Chapter Fifteen

SPECIAL DESIGN ELEMENTS

Table of Contents

Section **Page**

Table of Contents
(Continued)

Section **Page**

Table of Contents
(Continued)

Section **Page**

Chapter Fifteen

SPECIAL DESIGN ELEMENTS

15-1.0 ACCESSIBILITY FOR DISABLED INDIVIDUALS

Many highway elements can affect the accessibility and mobility of disabled individuals. These include sidewalks, parking lots, buildings at transportation facilities, overpasses and underpasses. The Department's accessibility criteria comply with the 1990 *Americans with Disabilities Act* (ADA) and the *General Statutes of Connecticut* (CGS). The following Sections present accessibility criteria that are based on information presented in the *ADA Accessibility Guidelines* for Buildings and Facilities (*ADA Guidelines*). Designers are required to meet the criteria presented in the following Sections. Where other agencies or local codes require standards that exceed the *ADA Guidelines*, the stricter criteria may be required. This will be determined on a case-by-case basis.

15-1.01 Buildings

ADA Reference: Section 4.1

For interior accessibility criteria in all buildings, airport terminals, rest areas, weigh stations and transit stations (e.g., stations for intercity bus, intercity rail, high-speed rail and other fixed guideway systems), the accessibility criteria set forth in the *ADA Guidelines* shall apply. The designer should review the *ADA Guidelines* to determine the appropriate accessibility requirements for building interiors, including rest rooms, drinking fountains, elevators, telephones, etc.

15-1.02 Bus Stops

ADA Reference: Section 10.2

The following accessibility criteria apply to the construction of bus stops:

2. Bus Stop Pads. New bus stop pads constructed to be used in conjunction with a lift or ramp shall meet the following criteria:

    a. A firm stable surface must be provided.

    b. It must have a minimum clear length of 96 in (measured from the curb or roadway edge) and minimum clear width of 60 in (measured parallel to the roadway) depending on the legal or site constraints.

c. It must be connected to streets, sidewalks or pedestrian paths by at least one accessible route.

d. The slope of pad parallel to the roadway must be the same as the roadway to the maximum extent practical.

e. For drainage purposes, a maximum cross slope of 2% perpendicular to the roadway is allowable.

3. Bus Shelters. Where new or replaced bus shelters are provided, they must be installed or positioned to permit a wheelchair user to enter from the public way and reach a location within the shelter having a minimum clear floor area of 30 in by 48 in. An accessible route shall be provided from the shelter to the boarding area.

4. Signing. All new bus route identification signs should be sized based on the maximum dimensions permitted by local, State or Federal regulations or ordinances. The signs shall have an eggshell, matte or other non-glare finish. The characters or symbols shall contrast with their background (i.e., light characters on a dark background or dark characters on a light background).

15-1.03 Parking

ADA Reference: Section 4.1.2

Connecticut General Statutes: CGS 14-253a Parking privileges for blind or handicapped persons. Identification card. License plates. Parking spaces. Penalty.

15-1.03.01 Off-Street Parking

ADA Reference: Section 4.1.2 and 4.6

The following criteria apply to off-street disabled parking spaces:

1. Minimum Number. Figure 15-1A provides the criteria for the minimum number of accessible spaces. A typical disabled parking stall layout is shown in Figure 15-1B.

2. Location. Parking spaces for disabled individuals and accessible passenger loading zones that serve a particular building shall be the spaces or zones closest to the nearest accessible entrance on an accessible route. In separate parking structures or lots that do not serve a particular building, parking spaces for disabled individuals shall be located on the shortest possible circulation route to an accessible pedestrian entrance of the parking facility. In buildings with multiple access entrances with adjacent parking, accessible parking spaces shall be dispersed and located closest to the accessible entrances.

Total Number of Parking Spaces	Minimum Number of Accessible Spaces
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1000	2% of total
1001 and over	20 plus one for each 100 over 1000

Notes:

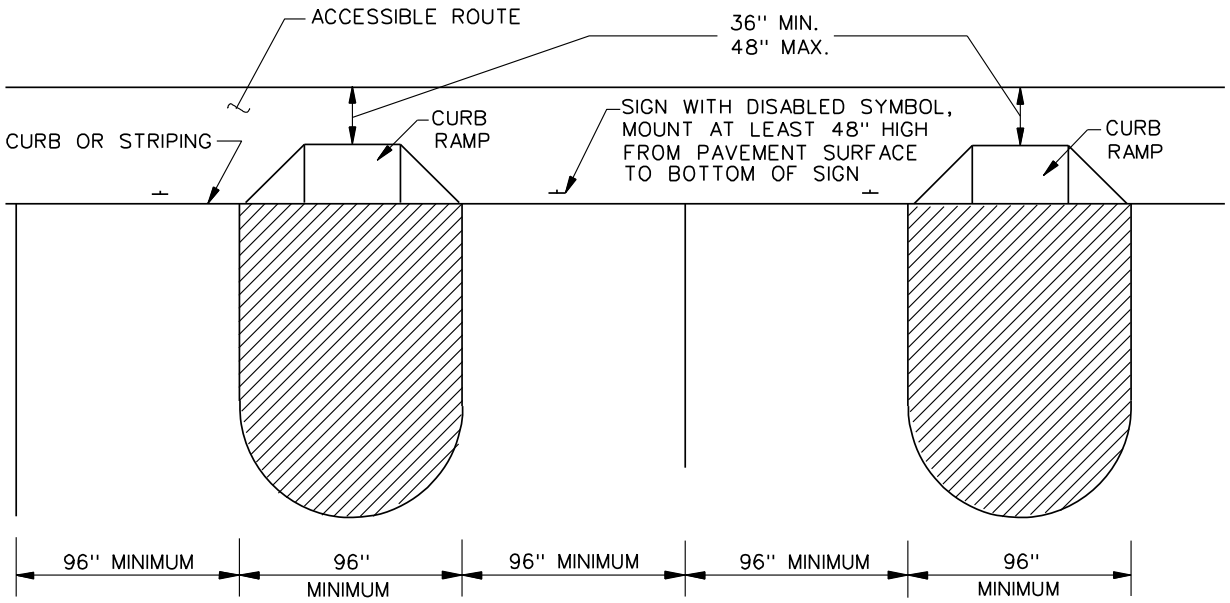
a. If one or more passenger loading zones are provided, then at least one passenger-loading zone shall comply with Item #5 in Section 15-1.03.01.

b. Use the universal parking space design for all parking lots; see Figure 15-1B. Consequently, all disabled parking spaces are considered van accessible and signing for vans is not required.

c. The total number of accessible parking spaces may be distributed among closely spaced parking lots, if greater accessibility is achieved.

MINIMUM NUMBER OF ACCESSIBLE SPACES FOR DISABLED USERS

Figure 15-1A



Notes: Two accessible parking spaces may share a common access aisle.

DISABLED PARKING STALL DIMENSIONS
(Off-Street Parking — Universal Parking Space Design)

Figure 15-1B

3. Signing. Parking spaces for the disabled shall be designated by above-grade signs with white lettering against a blue background and shall bear the international symbol of access (see *MUTCD*), and the words “Disabled Parking State Permit Required” and “Violators Will Be Fined”. A vehicle parked in the space shall not obscure the sign.

4. Dimensions. The parking spaces designated for the disabled shall be at a minimum 192 in wide which includes a 60-in minimum access aisle, or the space should be parallel to a sidewalk on a public highway. Parking access aisles shall be part of an accessible route to the building or facility entrance. Parked vehicular overhangs shall not reduce the clear width of an accessible circulation route. Parking spaces and access aisles shall be level with surface slopes not exceeding 2% in all directions. The Division of Traffic Engineering will determine the striping plan for the disabled parking spaces.

5. Passenger Loading Zones. Passenger loading zones shall provide an access aisle at least 60 in wide and 240 in long adjacent and parallel to the vehicular pull-up space. If there are curbs between the access aisle and the vehicular pull-up space, then a curb ramp complying with Section 15-1.08 shall be provided. Vehicular standing spaces and access aisles shall be essentially level. Surface slopes shall not exceed 2% in all directions.

The criteria above shall meet any requirements of *CGS 14-253a* for parking spaces.

15-1.03.02 On-Street Parking

Where new on-street paid or time-limited parking is provided and designated in districts zoned for business uses, the designer should consider the following accessibility criteria for the on-street parking:

1. Minimum Number. Figure 15-1A provides the criteria for the minimum number of on-street accessibility spaces.

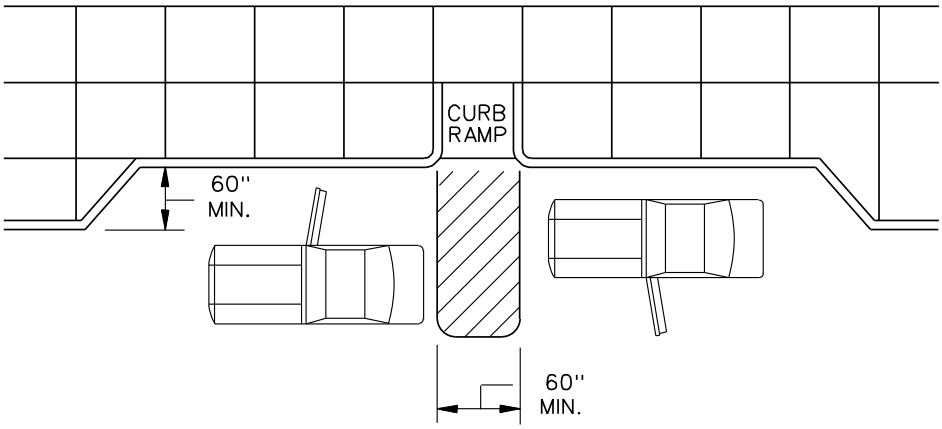
2. Location. On-street accessibility parking spaces will be dispersed throughout the project area. To the maximum extent feasible, accessible on-street parking should be located in level areas.

3. Dimensions. At a minimum, a 60-in wide perpendicular access aisle must be provided at the head or foot of the parking space. This is illustrated in Figure 15-1C. The travel lane shall not encroach into the access aisle.

