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CHAPTER FIFTY-THREE

Geometric Design Tables (New Construction/Reconstruction)

This chapter provides the Department's criteria for the design of a new construction or reconstruction (4R) project. The following should be considered in the use of the figures.

1. Project Scope of Work (Freeway). The geometric design criteria shown in Figure 53-1 apply to new construction or complete reconstruction of a freeway. The Department has adopted separate criteria for a 3R project or a partial 4R project on a freeway. See Chapter Fifty-four. Chapters Forty and Fifty-four provide definitions for the freeway-project scope of work, which will determine which set of criteria should be used for project design.

2. Project Scope of Work (Non-Freeway). The geometric design criteria shown in Figures 53-2 through 53-9 apply to a new construction or reconstruction (4R) project on a non-freeway. The Department has adopted separate criteria for the geometric design of a 3R non-freeway project. See Chapter Fifty-five. Chapter Forty provides definitions for the non-freeway-project scope of work, which will determine which set of criteria should be used for project design.

3. Functional Classification. The selection of design values depends on the functional classification of the highway facility. This is discussed in Section 40-1.01. Functional-classification maps for all public roads are available from the Planning Division.

   See Section 40-1.01 for definitions of the functional classifications.

4. Urban Design Subcategories. Within an urbanized or urban area, the selection of design values depends on the design subcategory of the facility. Separate criteria are provided for suburban, intermediate, and built-up subcategories. These classifications are defined as follows.

   a. Suburban. This type of area is located at the fringe of an urbanized or small urban area. The predominant character of the surrounding environment is residential, but it may include a considerable number of commercial establishments, especially strip development along a suburban arterial. There may also be a few industrial parks. On a suburban road or street, a motorist has a significant degree of freedom, but nonetheless he or she must also devote some of their attention to entering and exiting vehicles. Roadside development is characterized by low to moderate density.

Pedestrian activity may or may not be a significant design factor. Right of way is often available for roadway improvements.

A local or collector street is located in a residential area, but may also serve a commercial area. The posted speed limit ranges between 30 and 50 mph. The majority of intersections will have stop or yield control, but there will be an occasional traffic signal. A suburban arterial will have strip commercial development and perhaps a few residential properties. The posted speed limit ranges between 35 and 55 mph, and there will usually be a few signalized intersections along the arterial.

b. Intermediate. As the name implies, an intermediate area is between a suburban and a built-up area. The surrounding environment may be either residential, commercial, or industrial or a combination of these. The extent of roadside development will have a significant impact on the selected speeds of motorists. The increasing frequency of intersections is also a control on average speed. Pedestrian activity has now become a significant design consideration, and sidewalks and cross walks at intersections are common. The available right of way will restrict the practical extent of roadway improvements.

A local or collector street has a posted speed limit ranging between 30 and 45 mph. The frequency of signalized intersections has increased substantially if compared to a suburban area. An arterial will have intensive commercial development along its roadside. The posted speed limit ranges between 35 and 50 mph. Such an arterial has several signalized intersections per mile.

c. Built-up. This type of area refers to the central business district within an urbanized or small urban area. The roadside development has a high density and is often commercial. However, a substantial number of roads and streets pass through a high-density environment (e.g. apartment complexes, row houses). Access to property is the primary function of the road network. Pedestrian considerations may be as important as vehicular considerations, especially at intersections. Right of way for roadway improvements is usually not available.

Because of the high density of development, the distinction between the functional classifications (local, collector, or arterial) becomes less important when considering signalization and speeds. The primary distinction among the three functional classes is often the relative traffic volume and, therefore, the number of lanes. As many as half the intersections may be signalized. The posted speed limit ranges between 25 and 35 mph.

If the area is rural in character (e.g., a sparsely-populated area without a gridlike street system), it may be appropriate to use the rural-area design criteria though the facility is urban.

5. Rural-Area Figures. These do not provide design criteria for sub-categories. However, there are many rural facilities which pass through relatively built-up, but unincorporated, areas. It may be inappropriate to use the rural-area design criteria. The designer may, as an option, use the suburban criteria for a functional classification (e.g., arterial) in a relatively built-up rural area. Therefore, if the area is urban in character (e.g., a densely populated area with a grid-like street system) it may be appropriate to use the urban-area design criteria even though the facility is rural. This decision will be documented in the Engineer's Report (see Chapter Seven).

