



Transport
State Transit

STATE TRANSIT

BUS INFRASTRUCTURE GUIDE

State Transit
P.O Box 2557
Strawberry Hills NSW 2012
Facsimile (02) 9245 5710
www.sydneybuses.nsw.gov.au

ISSUE 2

Table of Contents

1	INTRODUCTION	1
1.1	Comments and registration.....	1
1.2	Purpose	1
1.3	Flexibility of infrastructure design.....	1
1.4	Relevant Standards and Legislation	1
2	BUS DESIGN ENVELOPE	2
2.1	Design dimensions	2
	Length.....	2
	Width.....	2
	Height	2
	Overhang and underside clearance	2
2.2	Bus door locations.....	2
2.3	Turning templates	3
	Turning diameter	3
2.4	Access ramps	3
3	BUS STOP DESIGN ELEMENTS	3
3.1	Location.....	3
	Straight roads.....	3
	Signalised intersections	3
	Sight distance at intersections	3
	Heavy left turns.....	3
	Pedestrian crossing facilities.....	4
	Weave length.....	4
	Taxi ranks.....	4
3.2	Street Furniture.....	4
3.3	Planning considerations.....	4
	Retail, commercial and community facilities	4
	Shops with high parking turnover.....	4
	Bus stop spacing	4
3.4	J-stems, U-stems, blades and plinths.....	4
3.5	Bus Stops & Bus Zones.....	5
	Bus stops with no bus zones.....	5
	Bus stops with bus zones	5
3.6	Bus stop configurations	5
	Bus bay.....	5

	Kerbside	6
	Open bus bay.....	6
	In-lane bus stop	6
3.7	Draw in and draw out lengths.....	7
	Independent and nose to tail operation.....	7
3.8	Bus stop accessibility	7
3.9	Shelters	7
3.10	Bus stop capacity.....	7
3.11	Critical design elements	8
	Clear Zones.....	8
	Tail swing and front overhang	8
4	CIVIL CONSTRUCTION REQUIREMENTS.....	9
4.1	Kerb types and driveway laybacks.....	9
4.2	Construction materials.....	9
4.3	Passenger waiting area (stand pads).....	9
4.4	Bus stop painted pavement box marking	9
4.5	Lighting	9
5	BUS ROUTE ELEMENTS	10
5.1	Bus priority measures	10
	Bus Lanes	10
	Bus Only lane.....	10
	B Signals	10
	Transit Way	10
5.2	Lane widths	10
	Kerb lane	10
	Travel lanes.....	10
5.3	Road Camber.....	10
6	LATM TRAFFIC CALMING DEVICES	11
	Roundabouts.....	11
	Traffic slow point – One way	12
	Traffic slow points - Two way	12
	Speed humps.....	13
	Speed cushions	13
	Chicanes / angled slow points.....	14
	Pedestrian refuge islands	14
6.1	Bicycle lanes and shared paths	14
APPENDIX A	VERTICAL GEOMETRY CLEARANCE	15

1 INTRODUCTION

This guide supersedes the State Transit “Bus Stop Style Guide” published in 1999. This document has been created due to changes in government policies, the Disability Discrimination Act (DDA) and changes in bus characteristics. The document will be continually developed in light of experience gained from its use. There may be situations that arise that will require these guidelines to be varied. .

1.1 Comments and registration

Comments and suggestions are welcome at any time. Please register your use of the Infrastructure Guide with State Transit by sending an email to the address below;

businfrastructureguide@sta.nsw.gov.au

1.2 Purpose

The objective of the guide is to assist State Transit, state and local government agencies in providing consistent, safe and effective bus infrastructure. Bus services are to be accessible to all passengers. This responsibility extends to both the bus service provider and the road infrastructure providers. The aim is a comfortable, convenient, reliable, safe service that is accessible to all. When designing facilities for bus passengers, designers should keep in mind the requirements of the following groups:

- The elderly
- The mobility, vision and hearing impaired;
- People with young children, strollers and prams;
- People with large or heavy luggage or shopping;

1.3 Flexibility of infrastructure design

Public transport technology is constantly changing and improving. These changes require flexibility and adaptability of infrastructure to cater for future improvements to the network.

1.4 Relevant Standards and Legislation

The Accessible Transport Action Plan for NSW Transport, Roads and Maritime Agencies (Ministry of Transport, 2005 update) and the Commonwealth Disability Discrimination Act requires that services should provide equitable access for those with a disability. The timeframe for bus services and bus stops is as follows:

- 25% of bus stops to be wheelchair accessible by 2007, 55 % by 2012 and 100% by 2022.
- 25% of bus services to be wheelchair accessible by 2007, 55 % by 2012 and 100% by 2022.

The Accessible Transport Plan requires transport agencies to continue to work with local councils to develop practical responses to accessibility issues such as the provision of accessible bus stops, footpaths and kerb side infrastructure. Sydney Buses role is that of a bus service provider. It does not provide bus shelters, nor contribute to the cost of road infrastructure or bus priority measures.

2 BUS DESIGN ENVELOPE

This section provides the critical dimensions of STA buses. These dimensions need to be taken into account for all bus infrastructure design.

2.1 Design dimensions

Length

The current STA bus fleet varies in length from a 12.5m standard bus to an 18m articulated bus.

Width

A design width of 3.1m should be used when designing bus infrastructure. This figure includes the 230mm extrusion of rear view mirrors on both sides of the bus.

(NOTE: THIS FIGURE IS NOT TO BE USED TO DETERMINE TRAVEL AND PARKING LANE WIDTHS. SEE SECTION 5 FOR LANE WIDTH REQUIREMENTS)

Height

A design height of 4.3m (for single storey vehicles) should be used when designing bus infrastructure.