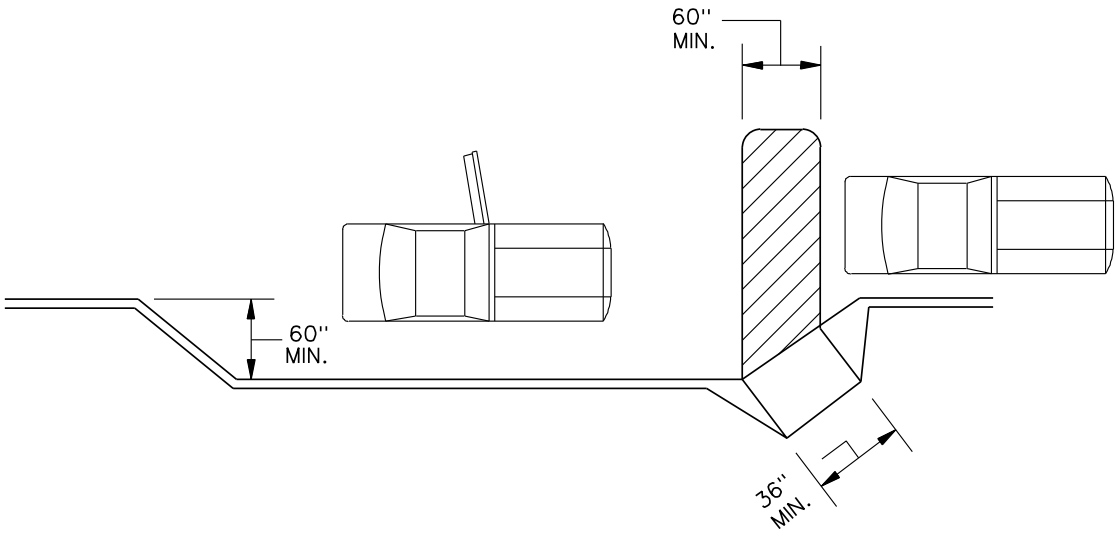
4. Signing. Aboveground signs with white lettering against a blue background shall designate parking spaces for the disabled, and the signs shall bear the international symbol of access (see MUTCD) and the words “Disabled Parking State Permit Required” and “Violators Will Be Fined.” These signs will be located so as to be visible from a driver’s seat.

5. Curb Ramps. If there are curbs next to an on-street accessible parking space, then a curb ramp complying with Section 15-1.08 shall be provided. Access parking spaces adjacent to intersections may be served by the sidewalk curb ramp at the intersection, provided that the path of travel from the access aisle to the curb ramp is within the pedestrian crossing area.

6. Parking Meters. Where provided, parking meter controls shall be a maximum of 48 in above the sidewalk or pedestrian circulation path. Controls and operating mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist. The force required to activate controls shall be no greater than 5 lbs. A firm, stable and slip-resistant area (30 in by 48 in), with the least possible slope, shall be provided at the controls and shall be connected to the sidewalk by a continuous passage that is a minimum of 36 in wide.



(a) TWO ACCESSIBLE PARALLEL PARKING SPACES IN SERIES, SEPARATED BY AN ACCESSIBLE AISLE, WITH BOTH DRIVER-SIDE AND PASSENGER-SIDE ACCESS DEMONSTRATED.



(b) SINGLE ACCESSIBLE PARALLEL PARKING SPACE WITH DRIVER-SIDE ACCESS DEMONSTRATED; PASSENGER SIDE ACCESS CAN BE PROVIDED BY PARKING IN LINE WITH STANDARD ON-STREET SPACES.

DISABLED PARKING
(On-Street Parking)

Figure 15-1C

15-1.04 Accessible Route

ADA Reference: Section 4.3

An accessible route is a continuous, unobstructed path connecting all accessible elements and spaces in a building, facility or site. A “site” is defined as a parcel of land bounded by a property line or a designated portion of a public right-of-way. A “facility” is defined as all or any portion of buildings, structures, site improvements, complexes, equipment, roads, walks, passageways, parking lots, or other real or personal property on a site. Interior accessible routes may include corridors, floors, ramps, elevators, lifts and clear floor space at fixtures. Exterior accessible routes may include parking access aisles, curb ramps, crosswalks at vehicular ways, walks, ramps and lifts.

Accessible routes must be provided as follows:

1. At least one accessible route within the boundary of the site shall be provided from public transportation stops, accessible parking, accessible passenger-loading zones, and public streets or sidewalks to the accessible building entrance they serve. The accessible route shall, to the maximum extent feasible, coincide with the route for the general public.

2. At least one accessible route shall connect accessible buildings, facilities, elements and spaces that are on the same site.

3. At least one accessible route shall connect accessible buildings or facility entrances with all accessible spaces and elements and with all accessible dwelling units within the building or facility.

For highway projects, the application of the accessible route criteria applies to definitive sites that are related to highway purposes. These include rest areas, recreational areas, park-and-ride lots, etc. Section 15-1.05 provides the accessibility requirements for sidewalks. Most sidewalks along public right-of-way are considered non-accessible.

15-1.05 Sidewalks

Section 10-2.01 presents the Department’s warrants and design criteria for sidewalks. In addition, all sidewalks must comply with the *ADA Guidelines* presented in the following Sections.

15-1.05.01 Criteria for Accessible Routes

ADA Reference: Various.

For sidewalks on accessible routes, the following accessibility criteria shall be met:

1. Width. The minimum clear width shall be 36 in, except at doors that may have a minimum width of 32 in.

2. Passing Space. If the sidewalk has less than 60 in clear width, then passing spaces at least 60 in by 60 in shall be located at reasonable intervals not to exceed 200 ft. A T-intersection between two walks is an acceptable passing space. Paved driveways also provide acceptable passing space in residential areas.

3. Surface. All sidewalk surfaces shall be stable, firm and slip resistant. The longitudinal gradient should be flush and free of abrupt changes. However, changes in level up to 0.25 in may be vertical and without edge treatment. Changes in level between 0.25 in and 0.5 in shall be beveled with a slope no greater than 50%. Changes greater than 0.5 in shall be accommodated with a ramp; see Section 15-1.07.

   Gratings should not be placed within the walking surface. If, however, gratings are located in walking surfaces, they shall have spaces no greater than 0.5 in wide in one direction. If gratings have elongated openings, then they shall be placed so that the long dimension is perpendicular to the dominant direction of travel.

4. Slope. The sidewalk cross slope shall not exceed 2%. If the longitudinal gradient exceeds 5%, the sidewalk must meet the accessibility criteria for ramps (see Section 15-1.07).

5. Protruding Objects. Objects projecting from walls (e.g., signs, telephones, canopies) with their leading edges between 27 in and 80 in above the finished sidewalk shall not protrude more than 4 in into any portion of the sidewalk. Freestanding objects mounted on posts or pylons may overhang their mountings up to a maximum of 12 in when located between 27 in and 80 in above the sidewalk or ground surface. Protruding objects less than 27 in or greater than 80 in may protrude any amount provided that the effective width of the sidewalk is maintained. Where the vertical clearance is less than 80 in, a barrier shall be provided to warn the blind or visually impaired person.

6. Separation. Sidewalks will be separated from roadways by curbs, snow shelf or other barriers, which will be continuous except where interrupted by driveways, alleys or connections to accessible elements.

7. Bus Stops. Where bus passenger-loading areas or bus shelters are provided on or adjacent to sidewalks, they must comply with the criteria in Section 15-1.02.

8. Curb Ramps. All curb ramps on an accessible route must comply with the criteria in Section 15-1.08.

15-1.05.02 Criteria for Public Rights-of-Way

In general, sidewalks along public rights-of-way should meet the criteria presented in Section 15-1.05.01. However, some flexibility is required to meet the adjacent roadway conditions and to

provide practical designs. The criteria in Section 15-1.05.01 should be implemented, unless noted as follows:

1. Slopes. The flattest longitudinal slope practical should be provided. Preferably, the longitudinal slope should not exceed 8%. Sidewalk slopes 5% or greater do not require the use of handrails as defined in Section 15-1.07. Cross slopes greater than 2% may be used provided adjacent portions are smoothly blended.

2. Stairs. Sidewalks with stairs are allowed on non-accessible routes, provided an unobstructed route is available between accessible entrances. Section 15-1.06 presents criteria for stairs.

3. Separation. Sidewalks adjacent to the curb or roadway may be offset to avoid a non-conforming cross slope at driveway aprons by diverting the sidewalk around the apron.

4. Protruding Objects. On or along a sidewalk, objects that are not fixed (e.g., newspaper vending machines, trash receptacles) are not subject to the ADA Guidelines.

15-1.06 Stairs

ADA Reference: Section 4.9

Stairs shall not be part of an exterior accessible route because individuals in wheelchairs cannot safely negotiate them. Where stairs are used, they should be designed to be accessible by other disabled individuals. Therefore, the design of stairs must comply with Section 4.9 of the *ADA Guidelines* and the *Connecticut Standard Drawings*. This includes the provision of handrails.

15-1.07 Ramps

ADA Reference: Sections 4.1.6, 4.8 and 4.26

Any part of an accessible route with a slope greater than 5% shall be considered a ramp and shall conform to the *ADA Guidelines*. This includes the provision of handrails. The following criteria must be met for ramps on accessible routes:

1. Slope and Rise. The least possible slope should be used for any ramp. Figure 15-1D provides the maximum allowable ramp slopes for new construction. Curb ramps and ramps to be constructed on existing sites or in existing buildings or facilities may have slopes and rises as shown in Figure 15-1E, if space limitations prohibit the use of a 1:12 slope or less.

2. Width. The minimum clear width of a ramp shall be 36 in.

Slope	Maximum Rise	Maximum Run
Steeper than 1:16 but no steeper than 1:12	30 in	30 ft
Steeper than 1:20 but no steeper than 1:16	30 in	40 ft

Note: A slope steeper than 1:12 is not allowed.

ALLOWABLE RAMP DIMENSIONS
(New Construction)

Figure 15-1D

Slope	Maximum Rise	Maximum Run
Steeper than 1:10 but no steeper than 1:8	3 in	2 ft
Steeper than 1:12 but no steeper than 1:10	6 in	5 ft

Note: A slope steeper than 1:8 is not allowed.

ALLOWABLE RAMP DIMENSIONS
(Existing Sites, Buildings and Facilities)

Figure 15-1E

3. Landings. Ramps shall have level landings at the bottom and top of each run. Landings shall have the following features:

   a. The landing shall be at least as wide as the ramp run leading to it.

   b. The landing length shall be a minimum of 60 in clear.

   c. If ramps change direction at landings, the minimum landing size shall be 60 in by 60 in.

4. Handrails. If a ramp run has a rise greater than 6 in or a horizontal projection greater than 72 in, then it shall have handrails on both sides. Handrails are not required on curb ramps. Handrails shall have the following features:

   a. Handrails shall be provided along both sides of ramp segments. The inside handrail on switchback or dogleg ramps shall be continuous.

b. If handrails are not continuous, they shall extend at least 12 in beyond the top and bottom of the ramp segment and shall be parallel with the floor or ground surface.

c. The clear space between the handrail and the wall shall be 1.5 in.

d. Gripping surfaces shall be continuous.

e. Top of handrail gripping surfaces shall be mounted between 34 in and 38 in above ramp surfaces.

f. Ends of handrails shall be either rounded or returned smoothly to floor, wall or post.

g. Handrails shall not rotate within their fittings.

5. Cross Slope and Surfaces. The cross slope of ramp surfaces shall be no greater than 2%. Ramp surfaces shall comply with the criteria for "Surface" for sidewalks (Section 15-1.05).

6. Edge Protection. Ramps and landings with drop-offs shall have curbs, walls, railings or projecting surfaces that prevent people from slipping off the ramp. Curbs shall be a minimum of 2 in high.

7. Outdoor Conditions. Outdoor ramps and their approaches shall be designed so that water will not accumulate on walking surfaces.

15-1.08 Curb Ramps

ADA Reference: Section 4.7

Connecticut General Statutes: CGS 7-118a

15-1.08.01 General

"Curb cuts" and "curb ramps" are terms that describe the treatment at intersections for gradually lowering the elevation of sidewalks with curbs to the elevation of the street surface. The term "curb ramps" will be used in this *Manual*.

