Chapter 15

COLLECTOR ROADS AND STREETS

SOUTH CAROLINA ROADWAY DESIGN MANUAL

February 2021

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Chapter 15
COLLECTOR ROADS AND STREETS

This chapter discusses the minimum criteria used in the design of collector roads and streets. Information that is also applicable to the design of collector roads and streets is included in the following chapters:

- Chapter 3 “Basic Design Controls,” Chapter 4 “Sight Distance,” Chapter 5 “Horizontal Alignment,” Chapter 6 “Vertical Alignment” and Chapter 7 “Cross Section Elements” provide guidance on geometric design elements.

- Chapter 9 “Intersections” provides information on the design of intersections, including intersection alignment, left- and right-turn lanes and channelization.

15.1 FUNCTIONAL CLASSIFICATION

Collector routes are characterized by a roughly even distribution of their access and mobility functions. Traffic volumes and speeds will typically be somewhat lower than those of arterials. Access to properties is normally allowed on collector roads. Section 3.4.1 provides guidance on functional classifications.

The function of rural collector roads is to serve intracounty travel needs and collect traffic flow from the rural local roads to the rural arterials and to distribute traffic flow from arterials back to the local roads. In rural areas, the collectors provide the following functions:

- provide access to adjacent land uses;

- carry traffic into areas with sparse development;

- serve larger towns and significant traffic generators (e.g., shipping ports, mining areas) that are not served by an arterial or freeway;

- spaced at intervals consistent with the traffic population density to accumulate traffic from local roads;

- provide service to smaller communities; and

- link locally important traffic generators with higher classified routes.

In urban areas, collector streets serve as intermediate links between the arterial system and points of origin and destination. Urban collectors typically have the following characteristics:

- provide both access and traffic circulation within residential neighborhoods and commercial/industrial areas;

- may penetrate residential neighborhoods or commercial/industrial areas to collect and distribute trips to and from the arterial system;

- in the Central Business District (CBD), may include the streets that are not classified as arterials;
- in fully developed areas, spacing generally is approximately ½ mile between routes and, within the CBD, between 650 feet and ½ mile;
- may be an urban extension of rural collector roads; and
- often include local bus routes.

To determine the functional classification of a facility, the designer should contact Road Data Services.

15.2 DESIGN ELEMENTS

15.2.1 Traffic Volumes

Traffic volumes are a major consideration in justifying highway facilities and assisting designers in the establishment of geometric and cross section design characteristics. The designer should use the design year traffic volumes to determine the design criteria for collector roads and streets.

For urban streets, traffic volumes and characteristics usually dominate vehicular traffic demands. In addition, the designer must also consider pedestrians, bicyclists and transit service. For urban streets, the designer should determine the annual average daily traffic (AADT), peak-hour traffic, peak-hour factor, directional distribution, traffic composition and projection of future traffic demands for all modes of travel. The designer should review the *Highway Capacity Manual* for guidance on making these determinations.

15.2.2 Level of Service

Design the highway mainline and intersections to accommodate the selected design hourly volume (DHV) at the selected level of service (LOS). This may involve adjusting the various highway factors that affect capacity until the design will accommodate the DHV. Further discussion on the LOS design concept is included in Section 3.6.4. Detailed calculations, factors and methodologies are presented in the *Highway Capacity Manual*.

15.2.3 Design Speed

The design speed establishes the range of design values for many of the geometric elements of the highway (e.g., sight distance, horizontal alignment, vertical alignment). The selected design speed should be high enough so that an appropriate regulatory speed limit will be less than or equal to it. Desirably, the speed at which drivers are operating comfortably will be close to the posted speed limit. See Section 3.5.2 and the FHWA publication *Mitigation Strategies for Design Exceptions* for additional guidance on the selection of design speeds.

Design speeds for rural collectors are based on terrain, traffic volumes, driver expectancy and alignment, and may range from 30 to 60 miles per hour. Urban design speeds for collectors can range from 30 to 45 miles per hour, depending on available right of way, terrain, adjacent development, likely pedestrian presence and other site controls. Design speeds in CBDs are generally 30 miles per hour or less, while higher speeds are more applicable to outlying suburban and developing areas.

The geometric design tables in Section 15.3 provide the applicable design speeds for collector roads and streets.

15.2.4 Sight Distances

See Chapter 4 “Sight Distance” for guidance on stopping, decision, passing and intersection sight distances.