Overhang and underside clearance

Front and rear overhangs must be taken into consideration when designing any infrastructure that requires a vertical deflection/deviation of buses, such as LATM devices and dish drains across intersections.

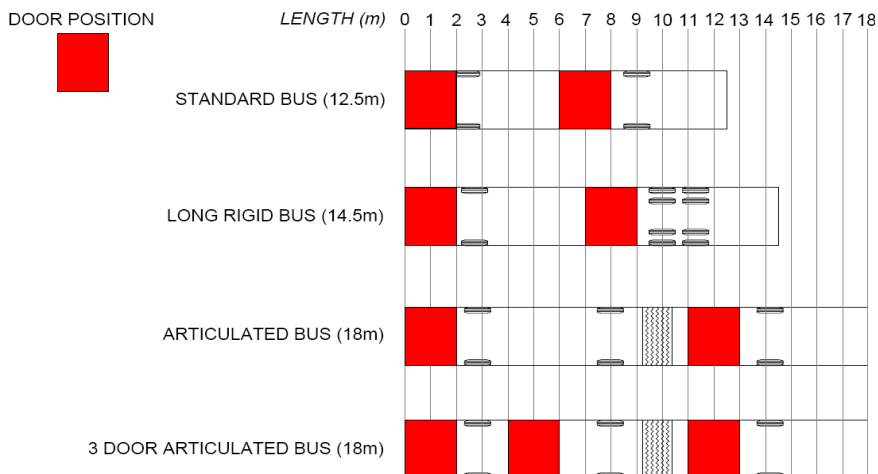
As a guide, the following overhangs and clearances for a standard 12.5m bus should be used;

Front 2.7m.
Rear 3.5m.
Underside clearance 75mm (at axles) and 160mm when kneeling

The bus clearance templates for vertical geometry are attached as Appendix A

2.2 Bus door locations

The door locations for the bus types in State Transit's fleet are shown below.



2.3 Turning templates

State Transit specifies as a minimum the 12.5m Austroads bus template turning at 5km/h – 15km/h is to be used. When undertaking an assessment using AutoTURN, the Austroads 12.5m bus is to be used and the simulation is to be at 15km/h unless otherwise specified.

Turning diameter

A turning diameter of 30m should be used when designing bus infrastructure.

2.4 Access ramps

All new buses are fitted with wheelchair access ramps. A 150mm barrier kerb and a sealed area (preferably concrete) that is clear of obstructions is required to deploy the ramp. If seating is provided, it must be positioned such that it does not interfere with the operation of the access ramp. See section 3.6 and 4.3 for wheelchair accessible bus stop requirements.



3 BUS STOP DESIGN ELEMENTS

3.1 Location

Some of the factors taken into consideration when considering bus stop locations are;

- Curvature of the road and sight distance
- Location in relation to traffic signals and pedestrian crossings
- Adjacent land uses
- Vegetation and street tree plantings
- Adjacent traffic or parking restrictions
- Distances to adjacent bus stops

In considering the locations of bus stops, consultation with the STA should be undertaken to ensure the proposed location is suitable. As a guide, the following factors should be taken into consideration in a preliminary assessment for bus stop locations.

Straight roads

Bus stops should be located on a straight section of roadway. This improves the sight distance for bus drivers as they leave the stop, and is easier for the driver to draw in.

Signalised intersections

The location of each stop should always be considered based on the individual characteristics of the site in question. However, it is often preferred to position bus stops on the departure side of signalised intersections.

Sight distance at intersections

In determining appropriate sight distances at intersections, section 2.1 of the RTA Road Design Guide should be consulted.

Heavy left turns

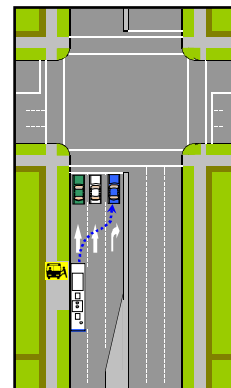
Bus stops should not be located on the advance side of an intersection that is subject to heavy left turns, as vehicles turn left in front of the bus as it leaves the stop.

Pedestrian crossing facilities

Where possible, stops should be placed on the downstream side of a pedestrian crossing to reduce the risk of passengers crossing the road in front of a stopped bus.

Weave length

There must be adequate weave length provided where buses are required to enter the traffic lane and cross additional lanes to make a turning movement. The determination on the appropriate weave length is dependant on the particular circumstances of the site and must be undertaken in consultation with State Transit.



Taxi ranks

Bus stops should be placed in front of taxi ranks. Positioning taxi ranks in front of bus zones will result in taxi queuing back into the bus zone when the rank is full.

3.2 Street Furniture

Street furniture such as seats or bus shelters may be placed in the bus zone or bus stop area provided that it does not conflict with passenger movements on and off buses (see section 2.2 for door locations).

In determining the position of street furniture, councils should consult with the STA to ensure there are no conflicts with passenger movements. Further information regarding bus stops see section 3.9 for Clear zones and 4.3 Passenger waiting areas.

3.3 Planning considerations

Retail, commercial and community facilities

It is highly desirable to locate bus stops close to land uses that are likely to attract the most passengers, such as retail areas, commercial buildings and community facilities.

Shops with high parking turnover

Bus stops should not be located adjacent to facilities that induce a high parking turnover, such as ATM's, post boxes, video stores, newsagents etc as is likely that vehicles will park illegally within the bus stop.

Bus stop spacing

The Ministry of Transport is responsible for determining bus stop spacing. As a guide, bus stops are generally to be spaced at 200m to 400m intervals. The number of bus stops will be kept to a practical minimum to reduce journey times and passenger delays.

3.4 J-stems, U-stems, blades and plinths

Bus stops and zones are identified by the use of J-stems, U-stems, blades or plinths. Measurements to items such as posts, trees, bus shelters should be made using this as the reference point.