6. Cross-Section Elements. Some of the cross-section elements included in a figure (e.g., sidewalk width) are not automatically warranted in the project design. The values will only apply after the decision has been made to include the element in the highway cross section.

7. *Manual* Section References. The figures are intended to provide a concise listing of design values for easy use. However, the designer should review the *Manual* section references for greater insight into the design elements.

8. Footnotes. The figures include many footnotes, which are identified by a number in parentheses, e.g., (6). The information in the footnotes is critical to the proper use of the figures.

Design Element				Manual Section	Rural	Urban
Design Controls	Design Forecast Period			40-2.02	20 Years	20 Years
	*Design Speed (mph)			40-3.0	70	50-70 (1)
	Access Control			40-5.0	Full Control	Full Control
	Level of Service			40-2.0	Desirable: B Minimum: C	Desirable: B Minimum: C (2)
Cross Section Elements	Travel Lane	*Width		45-1.01	12 ft	12 ft
		Surface Type(3)		Chp. 52	Asphalt / Concrete	Asphalt / Concrete
	Shoulder	*Right Width(4)		45-1.02	Usable: 11 ft Paved: 10 ft	Usable: 11 ft Paved: 10 ft
		*Left Width(5)			2 Ln: D 2.4, M 4 ft Paved; 3 Ln: 10 ft Paved	2 Lanes: 4 ft Paved 3 Lanes: 10 ft Paved
		Surface Type(3)		Chp. 52	Asphalt / Concrete	Asphalt / Concrete
	Cross Slope	*Travel Lane (6)		45-1.01	2%	2%
		Shoulder (6A)		45-1.02	Paved Width ≤ 4 ft: 2% Paved Width > 4 ft: 4%	Paved Width ≤ 4 ft: 2% Paved Width > 4 ft: 4%
	Auxiliary Lane	*Lane Width		45-1.03	12 ft	12 ft
		*Shoulder Width			Right: 10 ft (7) Left: 4 ft	Right: 10 ft (7) Left: 4 ft
	Median Width	Depressed		45-2.0	Desirable: 100 ft Minimum: 54.5 ft	Desirable: 60 ft Minimum: 10 ft for 4 lanes, 54.5 ft for 6 lanes
		Flush (CMB)			Desirable: 30.5 ft Minimum: 26.5 ft	Minimum: 26.5 ft
	Clear Zone			49-2.0	(8)	(8)
	Side Slopes (9)	Cut	Foreslope	45-3.0	6:1 (10)	6:1 (10)
			Ditch Width		4 ft (11)	4 ft (11)
			Backslope		4:1 (12)	4:1 (12)
		Fill		45-3.0	6:1 to Clear Zone; 3:1 max. to Toe	6:1 to Clear Zone; 3:1 max. to Toe
	Median Slopes			45-2.02	Desirable: 8:1 Maximum: 5:1	Desirable: 8:1 Maximum: 5:1
Bridges	New or Reconstructed Bridge	*Structural Capacity		Chp. 60	HL-93 (13)	HL-93 (13)
		*Clear-Roadway Width (14)		45-4.01	Full Paved Approach Width	Full Paved Approach Width
	Existing Bridge to Remain in Place	*Structural Capacity		Chp. 72	HS-20	HS-20
		*Clear-Roadway Width		45-4.01	Travelway Plus 10 ft Rt. & 4 ft Lt. Shoulders	Travelway Plus 10 ft Rt. & 4 ft Lt. Shoulders
	*Vertical Clearance (Freeway Under) (15c)	New or Replaced Overpassing Bridge (15a)		44-4.0	16.5 ft	16.5 ft(15b)
		Existing Overpassing Bridge			16 ft	16 ft (15b)
		Sign Truss / Pedestrian Bridge (15a)			New: 17.5 ft Existing: 17 ft	New: 17.5 ft Existing: 17 ft
	Vertical Clearance (Freeway over Railroad) (16)			Chp. 69	23 ft	23 ft

* Controlling design criterion.

