BCDCOG

Transit and Bus Stop Design Guidelines

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BERKELEY-CHARLESTON-DORCHESTER
COUNCIL OF GOVERNMENTS

CARTA

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7 OPERATIONAL CONSIDERATIONS

This section covers relevant technical and engineering considerations associated with transit operations: (1) vehicle dimensions, (2) turn radii, (3) visibility, (4) lane widths, and (5) coordination with other curb uses.

VEHICLE DIMENSIONS

Any space that will be served by a CARTA bus should consider the height, width, and length of vehicles to ensure safe accommodation. CARTA currently operates a fleet of standard transit buses in two sizes: 35 feet and 40 feet. CARTA has programmed 60' buses to come online in the future, and they will fit within the operational limitations described here. Most buses operated in CARTA's service area are 35' in length. Most buses are equipped with bicycle racks, front wheelchair ramps and a front-end kneeling feature that reduces step height for mobility-impaired patrons. CARTA owns and operates Tel-A-Ride, the regional paratransit service. At several bus stop locations, the curb space is shared by both standard transit buses and paratransit vehicles.

The most common lifts used on buses are conventional wheelchair lifts. Since the wheelchair lift may be at the front or rear door, bus stop designs need to allow for either possibility. The length of the ramp typically extends 2 to 3 feet from the edge of the bus for a standard height curb.