3.5 Bus Stops & Bus Zones

Bus stops with no bus zones

A bus stop is identified by the use of a J-stem or plinth. Australian Road Rule 195 outlines the permissions for stopping in a bus stop, and states that stopping is prohibited within 20m on the approach and 10m on the departure of a bus stop

Bus stops with bus zones

A bus zone is used where a bus stop is considered to give inadequate provision for buses. Bus zones should be installed at bus stops where it is likely that more than one bus will use the stop, or where parking is at a premium and vehicles encroach within the bus stop. Australian Road Rule 183 outlines the permissions for stopping in a bus zone.

The length of a bus zone should not be less than the 30m requirement specified by Australian Road Rule 195. No stopping restrictions may be substituted for draw out and draw in lengths in conjunction with a Bus zone. A No parking restriction cannot substitute draw in and out lengths as vehicles are permitted to stop for up to 2 minutes.

The STA is willing to consider the use of operation times to regulate bus zones, however the use of operation times on bus zones where bus operations commence prior to 9am will not be supported due to the likelihood of vehicles parking in the zone during the evening not being moved prior to 9am.



BUS STOP SIGNPOSTING



BUS ZONE SIGNPOSTING

3.6 Bus stop configurations

Bus stops/zones can be configured in a number of ways:

Bus bay

Bus bays are most suited where they are adjacent to bus or bus only lanes. On major bus corridors it is often necessary to provide bus bays so that limited stop or express buses can pass other buses. Bus bays should be regulated by a bus zone and should not be used where a bus will be delayed in re-entering the traffic stream. Consideration should be given to the following issues before installing a bus bay.

<i>Traffic Volume</i>	Acceptable gaps must be available in the through traffic lane so that the bus can re-enter the traffic stream.
<i>Sight distance</i>	Sight distance as specified in section 2.1 of the RTA Road Design Guide to be provided.
<i>Traffic Speed</i>	Bus bays should not be used on roads where the speed limit, or 85% percentile speed, exceeds 60 km/h, unless adequate deceleration and acceleration lanes /can be provided.
<i>Bus volumes</i>	Bus bays cannot be readily extended or shortened as demand and bus configurations change. Adjoining land uses must be taken into consideration in determining bus bay lengths

Kerbside

Kerbside Bus Stops are the most common type. They can be readily increased in length to accommodate the changing dimensions and types of buses.

Open bus bay

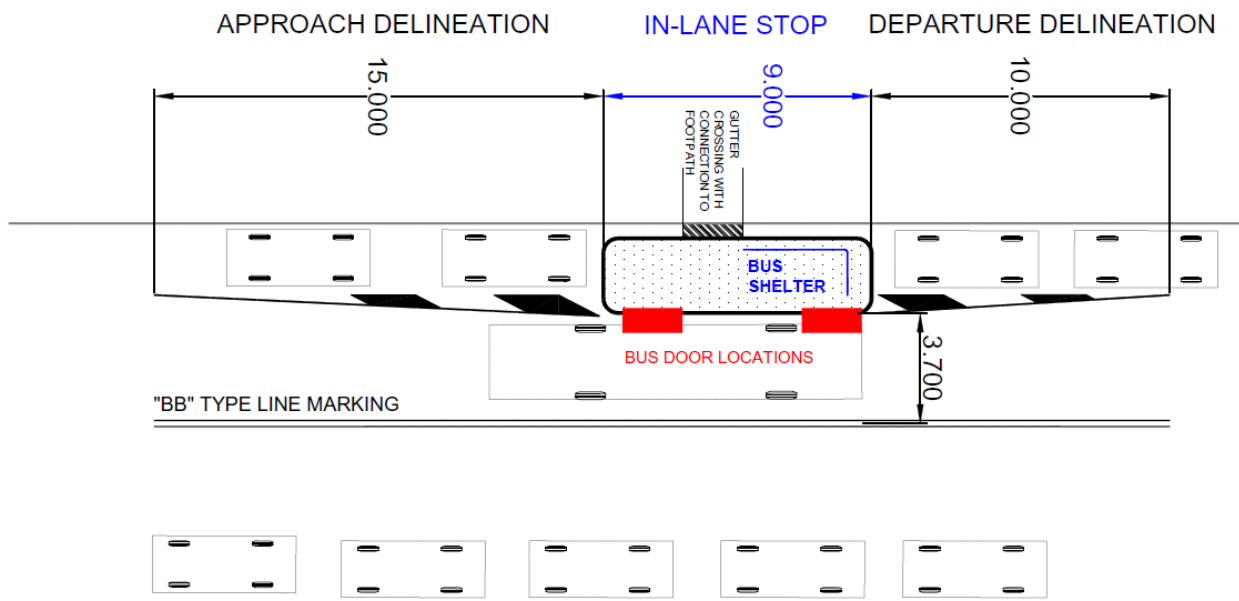
An open bus bay is a variant of the indented bus bay. It allows buses to drive straight into or out off the stop. They are generally located in advance or after intersections. A bus zone should regulate open bus bays.

In-lane bus stop

Consideration for in-lane bus stops will be on a case by case basis. Factors that need to be taken into account when considering the suitability of an in-lane bus stop include;

- Average Annual Daily Traffic (AADT) of the road in question
- Route service frequency
- Passenger loadings and bus dwell time
- On-street parking demand
- Obstructions on the footpath such as trees that prevent the bus from manoeuvring close and parallel to the kerb.

If an in-lane bus stop is deemed appropriate, the kerb extension to facilitate the in-lane stop should be a minimum of 9m long to accommodate both doors on a rigid and 3 door articulated bus (see section 2.2 for bus door locations). The kerb extension should be sufficient in width to allow the bus a straight and unimpeded run in to the stop. A suitable pedestrian connection that complies with AS 1428.1—2001 Design for Access and Mobility should be provided from the in-lane bus stop to the nearest sealed footpath. A typical in-lane bus stop arrangement is shown below.