15.2.5 Alignment

The horizontal and vertical alignment should complement each other and should be considered in combination to achieve appropriate safety, capacity and appearance for the type of improvement proposed. Proper combinations of curvature, tangents, grades, variable median widths and separate roadway elevations all combine to enhance safety and aesthetics of collectors. When designing the horizontal and vertical alignments, the designer should consider the following:

1. Horizontal Alignment. Note the following:

   a. Rural Collectors. The designer should provide the most favorable alignment practical for rural collectors. The following guidelines should be applied when laying out the horizontal alignment:

      - Only use minimum radii where it is necessary due to restricted conditions.
      - Avoid abrupt changes in alignment.
      - Avoid alignments that require superelevation transitions on bridges, bridge approach slabs or at intersections.

   b. Low-Speed Urban Collectors. Where superelevation is required on low-speed urban streets ($V_d \leq 45$ mph), the design should use AASHTO Method 2 in determining the design superelevation. See Chapter 5 “Horizontal Alignment” for minimum radii and superelevation rates for low-speed urban streets.

2. Vertical Alignment. Even though the profile may satisfy all design controls, the use of minimum criteria may appear forced and angular. Therefore, the designer should use higher values to produce a smoother, more aesthetically pleasing alignment. Note that flat vertical curves may produce flat areas that may cause drainage problems. For further guidance, see Chapter 6 “Vertical Alignment.”

3. Horizontal and Vertical Combinations. Consider the relationship between horizontal and vertical alignments simultaneously to obtain a desirable condition. Section 6.2.2 discusses this relationship in detail and its effect on aesthetics and safety.

4. Minimum Grades. Desirably, the longitudinal grade should be 0.5 percent or greater. For curbed facilities and bridges, it is necessary to provide a minimum longitudinal grade of 0.3 percent to facilitate drainage. For curbed sections, ensure curb profiles provide positive drainage. For uncurbed facilities, a minimum longitudinal grade of 0.0 percent may be considered if adequate cross slopes are provided. Ensure superelevation transitions are not developed in areas with 0.0 percent grade. Special ditch grades may be necessary to ensure proper drainage.

5. Climbing Lanes. Section 6.4 discusses the warrants and design criteria for climbing lanes.

15.2.6 Cross Section Elements

The following sections summarize the cross section criteria for collectors. For additional information concerning cross sections, the designer should review Chapter 7 “Cross Section Elements.”

15.2.6.1 Typical Sections

The following figures present typical sections for collector roads and streets:

- Figure 15.2-A – Typical Rural Two-Lane Collector
- Figure 15.2-B – Typical Urban Five-Lane Collector (TWLTL) with Shoulders
- Figure 15.2-C – Typical Urban Two-Lane Collector (Curb and Gutter and Bike Lanes)

15.2.6.2 Travel Lane and Shoulder Widths

Travel lane widths on rural collectors should be 11 to 12 feet. For rural collectors where the ADT is less than 250 vehicles per day and where the design speed is 40 miles per hour or less, the designer may consider a 10-foot travel lane. Travel lane widths for urban collectors should be 12 feet; however, travel lane widths in CBDs may be 11 feet if the truck traffic is less than or equal to 5 percent.

Provide a 6-foot shoulder where the ADT is 2000 vehicles per day or less and an 8-foot shoulder for facilities with greater ADTs. The shoulder width includes a minimum paved width of 2 feet. Where bicycles are to be accommodated on the shoulder, the designer should provide a minimum paved shoulder width of 4 feet. In constrained urban areas with curb and gutter and low speeds, the shoulder width may be just the 2-foot curb and gutter width. On high-speed facilities with curb and gutter sections, provide an 8-foot shoulder.

15.2.6.3 Cross Slopes

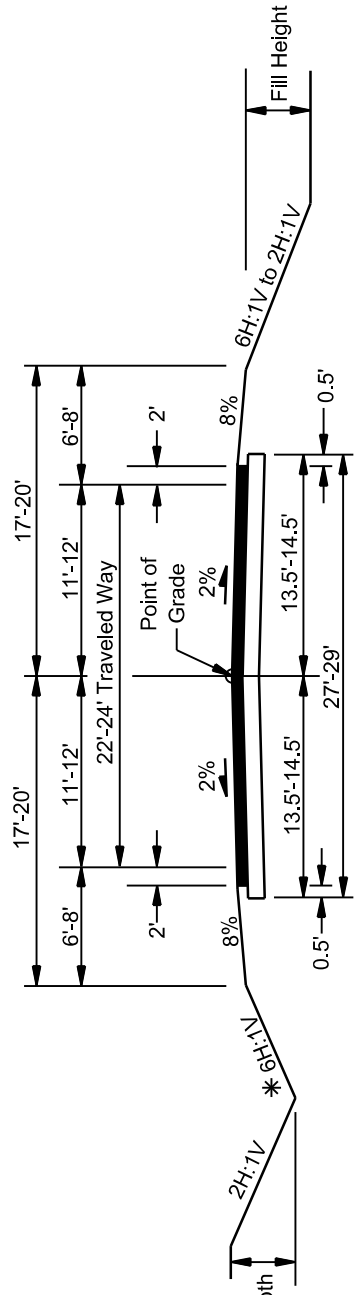
Use a cross slope of 2.00 percent for up to two lanes plus one half the width of the flush median or TWLTL. Travel lanes beyond the second lane on one side of the crown should have a cross slope of 2.50 percent. Crown the pavement at the center of the TWLTL and use a cross slope of 2.00 percent away from the centerline for all lanes on three- and five-lane highways. For a seven-lane section, use a cross slope of 2.50 percent for the outside lanes. If a roadway profile grade is less than 2.00 percent, the designer may consider using a cross slope of 2.50 percent for the outside lane to improve drainage. See Section 7.2.3.3.