All curbs and sidewalks shall be designed with curb ramps at all pedestrian crosswalks to provide adequate and reasonable access for the safe and convenient movement of physically disabled persons. This applies to new construction, reconstruction, 3R and spot improvement projects. For the purpose of this Section, a pedestrian crosswalk is defined as that portion of a highway or street ordinarily included within the prolongation or connections of lateral lines of sidewalks at intersections. It also includes any portion of a highway or street distinctly indicated

as a crossing for pedestrians by lines or other markings on the surface, except such prolonged or connecting lines from an alley across a street.

15-1.08.02 Location

When determining the need for a curb ramp, the designer should consider the following:

1. If at least one curb will be disturbed by construction at an existing intersection, then curb ramps shall be constructed at all crosswalks which extend from a paved sidewalk in that intersection.

2. For all projects, curb ramps will be constructed at all crosswalks that provide pedestrian access in that intersection and will be provided on all corners. At T-intersections, the designer must ensure that curb ramps are located on the side opposite the minor intersecting road if warranted for pedestrian access.

3. Opposing ramps must always be provided on adjacent legs of an intersection even if outside project limits.

4. Curb ramps shall be positioned so as not to cause a safety hazard for blind pedestrians.

5. Curb ramps shall be located or protected to prevent their obstruction by parked vehicles.

6. Curb ramps at marked crossings shall be wholly contained within the markings, excluding any flared sides.

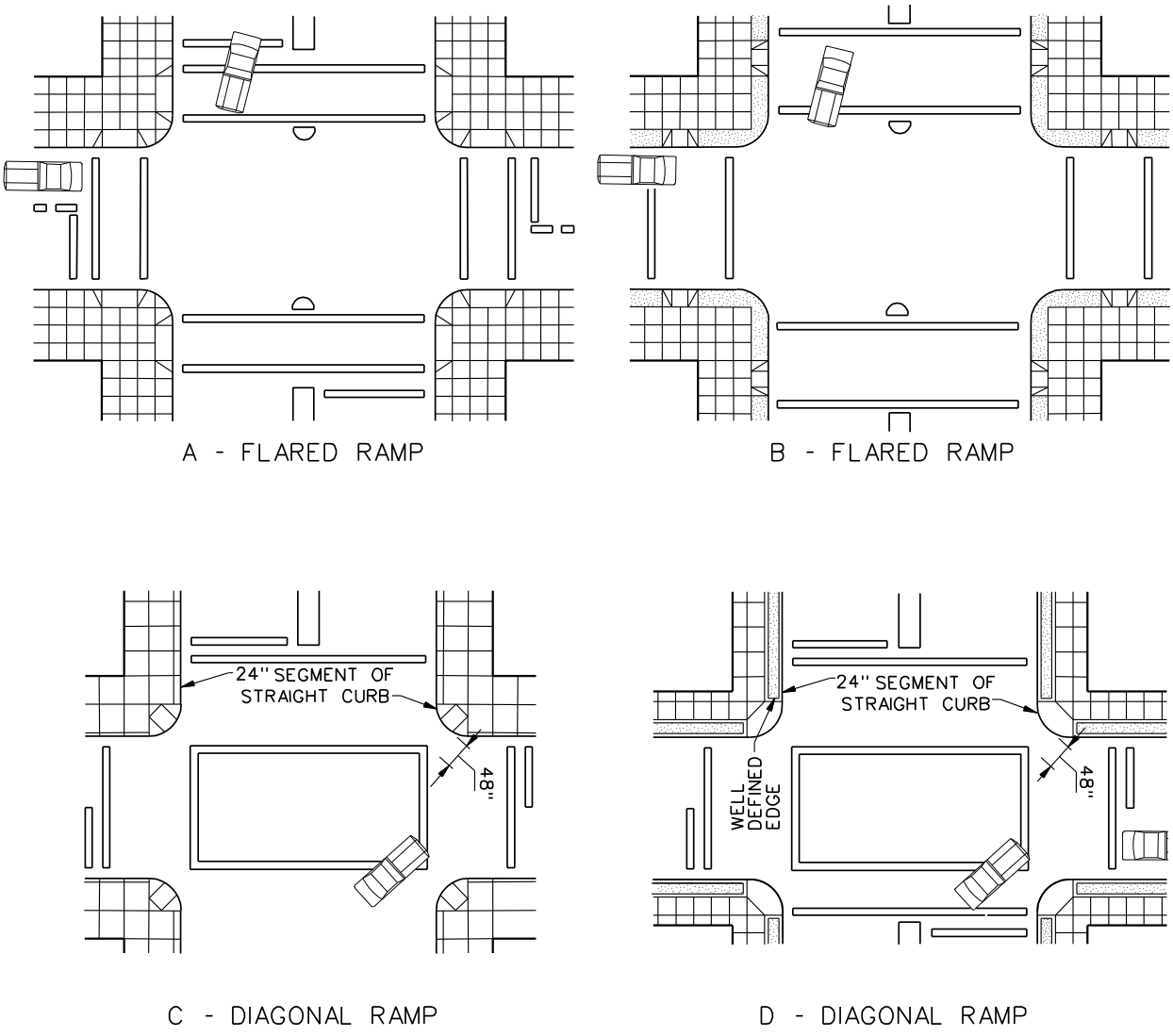
7. A diagonal curb ramp shall be wholly contained within the painted markings, excluding any flared sides. There shall be at least 24 in of full-height curb within the crosswalk. In addition, there shall be at least 48 in between the gutter line and the corner of the two intersecting crosswalks. See Figure 15-1F for an illustration of these criteria.

8. The function of the curb ramp must not be compromised by other highway features (e.g., guiderail, catch basins, utility poles, signs).

9. Curb ramps are required at all curbed intersections with sidewalks or along all accessible routes.

10. The location of the curb ramp must be consistent with the operation of pedestrian-actuated traffic signals, if present. In addition, a pedestrian push-button must be located so wheelchair-bound individuals can reach it.

11. The designer will provide the Division of Traffic Engineering with a set of plans at the preliminary design stage and before the preliminary design review. The Division of Traffic Engineering, in its review, will determine the need and location of mid-block curb ramps. These recommendations will be incorporated into the design before the



Notes:

1. *See Figure 15-1G for details of flared curb ramps.*

2. *See Figure 15-1H for details of diagonal curb ramps.*

3. *As an alternative to the diagonal curb ramp, the designer can provide two flared curb ramps at each corner.*

CURB RAMPS AT MARKED CROSSINGS

Figure 15-1F

preliminary design review. In addition, the Division of Traffic Engineering will be notified of any geometric changes that will impact the location of any curb ramp included in the preliminary design review.

15-1.08.03 Crossing Controls

If a pedestrian crosswalk and curb ramp are present at an intersection with a traffic signal that has pedestrian detectors (push buttons), the following will apply:

1. Location. Controls shall be located as close as practical to the curb ramp and, to the maximum extent feasible, shall permit operation from a level area immediately adjacent to the controls.

2. Surface. A firm, stable and slip-resistant area, a minimum of 36 in by 48 in, shall be provided to allow a forward or parallel approach to the controls.

15-1.08.04 Types

Figure 15-1F illustrates the two basic types of curb ramps — flared and diagonal. Details for the construction of flared curb ramps are provided in Figure 15-1G and for diagonal curb ramps in Figure 15-1H.

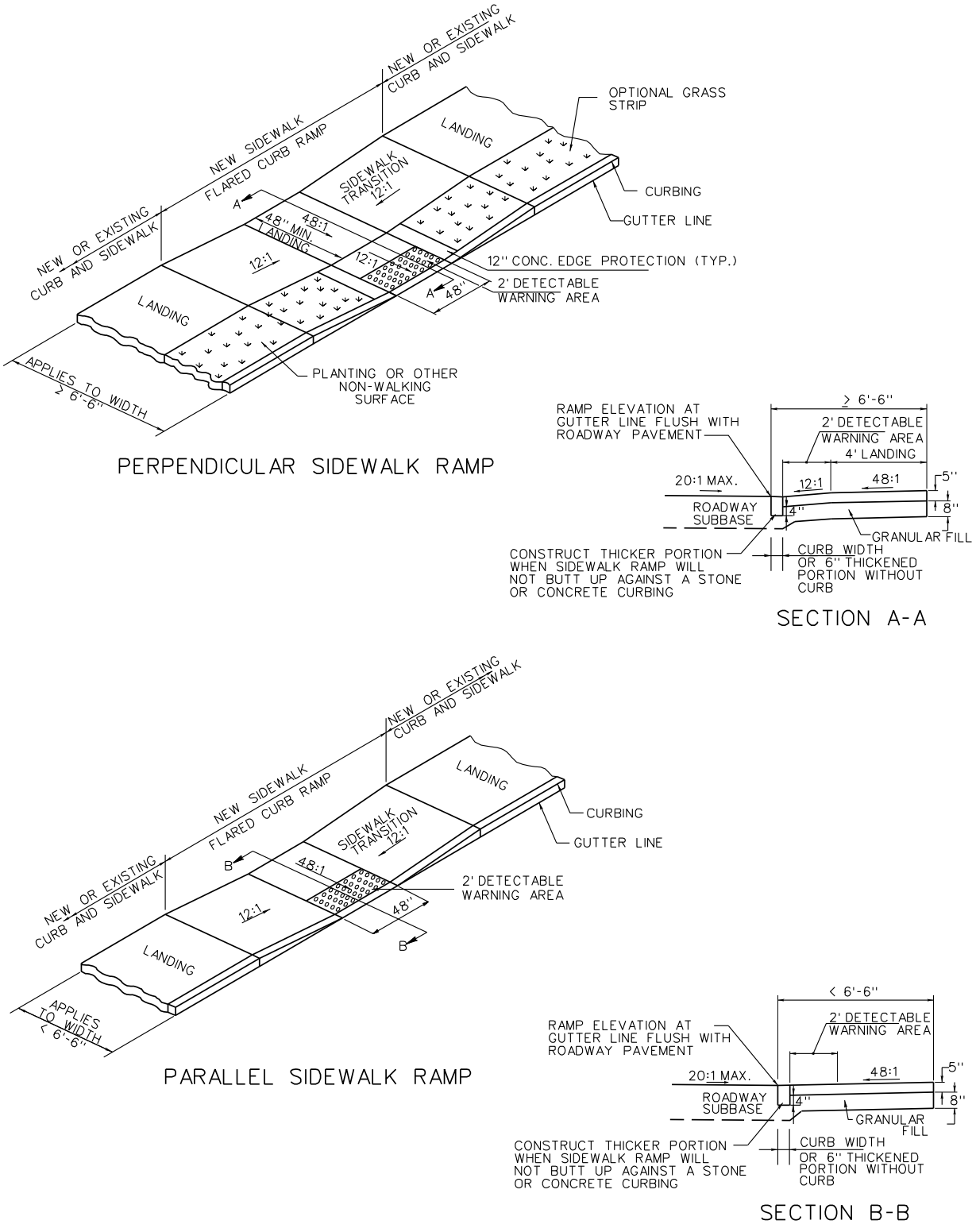
The following provides several suggestions for selecting the appropriate curb ramp:

1. Crosswalk Markings and Stop Bars. The placement of curb ramps affects the placement of crosswalk markings and stop bars. Conversely, the location of existing crosswalk markings and stop bars affect the placement of curb ramps. Some of the crosswalk-marking constraints are shown in Figure 15-1F and in the *Connecticut Standard Drawings*. The *MUTCD* contains additional constraints on crosswalk markings and stop bar placement.