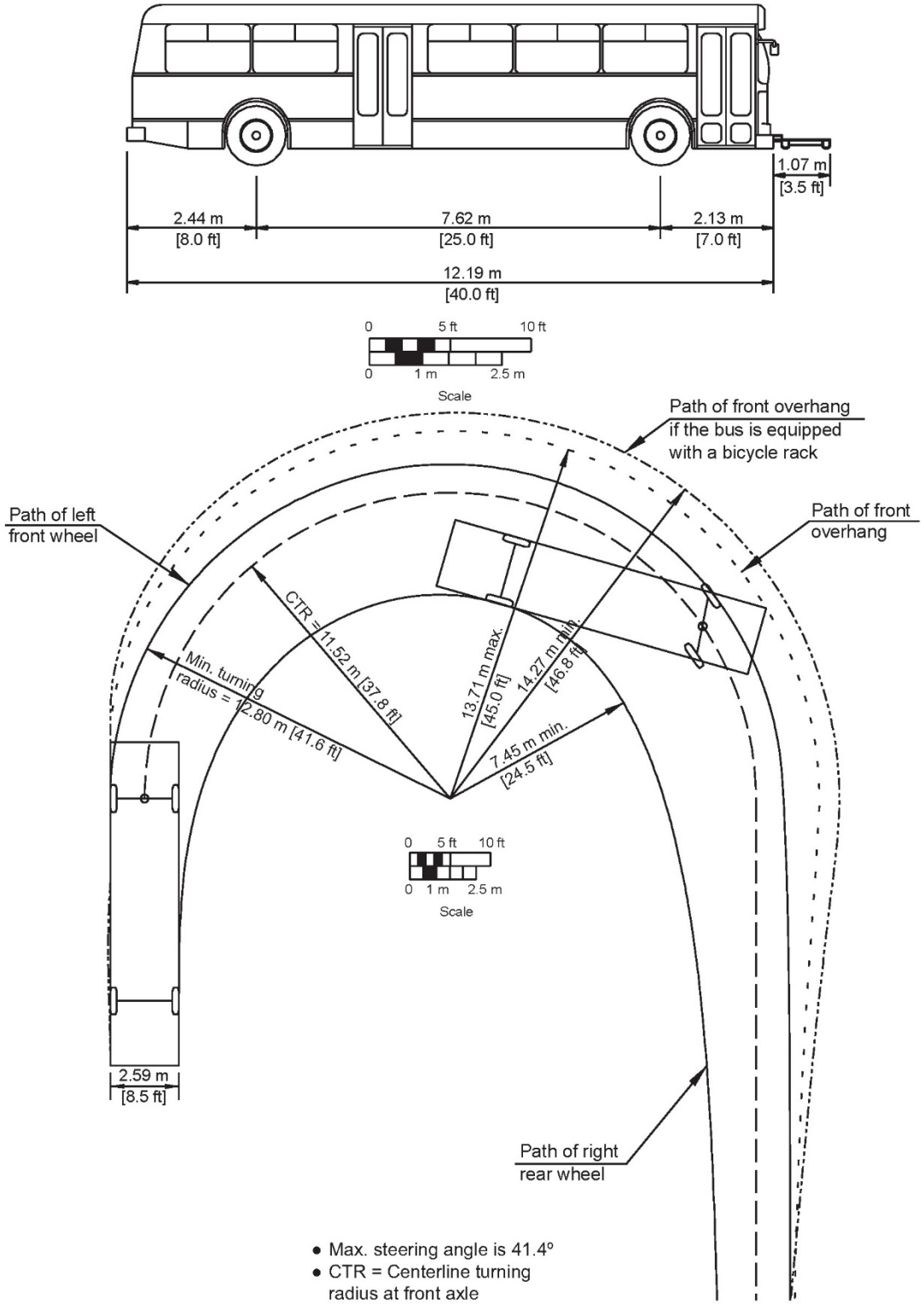
TURN RADII

Because transit vehicles make wide turns, properly designing or modifying the geometry of an intersection through corner radii, stop lines, and on-street parking helps minimize conflicts among buses, cars, bicycles, and pedestrians. Minimizing turning speeds is also critical to the safety of pedestrians, who are the most vulnerable street users.

Standards for turning radius can vary depending on the effective radius of each bus and other factors such as whether a bicycle lane or parking lane is available or if traffic volumes are so low as to allow transit vehicles to make full use of either or both of the departure or receiving lanes. Design considerations for designing turning radii include:

- Turning speeds should be limited to 15 miles per hour or less, with turn radii as small as is feasible.
- Since 30'-, 35'-, and 40' buses are used throughout the region, all future transit designs shall accommodate the AASHTO standard 40' city bus to accommodate fleet flexibility and future needs.
- Curb radii on dense urban grid streets where buses operate should be designed with a target radius of 20-30 feet.
- Parking may need to be restricted close to a street corner to achieve the required effective turn radii.
- A stop line on a receiving street may need to be relocated back from an intersection to achieve the required effective turn radii.
- Other modifications to striping at intersections may be made to achieve the required effective turn radii, including shifting through lanes.
- At intersections where buses turn, bus stops for the turning bus route should be located only on the far side of the intersection.

Figure 7-1 Standard 40-Foot Bus Dimensions and Curb Radii Dimensions (AASHTO, 2011)