For paved shoulders greater than 4 feet, provide a shoulder cross slope of 4.00 percent. For paved shoulders less than or equal to 4 feet, the cross slope should match the adjacent travel lane slope. For earth shoulders, provide a shoulder cross slope of 8.00 percent.

For cross slopes on bridges, see the *SCDOT Bridge Design Manual*.

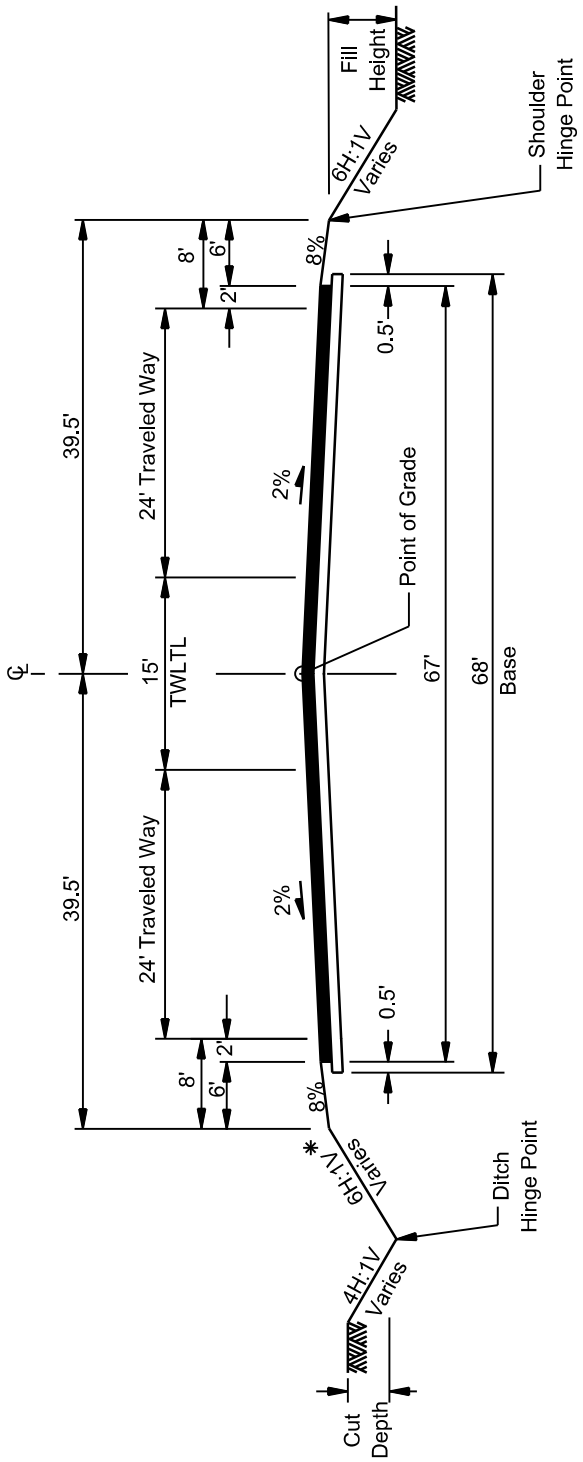
15.2.6.4 Auxiliary Lanes

Auxiliary lanes (e.g., passing lanes, parking lanes, turn lanes) are lanes beyond the through travel lanes intended for use by vehicular traffic for specific functions. Desirably, auxiliary lanes will have the same width and cross slope as the adjacent through lanes, although in many cases a lesser width may be appropriate. The geometric design tables in Section 15.3 present lane and shoulder widths for auxiliary lanes.