2. Obstructions. It is desirable to move any obstructions from curb ramps whenever practical. When this is not practical, the direction of traffic relative to the placement of the curb ramp must be considered. It is important that drivers can see the disabled person using the curb ramp.

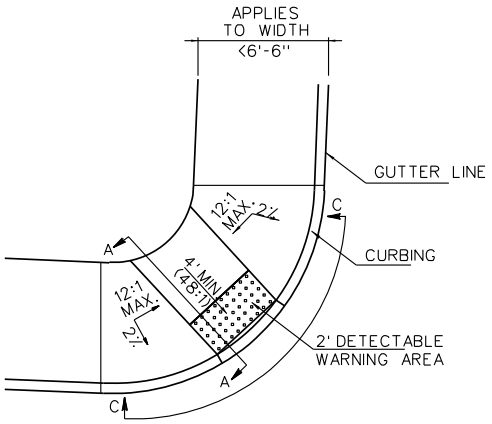
3. Diagonal Curb Ramps. The usage of a diagonal curb ramp should be avoided whenever practical due to its effect on the crosswalk width. It is preferable to use the straight curb ramp or several straight ramps rather than to use a diagonal curb ramp.

4. Islands. Any raised islands in a pedestrian crosswalk shall be cut through level with the street or have curb ramps at both sides and a level area at least 48 in long in the part of the island intersected by the crossing; see Figure 15-1I.

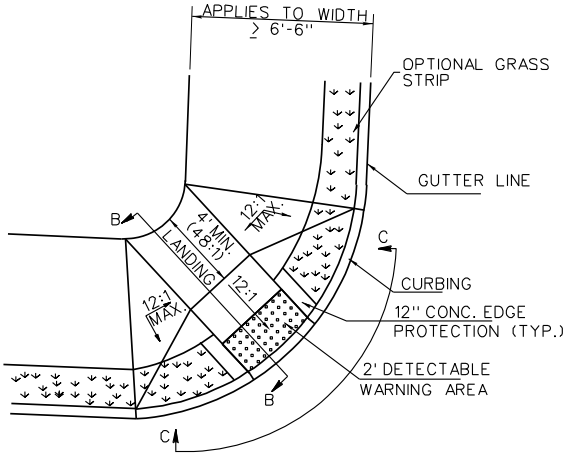


FLARED CURB RAMPS

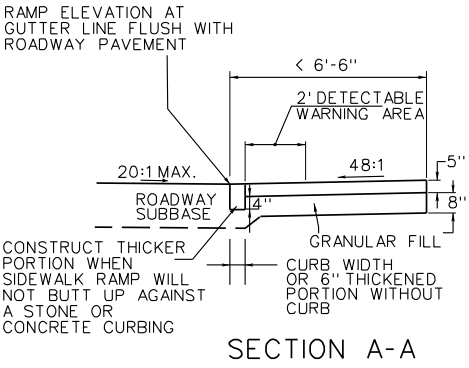
Figure 15-1G



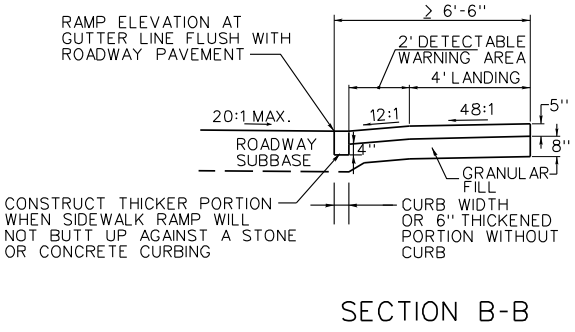
DIAGONAL/PARALLEL SIDEWALK RAMP



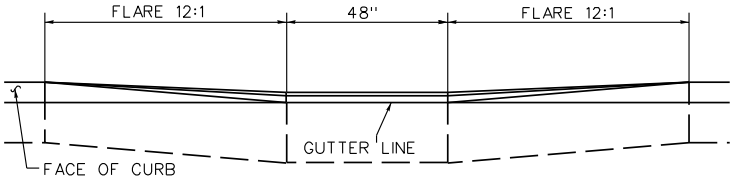
DIAGONAL SIDEWALK RAMP



SECTION A-A



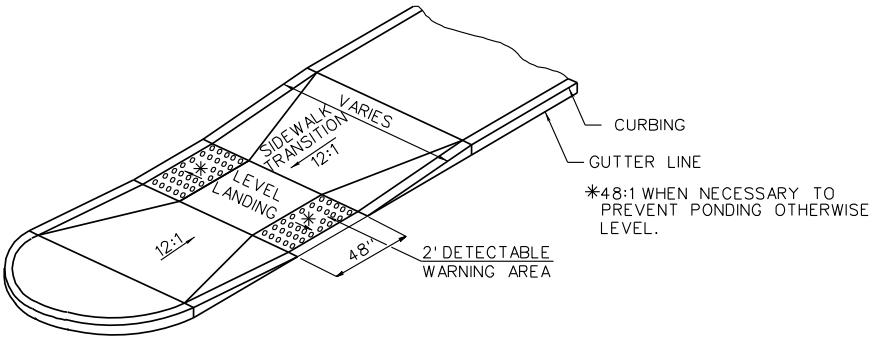
SECTION B-B



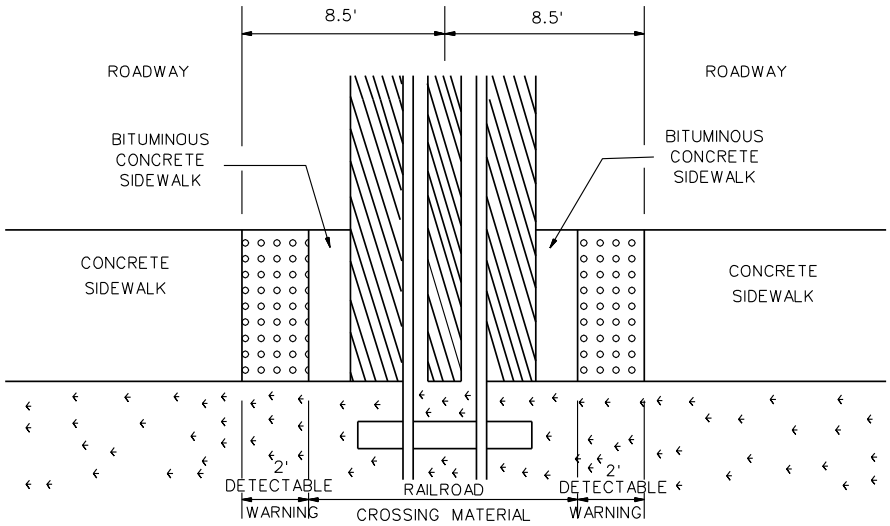
SECTION C-C

DIAGONAL CURB RAMPS

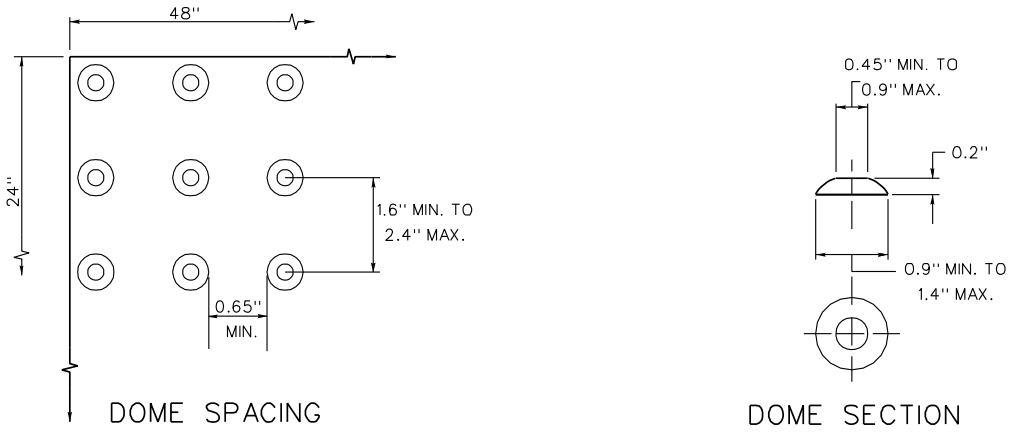
Figure 15-1H



RAISED ISLAND SIDEWALK RAMP



DETECTABLE WARNINGS AT RAILROAD CROSSING



DOME SPACING

DOME SECTION

DOME DETAILS FOR DETECTABLE WARNINGS

Figure 15-1I

5. Material. Regardless of the type of pavement of the adjacent sidewalk, all curb ramps shall be constructed of Portland cement concrete. Also, all curb ramps shall be constructed in accordance with the details of the *Connecticut Standard Drawings* for concrete sidewalk, except for the ramp, which will have a textured and non-slip surface.

6. Specifications. Curb ramps shall be constructed, measured and paid for as concrete sidewalks, as referred to in the Department's *Standard Specifications for Roads, Bridges and Incidental Construction*, latest issue.

15-1.09 Pedestrian Overpasses and Underpasses

ADA Reference: Various

When deciding where to locate a pedestrian crossing, the highway and structure designers must coordinate their efforts to properly address the accessibility considerations. The following are applicable:

1. All current and future accessible routes must be identified. If existing routes are inaccessible, the designer must evaluate the likelihood the routes will be made accessible in the future. This could be done as part of the project under design.

2. The evaluation in Item #1 may lead to the decision to relocate the pedestrian overpass or underpass to another site where accessibility can be more easily provided.

3. The proposed design must meet the *ADA Guidelines* criteria for stairs, ramps, curb ramps and accessible routes.

4. The designer should reference FHWA-IP-84-6 *Guidelines for Making Pedestrian Crossing Structures Accessible* for additional design information.

15-1.10 Detectable Warning Surfaces

ADA Reference: 4.29

Detectable warnings are required on all curb ramps and at sidewalk railroad crossings. Details for the construction of detectable warnings are provided in Figures 15-1G, 15-1H and 15-1I.

The following provides guidance for the installation of detectable warnings:

1. Any island that is to be used for pedestrian refuge shall have detectable warnings on the curb ramps located at both sides of the island.

2. Where a railroad crosses pedestrian facilities at grade, detectable warnings shall be installed in the sidewalk on both sides of the railroad crossing.

15-2.0 COMMUTER LOTS

15-2.01 General

Commuter lots may be located in rural or urban areas to accommodate car-pooling or to provide access to transit terminals. By locating these lots outside of the downtown area, congestion is reduced, parking lot property costs are lowered, and accessibility is improved. The general location and size of commuter lots is normally determined during planning studies for transportation facilities by the Bureau of Planning. Guidance for site selections can be found in the AASHTO *Guide for the Design of Park-and-Ride Facilities*. The designer is responsible for the internal design and layout of the commuter lot.

