructure associated with easy access tram stops located within an undivided road.

Easy Access Stops (EAS) provide level access to trams for passengers by integrating platforms within the roadway by raising the road pavement and/or lowering the tram tracks. With this platform arrangement, traffic is permitted to travel in the kerbside lane over the EAS as well as along the tram tracks to the right of the raised roadway. Tram passengers are still required to wait on the footpath or nature strip area and cross the roadway to board or after alighting the tram. Traffic is required to stop in the same manner as for a kerbside tram stop.

This RDN provides guidelines for Easy Access Stops where traffic is permitted to travel in the kerbside lane as well as along the tram tracks, such as those installed in Bridge Road Richmond, Danks St Middle Park and Macarthur St Melbourne.

This platform design enables traffic carrying capacity to be maintained on roads where construction of other platform options are not suitable or would otherwise impact adversely on traffic queues and operation of tram services. Clearways operate in the peak direction, allowing cars to travel in both the kerbside lane and the central lane. Kerbside parking either end of the EAS is permitted outside of clearway hours.

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.

This RDN also takes into account the outcomes of the "before" and "after" monitoring and analysis undertaken to evaluate the impacts of the EAS in Bridge Road, Richmond.

2. Scope

This RDN is applicable for easy access stops (EAS) 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 EAS would be appropriate.
- road safety barrier requirements/consideration.
- pedestrian operated signals, signing, line marking and street lighting requirements.
- intersection sight line requirements.
- access and storage requirements.

3. Tram Route Selection

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

- are priority tram routes under the SmartRoads network operating plans
- where tram tracks are at 3.8m centres or space is available to widen tracks to 3.8m.
- located within strip shopping centres
- 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 for the EAS and vehicular access to driveways can be provided.
- where clearways can be implemented
- optimisation of existing tram stops is planned.

4. Traffic Lane Width

4.1. Traffic lane width requirements.

Minimum lane widths are as follows:

- 3.3m adjacent to EAS (Cross section is based on tram tracks being renewed with tracks being offset by 200mm to provide minimum 3.3m offside lane widths.)
- 3.0m min - Kerbside lane on trafficable platform

4.2. Pavement width requirements for turning movements at intersections.

Refer *AGRD Part 4: Intersections and Crossings – General and VicRoads Supplement to AGRD Part 4* and *Design Vehicles and Turning Path Templates (Austroads, 2006)* and applicable VicRoads Region for advice on appropriate design vehicles, and combinations of design vehicles. Particular consideration should be made for buses turning left.

4.3. 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.

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

Appendix A provides details of the cross section and layout of an EAS in Bridge Road.

5. Trafficable Platform Requirements

5.1. Platform

5.1.1 Width

Trafficable Platform width: 3.1m min

5.1.2 Length

33.0m unless otherwise approved.

Should site constraints restrict this length, it should be of sufficient length to accommodate all access doors of the design tram vehicle. Note, in some extreme cases, a 23m long platform may be acceptable following consultation with relevant stakeholders.

5.1.3 Location

Depending on site conditions, EAS can be located either directly opposite each other or staggered. EAS should desirably be located close to existing pedestrian operated signal crossings at intersections or midblock locations. New pedestrian operated signal crossings to be installed at EAS where none exist.

Where an EAS is proposed on the departure side of an intersection, it should be located a minimum distance of 50m from the intersection.

5.1.4 Longitudinal Grade and Crossfall

Proposed EAS locations should be chosen based on compliance with *Disability Discrimination Act 1992, Disability Standards for Accessible Public Transport 2002 (DSAPT)* in relation to acceptable longitudinal grade and crossfall.

EAS trafficable platforms are used as a walkway/ramp for pedestrians, between the tram and footpath. As such the longitudinal grade and crossfall should consider the requirements for both users.

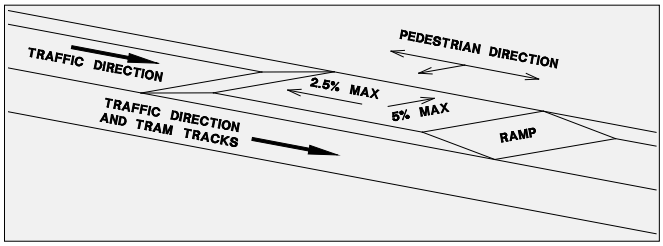

Figure 5.1: EAS Platform Grade

Grade (platform): 2.5% maximum

Crossfall (platform): 5.0% maximum

Note: Platform crossfall acts as a walkway gradient for pedestrian tram access.

