



BUS STOP SAFETY AND DESIGN GUIDELINES



PREPARED BY:



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**Prepared For:
Orange County Transportation Authority**

**Prepared By:
Kimley-Horn and Associates, Inc.**

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INTRODUCTION

1.1 PURPOSE OF THE DESIGN GUIDELINES

The purpose of this manual is to provide local jurisdictions with a set of suggested design criteria that should be considered when designing and placing transit facilities. These guidelines are provided by the Orange County Transportation Authority (OCTA) as a resource to local jurisdictions in providing comfortable and convenient high quality facilities at bus stop locations, while considering the operational needs of the Authority, the requirements of the Americans with Disabilities Act (ADA), and public safety.

These guidelines are intended for use by city planners, designers, traffic engineers, developers, and other public officials. The general public may also find these guidelines useful in understanding the current practices for the placement of transit facilities.

By no means is this information to be used as standard details on which to base a final design, but rather as recommended criteria and general guidance for the placement and safe design of transit facilities. It cannot be overemphasized that these guidelines must be used in conjunction with sound evaluation of the facts and engineering judgment. Each particular site must be thoroughly examined and each particular project must be evaluated from the aspect of safety, operational requirements, and cost-effectiveness, and design solutions may need to be adjusted accordingly to satisfy site specific constraints and applicable local ordinances.

The information in this handbook is the result of extensive research in the state-of-the-practice in bus facilities design and safety and a compilation of best practices from bus facility design guidelines from transit agencies throughout the United States and Canada. Guidelines have been incorporated from many research organizations including the Institute of Transportation Engineers, the Transit Cooperative Research Program, the National Cooperative Highway Research Program and the Transportation Research Board. Finally, the guidelines include recent changes in the Americans with Disabilities Act (ADA) as revised in 2002 to provide guidance on accessible design. The Bus Stop Safety and Design Guidelines are inherently an evolving set of guidelines and design considerations. As new information becomes available and methods are improved, this new information can be added to the handbook. It is intended to become a working document that adapts to changing times, changing environments and new policies.

1.2 GOALS OF THE DESIGN GUIDELINES

The goals of the guidelines are to:

1. Promote consistency in bus stop placement and design throughout Orange County;
2. Encourage local jurisdictions to design bus stops that are serviceable by the OCTA, meeting operational requirements of their fleet; and
3. Encourage the members of the community to use public transit through the provision of safe, comfortable, and convenient transit facilities.

The guidelines presented in this document are intended to help local jurisdictions, in partnership with OCTA, in meeting these goals.

1.3 DISCLAIMER

These guidelines are intended to provide general parameters for local jurisdictions when designing and placing transit facilities. They are not intended as an engineering design manual, and does not provide site specific detailed public transit, engineering, architectural, construction, or legal information. Users of this document will need to adjust the information contained in the guidelines to site specific needs, constraints and applicable laws, regulations, and ordinances. If the user desires expert advice concerning any of the information in these guidelines, the user is encouraged to retain the services of an appropriate expert. These guidelines are provided with the understanding that the Orange County Transportation Authority (OCTA) is not engaged in the rendering of any professional services.

Existing Facilities and Limitations

Some existing bus stops are inconsistent with the goals listed above and the guidelines presented in this manual. In some instances, bus stops are defined by the underdeveloped corridors or roads they serve. In these cases application of the design guidelines may be limited by a lack of right-of-way, constraints due to the natural terrain, unimproved roadways with no curb and gutter, drainage or sidewalks, or because of the policies and standards of the jurisdiction in which the stop is located. Because of these conditions local agencies may not be able to improve these bus stops without making significant street, sidewalk and utility enhancements, removing, relocating, or reducing the number of stops, or requiring OCTA to change service. These facilities can best be improved through a coordinated planning and design effort between OCTA and the local agencies responsible for maintaining and upgrading the roadway system.

CHAPTER 1

BUS DIMENSIONS AND STREET GEOMETRICS

1.1 VEHICLE CHARACTERISTICS

This handbook includes design parameters for three basic vehicle types: Large bus, mid-size bus, and an articulated bus. Other vehicles may also be used for transit services but generally



Photo 1: Typical 40-foot bus.

their characteristics are not critical in designing streets and facilities. All buses in the OCTA fleet are wheelchair lift equipped and their requirements need to be considered in bus stop design. Bus stop design should be based on the design parameters for articulated buses. Photo 1 shows a typical OCTA 40-foot bus while Photo 2 shows an OCTA 60-foot articulated bus. **Tables 1 through 3** outline vehicle dimensions and weights for various buses currently in OCTA's inventory. Additionally, **Figures 1 through 3** graphically display the vehicle design elements and dimensions.

The most important dimensions of a design vehicle for street design are shown below.



Photo 2: Typical 60-foot articulated bus.

Overall Dimensions

Overall height: 10 feet, 6 inches

Overall width: 10 feet, 4 inches
(including mirrors)

Overall length (large bus): 40 feet, 8 inches

Overall length (articulated bus): 61 feet

Axle Weight

Rear axle for large buses: 26,000 pounds

Rear axle for articulated buses: 24,700 pounds

Wheelchair Lift Dimensions

Width: 4 feet

Extension (from edge of bus): 4 feet, 6 inches

Table 1: OCTA Large Bus Characteristics

VEHICLE CHARACTERISTICS (A)		TYPE OF VEHICLE								
		RTS 30 - 3100 SERIES	GILLIGS PHANTOM 4200 SERIES	NEW FLYER 5000 / 5100 SERIES	NEW FLYER 5200 SERIES	NEW FLYER 5300 SERIES	NEW FLYER 5400 SERIES	NABI 2100 SERIES	NABI 2200 / 2300 SERIES	DIMENSIONS USED IN GUIDELINE
A.	Overall Length (B)	39'10"	37'10"	40'5"	40'9"	40'9"	40'8"	40'8"	40'8"	40'9"
B1.	Overall Width (with mirrors)	10'0"	9'6"	10'4"	10'0"	10'0"	10'0"	10'2"	10'2"	10'4"
B2.	Overall Width (without mirrors)	8'6"	7'11"	8'6"	8'6"	8'6"	8'6"	8'6"	8'6"	8'6"
C.	Overall Height	9'6"	10'0"	10'0"	9'3"	9'3"	9'3"	10'6"	10'6"	10'6"
D.	Wheelbase Length	24'10"	20'3"	22'8"	24'5"	24'5"	24'5"	22'11"	22'11"	25'0"
E.	Front Overhang (B)	7'9"	7'5"	8'3"	6'11"	6'11"	6'11"	7'6"	7'6"	8'3"
F.	Rear Overhang	7'4"	10'2"	9'6"	9'5"	9'5"	9'5"	10'3"	10'3"	10'3"
G.	Front Bumper Distance to Ground	1'4"	1'2"	1'4"	1'2"	1'2"	1'2"	1'2"	1'2"	1'4"
H.	First Step Distance to Ground	1'0"	1'3"	1'3"	1'3"	1'3"	1'3"	1'3"	1'3"	1'3"
I.	Centerline Front Door to Rear Door	22'0"	20'2"	20'2"	20'2"	21'2"	21'2"	16'10"	16'10"	22'0"
J.	Wheelchair Lift Width	3'0"	2'8"	2'10"	2'6"	2'6"	2'7"	2'7"	2'7"	4'0"
K.	Wheelchair Lift Extension (From edge of Bus)	3'7"	3'2"	4'6"	3'9"	3'9"	3'9"	4'2"	4'2"	4'6"
	Location of Wheelchair Lift	Rear	Rear	Front	Front/Rear	Front	Front/Rear	Rear	Rear	Front/Rear
	Minimum Turning Radius	44'0"	46'0"	35'6"	43'8"	44'6"	44'0"	44'0"	44'0"	50' (C)
	Gross Vehicle Weight (Pounds)	36,900	37,500	39,600	37,930	37,930	37,930	40,600	40,600	40,600
	Front Axle Capacity	13,400	14,500	14,600	13,230	13,230	13,230	14,600	14,600	14,600
	Rear Axle Capacity	23,500	23,000	25,000	24,700	24,700	24,700	26,000	26,000	26,000
	Seating Capacity	43	47	44/42	37	37	37	38	38	47

(A) Lettered items refer to specific dimensions as shown in Figure 1.

(B) Add 3'0" to overall length and front overhang to account for buses with bike racks.

(C) A 50' radius was used to ensure that over-the-road vehicles such as tourist coaches can also safely use transit amenities based on the Guidelines.

Table 2: OCTA Mid-Size Bus Characteristics

VEHICLE CHARACTERISTICS (A)		TYPE OF VEHICLE					DIMENSIONS USED IN GUIDELINE
		AEROTECH 8100 / 8200 SERIES	AEROTECH 8300 SERIES	AEROTECH 8400 SERIES	AEROTECH 8900 SERIES	EL DORADO NATIONAL E-Z RIDER 6000 SERIES	
A.	Overall Length	24'6"	24'6"	24'6"	24'6"	29'10"	29'10"
B1.	Overall Width (with mirrors)	10'0"	10'0"	10'0"	10'0"	10'10"	10'10"
B2.	Overall Width (without mirrors)	8'0"	8'0"	8'0"	8'0"	8'6"	8'6"
C.	Overall Height	9'4"	9'4"	9'4"	9'4"	10'0"	10'0"
D.	Wheelbase Length	14'8"	14'8"	14'8"	14'8"	12'8"	14'8"
E.	Front Overhang	2'6"	2'6"	2'6"	2'6"	7'6"	7'6"
F.	Rear Overhang	7'3"	7'3"	7'3"	7'3"	9'8"	9'8"
G.	Front Bumper Distance to Ground	1'1"	1'1"	1'1"	1'1"	1'3"	1'3"
H.	First Step Distance to Ground	1'0"	1'0"	1'0"	1'0"	1'1"	1'1"
I.	Centerline Front Door to Rear Door	N/A	N/A	N/A	N/A	12'9"	12'9"
J.	Wheelchair Lift Width	2'8"	2'8"	2'8"	2'8"	2'8"	2'8"
K.	Wheelchair Lift Extension (From edge of Bus)	4'2"	4'2"	4'2"	4'2"	3'2"	4'2"
	Location of Wheelchair Lift	Rear	Front/Rear	Front	Rear	Rear	Front/Rear
	Minimum Turning Radius	31'0"	31'0"	31'0"	31'0"	35'0"	35'
	Gross Vehicle Weight (Pounds)	14,050	14,050	14,050	14,050	30,980	30,980
	Front Axle Capacity	4,600	4,600	4,600	4,600	10,700	10,700
	Rear Axle Capacity	9,450	9,450	9,450	9,450	20,280	20,280
	Seating Capacity	16	15	19	16	25	25

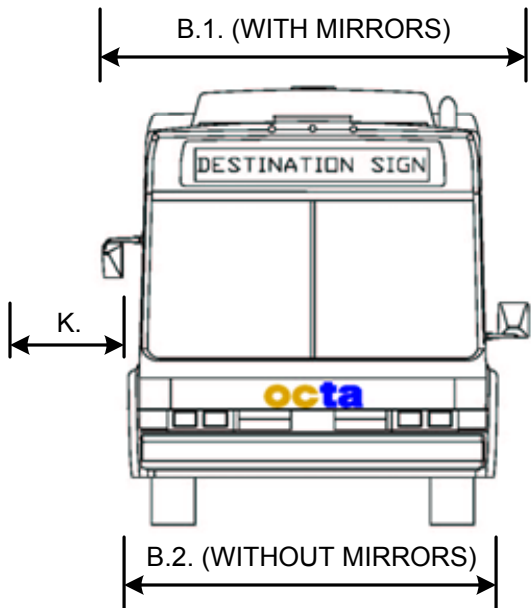
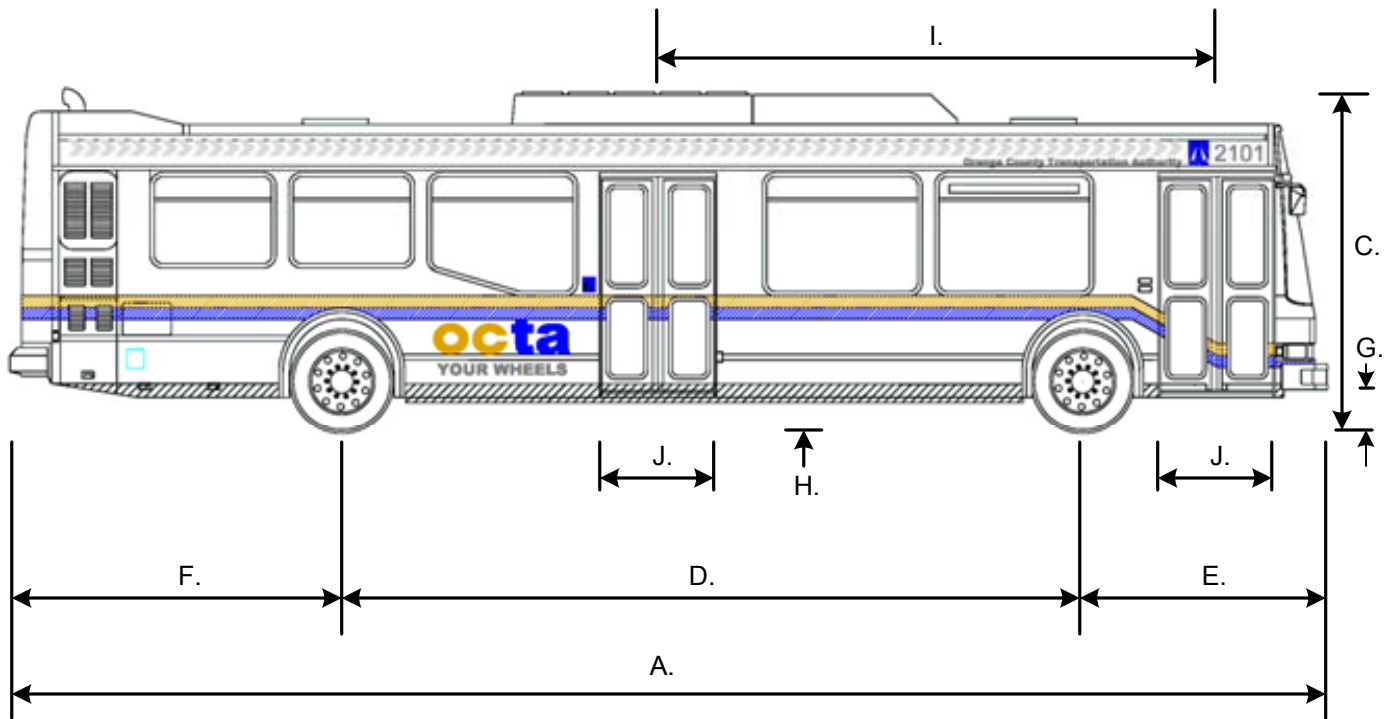
(A) Lettered items refer to specific dimensions as shown in Figure 2.

Note: For the majority of bus stops, the design parameters for large buses are used to ensure that all OCTA vehicles can safely use the facilities. Where appropriate, the additional specifications for small vans are also identified.

Table 3: OCTA Articulated Bus Dimensions

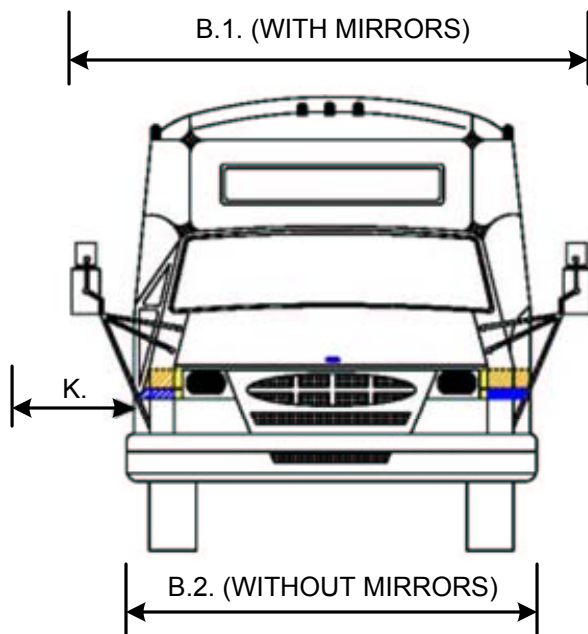
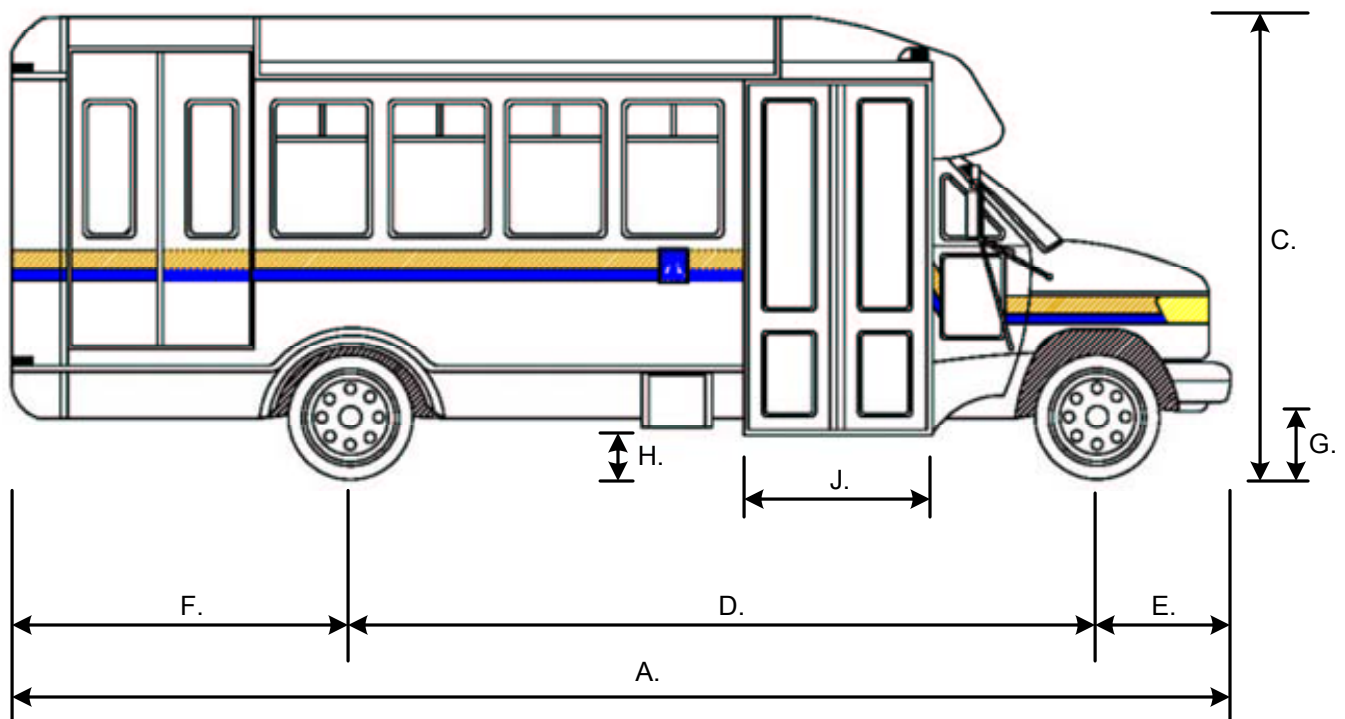
VEHICLE CHARACTERISTICS (A)		Type of Vehicle
		New Flyer Articulated Bus
A.	OVERALL LENGTH	61'4"
B1.	Overall Width (with mirrors)	10'4"
B2.	Overall Width (without mirrors)	8'6"
C.	Overall Height	10'3"
D.	Wheelbase Length – Front axle to rear axle	44'3"
E.	Wheelbase Length - Center axle to front axle	19'0"
F.	Wheelbase Length – Center axle to rear axle	25'3"
G.	Front Overhang	7'0"
H.	Rear Overhang	10'1"
I.	First Step Distance to Ground	1'3"
J.	Wheelchair Lift Width	2'6"
K.	Wheelchair Lift Extension (Edge of Bus)	3'9"
	Minimum Turning Radius	42'6"
	Gross Vehicle Weight (Pounds)	62,630
	Front Axle Capacity:	13,230
	Center Axle Capacity:	24,700
	Rear Axle Capacity:	24,700
	Seating Capacity	64

(A) Lettered items refer to specific dimensions as shown in Figure 3.



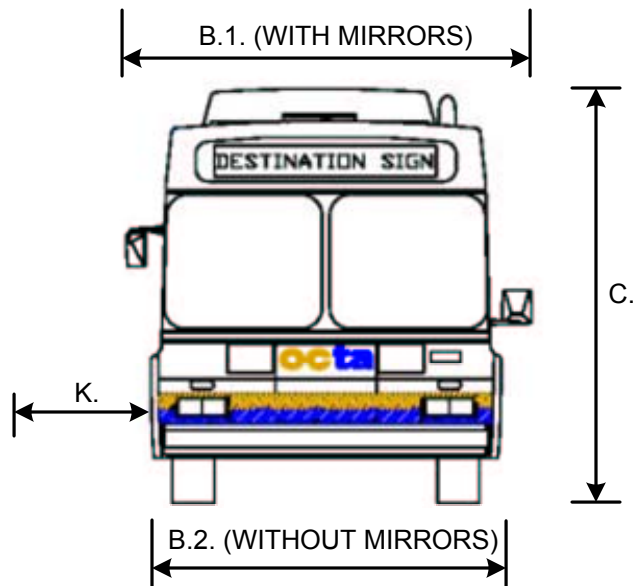
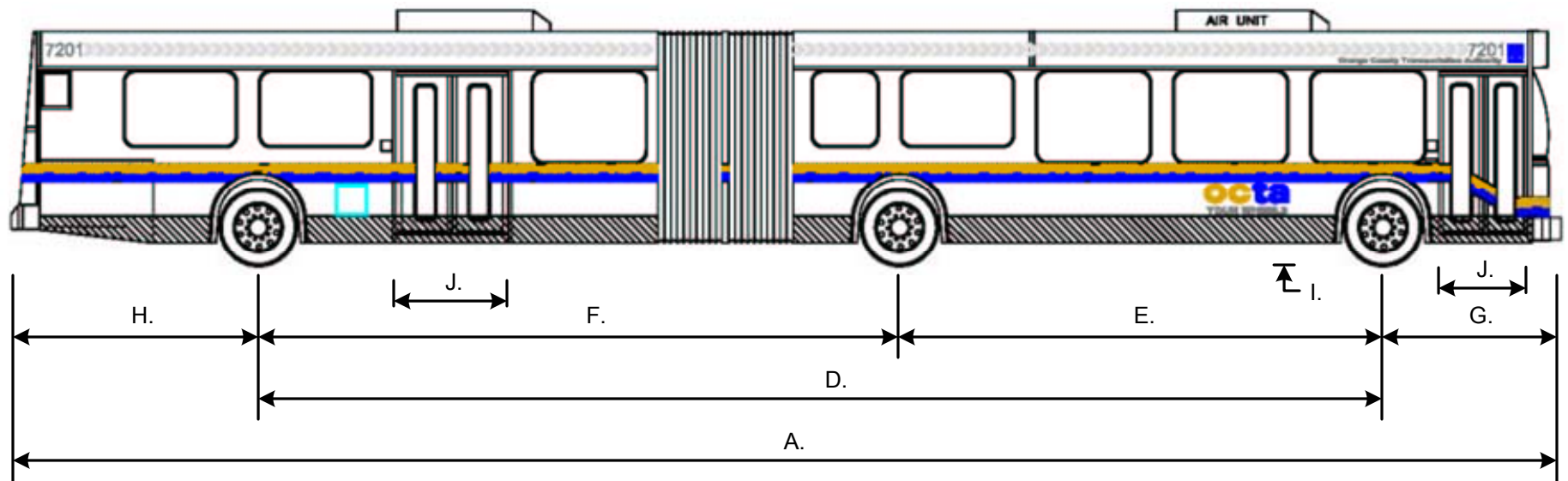
LETTERED ITEMS REFER TO VEHICLE CHARACTERISTICS SHOWN IN TABLE 1.





LETTERED ITEMS REFER TO VEHICLE CHARACTERISTICS SHOWN IN TABLE 2.





LETTERED ITEMS REFER TO VEHICLE CHARACTERISTICS SHOWN IN TABLE 3.



FIGURE 3
DESIGN PARAMETERS FOR OCTA
ARTICULATED BUSES

1.2 WHEELCHAIR LIFT

The wheelchair lift is an important part of the vehicle design. Currently, OCTA buses have either a front door, rear door, or front/rear door lift configuration. Since there is no way to predict whether the wheelchair lift will be at the front or rear door, bus stop design needs to accommodate for either possibility. Critical dimensions for a wheelchair lift are listed in **Tables 1, 2, and 3** and illustrated in **Figure 4**. Regardless of the bus stop location, adequate clearance for deploying a wheelchair lift should be provided at each designated location.

1.3 TURNING RADIUS TEMPLATE

Figure 5 and 5A shows bus turning radii requirements for a 40 foot coach and 60 foot articulated vehicles. The minimum interior radius is 28 feet and the minimum outer radius is 50 feet. These templates may be used in the design of facilities to identify required pavement width and possible vehicle encroachment. Additional allowance should be made under special circumstances such as:

- bus speeds greater than 10 miles per hour
- reverse turns
- sight distance limitations
- bike racks on front of bus (which add three feet to the length of the bus)
- changes in pavement grade
- restrictions to bus overhang

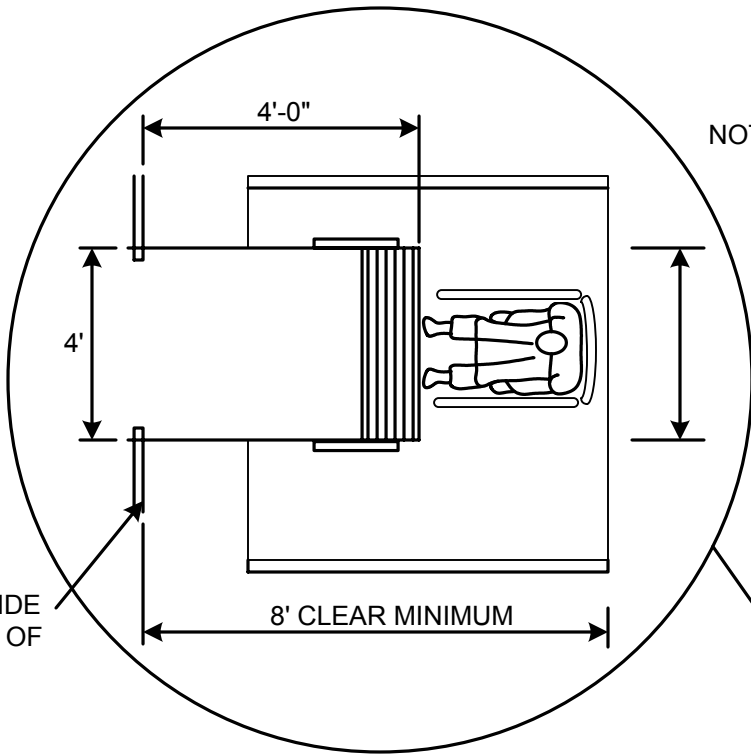
1.4 CURB RADIUS DESIGN

The corner radius at street intersections is a common transit related design problem. Some intersections are difficult to negotiate with a bus. Several advantages of a properly designed corner curb radius are:

- less bus/auto conflict at heavily used intersections
- higher bus operating speeds and reduced travel time
- improved bus rider comfort

The design of intersection radii should consider the following elements:

- bus turning radius
- on street parking
- right of way/building restrictions
- allowable bus encroachment into other traffic lanes traveling in the same direction
- placement of power poles or other utilities



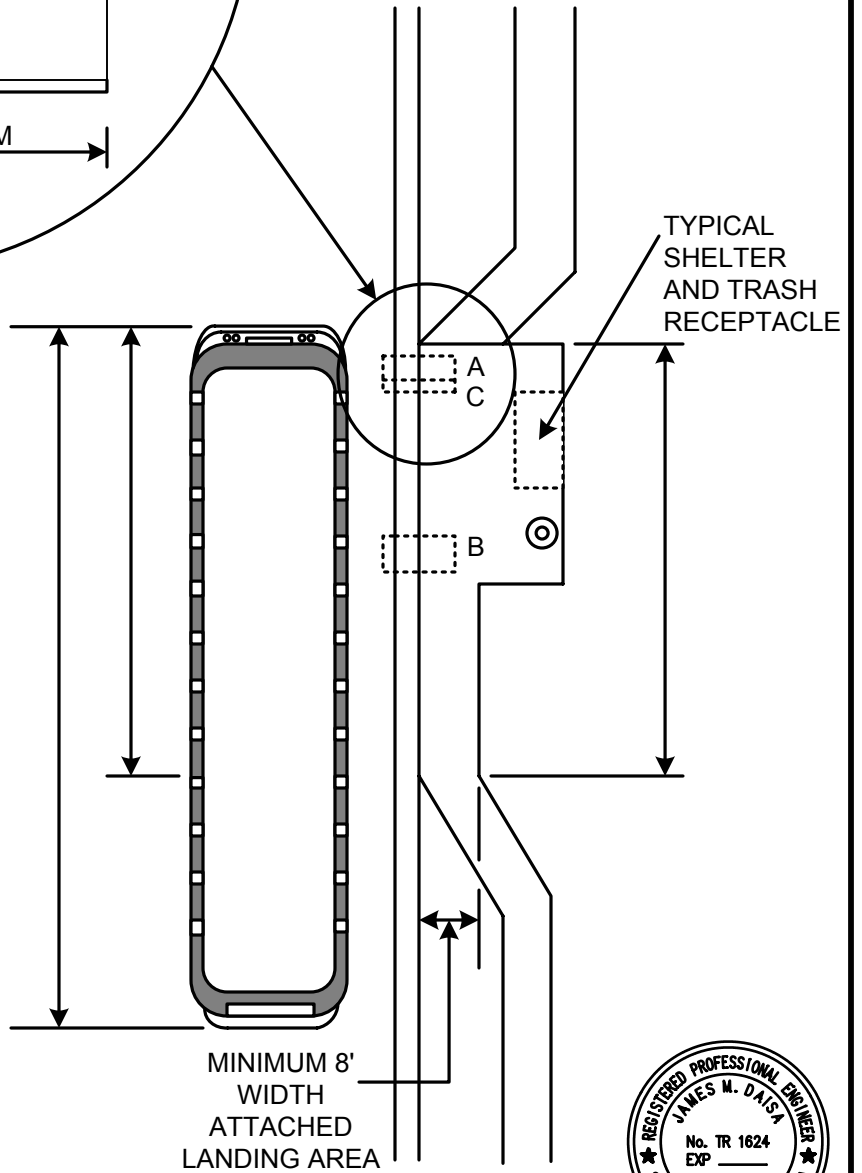
NOTE: 5' x 8' CLEAR SPACE FOR WHEELCHAIR LOADING REQUIRED BY ADA

OUTSIDE EDGE OF BUS

8' CLEAR MINIMUM

DESIGN FACTORS

- A. WHEELCHAIR LIFT EXTENSION: FRONT DOOR OF 40' BUS
- B. WHEELCHAIR LIFT EXTENSION: REAR DOOR OF 40' BUS
- C. WHEELCHAIR LIFT EXTENSION: FRONT DOOR OF 60' BUS



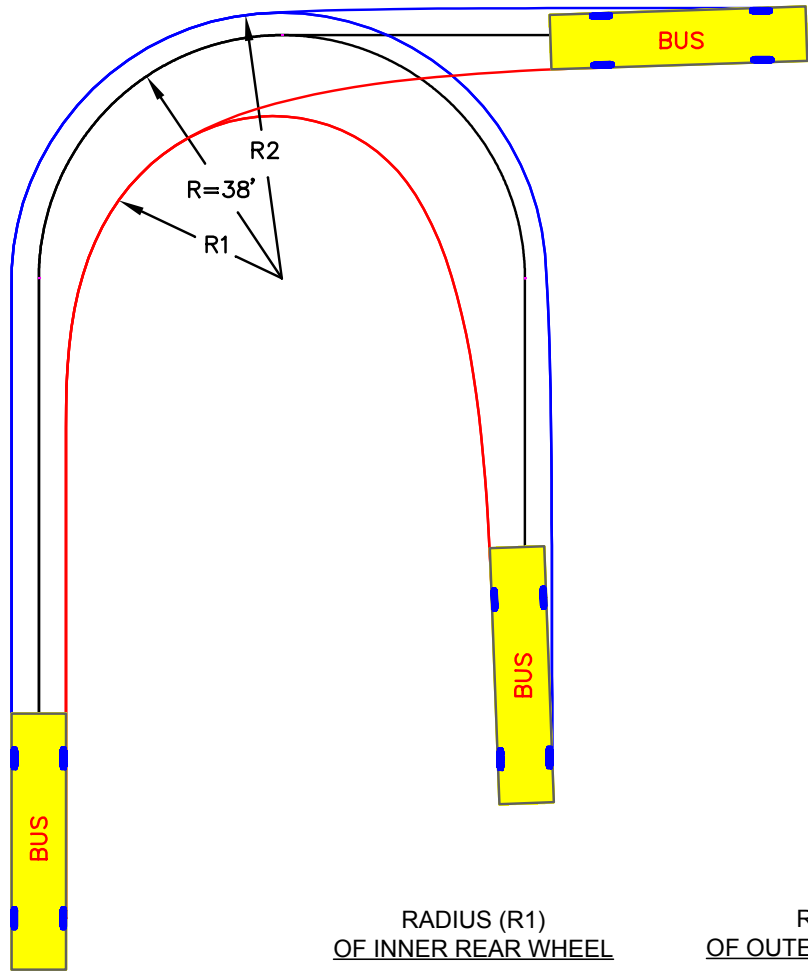
TYPICAL SHELTER AND TRASH RECEPTACLE

A
C

B

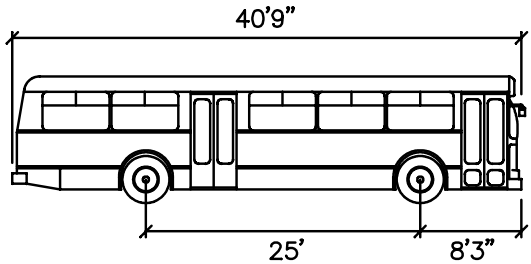
MINIMUM 8' WIDTH ATTACHED LANDING AREA

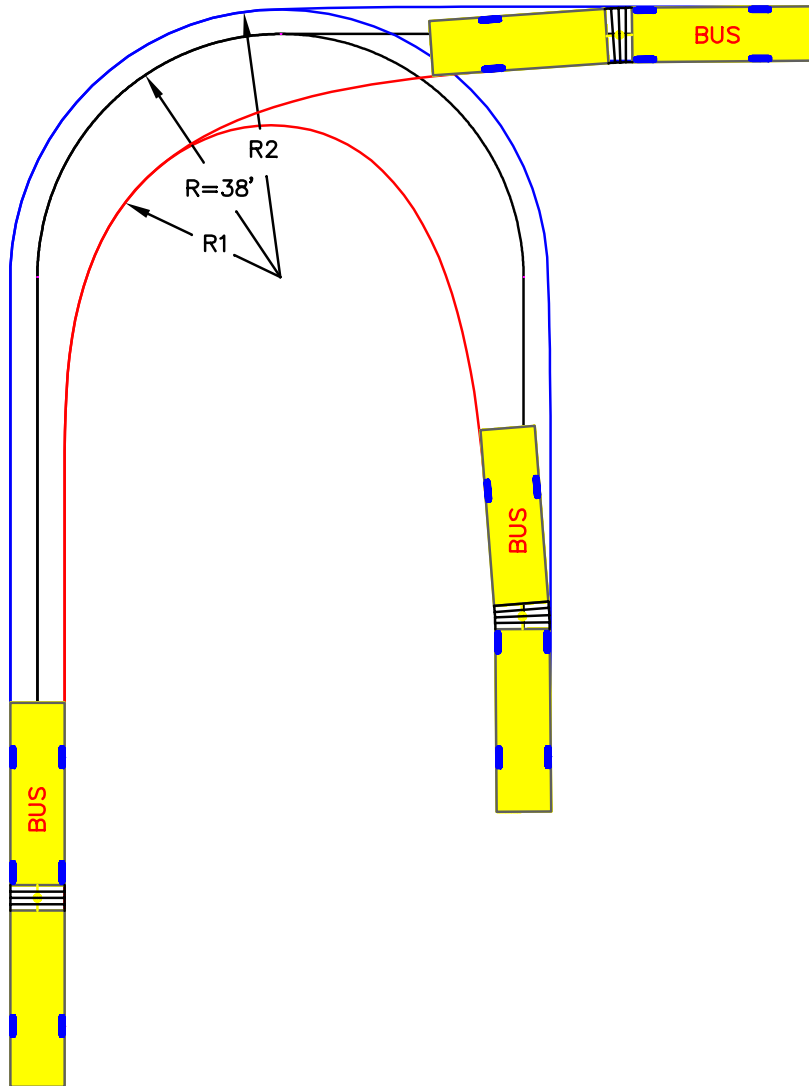




	<u>RADIUS (R1)</u> <u>OF INNER REAR WHEEL</u>	<u>RADIUS (R2)</u> <u>OF OUTER FRONT CORNER</u>
MINIMUM	28'	50'
DESIRABLE	30'	55'

MINIMUM CENTERLINE RADIUS = 38 FEET





	<u>RADIUS (R1)</u> <u>OF INNER REAR WHEEL</u>	<u>RADIUS (R2)</u> <u>OF OUTER FRONT CORNER</u>
MINIMUM	28'	50'
DESIRABLE	30'	55'
MINIMUM CENTERLINE RADIUS = 38 FEET		



OCTA's larger buses have bike racks mounted on the front of each bus, and have the capacity to carry up to two bicycles. Because of the bicycle rack, the turning radius of OCTA's larger buses increases an additional three feet.