15-2.02 Layout

15-2.02.01 Entrances and Exits

The designer should locate entrances and exits so that they will have the least disruption to existing traffic on the street, allow easy access to and from the lot, and provide the maximum storage space within the lot. In addition, consider the following:

1. Location. Separate entrances and exits whenever practical, preferably on different streets. The entrance should be on the “upstream” side of the traffic flow nearest the lot and the exit on the “downstream” side. If separation is not possible, the combined entry-exit point should be as close to mid-block as practical.

2. Spacing. Entrances and exits should be at least 150 ft apart and 150 ft from a public intersection. Where practical, these distances should be 300 ft. For lots with less than 150 spaces, these dimensions may be reduced to 100 ft.

3. Storage. The designer needs to ensure that there is sufficient storage on the mainline for entering the lot. This may require providing a separate left-turn lane. Also, check the exiting traffic to ensure the exiting queue will not adversely affect the traffic circulation in the lot itself.

4. Design. Design all entrance and exits for capacity, sight distance, turning radii, acceleration and deceleration lanes, turn lanes, etc., according to the criteria in Chapter Eleven. The typical design vehicle will be a BUS.

15-2.02.02 Traffic Circulation

Arrange the traffic circulation to provide maximum visibility and minimum conflict between small vehicles (e.g., autos, taxis) and large vehicles (e.g., large vans, buses). Locate major circulation routes at the periphery of the lot to minimize vehicular-pedestrian conflicts. A counter-clockwise circulation of one-way traffic is preferred. This allows vehicles to unload from the right side.

15-2.02.03 Pedestrian and Bicyclist Considerations

The designer should consider pedestrian and bicycle routes when laying out the commuter lot. Avoid entrance and exit points in areas with high pedestrian volumes, if practical. Provide sidewalks between the parking areas and the modal transfer points. Locate passenger waiting areas in a central location or near the end of the facility. Maximum walking distances to loading area should not exceed 1000 ft. Longer walking distances may require more than one loading area.

Crosswalks should be provided where necessary and clearly marked and signed. Include signing and pavement markings for all pedestrian and bicycle paths to eliminate indiscriminate movements. In high-volume lots, fencing, barriers or landscaping may be warranted to channel pedestrians and bicyclists to appropriate crossing points. Crossings at major two-way traffic circulation lanes should have a refuge island separating the travel directions.

Include a bicycle parking area relatively close to the loading area. Provide bicycle stalls that allow the use of locking devices. If a large volume of bicycle traffic is expected, provide a designated bicycle lane to and from the bicycle parking area.

15-2.02.04 Accessibility for Disabled Individuals

Section 15-1.0 discusses the accessibility criteria for disabled individuals, which also apply to commuter lots.

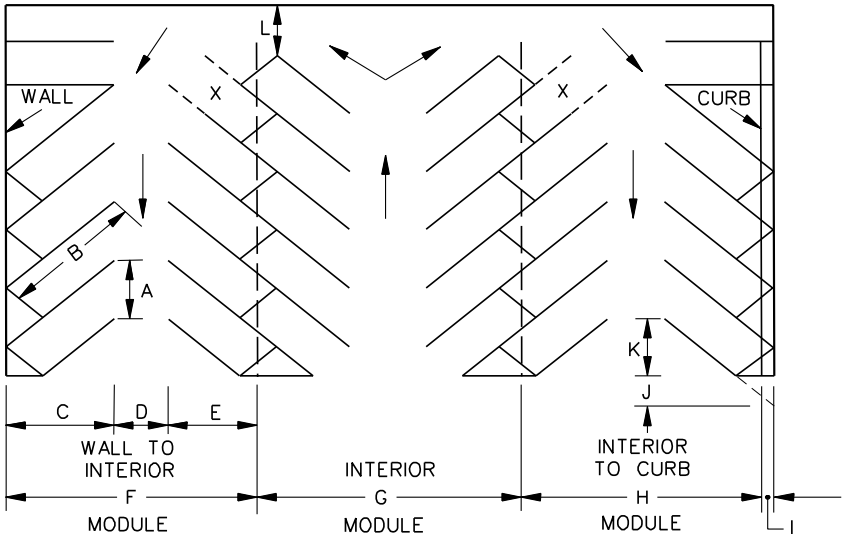
15-2.03 Design Elements

Consider the following elements in the design of a commuter lot:

1. Parking Stall Dimensions. Figure 15-2A provides the design dimensions for 9 ft x 18.5 ft parking stalls based on one-way circulation and angle of parking. Where feasible, the lot should provide two-way flow with 90° parking spaces.

2. Bus Loading Areas. Design the bus loading and unloading areas to provide for continuous counter-clockwise circulation and for curb parking without backing maneuvers. The traffic lanes and the curb loading area should each be 12 ft wide. Figure 15-2B provides criteria for the recommended lengths of bus-loading areas. Section 15-3.0 discusses bus stops along streets and other access facilities.

3. Sidewalk Dimensions. All sidewalks should be paved and be at least 5 ft wide. In loading areas, the width should be at least 12 ft. Provide a 6-in raised platform in the loading area to assist in the loading. Curb-cut ramps are required for access to sidewalks and loading areas, see Section 15-1.0.



Parking Layout Dimension (in ft) for 9 ft x 18.5 ft Stalls at Various Angles

Dimension	On Diagram	Angle			
		45°	60°	75°	90°
Stall width, parallel to aisle	A	12.7	10.4	9.3	9.0
Stall length of line	B	25.0	22.0	20.0	18.5
Stall depth to wall	C	17.5	19.0	19.5	18.5
Aisle width between stall lines	D	12.0	16.0	23.0	26.0
Stall depth, interlock	E	15.3	17.5	18.8	18.5
Module, wall to interlock	F	44.8	52.5	61.3	63.0
Module, interlocking	G	42.6	51.0	61.0	63.0
Module, interlock to curb face	H	42.8	50.9	58.8	60.5
Bumper overhang (typical)	I	2.0	2.3	2.5	2.5
Offset	J	6.3	2.7	0.5	0.0
Setback	K	11.0	8.3	5.0	0.0
Cross aisle, one-way	L	14.0	14.0	14.0	14.0
Cross aisle, two-way	—	24.0	24.0	24.0	24.0

Notes:

1. *See Section 15-1.0 for criteria on the number and dimensions of parking spaces for disabled individuals.*

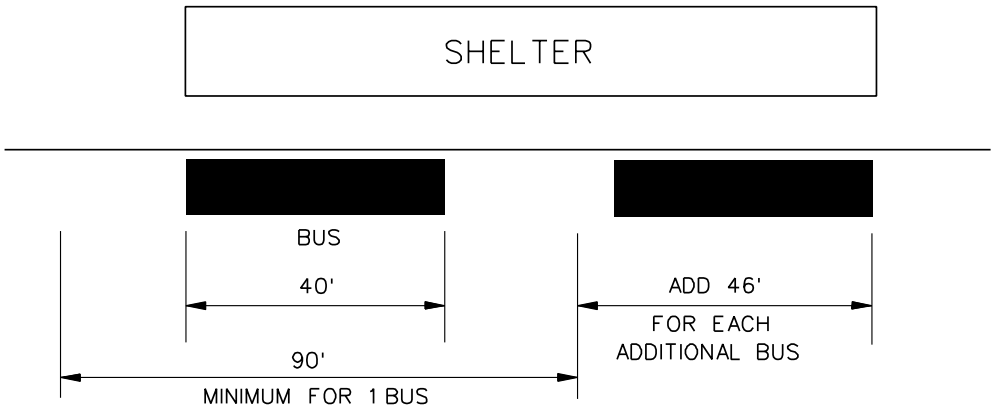
2. *If a special section is designated for subcompact vehicles, these stalls can be 8 ft x 15 ft for a 90° angle.*

3. *The designer should consider bumper overhang when placing lighting, railing, etc. Place these appurtenances beyond dimension "I" in the figure.*

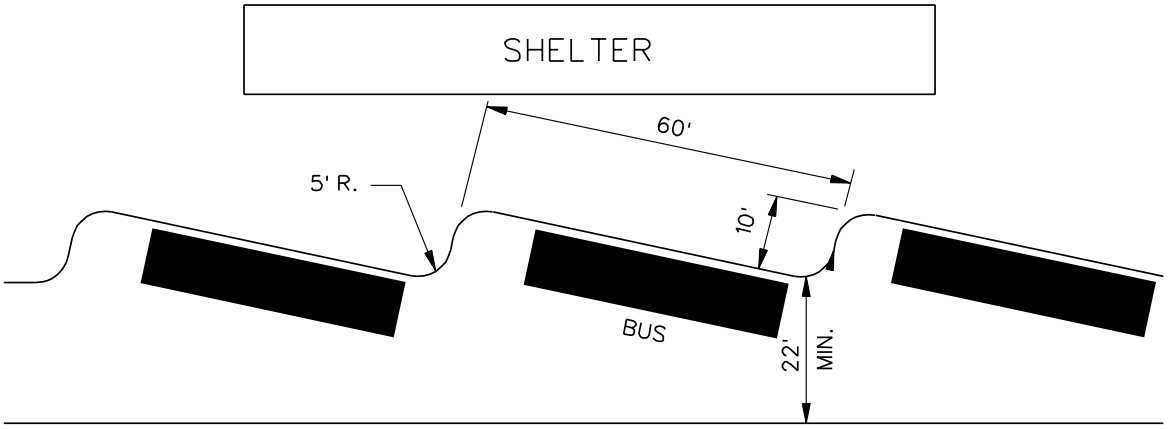
4. *Two-way traffic may only be used with a 90° parking angle.*

PARKING STALL DIMENSIONS

Figure 15-2A



PARALLEL PARKING



SHALLOW SAWTOOTH PARKING

RECOMMENDED LENGTHS FOR BUS-LOADING AREAS

Figure 15-2B

5. Cross Slope. To provide proper drainage, the minimum gradient on the commuter lot should be 1%. At a maximum, the gradient should not exceed 5%. If available, design the lot to direct the drainage runoff into existing drainage systems. If water impoundment cannot be avoided along pedestrian routes, bicycle routes and standing areas, provide drop inlets and underground drainage. In parking areas, design the drainage to avoid standing water. The detailed drainage design for the lot should be prepared using the Department's *Drainage Manual* to determine design frequency, pavement discharge and capacity of drainage inlets.

6. Pavement Design. A typical pavement design for a commuter lot is 2 to 3 in of bituminous concrete on 10 in of subbase. Where curbs are used within the lot, they will normally be the bituminous concrete lip curbing (BCLC) type.

7. Shelters. Where a loading area for buses or trains will be provided, include a shelter in the design. The shelter should provide approximately 5.0 ft^2 of covered area per person. At a minimum, the shelter should provide lighting, benches and trash receptacles. Other amenities may include routing information signs and a telephone. For disabled accessibility requirements, see Section 15-1.0.

8. Lighting. Light the commuter lot for pedestrian safety and lot security. Ensure provisions are considered for location of lighting supports and power lines. Coordinate the lighting design with the Division of Traffic Engineering. All interior light standards should be protected from bumper damage.

9. Traffic Control Devices. Provide signs and pavement markings to direct drivers and pedestrians to appropriate loading zones, parking areas, bicycle facilities, disabled parking and entrances and exits. Coordinate the use of traffic control devices with the Division of Traffic Engineering.