3.7 Draw in and draw out lengths

The minimum lengths for draw in and draw out are shown in the table below.

Bus Stop Dimension (m)	Standard	Long Rigid	Articulated
Length of Bus	12.5	14.5	18.0
Minimum draw-out length	6.0	6.5	8.0
Minimum draw-in length	11.5	14.0	14.0
Bus Zone length for one bus	30.0	35.0	40.0

Note: (1) Dimensions are based on stopping at the bus stop sign with a suitable length of straight, flat standard height kerb to stop alongside.

Independent and nose to tail operation

The independent operation of bus movements requires the full length of bus zone as specified in the table above. For nose to tail operation of a bus zone a clear distance of 6m should be allowed between buses.

3.8 Bus stop accessibility

The provision of accessible bus stops is the responsibility of council. Bus stops should be designed in accordance with AS 1428.1—2001 Design for Access and Mobility.

3.9 Shelters

State Transit does not undertake provision of bus shelters and seats. Bus shelters and bench seats should be designed and located so that they do not interfere with passenger movements on and off buses (see section 2.2 for door locations). The positioning and dimensions of bus shelters are to comply with AS 1428.1—2001 Design for Access and Mobility.

3.10 Bus stop capacity

Bus stop capacity is dependant on the frequency of bus arrival and the dwell time at the stop. The following table is provided as a guideline to the number of spaces required. It is based on a 20 – 30 second dwell time.

Minimum Bus Stop Capacity

Buses Passing Stop in Busiest Hour	Number of Bus Spaces
Up to 15	1
30 -45	2
60 – 75	3
75 – 90	4
90-120	5
120-180	6

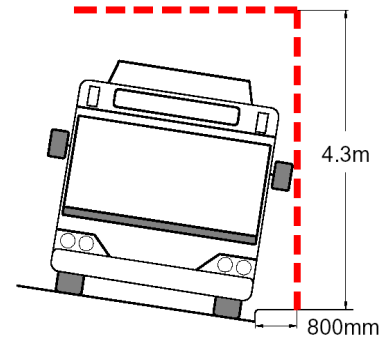
Note: Source: TCRP Report 19. Guidelines for the Location and Design of Bus Stops

- (1) Space requirements for buses dependant on operational, ticketing and scheduling.
- (2) Scheduling and operational circumstances may require up to 50% more bus stop space
- (3) Bus spaces required could be standard, long rigid and articulated buses depending on the type(s) of buses used.

3.11 Critical design elements

Clear Zones

All bus stops and routes should have a clear zone of 800mm across the footpath from the face of the kerb and 4.3m (the allowable height for medium rigid vehicles as determined by the RTA) above pavement level. The camber of the road at the bus stop should be taken into account when determining the clear zone.



When re-sheeting the road, care must be taken to ensure the crossfall is not increased such that it will encroach on the zone.

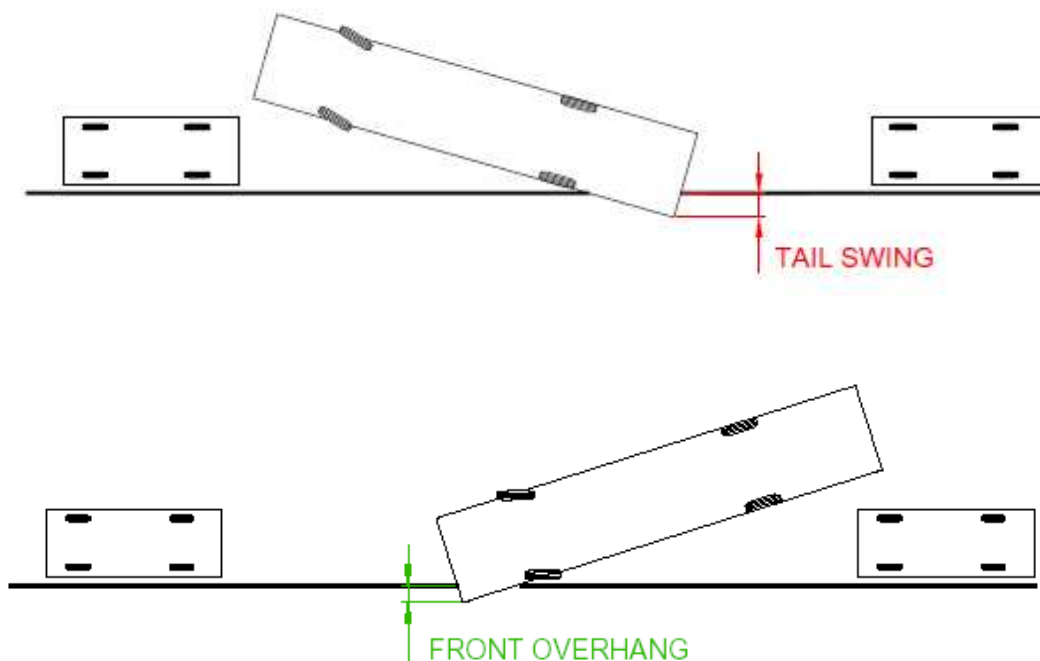
The relevant road authority's policy on street tree plantings adjacent to bus routes should take the following points into account.

- Tree branches within the clear zone are to be pruned.
- Young trees are to be adequately braced to prevent them being blown or sucked into the clear zone.
- Replacement / removal if they cannot be stopped from growing into the clear zone.