5.1.6 Height

Height: 290mm (adjacent to tram tracks)

5.2. Ramp Details

As outlines in the 'Trafficable easy access tram stop vehicle interaction study' conducted by ARRB, the following ramp grades are considered desirable:

Ramp grade	Recommended maximum speed (km/h)
1:12	10
1:20	20
1:40	60
1:55	70

At constrained sites or if specific vehicle requirements are required, ramp grades can vary depending on road design speed, design vehicle criteria and emergency services requirements, etc. e.g Where low floor buses do not utilize that particular route. Approval from the relevant VicRoads Region is required.

6. 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 B provides details of road safety barrier requirements for different speed zones and platform arrangements.

7. Pedestrian Operated Signals, Signing, Line Marking & 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 EAS shall be lit to a minimum of V3 standard. Particular attention should be paid to ensure appropriate lighting of lane re-alignments, the ramps abutting the tram platform, lane narrowings, pedestrian crossings and bollards. Lighting shall also comply with *Disability Discrimination Act 1992, Disability Standards for Accessible Public Transport 2002 (DSAPT)*.

8. Intersection Sight Line Requirements

Sight line requirements at intersections are defined in *AGRD Part 4A: Unsignalised and Signalised Intersections* and *VicRoads Supplement to AGRD Part 4*. Mid-block locations are defined in *AGRD Part 3: Geometric Design* and *VicRoads Supplement to AGRD Part 3*.

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

9. Drainage Requirements

The effect of EAS on the existing drainage system should be checked. For drainage purposes, EAS 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*.

10. Delineation and Bollard Protection

10.1. Delineation

To provide additional legibility and to highlight to road users the presence of the EAS, three yellow frangible guide posts should be installed at 2 metre centres on the approach to the EAS. This assists to deter lane changing close to the EAS and also encourage drivers to avoid traversing the EAS outside clearway periods.

An approved flexible guide post (white with an in-built white delineator) should be installed on the ramps and platform to highlight the presence of a change in level. A minimum of three guide posts should be installed on the ramps. The spacing on the platform is dictated by the potential position of the tram doors. For a 33m EAS, the suggested spacing for guide posts is 4m from start, 8m, 9m, and 8m and 4m from other end.

Linemarking on the approach to an EAS is important as drivers may wish to change lanes prior to the platform. To avoid any last minute maneuvers, that could result in a vehicle straddling the ramp, it is recommended that 40m of dual continuous solid line be painted on the approach to the EAS. This would act as a deterrent and encourage drivers to avoid traversing the EAS outside clearway periods.

Some photographs of enhancement treatments adopted at the Bridge Road EAS are contained in Appendix C.

10.2. Bollard Protection

Given the EAS platform is raised to the same height as the top of existing kerb, any pedestrians waiting for a tram are vulnerable to an errant vehicle. It has been observed that some pedestrians do not stand behind the designated yellow line whilst waiting for trams. There is potential also for vehicles to impact the adjoining businesses. In order to prevent errant vehicles leaving the platform on the kerbside, it is recommended that crashworthy bollards (refer Section A2 in Appendix B) be installed behind the kerb over the length of the ramps and the platform. Spacing of the bollards at 5m centres should be sufficient to prevent errant vehicle entry. In some cases, a tram pole will be present and somewhat exposed, so ideally the pole should be protected with a bollard where possible. The placement of bollards in advance of the pole should commence at 0.5m from the pole with the remaining at 5m centres from there. The placement of bollards past the tram pole should be at 5m centres.

The above bollard treatment should also increase the conspicuity of the EAS.

11. Providing for Cyclists

On arterial roads of limited road reservation width, there is inadequate width for a designated bicycle lane or a minimum kerbside lane width of 3.42m as required under *AGRD Part 3: Geometric Design*. Therefore no cycle lanes are shown as part of the EAS design.

The locations of the EAS at particular stops will mean that few vehicles are anticipated to traverse the EAS (use the kerbside lane) outside clearway times during the day, so cyclists should therefore be able to use the EAS without, or with few vehicle interactions. During clearway times, which are the peak traffic flow times for vehicles and bicycles, vehicles and bicycles will need to share the kerbside lane and the EAS. Cyclists must stop when a tram enters the stop, but passengers should wait clear of the roadway until the tram has stopped and opened its doors.

Provision for cyclists must consider not only the cross section width available but the suitability of the pavement surface for bicycles. Examples where pavement surfaces 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.

12. Parking

The provision of EAS will impact on the existing parking capacity along a route. 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 EAS works.

Kerbside parking is permitted outside of clearway hours. Parking should be positioned as to make it difficult for vehicles to travel in the left lane over the EAS during non-clearway times. If driveways or adjoining roads are located within the EAS, positioning of parking bays will need to allow access to be maintained.

Parking bay locations to consider the following key factors but not limited to:

- Speed limits
- Pedestrian crossing locations
- Vehicle access requirements
- Emergency service requirements
- Clearway requirements
- Driveways and side streets

To be assessed on a site by site basis taking local area needs into consideration.