10. Fencing. Provide fencing around the entire lot according to field conditions.

11. Landscaping. In some locations, consider landscaping to minimize the visual impact of the commuter lot. This may include providing a buffer zone around the perimeter of the lot or improving the aesthetics of the lot itself. Desirably, include a 10 to 20 ft buffer zone around the lot to accommodate vegetation screens. Also, traffic islands and parking lot separators provide suitable locations for shrubs and trees. Section 15-5.0 discusses Department policies on landscaping. Specifically for commuter lots, landscaping should include low maintenance vegetation and vegetation which does not cause visibility problems.

12. Maintenance Considerations. To minimize maintenance, the design should include a 10-ft to 20-ft snow shelf around the perimeter of the lot, at least on two sides, to provide storage space for snow removal. This area can coincide with the buffer zone around the lot, provided that the entire area is not filled with shrubs or trees. Place any fencing outside the snow shelf. Also, keep raised traffic islands to a minimum; painted islands are preferred.

15-3.0 BUS STOPS AND TURNOUTS

15-3.01 Location

15-3.01.01 Bus Stops

If local bus routes are located on an urban or suburban highway, the designer should consider their impact on normal traffic operations. The stop-and-go pattern of local buses will disrupt traffic flow, but certain measures can minimize the disruption. The location of bus stops is particularly important. These are determined not only by convenience to patrons, but also by the design and operational characteristics of the highway and the roadside environment. If the bus must make a left-turn, for example, do not locate a bus stop in the block preceding the left turn.

Some considerations in selecting an appropriate bus-stop location are listed below:

1. Far-Side Stops. The far side of at-grade intersections is generally superior to near-side or mid-block bus stops. Far-side stops produce fewer impediments to through traffic and right-turning traffic; they do not interfere as much with corner sight distance; and they lend themselves better to bus turnouts.

2. Near-Side Stops. Near-side stops allow easier vehicle re-entry into the traffic stream where curb parking is allowed, and they can increase street capacity. At intersections where there is a high volume of right-turning vehicles, near-side stops can result in traffic conflicts and should be avoided. However, near-side stops must be used where the bus will make a right turn at the intersection.

3. Mid-Block Stops. Mid-block bus stops may be advantageous where the distance between intersections is large or where there is a fairly heavy and continuous transit demand throughout the block. They may be appropriate if a large traffic generator is located in mid-block. Mid-block bus stops may also be considered where right turns at an intersection are high (250 in peak hour) and far-side stops are not practical.

15-3.01.02 Bus Turnouts

Providing bus turnouts can reduce interference between buses and other traffic significantly. Turnouts remove stopped buses from the through lanes and provide a well-defined user area for bus stops. Consider turnouts under the following conditions:

1. The street provides arterial service with high-traffic speeds and volumes and high-volume bus patronage.

2. Right-of-way width is sufficient to prevent adverse impact on sidewalk pedestrian movements.

3. Curb parking is prohibited, at least during peak hours.

4. During peak-hour traffic, there are at least 500 vehicles per hour in the curb lane.

5. There are at least 100 buses per day and at least 10 to 15 buses during the peak hour.

6. The average bus dwell time generally exceeds 10 seconds per stop.

7. At locations where specially equipped buses are used to load and unload disabled individuals.

15-3.02 Design

15-3.02.01 Bus Stops

Figure 15-3A provides the recommended distances for the prohibition of on-street parking near bus stops. Where articulated buses are expected to use these stops, add an additional 20 ft to these distances. Provide an additional 50 ft of length for each additional bus expected to stop simultaneously at any given bus stop area. This allows for the length of the extra bus (i.e., 40 ft) plus 6 ft between buses.

15-3.02.02 Bus Turnouts

The following design criteria will apply:

1. The bus turnout should be 10 ft to 12 ft wide.

2. The full-width area of the turnout should be at least 50 ft long. Where articulated buses are expected, the turnout should be 70 ft. For a two-bus turnout, add 50 ft.

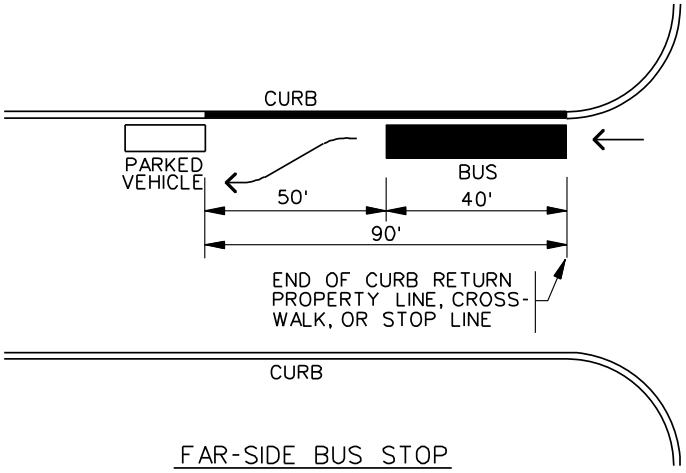
3. Figure 15-3B illustrates the design details for bus turnouts.

15-3.02.03 Bus Stop Pads

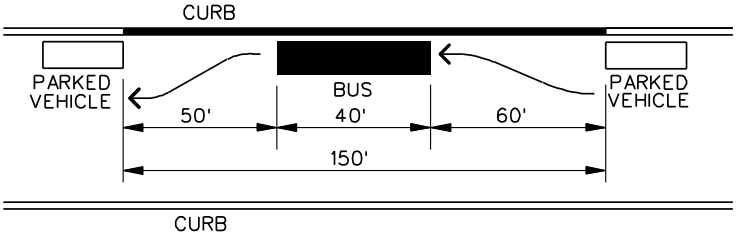
All new bus stops that are constructed for use with lifts or ramps must meet the disabled accessibility criteria set forth in Section 15-1.0.

15-3.02.04 Bus Shelters

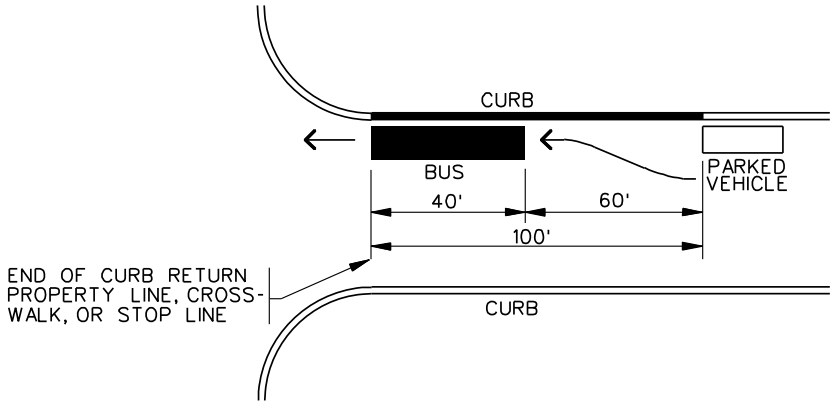
Provide shelters at all major bus stops (more than 100 boarding or transferring passengers per day). Also, provide shelters at stops that primarily serve the elderly and disabled individuals (e.g., retirement homes, hospitals). Benches are also desirable at these locations. The designer should consider the following in the design of bus shelters:



FAR-SIDE BUS STOP



MID-BLOCK BUS STOP

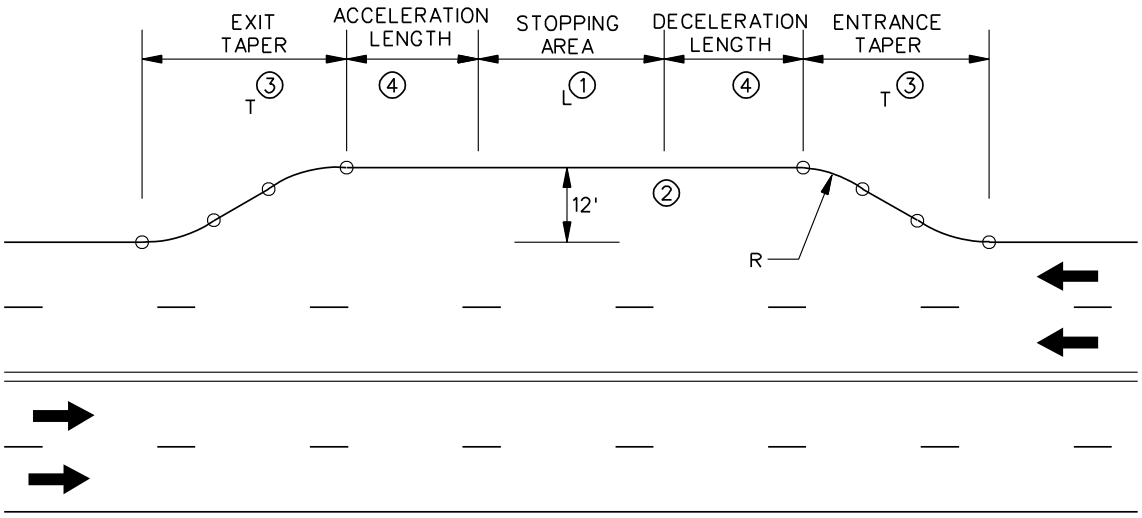


NEAR-SIDE BUS STOP

* Provide an additional 50 ft of length for each additional bus expected to stop simultaneously.

ON-STREET BUS STOPS

Figure 15-3A



Notes:

① *Stopping area length consists of 50 ft for each standard 40 ft bus and 70 ft for each 60 ft articulated bus expected to be at the stop simultaneously.*

② *Bus turnout width is desirably 12 ft. For posted speeds under 30 mph, a 10 ft minimum bay width is acceptable.*

③ *Suggested taper lengths are listed below. A minimum taper of 5:1 may be used for an entrance taper from an arterial street for a bus turnout while the merging or re-entry taper should not be sharper than 3:1. As an alternative, short horizontal curves (100-ft radius) may be used on the entry end and 50-ft to 100-ft curves on the re-entry end. Where a turnout is located at a far-side or near-side location, the cross street area can be assumed to fulfill the need for the exit or entry area, whichever applies.*

④ *The minimum design for a bus turnout does not include acceleration or deceleration lengths. Recommended acceleration and deceleration lengths are listed below.*

Design Speed	Entering Speed*	Acceleration Lengths	Deceleration Lengths **	Suggested Taper Lengths
US CUSTOMARY				
35 mph	25 mph	250 ft	185 ft	170 ft
40 mph	30 mph	400 ft	265 ft	190 ft
45 mph	35 mph	700 ft	360 ft	210 ft
50 mph	40 mph	975 ft	470 ft	230 ft

* *Desirably, the bus speed at the end of taper should be within 10 mph of the design speed of the traveled way.*

** *Based on a 2.5 mph/sec deceleration rate.*

BUS TURNOUT DESIGN

Figure 15-3B

1. Visibility. To enhance passenger safety, the shelter sides should provide the maximum transparency as practical. In addition, do not place shelters so that it limits the general public's view of the shelter interior.