When trimming to vertical clearance, vertical deflection of branches due to wind and rain loads must be taken into account

Tail swing and front overhang

The front and rear overhang of buses can result in the front and rear of the bus overhanging the kerb line on turning movements



4 CIVIL CONSTRUCTION REQUIREMENTS

4.1 Kerb types and driveway laybacks

Standard barrier kerbs of 150mm minimum height are to be used at bus stops. Mountable kerbs should not be used at bus stops.

In residential areas it is inevitable that bus stops will be located adjacent to driveways. This is considered acceptable for a small residential complex and fast turnover bus stop. Driveways should be positioned so that laybacks do not line up with the front or back door.

4.2 Construction materials

To prevent rutting, pavements at bus stops should be constructed using concrete. For pavement design purposes the number of axle passes can be calculated using the bus timetables.

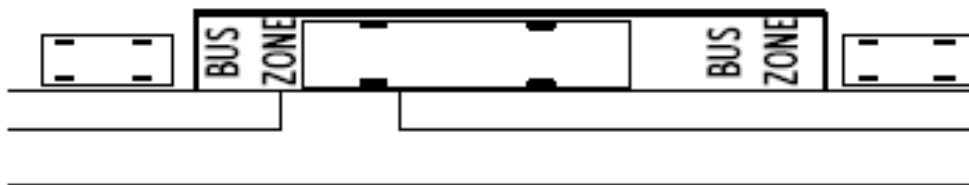
4.3 Passenger waiting area (stand pads)

The footpath width should provide enough space for passengers to board and alight and move past each other. The access / egress areas are to comply with AS 1428.1—2001 Design for Access and Mobility, and as a minimum should cover the width of the front and rear doors (approximately 3m). A suitable pedestrian connection that complies with AS 1428.1—2001 Design for Access and Mobility should be provided from the stand pad to the nearest sealed footpath. See section 2.4 Access ramps for required clearances for buses to deploy access ramps.

4.4 Bus stop painted pavement box marking

Painted boxes can be used at bus stops and bus zones where there is a high incidence of illegal parking. This treatment is only to be used at locations where persistent illegal parking is restricting bus access, as the significance of the treatment will be devalued if it is used at every stop.

Bus boxes should be between 2.7m and 3.0m wide and should cover the full length of the bus zone



4.5 Lighting

The minimum lux at and around the bus stop should be as per AS 1158.1-1986 Public Lighting Code.

5 BUS ROUTE ELEMENTS

5.1 Bus priority measures

Bus Lanes

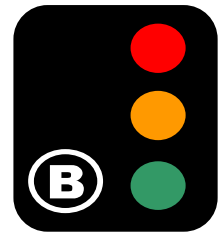
Bus Lanes are for the use of buses, taxis, hire cars, bicycles, and motorcycles. They enable buses to bypass queues on the approach to intersections and improve travel speed. Other vehicles may only drive in bus lanes for a maximum of 100m to enter or leave the road at a driveway or intersection.

Bus Only lane

Only buses are able to use Bus Only lanes. Taxis, hire cars, bicycles, and motorcycles are not exempt, and vehicles cannot enter the lane to access driveways or intersections.

B Signals

B signals are used to separate buses from other vehicles at signalised intersections. They enable buses to proceed from the stop line while all other vehicles travelling in the same direction are stopped. At B signals, buses must be provided with a Bus Only Lane.



Transit Way

Transit Ways or T-way lanes can only be used by buses and authorised Transit Way vehicles. They generally operate 24 hours per day, seven days per week.

5.2 Lane widths

Kerb lane

The kerb lane is generally used in two configurations;

- | | |
|--------------------------|---|
| <i>As a parking lane</i> | minimum of 3.0 m wide to cater for bus stops and allow the bus to move out of the through traffic lane. |
| <i>As a traffic lane</i> | minimum of 3.5 m to allow buses to use the lane without passing over drainage structures. |

Where the kerb side lane operates as both parking and travel lane, a width of 3.5m must be provided

Travel lanes

The minimum desirable lane width for bus routes is 3.2m. A minimum lane width of 3.5m is to be provided on one-way or one-lane sections of road. Additional width may be required on curved sections of road.

5.3 Road Camber

The kerb lane may be unsuitable for a travel lane where excessive camber results in the bus “leaning” over the footpath. In addition to the discomfort caused to passengers it can result in buses hitting trees and power poles.

6 LATM TRAFFIC CALMING DEVICES

When designing traffic calming measures on bus routes, bus swept path templates should be used to ensure bus access is maintained. Prior to construction, the footprint of the device should be marked out on site to allow State Transit to conduct a field assessment of the proposed traffic calming measure.