GEOMETRIC DESIGN CRITERIA FOR FREEWAY
(New Construction or Complete Reconstruction)

Figure 53-1

Design Element			Manual Section	Rural	Urban			
Alignment Elements	Design Speed		---	70 mph	50 mph	55 mph	60 mph	70 mph
	*Stopping Sight Distance		42-1.0	730 ft	425	495 ft	570 ft	730 ft
	Decision Sight Distance (17)		42-2.0	780 ft	910	1030 ft	1150 ft	1410 ft
	*Minimum Radius (e=8%)		43-2.0	1640 ft	750	1000 ft	1290 ft	1650 ft
	*Superelevation Rate		43-3.0	e_{max}=8% (18)	e_{max}=8% (18)			
	*Horizontal Sight Distance		43-4.0	(19)	(19)			
	*Vertical Curvature (K-value)	Crest	44-3.0	247	84	114	151	247
		Sag		181	96	115	136	181
	*Maximum Grade (20)	Level	44-1.02	3%	4%	3.5%	3%	3%
		Rolling		4%	5%	4.5%	4%	4%
	Minimum Grade		44-1.03	Desirable: 0.5% Minimum: 0.0%	Desirable: 0.5% Minimum: 0.0%			

* Controlling design criterion: A deviation from such is a design exception, and is subject to approval. See Section 40-8.0.

These criteria apply to a route either on or off the National Highway System, regardless of funding source.

GEOMETRIC DESIGN CRITERIA FOR FREEWAY
(New Construction or Complete Reconstruction)

Figure 53-1 (continued)

GEOMETRIC DESIGN CRITERIA FOR FREEWAY
(New Construction or Complete Reconstruction)

Footnotes to Figure 53-1

(1) Design Speed. A 50 mph design speed may be considered in a restricted urban area.

(2) Level of Service. A minimum Level of Service of D may be used on an urban reconstruction project.

(3) Surface Type. The pavement-type selection will be determined by the INDOT Office of Pavement Engineering.

(4) Shoulder Width (Right). The following will apply.
- a. The shoulder is paved to the front face of guardrail. The desirable guardrail offset is 2 ft from the effective usable-shoulder width. See Section 49-5.0 for more information.
- b. Where the number of trucks exceeds 250 DDHV, a 12-ft width should be used. If the 12-ft width is used, the usable-shoulder width will be 13 ft.
- c. Usable-shoulder width is defined as the distance from the edge of the travel lane to the shoulder break point.

(5) Shoulder Width (Left). The following will apply.
- a. The usable-shoulder width is equal to the paved-shoulder width. The desirable guardrail offset is 2 ft from the usable-shoulder width. See Section 49-5.0 for more information.
- b. Where there are 3 or more lanes in one direction and the volume of trucks exceed 250 DDHV, a 12-ft width should be used.
- c. For a left shoulder of 4 ft or wider, the usable-shoulder width will be 1 ft more than the paved-shoulder width.

(6) Cross Slope (Travel Lane). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(6A) Cross Slope (Shoulder). See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information.

(7) Auxiliary-Lane Shoulder Width (Right). On a reconstruction project, a 6-ft width may be used.

(8) Clear Zone. The clear zone will vary according to design speed, traffic volume, side slopes, and horizontal curvature. See Section 49-2.0.

(9) Side Slopes. Value is for new construction. See Sections 45-3.0 and 45-8.0 for more information. For a reconstruction project, see Section 49-3.0.

GEOMETRIC DESIGN CRITERIA FOR FREEWAY
(New Construction or Complete Reconstruction)

Footnotes to Figure 53-1 (continued)

(10) Foreslope. See Sections 49-2.0 and 49-3.0 for the lateral extent of the foreslope in a ditch section.

(11) Ditch Widths. A V-ditch should be used in a rock cut. See Section 45-8.0.