2. Selection. Contact the local transit agency to determine if they use a standardized shelter design.

3. Appearance. Shelters should be pleasing and blend with their surroundings. Shelters should also be clearly identified with "bus logo" symbols to discourage non-patron use.

4. Disabled Accessibility. Design new bus shelters to meet the accessibility criteria presented in Section 15-1.0.

5. Placement. Do not place shelters where they will restrict vehicular sight distance, pedestrian flow or disabled accessibility. It should also be placed so that waste and debris are not allowed to accumulate around the shelter.

6. Responsibility. The local transit agency is responsible for providing and maintaining the shelter.

7. Capacity. The maximum shelter size is based upon the maximum expected passenger accumulation at a bus stop between bus runs. This determination should be coordinated with the Bureau of Public Transportation. The designer can assume approximately 5.0 ft^2 per person to determine the appropriate shelter size. See Section 15-1.0 for minimum disabled accessibility requirements.

15-4.0 BIKEWAYS

The majority of bicycling will take place on public roads with no dedicated space for bicyclists. Bicyclists can be expected to ride on almost all roadways. Sometimes they use sidewalks as joint bicycle and pedestrian facilities, unless such usage is prohibited by local ordinance. This Section primarily provides information on the development of new facilities to enhance and encourage safe bicycle travel.

15-4.01 Bikeway Classifications

The Department has adopted the nomenclature used by AASHTO for bikeway classifications. The following definitions will apply:

1. Bikeway. Any road, path or way which in some manner is specifically designated as being open to bicycle travel, regardless of whether such facilities are designated for the exclusive use of bicycles or are to be shared with other transportation modes.

2. Shared Roadway. Any roadway upon which a bicycle lane is not designated and which may be legally used by bicycles regardless of whether such facility is specifically designated as a bikeway.

3. Bicycle Path. A bikeway physically separated from motorized vehicular traffic by an open space or barrier and either within the highway right-of-way or within an independent right-of-way. Bicycle paths may assume different forms, as conditions warrant. They may be two-direction, multilane facilities or, where the path would parallel a roadway with limited right-of-way, a single lane on both sides of the road.

4. Bicycle Lane. A portion of a roadway that has been designated by striping, signing and pavement markings for the preferential or exclusive use of bicyclists. It is distinguished from the traveled way portion of the roadway by a physical or symbolic barrier. Bicycle lanes may also assume varying forms but may generally be included in one of the following categories:

    a. bicycle lane between parking lane and traveled way; or

    b. bicycle lane between roadway edge and traveled way, where parking is prohibited.

15-4.02 Warrants

Each type of facility has its own merits and disadvantages. Care must be exercised in choosing the appropriate type of facility for a given situation. Each route is unique and must be judged on its individual conditions. The *Connecticut Statewide Bicycle and Pedestrian Transportation Plan* and AASHTO *Guide for the Development of Bicycle Facilities* provide additional guidance on the selection of bikeways.

15-4.03 Bikeway Design Elements

For design details of bicycle facilities, the designer is referred to the Connecticut Statewide Bicycle and Pedestrian Transportation Plan and the AASHTO *Guide for the Development of Bicycle Facilities*.

15-5.0 LANDSCAPING

Roadside landscaping can greatly enhance the aesthetic value of a highway. Consider landscaping treatments early in the project development so that they can be easily and inexpensively incorporated into the project design. Landscaping will be considered on a project-by-project assessment. The designer should also reference the AASHTO *A Guide for Transportation Landscape and Environmental Design* for more information on landscaping. The Department's landscaping staff within the Office of Engineering will determine the proper landscaping treatment for each project.

15-5.01 General Benefits

Roadside landscaping can be designed advantageously to yield several benefits. The most important objective is to fit the highway naturally into the existing terrain. Retain the existing landscape to the maximum extent practical. Following is a brief discussion of the benefits of proper landscaping:

1. Aesthetics. Gentle slopes, mountains, parks, bodies of water, and vegetation have an obvious aesthetic appeal to the highway user. Landscaping techniques can be used effectively to enhance the view from the highway. The designer should reference the FHWA publication *Visual Impact Assessment for Highway Projects* for more information.

   In rural areas, the landscaping should be natural and eliminate construction scars. The planting shape and spacing should be irregular to avoid a cosmetic appearance.

   In urban areas, the smaller details of the landscape predominate and plantings become more formal. The interaction between the occupants of slow-moving vehicles and pedestrians with the landscape determines the scale of the aesthetic details. In some cases, the designer may be able to provide walking areas, small parks, etc. Landscaping should be pleasant, neat, sometimes ornamental and require low maintenance.

2. Erosion. Landscaping and erosion control are interrelated. Flat and rounded slopes and vegetation serve to both prevent erosion and provide aesthetic value.

3. Screening. Landscaping can be used to effectively screen headlight glare and unsightly roadside views. It also can be used as a buffer for existing residences.

4. Maintenance. Landscaping decisions will greatly affect roadside maintenance. Maintenance activities for mowing, fertilizing and using herbicides should be considered when designing the roadside landscape.

5. Safety. The effects on roadside safety should be reflected in the landscape treatment; see Chapter Thirteen. Flat, rounded slopes are both safer and more aesthetic. Unless protected by guiderail, plant major trees outside of the clear zone; see Section 13-2.0. Shrubs and minor trees may be planted closer to the traveled way where traffic

delineation will be required. Landscaping should not be placed in ramp gore areas, near intersections or turnouts that would restrict sight distances.

15-5.02 Landscaping Policies

15-5.02.01 Planting Policy

All projects which include planting must have a special provision which requires the contractor to be responsible for a plant establishment period of one growing season. The time begins after all plant materials in the contract have been planted.

15-5.02.02 Protection of Existing Vegetation

The Department's general policy is that, wherever practical, trees and other landscaping features will not be removed on highway projects. This objective, however, must be compatible with other considerations (e.g., roadside safety, geometric design, utilities, terrain, public acceptance, economics). The Department has placed a special emphasis on saving valuable shade trees, wherever practical. The plans should clearly designate all shade trees that will be saved.

15-5.02.03 Turf Establishment, Topsoil and Sodding

In areas disturbed by construction work, the designer must ensure that the turf is reestablished. Turf establishment refers to the reseeding of disturbed areas. The designer should use the guidance in the following comments to determine the appropriate turf establishment, depending upon individual site conditions. In addition, the turf placement must reflect the requirements of the Department's *Standard Specifications for Roads, Bridges and Incidental Construction*.

1. Topsoil. Place topsoil to a depth of 6 in at all designated locations. The following topsoil requirements apply to the indicated location:

    a. Freeways. Place topsoil on all fill slopes 1:5 and flatter to a width not to exceed 20 ft from the edge of shoulder. Where abutting properties are subject to intensive mowing or in other special cases, include topsoil for all areas disturbed by construction.

    b. All Other Highways. Topsoil should normally not be required at locations involving abutting undeveloped properties. In areas where sodding is required, include topsoil in accordance with the Department's specifications.

    c. Medians. In general, median areas should be topsoiled to a width not to exceed 20 ft from the edge of shoulders on both sides. Where the width remaining is 20 ft or less, include topsoil for the entire median.

d. Gore Areas. Place topsoil from the end of the gore area pavement (10 ft width) at the bifurcation for a distance not to exceed 75 ft parallel to the highway for the full width between the roadways.

e. Bridge Abutments. For structures crossing roadways, place topsoil on the approach slopes for a distance not to exceed 50 ft. This coverage is to extend from the top of slope to the toe of slope.

f. Other Locations. Place topsoil at any other special locations, especially in interchange areas as designated by qualified personnel.

2. Planting of Grass. Lime, seed, fertilize and mulch all areas disturbed by construction, except exposed rock surfaces and areas to be sodded, regardless of the presence or absence of topsoil. Estimate the amount of fertilizing, seeding, mulching and liming for such areas. Estimate liming at the rate of one ton per acre.

3. Sodding. Where developed properties and/or areas of intensive mowing abut the highway project (e.g., lawns of residences, hospitals, public parks), sod all adjacent areas disturbed by construction in accordance with the Department's specifications.

In addition to the above guidance for turf establishment, the designer must ensure that the project plans and quantity estimates adhere to certain criteria. The designer will determine the type of turf establishment and the areas within the construction limits that will be treated. These must be designated on the project plans. On this basis, the Office of Engineering, either by its own forces or with consulting engineers, will compute the quantities and prepare the necessary plans, special provisions and estimates for inclusion in the construction plans. In addition, the following will apply:

1. Project Plans. The requirements of turf establishment should be indicated on the plans according to the size of the project. On minor projects, these requirements generally should be reported on the detailed estimate sheet by stations. On larger projects that require Index Plans, indicate the turf establishment on these sheets where this information will not seriously conflict with the data normally reported thereon. Otherwise, prepare supplemental Index Plan sheets showing turfing requirements and include them in the contract drawings.

2. Quantity Estimates. Before preparing quantity estimates, the designer should schedule a review of the proposed turf establishment requirements with the qualified personnel in the Office of Engineering. When estimating quantities of work for turf establishment, add 10 ft to the measured length of slope to minimize the possibility of overruns. Do not indicate this additional slope length on the plans. When estimating topsoil and sodding quantities, use the measured length of the cross section and not the projected length from the plan sheets.

15-6.0 FENCING

Fencing should be provided along high-speed highways to protect the driver from unexpected intrusions from outside of the right-of-way line. Fencing prevents unauthorized and unsafe entry to the highway by vehicles, pedestrians or animals. It also prevents objects from being dropped or thrown from highway overpasses.

Except where warranted for highway reasons, fencing is normally the responsibility of the abutting property owner. They may be necessary for retaining livestock, discouraging trespassing, defining property boundaries, or otherwise to keep land use activities within bounds. If private fences are impacted by a highway project, their relocation or disposition is usually reconciled as part of the property agreement.

15-6.01 General Warrants and Location

In general, the following will apply:

1. Warrants. Fencing is warranted to:

   a. keep animals off the highway,

   b. keep children or pedestrians off the highway,

   c. protect children and pedestrians from a precipitous slope or drop off,

   d. prevent vehicles and people from entering or leaving the highway at unauthorized places, and

   e. prevent stones or other objects from being dropped or thrown from highway overpasses onto vehicles passing underneath.

2. Location. Fencing is typically provided along access-controlled facilities; near schools, playgrounds and parks; near livestock areas; on some bridges; and between frontage roads and the highway mainline. Fencing is usually erected parallel to the highway centerline. Where taking lines are irregular, the fencing should still be basically parallel to the highway, provided the fencing is within the highway right-of-way. The fence line should be reasonably close to the right-of-way line; however, deviations are acceptable where existing obstructions (e.g., hedges) would have to be destroyed.

   Occasionally, the fence line will intersect a stream. The fencing may cross the stream without deviation, or it may be angled in and terminated at the bridge abutment or culvert wing wall. The treatment will vary according to the size of the stream.

15-6.02 Freeways

The following will apply to fencing along freeways:

1. Warrants. Provide continuous fencing on either the right-of-way or access-control line. However, engineering judgment should dictate exceptions. In addition, where a noise barrier exists, fencing may not be required to effectively preserve access control.

2. Location. Construct controlled-access fencing on State right-of-way with the face of the fencing toward the abutting property. It will be maintained by the State, delineated on contract plans and determined in the overall development of the design.