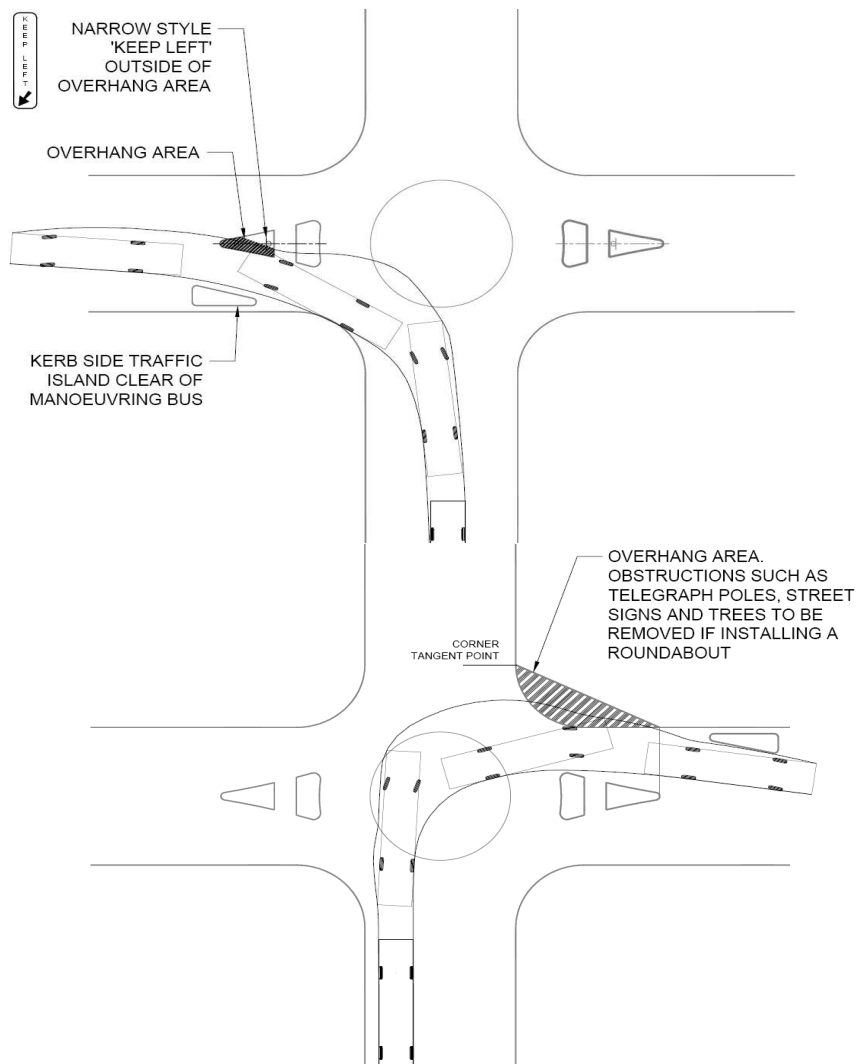
Roundabouts

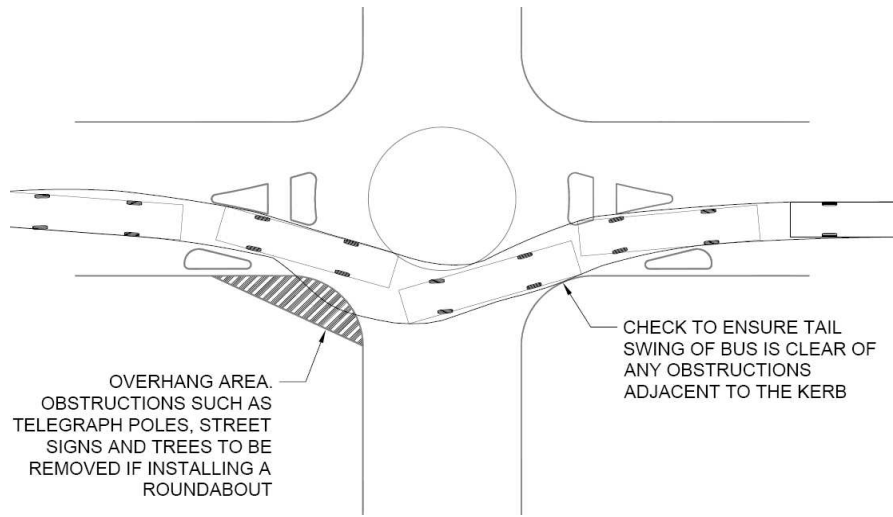
Ideally, roundabouts on bus routes should be designed such that buses are not required to traverse or overhang over any part of the device (central islands, median islands and splitter islands) or the intersection corners.

Where this cannot be achieved, it is acceptable to design the central island such that it can be traversed for right-turn and straight through movements. To ensure this, the central island should;

- Be constructed to a height no greater than 50mm
- Be clear of obstructions such as traffic signage or plantings.

The nature-strip and or kerb island on the departure side of the intersection should be designed to a height such that the front of the bus can overhang the face of kerb, and should be kept clear of obstructions such as traffic signs and plantings.





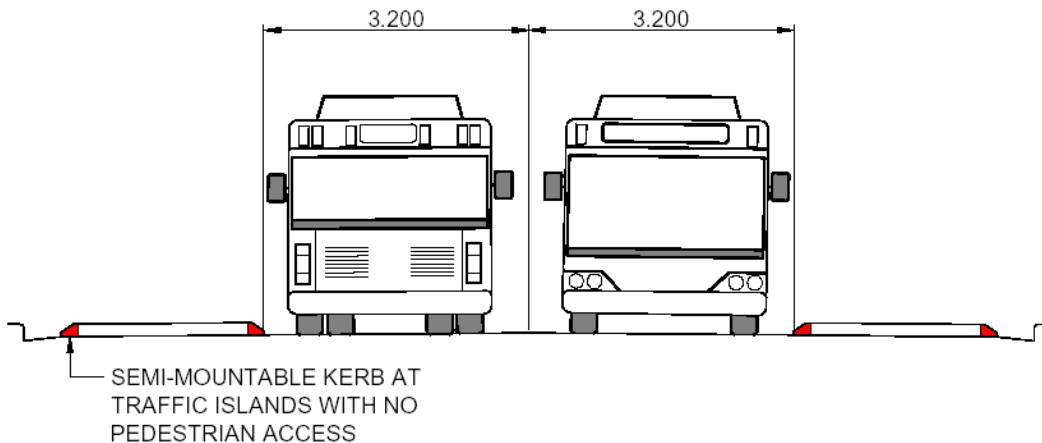
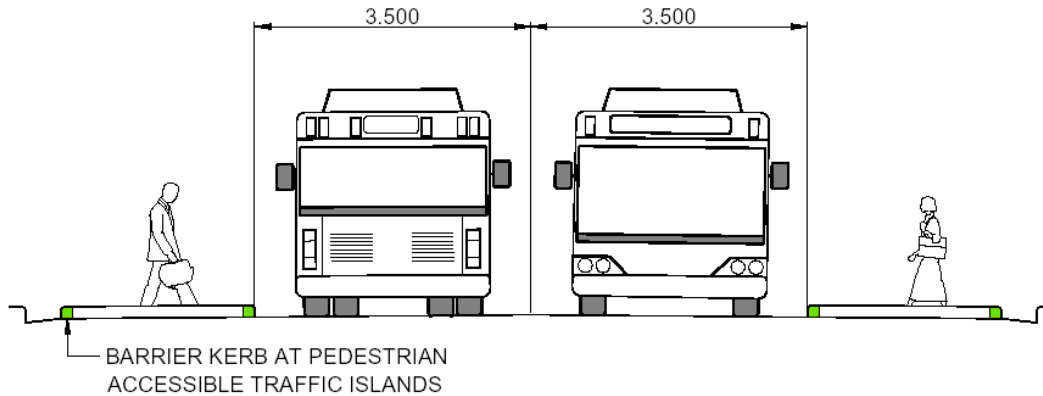
Traffic slow point - One way