(12) Backslope. For an earth cut of 10 ft or deeper, the first horizontal 20 ft of the backslope will be sloped at a rate of 4:1. Then, a slope rate of 3:1 is normally used to the natural ground line. See Section 45-3.0 and the INDOT *Standard Drawings*. The backslope for a rock cut will vary according to the height of cut and the geotechnical requirements. See the INDOT *Standard Drawings* for typical rock-cut sections.

(13) Structural Capacity (New or Reconstructed Bridge). HS-25 loading with Alternate Military Loading should be applied for each project with notice to proceed with design beginning September 1, 2004, through December 31, 2005. Other loadings will apply to the Toll Road system or an Extra-Heavy-Duty Highway. See Chapter Sixty for more information.

(14) Width (New or Reconstructed Bridge). See Section 59-1.0 for more information on bridge width.

(15) Vertical Clearance (Freeway Under). The following will apply.
a. Table value includes an additional 6 in. allowance for future overlays.
b. A 14-ft clearance may be used in an urban area where an alternate freeway facility with a 16-ft clearance is available.
c. Vertical clearance applies from usable edge to usable edge of shoulders.

(16) Vertical Clearance (Freeway Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(17) Decision Sight Distance. Value is for the avoidance maneuver (speed/path/direction change). See Section 42-2.0.

(18) Superelevation Rate. See Section 43-3.0 for value of superelevation rate based on design speed and radius.

(19) Horizontal Sight Distance. For a given design speed, the necessary middle ordinate will be determined by the radius and the sight distance. Sometimes, the stopping-sight-distance value for a truck should be considered. See the discussion in Section 43-4.0.

(20) Maximum Grade. A grade of 1% or steeper may be used in a restricted urban area where development precludes the use of a flatter grade. A grade of 1% or steeper may also be used for a one-way-roadway downgrade.

(21) For a bridge of 200 ft or longer that is to remain in place, the minimum width of each shoulder is 4 ft. This requirement does not apply to a bridge-deck replacement.

Design Element				Manual Section	2 Lanes			4 or More Lanes	
Design Controls	Design-Year Traffic (AADT)			40-2.01	< 400	400 ≤ AADT < 2000	≥ 2000	**Undivided	Divided
	Design Forecast Period			40-2.02	20 Years			20 Years	
	*Design Speed (mph) (1)			40-3.0	Level: 60 – 70; Rolling: 50 – 60			60	60-70
	Access Control			40-5.0	Partial Control / None			Partial Control / None	
	Level of Service			40-2.0	Desirable: B; Minimum: C			Desirable: B; Minimum: C	
Cross Section Elements**	Travel Lane	*Width		45-1.01	12 ft			12 ft	
		Typical Surface Type (2)		Chp. 52	Asphalt / Concrete			Asphalt / Concrete	
	Shoulder (3)	*Width Usable		45-1.02	6 ft	8 ft	11 ft (3b)	11 ft (3b)	Right: 11 ft (3b) Left: 4 ft (3e)
		*Width Paved		45-1.02	4 ft	6 ft	10 ft (3b)	10 ft (3b)	Right: 10 ft (3b) Left: 4 ft (3e)
		Typical Surface Type (2)		Chp. 52	Asphalt / Concrete			Asphalt / Concrete	
	Cross Slope	*Travel Lane (4)		45-1.01	2%			2%	
		Shoulder (4A)		45-1.02	Paved Width ≤ 4 ft: 2%; Paved Width > 4 ft: 4%			Paved Width ≤ 4 ft: 2%; Paved Width > 4 ft: 4%	
	Auxiliary Lane	Lane Width (5)		45-1.03	Desirable: 12 ft; Minimum: 11 ft			Desirable: 12 ft; Minimum: 11 ft	
		Shoulder Width (6)			Same as Next to Travel Lane			Same as Next to Travel Lane	
	Median Width			45-2.0	N/A			0.0 ft	Desirable: 80 ft Minimum: 16 ft (7)
	Clear Zone			49-2.0	(8)			(8)	
	Side Slopes (9)	Cut	Foreslope	45-3.0	6:1 (10)			6:1 (10)	
			Ditch Width		4 ft (11)			4 ft (11)	
			Backslope		4:1 for 20 ft; 3:1 Max. to Top (12)			4:1 for 20 ft; 3:1 Max. to Top (12)	
		Fill		45-3.0	6:1 to Clear Zone; 3:1 Max. to Toe			6:1 to Clear Zone; 3:1 Max. to Toe	
	Median Slopes			45-2.02	N/A			Desirable: 8:1; Maximum: 5:1	
Bridges***	New or Reconstructed Bridge	*Structural Capacity		Chp. 60	HL-93 (13)				
		*Clear-Roadway Width(14)		45-4.01	Full Paved Approach Width				
	Existing Bridge to Remain in Place	*Structural Capacity		Chp. 72	HS-20				
		*Clear-Roadway Width		45-4.01	Travelway Plus 2 ft on Each Side				
	*Vertical Clearance (Arterial Under)	New or Replaced Overpassing Bridge (15)		44-4.0	16.5 ft				
		Existing Overpassing Bridge			14 ft				
		Sign Truss / Pedestrian Bridge (15)			New: 17.5 ft; Existing: 17 ft				
	Vertical Clearance (Arterial Over Railroad) (16)			Chp. 69	23 ft				