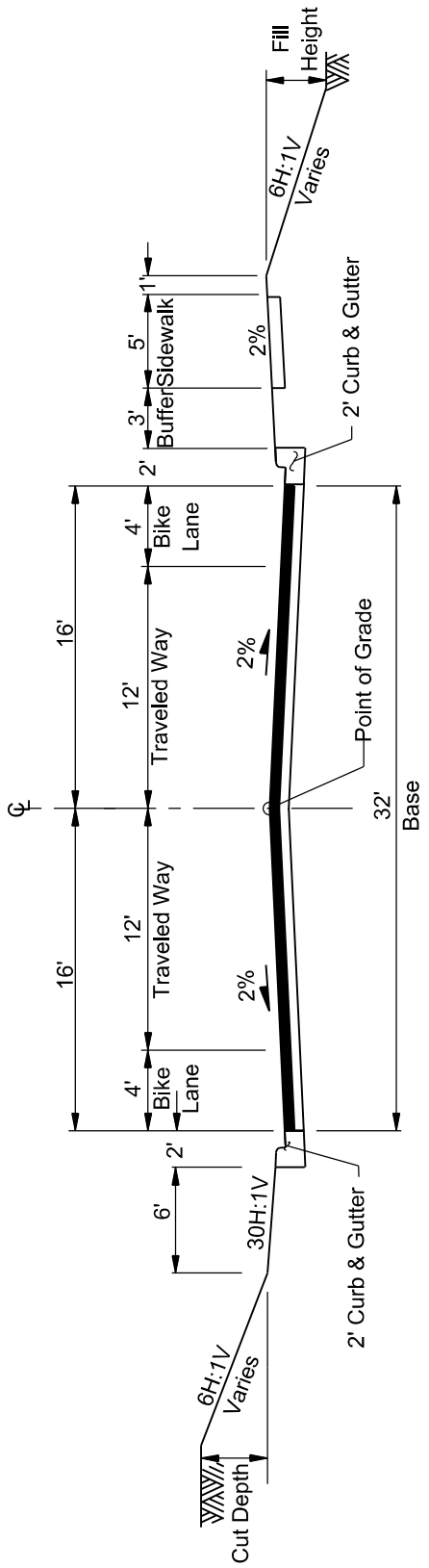
*This slope may vary between a minimum slope of 12.5H:1V to a maximum slope of 4H:1V. Where a deeper ditch than provided by a 4H:1V slope is necessary for drainage purposes, continue the 4H:1V slope until the necessary depth has been obtained. This will place the ditch further from the roadway. Provide a separate profile for special ditch grades.

TYPICAL RURAL TWO-LANE COLLECTOR
Figure 15.2-A



*This slope may vary between a minimum slope of 12.5H:1V to a maximum slope of 4H:1V. Where a deeper ditch than provided by a 4H:1V slope is necessary for drainage purposes, continue the 4H:1V slope until the necessary depth has been obtained. This will place the ditch further from the roadway. Provide a separate profile for special ditch grades.

TYPICAL URBAN FIVE-LANE COLLECTOR (TWLTL) WITH SHOULDERS
Figure 15.2-B



TYPICAL URBAN TWO-LANE COLLECTOR
(Curb and Gutter and Bike Lanes)
Figure 15.2-C

15.2.6.5 Bicycle Accommodations

For accommodation of bicyclists, the designer should review the guidance provided in Section 13.2. Where accommodations for bicycles are warranted, the designer should provide a minimum 4-foot paved shoulder (beyond the rumble strips/stripes) or a minimum 4-foot bike lane.

15.2.6.6 Medians

A median may be considered on an urban collector. The principal functions of a median are to provide separation from opposing traffic, manage access, accommodate turning movements, provide a pedestrian refuge and to allow additional width for future lanes. Medians on urban collectors may be one of the following median types:

1. Flush Medians Flush medians provide an area for left-turn movements and permit direct access to adjoining properties. This allows for numerous unrestricted conflict points. The flush median may serve as refuge for disabled vehicles and as a temporary lane for emergency vehicles. The two-way, left-turn lane (TWLTL) is considered a type of flush median. Desirably, the roadway cross section with a flush median will allow development of a TWLTL, if applicable.

2. Raised Medians Raised medians restrict left-turn movements to select locations, which allows for better access management. This median may provide a refuge area for pedestrians and an open space for aesthetic considerations.

For guidance on medians and TWLTL, see Chapter 7 “Cross Section Elements.”