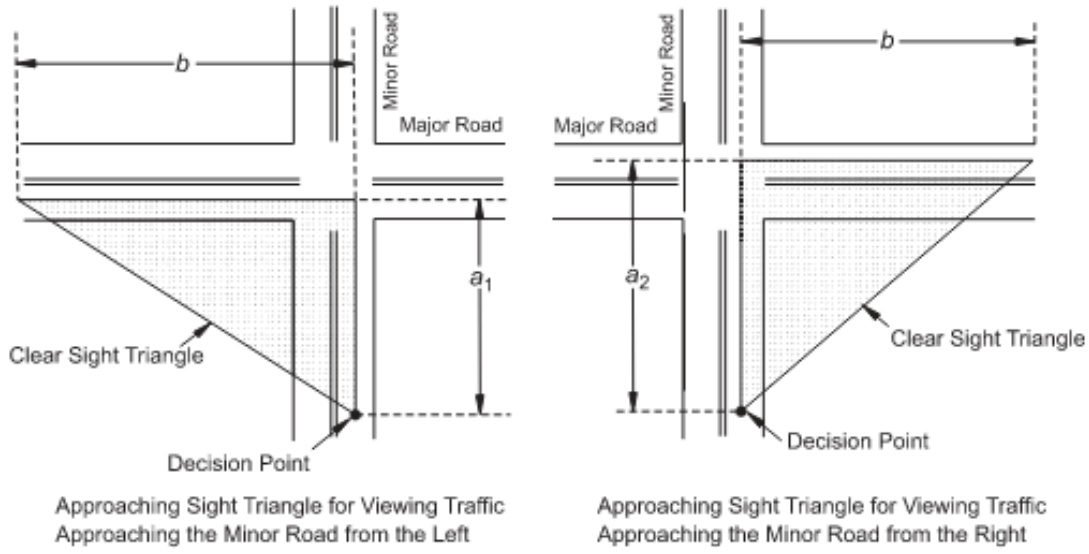


VISIBILITY

Bus operators need to see far enough ahead to assess developing situations and take actions appropriate for the conditions. This includes being able to see bus stops and waiting passengers adjacent to a roadway, approaching vehicles, crossing cyclists, and pedestrians. Short sight distances due to topography or curves can prevent traffic from stopping safely behind a stopped bus. Sight distance calculations for road design should follow the AASHTO requirements outlined in the Geometric Design Guide for Transit Facilities on Highways and Streets, or specific local jurisdiction requirements. Design considerations for appropriate sight distances include:

- When developing transit facilities, bus shelters and other sight-obscuring amenities such as trees should be located outside of the sight distance triangle of intersections and driveways. Professional judgment should be used to ensure that the shelters minimize visual obstructions between the approaching operator's view and the shelter location.
- Bus stops must not be placed over the crest of a hill or around a blind curve, nor located near a corner, curve, gully, traffic island, or intersection if the stop blocks sight lines for pedestrians and vehicle drivers.

Figure 7-2 Sight Distance Triangles for Intersections and Driveways



Source: AASHTO A Policy on Geometric Design of Highways and Streets, Figure 9-15 Intersection Sight Triangles (2011). Variables:

a_1: Distance from the major road along the minor road

a_2: Distance of a_1 plus the width of the lanes departing from the intersection on the major road. This should also include the width of any median present on the major road unless the median is wide enough to permit a vehicle to stop before entering or crossing the roadway beyond the median

b: Length of the leg of the sight triangle.

Note: The appropriate measurement of distances a_1 and a_2 for departure sight triangles depends on the placement of any marked stop line that may be present.

LANE WIDTHS

Bus travel lanes should be designed to ensure the safety of both the passenger on-board and the surrounding vehicles, bicycles and pedestrians. Street transit operations are best accommodated on streets with travel lanes that are a minimum of 10 feet, or 11 feet for center running travel lanes, but operations can still be possible on narrow streets such as those found throughout downtown Charleston. Narrower lanes can impede maneuverability, result in more difficult turning movements for buses and/or a need for buses to encroach into the adjacent lane to complete a turn (known as lane splitting).

COORDINATION WITH OTHER CURB USES

Parking and Loading Zones

In many locations, on-street parking and/or loading zones may surround the bus stop and compete for available curb space. Since many bus stops need to be lengthened in order to meet modern accessibility standards, the impact to on-street parking can be somewhat offset by increasing the space between bus stops to the recommended 1000 feet. Alternatively, a curb extension (also known as a bulb-out) may also be developed in order to leave more on-street parking in place.

Driveways

Driveways and other curb cuts near bus stops can pose safety hazards for boarding and alighting passengers and transit vehicles. There are six principles that guide the siting of bus stops in relation to driveways, as described below:

1. Avoid restricting sight distances for exiting vehicles.
2. Avoid blocking a driveway that provides the only access to a property.
3. Avoid unloading passengers into driveways.
4. Stop on the far side of a driveway if there is adequate sidewalk length close to the intersection.
5. Allow for safe sight distances for exiting vehicles.
6. Where there are two driveways in a constrained location near an intersection and the best stop location is on the far side of the second driveway, a transit vehicle may block the second driveway.

There may be locations where it is not possible to meet all six principles for driveway arrangements to create or preserve equal access to the transit stop. Safety and accessibility are the most important considerations when siting stops around driveways and curb cuts.