* Controlling design criterion. ** An arterial of 4 or more lanes on a new location should be designed as Divided.
*** Selection of the cross section and bridge elements is based on the design-year traffic volume irrespective of the design speed.

GEOMETRIC DESIGN CRITERIA FOR RURAL ARTERIAL
(New Construction or Reconstruction)

Figure 53-2

Design Element			Manual Section	Rural Arterial			
Alignment Elements	Design Speed		---	50 mph	55 mph	60 mph	70 mph
	*Stopping Sight Distance		42-1.0	425 ft	495 ft	570 ft	730 ft
	Decision Sight Distance	Speed / Path / Direction Change	42-2.0	750 ft	865 ft	990 ft	1105 ft
		Stop Maneuver		465 ft	535 ft	610 ft	780 ft
	Passing Sight Distance		42-3.0	1835 ft	1985 ft	2135 ft	2480 ft
	Intersection Sight Distance, -3% to +3% (20)		46-10.0	P: 630 ft; SUT: 780 ft	P: 730 ft; SUT: 890 ft	P: 840 ft; SUT: 1020 ft	P: 1030 ft; SUT: 1240 ft
	*Minimum Radius (e=8%)		43-2.0	750 ft	1000 ft	1290 ft	1650 ft
	*Superelevation Rate		43-3.0	emax = 8% (17)			
	*Horizontal Sight Distance		43-4.0	(18)			
	*Vertical Curvature (K-value)	Crest	44-3.0	84	114	151	247
		Sag		96	115	136	181
	*Maximum Grade (19)	Level	44-1.02	4%	4%	3%	3%
		Rolling		5%	5%	4%	4%
	Minimum Grade		44-1.03	Desirable: 0.5%; Minimum: 0.0%			

* Controlling design criterion. A deviation from such is a design exception, and is subject to approval. See Section 40-8.0.

These criteria apply to a route either on or off the National Highway System, regardless of funding source.

GEOMETRIC DESIGN CRITERIA FOR RURAL ARTERIAL
(New Construction or Reconstruction)

Figure 53-2 (continued)

GEOMETRIC DESIGN CRITERIA FOR RURAL ARTERIAL
(New Construction or Reconstruction)
Footnotes to Figure 53-2

(1) Design Speed. The minimum design speed should equal the minimum value from the table or the anticipated posted speed limit after construction, whichever is greater. The legal speed limit is 60 mph on a non-posted divided highway.

(2) Surface Type. The pavement-type selection will be determined by the INDOT Office of Pavement Engineering.

(3) Shoulder. The following will apply.

a. If there are 3 or more lanes in each direction and there is a median barrier, a 10-ft paved shoulder and a 2-ft offset is required.
b. For new construction with 2000 ≤ AADT < 5000, this may be 8 ft. On a reconstruction project, the usable-shoulder width may be 10 ft, and the paved-shoulder width may be 8 ft.
c. The shoulder is paved to the front face of guardrail. The desirable guardrail offset is 2 ft from the effective usable-shoulder width. See Section 49-5.0 for more information.
d. Usable-shoulder width is defined as the distance from the edge of the travel lane to the shoulder break point.
e. If there are 3 or more lanes in each direction, a full-width shoulder, 11 ft usable and 10 ft paved, is desirable.
f. If curbs are to be used, the criteria described in Figure 53-6 or 53-7 should be applied.