15.2.6.7 Right of Way

Providing right-of-way widths that accommodate construction, drainage and proper maintenance of a collector is an important part of the overall design. Wider right of way allows for gentler side slopes, which results in reduced crash severity potential and easier maintenance operations. Right of way is typically configured to accommodate all proposed cross section elements throughout the project (e.g., travel lanes, shoulders, medians, parking lanes, bike lanes, sidewalks, ditches, outer slopes). If a long-range plan identifies a future widening, give consideration to accommodate a future proposed cross section. A uniform right-of-way width is preferred; however, do not base the width on the critical point of the project. A critical point may occur where the side slopes extend beyond the normal right of way, for clear areas at the bottom of traversable slopes, for wider clear areas on the outside of curves, where greater sight distance is desirable, at intersections and junctions with other roads, at railroad-roadway grade crossings, for environmental considerations and for maintenance access.

15.2.7 Alternatives to Widening Two-Lane Facilities

For rural two-lane collectors that are not candidates for widening to a four-lane or five-lane facility, but are experiencing operational and safety problems or site-specific reductions in the level of service, the designer should consider the guidance provided in Section 16.2.7 for possible improvements.

15.2.8 Roadside Safety

The designer should provide adequate horizontal clearance between the traveled way and roadside obstructions on collectors. The designer should provide roadside clear zones as discussed in the AASHTO *Roadside Design Guide*.

15.3 TABLES OF DESIGN CRITERIA

The geometric design tables in this section present the Department's design and alignment criteria for rural and urban collector projects. The designer should consider the following when using these tables:

1. Functional Classification To determine the latest functional classification of a facility, the designer should contact Road Data Services. Designers should use the information from Road Data Services and engineering judgement to determine the context of the highway when determining if a project is considered rural or urban.

2. Applicability Note that some cross-section elements included in the tables (e.g., bike lanes) are not automatically warranted in the project design. The values in the figures only apply after the decision has been made to include the design element in the highway cross section.

3. Manual Section References These tables are intended to provide a concise listing of design values for easy use. However, the designer should review the section references for more information on the design elements.

4. Footnotes The figures include many footnotes, which are identified by a number in parentheses (e.g., **(3)**). The information in the footnotes is critical to the proper use of the design tables.

The following design tables are provided for collectors:

- Figure 15.3-A — "Geometric Design Criteria for Rural Collectors (New Construction/ Reconstruction)"
- Figure 15.3-B — "Alignment Criteria for Rural Collectors (New Construction/ Reconstruction)"
- Figure 15.3-C — "Geometric Design Criteria for Urban Collectors (New Construction/ Reconstruction)"
- Figure 15.3-D — "Alignment Criteria for Urban Collectors (New Construction/ Reconstruction)"

	Design Element			Manual Section	Rural			
Design Controls	Design Year Traffic (AADT)			3.6.3	**≤ 400**	**401 to 1500**	**1501 to 2000**	**Over 2000**
	Design Forecast Year			15.2.1	20 Years			
	Minimum Design Speed	Level		15.2.3	40 mph	50 mph	50 mph	60 mph
		Rolling			30 mph	40 mph	40 mph	50 mph
		Mountainous			30 mph	30 mph	30 mph	40 mph
	Access Control			3.8	Control by Regulation			
	Level of Service			3.6.4	Level/Rolling: C Mountainous: D			
Cross Section Elements	Travel Lane Width			15.2.6	11 ft **(1a)**	11 ft	11 ft	12 ft **(1b)**
	Shoulder **(2)**	Total Width		15.2.6	6 ft	6 ft	6 ft	8 ft
		Paved Width			2 ft			
	Auxiliary Lanes	Lane Width		15.2.6	Same as Mainline Travel Lanes			
		Shoulder Width	Total		Same as Mainline Shoulders			
			Paved		2 ft			
	Cross Slope	Travel Lane		15.2.6	2.00%			
		Auxiliary Lane			2.00%			
		Shoulder	Paved **(3)**		2.00%			
			Unpaved		8.00%			
	Bicycle	Bike Lane Width **(4)**		13.2	4 ft			
		Shared Lane Width			14 ft Outside TL			
	TWLTL			15.2.6	15 ft			
	Rights of Way Width			15.2.6	Project Specific			
Roadway Slopes	Side Slopes	Cut Section	Foreslope	7.3.2	6H:1V to 4H:1V			
			Ditch Type		V-Ditch			
			Back Slope		4H:1V to 2H:1V			
			Rock Cut		0.25H:1V			
		Fill Section	0 ft – 5 ft	7.3.2	6H:1V			
			5 ft – 10 ft		4H:1V			
			> 10 ft		2H:1V			
	Clear Zone				**(5)**			

GEOMETRIC DESIGN CRITERIA FOR RURAL COLLECTORS
(New Construction/Reconstruction)
Figure 15.3-A

(Continued on next page)