Traffic slow points that constrain two-way traffic flows into a single lane are not to be installed on bus routes.

Traffic slow points - Two way

Two-way traffic slow points are acceptable on bus routes provided that the positioning of the kerb side islands does not impede access to a Bus Stop.

Where barrier kerb is used for the kerb side islands (for pedestrian access), the lane width through the slow point is to be 3.5m in either direction. Where semi-mountable kerb is used (no pedestrian access), the lane width may be reduced to 3.2m.

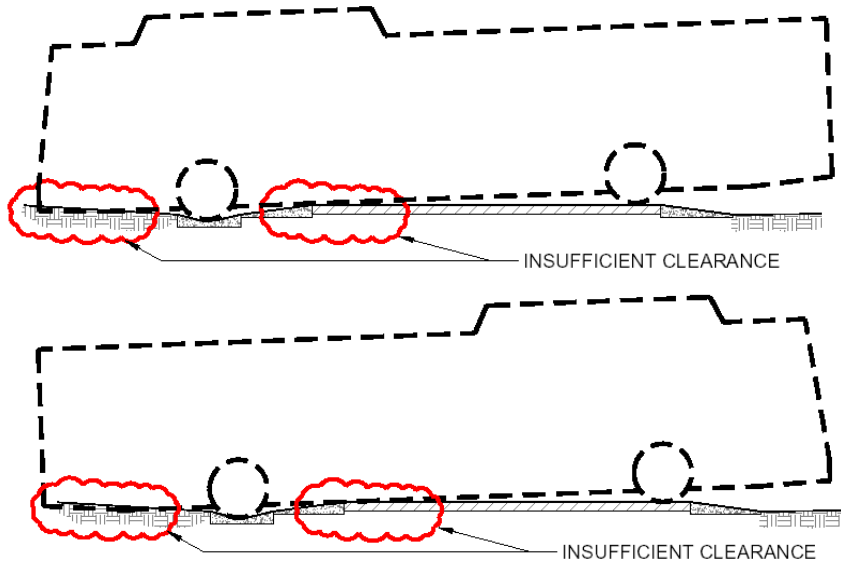


Speed humps

With the exception of raised pedestrian crossings, speed humps (such as Watts profile humps) are not to be constructed on bus routes.

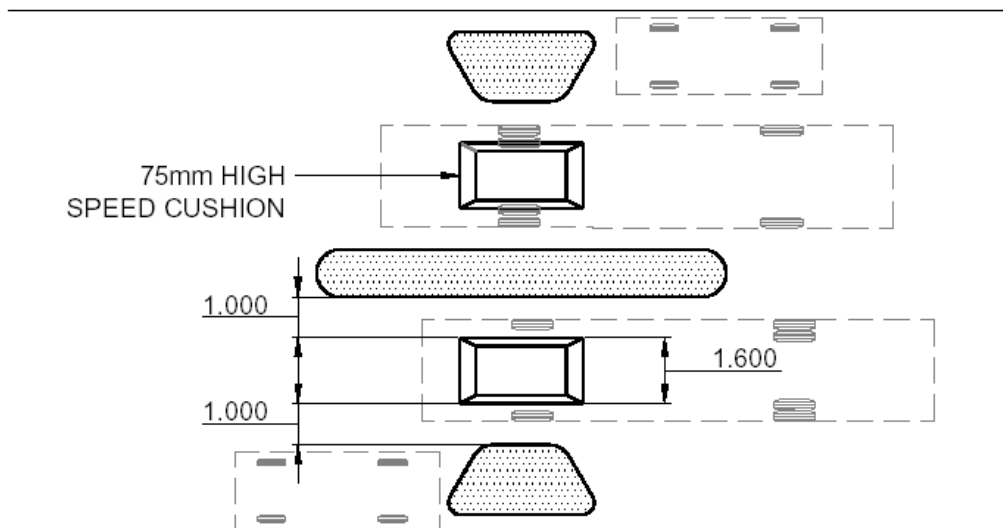
Where a raised pedestrian crossing is to be constructed on a bus route, the height shall not exceed 75mm with ramp grades no greater than 1 in 16 (6.25%). The length of the central platform should be no longer than 5.5m with provision for 3.5m travel lanes in either direction. For raised pedestrian crossings at intersections, additional lane width may be required to cater for bus turning movements. Raised threshold design should also take into consideration vertical clearances to adjoining dish drains.

The placing of raised thresholds adjacent to bus stops is not supported as passengers are likely to be walking on the bus at this point, and movement over a speed hump may result in a loss of balance.