(4) Cross Slope (Travel Lanes). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place. Where three or more lanes are sloped in the same direction, each successive pair of lanes may have an increased sideslope.

(4A) Cross Slope (Shoulder). See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information.

(5) Auxiliary Lane (Lane Width). Truck climbing-lane width is 12 ft.

(6) Auxiliary Lane (Shoulder Width). At a minimum, a 2-ft shoulder may be used adjacent to an auxiliary lane. At a minimum, the shoulder adjacent to a truck climbing lane is 4 ft.

(7) Median Width (Flush). Value is for new construction. A median of 25 ft or narrower should be avoided at an intersection. A median wider than 60 ft is undesirable at a signalized intersection or at an intersection that may become signalized in the foreseeable future. On a reconstruction project, the minimum flush-median width is 14 ft for a roadway with left-turn lanes, or 22 ft for a roadway with concrete median barrier.

(8) Clear Zone. The clear zone will vary according to design speed, traffic volume, side slopes, and horizontal curvature. See Section 49-2.0.

GEOMETRIC DESIGN CRITERIA FOR RURAL ARTERIAL
(New Construction or Reconstruction)
Footnotes to Figure 53-2 (continued)

(9) Side Slope. Value is for new construction. See Sections 45-3.0 and 45-8.0 for more information. For a reconstruction project, see Section 49-3.0.

(10) Foreslope. See Sections 49-2.0 and 49-3.0 for the lateral extent of the foreslope in a ditch section.

(11) Ditch Width. A V-ditch should be used in a rock cut. See Section 45-8.0.

(12) Backslope. The backslope for a rock cut will vary according to the height of the cut and the geotechnical requirements. See Section 45-8.0 for typical rock-cut sections.

(13) Structural Capacity (New or Reconstructed Bridge). The following will apply.
- a. HS-25 loading with Alternate Military Loading should be applied for each project with notice to proceed with design beginning September 1, 2004, through December 31, 2005.
- b. A State-highway bridge within 15 mi of a Toll-Road gate must be designed for Toll-Road loading.
- c. A bridge on an Extra-Heavy-Duty Highway must be designed for the Michigan Train truck-loading configuration.
- d. See Chapter Sixty for additional information on the loading configurations.

(14) Width (New or Reconstructed Bridge). See Section 59-1.0 for more information on bridge width.

(15) Vertical Clearance (Arterial Under). Value includes an additional 6-in. allowance for future pavement overlays. Vertical clearance applies from usable edge to usable edge of shoulders.

(16) Vertical Clearance (Arterial Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(17) Superelevation Rate. See Section 43-3.0 for value of superelevation rate based on design speed and radius.

(18) Horizontal Sight Distance. For a given design speed, the necessary middle ordinate will be determined by the radius and the sight distance which applies at the site. Sometimes, the stopping-sight-distance value for a truck will apply. See the discussion in Section 43-4.0.

(19) Maximum Grade. A grade of 1% or steeper may be used for a downgrade on a one-way roadway.

(20) Intersection Sight Distance. For a left turn onto a 2-lane road: P = Passenger car; SUT = single unit truck. See Figure 46-10G for value for a combination truck.