Design Element			Manual Section	Rural			
Structures	New and Reconstructed Bridges	Structural Capacity	7.5.1	HL-93			
		Clear Roadway Width **(6)**		34 ft	34 ft	34 ft	40 ft
	Existing Bridges to Remain in Place	Structural Capacity	7.5.1	**(7)**			
		Clear Roadway Width (**6)**		22 ft	22 ft	24 ft	28 ft
	Vertical Clearance (Collector Under) **(8a)**	New and Replaced Overpassing Bridges **(8b)**	6.6	16 ft – 0 in			
		Existing Overpassing Bridges		16 ft – 0 in			
		Pedestrian Bridges		18 ft – 0 in			
		Overhead Signs		17 ft – 6 in			
		Overhead Utilities		Coordinate with Utilities Office			
	Vertical Clearance (Collector Over)	Railroads	6.6	23 ft – 0 in			
		Underpass Width	7.5.2	Traveled Way plus Clear Zone			
	Vertical Clearance (Over Water)	Navigable Water	6.6	See Environmental Services Office			
		Major Lakes & Reservoirs (with boat traffic)		8 ft – 0 in above the high water mark			
		Rivers		2 ft – 0 in above the design high water. Freeboard may be increased to a maximum of 7 ft – 0 in for large rivers.			
		Tidal Waters		2 ft above the 10-year high water elevation including wave height.			

GEOMETRIC DESIGN CRITERIA FOR RURAL COLLECTORS
(New Construction/Reconstruction)
Figure 15.3-A

(Continued on next page)

Footnotes for Figure 15.3-A

(1) Travel Lane Width.

a. Where the design speed is 40 miles per hour or less and the ADT is less than 250 vehicles per day, 10-foot travel lanes may be considered.

b. On reconstructed collectors, an existing 22-foot traveled way may be retained where the alignment is satisfactory and there is no crash pattern suggesting the need for widening.

(2) Shoulder Width (Total Width) Where guardrail is required, increase the shoulder width an additional 3.75 feet.

(3) Shoulder Cross Slope For paved shoulders wider than 4 feet, use a 4.00 percent shoulder cross slope.

(4) Bicycle Facilities Lane Width 4-foot bicycle lane width is measured exclusive of rumble strips/stripes. For design speeds greater than 45 miles per hour, increase the bike lane width in accordance with AASHTO Guide for the Development of Bicycle Facilities.

(5) Clear Zone See the AASHTO *Roadside Design Guide* for the applicable clear zones.

(6) Bridge Widths Clear roadway bridge widths are measured from face to face of parapets or rails. Bridge widths are normally defined as the sum of the approach traveled way width plus total width for both shoulders See Section 7.5.1.1 for further guidance.

(7) Structural Capacity (Existing Bridges) Consult with the State Bridge Maintenance Engineer to determine the allowable structural capacity of bridges to remain in place.

(8) Vertical Clearance (Collector Under).

a. The clearance must be available over the traveled way, shoulders and any future widening identified in a long-range plan.

b. Table value includes allowance for future overlays.

GEOMETRIC DESIGN CRITERIA FOR RURAL COLLECTORS
(New Construction/Reconstruction)
Figure 15.3-A
(Continued)

Design Element		Manual Section	Design Speed						
			30 mph	35mph	40 mph	45 mph	50 mph	55 mph	60 mph
Stopping Sight Distance **(1)**		4.1	200 ft	250 ft	305 ft	360 ft	425 ft	495 ft	570 ft
Passing Sight Distance		4.2	500 ft	550 ft	600 ft	700 ft	800 ft	900 ft	1000 ft
Decision Sight Distance **(2)**		4.3	450 ft	525 ft	600 ft	675 ft	750 ft	865 ft	990 ft
Intersection Sight Distance **(3)**		4.4	335 ft	390 ft	445 ft	500 ft	555 ft	610 ft	665 ft
Minimum Radii	e_{max} = 8%	5.2					758 ft	960 ft	1200 ft
	e_{max} = 6%		231 ft	340 ft	485 ft	643 ft	833 ft		
Superelevation Rate **(4)**		5.3	6%	6%	6%	6%	6% or 8%	8%	8%
Horizontal Sight Line Offset **(5)**		5.4	21 ft	23 ft	24 ft	25 ft	27/30 ft	32 ft	34 ft
Vertical Curvature (K-Values) **(6)**	Crest	6.5	19	29	44	61	84	114	151
	Sag		37	49	64	79	96	115	136
Maximum Grade **(7)**	Level	6.3.1	7%	7%	7%	7%	6%	6%	5%
	Rolling		9%	9%	8%	8%	7%	7%	6%
	Mountainous		10%	10%	10%	10%	9%	9%	8%
Minimum Grade **(8)**		6.3.2	0.5%						

Footnotes

(1) Stopping Sight Distance. Table values are for passenger cars on level grade.