3. Type. The following will apply:

   a. Chain link fence is generally used on freeways; see the *Connecticut Standard Drawings*. Use 6-ft high chain link fence in areas having a high concentration of children (e.g., schools, churches, playgrounds). Use 5-ft high chain link fence in areas adjacent to housing developments, single-family homes, parks, reservoirs, commercial and industrial properties, etc. During design and construction, the designer must consider impending development of this type adjacent to the highway, and chain link fence of the appropriate height may be installed to preclude replacement a short time later. In rural areas where little development is planned, wire fencing on steel posts may be used.

   b. Normally, a coil spring tension wire is used at the top of a chain link fence. However, in areas where the fence will be subject to abuse and where there is little likelihood that it will be struck by a vehicle, a top rail may be used to provide rigidity to the installation.

   c. Provide gates with locks, where required, to allow access by maintenance forces.

4. Payments. Fencing payments (for fencing along the right-of-way boundary) will not be made in right-of-way settlements. The Office of Right of Way will note on property agreements that fencing will be installed by the State wherever delineated on the plans.

15-6.03 Unlimited Access Highways

The following will apply to fencing along unlimited access highways:

1. Location. Posts will be on the land of the abutting owner, and the face of the fencing is usually on the highway line. If by agreement with the property owner, the face of the fence may be on the other side of post. For stone walls, the face will be on the highway line, and the wall on the land of the abutting owner. The abutting owner is responsible for maintenance of all fences on unlimited access highways. The designer will include an unassigned length in the contract estimate.

2. Type. Fencing may be:

   a. wire fencing on wood posts (steel posts as required for ledge),
   b. stone wall or farm wall fencing, or
   c. chain link fence.

Fencing locations and types will be determined by agreement between the property owner and Department.

15-6.04 Fencing and Railings on Highway Structures

15-6.04.01 General

A railing is required on all parapets less than 42 in in height. The railing will be a pedestrian railing, bicycle railing or protective fence. In addition to the following Sections, Section 12 of the *Bridge Design Manual* contains additional information on railing and fencing of highway overpasses.

Protective fencing should satisfy the aesthetic consideration of the structure and should be designed in conformance with the latest Department criteria for fencing. From a maintenance perspective, vinyl-coated chain-link fabric should be used on most bridges. Anodized aluminum fences should only be used with written approval. If protective fencing is provided, pedestrian and bicycle railings do not need to be provided.

15-6.04.02 Highway Overpasses with Sidewalks

The following will apply for highway overpasses with one or more sidewalks:

1. Protective Fencing. Protective fencing is required on both parapets. The height of the fencing above the top of the parapet will be a minimum of 60 in. The maximum size opening in the fence will be determined by the designer and will be approved by the Department. Also, the designer should investigate the need for a curved top fence.

2. Pedestrian Railing. A pedestrian railing is not required.

3. Bicycle Railing. A bicycle railing is not required.

15-6.04.03 Highway Overpasses without Sidewalks

The following will apply for highway overpasses without sidewalks:

1. Protective Fencing. Protective fencing is required on highway overpasses without sidewalks, which carry local or secondary roads over a limited access highway.

2. Pedestrian Railing. A pedestrian railing is required on both parapets for parapets less than 42 in high, unless protective fencing is provided.

3. Bicycle Railing. A bicycle railing is required on designated bicycle routes, unless protective fencing is provided.

15-6.04.04 Stream and Wetland Overpasses

The following apply to stream and wetland overpasses with or without sidewalks:

1. Protective Fencing. In general, fencing is not required on highway overpasses without sidewalks, except where unusual conditions are present which affect public safety below.

2. Pedestrian Railing. A pedestrian railing is required on both parapets for parapets less than 42 in high.

3. Bicycle Railing. A bicycle railing is required on designated bicycle routes.

15-6.04.05 Railroad Overpasses

The following will apply to all railroad overpasses:

1. Protective Fencing. Protective fencing is generally required on both parapets on the span over the railroad tracks. On long structures, protective fencing is required over the tracks plus a minimum of 25 ft beyond the outside of track, measured perpendicular to the track.

   The following criteria pertain to the height of the protective fence above the top of the parapet and the maximum size of opening:

Location	Height (in)	Maximum Size Opening
Non-Electrified Zone	60 (min.)	0.5 in or as approved by the Department
Electrified Zone	60 (min.)*	Solid Barrier Required

   * *Use an 84-in high protective fence with a curved top at all sidewalks.*

2. Pedestrian Railing. A pedestrian railing is not required where a protective fence is provided. However on long structures, provide pedestrian railing on both parapets outside the limits for protective fencing as defined in Comment #1.

3. Bicycle Railing. A bicycle railing is not required where a protective fence is provided. However on long structures, provide bicycle railing outside the limits for protective fencing as defined in Comment #1 on designated bicycle routes.

15-6.04.06 Pedestrian Overpasses

Provide complete enclosures for pedestrian structures crossing over highways and railroads. The need for protective fencing on pedestrian structures at streams or woodland crossings will be determined on a case-by-case basis.

15-6.04.07 Walls

The following will apply to fencing and railing on structures other than overpasses:

1. U-Type Wingwalls. The warrants for pedestrian railing, bicycle railing or protective fencing on U-type wingwalls are the same as for overpasses.

2. Retaining Walls Adjacent to Traffic. A pedestrian railing is generally required for retaining walls with parapets less than 42 in high and adjacent to traffic. Retaining walls along a sidewalk generally will follow the requirements of Section 15-6.04.02.

3. Retaining Walls not Adjacent to Traffic. A pedestrian railing or protective fencing is generally required for walls that are not adjacent to traffic or for a sidewalk where the vertical drop off is greater than 60 in.

4. Concrete Barrier Walls. Pedestrian railing, bicycle railing and protective fencing are generally not required on concrete barrier walls.

15-6.04.08 Railing and Fencing at Lighting and Signing Standards

Where lighting and signing standards are located on structures, the railing or fencing will be continuous at these locations. Locate the lighting and signing standards outside of the continuous railing or fence. Design the protective fencing with removable panels or other means to provide access to the handhole locations. Where practical, do not locate lighting and signing standards on a span over a railroad-electrified zone.

15-6.05 Fencing Delineation on Contract Plans

Delineate all fencing requirements on contract plans. Show station references where needed for clarity. Where a fence is erected or replaced between a State highway and agricultural property, payment will be according to the provisions of the *Connecticut General Statutes*, Section 47-46 of Title 47, Chapter 823.

15-7.0 NOISE BARRIER IMPACTS

Noise barriers are erected to reduce the environmental impact on areas adjacent to a highway. They are designed to reduce the noise level of traffic adjacent to existing buildings to an acceptable level as determined by Federal guidelines. The Office of Planning is responsible for selection, location and design as related to the environment. However, the Office of Engineering must evaluate the impacts of the noise barrier on the highway design. This Section discusses those impacts.

15-7.01 Roadside Safety

Section 13-2.0 provides the Department's design criteria for clear zones. If practical, noise barrier walls should be placed outside of the applicable clear zone value. Otherwise, guiderail should be considered to shield the wall from run-off-the-road vehicles. The designer must ensure that adequate deflection distance is available between the guiderail and noise barrier. Chapter Thirteen discusses the design of guiderail in detail.

If the noise barrier is a mound of dirt, the toe of the barrier should be traversable by a run-off-the-road vehicle.

15-7.02 Sight Distance

For at-grade intersections, noise barriers should not be located in the triangle required for corner sight distance. Section 11-2.0 provides the criteria to determine the required sight distance triangle.

Noise barriers can also impact sight distance along horizontal curves. Section 8-2.04 provides the detailed criteria to determine the middle ordinate value that will yield the necessary sight distance. The location of the noise barrier must be outside of this value.

15-7.03 Right-of-Way

The noise barrier must be located within the highway right-of-way.

15-7.04 Interference with Roadside Appurtenances

A noise barrier may be constructed on a new or on an existing highway. Its proposed location could interfere with proposed or existing roadside features, including signs, sign supports, utilities and illumination facilities. The designer must determine if these features are impacted by the noise barrier and must coordinate with the applicable Department units to resolve any conflicts.

15-7.05 Additional Design Criteria

In addition to the criteria in the previous Sections, the designer should also consider the following:

1. Standard Drawings. The *Connecticut Standard Drawings* provide additional details on noise walls used by the Department.

2. Plans. All approved noise wall options will be included in the plans, unless there is a specific noise design criteria that would suggest one design over another.

3. Bridges. Bridge designs will not include masonry walls, or other walls with similar weight or attachment problems, which would result in additional structural loading problems.

4. Transitions. The Contractor will be responsible for any transition details that are necessary to properly interface a structural noise wall with a ground-mounted wall of a different type, subject to the approval of the Engineer.

5. Earth Berms. Where field conditions and right-of-way permit, earth berms will be the primary design for noise barriers.

6. Wood Walls. The designer will design the structure mounted noise barrier walls, which will include all of the wood noise barrier walls in the *Connecticut Standard Drawings*. For other than the wood noise barrier walls, the designer will invite the manufacturer to design the wall for each structure, unless the manufacturer has requested the Department not to have its wall included in structure designs.

7. Design Criteria. The designer will be responsible for obtaining the latest criteria for noise barrier walls immediately before submitting the project for processing. This will ensure that all of the latest criteria will be included. Where a structure is involved, the structural designer will obtain the latest criteria for noise barrier walls immediately before designing the structure to ensure that the structure is designed to accommodate all of the suitable types of walls. The structural designer is also responsible for all modifications to the design of the applicable standard walls which may be required to ensure their suitability for use as a structure mounted noise barrier wall and for the connection of the wall to the structure.

15-8.0 ILLUMINATION (CUTOFF LIGHTING)

For roadway illumination on State primary highways, the lighting shall be designed utilizing fixtures that are classified as “full cutoff” type. The use of “full cutoff” light fixtures will not be required if an engineering study is conducted and determines that highway safety will be compromised, the cost of the lighting installation or operation will be substantially increased, or that its use will violate any applicable Federal laws.

15-9.0 REFERENCES

1. *Accessibility Guidelines for Building and Facilities*, U.S. Architectural and Transportation Barriers Compliance Board, 1991, 1994.

2. FHWA-IP-84-6, *Guidelines for Making Pedestrian Crossing Structures Accessible*, August, 1984.

3. *A Policy on Geometric Design of Highways and Streets*, AASHTO, 2001.

4. *Guide for the Design of Park-and-Ride Facilities*, AASHTO, 1992.

5. *Traffic Engineering Handbook*, Institute of Transportation Engineers, 1999.

6. *The Location and Design of Bus Transfer Facilities*, Institute of Transportation Engineers, 1992.

7. *Guidelines for the Location and Design of Bus Stops*, TCRP Report 19, Transportation Research Board, 1996.

8. *Guide for the Development of Bicycle Facilities*, AASHTO, 1999.

9. *Visual Impact Assessment for Highway Projects*, FHWA, 1981.

10. *A Guide for Transportation Landscape and Environmental Design*, AASHTO, 1991.

11. *An Informational Guide on Fencing Controlled Access Highways*, AASHTO, 1990.