If the facility being designed is intended to be used exclusively by transit vehicles, a bus would be an appropriate choice for a design vehicle. If, however, the facility is to be used by general traffic, the selection of either a single unit truck or a tractor-semi-trailer may be more appropriate. In the latter case, a design based on the operating characteristics of a truck should be checked to ensure that a bus would also be satisfactorily accommodated.

The width of the roadways involved enters into the design because as the width increases, the length of the radius required to accommodate the turning vehicle decreases. For example, if the width of both roadways is 12 feet, a single curve with a radius of approximately 50 feet is required in order to accommodate a 90° turn by a bus with no encroachment outside the 12 foot lanes. If the width of both roadways is increased to 16 feet, the radius required in order to accommodate the bus with no encroachment outside the 16 foot lanes decreases to 40 feet.

The final element of corner radii design is the amount of lane encroachment which can be tolerated. This tends to be a subjective decision made by the designer based on an evaluation of the speed and volume of the vehicles involved and the functional classification of the roadways. In general, there should be no encroachment. However, in low speed, low volume situations, some encroachment into adjacent lanes may be acceptable.

One additional item should also be evaluated. At intersections, as the size of the corner radius increases, the walking distance across the intersection increases. Designers should be aware of this pedestrian factor and be prepared to accommodate the pedestrians if the length of one particular crossing increases to the point where it may create operational problems.

When designing a new facility, the designer should select the design vehicle, the roadway widths, and determine the amount of encroachment which can be tolerated. **Figure 6** shows appropriate corner radii for transit vehicles and various combinations of lane widths and turning maneuvers. **Figure 6** does not present all situations, so it should be used as a starting point and turn radii must be checked with an appropriate turning radius template before being incorporated in a final design.

If an existing intersection or driveway is to be evaluated for transit operations, a layout showing existing lane widths and corner radii should be prepared. The layout should then be checked with the appropriate turning radius template and the resulting encroachment, if any, determined. This can then be compared to the amount of encroachment that can be tolerated and potential remedial efforts such as increases in lane width or corner radii evaluated.

The simple curve is the most simple corner radius which will be encountered in typical urban designs. A simple curve uses a uniform radius connecting the points of tangency of the intersecting streets. However, in some special situations such as a skewed intersection or when it is desirable to allow turns at speeds greater than 10 miles per hour, the designer should consider using a compound curve. Compound curves are a combination of simple curves with different radii joined together. Compound curves have an advantage over simple curves because they more closely fit the natural turning paths of design vehicles. Design procedures using compound curves and the channelization which frequently accompanies them can be found in the Caltrans Highway Design Manual, local agency street design standards, or the Association of American State Highway Transportation Officials (AASHTO) "greenbook".

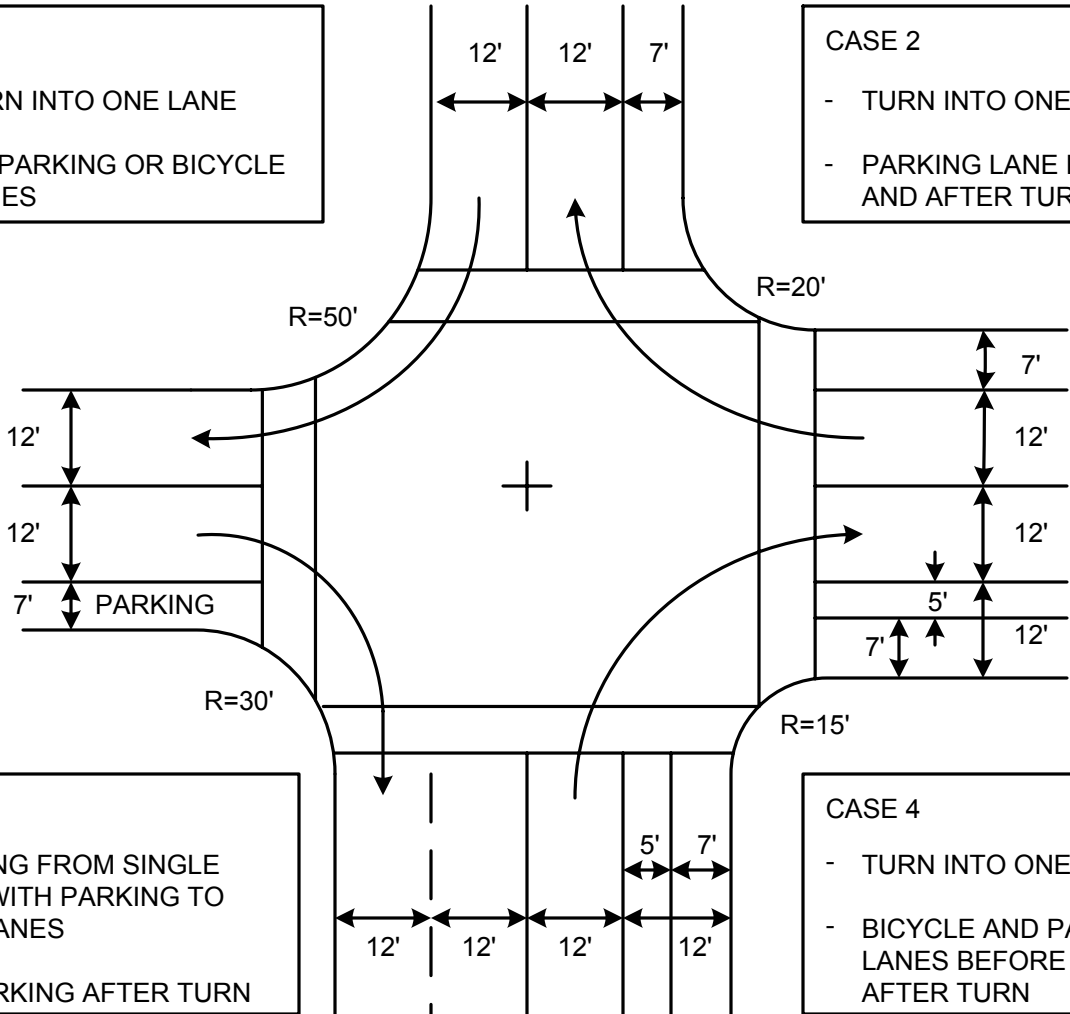
- DESIGNER SHOULD PLAN FOR AN EFFECTIVE RADIUS OF 28' (RIGHT REAR WHEEL).
- TRANSIT VEHICLES ARE ASSUMED TO BE 44' IN LENGTH (WITH BIKE RACK) BY 10'4" IN WIDTH.
- ASSUMES NO ENCROACHMENT INTO OPPOSITE LANES.
- ASSUMES PARKING IS PROHIBITED WITHIN 20' OF END OF CURB RETURN.
- THESE ARE EXAMPLES, APPROPRIATE CURB RADII MUST BE DETERMINED ON A CASE BY CASE BASIS BY THE LOCAL JURISDICTION.

CASE 1

- TURN INTO ONE LANE
- NO PARKING OR BICYCLE LANES

CASE 2

- TURN INTO ONE LANE
- PARKING LANE BEFORE AND AFTER TURN



CASE 3

- TURNING FROM SINGLE LANE WITH PARKING TO TWO LANES
- NO PARKING AFTER TURN

CASE 4

- TURN INTO ONE LANE
- BICYCLE AND PARKING LANES BEFORE AND AFTER TURN



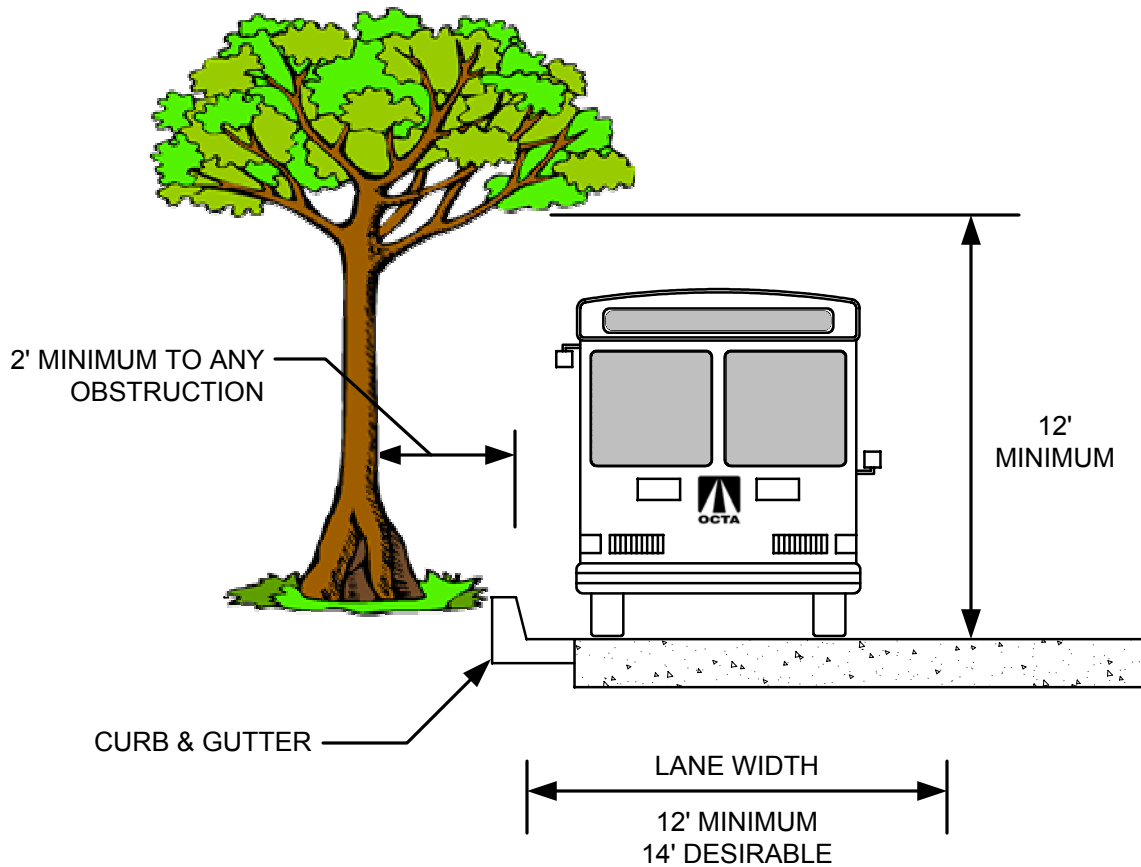
1.5 STREET PAVEMENTS

Roadway pavements need to be of sufficient strength to accommodate repetitive bus axle loads of 24,700 pounds, the rear axle load of a large or articulated bus. Exact pavement designs will depend on site specific soil conditions. Areas where buses start, stop, and turn will be of particular concern for pavement design. Concrete pavement is desirable in these areas to avoid failure problems that are experienced with asphalt. Additional information is provided in Section 2.11, Concrete Bus Pads.

1.6 CLEARANCE REQUIREMENTS

Buses usually travel in the curbside traffic lane and make frequent stops to pick up and drop off passengers. Therefore, it is important to consider bus clearance requirements as shown in **Figure 7**.

- Overhead obstructions should be a minimum of 12 feet above the street surface.
- For future street improvements, obstructions should not be located within a minimum of two (2) feet of the edge of the street to avoid being struck by a bus mirror. (This lateral clearance is not only important at ground level, but it is also necessary at the top of the bus.)
- A traffic lane used by buses should be wide enough to permit adequate maneuvering space and to avoid sideswipe accidents. Since the maximum bus width including mirrors is 10'-6", the desirable curb lane width (including the gutter) is 14 feet and the minimum width is 12 feet.
- When buses pull out of the bus zone to reenter traffic, on occasion the rear of the bus will pivot and extend over the curb line. If above grade obstacles are located too close to the street, buses could sideswipe these fixtures damaging both the fixed object and/or the bus. The rear overhang swing should be checked, possibly requiring a lateral clearance greater than two (2) feet.



CHAPTER 2

BUS STOP SPECIFICATIONS

2.1 BASIC ELEMENTS OF BUS STOP PLACEMENT

These guidelines emphasize the following six basic elements local jurisdictions should consider when designing new transit facilities:

1. Stops should be placed based on population density and/or major passenger generators (i.e. major employment centers, regional shopping centers, hospitals, etc.);
2. Bus stop locations should be clearly marked by an OCTA bus stop sign with appropriate vertical and horizontal clearance;
3. Bus stop locations should have adequate parking restrictions to allow buses to pull into and out of the bus zone unimpeded;
4. Bus stop locations should have a level surface and preferably a firm surface to accommodate boarding and alighting of passengers with special needs;
5. Pathways leading to and from bus stop areas should be level, and preferably a firm surface to accommodate passengers with special needs; and
6. Bus stops should be located in places with minimal above grade obstacles (i.e. guide wires, power poles, utility boxes, etc.)

When establishing new bus stops or relocating existing bus stops it is the policy of the OCTA to confer with the appropriate city or local jurisdiction to locate and properly identify bus zones mutually acceptable to the Authority and the jurisdiction. Ultimately, the final decision as to bus stop placement or relocation, and its design, rests solely with the local jurisdiction.

2.2 DENSITY AND SPACING

For an area to properly support transit service, certain density thresholds need to be met. Density measurement varies according to the type of development. For residential areas, a review of population density and housing density are used. Employment density and square footage variables are used for commercial and industrial areas.

To add new service or to increase local fixed-route service, two minimum productivity standards are considered: 1) when research indicates that the new service would achieve a minimum productivity of 10 boardings per hour of service after a year in service, or 2) achieve a minimum productivity of 75% of the average for the category of service under consideration.¹

¹ For example, OCTA categorizes its bus system into four categories; local, community, StationLink, and express. If additional service is being considered on a route under any of these categories, research should indicate that the bus route would be performing at a productivity level of at least 75% of the average for that category after a year in service.

StationLink shuttles are another type of service. These shuttles supplement regular transit services and accommodate short trips (less than three miles) when the area is not directly served by local bus operations. These shuttles should be considered when:

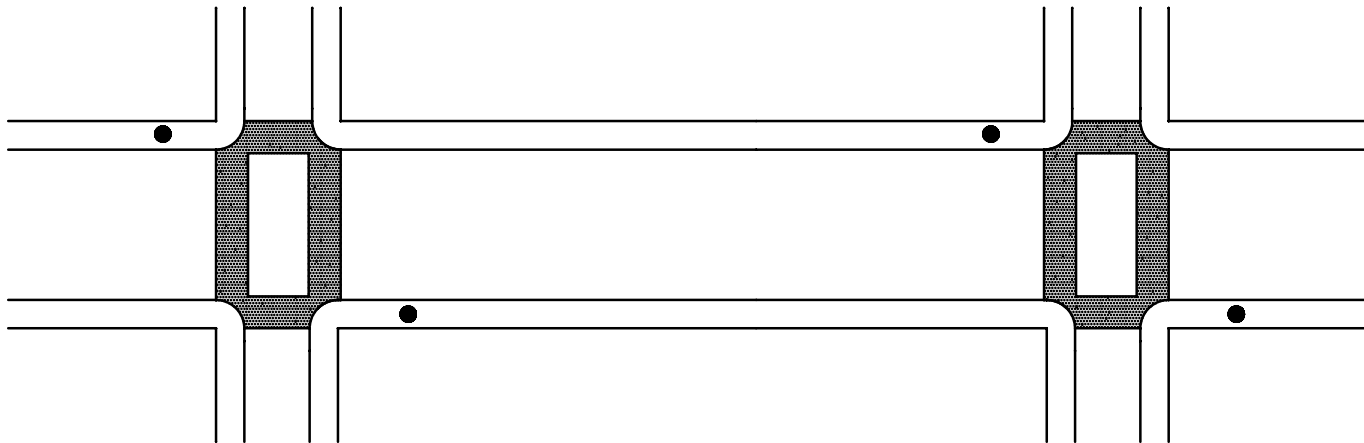
1. Research indicates potential for 7.5 boardings per service hour, and
2. There is at least one large employer (2500+ employees) or three major employers (1000+ employees) within a 15-minute radius of a Metrolink station.

2.2.1 BUS STOP SPACING GUIDELINES

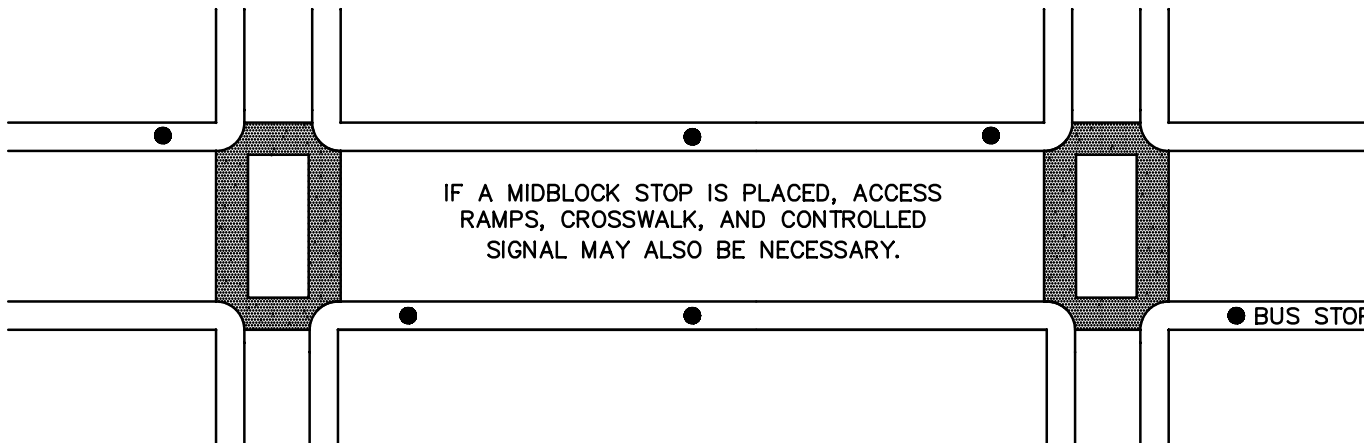
1. Provide stops at major generators:
 - Employment centers with 1,000+ employees
 - Residential areas with 500+ units or minimum population density of 5000 per square mile
 - Retail centers with 400,000+ square feet of leasable space
 - Education centers with 2,500+ students
 - Major medical facilities with out-patient care
2. Provide bus stops at transfer points
3. Provide intermediate stops based on the distance a person has to travel to arrive at a bus stop spaced as follows and illustrated in **Figure 8**:
 - Central Business Districts or Major Commercial District: Maximum 500 feet
 - High to medium density areas: 750 to 900 feet (5,000+ persons/square mile)
 - Medium to low density areas: 900 to 1,300 (3,500 – 5,000 persons/square mile)
 - Low density to rural areas: 1,500 to 2,500 feet (less than 3,500 persons/square mile)

Table 4 defines densities in terms of residential units per acre and commercial floor area ratio.

Table 4 Commonly Used Definitions of Residential and Commercial Density	
High Density	Residential: 18 DUs/acre minimum, (30 DUs/acre average) Commercial: 0.50 Floor Area Ratio minimum
Medium to Low Density	Residential: 7 DUs/acre minimum, (12 DUs/acre average) Commercial: 0.35 Floor Area Ratio minimum
Low to Rural Density	Residential: below 7 DUs/acre minimum Commercial: less than 0.35 Floor Area Ratio
DUs = Residential dwelling units. Floor area ratio refers to the average allowable building coverage of land in zoning code.	



BUS STOP FOR MEDIUM TO LOW DENSITY DEVELOPMENT AREAS
 (STOPS APPROXIMATELY 900' TO 1300' APART)
 IN RURAL AREAS BUS STOPS MAY BE SPACED 1,500' TO 2,500' APART



IF A MIDBLOCK STOP IS PLACED, ACCESS
 RAMPS, CROSSWALK, AND CONTROLLED
 SIGNAL MAY ALSO BE NECESSARY.

BUS STOP SPACING FOR MEDIUM TO HIGH DENSITY DEVELOPMENT AREAS
 (STOPS APPROXIMATELY 750' TO 900' APART)
 IN CENTRAL BUSINESS DISTRICTS PLACE BUS STOPS A MAXIMUM OF 500' APART

NOT TO SCALE
 ● BUS STOP



It is important to emphasize that these are general guidelines and should not be construed as absolutes. Regardless of density, if sufficient potential demand is exhibited and if funds allow, service should be considered and scheduled for an area.

2.3 PEDESTRIAN PATHWAYS

2.3.1 PEDESTRIAN ACCESS

Land uses that are designed for proper pedestrian access are located and concentrated in ways that minimize the distances between the development and the transit services. Land uses should be arranged to facilitate the movement of people from their origins to the bus stop or local transit center and back again. The process of designing and locating a bus stop should begin with understanding the experience of accessing the stop from home or work. Good pedestrian access can be achieved by considering the following guiding principles:

- Provide a safe pedestrian environment – sidewalks, walkways and street crossings should be free of hazards, well lit, and have minimal conflicts with vehicular traffic.
- Provide an accessible pedestrian system – pedestrian routes to bus stops should be designed to meet the needs of all users, particularly the disabled, the elderly, and children.
- Provide direct connections between places – the pedestrian system should be comprised of continuous and direct routes and convenient connections between destinations including residential areas, schools, shopping centers, public services and institutions, recreation, and transit.
- Provide a pedestrian system that is easy to use – the pedestrian system should be designed so people can easily find the most direct route to their destination with appropriate wayfinding signs if necessary.

The following guidelines can help achieve the guiding principles:

- Main entrances to commercial buildings should face the street with close pedestrian access to the nearest bus stop.
- Provide a dedicated sidewalk and/or bike paths through new development that are safe and direct to the nearest bus stop or transit center.
- Minimize the distance between buildings and the bus stop through proximity and orientation. Municipalities can encourage this strategy by reviewing zoning policies, setback guidelines, building orientation guidelines, and parking requirements to encourage transit-oriented development.
- Link access points to bus stops or transit centers with building entrances by developing walkway systems and plazas that emphasize pedestrian activities and access.
- Bus stops should be located so that passengers do not have to walk more than ¼ mile from major employment centers, residential development, or retail centers.

- Minimize the use of elements that restrict pedestrian movement such as meandering sidewalks, walled communities, and expansive parking lots. Pathways should be designed so pedestrians traverse as straight of path as possible.
- Eliminate barriers to pedestrian activity. This includes landscaping, berms, or fences which impede pedestrian access or visibility. If there is restricted access, gates should be installed at access points.
- Pave pedestrian pathways and ensure they are accessible to people with disabilities. Provide wheelchair accessible circulation routes, including curb cuts, ramps, and railings where needed. Place ADA compliant curb ramps at each corner of an intersection.
- Adequate drainage should be provided to avoid pooling and muddy conditions.
- Provide street lighting along bus stop access routes and safety lighting at intersections to promote safety and security for transit patrons. Ideally bus stops should be illuminated by street lighting, if not, consider installation of pedestrian scaled lighting at the bus stop.
- Sidewalks should be in good repair and free of trip hazards.
- Pedestrian connections should be buffered from adjacent traffic using planting strips with street trees that also provide shading.
- New residential development should provide breaks in walls between properties to allow pedestrian access to bus stops.
- In rural areas without sidewalks, a shoulder of decomposed granite, compacted and stabilized, should be provided if possible.
- At rural bus stops, a concrete waiting area should be provided if possible.
- Where a bus stop serves as a transfer point, there should be a paved, ADA compliant connection to the connecting route stops.

Pedestrian access is a key component for bus stop locations and should be considered early in the design phase. Without proper pedestrian access, foot traffic will be discouraged. Specific criteria for designing pedestrian pathways include:

- Pathway slope should not exceed 1 foot vertical over 20 feet horizontal (5%).
- Pathway cross slope should not exceed 1 foot vertical over 50 feet horizontal (2%).
- A minimum horizontal clearance of 48 inches (preferable 60 inches) should be maintained along the entire pathway.
- A vertical clearance of 84 inches should be maintained along the entire pathway.

2.4 CURB RAMPS

Curb ramps are usually installed at corners or intersections to allow entrance to the street surface. Ramps may also be installed mid-block to provide crossing of streets which are not near an intersection. Photo 3 shows a typical curb ramp at an intersection.



Photo 3 shows a typical curb ramp at an intersection.

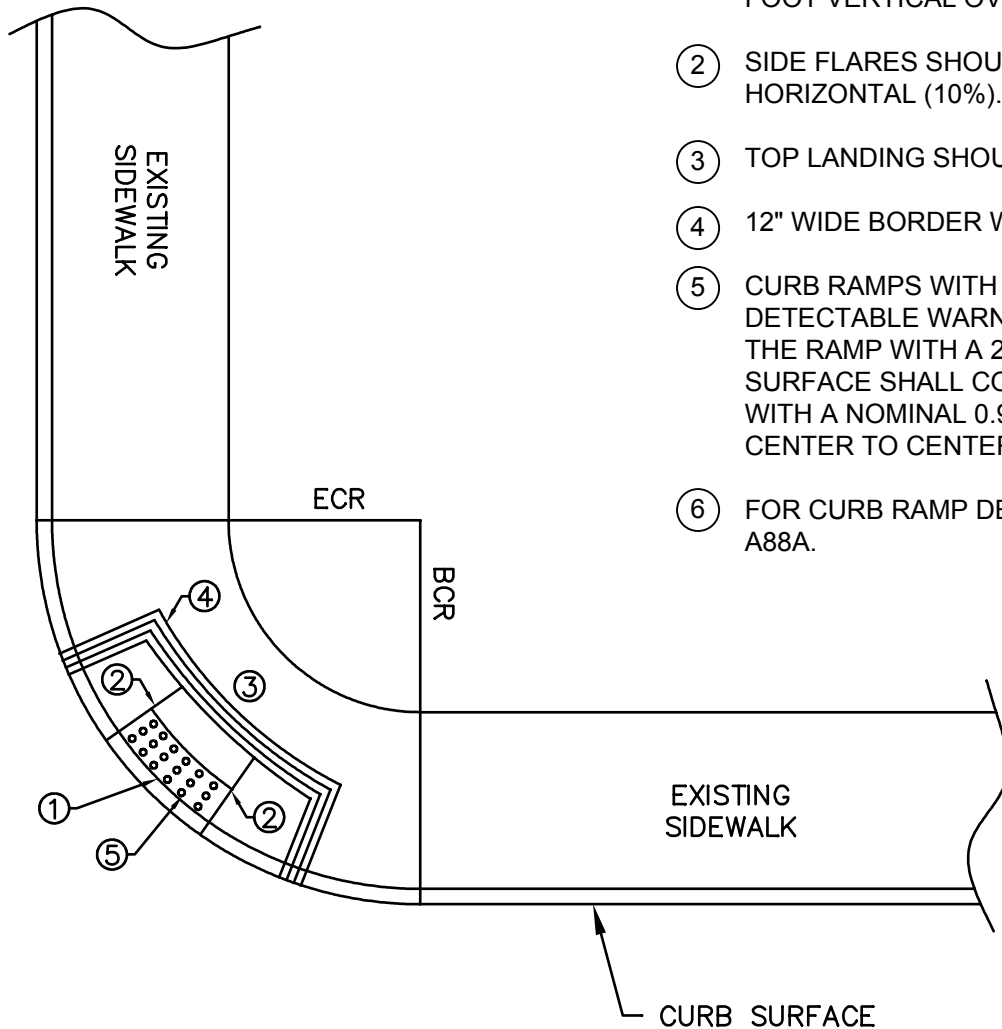
Ramps can either be horizontal or diagonal to the intersection and have slightly different compliance properties, depending on the design standards of the local agency responsible for road construction.

For purposes of ADA, the following criteria should be incorporated into all curb ramps designs (**See Figure 9**):

- Slope length should not exceed 1 foot vertical over 12 feet horizontal (8.33%).

Photo 3: Typical intersection curb ramp.

- Side flares should not exceed 1 foot vertical over 10 feet horizontal (10%).
- Ramp width should be a minimum of 48 inches.
- Top landing width should be a minimum of 48 inches.
- Transition to the street should have a lip of 1/2 inch beveled at 45 degrees, or slope transition should not exceed 11%, or conform to City standards as appropriate.
- Curb ramps should be provided on raised islands (whether raised medians or channelized turn lane islands) with a level area of at least 48 inches between ramps, or a street-level passageway should be installed through the island (**see Figures 9A and 9B**).
- Curb ramps with slopes flatter than 6.67% should have a detectable warning which should extend the full width of the curb ramp. A detectable warning is a distinctively textured surface detectable by cane and foot, on the surface of curb ramps to provide a tactile cue for persons with vision impairments of their approach to streets.
 - Detectable warnings should consist of raised truncated domes with a diameter of nominal 0.9 inches, a height of nominal 0.2 inches and a center-to-center spacing of nominal 1.67 inches and should contrast visually with adjoining surfaces, either light-on-dark, or dark-on-light per ADA Accessibility Guidelines for Buildings and Facilities (ADAAG).
 - If a walk crosses or adjoins a vehicular way, and the walking surfaces are not separated by curbs, railings, or other elements between the pedestrian areas and vehicular areas, the boundary between the areas should be defined by a continuous detectable warning which is 36 inches wide.