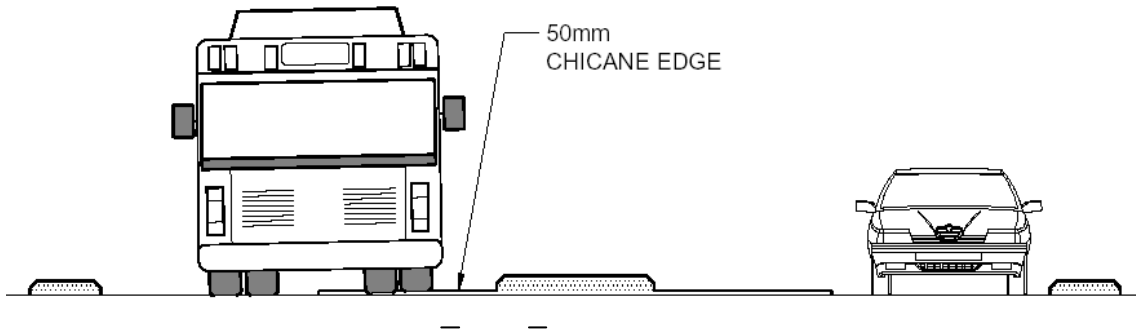
Speed cushions

Speed cushions can be used on bus routes provided that the width of the speed cushion is not greater than 1.6m wide and a 1m wide wheel path is provided from the speed cushion to any kerb face or median. The height of the speed cushion is to be 75mm.



Chicanes / angled slow points

Chicanes or angled slow points on bus routes will only be supported in instances whereby a bus can traverse/mount the chicane. The height on any mountable section of the chicane/angled slow point is not to exceed 50mm.



6.1 Bicycle lanes and shared paths

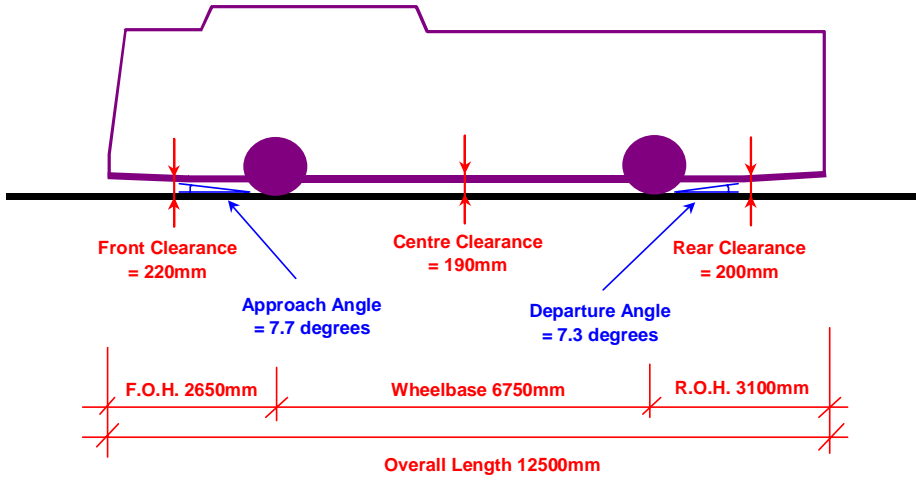
The design of bicycle lanes at bus stops is to be in accordance with the *AUSROADS Guide to Traffic Engineering Practice Part 14 Bicycles* and the RTA Bicycle Design Guidelines. For off-road/shared paths, adequate sight distance to be provided at bus stops to the approaching cyclists. The pathway should be designed such that bicycles are directed behind the bus waiting area to minimize conflict with bus passengers.

For on-street bicycle lanes (such as shoulder/parking lanes), the minimum 3.2m travel lane for bus movements is to be maintained. Where the carriageway width is insufficient to accommodate bicycle lanes in both directions whilst maintaining a 3.2m lane for bus access, possible options to accommodate bicycle movements could include;

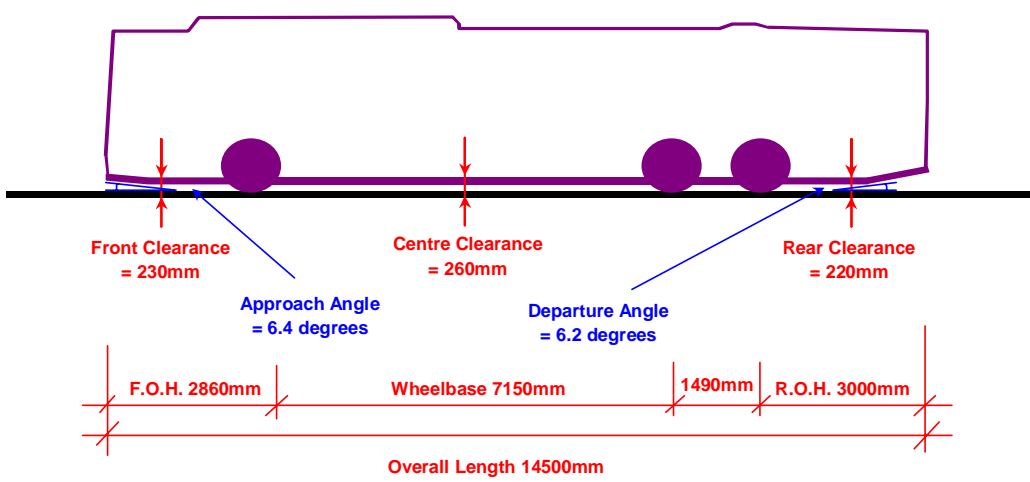
- Having the bicycle lane in one direction only, with a wide mixed use lane in the opposing direction
- Removal of on-street parking to accommodate dedicated bicycle lanes in both directions.

APPENDIX A VERTICAL GEOMETRY CLEARANCE

Standard Length Bus - 12.5 metres



Long Rigid Bus - 14.5 metres



Articulated Bus - 18.0 metres