13. 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.

14. Bus Stops

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

15. 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.

Appendices

Appendix A: Cross section and layout of an EAS in Bridge Road

Appendix B: Road Safety Barrier Requirements

Appendix C: Linemarking and Delineation Enhancements

References

Austroads Guide to Road Design
VicRoads Supplements
Supersedes: Nil

Road Design Note 03-03

Traffic Engineering Manual

Trafficable easy access tram stops vehicle interaction study – ARRB

The following SKM reports:

- Easy Access Tram Stops – Bridge Road Stops 15 and 17, Richmond FUNCTIONAL DESIGN REPORT March 2012
- Bridge Road Easy Access Stop Monitoring
- BRIDGE ROAD DISABILITY ACCESS VISIT July 2013 and BEFORE AND AFTER ANALYSIS August 2013
- Bridge Road EAS Monitoring Stage 3 Monitoring February 2014

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

Road Design Note 03-06 – Revision Summary

Issue	Approved	Date	Amendment
03-06	Mgr RS&T	JAN 2016	First Edition

Appendix A

15.1. Cross Section and Layout of an EAS in Bridge Road

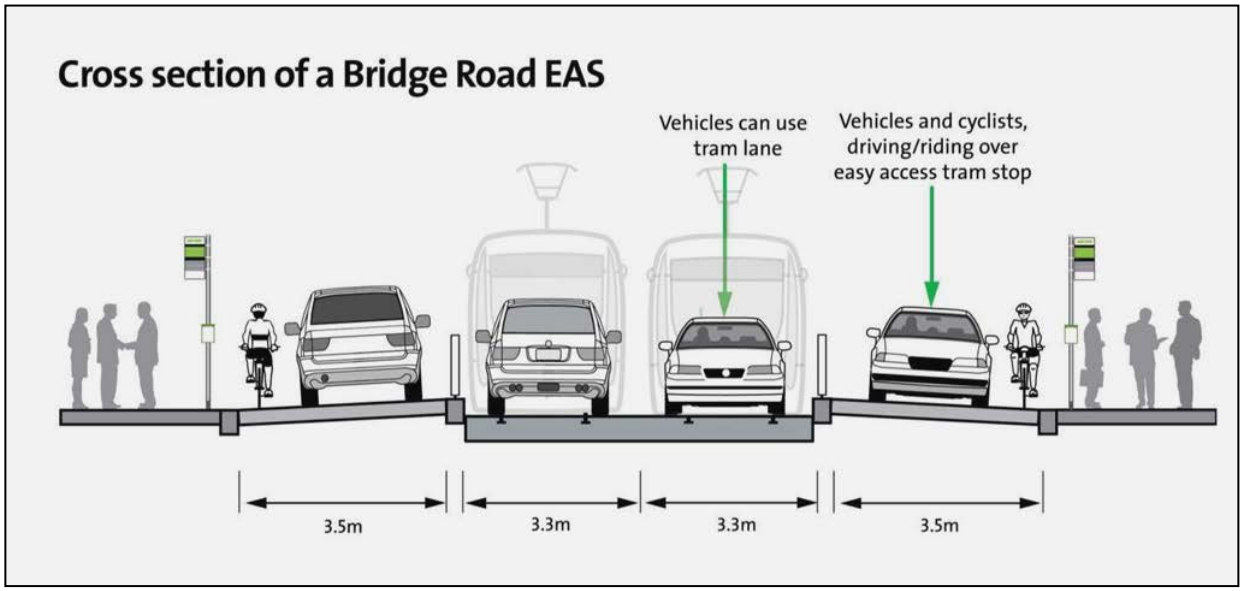


Figure 1: Typical cross section of an EAS in Bridge Road

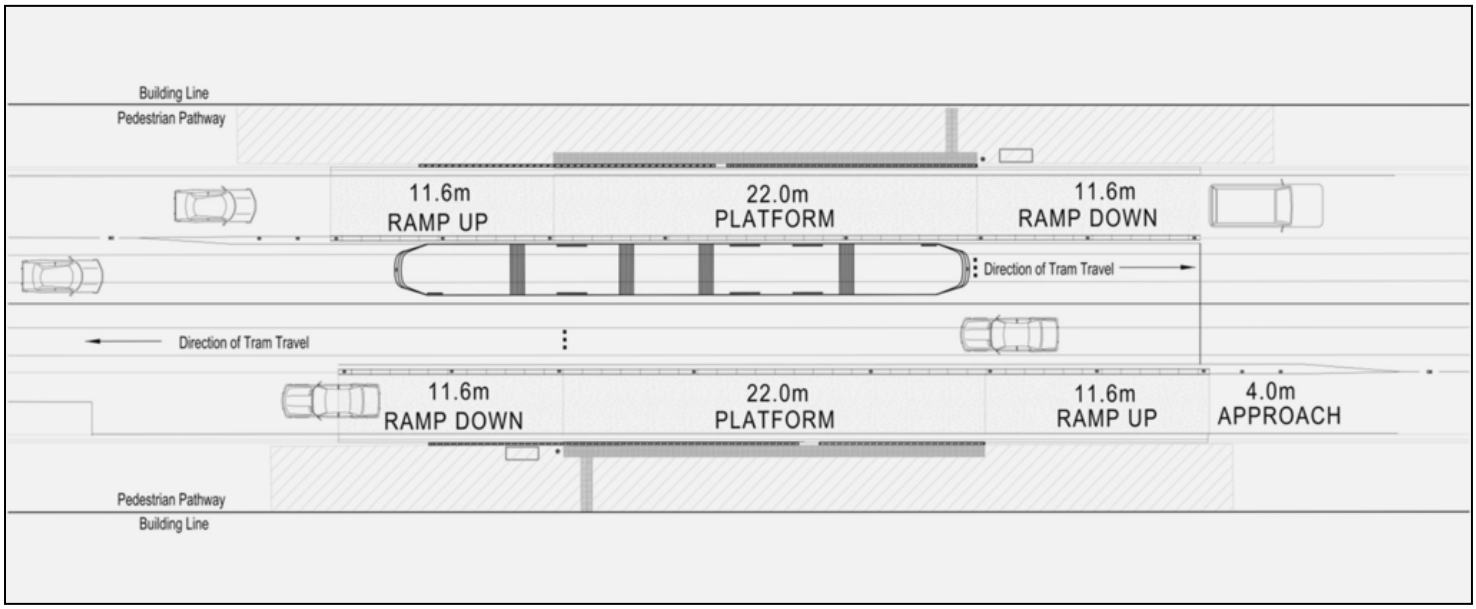


Figure 2: An example of a layout of an EAS in Bridge Road

Appendix B

15.2. 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.

Note: This type of treatment is not applicable for EAS.

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.

Note: This type of treatment is not applicable for EAS.

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.

A1. 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

A2. Site Conditions where Category 3 Barriers May be Acceptable