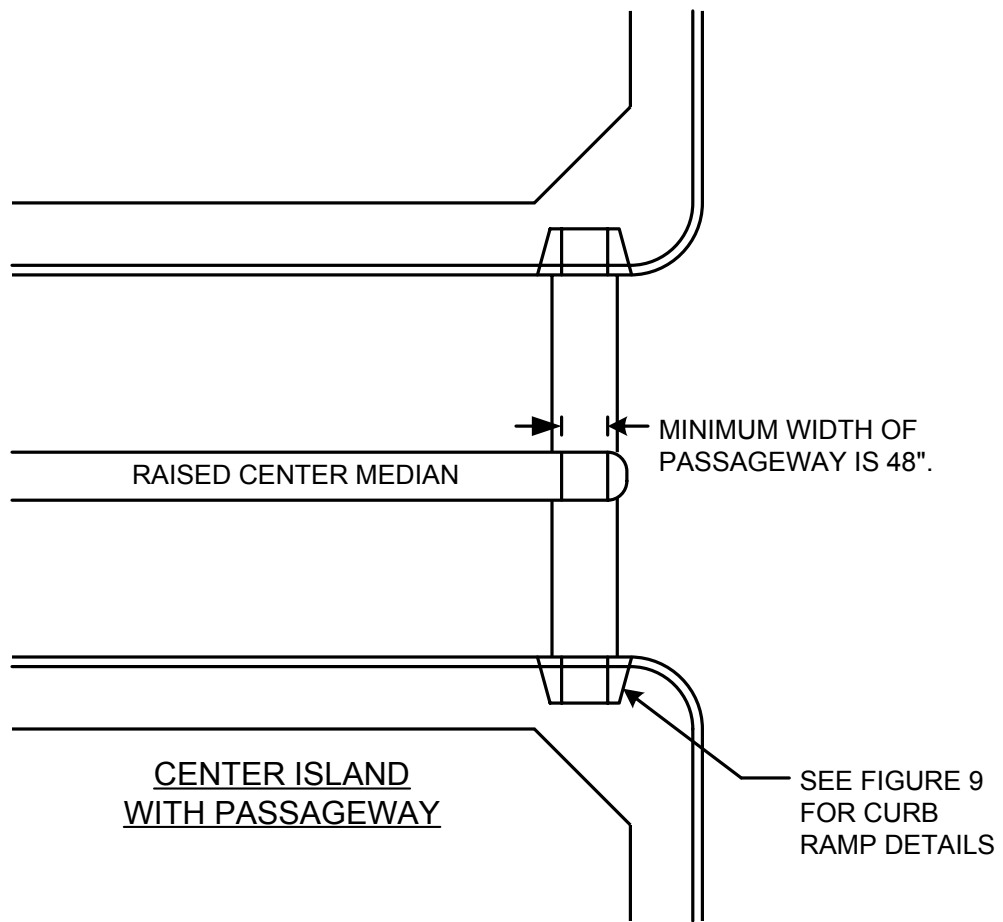
LEGEND

- ① MINIMUM RAMP WIDTH IS 48", AND SLOPE SHOULD NOT EXCEED 1 FOOT VERTICAL OVER 12 FEET HORIZONTAL (8.33%).
- ② SIDE FLARES SHOULD NOT EXCEED 1 FOOT VERTICAL OVER 10 FEET HORIZONTAL (10%).
- ③ TOP LANDING SHOULD BE LEVEL AND HAVE A MINIMUM WIDTH OF 48".
- ④ 12" WIDE BORDER WITH 1/4" GROOVES APPROXIMATELY 3/4" ON CENTER.
- ⑤ CURB RAMPS WITH SLOPE FLATTER THAN 6.67% SHALL HAVE A DETECTABLE WARNING SURFACE THAT EXTENDS THE FULL WIDTH OF THE RAMP WITH A 24" MINIMUM LENGTH. DETECTABLE WARNING SURFACE SHALL CONSIST OF A RAISED TRUNCATED DOME PATTERN WITH A NOMINAL 0.9" DIAMETER, A NOMINAL HEIGHT OF 0.2", AND CENTER TO CENTER SPACING OF 1.67".
- ⑥ FOR CURB RAMP DESIGN DETAILS SEE CALTRANS STANDARD PLAN A88A.

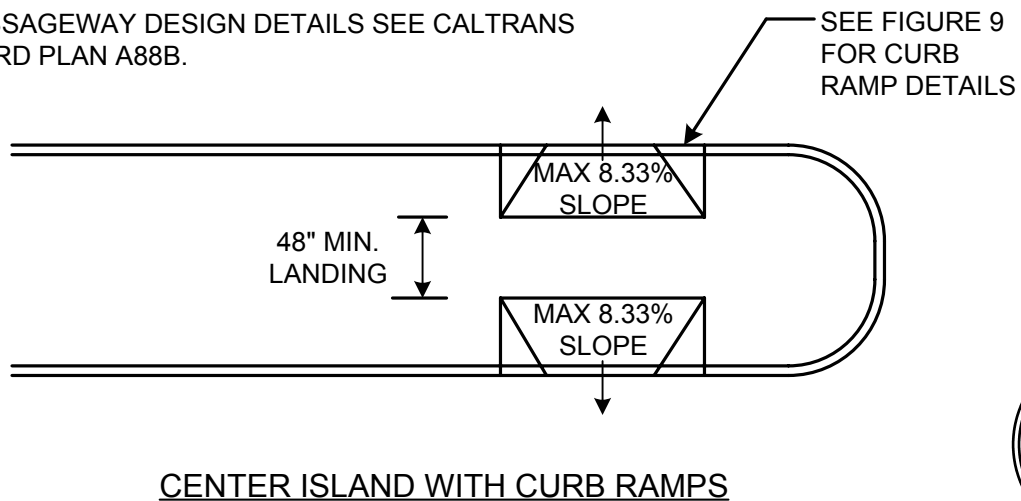
NOTE

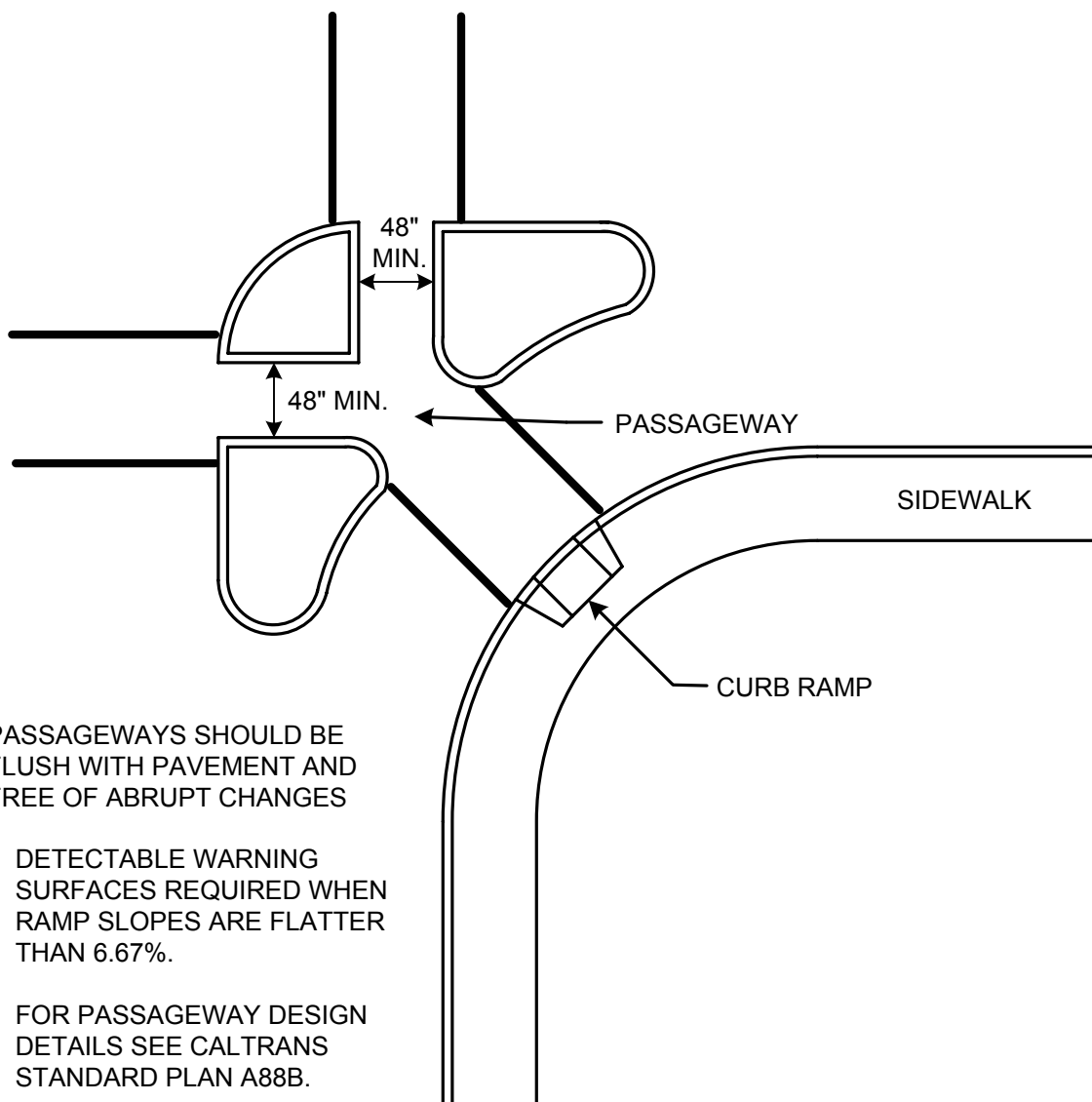
ENTIRE RAMP SHOULD BE BROOMED TO PRODUCE A SLIP-RESISTANT SURFACE.





- IF RAISED MEDIAN IS WIDER THAN 12', CURB RAMPS MAY BE USED AS LONG AS MINIMUM SLOPE AND LANDING REQUIREMENTS ARE MET.
- IF NOT USING CURB RAMPS, PASSAGEWAY SHOULD BE FLUSH WITH PAVEMENT AND FREE OF ABRUPT CHANGES.
- DETECTABLE WARNING SURFACE REQUIRED WHEN RAMP SLOPES ARE FLATTER THAN 6.67%.
- FOR PASSAGEWAY DESIGN DETAILS SEE CALTRANS STANDARD PLAN A88B.





PASSAGEWAYS SHOULD BE FLUSH WITH PAVEMENT AND FREE OF ABRUPT CHANGES

- DETECTABLE WARNING SURFACES REQUIRED WHEN RAMP SLOPES ARE FLATTER THAN 6.67%.
- FOR PASSAGEWAY DESIGN DETAILS SEE CALTRANS STANDARD PLAN A88B.



- Where a sidewalk crosses a driveway there are several techniques to minimize crossing the slope of the driveway:
 - 1) Construct a wide sidewalk that allows a minimum level area 48 inches in width at the driveway. The overall width of the driveway should be sufficient to avoid an abrupt driveway slope.
 - 2) Using a planting strip between the street and the sidewalk allows the sidewalk to remain level, with the driveway grade change occurring in the width of the planting strip.
 - 3) In constrained right-of-way where a planting strip is not feasible the sidewalk may be wrapped around driveway entrance. However, this method may have disadvantages for the vision-impaired who follow the curb line for guidance.
 - 4) When constraints allow for only minimal sidewalks behind the curb, dipping the entire sidewalk at driveways keeps the cross-slope at a constant grade.

2.5 PLACEMENT OF BUS STOPS

Since bus stops provide interface points between the walkway system, the roadway network, and transit routes, proper location is critical. Bus stop locations are usually determined by OCTA, while final approval rests solely with the local jurisdiction.

The location of the bus stop must address both traffic operation issues and passenger accessibility issues. If possible, the bus stop should be located in an area where typical improvements, such as a bench or shelter, can be placed in the public right of way. A bus stop location should consider potential ridership, traffic and rider safety, and bus operation elements that require site-specific evaluation. Significant emphasis should be placed on factors affecting personal security; well-lit open spaces visible from the street create a safer environment for waiting passengers. Elements to consider in bus stop placement include the following:

Use:

- Proximity to major trip generators;
- Presence of sidewalks, marked crosswalks, and curb ramps;
- Protected crossings at signalized intersections;
- Connection to nearby pedestrian circulation system;
- Access for people with disabilities;
- Convenient passenger transfers to other routes; and
- Effect on adjacent property owners.

Traffic and Rider Safety:

- Conflict between buses, other traffic, and pedestrians;
- Passenger protection from passing traffic;
- Width of sidewalks;
- Pedestrian activity through intersections;
- All weather surface to step to/from the bus;
- Open and visible spaces for personal security and passenger visibility; and
- Street illumination.

Bus Operations:

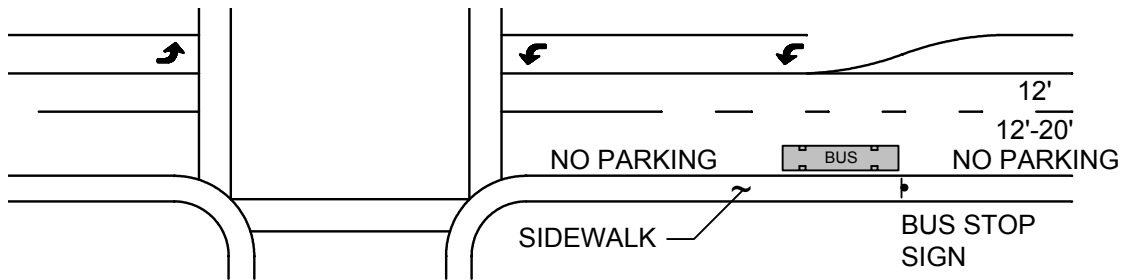
- Restrictive parking;
- Adequate curb space for the number of buses expected at the stop at any one time;
- On-street automobile parking and truck delivery zones;
- Traffic control devices near the bus stop, such as signals or stop signs;
- Volumes and turning movements of other traffic, including bicycles;
- Proximity and traffic volumes of nearby driveways;
- Street grade;
- Ease of re-entering traffic stream; and
- Proximity to rail crossings.



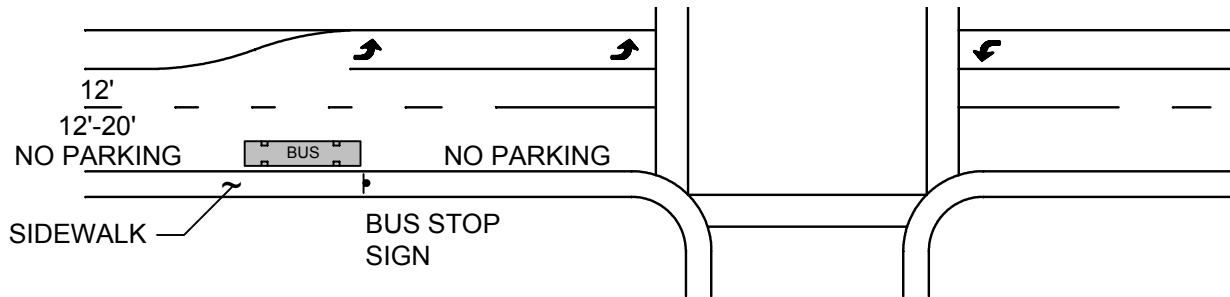
Photo 4: Typical farside bus stop.

Bus stops are generally located at intersections where they may be placed on the nearside or farside of an intersection. This maximizes pedestrian accessibility from both sides of the street and provides connection to intersecting bus routes. Photo 4 shows a typical farside bus stop.

Under certain situations, bus stops may also be placed at a mid-block location. **Figures 10 and 10A** show several general bus placement scenarios.

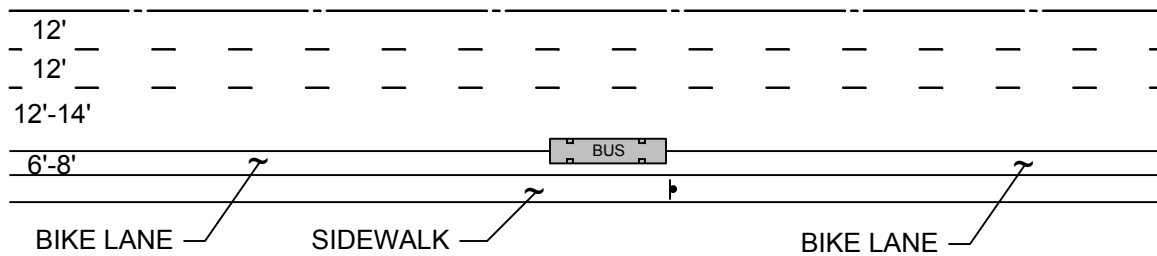


CASE 1: FARSIDE BUS STOP



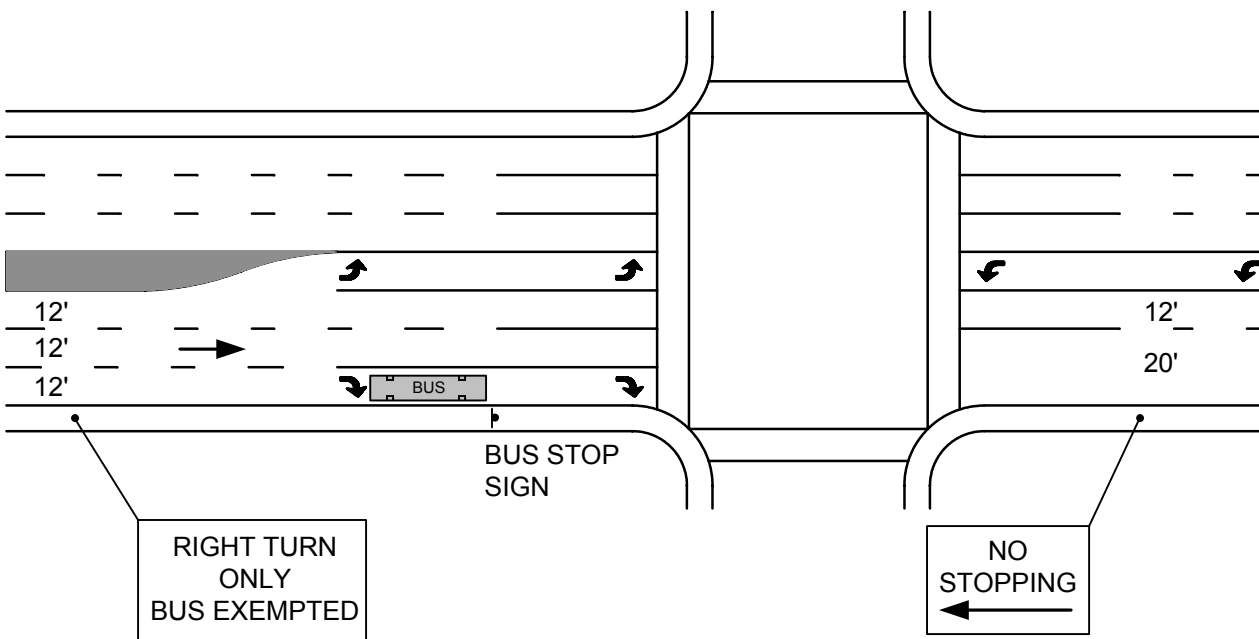
CASE 2: NEARSIDE BUS STOP





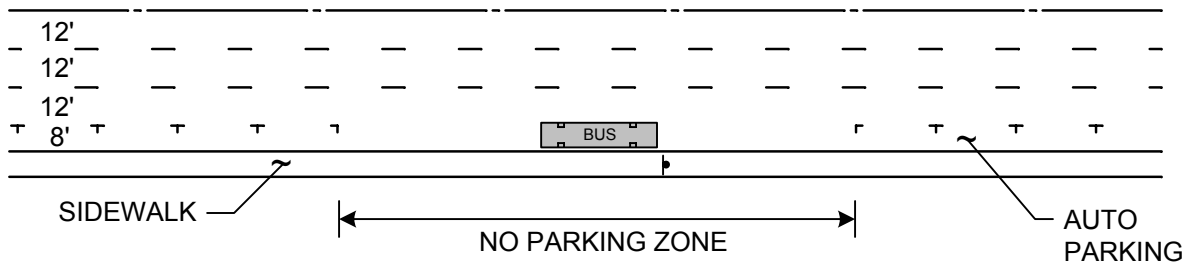
CASE 3: BUS STOP IN BIKE LANE

(IF COMBINED WIDTH OF BIKE LANE AND OUTSIDE LANE IS LESS THAN 20', TURNOUT MAY BE NECESSARY.)



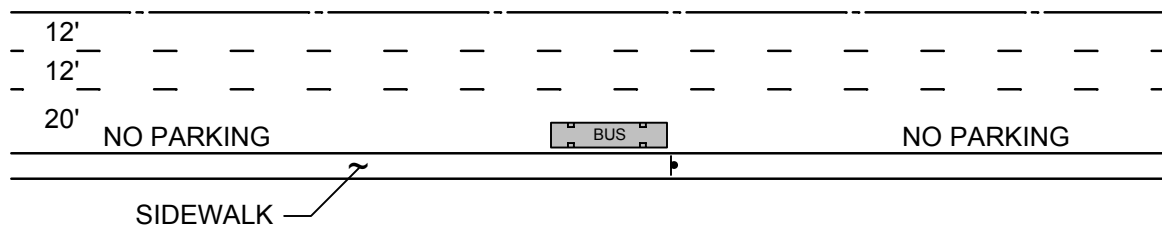
CASE 4: BUS STOP IN RIGHT TURN LANE





CASE 5: BUS STOP IN PARKING LANE

(IF COMBINED WIDTH OF PARKING AND OUTSIDE TRAVEL LANES IS LESS THAN 20', TURNOUT MAY BE NECESSARY.)



CASE 6: BUS STOP IN EXTRA-WIDE CURB LANE

(IF CURB LANE IS LESS THAN 20', TURNOUT MAY BE NECESSARY.)



In general, a nearside stop is preferred on two lane streets where vehicles will not pass around a stopped bus. Photo 5 shows a typical nearside bus stop. In the case of a street with wide shoulders or multiple lanes where vehicular traffic may pass uncontrolled around the bus, a farside stop is preferred for sight distance issues. In the case of a street with wide shoulders or multiple lanes where vehicular traffic is controlled by a signal, the bus stop may be located either nearside or farside.



Photo 5: Typical nearside bus stop.

Stops should be placed to minimize the difficulties associated with lane changes and weaving maneuvers of approaching vehicles. Where it is not acceptable to stop the bus in traffic and a bus pullout is warranted, a farside or mid-block stop is generally preferred. As with other elements of the roadway, consistency of stop placement lessens the potential for operator and passenger confusion.

In locating of a bus stop in the vicinity of a driveway, the local jurisdiction should be aware of issues related to sight distance, blocking access to development, and potential conflicts between automobiles and buses.

Table 5 compares advantages and disadvantages of nearside, farside, and mid-block bus stop types.

The placement of bus stops at intersections vary from site to site. However general considerations for the placement of bus stops at intersections include:

- When the route alignment requires a left turn, the preferred location for the bus stop is on the farside of the intersection after the left turn is completed (see Example A **Figure 11**).
- When the route alignment requires a left turn and it is infeasible or undesirable to locate a bus stop farside of the intersection after the left turn, a mid-block location is preferred. A mid-block bus stop should be located at least 500 feet from the intersection so a bus can maneuver into the proper lane to turn left. (see Example B **Figure 11**).
- If there is a high volume of right turns at an intersection or when the transit route turns right at an intersection, the preferred location for a stop is on the farside of the intersection (see Example C **Figure 11**).
- In circumstances where the accumulation of buses at a farside stop would spill over into the intersection and additional length is not available, the stop should be placed on the nearside of the intersection. This removes the potential for queuing buses to overflow into the intersection (see Example D **Figure 11A**).

Table 5	
Advantages and Disadvantages of Farside, Nearside, and Mid-block Bus Stops	
FARSIDE STOP	
Advantages	Disadvantages
<ul style="list-style-type: none"> • Minimizes conflict between buses and right turning vehicles traveling in the same direction • Minimizes sight distance problems on approaches to the intersection • Encourages pedestrians to cross behind the bus • Minimizes area needed for curbside bus zone • If placed just beyond a signalized intersection in a bus turnout, buses may more easily re-enter the traffic stream • If a turnout is provided, vehicle capacity through intersection is unaffected 	<ul style="list-style-type: none"> • If bus stops in travel lane, could result in traffic queued into intersection behind the bus (turnout will allow traffic to pass around the stopped bus) • If bus stops in travel lane, could result in rear-end accidents as motorists fail to anticipate stopped traffic • May cause passengers to access buses further from crosswalk • May interfere with right turn movement from cross street
NEARSIDE STOP	
Advantages	Disadvantages
<ul style="list-style-type: none"> • Minimizes interference when traffic is heavy on the farside of an intersection • Allows passengers to access buses close to crosswalk • Driver may use the width of the intersection to pull away from the curb • Allows passengers to board and alight when the bus is stopped for a red light • Provides the driver with the opportunity to look for oncoming traffic, including other buses with potential passengers 	<ul style="list-style-type: none"> • Stopped bus may interfere with a dedicated right turn lane • May cause sight distance problem for cross-street traffic and pedestrians • If located at a signalized intersection, and if the shoulder width at the stop is such that buses will exit the traffic stream, a traffic queue at a signal may make it difficult for buses to re-enter the traffic stream • Prohibits through traffic movement with green light, similar to farside stop without a bus turnout • May cause pedestrians to cross in front of the bus at intersections

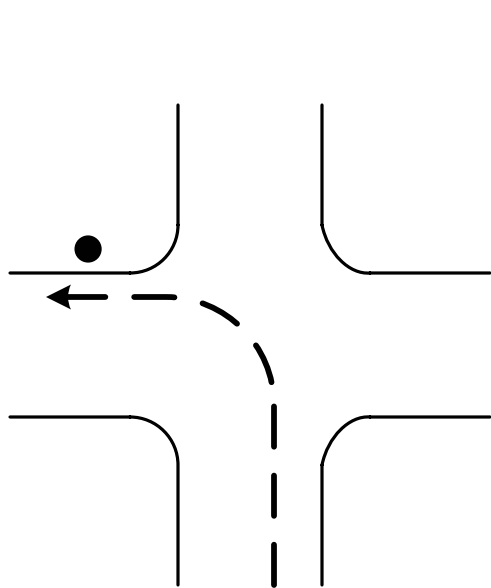
Table 5 (Cont.)	
Advantages and Disadvantages of Farside, Nearside, and Mid-block Bus Stops	
MID-BLOCK STOP	
Advantages	Disadvantages
<ul style="list-style-type: none"> • Minimizes sight distance problems for vehicles and pedestrians • May result in passenger waiting areas experiencing less pedestrian congestion • May be closer to passenger origins or destinations on long blocks • May result in less interference with traffic flow 	<ul style="list-style-type: none"> • Requires additional distance for no-parking restrictions • Increases walking distance for patrons crossing at intersection, or requires special features to assist pedestrians with mid-block crossing • May encourage jay-walking

- At complex intersections with multi-phase signals or dual right or left turn lanes, farside stops are preferred because they remove the buses from the area of complicated traffic movements at that intersection (see Example E **Figure 11A**).
- When transfer activity between two lines exhibits a strong direction pairing (i.e., heavy volumes from westbound to northbound) placing one stop nearside and one farside can minimize pedestrian activity within the intersection (see Example F **Figure 11A**).

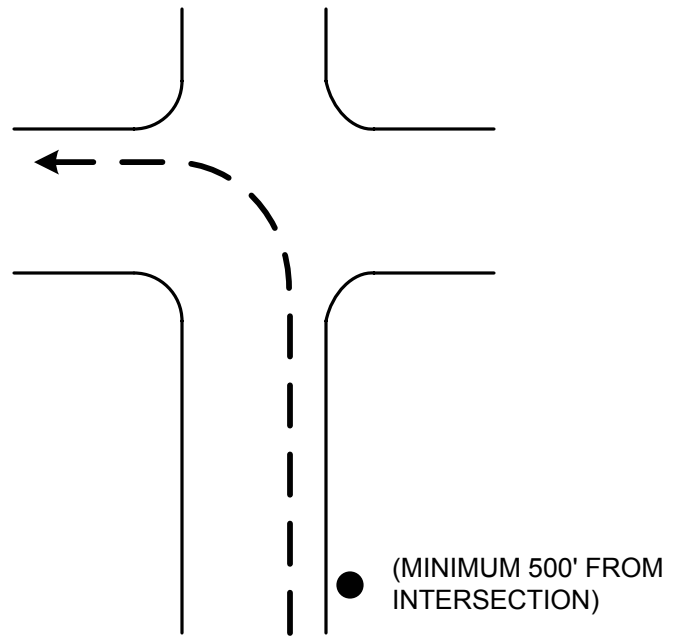
When a bus stop must be located at a mid-block location consideration should be given to ways of preventing jay-walking. There may be a tendency for passengers to jay-walk at mid-block bus stops if the nearest intersection crossing point is distant. There are several ways to discourage or prevent jay-walking at mid-block locations. Some possible methods to consider include:

- No-pedestrian crossing signs
- Landscaped raised medians
- Fencing, either on the edge of the street or in the median
- Placement of a mid-block crosswalk (if warranted)
- Pedestrian signals (if warranted)

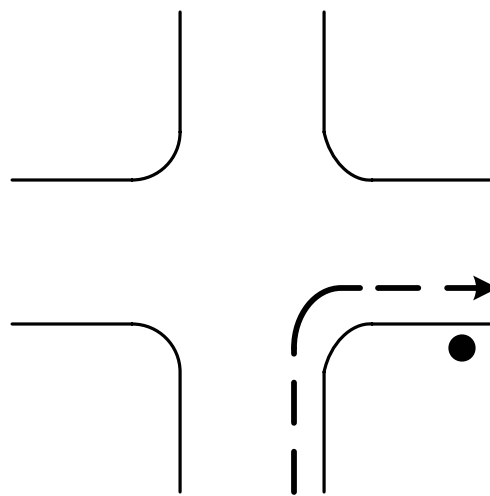
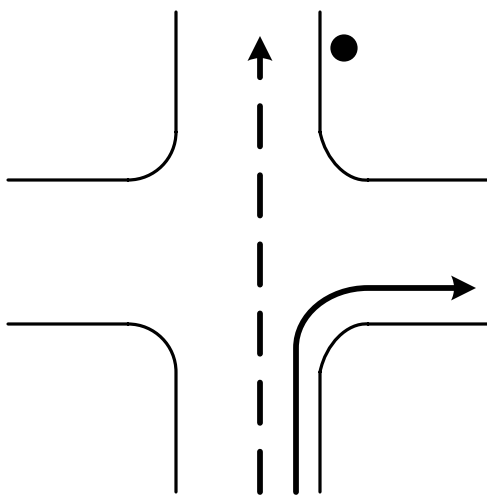
Table 6 summarizes some common situations encountered when locating bus stops at intersections and indicates which type of stop is usually most appropriate.