(2) Decision Sight Distance. Table values are for speed/path/direction change on rural road, Avoidance Maneuver C. See Section 4.3 for other maneuvers.

(3) Intersection Sight Distance. Table values are for passenger cars for assumed conditions described in Figure 4.4-C. See Section 4.4 for other conditions.

(4) Superelevation Rate. See Section 5.3 for superelevation rates based on e_{max}, design speed and radii of horizontal curves.

(5) Horizontal Sight Line Offset. Table values provide the necessary middle ordinate assuming the design speed, stopping sight distance and minimum radii based on an e_{max} = 6 percent for design speeds 30 to 50 miles per hour and e_{max} = 8 percent for design speeds of 50 to 60 miles per hour.

(6) Vertical Curvature (K-Value). K-values are based on the level stopping sight distances.

(7) Maximum Grade. Short lengths of grades (e.g., less than 500 feet), one-way downgrades and low-volume collectors may be up to 2 percent steeper.

(8) Minimum Grade. Longitudinal gradients of 0.0 percent may be acceptable on some pavements that have cross slopes that have adequate drainage. Ensure superelevation transitions are not developed in areas with 0.0 percent grade. Special ditch grades may be necessary to ensure proper project runoff management.

ALIGNMENT CRITERIA FOR RURAL COLLECTORS
(New Construction/Reconstruction)
Figure 15.3-B

Design Element				Manual Section	Urban
Design Controls	Design Forecast Year			15.2.1	20 Years
	Minimum Design Speed			15.2.3	30 mph
	Access Control			3.8	Limited/Control by Regulation
	Level of Service			3.6.4	Desirable: C
Cross Section Elements	Travel Lane Width **(1)**			15.2.6	12 ft
	Shoulder Width	Total		15.2.6	8 ft or Curb and Gutter
		Paved			2 ft or Curb and Gutter
	Auxiliary Lanes	Lane Width		15.2.6	match travel lane
		Shoulder Width	Total		match travel lane shoulder
			Paved		2 ft or Curb and Gutter
	Parking Lane Width			7.2.7	8-12 ft
	Cross Slope	Travel Lane		15.2.6	2.00%
		Auxiliary Lane			2.00%
		Shoulder	Paved **(2)**		2.00%
			Unpaved		8.00%
	Bicycle	Bike Lane Width **(3)**		13.2	4 ft
		Shared Lane Width			14 ft Outside Travel Lane
	Curb and Gutter	Type **(4)**		7.2.8	Vertical or Sloping
		Width			2 ft
	Sidewalk Width			13.3	5 ft
	Median	Width	Flush	15.2.6	Desirable: 12 ft Minimum: 4 ft
			TWLTL		15 ft
		Flush/TWLTL Slopes		7.3.2	2.00%
	Right of Way Width			15.2.6	Project Specific
Roadway Slopes	Side Slopes	Cut Section	Foreslope	7.3.2	12.5H:1V to 4H:1V
			Ditch Type		V-Ditch
			Back Slope		4H:1V to 2H:1V
		Fill Section	0 ft – 5 ft	7.3.2	6H:1V
			5 ft – 10 ft		4H:1V
			> 10 ft		2H:1V
	Clear Zone				**(5)**

GEOMETRIC DESIGN CRITERIA FOR URBAN COLLECTORS
(New Construction/Reconstruction)
Figure 15.3-C

(Continued on next page)

Design Element			Manual Section	Urban
Structures	New Bridges	Structural Capacity	7.5.1	HL-93
		Clear Roadway Width		**(6)**
	Existing Bridges to Remain in Place	Structural Capacity	7.5.1	**(7)**
		Clear Roadway Width		**(6)**
	Vertical Clearance (Collector Under) **(8a)**	New and Replaced Overpass Bridges **(8b)**	6.6	16 ft – 0 in
		Existing Overpassing Bridges	6.6	16 ft – 0 in
		Pedestrian Bridges	6.6	18 ft – 0 in
		Overhead Signs	6.6	17 ft – 6 in
		Overhead Utilities	6.6	Coordinate with Utility Office
	Vertical Clearance (Collector Over)	Railroads	6.6	23 ft – 0 in
		Underpass Width	7.5.2	Traveled Way plus Clear Zone
	Vertical Clearance (Over Water)	Navigable Water	6.6	See Environmental Services Office
		Major Lakes & Reservoirs (with boat traffic)		8 ft – 0 in above the high water mark
		Rivers		2 ft – 0 in above the design high water. Freeboard may be increased to a maximum of 7 ft – 0 in for large rivers.
		Tidal Waters		2 ft above the 10-year high water elevation including wave height.