Crashworthy bollards may be used for EAS 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 as defined in AS/NZS 3845:2015.

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:

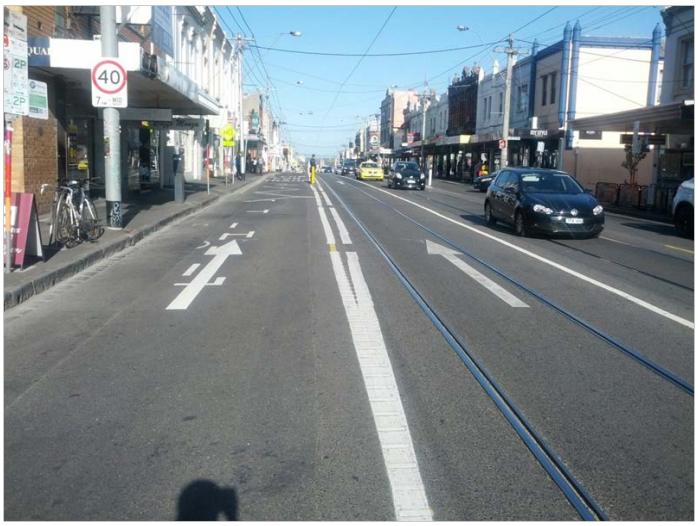
- The width of the island is no less than the maximum width of the platform.

- The length of island is no less than 10m.
- Barrier kerb as shown on standard drawing SD2001D, 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 a bollard array. 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 C

15.3. Linemarking and Delineation Enhancements



Continuous solid line 40m in length painted (tactile) on approach to EAS.

Three white arrows painted onto the pavement in the following locations:

- Approximately 25 metres in advance of the stops centrally in tram tracks
- Approximately 25 metres in advance of the stops, in the centre of the left lane within the first parking bay
- At commencement of tram stop in central lane

"STOP FOR TRAMS" stencilled in the left lane on the approach ramp just before the accessible stop area

Approximately 18m of zigzag approach line markings painted on approach to the tram stop before the "STOP FOR TRAMS" markings

In order to highlight to road users the presence of a raised pavement (EAS) ahead, it is recommended that road hump linemarking be used at the start of the approach ramp (between the zigzag marking and text "TRAMS" in above photograph).

"WATCH FOR TRAFFIC" stencilled in the left lane of the platforms in the accessible stop area, 300mm offset from the kerb and facing the footpath so that passengers waiting at the stops can read the text.

A wide 200mm line with "STAND BEHIND THIS LINE" text serves as a demarcation of the footpath and the roadway to pedestrians and a reminder to stay on the footpath while waiting for trams.