A. FARSIDE STOP AFTER LEFT TURN



B. MID-BLOCK STOP BEFORE LEFT TURN WHICH WILL ALLOW BUS TO MAKE A LEFT TURN

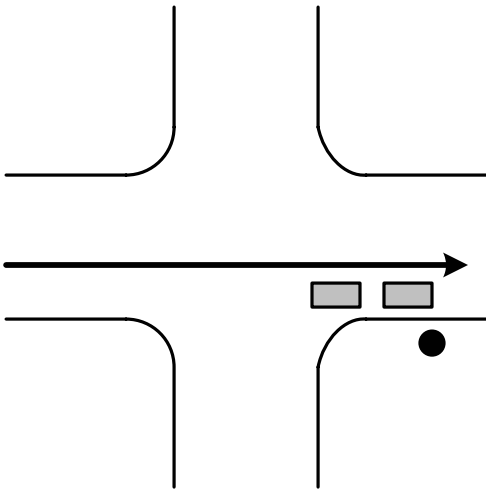


C. FARSIDE STOP AT INTERSECTION WITH A HIGH VOLUME OF RIGHT TURN MOVEMENTS OR WHEN ROUTE TURNS RIGHT

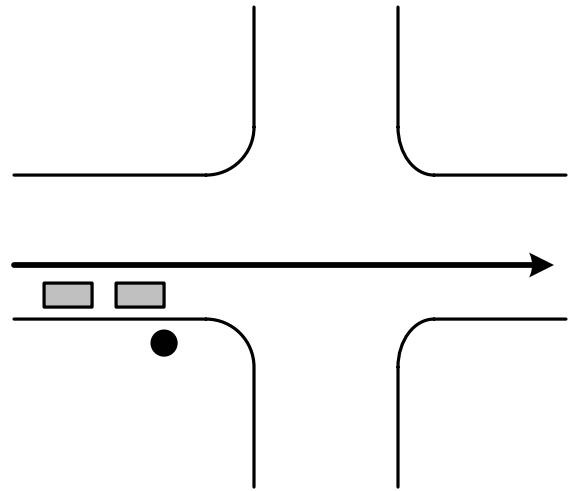
- ROUTE ALIGNMENT
- CARS
- BUS STOP



FIGURE 11
GENERAL CONSIDERATION IN THE
PLACEMENT OF BUS STOPS

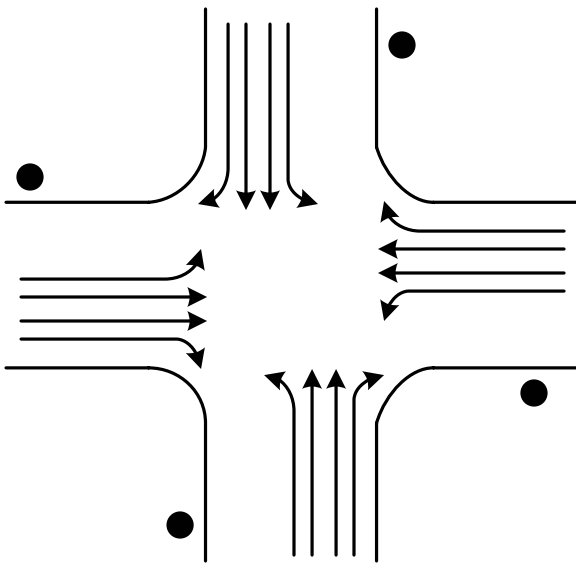


UNDESIRABLE

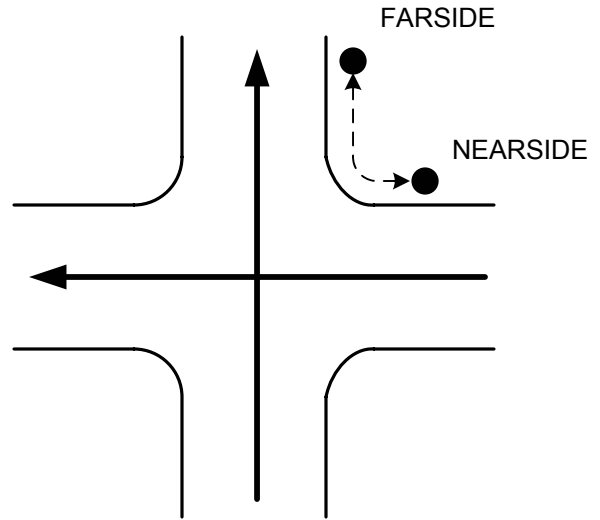


PREFERRED

D. NEARSIDE STOP WHEN BUS ACCUMULATION EXCEEDS FARMSIDE BUS ZONE



E. FARMSIDE STOPS AT COMPLEX INTERSECTIONS



F. FARMSIDE/NEARSIDE STOPS TO MINIMIZE PEDESTRIAN STREET CROSSINGS BETWEEN TRANSFERS



Table 6 Stop Placement Situations and Preferred Placement	
Situation	Preferred Placement
Any signalized intersection where bus can stop out of travel lane	Farside
If bus turns at intersection	Farside
Intersection with many right turns	Farside
Complex intersections with multi-phase signals or dual turn lanes	Farside
If nearside curb extension prevents autos from trying to turn right in front of bus	Nearside
Bus accumulation exceeds farside bus zone	Nearside
If two or more consecutive stops have signals	Alternate nearside and farside (starting nearside) to maximize advantage from timed signals
If obvious, heavy single-direction transfer activity	One nearside; one farside to eliminate street crossings required to transfer
If blocks are too long to have all stops at intersections	Mid-block
Major transit generators not served by stops at intersections	Mid-block
Mid-block pedestrian-crossing combined with mid-block pedestrian access into block	Mid-block
Transit Center	Off-street
Major transit generator that cannot be served by on-street stop, or where ridership gain will far outweigh inconvenience to passengers already on-board	Off-street

In general, bus stops can be accommodated on-street in the parking or curb lane, bike lane, or in the right turn lanes. In cases where there are no parking spaces or right turn lanes or passenger volumes are high, a bus turnout may be necessary. The same is true when vehicular volumes are high. Refer to **Figures 12, 12A, 12B, and 13** for placement criteria and dimensions of common on-street stop conditions.

At some bus stops, more than one bus may be at the stop at a given time. The number of bus-loading positions required depends upon 1) the rate of bus arrivals and 2) passenger service time at the stop. In general, bus zones should increase by 50 feet for each additional standard bus and 70 feet for each additional articulated bus that is expected to use the zone simultaneously.

2.6 IDENTIFICATION OF BUS STOP

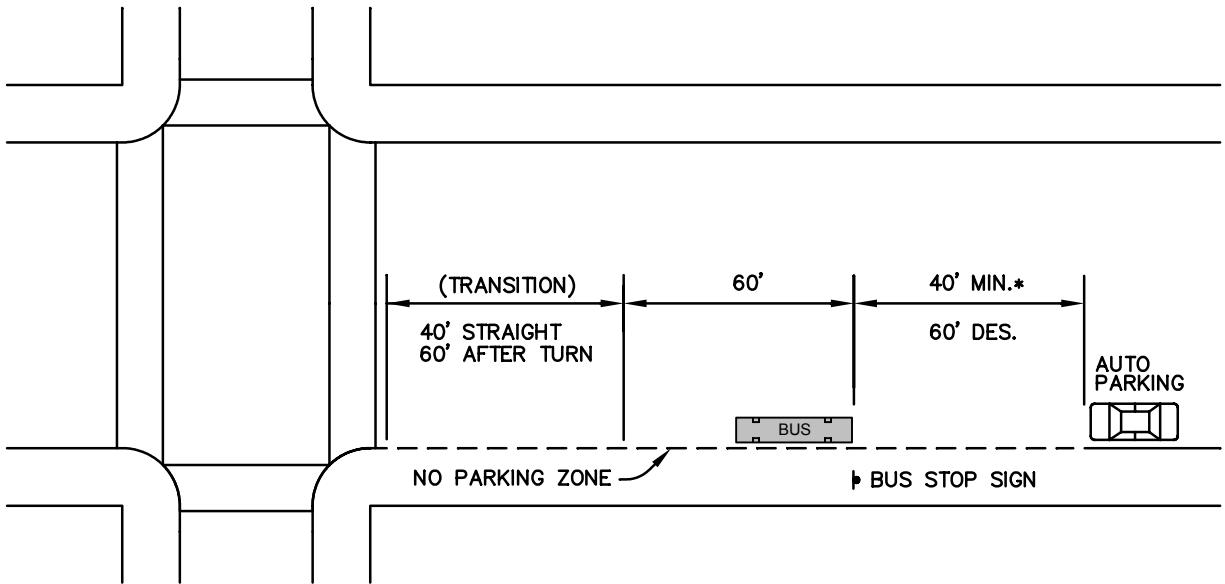
Bus stop signs are placed to notify the general public where the bus will stop, to provide reference for coach operators, and to assist in marketing the system. To mark the location of all bus stops, the Authority will provide signs as shown on **Figure 14** and install them free of charge. **Figure 14A** illustrates a typical post anchor detail. The Authority's standard bus stop sign is 18 inches wide x 18 inches high, reflective, and double-sided for visibility when approached from either direction. The sign:

- Identifies the location as a designated bus stop.
- Provides route specific information.
- Displays the transit information telephone number.

There are multiple criteria involved in placing a bus stop sign. Concerns for passenger and public safety, ADA requirements, convenience, bus stop visibility and passenger amenities must all be addressed.

The following are general guidelines for bus stop sign locations and clearances:

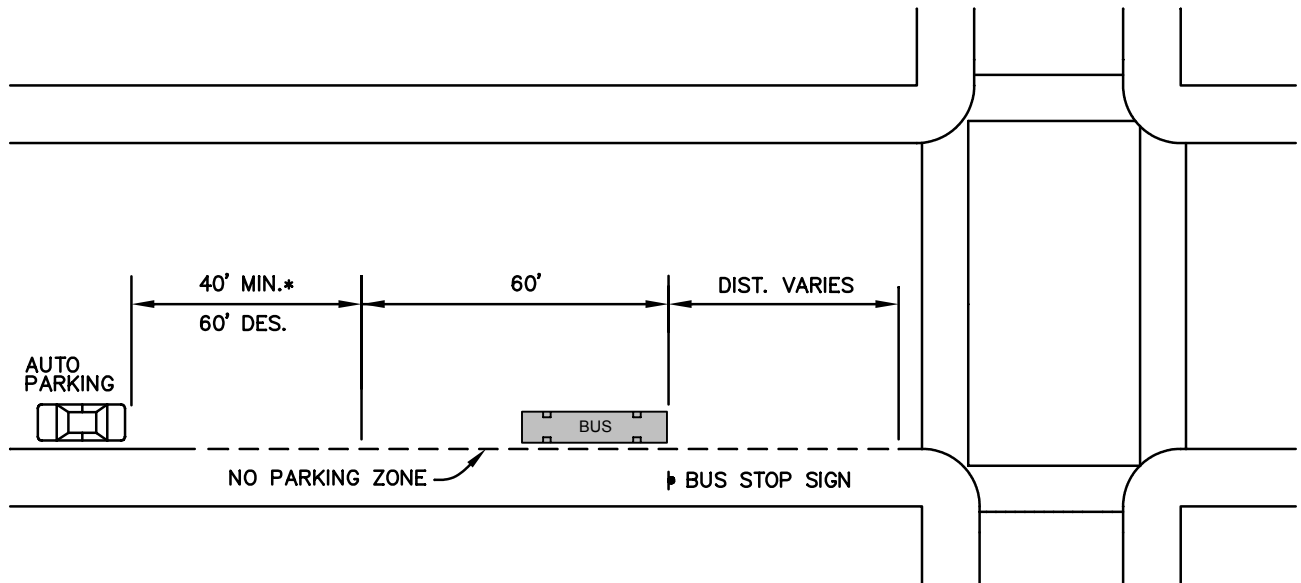
- In no case should the post be located closer than 24 inches from the curb face.
- Whenever possible, the bus stop sign should be located at the front of each bus zone.
- Bus stop signs should be mounted on square unistrut posts. This is particularly useful for visually impaired patrons to locate the exact location where the bus will stop.
- Whenever possible bus stop signs should be placed independently of all other street signs to maintain transit stop identity.
- The bottom of the sign should be 7 feet above grade and no higher than 10 feet, consistent with **Figure 14**.
- The top of the informational cassette should be mounted no higher than 60 inches above grade.



FARSIDE STOP

* 40' MINIMUM FOR LOW SPEED AND LOW VOLUME STREETS
 60' DESIRABLE FOR HIGH SPEED AND HIGH VOLUME STREETS.

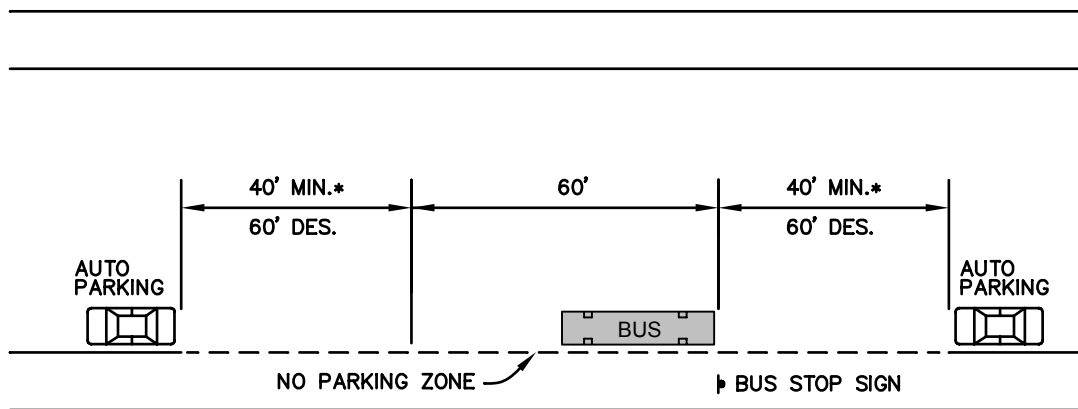




NEAR SIDE STOP

* 40' MINIMUM FOR LOW SPEED AND LOW VOLUME STREETS
 60' DESIRABLE FOR HIGH SPEED AND HIGH VOLUME STREETS.

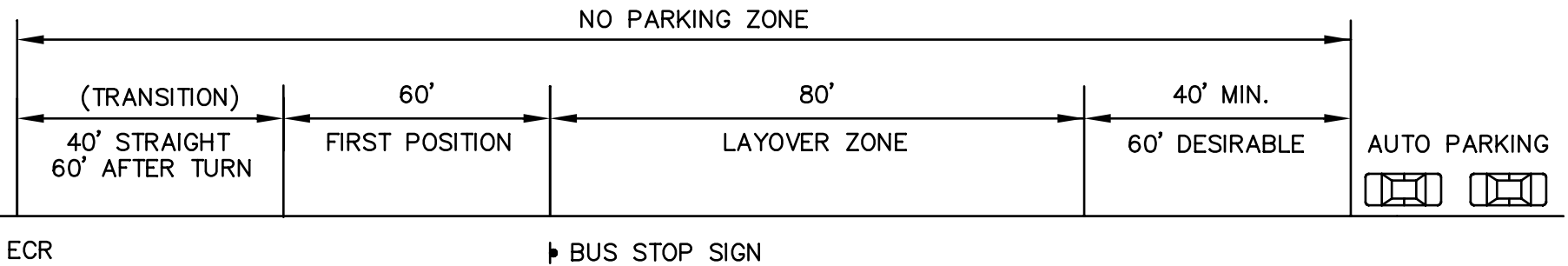
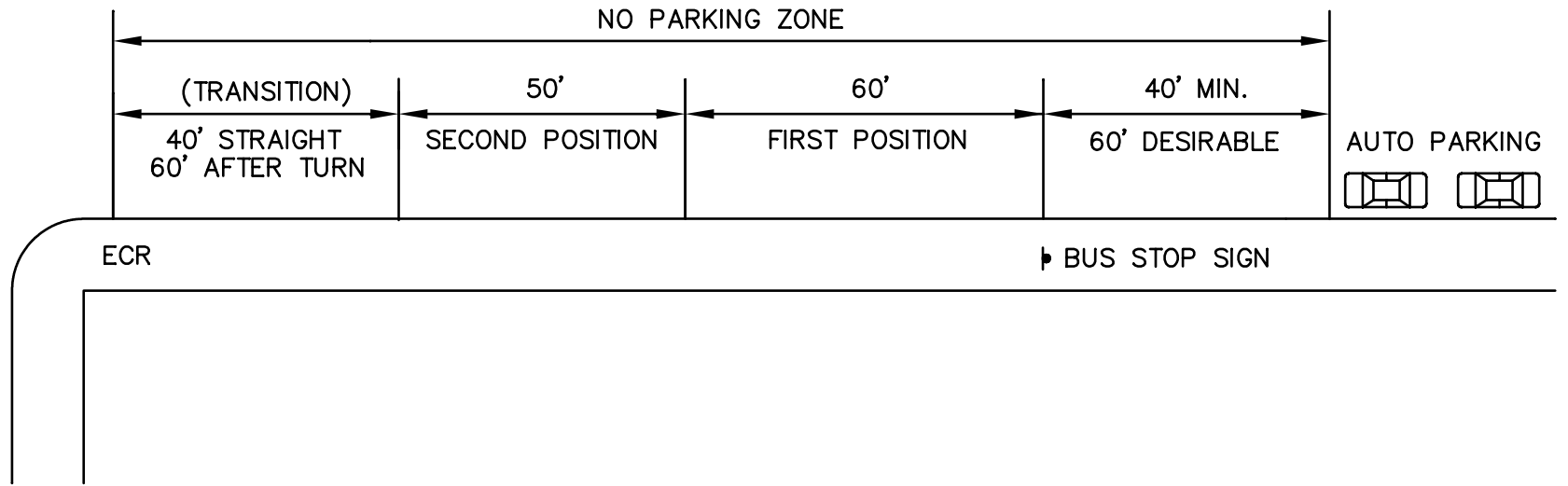




MID-BLOCK STOP

*40' MINIMUM FOR LOW SPEED AND LOW VOLUME STREETS
 60' DESIRABLE FOR HIGH SPEED AND HIGH VOLUME STREETS.

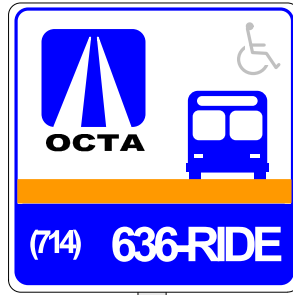




TO DETERMINE THE DIMENSIONS FOR A BUS STOP WITH MULTIPLE BERTHS:

- THE FIRST POSITION SHOULD BE 60 FEET LONG FOR 40 FOOT VEHICLES
(80 FEET FOR ARTICULATED VEHICLES)
- FOR EACH ADDITIONAL PASS-THROUGH BUS, 50 FEET SHOULD BE ADDED
(70 FEET FOR ARTICULATED VEHICLES)
- FOR EACH ADDITIONAL LAYOVER BUS, 80 FEET SHOULD BE ADDED
(100 FEET FOR ARTICULATED VEHICLES)





7' Minimum
10' Maximum

60"

AC or Concrete
Sidewalk

Roadway

Curb/Gutter

90°

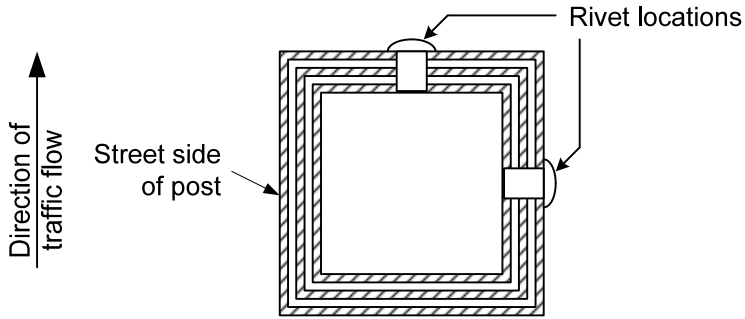
24" Minimum Clearance
Is Required To Eliminate
Damage To Buses

See Post Anchor Detail

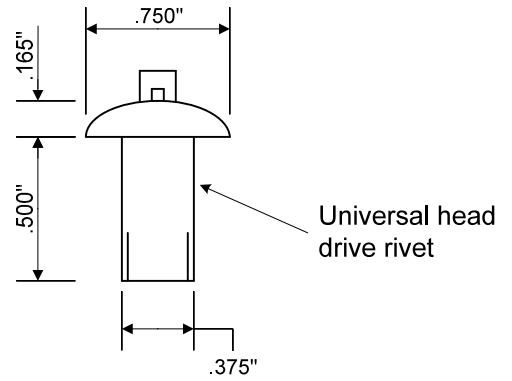


**ORANGE COUNTY
TRANSPORTATION AUTHORITY**

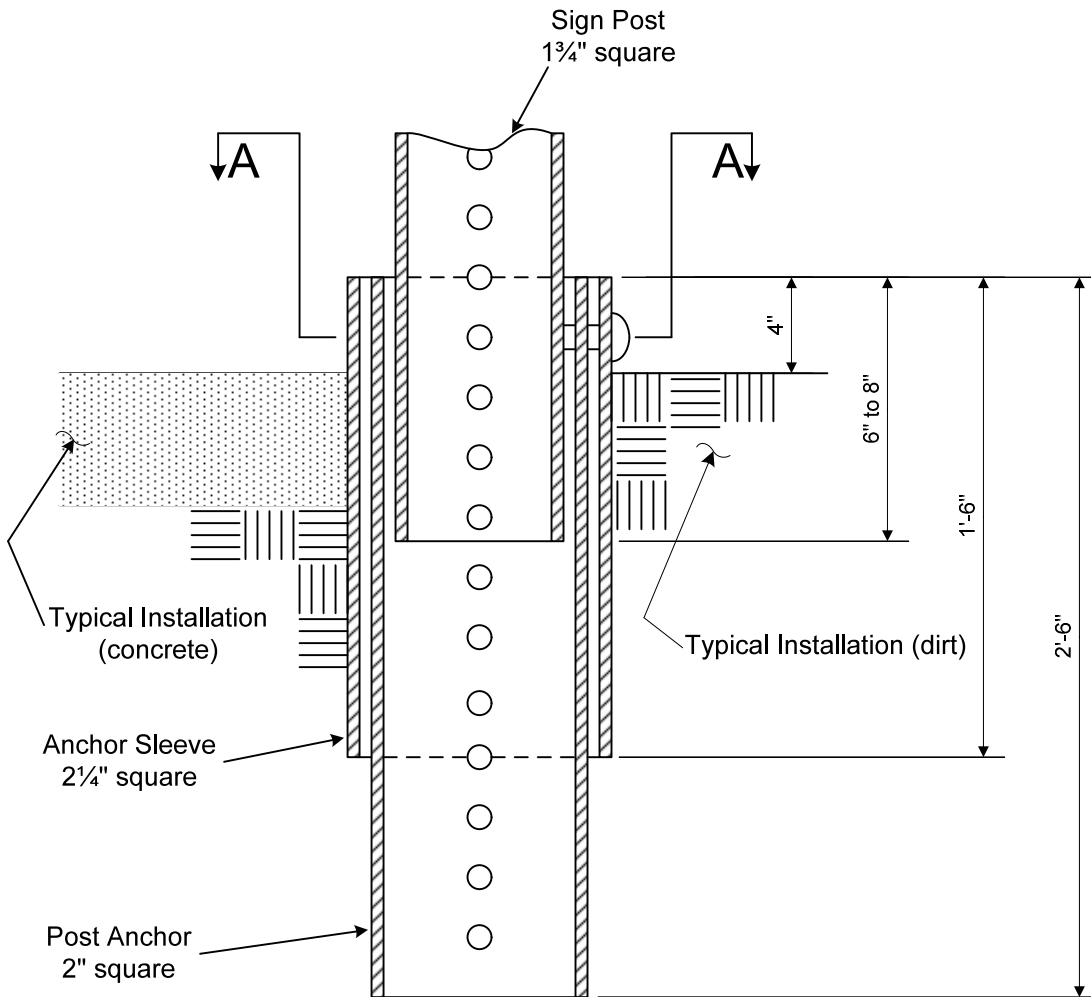
**FIGURE 14
BUS STOP SIGN
PLACEMENT CRITERIA**



SECTION A-A



RIVET DETAIL



TYPICAL SECTION



2.7 BUS STOPS AND PROPERTY OWNERS

To promote good public relations, it is desirable that bus stops be placed at locations where they will minimize the annoyance to the adjacent residents or business owners. Some commercial establishments are interested in having a bus stop placed in front of their establishment, while residents may object to the presence of a bus stop in front of their home. All efforts should be taken to minimize the impact to each property owner, but vehicle and pedestrian safety should be the over-riding factor in determining the final bus stop location.

2.8 PARKING RESTRICTIONS AT BUS STOPS

It is crucial that parking restrictions (either red curb or “No Parking” signs) be placed at bus zones. The lack of parking restrictions could impact bus operations, traffic movement, safe sight distance, and passenger access. Potential issues include:



Photo 6: Bus stop in parking lane.

- The bus may have to double park when servicing a stop, which would interfere with traffic movements.
- Passengers would have to maneuver between parked vehicles when entering or exiting the bus, which can endanger the passengers.
- The bus would lack access to the curb/sidewalk area to board or alight wheelchair passengers.

Motorists are accustomed to the standard parking regulations that are used at intersection approaches. For this reason, parking restrictions at nearside and farside stop locations can be enforced with comparatively less difficulty than mid-block locations.

Parking regulations should be legally enforceable for all bus zones. Further, all violations should be fully enforced both in a consistent and expedient manner by the appropriate local jurisdiction. Photo 6 shows a red painted curb as an example of one form of parking restriction at bus stops.

2.9 BUS STOPS AND DRIVEWAYS

Whenever possible, bus stops should not be placed within the proximity of a driveway. However, if a driveway is unavoidable:

- Attempt to keep at least one exit and entrance open to vehicles accessing the property while a bus is loading or unloading passengers.
- Locate bus stops to allow good visibility for vehicles leaving the property and to minimize vehicle/bus conflicts. This is best accomplished by placing bus stops where driveways are behind the stopped bus.

- Never place a bus stop that forces passengers to wait for a bus in the middle of a driveway.
- It is preferable to fully rather than partially block a driveway to prevent vehicles from attempting to squeeze by the bus in a situation with reduced sight distance.

Figure 15 depicts undesirable driveway situations where either visibility is restricted or the only drive into a parking area is blocked. **Figure 15** also shows acceptable driveway situations where visibility is enhanced and access is maintained. The best opportunity to eliminate driveway conflicts for passengers and buses is during early planning of development projects. New developments can arrange their access to avoid constructing driveways near existing or proposed bus stop locations if the driveway location would result in inadequate sight distance. Each developer should contact OCTA for bus stop locations prior to starting the preliminary site plan for the project.

2.10 BUS TURNOUTS

Bus turnouts (a recessed curb area located adjacent to the traffic lane) are desirable under selected conditions because of the delay created when the bus must re-enter traffic. Bus turnouts have advantages and disadvantages:

Advantages:

- Allows traffic to proceed around the bus, reducing delay for general traffic;
- Maximizes vehicular capacity of roads;
- Clearly defines the bus stop;
- Passenger loading and unloading can be conducted in a more relaxed manner; and
- Eliminates potential rear-end accidents.

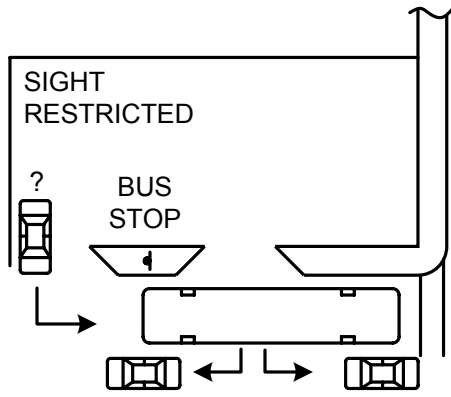
Disadvantages:

- More difficult to re-enter traffic, increasing bus delay and increasing average travel time for buses; and
- Uses additional space and may require right-of-way acquisition.

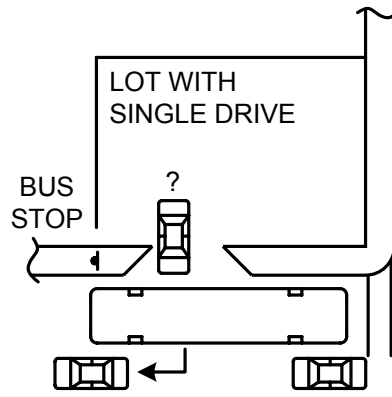
Bus turnouts are desirable where street traffic speeds are 40 mph or more and one of the following conditions exist:

- Peak period boarding average exceeds 20 boardings per hour.
- Average peak period dwell time exceeds 30 seconds per bus.
- A high frequency of accidents involving buses and/or pedestrians occurred within the past year.
- When traffic in the curb lane exceeds 250 vehicles during the peak hour and the curb lane is less than 20 feet wide or when bus volumes exceed 10 or more per peak hour.

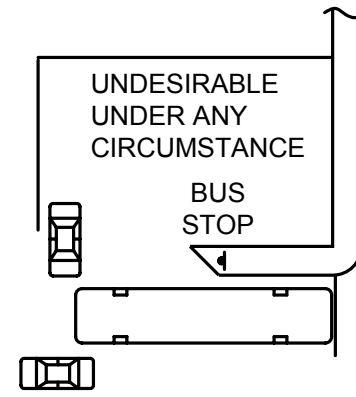
UNDESIRABLE DRIVEWAY ARRANGEMENTS



BUS IMPEDES SIGHT DISTANCE FROM ADJACENT DRIVEWAY

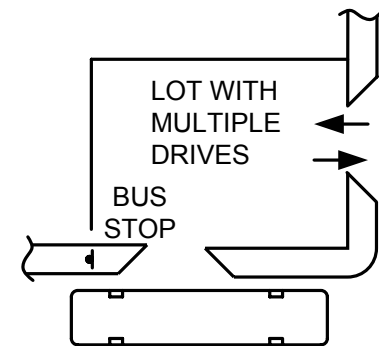
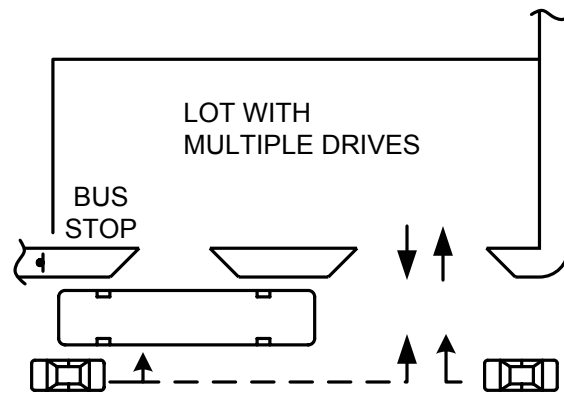
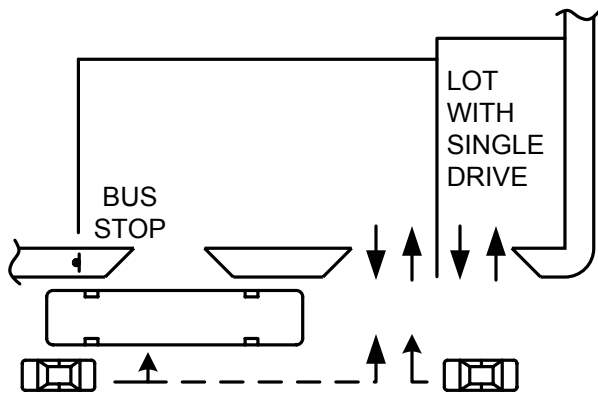


BUS ENTIRELY BLOCKS SINGLE DRIVEWAY



BUS PARTIALLY BLOCKS DRIVEWAY WHERE VEHICLES CAN ATTEMPT TO SQUEEZE PAST BUS

ACCEPTABLE DRIVEWAY ARRANGEMENTS



- Where bus stops in the curb lane are prohibited.
- Where sight distances prevent traffic from stopping safely behind a stopped bus (e.g. hills, curves).
- At stops where there are 2 or more consistent wheelchair lift boardings.
- Where buses are expected to layover at the end of a trip.



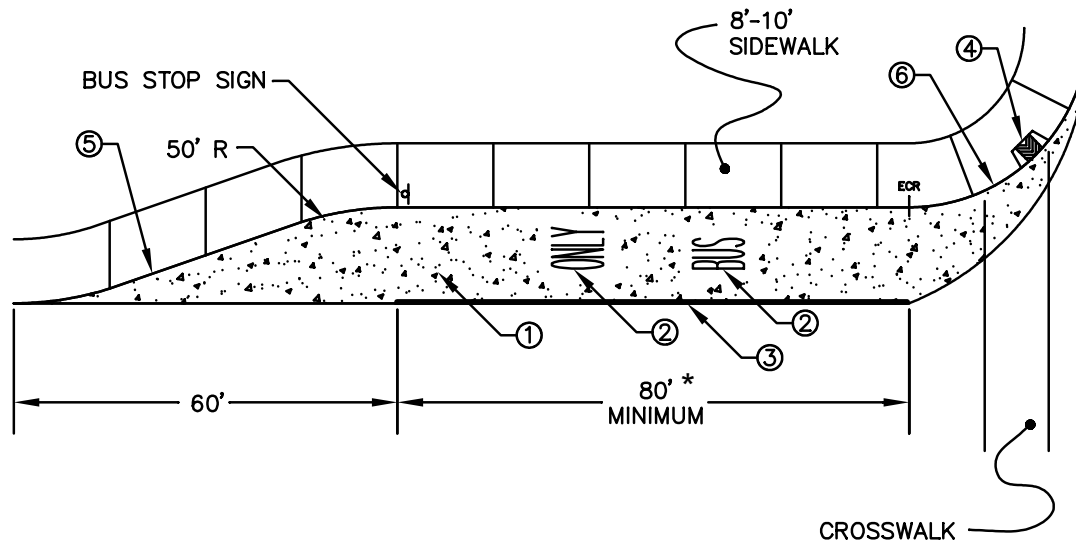
Photo 7: Typical “mid-block” type turnout on arterial street.

The farside of an intersection is the preferred location for warranted turnouts. Nearside turnouts typically should be avoided because of conflicts with right turning vehicles, delays to transit service as buses attempt to re-enter the travel lane, and obstruction of pedestrian activity as well as traffic control devices. The exception would be where buses would use a right turn lane as a queue jump lane associated with a bus signal priority treatment at an intersection (where a farside pullout is not possible). Turnouts in mid-block locations are not desirable unless associated with key pedestrian access to a major transit-oriented activity center and subject to the general warrants above. Photo 7 shows a typical mid-block turnout on a major arterial street.

Guidelines for bus turnouts

- Turnout should be placed at signalized intersections where the signal can create gaps in traffic allowing the bus to re-enter the street.
- Twelve foot width is desirable to reduce sideswipe accidents, ten foot width is minimum.
- On streets with bike lanes and where bus layovers occur, the turnout should be wide enough so that buses do not impede the bike lane.

Bus turnout designs and cross-sections are illustrated in **Figures 16 through 21**. A severe physical obstruction or major activity center may require a mid-block bus turnout as discussed above but this design should only be used when the standard farside turnout is infeasible. A farside bus turnout is superior to the mid-block design because it reduces walking distances for bus transfers, encourages patrons to use intersection crosswalks, and reduces right-of-way acquisition.