GEOMETRIC DESIGN CRITERIA FOR URBAN COLLECTORS
(New Construction/Reconstruction)
Figure 15.3-C

(Continued on next page)

Footnotes for Figure 15.3-C

(1) Travel Lane Width. In CBDs, an 11-foot traveling lane may be used if the truck volumes are less than or equal to 5 percent.

(2) Shoulder Cross Slope. For paved shoulders wider than 4 feet, use a 4.00 percent shoulder cross slope.

(3) Bicycle Lane Width. 4-foot bicycle lane width is measured exclusive of curb & gutter or rumble strips/stripes. For design speeds greater than 45 miles per hour, increase the bike lane width in accordance with the AASHTO *Guide for the Development of Bicycle Facilities*.

(4) Curb and Gutter (Type). If curb and gutter is used on streets with design speeds greater than 45 miles per hour, place the curb and gutter outside of the shoulder and use a sloping curb.

(5) Clear Zone. See the AASHTO *Roadside Design Guide* for the applicable clear zones.

(6) Bridge Widths. Clear roadway bridge widths are measured from face to face of parapets or rails. Bridge widths are normally defined as the sum of the approach traveled way width, shoulders and median width, where applicable. For curbed sections, the clear roadway width will be the curb-to-curb width plus the sidewalk width on one or both sides. See Section 7.5.1.1 for further guidance.

(7) Structural Capacity (Existing Bridges). Consult with the State Bridge Maintenance Engineer to determine the allowable structural capacity of bridges to remain in place.

(8) Vertical Clearance (Collector Under).

a. The clearance must be available over the traveled way, shoulders and any future widening identified in a long-range plan.

b. Table value includes allowance for future overlays.

GEOMETRIC DESIGN CRITERIA FOR URBAN COLLECTORS
(New Construction/Reconstruction)
Figure 15.3-C
(Continued)

Design Element		Manual Section	Design Speed			
			30 mph	35 mph	40 mph	45 mph
Stopping Sight Distance **(1)**		4.1	200 ft	250 ft	305 ft	360 ft
Decision Sight Distance **(2)**		4.3	490 ft	590 ft	690 ft	800 ft
Intersection Sight Distance **(3)**		4.4	335 ft	390 ft	445 ft	500 ft
Minimum Radii	e_{max} = 6%	5.2	231 ft	340 ft	485 ft	643 ft
	e_{max} = 4%		250 ft	371 ft	533 ft	711 ft
Superelevation Rate **(4)**		5.3	4% or 6%	4% or 6%	4% or 6%	4% or 6%
Horizontal Sight Line Offset **(5)**		5.4	21 ft	23 ft	24 ft	25 ft
Vertical Curvature (K-Values) **(6)**	Crest	6.5	19	29	44	61
	Sag		37	49	64	79
Maximum Grade **(7)**	Level	6.3.1	9%	9%	9%	8%
	Rolling		11%	10%	10%	9%
	Mountainous		12%	12%	12%	11%
Minimum Grade		6.3.2	Desirable: 0.5% Minimum: 0.3% (Curb and Gutter)			

Footnotes

(1) Stopping Sight Distance. Table values are for passenger cars on level grade.

(2) Decision Sight Distance. Table values are for stop on an urban road, Avoidance Maneuver B, as described in Figure 4.3-A.

(3) Intersection Sight Distance. Table values are for passenger cars for assumed conditions described in Figure 4.4-C. See Section 4.4 for other conditions.

(4) Superelevation Rate.

a. See Section 5.3 for superelevation rates based on e_{max}, design speed and radii of horizontal curves.

b. The 6 percent superelevation rate should only be used on suburban collectors.

(5) Horizontal Sight Line Offset. Table values provide the necessary middle ordinate assuming the design speed, stopping sight distance and minimum radii based on an e_{max} = 6 percent.

(6) Vertical Curvature (K-Value). K-values are based on the level stopping sight distances.

(7) Maximum Grade. Short lengths of grades (e.g., less than 500 feet), one-way downgrades and low-volume collectors may be up to 2 percent steeper.

ALIGNMENT CRITERIA FOR URBAN COLLECTORS
(New Construction/Reconstruction)
Figure 15.3-D

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15.4 REFERENCES

1. *A Policy on Geometric Design of Highways and Streets*, AASHTO, 2011.

2. *Mitigation Strategies for Design Exceptions*, FHWA, 2007.

3. *Highway Safety Design and Operations Guide*, AASHTO, 1997.

4. *Roadside Design Guide*, AASHTO, 2011.

5. *Highway Capacity Manual*, Transportation Research Board, 2010.

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