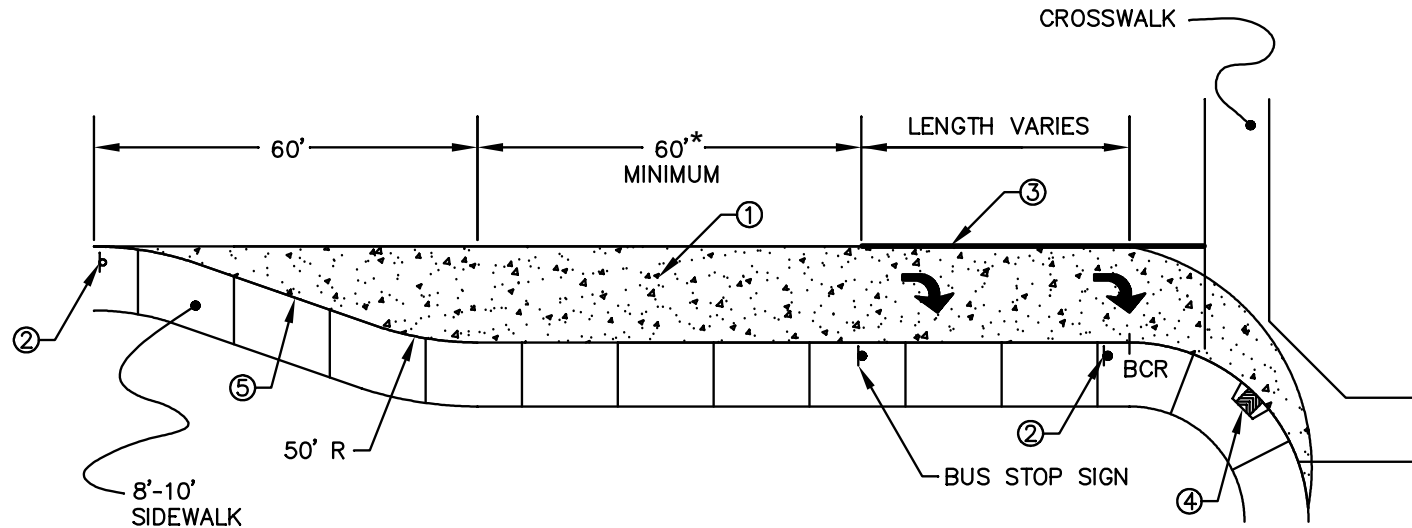
NOTES:

- ① 12' TO 14' WIDE CONCRETE BUS PAD INCLUDING MONOLITHIC CURB - 3000 PSI P.C.C. PAVEMENT, 9" DEEP WITHOUT RE-BAR, OR 8" DEEP WITH #3 RE-BAR AT 18" ON CENTER.
- ② PER CALTRANS STANDARD PLANS A24E (OPTIONAL).
- ③ PER CALTRANS STANDARD PLANS A20D, DETAIL 38A.
- ④ WHEELCHAIR ACCESS RAMP (LOCATION MAY VARY).
- ⑤ WHENEVER POSSIBLE DRIVEWAYS SHOULD NOT BE PLACED WITHIN THE TURNOUT/BUS ZONE.
- ⑥ TURN RADIUS VARIES, BUT SHOULD BE A MINIMUM OF 28' (30' DESIRABLE). USE APPROPRIATE TURNING TEMPLATE FOR DESIGN.

* DIMENSIONS FOR A BUS TURNOUT USED BY MULTIPLE BUSES:

- ADD 60' FOR EACH ADDITIONAL PASS-THROUGH BUS
- IF TURNOUT WILL BE USED AS A LAYOVER ZONE, ADD AN ADDITIONAL 80' (100' FOR ARTICULATED BUSES).





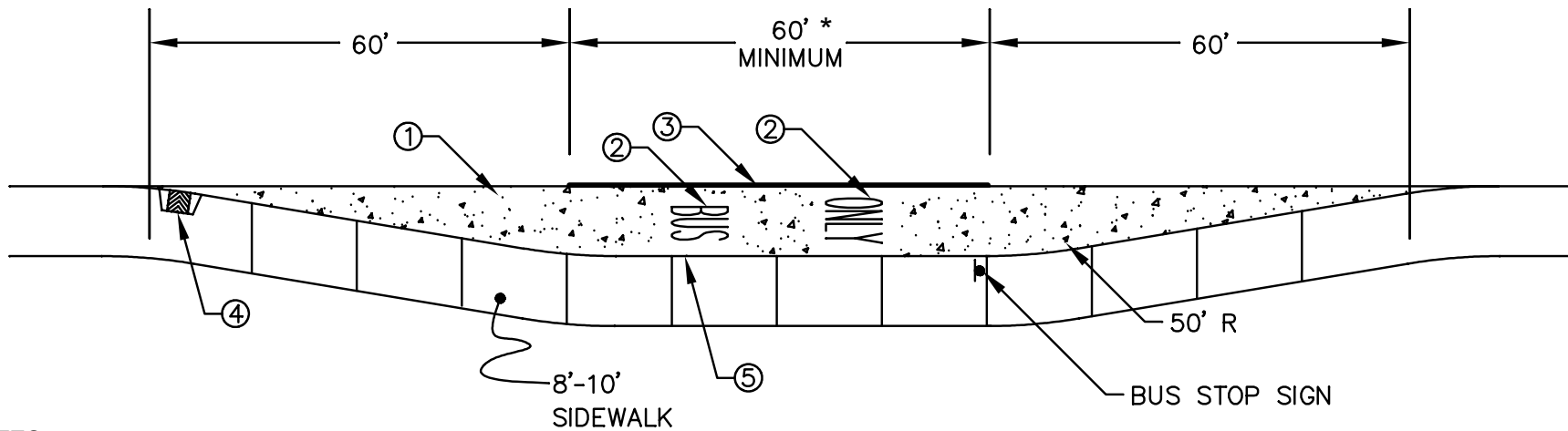
NOTES:

- ① 12' TO 14' WIDE CONCRETE BUS PAD INCLUDING MONOLITHIC CURB - 3000 PSI P.C.C. PAVEMENT, 9" DEEP WITHOUT RE-BAR, OR 8" DEEP WITH #3 RE-BAR AT 18" ON CENTER.
- ② R18 SIGN WITH "BUS EXEMPT" SIGN.
- ③ PER CALTRANS STANDARD PLANS A20D, DETAIL 38A.
- ④ WHEELCHAIR ACCESS RAMP (LOCATION MAY VARY).
- ⑤ WHENEVER POSSIBLE DRIVEWAYS SHOULD NOT BE PLACED WITHIN THE TURNOUT/BUS ZONE.

* DIMENSIONS FOR A BUS TURNOUT USED BY MULTIPLE BUSES:

- ADD 60' FOR EACH ADDITIONAL PASS-THROUGH BUS.
- IF TURNOUT WILL BE USED AS A LAYOVER ZONE, ADD AN ADDITIONAL 80' (100' FOR ARTICULATED BUSES).





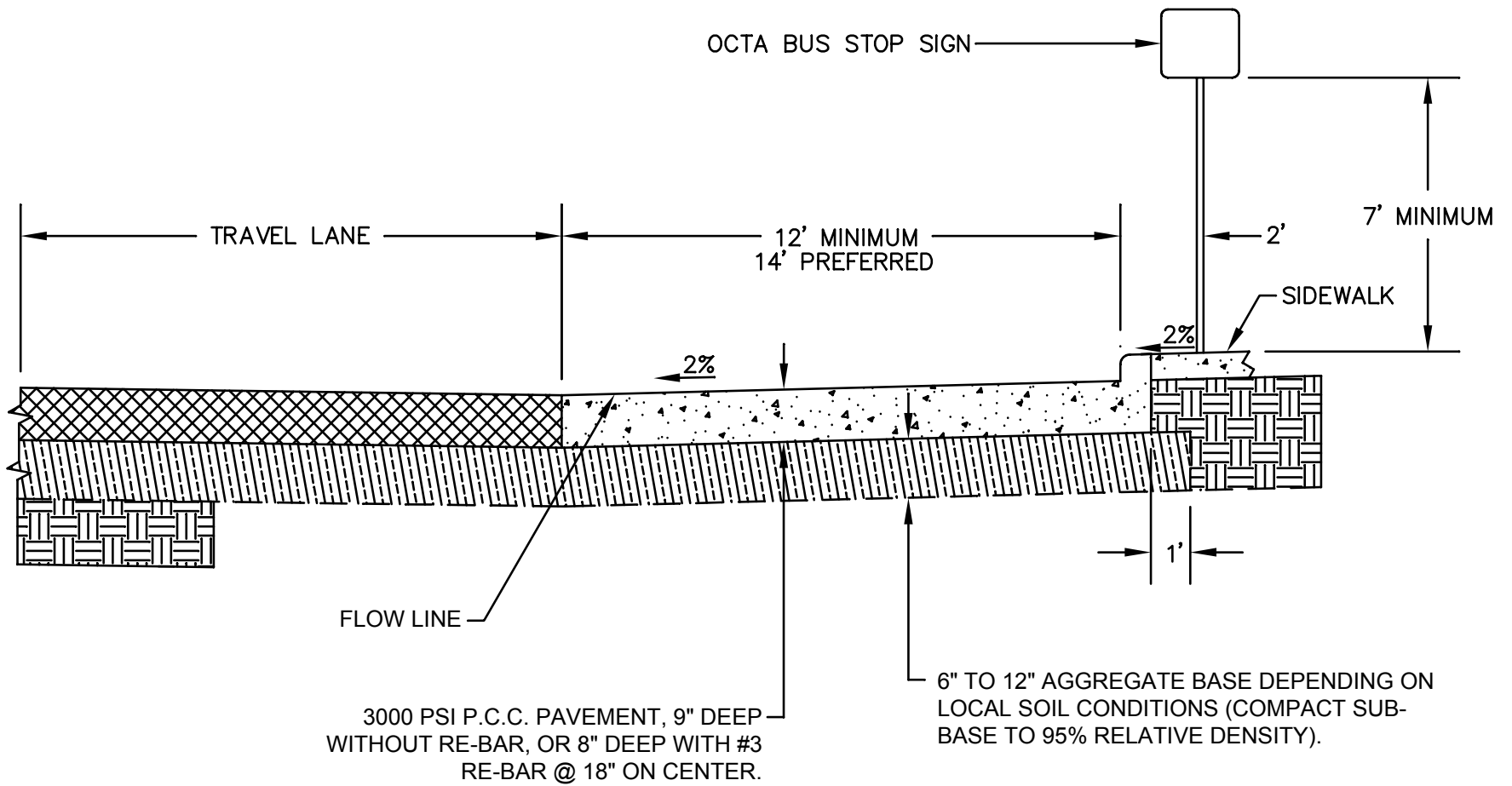
NOTES:

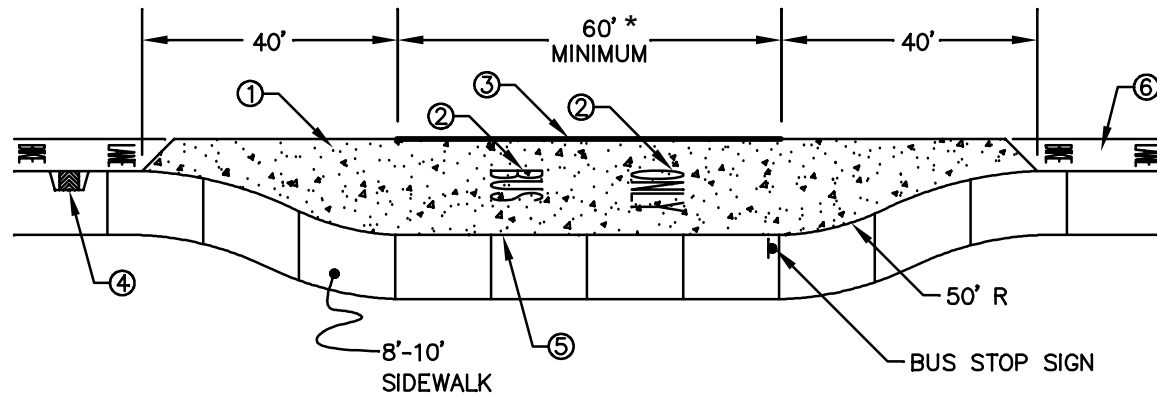
- ① 12' TO 14' WIDE CONCRETE BUS PAD INCLUDING MONOLITHIC CURB - 3000 PSI P.C.C. PAVEMENT, 9" DEEP WITHOUT RE-BAR, OR 8" DEEP WITH #3 RE-BAR AT 18" ON CENTER.
- ② PER CALTRANS STANDARD PLANS A24E (OPTIONAL).
- ③ PER CALTRANS STANDARD PLANS A20D, DETAIL 38A.
- ④ WHEELCHAIR ACCESS RAMP (LOCATION MAY VARY).
- ⑤ WHENEVER POSSIBLE DRIVEWAYS SHOULD NOT BE PLACED WITHIN THE TURNOUT/BUS ZONE.

*** DIMENSIONS FOR A BUS TURNOUT USED BY MULTIPLE BUSES:**

- ADD 60' FOR EACH ADDITIONAL PASS-THROUGH BUS
- IF TURNOUT WILL BE USED AS A LAYOVER ZONE, ADD AN ADDITIONAL 80' (100' FOR ARTICULATED BUSES).







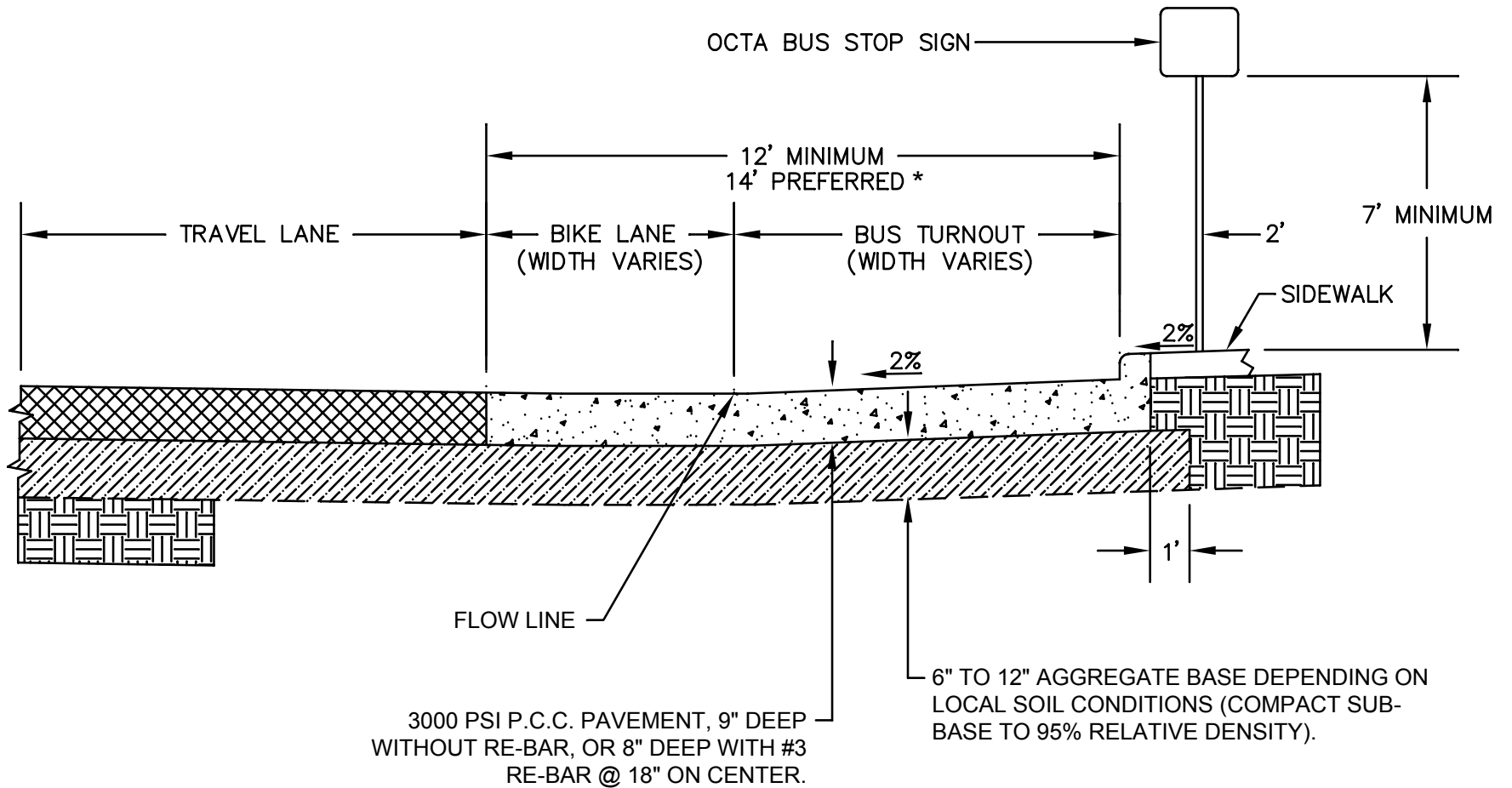
NOTES:

- ① 12' TO 14' WIDE CONCRETE BUS PAD INCLUDING MONOLITHIC CURB - 3000 PSI P.C.C. PAVEMENT, 9" DEEP WITHOUT RE-BAR, OR 8" DEEP WITH #3 RE-BAR AT 18" ON CENTER.
- ② PER CALTRANS STANDARD PLANS A24E (OPTIONAL).
- ③ PER CALTRANS STANDARD PLANS A20D, DETAIL 38A.
- ④ WHEELCHAIR ACCESS RAMP (LOCATION MAY VARY).
- ⑤ WHENEVER POSSIBLE DRIVEWAYS SHOULD NOT BE PLACED WITHIN THE TURNOUT/BUS ZONE.
- ⑥ IF TURNOUT WILL BE USED AS A LAYOVER ZONE, THEN TURNOUT SHOULD BE DESIGNED SO BUSES WILL NOT OBSTRUCT BIKE LANE.

* DIMENSIONS FOR A BUS TURNOUT USED BY MULTIPLE BUSES:

- ADD 60' FOR EACH ADDITIONAL PASS-THROUGH BUS.
- IF TURNOUT WILL BE USED AS A LAYOVER ZONE, ADD AN ADDITIONAL 80' (100' FOR ARTICULATED BUSES).





* IF TURNOUT WILL BE USED AS A LAYOVER ZONE,
THEN TURNOUT SHOULD BE WIDENED TO 12'-14' SO
BUS WILL NOT OBSTRUCT BIKE LANE.



2.11 CONCRETE BUS PADS

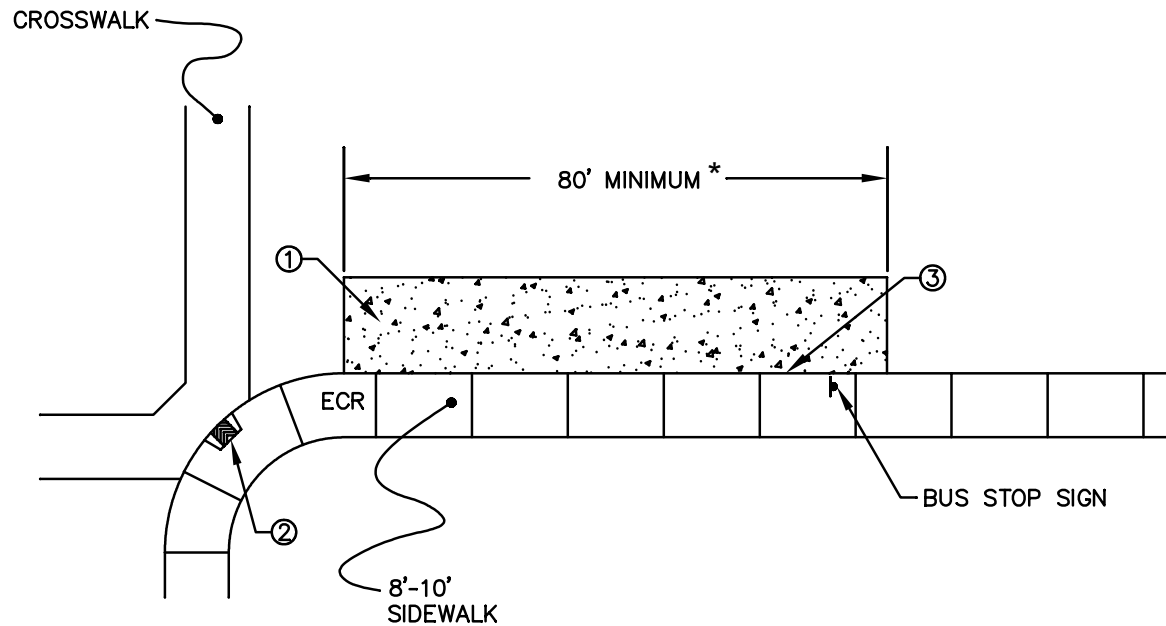
Concrete bus pads are recommended for all stops because they can withstand the weight of a bus better than asphalt bus pads. OCTA recommends that bus pads be considered at the earliest phase of project development because it is advantageous to install concrete pads before road construction is complete. For technical specifications and dimensions for concrete bus pads, refer to **Figures 22, 22A, and 23**. Photo 8 shows a typical concrete pad constructed adjacent to a bus stop.



Photo 8: Concrete pad at bus stop.

2.12 RURAL OR UNDEVELOPED AREA BUS STOP CONSIDERATION AND DESIGN

In rural or undeveloped areas where there are no sidewalks and/or roads have open drainage ditches along the sides, care should be taken when locating potential bus stops. Every effort should be made to find a flat level area in which to place the stop. If funding is available, a concrete or asphalt passenger pad, up to 8 feet wide and 35 feet in length, should be placed. In these cases, curb ramps and a compacted and stabilized decomposed granite, asphalt, or concrete pathway to the nearest intersection or development should also be considered. On roads without curbs, the local jurisdiction should consider placing a tactile warning device (such as grooved concrete or truncated domes) between the road's shoulder and the passenger waiting area.



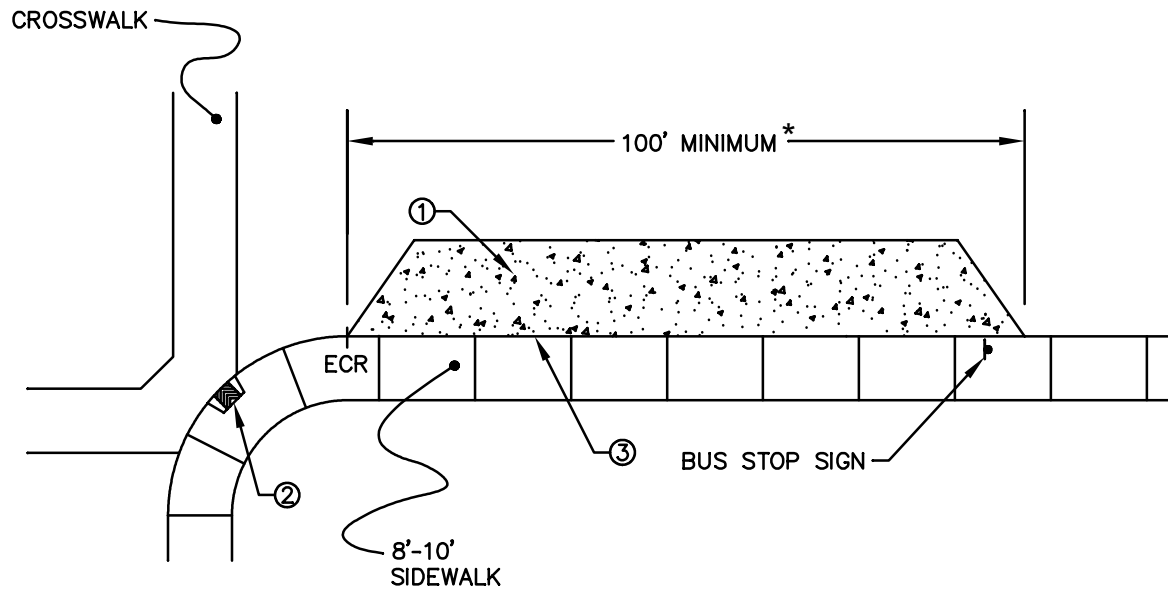
NOTES:

- ① 12' TO 14' WIDE CONCRETE BUS PAD INCLUDING MONOLITHIC CURB - 9" DEEP WITHOUT RE-BAR, OR 8" DEEP WITH #3 RE-BAR AT 18" ON CENTER. EXACT PAD PLACEMENT WILL VARY BY LOCATION. CONTACT OCTA BEFORE PLACING PAD.
- ② WHEELCHAIR ACCESS RAMP (LOCATION MAY VARY).
- ③ WHENEVER POSSIBLE DRIVEWAYS SHOULD NOT BE PLACED WITHIN THE TURNOUT/BUS ZONE.

*** DIMENSIONS FOR A BUS PAD USED BY MULTIPLE BUSES:**

- ADD 60' FOR EACH ADDITIONAL PASS-THROUGH BUS.
- IF BUS STOP WILL BE USED AS A LAYOVER ZONE, ADD AN ADDITIONAL 80' (100' FOR ARTICULATED BUSES).





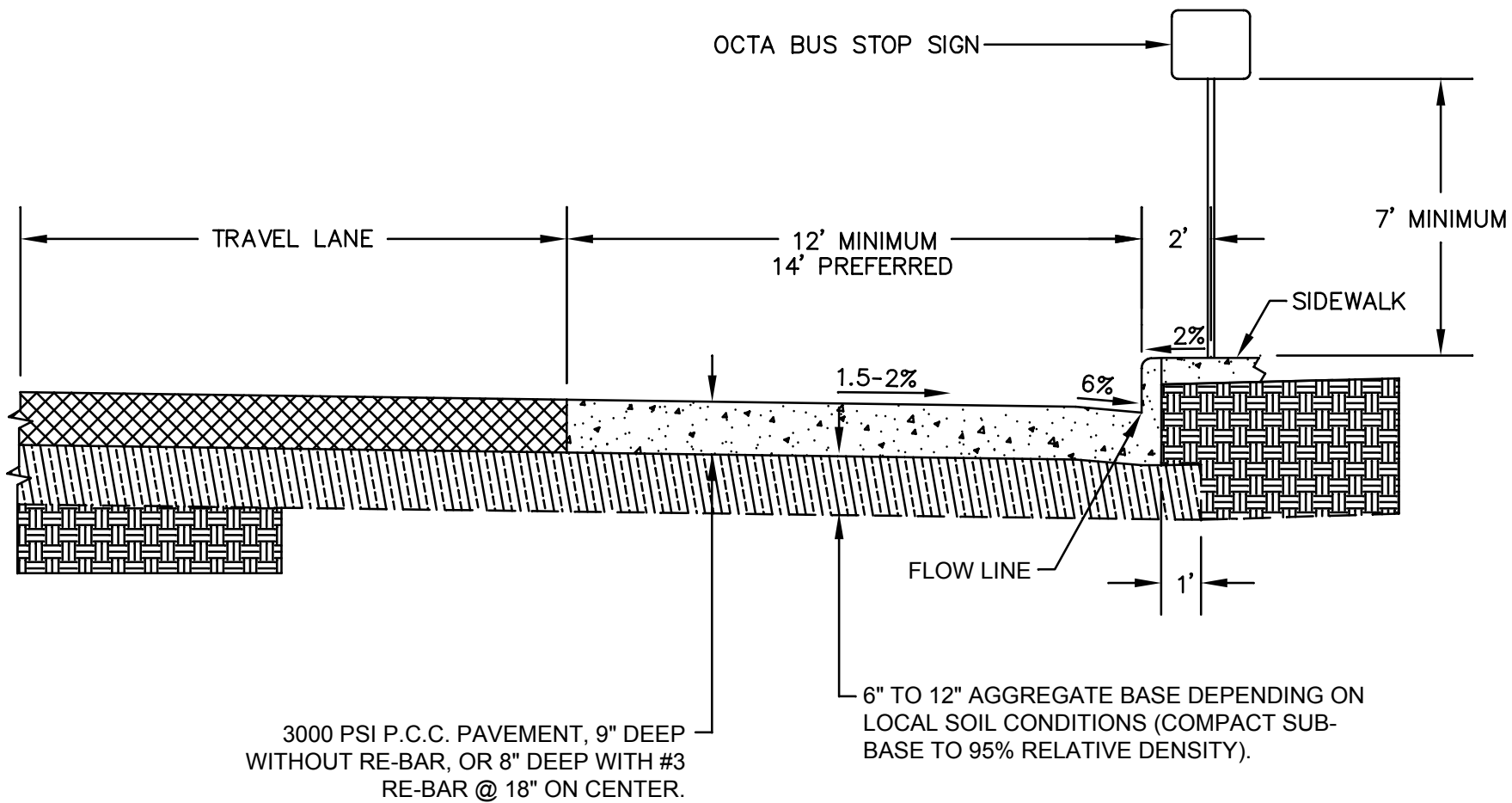
NOTES:

- ① 12' TO 14' WIDE CONCRETE BUS PAD INCLUDING MONOLITHIC CURB - 9" DEEP WITHOUT RE-BAR, OR 8" DEEP WITH #3 RE-BAR AT 18" ON CENTER. EXACT PAD PLACEMENT WILL VARY BY LOCATION. CONTACT OCTA BEFORE PLACING PAD.
- ② WHEELCHAIR ACCESS RAMP (LOCATION MAY VARY).
- ③ WHENEVER POSSIBLE DRIVEWAYS SHOULD NOT BE PLACED WITHIN THE TURNOUT/BUS ZONE.

*** DIMENSIONS FOR A BUS PAD USED BY MULTIPLE BUSES:**

- ADD 60' FOR EACH ADDITIONAL PASS-THROUGH BUS.
- IF BUS STOP WILL BE USED AS A LAYOVER ZONE, ADD AN ADDITIONAL 80' (100' FOR ARTICULATED BUSES).





CHAPTER 3

PASSENGER AMENITIES

3.1 INTRODUCTION

The design of bus stop waiting areas and provision of amenities that enhance security and comfort plays a significant role in a person's decision to use transit. Design of bus stops can affect a person's actual or perceived sense of safety, comfort and convenience. The following sections identify the factors to consider, and provide guidelines for locating bus stops and designing passenger waiting areas.

3.2 PASSENGER BOARDING AREA

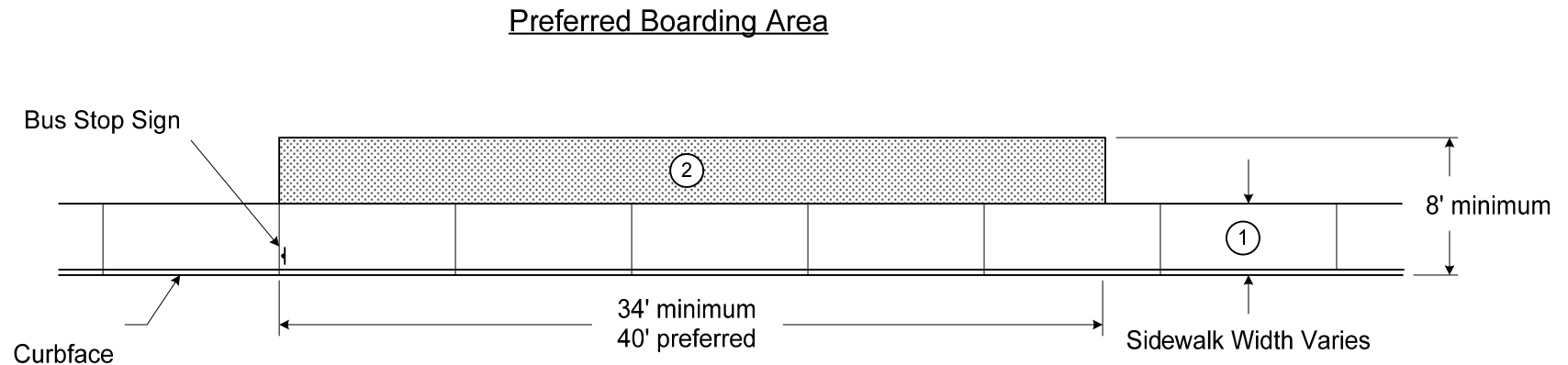
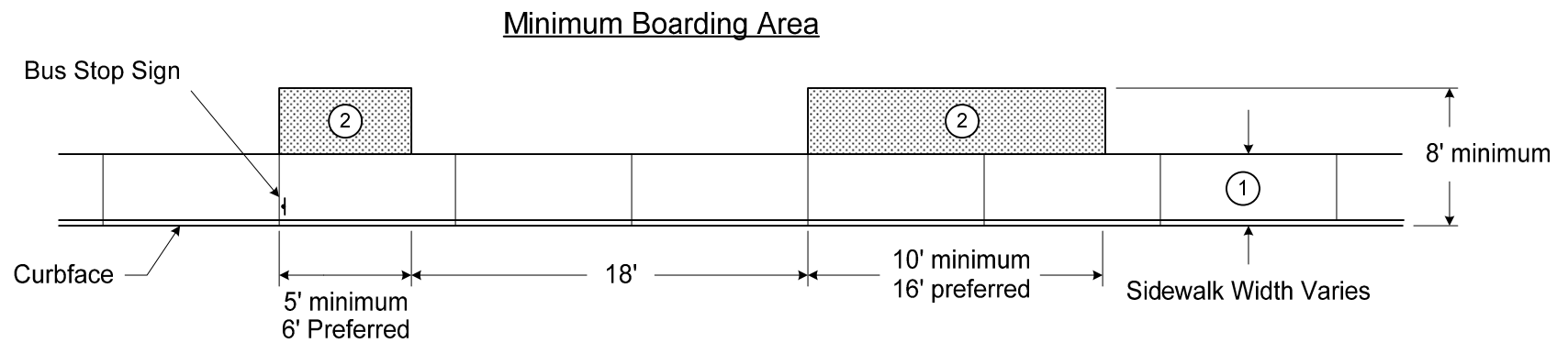
The bus stop passenger boarding area is that area described as a firm, solid, level platform, standardized by OCTA's rolling stock dimensions (see **Tables 1, 2, and 3** for wheelchair lift characteristics). Due to the different sizes of various buses, all equipped with either a front door or rear door wheelchair lift, the boarding area must include a front and rear loading area free of obstacles. The boarding area may also be the pathway, but requires greater clearance than a standard sidewalk to allow deployment of the wheelchair lift. See **Figures 24, 24A and 24B** for illustrations of typical boarding area design and dimensions for various sidewalk configurations. Photo 9 shows a basic boarding area.



Photo 9: Typical passenger boarding area.

The following criteria for boarding areas should be used to ensure compliance with ADA:

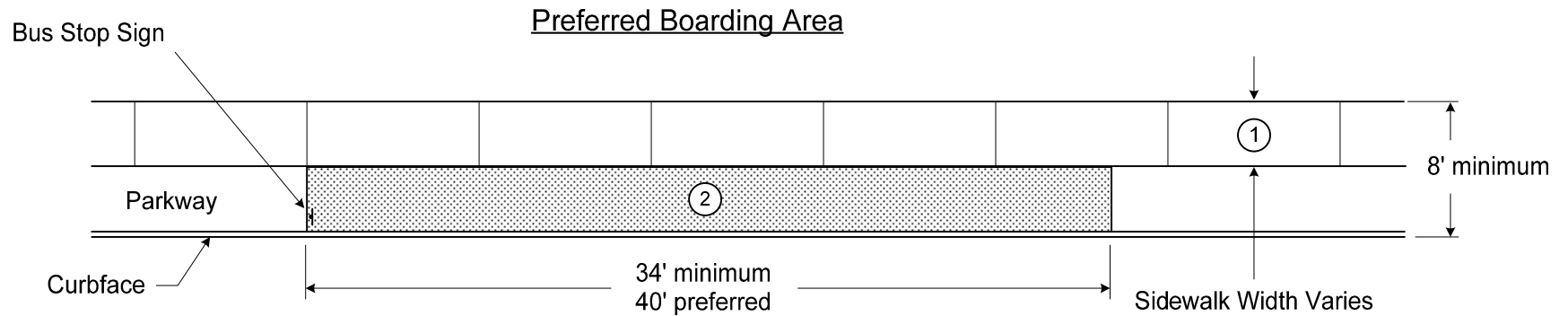
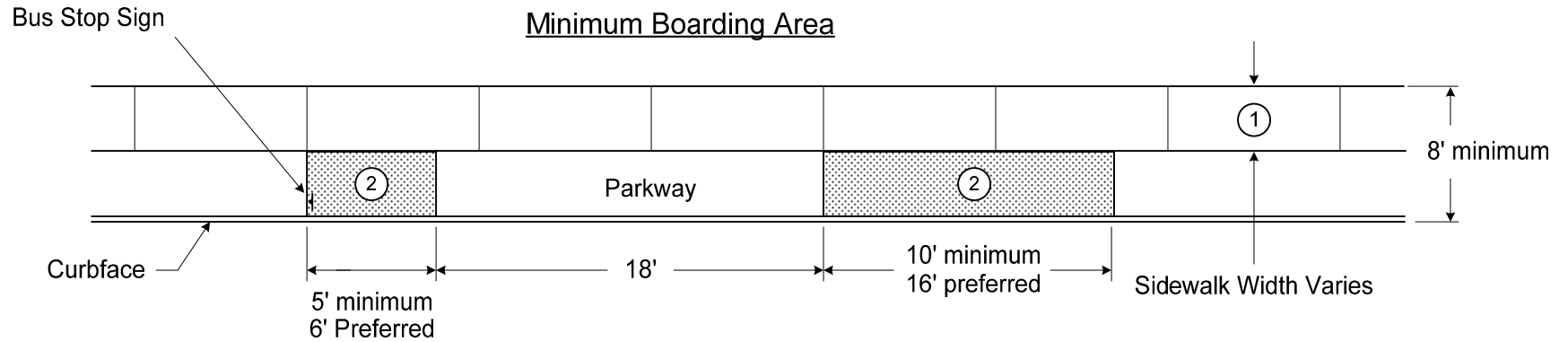
- Front door clearance minimum 5 feet by 8 feet
- Rear door clearance minimum 10 feet by 8 feet
- Distance between front and rear boarding area is 18 feet
- Surface material is stable, firm, and slip resistant
- Slope does not exceed 1 foot vertical over 20 feet horizontal (5%)
- Cross slope does not exceed 1 foot vertical over 50 feet horizontal (2%)
- Horizontal clearance of 48 inches maintained in boarding area
- Vertical clearance of 84 inches maintained in boarding area



Note:

- 1) The minimum sidewalk/pathway width should be 48" wide, with a 84" vertical clearance.
- 2) When the existing sidewalk is less than 8 feet wide, it should be widened accordingly to meet current ADA standards for accommodating both a front and rear door wheelchair lift. Wheelchair boarding areas should be constructed with either P.C.C. or A.C. pavement. Above grade obstacles, or street furniture should be placed in such a manner as to not interfere with the designated front of rear door boarding areas.



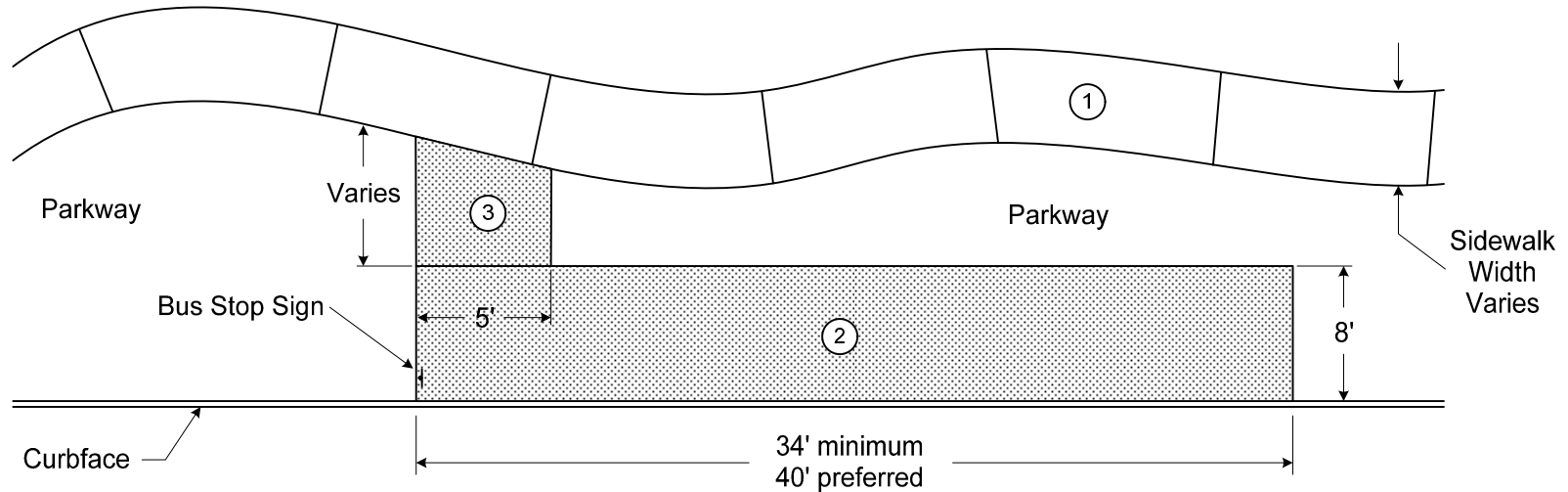


Note:

- 1) The minimum sidewalk/pathway width should be 48" wide, with a 84" vertical clearance.
- 2) When the existing sidewalk is less than 8 feet wide, it should be widened accordingly to meet current ADA standards for accommodating both a front and rear door wheelchair lift. Wheelchair boarding areas should be constructed with either P.C.C. or A.C. pavement. Above grade obstacles, or street furniture should be placed in such a manner as to not interfere with the designated front of rear door boarding areas.



Preferred Boarding Area



Note:

- 1) The minimum sidewalk/pathway width should be 48" wide, with a 84" vertical clearance.
- 2) At locations with large parkways, it will be necessary to construct an ADA compliant wheelchair boarding area to accommodate both a front and rear door wheelchair lift. The wheelchair boarding area should be constructed with either P.C.C. or A.C. pavement. Above grade obstacles, or street furniture should be placed in such a manner as to not interfere with the designated front of rear door boarding areas.
- 3) In addition to constructing the boarding area, a 5 foot wide pathway should be constructed connecting the boarding area to the existing sidewalk. As with the boarding area, it should be constructed with either P.C.C. or A.C. pavement.



3.3 PASSENGER AMENITIES WARRANTS

A sheltered, paved waiting area outside the flow of pedestrian traffic and secure from automobile traffic is important to the transit patron. The goal is to provide this protection at all bus stops to encourage transit ridership. However, since resources are limited, a system to set priorities for bus stop improvements is needed. **Table 7** shows one way of establishing priorities for placement of bus stop amenities. It is recognized that the limiting of criteria and ordering of priorities are artificial boundaries, however it is an attempt to bring order to the selection process.

Table 7 Bus Stop Amenities Warrants Sample	
Bus stops that accumulate 10 points or more may be considered for shelter placement: 6 points or more may warrant a bench and trash receptacle.	
<ul style="list-style-type: none"> • 7 points 	High boarding count or transfer location - Number of patrons getting on the bus at this stop exceeds 20 people per day. (Variations can include 3 points for 10 people per day, 10 points for 100 people per day, 15 points for 200 people per day)
<ul style="list-style-type: none"> • 4 points 	Special needs – Includes small facilities or people with special requirements for shelter that might not qualify for attention based on boarding counts (senior citizen centers, medical offices, libraries, persons with certain disabilities, etc.)
<ul style="list-style-type: none"> • 4 points 	Activity Location - Locations with high density of people and thus high potential for ridership (apartments, high rise office building, shopping center, schools, hospitals.)
<ul style="list-style-type: none"> • 3 points 	Exposure to elements – Locations with no landscape or buildings to offer shade/rain protection, no seat walls, no area to stand outside of sidewalk, and 2-3 lanes of traffic of 40 mph or more, giving patron no feeling of security at stop.
<ul style="list-style-type: none"> • 2 points 	Long waiting time for bus – stops at which patrons wait 30 minutes or more between buses.
<ul style="list-style-type: none"> • 1 point 	Request for improvement – Citizen requests improvements at stop.
Note: The warrants serve to direct an agency's limited resources when not every location can be improved. Ideally, every bus stop should have at least one bench and/or shelter, and a trash receptacle. Due to the lack of room at most bus stops, no more than two (2) pieces of furniture should be placed at each stop.	

If a bus stop meets the amenities criteria it may be considered for a shelter or bench and trash receptacle placement by the local agency. Meeting these criteria does not guarantee shelter installation. Existing site conditions and pedestrian infrastructure, public right-of-way availability, accessibility and safety issues, and other concerns must be reviewed and addressed before future shelter or bench placements are confirmed. OCTA does not own, install, or maintain benches or shelters so the decision to place street furniture lies solely with the local jurisdiction. Before a shelter, bench, or trash receptacle is placed, it is recommended that the local agency provide OCTA with site plans. This will give the Authority an opportunity to review all proposed amenities placement to ensure ADA clearance and/or operational requirements are maintained. This will avoid costly relocations if the amenities are not placed per the criteria suggested in these guidelines.

3.4 BENCH AND TRASH RECEPTACLE DESIGN AND PLACEMENT

The following are criteria for providing passenger benches and trash receptacles at bus stops:

- Benches should be placed facing the street.
- Design and colors should respond to architectural character of street furniture and adjacent development in the area.
- Artistic and aesthetic elements may be incorporated into the street furniture design as part of a streetscape effort to enhance the urban environment.
- Trash receptacles should be designed compatible with other bus stop components and with removable plastic liner with a 35 gallon minimum capacity.

- Avoid installing trash receptacles with design features that permit liquids to pool or remain near the receptacle and attract insects.
- If possible, install trash receptacles in shaded areas a minimum of 3 feet from a bench. When installed in areas that receive direct sunlight most of the day, the heat may cause foul odors to develop.
- Both benches and trash receptacles should be anchored to prevent unauthorized movement.



Photo 10: Typical bench and trash receptacle layout.

- Construct furniture for easy relocation to allow for bus route changes, street improvement projects, etc.
- Materials, coatings, and surfaces should be graffiti resistant. Furniture should be readily replaceable.
- Benches should be placed on the back side of sidewalk a minimum of six to nine feet from the bus sign post, to allow pedestrians to move past people sitting on the bench. In addition, local jurisdictions may have special standards for physical clearance which must be satisfied.
- Seating areas should be well shaded, if possible, either using shade trees preferably planted at the back of the sidewalk, or existing buildings.

Photo 10 shows a typical bench and trash receptacle layout. Install trash receptacles at bus stops when:

- There is a request for placement of a receptacle;
- There is evidence of a litter problem at the bus stop;

- A sponsor (such as a business or community group, or local jurisdiction) steps forward to take maintenance responsibility, and;
- The receptacle can be located within close proximity to the bus stop.

The Authority relies on the private sector and local jurisdictions to provide benches and, in some cases, trash receptacles. Developers and local jurisdictions may design a special style of bench to fit into the landscape and complement the architectural style of their project or streetscape. They can also contact private bench advertising companies which will provide benches for free. **Figures 25, 25A, and 25B** show typical bench and trash receptacle placements in relation to the passenger boarding area. Placement of benches and receptacles must maintain proper clearances for passage and wheelchair boarding areas.

While bench designs vary among manufacturers, some standards do exist. Benches usually seat three (3) to four (4) people and may have an upright back support. Some bench designs come with a D metal bar in the center of the bench to discourage sleeping on the bench for a prolonged period of time. **Figure 26** illustrates a “park” style bench with a back support.

3.5 SHELTER DESIGN

Passenger shelters are provided to enhance the safety, security and comfort of transit patrons. Shelters can be provided in many ways and can take almost any form or appearance since local agencies typically select and install their own shelters. Most often, passenger shelters are free

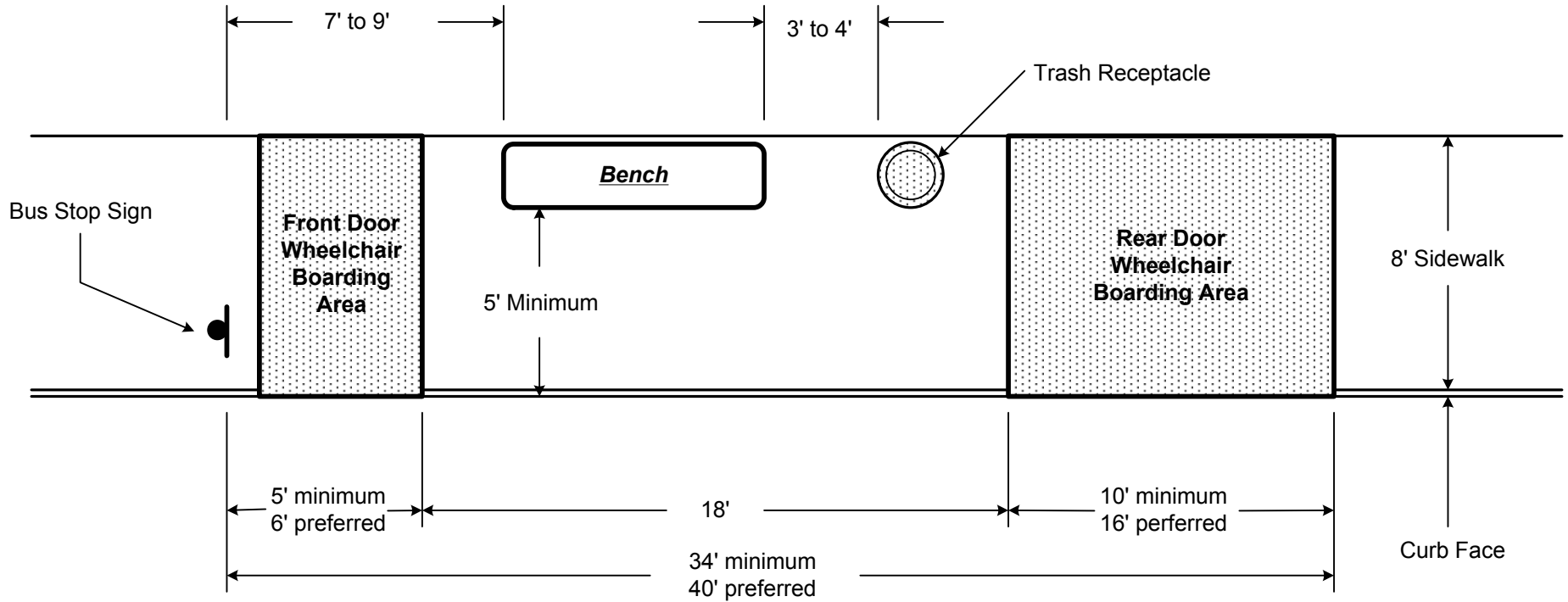


Photo 11: Bus stop with shelter.

standing structures (see Photo 9), but sometimes they are incorporated into adjacent buildings.

The guidelines presented in this section are most applicable to free standing structures. When considering the placement of passenger shelters, each jurisdiction should evaluate the following:

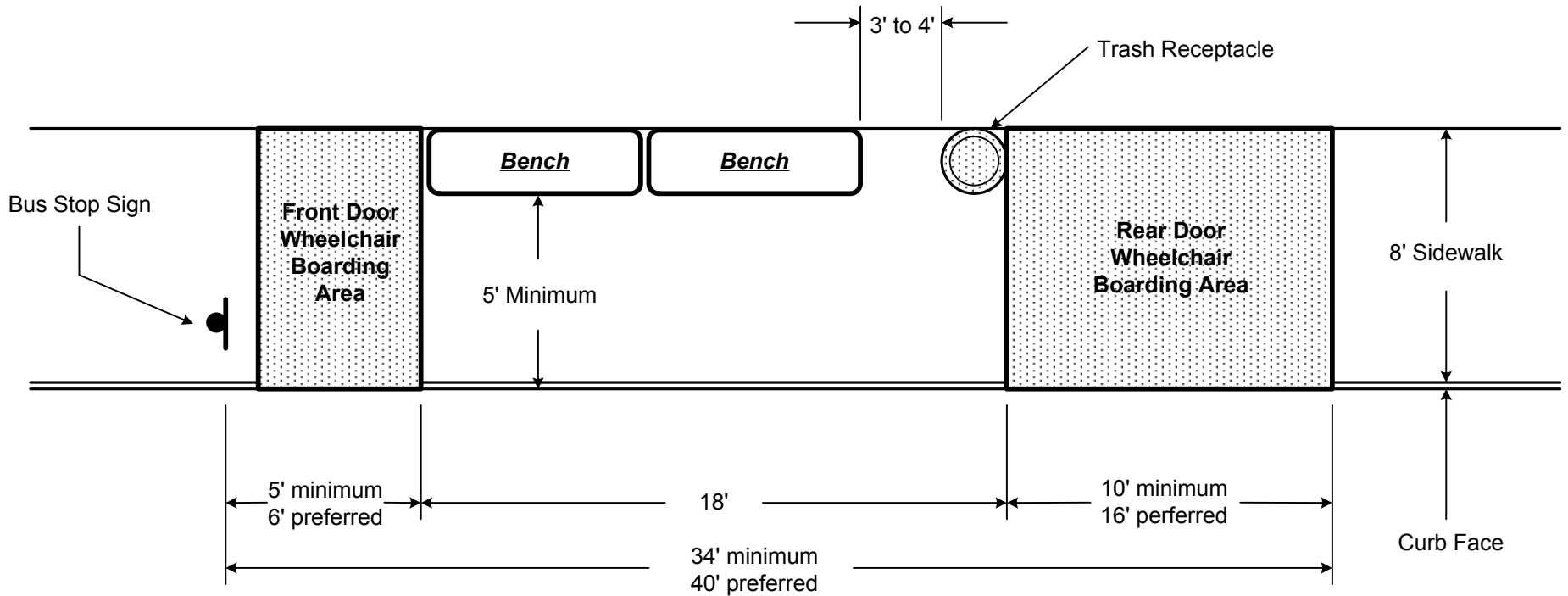
- Type and intensity of adjacent land uses.
 - Sidewalk condition at the bus stop and access to and from the stop.
-
- Location of doors/wheelchair lifts on OCTA buses.
 - Visibility of the shelter and visibility impacts of the shelter. Ensuring shelter is located where it will not impede sight lines from nearby streets and driveways.
 - Location of other street furniture, avoiding crowding of street furniture and ensuring ample waiting space around shelter.
 - Ensure location has appropriate drainage and water does not pool near shelter.



NOTE:

- 1) The bench should be placed between 7' to 9' from the bus stop sign, on the back side of the sidewalk. Two benches can be placed as long as they do not obstruct the front and rear wheelchair boarding areas.
- 2) Both front door and rear door wheelchair boarding areas need to be free of **all** above ground obstacles. This includes street furniture (benches/shelters), trash receptacles, treewells, utility poles, light standards, mail boxes, miscellaneous signs, newsracks, etc.
- 3) Trash receptacles can be placed on either side of the bench, but should be placed at least 3' - 4' from the bench.

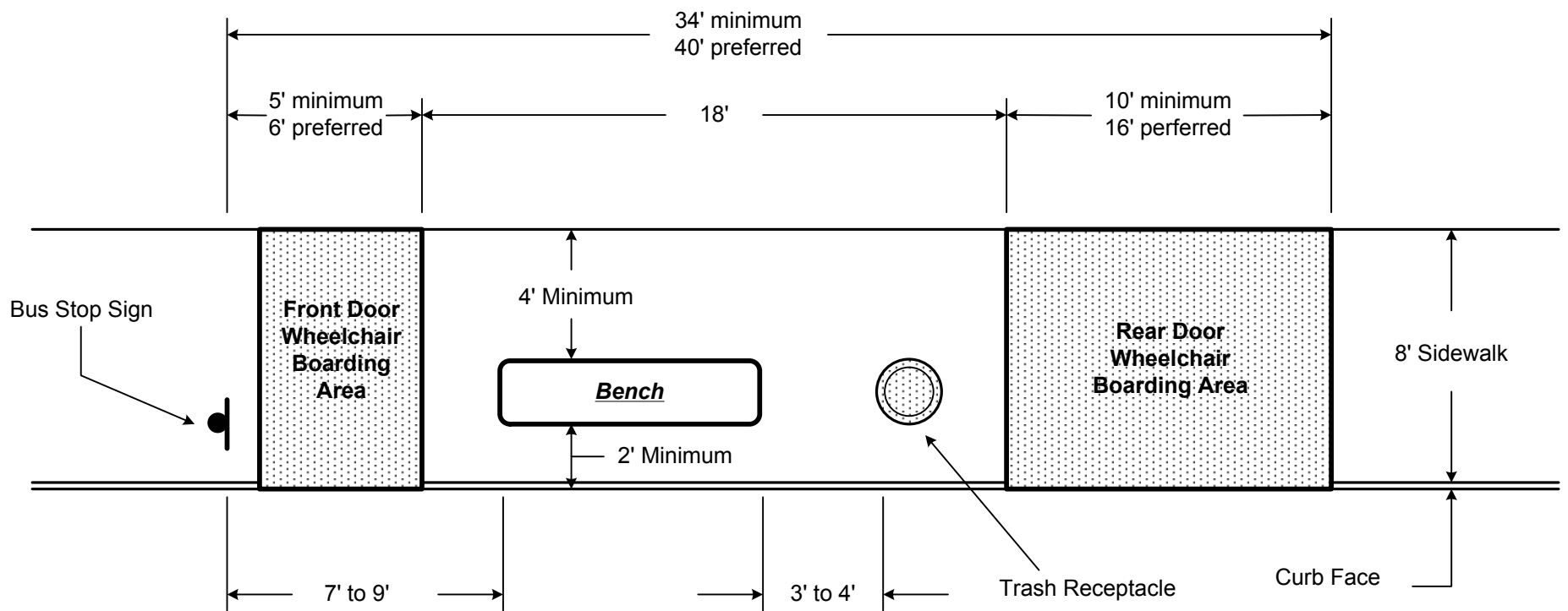




NOTE:

- 1) Two benches can be placed as long as they do not obstruct the front and rear wheelchair boarding areas.
- 2) Both front door and rear door wheelchair boarding areas need to be free of **all** above ground obstacles. This includes street furniture (benches/shelters), trash receptacles, treewells, utility poles, light standards, mail boxes, miscellaneous signs, newsracks, etc.
- 3) Trash receptacles can be placed on either side of the bench, but should be placed at least 3' to 4' from the bench.

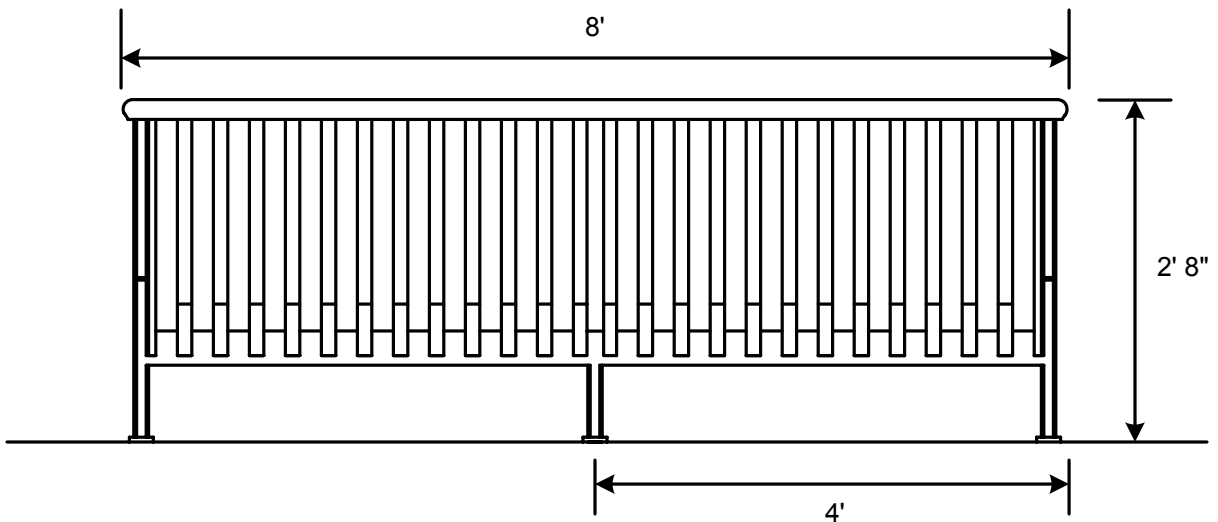




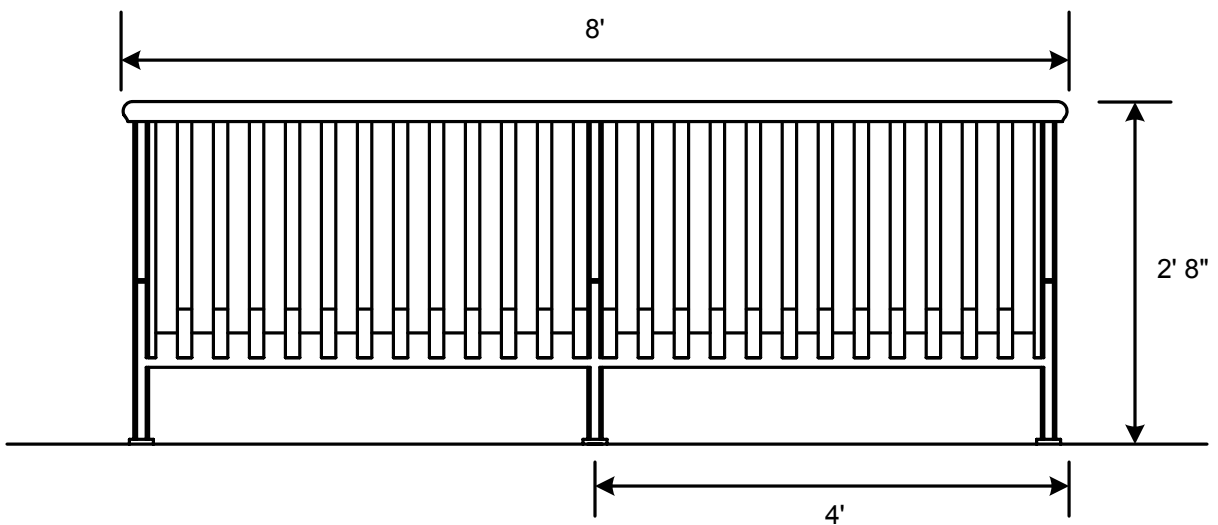
NOTE:

- 1) The bench should be placed between 7' to 9' from the bus stop sign, and a minimum of 2' back from the curb face. Two benches can be placed as long as they do not obstruct the front and rear wheelchair boarding areas.
- 2) Both front door and rear door wheelchair boarding areas need to be free of **all** above ground obstacles. This includes street furniture (benches/shelters), trash receptacles, treewells, utility poles, light standards, mail boxes, miscellaneous signs, newsracks, etc.
- 3) Trash receptacles can be placed on either side of the bench, but should be placed at least 3' to 4' from the bench.

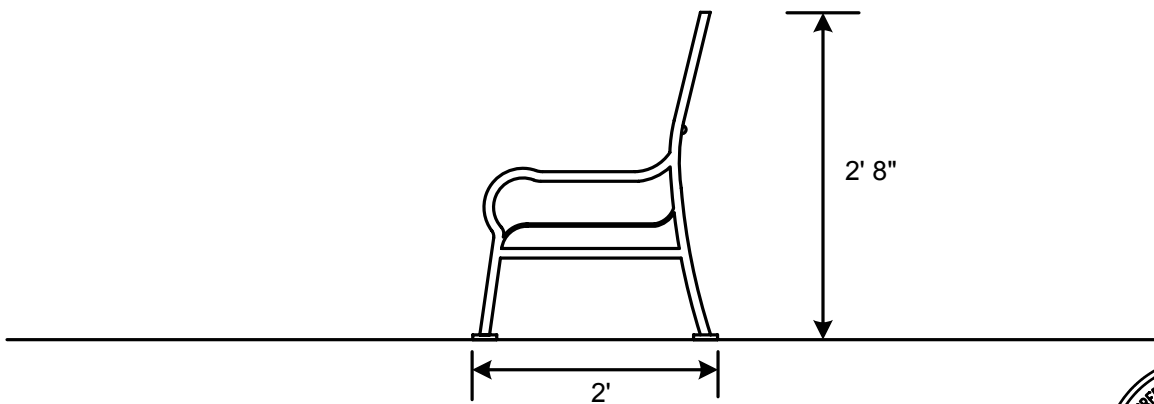




FRONT VIEW - BENCH WITHOUT CENTER ARM



FRONT VIEW - BENCH WITH CENTER ARM



SIDE VIEW



- The availability of electrical service.
- The availability of necessary right-of-way and/or the ability of adjacent property owner to dedicate the necessary right-of-way.
- Accessibility for elderly and mobility impaired persons (See Chapter 7 for ADA requirements).

The following design and placement criteria will assist local agencies after it has been determined a shelter will be placed at an existing bus stop:

- All requirements under "General Site Design" (see below) and "Bench and Trash Receptacle Design" should be met.
- Minimum overhead canopy of 72 square feet with a minimum width of 6 feet is desired.
- Minimum 7.5 feet clearance between underside of roof and sidewalk surface is desired.
- Minimum two feet clearance between overhead canopy and curb face is required.



Photo 12: Multiple shelter bus stop.

- Shelter canopy should be waterproof with provisions for drainage away from waiting passengers and boarding area.
- Shelter should have owner's name and 24-hour telephone number displayed for emergency purposes.
- Seating for at least four people located under the shelter canopy is desired.
- A minimum space of 36 inches by 48 inches of clear floor space for people in wheelchairs is required within the shelter per ADA regulations.
- For passenger comfort and convenience, a minimum lighting level of two footcandles is required throughout the shelter.
- Accessories to be added to the transit shelter and passenger boarding area (such as telephone, water fountain, additional information panels, etc.) are a decision for the individual agency responsible for the shelter. Each item can be weighed to balance the concerns for greater passenger comfort and convenience versus concerns for security, maintenance and cost.
- The shelter should be located in reasonably close proximity to where the front door of the bus will open to facilitate timely passenger loading.



Photo 13: Typical shelter design on narrow sidewalk.

- Shelter screens should keep a minimum 6 inches vertical clearance from sidewalk to avoid collection of trash and debris.
- The back of the shelter should be located at least 12 inches from a building face, wall, or other broad vertical surfaces to facilitate trash removal and panel cleaning.
- Shelters should not be placed between a regularly used building exit and the curb so that pedestrians retain direct access to the street from the building.

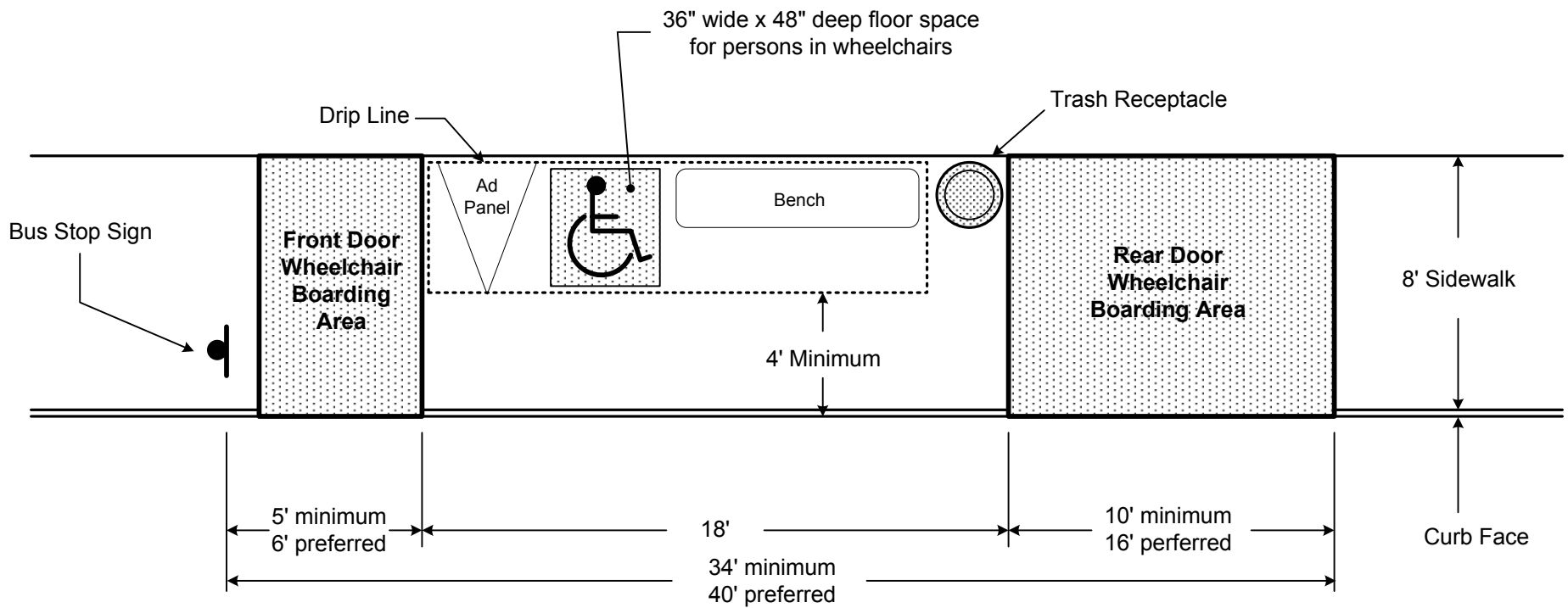
- Whenever possible, do not place shelters in front of building windows used for commercial purposes (e.g. advertising, display, business names, etc.).
- Shelters should be located to avoid exposing persons to splashing water from passing vehicles and runoff from adjacent buildings and landscaping.
- Shelters should be located so that their orientation provides as much protection as possible from wind and rain, and with consideration of the sun's angles to allow maximum shade during peak use in the morning and afternoon.

Photo 12 shows illustrates the layout of a multiple shelter bus stop, while Photo 13 shows how a shelter can be installed on a narrow sidewalk. See **Figures 27, 27A and 27B** for typical placement of a shelter at a bus stop under various shelter and bench configurations, and **Figure 28** for a typical passenger shelter design.

3.6 GENERAL SITE DESIGN

Every bus stop should include the following minimum elements for passenger safety and comfort:

- A farside bus stop sign should be located between 80 feet and 100 feet from point of tangency of the intersection. A nearside bus stop sign should have a minimum clearance of 40 feet from point of tangency of the intersection. The greater the distance between the bus stop and the intersection crossing, the greater the possibility of jay-walking.

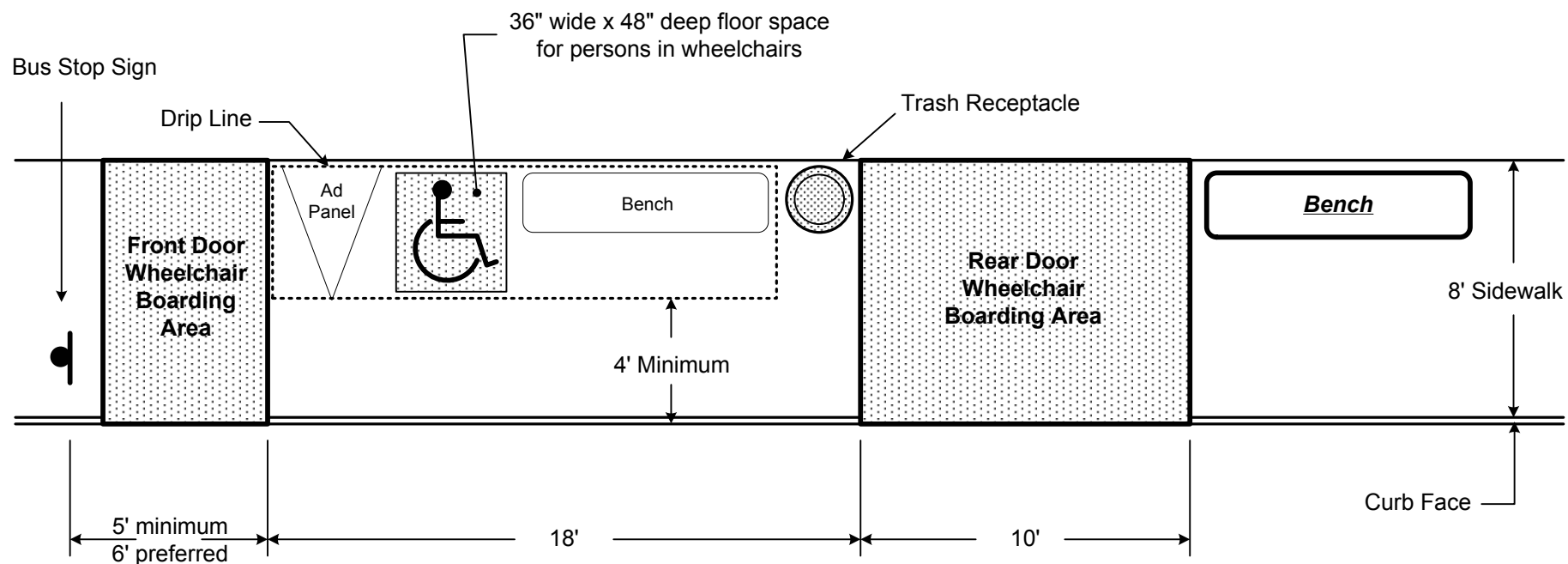


NOTE:

- 1) The shelter should be placed between the front and rear wheelchair boarding areas, 6' to 24' from the bus stop sign.
- 2) The shelter should be placed on the back side of the sidewalk, with a minimum clearance of 4' between the shelter and the curb face.
- 3) Both front door and rear door wheelchair boarding areas need to be free of **all** above ground obstacles. This includes street furniture (benches/shelters), trash receptacles, treewells, utility poles, light standards, mail boxes, miscellaneous signs, newsracks, etc.



FIGURE 27
TYPICAL SHELTER PLACEMENT - 8 FOOT WIDE SIDEWALK

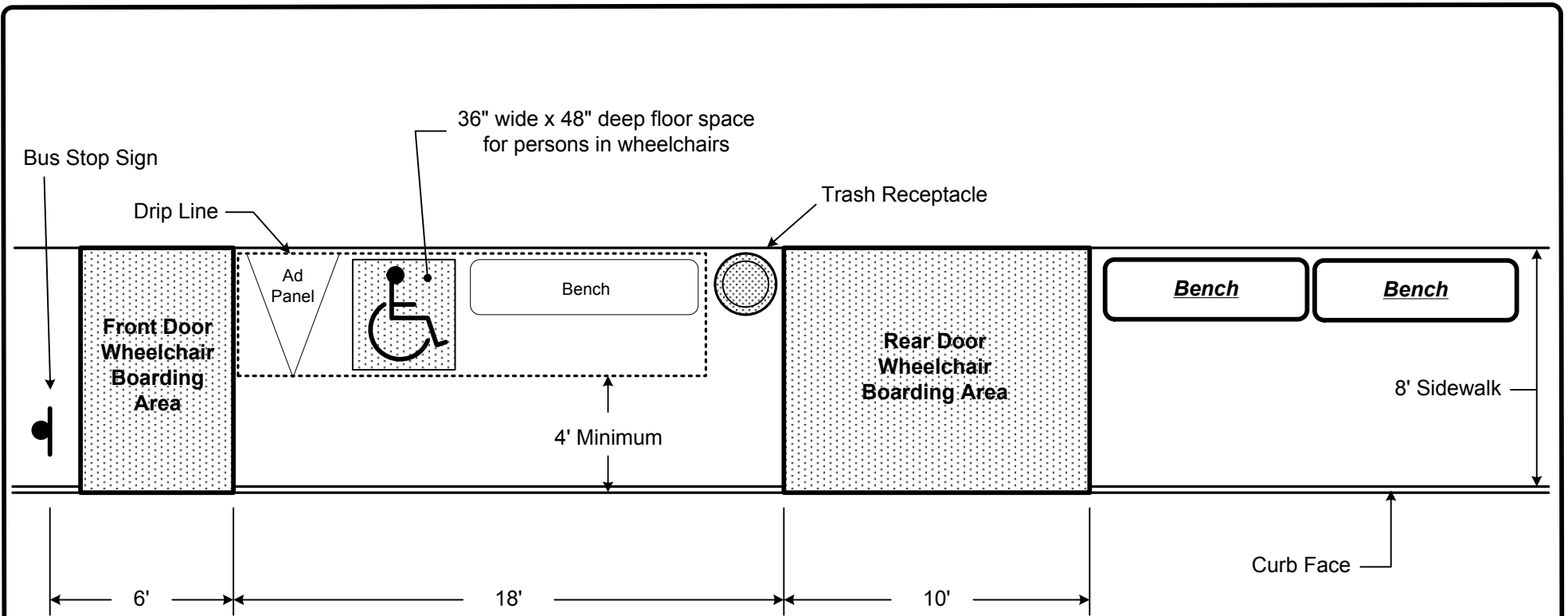


NOTE:

- 1) The shelter should be placed between the front and rear wheelchair boarding areas, 6' to 24' from the bus stop sign.
- 2) The shelter should be placed on the back side of the sidewalk, with a minimum clearance of 4' between the shelter and the curb face.
- 3) If a bench is placed in addition to the shelter, it should be placed on the back side of the sidewalk at least 34' from the bus stop sign.
- 4) Both front door and rear door wheelchair boarding areas need to be free of **all** above ground obstacles. This includes street furniture (benches/shelters), trash receptacles, treewells, utility poles, light standards, mail boxes, miscellaneous signs, newsracks, etc.



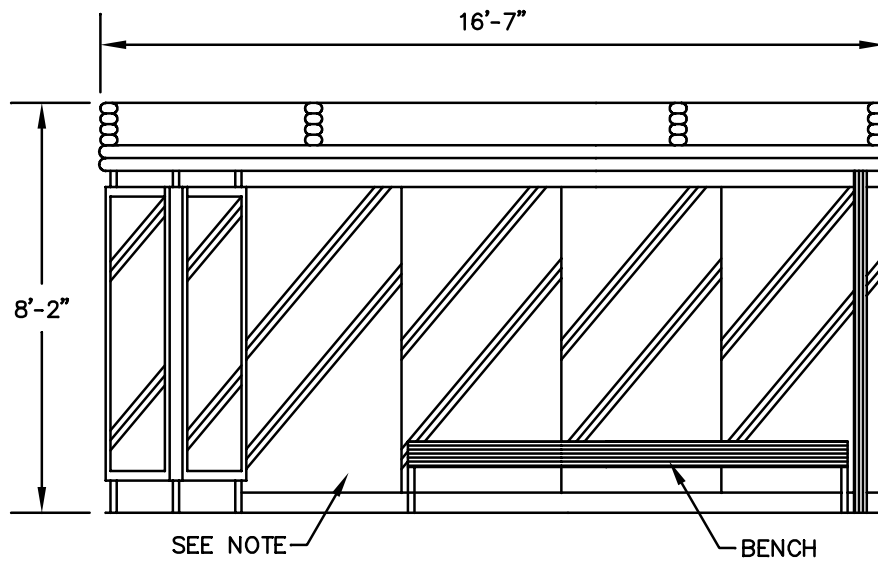
FIGURE 27A
 TYPICAL SHELTER/BENCH PLACEMENT - 8 FOOT WIDE SIDEWALK



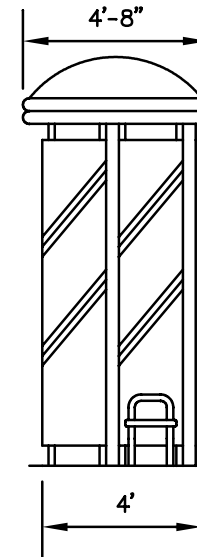
NOTE:

- 1) The shelter should be placed between the front and rear wheelchair boarding areas, 6' to 24' from the bus stop sign.
- 2) The shelter should be placed on the back side of the sidewalk, with a minimum clearance of 4' between the shelter and the curb face.
- 3) If a bench is placed in addition to the shelter, it should be placed on the back side of the sidewalk at least 34' from the bus stop sign.
- 4) Both front door and rear door wheelchair boarding areas need to be free of **all** above ground obstacles. This includes street furniture (benches/shelters), trash receptacles, treewells, utility poles, light standards, mail boxes, miscellaneous signs, newsracks, etc.

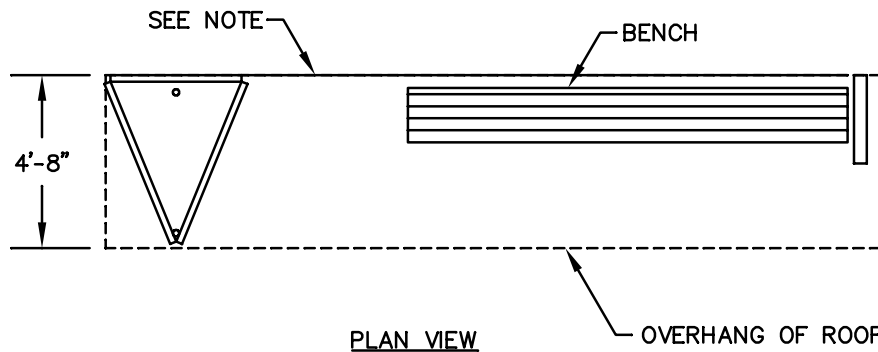




FRONT ELEVATION



RIGHT SIDE ELEVATION



NOTE: LEFT-MOST REAR GLASS PANEL MAY BE REMOVED IF ACCESS FROM THE REAR OF THE SHELTER IS REQUIRED.



- In a separated sidewalk situation (e.g. parkway between curb and sidewalk):
 1. Provide a landing area adjacent to the curb for a minimum distance of 34 feet in length and a minimum of 8 feet in depth (see **Figure 24A**); and
 2. Provide a connecting pathway from sidewalk to landing area (see **Figure 24B**).
- Provide convenient pedestrian pathways/access ways to and from adjacent buildings.
- Locate the bus stop to allow coach operators clear visibility of passengers and to allow passengers a view of the oncoming bus.
- Driveways should be kept at a minimum in and adjacent to the bus stop area.
- Street furniture over 2-1/2 feet high should be located in such a way to provide motorists exiting nearby driveways clear visibility of the street.



Photo 14: Typical shelter and trash receptacle layout.

- Passenger boarding area: Pads must have a smooth broom finished surface to accommodate high heels and wheelchairs and must have high strength capacity to bear the weight of a shelter.
Approved pavers (textured/decorative tiles) can be used in combination with the concrete pad to provide a pleasing aesthetic and architectural balance. Slope of pad should match slope of adjacent sidewalk and allow drainage of pad (2% maximum per ADA regulations).
- Landscaping near the passenger boarding area is encouraged to maximize passenger comfort, but far enough back from curb face as not to interfere with the bus. All landscaping should be carefully located so as not to obstruct the shelter canopy or obscure sight lines at the stop. Shade trees are desirable and the preferred location is at back of sidewalk.
- All street furniture should maintain a minimum of 48 inches of horizontal clearance wherever possible for access and maintenance between components and switch boxes, mail boxes, etc. Photo 14 illustrates a typical layout of a shelter and other street furniture.
- Maintain minimum 5 feet clearance between components and fire hydrants.
- Locate bus stops where there is a standard curb in good condition. Bus stops are designed with the assumption that the bus is the first step. It is more difficult for the elderly and mobility impaired passengers if the curb is absent or damaged.

- Ensure a minimum clearance distance of 10 feet between a pedestrian crosswalk and the front or rear of a bus at a bus stop.
- Whenever possible, avoid placing a bus stop such that the bus' wheels will cross over a catch basin as it pulls to the curb causing the bus to lurch and possibly throw off passenger balance. Additionally, it could eventually cause excessive settlement of the catch basin's structure.
- In rural or undeveloped areas, avoid placing bus stops adjacent to drainage ditches or uneven slopes. In these areas, every effort should be made to find a flat level area in which to place the stop. If funding is available, a concrete or asphalt passenger pad, up to 8 feet wide and 35 feet in length, should be placed. Curb ramps and a compacted and stabilized decomposed granite, asphalt, or concrete pathway to the nearest intersection or development should also be considered. If possible, construct an appropriate platform over drainage ditches to serve as a waiting area (see Section 2.12 on rural bus stops).
- Whenever possible, a bus stop should not be located adjacent to a long term construction zone. The local jurisdiction should ensure that a proper platform and access way is maintained or be required to move the bus stop temporarily to a nearby location that allows safe boarding and deboarding (see Chapter 5 for construction zone guidelines).

Passenger Security

Pedestrian security is one of the primary issues associated with the design of bus stops. Personal security is consistently mentioned in transit studies as a major concern among transit users. The following guidelines should be considered to improve passenger security:

- Place bus stop in locations providing between two to five footcandles of illumination within the bus stop area. If street lighting does not exist, solar lighting could be considered to enhance security at night.
- If possible, ensure adjacent shrubbery is trimmed low and thinned so passengers can view over and behind hedges. Consider using plants that are open and do not form solid hedges of vegetation.
- Ensure clear visibility of, through, and around the bus stop for both passenger surveillance of environment and for police surveillance. Provide adequate lines of sight as passengers and police approach the bus stop.
- If possible, ensure that the pedestrian circulation routes through bus stops and waiting areas are not blocked from view by walls or other structures.
- In placing bus stops avoid nearby edges and corners of walls that create blind spots.
- If possible, avoid design features that degrade access and security including sound-walls or similar structures that isolate passengers from surrounding neighborhoods. In general, there is no reason to locate bus stops adjacent to sound walls or tall fences, as these locations preclude direct access from adjacent land uses. If unavoidable, provide a pedestrian access-way through the wall.

- If possible, provide a public telephone, or place bus stop in view of a public telephone. Consider installation of emergency call boxes at isolated locations.
- Provide secure bicycle parking and ensure proper clearances are maintained when bikes are parked.
- If possible, provide multiple exits for bus shelters.
- Remove all evidence of vandalism and regularly repair and maintain benches and shelters to provide passengers a sense of security.

3.7 DEVELOPER RESPONSIBILITIES

When a development is constructed adjacent to an existing or proposed bus stop location, the developer should be responsible for providing amenities as described in Section 3.4, "General Site Design." Developers are encouraged to place shelters that conform to local standards for passenger recognition and ease of maintenance. Local cities may elect to submit a copy of all street improvement or re-development plans to the Authority to ensure proper placement of transit amenities (turnouts, bus pad, etc.).

3.8 BUS STOP MAINTENANCE

Well maintained bus stops are crucial to the image of the transit system. Damaged street furniture and trash build-up should be tended to immediately to create a positive impression for transit patrons and the general public.

OCTA does not own nor maintain shelters or benches systemwide. The owners of the street furniture have the obligation to maintain their furniture, and the political jurisdiction should be responsible for monitoring these items for compliance. Maintenance frequency of not less than once per week should include:

- Full wash down of shelter and accessories.
- Removal of all dirt, graffiti, and pasted material.
- Wipe down of glass surfaces.
- Removal and replacement of trash bags.
- Litter pick up around stop or shelter/accessories to a distance of 10 feet.
- Manual or chemical removal of weeds.
- Pruning of obstructing foliage.
- Touch up of marred paint.
- Verify shelter lighting levels and replace bad bulbs and ballasts.

Repair of items that pose a safety problem should be performed promptly or at least within 24 hours of notification. Repairs that do not pose safety problems should be completed within three (3) days.

3.9 BUS STOP LIGHTING DESIGN

Lighting affects transit patron's sense of security and safety at bus stops as well as on routes to bus stops. Good lighting can enhance a passenger's comfort and security. Poor lighting can encourage unintended use of the facility by non-patrons as well as criminal activity. Illumination standards are often a policy of the local jurisdiction that installs and maintains street lighting, but OCTA recommends lighting which provides between 2 and 5 footcandles at bus stops.

Availability of power is a key factor in providing bus stop illumination. Direct lighting, while ideal, is often difficult to implement at remote locations. If installing direct pedestrian-scaled lighting at bus stops, the fixtures should be vandal proof but easily maintained. For example, avoid using exposed bulbs or elements that can be easily tampered with or destroyed.

A cost-effective approach to providing indirect lighting is to locate bus stops near existing street lights. When locating bus shelters and benches near existing street lights, ensure the minimum clearances discussed elsewhere in this manual are met and that a minimum of two footcandles of light reaches inside the shelter if the location of the light standard meets the OCTA stop placement standards.

3.10 BICYCLE PARKING

Bicycle parking facilities, such as securement devices (bike racks and storage lockers), may be provided at bus stops by local jurisdictions or adjacent property owners for the convenience of bicyclists using transit.

Bicycle parking facilities discourage the practice of locking bicycles onto bus facilities or onto adjacent property. By confining bicycles to one area, securement devices can reduce visual clutter and maintain appropriate pedestrian clearances. Below are guidelines for the placement of bicycle parking facilities.

- Locate securement devices or bicycle lockers away from other pedestrian or bus patron activities to improve safety and reduce congestion.
- Coordinate the location of bicycle parking facilities with existing on-site or street lighting.
- Ensure parked bikes are visible at all times. Do not locate bicycle parking where views are restricted by a bus shelter, landscaping, or existing site elements, such as walls.
- Design and placement of bicycle parking facilities should complement other transit furniture at bus stop.
- Covered or weather protected parking locations is an important bonus to bicyclists.

When selecting bicycle securement devices, consider the following:

- Provide ability to lock bicycle frame and at least one wheel.
- Support bicycle without pinching or bending the wheel. If the wheel slot is too narrow, a mountain bike tire will not fit.
- Avoid scratching the paint on the frame of the bike.

- Provide a place to lean the bike while locking the bike.
- Locking procedure should be quick and easy to identify.
- Require minimal space.
- Design of securement device should not trap debris.
- Device should be easy to install but difficult to steal.

CHAPTER 4

CONSTRUCTION IMPACTS TO BUS OPERATIONS

Public Works and private development construction activities often impact bus operations and bus stops. Construction impacts caused by private development can be avoided through stipulations applied to the development. The following information attempts to reduce construction conflicts, provide information for the contractor, and guide local agency staff coordinating both design and construction work with the private development community. OCTA considers construction coordination a local function, but is available to provide assistance if necessary.

There are two predominant mechanisms for communicating transit needs to construction contractors. The first available and commonly used mechanisms are standard plans and specifications. They usually contain language requiring contractors to maintain access and signage, etc. Notes on the construction plans provide the second and often the most followed instructions to contractors and construction inspectors.

The **Goal:** Provide safe access to and from the bus stop for both passengers and buses.

Typical standard plans and specifications may include the following notes:

- A minimum four (4) feet wide walkway shall be provided to maintain passenger access to and from bus stops during construction.
- Temporary access to bus stop zones during construction shall be approved by OCTA in advance of construction activities.
- The contractor shall notify OCTA at least 14 days in advance for all street closures affecting transit operations regardless of the duration of the closure. This will allow OCTA sufficient time to plan detours and notify the general public.
- The contractor shall work with OCTA to establish an approved temporary bus stop location.
- OCTA will provide and post the appropriate temporary bus sign signage.
- The contractor shall notify OCTA at least 14 days in advance of construction completion so that permanent bus stop signs can be re-installed by OCTA.

Recommended construction plan notes include:

- Contact OCTA for coordination and review requirements.
- Contractor may not remove any bus stop signs without prior authorization from OCTA.
- All work shall conform to the requirements of the Americans with Disabilities Act (ADA) including provisions for temporary access to and from bus stops.
- Temporary access to bus stop zones during construction shall be approved by OCTA at least 14 days in advance of construction activities.

- The contractor is responsible for all costs incurred for loss or damage to bus stop signs and hardware and street furniture. Project acceptance will be delayed at the request of the local agency for any damaged street furniture or non-payment of costs.
- Temporary removal of street furniture to avoid damage and conflict during construction requires a 30 day advance notice to both the city and the owner of the street furniture.
- The contractor is responsible for construction of the passenger boarding pad on which street furniture will be placed. The pad must be designed and located in conformance with local agency standard details. Any necessary deviations from standard details require the written approval of the local agency.
- The contractor shall receive approval from the local agency for the location of street furniture placement prior to construction of the passenger boarding area.
- Prior to final acceptance or release of certificate of occupancy, the local agency must be notified to inspect and approve all bus stop related improvements.
- A minimum of 48 hours advance notice to local agency and OCTA for final inspections is required.

In addition, the construction plans need to show existing and proposed bus stop locations. The following special provisions may be included in the permitting process, the inspection process, pre-construction conferences, or wherever it is most appropriate:

- Contractor shall provide OCTA with the name and telephone number of the contractor's construction manager prior to the commencement of all construction projects involving bus stops or bus route detours.
- Contractors shall make every effort to schedule their work to minimize impacts and the duration of impacts to transit operations and the general public.
- The contractor is responsible for the construction of the passenger boarding area.
- A representative of OCTA should be invited to the project's pre-construction conference.

Contact: OCTA Detour Coordinator
550 South Main Street
P.O. Box 14184
Orange, CA 92613-1584
Ph. No. 714/265.4331
Fax No. 714/265.4317

CHAPTER 5

STREET PRIORITY TREATMENTS

5.1 TYPES OF TRANSIT PRIORITY MEASURES

There are several concepts and technologies widely used today to improve bus service and reduce travel time. Collectively these measures are part of what makes a Bus Rapid Transit (BRT) system. Transit priority measures seek to improve bus service by reducing travel time. The components of travel time include getting to and from bus stops, time waiting for the bus to arrive, and the time spent traveling on the bus. Additional time is required if a transfer is necessary. Transit priority measures primarily seek to reduce the in-vehicle component of travel time by giving buses priority over other types of vehicles on streets. These measures include reserved bus lanes and priority treatment for buses at traffic signals. The planning and implementation of bus priority measures works best in urban areas with a high concentration of bus services, high levels of traffic congestion, and good community support for transit service. To be successful, transit priority measures must be coordinated with the local jurisdictions responsible for traffic control and roadway planning and operations.

Transit priority measures should effectively:

- Alleviate existing bus service deficiencies,
- Achieve attractive and reliable bus service,
- Serve demonstrated existing demands for transit,
- Provide reserve capacity for future growth in bus trips, and
- Attract auto drivers to transit.

The following sections generally describe some of the transit priority measures either in use in Orange County today, or that may be implemented in the future.

5.2 QUEUE JUMPERS

Queue jumpers provide priority treatment for buses along arterial streets by allowing buses to bypass traffic queued at congested intersections. Queue jumpers evolved from the need to solve problems not answered by bus turnouts. In the past, traffic engineers constructed bus turnouts to move buses out of the traffic stream while they are stopped for passengers. Unfortunately, bus turnouts introduce significant travel time penalties to bus patrons because buses are delayed while attempting to reenter the traffic stream. Queue jumpers are able to provide the double benefit of removing stopped buses from the traffic stream to benefit the general traffic and getting buses through congested intersections so as to benefit bus operations.

Queue jumpers consist of nearside right turn lane and farside bus stop and/or acceleration lane. Buses are allowed to use the right turn lane to bypass traffic congestion and proceed through the intersection. Additional enhancements to queue jumpers could include an exclusive bus only lane upstream from the traffic signal, an extension of the right turn lane to bypass traffic queued at the intersection, or an advanced green indication allowing the bus to pass through the

intersection before general traffic does. Several options for queue jumpers are illustrated in **Figures 29 and 30**.

A. Queue Jumper with Acceleration Lane

This option includes a nearside right turn lane (buses excepted), a nearside bus stop, and an acceleration lane for buses with a taper back to the general purpose lanes (**Figure 29**). The length of the acceleration lane is based on speed and should be designed by an experienced engineer.

B. Queue Jumper with Farside Bus Stop

This option may be used when there is a heavy directional transfer to an intersecting transit route. Buses can bypass queues either using a right turn lane (buses excepted) or an exclusive bus queue-jump lane. Since the bus stop is located farside, a standard transition can be used for buses to re-enter the traffic lane (**Figure 30**).

C. Queue Jumper with Continuous Bus Lane

This option includes a nearside right turn lane or an exclusive bus queue-jump lane, a farside bus stop and a continuous bus lane extending to the next block or further, depending on bus circulation patterns. Right turns are allowable by general traffic from the bus lane (**Figure 30**).

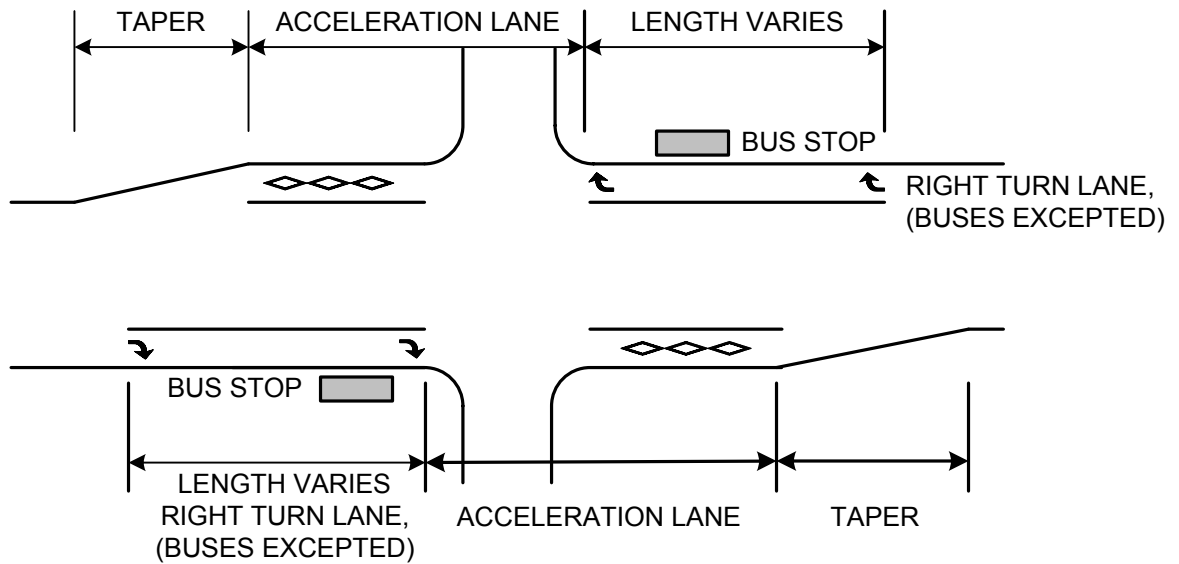
Queue jumpers at arterial street intersections should be considered when:

- High-frequency bus routes have an average headway of 15 minutes or less.
- Forecasted traffic volumes exceed 500 vehicles per hour in the curb lane during the peak hour and right turn volumes exceed 250 vehicles per hour during the peak hour.
- Intersection operates at an unacceptable level of service (defined by local jurisdiction).
- Cost and land acquisition are feasible.

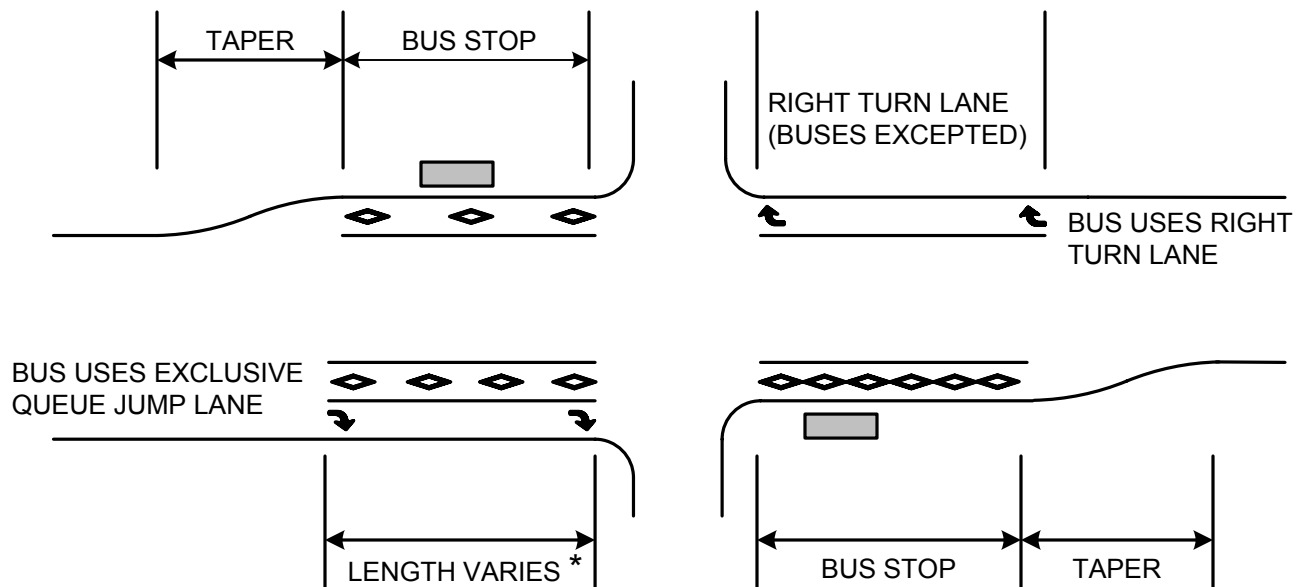
An exclusive nearside bus only lane in addition to the nearside right turn lane should be considered when the right turn volumes exceed 400 vehicles per hour during the peak hour.

Further analysis should be conducted to determine specific warrants for the implementation of queue jumpers. The analysis should consider travel time benefits for bus passengers given varying levels of traffic congestion. A benefit/cost analysis should be included to weigh the justification of purchasing added right-of-way for this bus priority treatment. Updated information will be added to this document as it becomes available.

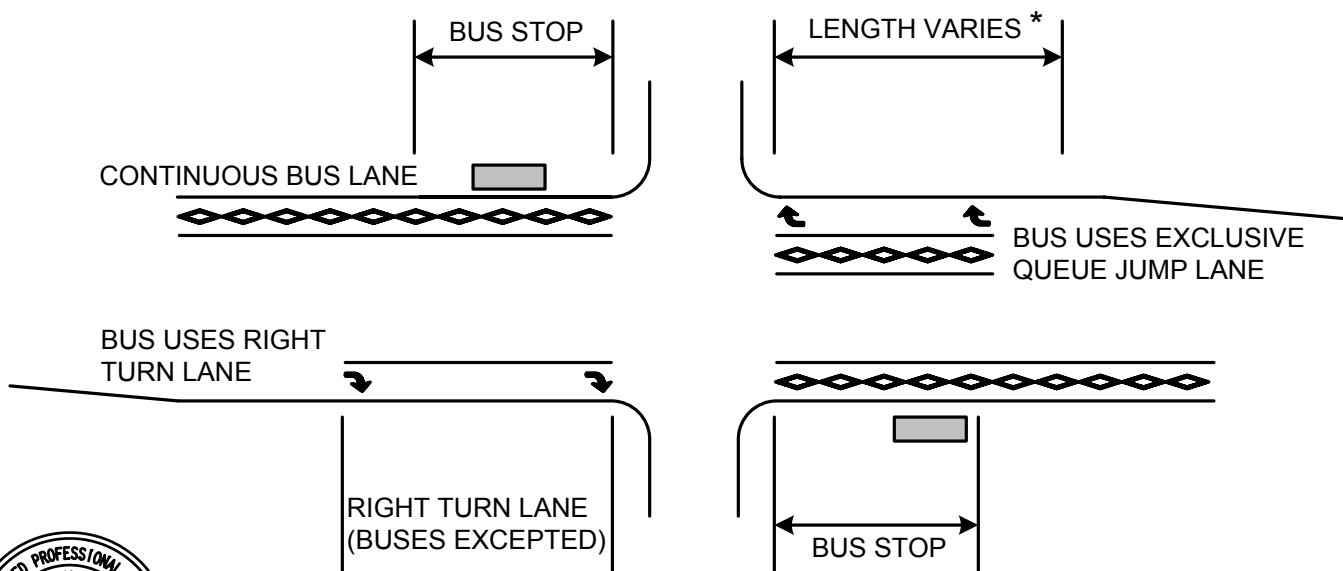
QUEUE JUMPER WITH NEARSIDE BUS STOP AND ACCELERATION LANE



QUEUE JUMPER WITH FARSIDE BUS STOP



QUEUE JUMPER WITH CONTINUOUS BUS LANE AND FARSIDE BUS STOP



* EXTEND QUEUE JUMP LANE AS NECESSARY TO BYPASS TRAFFIC QUEUE



5.3 TRAFFIC SIGNAL PRIORITY

Traffic signal priority measures are designed to eliminate delays in bus service due to excessive waits at intersection signals. There are two general types of systems. In the first, depending on the program algorithm, a bus approaching a downstream traffic signal extends the green light or advances the cycle to green, either through transponders or other electronic communications means, to proceed through the intersection. The bus operator determines when signal priority is needed to maintain the bus schedule. In the second, a bus system equipped with an automatic vehicle location (AVL) system and advanced radio communications gives signal priority control to the operations center, where typically a computerized system determines bus adherence to schedule and automatically triggers traffic signals when needed.

5.4 BUS RAPID TRANSIT

Conventional urban bus operations often are characterized by sluggish vehicles inching their way through congested streets, delayed not only by other vehicles and traffic signals, but also by frequent and time-consuming stops to pickup and discharge passengers. Buses travel on average at only around 60 percent of the speeds of automobiles using the same streets due to the cumulative effects of traffic congestion, traffic signals, and passenger boarding.

Low cost investments in infrastructure, equipment, operational improvements, and technology can provide the foundation for Bus Rapid Transit systems that substantially upgrade bus system performance. Conceived as an integrated, well-defined system, Bus Rapid Transit would provide for significantly faster operating speeds, greater service reliability, and increased convenience, matching the quality of rail transit when implemented in appropriate settings. Improved bus service would give priority treatment to buses on urban roadways and would be expected to include some or all of the following features:

- Bus lanes: a lane on an urban arterial or city street is reserved for the exclusive or near-exclusive use of buses.
- Bus streets and busways: A bus street or transit mall can be created in an urban center by dedicating all lanes of a city street to the exclusive use of buses.
- Bus signal preference and preemption: Preferential treatment of buses at intersections can involve the extension of green time or actuation of the green light at signalized intersections upon detection of an approaching bus. Intersection priority can be particularly helpful when implemented in conjunction with bus lanes or streets, because general-purpose traffic does not intervene between buses and traffic signals.
- Traffic management improvements: Low-cost infrastructure elements that can increase the speed and reliability of bus service include bus turnouts, bus boarding islands, and curb realignments.
- Faster boarding: Conventional on board collection of fares slows the boarding process, particularly when a variety of fares are collected for different destinations and/or classes of passengers. An alternative would be the collection of fares upon entering an enclosed bus station or shelter area prior to bus arrivals. This system would allow passengers to board through all doors of a stopped bus. A self-service or "proof-of-payment" system also would allow for boarding through all doors, but poses significant enforcement challenges. Prepaid "smart" cards providing for

automated fare collection would speed fare transactions, but would require that boarding remain restricted to the front door of the bus. Changes in bus or platform design that could provide for level boarding through the use of low-floor buses, raised platforms, or some combination thereof. This would expedite the boarding/alighting process.

5.5 AUTOMATIC VEHICLE LOCATING SYSTEMS

One of the advanced technologies used in Bus Rapid Transit and in conventional bus operations is Automatic Vehicle Location systems (AVL). These systems track transit vehicles against their designated route schedules. AVL is often integrated with other systems including:

- Automatic vehicle monitoring and control.
- Emergency vehicle locating.
- Fleet management including performance monitoring.
- Data collection.
- Fare collection, and
- Transit signal priority.

AVL can be integrated with a local jurisdiction's central traffic control center and used to dynamically adjust signal timing to maintain route schedules.

5.6 TRAVELER/CUSTOMER INFORMATION

Upon arrival to a bus stop or transit center, passenger orientation and wayfinding is a critical element of the convenience of using the transit system. Minimum information that should be displayed on bus stop signs includes route number, route name, transit agency symbol, and variable information such as operating times. Sign visibility and proper lighting of signs at night is also very important. In addition to basic signs, schedules and maps provide valuable information, particularly to new users. Specific guidance information to provide at bus stops includes:

- Hours of services and routes.
- Schedules/headways and waiting times.
- Locations of terminals, transfer points, and stops with routes served.
- Maps showing transit system and local area.
- Fare schedule.

In addition to basic signs, route maps, and schedules, another technology that OCTA may implement in the future is real time bus arrival information. This information utilizes AVL systems to notify passengers when the next bus will arrive. Real time displays are typically only installed at bus stops with shelters or at transit centers. The primary criteria for implementing this technology is:

- At bus stops with relatively low frequency service.
- At bus stops with a high rate of transfers.
- At bus stops with poor on-time performance or poor headway adherence.

CHAPTER 6

TRANSIT CENTERS AND PARK-AND-RIDE LOTS

Sidewalks, transit stops, and transit amenities are not the only transit-related issues that should be considered in project development. Other facilities such as transit centers and park-and-ride facilities should be considered for larger commercial or industrial developments.

6.1 TRANSIT CENTERS

Transit centers are major bus facilities that are designed to accommodate a variety of transit functions, including passenger loading, unloading, and transferring. In addition, transit centers can serve as park-and-ride lots. Photo 15 shows an OCTA transit center.

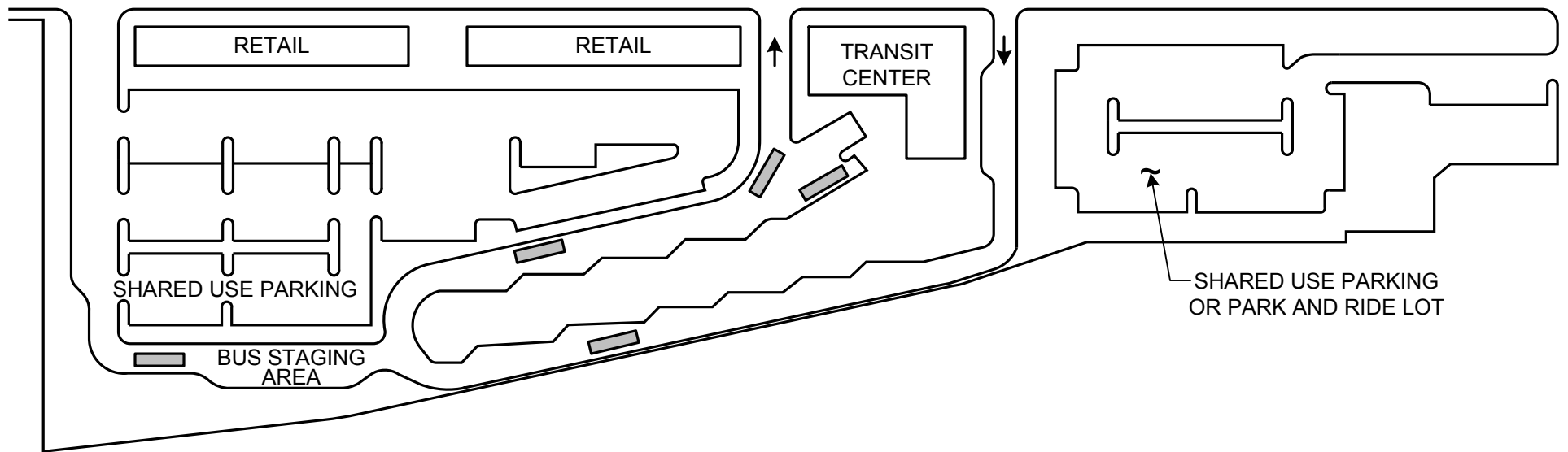
Transit centers are only appropriate for large scale developments such as shopping centers, planned communities and major office or commercial developments. The design of transit centers is based on two variables: The individual characteristics of a location and operation needs. Since transit needs and functions vary from location to location, no universal criteria can be developed. It is recommended, however, that transit centers be located as close as possible to the core of activity centers.



Photo 15: OCTA transit center.

A typical transit center layout is shown on **Figure 31**. Depending on the level of service and demand, transit centers could include enclosed buildings and a variety of amenities such as shelters, benches, bus bays, telephones, restrooms, food services, bicycle parking or bike stations, and trash receptacles. Some transit centers may be combined with retail and service establishments and provide shared parking facilities. When planning and designing transit centers there are six key considerations:

- Location – Where are the buses going to stop within the activity center?
- Identity – How will the transit center location be communicated and how will transit patrons be directed to it?
- Size – How many buses will the center serve, and will bus staging be required?
- Function – What kinds of service will be provided? Will the center serve only destination-oriented service or will the center be a hub for transfers and express services? Will other modes of public transportation use the center (e.g. Metrolink, taxis, shuttles, other agency vehicles).
- Pedestrian connections – How will patrons access the center on safe routes? Pedestrians should be discouraged from crossing bus roadways.



NOT TO SCALE



**ORANGE COUNTY
TRANSPORTATION AUTHORITY**

**FIGURE 31
CONCEPTUAL TRANSIT CENTER LAYOUT
WITH SHARED USE PARKING**

- Vehicle access – How will buses and automobiles, if the center is also a park-and-ride facility, access the center? Can buses and autos be separated? Will vehicle access conflict with pedestrians?

Authority staff is available to discuss a site's suitability for a transit center and to assist in addressing the planning and design issues described above.

6.2 PARK-AND-RIDE LOTS

Two types of park-and-ride programs exist in Orange County: 1) Shared use lot; 2) Permanent lot program. The following is a brief description of each type of park-and-ride program.

Shared Use Park-and-Ride Program

The shared-use program is administered by the California Department of Transportation (Caltrans). The Authority works closely with Caltrans to recruit new participants. Shared-use lots are portions of other parking lots where space has been dedicated for use by commuters.

Caltrans offers a three million dollar liability policy to protect property owners who make a portion of their parking lots available for shared-use park-and-ride facilities. In addition, Caltrans posts signs with the name of the participants to guide commuters to the lots. Caltrans also makes minor improvements to the park-and-ride section of the lot when necessary.

Considering the growing demand for park-and-ride lots and the limited amount of space for constructing new ones, it is recommended that shared-use lots be provided at sites such as shopping centers and planned communities. These parking lots, which are intended for use by residents of the immediate community, help mitigate the traffic impacts of the development and conserve energy resources.

Permanent Park-and-Ride Facility Program

The permanent park-and-ride program is administered by OCTA. The Authority identifies areas where the demand for park-and-ride lots is on the rise and seeks to have new facilities built or dedicated. Often the construction of permanent park-and-ride lots is a cooperative effort involving OCTA, Caltrans, and local government and developers.

6.3 DESIGN & PLACEMENT CRITERIA FOR PARK-AND-RIDE FACILITIES

Park-and-ride lots should be designed according to standard parking lot criteria. Occasionally, it makes sense to provide bus loading and auto drop-off areas at the lot. Depending on demand, covered passenger waiting areas or shelters, benches, bicycle storage facilities, restrooms, and pay phones should be included at park-and-ride lots. Adequate lighting should always be provided to enhance safety.

The actual design of a shared-use facility varies due to existing constraints. Common shared-use park-and-ride applications are shown on **Figures 32 and 33**.

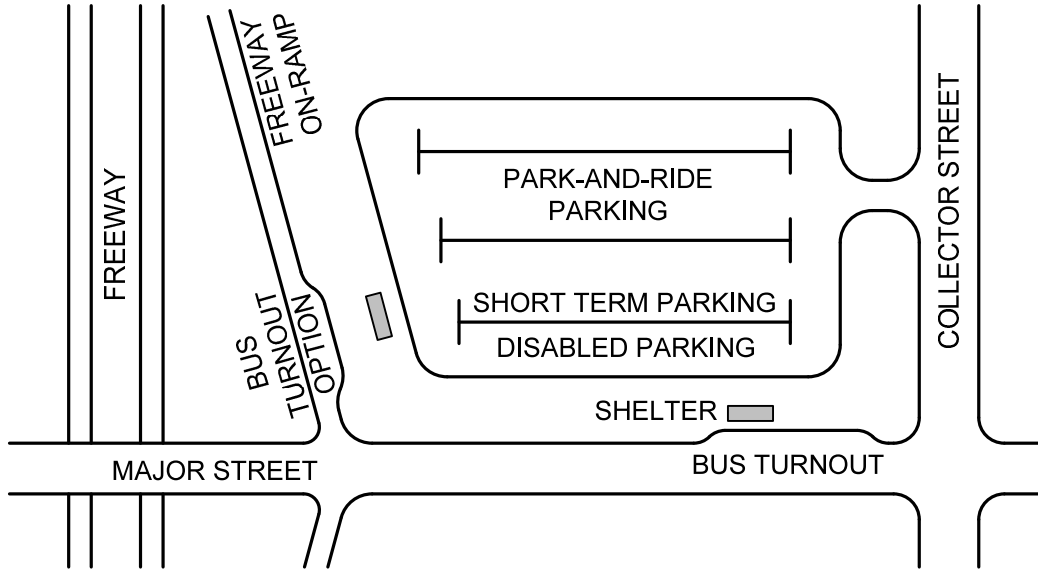
Placement Criteria

The general guidelines for placement of park-and-ride lots are:

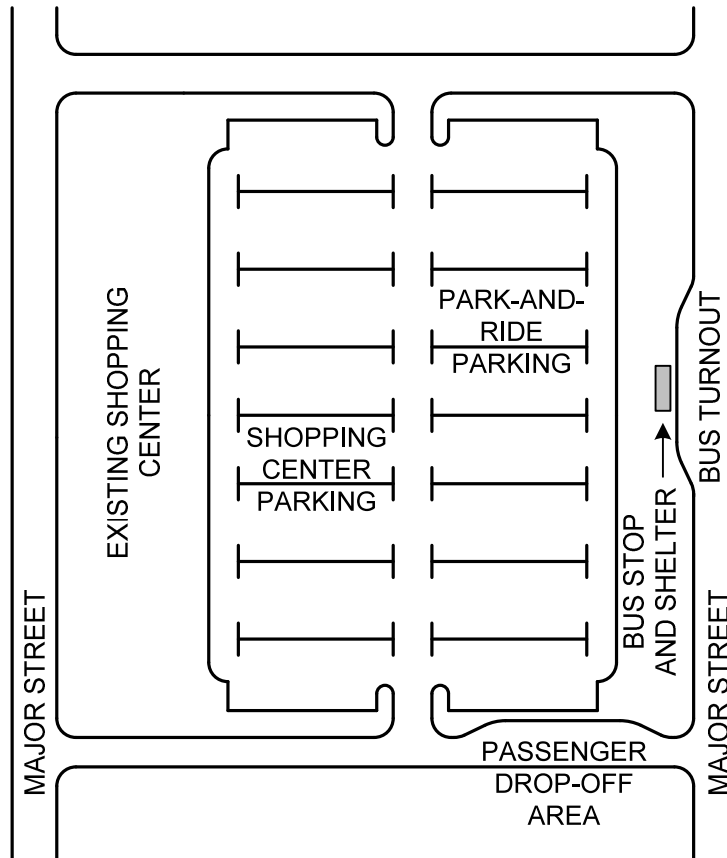
- Accessible to freeways and arterials.
- Close proximity to major traffic generators.

- Near other transportation facilities such as train stations, transportation centers, or other park-and-ride lots.
- Provide at least 25 parking spaces.

For more information on these park-and-ride programs, please contact OCTA at (714) 636-RIDE or 1-800-636-RIDE if you are in South Orange County. For more information regarding the shared-use park-and-ride program, call Caltrans at (714) 724-2240.



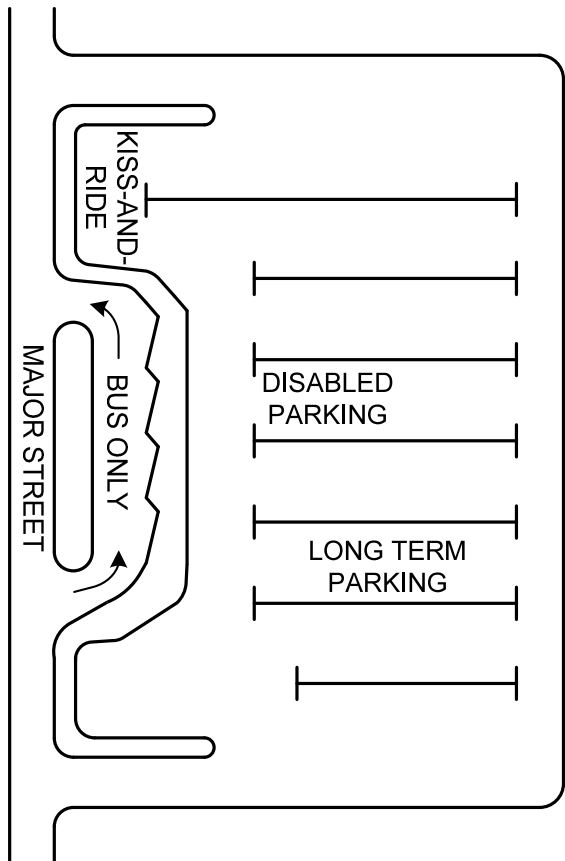
FREEWAY INTERCHANGE AREA



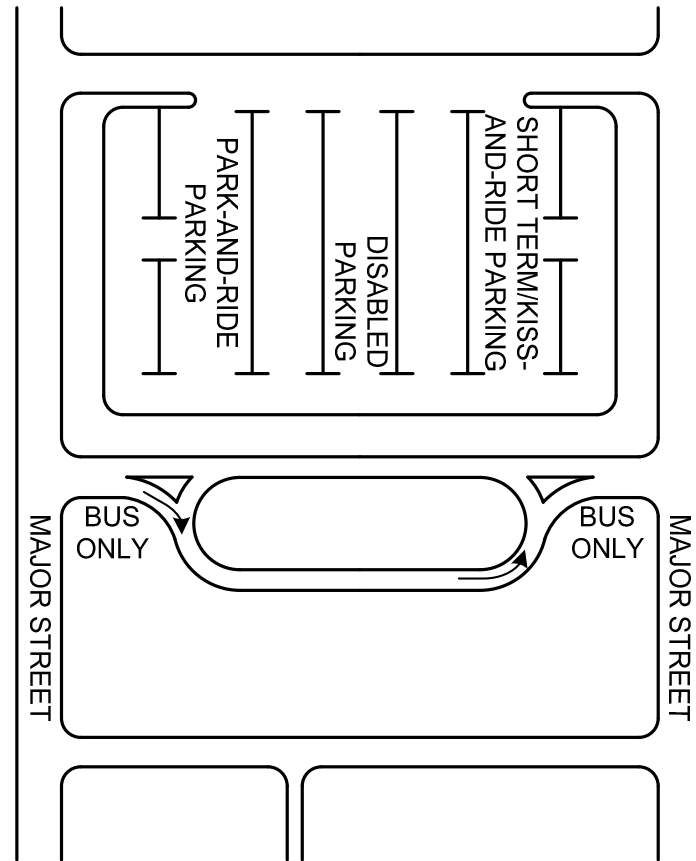
SHARED USE PARKING LOT

NOT TO SCALE





ONE ADJACENT STREET



TWO ADJACENT STREETS

NOT TO SCALE



CHAPTER 7

ACCESSIBLE BUS STOP DESIGN

The contents of this manual emphasize guidelines that improve the ADA accessibility and safety of bus stops and pedestrian access to bus stops. This chapter summarizes relevant transportation facility and accessibility design requirements for bus stops and accessways as specified in the Americans with Disabilities Act. The following sections refer to sections in the ADA regulations which can be viewed at www.access-board.gov.

7.1 GENERAL REQUIREMENTS OF ADA

Every station, bus stop, bus stop pad, terminal, building or other transportation facility, shall comply with the applicable provisions of 4.1 through 4.35, section 5 through 9 of the “ADA Standards for Accessible Design”, and the applicable provision of this section. The exceptions for elevators in 4.1.3.(5) exception 1 and 4.1.6 (1)(k) of the “ADA Standards for Accessible Design” do not apply to a terminal, depot, or other station used for specified public transportation, or an airport passenger terminal, or facilities subject to Title II.

7.2 BUS STOPS AND TERMINALS

7.2.1 NEW CONSTRUCTION

1. Where new bus stop pads are constructed at bus stops, bays or other areas where a lift or ramp is to be deployed, they shall have a firm, stable surface; a minimum clear length of 96 inches (measured from the curb or vehicle roadway edge) and a minimum clear width of 60 inches (measured parallel to the vehicle roadway) to the maximum extent allowed by legal or site constraints; and shall be connected to streets, sidewalks or pedestrian paths by an accessible route complying with Section 2.2 of this manual. The absolute minimum passage width for wheelchairs is 48 inches. If an accessible route has less than 60 inches clear width, then passing spaces at least 60 inches by 60 inches shall be located at reasonable intervals not to exceed 200 ft. The slope of the pad parallel to the roadway shall, to the extent practicable, be the same as the roadway. For water drainage, a maximum slope of 1:50 (2%) perpendicular to the roadway is allowed.
2. Where provided, new or replaced bus shelters shall be installed or positioned so as to permit a wheelchair or mobility aid user to enter from the public way and to reach a location, having a minimum clear floor area of 36 inches by 48 inches, entirely within the perimeter of the shelter. Such shelters shall be connected by an accessible route to the boarding area provide under paragraph (1) of this section.
3. Where provided, all new bus route identification signs shall comply with Section 4.30.5 of the “ADA Standards for Accessible Design.” In addition, to the maximum extent practicable, all new bus route identification signs shall comply with 4.30.2 and 4.30.3 of the “ADA Standards for Accessible Design.” Signs that are sized to the maximum dimensions permitted under legitimate local, state or federal regulations or ordinances shall be considered in compliance with 4.30.2 and 4.30.3 of the “ADA Standards for Accessible Design”, for the purposes of this section

EXCEPTION: Bus schedules, timetables, or maps that are posted at the bus stop or bus bay are not required to comply with this provision.

7.2.2 BUS STOP SITING AND ALTERATIONS

1. Bus stop sites shall be chosen such that, the maximum extent practicable, the areas where lifts or ramps are to be deployed comply with Section 7.2.1 (1) and (2).
2. When new bus route identification signs are installed or old signs are replaced, they shall comply with the requirements of 7.2.1.

GLOSSARY

Accessibility - The extent to which facilities are barrier free and useable by persons with disabilities, including wheelchair users.

Activity center - A small geographic area with a high concentration of employment and retail activity. High demand of services, including transportation, is characteristic of activity centers. Orange County is a multi-nucleated county, with activity centers scattered throughout.

Association of American State Highway Transportation Officials (AASHTO) – A national organization that develops and publishes planning and engineering design guidelines for streets and highways.

Alighting – Exiting a bus.

Americans with Disabilities Act (ADA) – An act passed by the United States Senate in 1990 to provide a clear and comprehensive national mandate for the elimination of discrimination against individuals with disabilities. Provides consistent, enforceable standards addressing discrimination against individuals with disabilities.

Articulated bus – A high capacity (60-70 seated passengers) transit vehicle consisting of two sections hinged together.

Attached sidewalk – A sidewalk which is directly attached to the back of curb.

Automatic Vehicle Location (AVL) – A type of technology that uses Global Positioning Systems to identify where transit vehicles are located, and the speed they are traveling, and transmits this information to a centralized control center.

BCR – Beginning of Curb Return. Where tangent of the curve meets with the curb. It is at this point that measurements are taken to determine the distance between the intersection and the bus stop location and/or turnout.

Boarding – Entering a bus.

Boarding area – See Transit accessory pad.

Bus bench – A bench that can accommodate three or more persons and is placed at a bus stop for use by waiting passengers.

Bus pad – Concrete pad constructed in the street, adjacent to a bus zone, that can accommodate the weight of a bus.

Bus Rapid Transit (BRT) - Bus transit service operating either completely separate from all modes of transportation on an exclusive right-of-way or operating within corridors with transit priority features such as queue-jump lanes, transit signal pre-emption, etc.

Bus signal preemption – Application of technology which allows a bus to trigger a green indication at a traffic signal as the bus approaches a signalized intersection.

Bus shelter – A covered passenger waiting area, often semi-enclosed with benches, that provide protection from the elements.

Bus stop – A linear curbside area that is specially designated for bus passenger boarding and alighting. It is identified by a bus stop sign and is accompanied by a red curb zone and/or “No Parking” sign. Bus stops can be located nearside, farside or between intersections (mid-block).

Bus turnout – A bus stop located in a recessed curb area, separated from moving lanes of traffic.

Bus zone – An length of curb designated as a bus stop where parking is prohibited.

Catch basin – A stormwater storage device usually associated with an inlet grate located in the gutter pan of a street.

Concrete bus pad – See Bus pad.

Curb lane – A travel, parking, or bike lane adjacent to the curb.

Curb ramps – A ramp constructed to allow persons with disabilities and wheelchairs to travel from a sidewalk to the street level.

Curb return radius – The radius of the curve of an intersection from the BCR to ECR.

Detached sidewalk – A sidewalk separated from the back of curb by a planting strip.

Detectable warning - a distinctively textured surface detectable by cane and foot, on the surface of curb ramps to provide a tactile cue for persons with vision impairments of their approach to streets.

ECR – Ending of Curb Return. Where tangent of the curve meets with the curb. It is at this point that measurements are taken to determine the distance between the intersection and the bus stop location and/or turnout.

Farside bus stop – A bus stop located at the farside of an intersection. At a farside bus stop, buses cross the intersection before stopping to serve passengers.

Fixed route – Transit service provided on a repetitive, fixed-schedule basis along a specific route with vehicles stopping to pick up and deliver passengers to specific locations; each fixed-route trip serves the same origins and destinations, unlike demand responsive service.

Footcandles – a standard measurement of lighting intensity.

Horizontal or Vertical Clearance – The distance between the grade level and any obstacle such as a sign, tree branch, overcrossing, etc.

Informational cassette – A device affixed to a transit sign pole that provides transit information such as route schedules or maps.

Landing – A level area of a sidewalk, or raised island, where wheelchair users may stop before proceeding down a curb ramp.

Large bus – a standard 40-foot long coach.

Layover – Time built into a schedule between arrivals and departures, used for the recovery of delays and preparation for the return trip.

Mid-block bus stop – A bus stop located between two adjacent intersections.

Mixed-use development – A development which has a variety of land uses placed together in one project area (commercial, residential, industrial). Mixed-use developments are different from activity centers because mixed-use developments are concentrated in relatively compact areas whereas activity centers have separate but complementary uses.

Nearside bus stop – A bus stop located at the approach side of an intersection. At a nearside bus stop, buses stop to serve passengers before crossing the intersection.

Park and Ride Lot - Designated parking areas for automobile drivers who then board transit vehicles from these locations.

Parking lane – A curb lane that is used for on-street parking.

Parkway – A strip of landscaped area located between the back of curb and the sidewalk.

Passenger boarding area – see Boarding area.

Pedestrian accessway – A lighted, paved, and disabled accessible walkway that provides convenient access to transit facilities and bus stops from adjacent land uses.

Pedestrian scaled lighting – Street lights designed to illuminate the pedestrian area. Usually lower and less intense than standard street lights, and frequently uses attractive or historic designs.

Planting strip – See Parkway.

Protected crossings – a pedestrian crosswalk controlled with a traffic signal.

Queue jump lane – A short section of preferential lane that allows transit vehicles to bypass an automobile queue or a congested section of roadway. Usually located at approaches to intersections.

Shared use or joint parking – A parking lot that serves multiple uses such as a retail center and a transit center or bus stop.

Sight distance – The distance between a driver's eye and some object allowing the driver to react to a hazard or decision.

Transfer – A passenger's change from one transit vehicle to another transit vehicle.

Transfer Center - A fixed location where passengers interchange from one route or vehicle to another.

Transit accessory pad – A concrete slab located at a bus stop. Its function is to both provide pavement to secure transit furniture and to allow an accessible landing area for passengers.

Transit center – A bus facility which acts as a hub for transit routes with a region.

Transit furniture – May consist of a transit shelter, bench, trash receptacle or other components provided at a bus stop for the comfort and convenience of waiting passengers. These may be provided by the local jurisdiction and/or private firms. OCTA does not provide transit furniture.

Travel lane – A lane devoted exclusively to vehicular travel.

Van stop – A linear curbside area that is specially designed for van passenger boardings and alightings.

Wheelchair boarding area – A paved area, or sidewalk, adjacent to the front and rear loading areas of a bus that allow the extension of a wheelchair lift and safe boarding or alighting of a person in a wheelchair.

Wheelchair lift – A device used to raise and lower a platform to transport a person in a wheelchair from the sidewalk area or paved landing area to the interior of the bus or vice versa.

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