Design Element				Manual Section	2 Lanes			
Design Controls	Design-Year Traffic (AADT)			40-2.01	< 400	400 ≤ AADT < 1500	1500 ≤ AADT < 2000	> 2000
	Design Forecast Period			40-2.02	20 Years (1)			
	*Design Speed (mph) (2)	Level		40-3.0	35 - 55	50 - 55	50 - 55	60
		Rolling			30 - 55	35 - 55	35 - 55	50 - 55
	Access Control			40-5.0	None			
	Level of Service			40-2.0	Desirable.: B; Minimum: C			
Cross Section Elements**	Travel Lane	*Width		45-1.01	D: 12 ft; M: 10 ft	D: 12 ft; M: 11 ft	D: 12 ft; M: 11 ft (20)	12 ft
		Typical Surface Type (3)		Chp. 52	Asphalt / Concrete			
	Shoulder (4)	*Width Usable		45-1.02	4 ft	6 ft	8 ft	10 ft
		*Width Paved		45-1.02	2 ft	4 ft	6 ft	8 ft
		Typical Surface Type (3)		Chp. 52	Asphalt / Concrete			
	Cross Slope	*Travel Lane (5)		45-1.01	2%			
		Shoulder (5A)		45-1.02	Paved Width ≤ 4 ft: 2%; Paved Width > 4 ft: 4%			
	Auxiliary Lane	Lane Width		45-1.03	Des: Same as Through Lanes; Min: 11 ft			Desirable: 12 ft Minimum: 11 ft
		Shoulder Width (6)			Same as Next to Travel Lane			
	Clear Zone			49-2.0	(7)			
	Side Slopes (8)	Cut	Foreslope	45-3.0	Des: 6:1; Max: 4:1 (9)			
			Ditch Width		4 ft (10)			
			Backslope		4:1 for 20 ft; 3:1 Max. to Top (11)			
		Fill		45-3.0	Des: 6:1 to Clear Zone; Max: 3:1 to Toe			
Bridges**	New or Reconstructed Bridge	*Structural Capacity		Chp. 60	HL-93 (12)			
		*Clear-Roadway Width (13)		45-4.01	Full Paved Approach Width			
	Existing Bridge to Remain in Place	*Structural Capacity		Chp. 72	HS-15			
		*Clear-Roadway Width (14)		45-4.01	22 ft	22 ft	24 ft	28 ft
	*Vertical Clearance (Collector Under)	New or Replaced Overpassing Bridge (15)		44-4.0	14.5 ft			
		Existing Overpassing Bridge			14 ft			
	Vertical Clearance (Collector Over Railroad) (16)			Chp. 69	23 ft			

D or Des: Desirable; M or Min: Minimum

* Controlling design criterion.
** Selection of the cross section and bridge elements is based on the design-year traffic volume irrespective of the design speed.

GEOMETRIC DESIGN CRITERIA FOR RURAL COLLECTOR, STATE ROUTE
(New Construction or Reconstruction)

Figure 53-3

Design Element			Manual Section	2 Lanes				
Alignment Elements	Design Speed			40 mph	45 mph	50 mph	55 mph	60 mph
	*Stopping Sight Distance		42-1.0	305 ft	360 ft	425 ft	495 ft	570 ft
	Decision Sight Distance	Speed / path / direction change	42-2.0	600 ft	675 ft	750 ft	865 ft	990 ft
		Stop Maneuver		330 ft	395 ft	465 ft	535 ft	610 ft
	Passing Sight Distance		42-3.0	1470 ft	1625 ft	1835 ft	1985 ft	2135 ft
	Intersection Sight Distance, -3% to +3% (21)		46-10.0	P: 440 ft SUT: 560 ft	P: 500 ft SUT: 630 ft	P: 630 ft SUT: 780 ft	P: 730 ft SUT: 890 ft	P: 840 ft SUT: 1020 ft
	*Minimum Radius (e=8%)		43-2.0	410 ft	590 ft	750 ft	1000 ft	1290 ft
	*Superelevation Rate		43-3.0	e_{max} = 8% (17)				
	*Horizontal Sight Distance		43-4.0	(18)				
	*Vertical Curvature (K-value)	Crest	44-3.0	44	61	84	114	151
		Sag		64	79	96	115	136
	*Maximum Grade (19)	Level	44-1.02	7%	7%	6%	6%	5%
		Rolling		8%	8%	7%	7%	6%
	Minimum Grade		44-1.03	Desirable: 0.5% Minimum: 0.0%				

* Controlling design criterion. A deviation from such is a design exception, and is subject to approval. See Section 40-8.0.

A deviation from a controlling design criterion should be addressed in an approved design exception.

These criteria apply to each project regardless of funding source.

GEOMETRIC DESIGN CRITERIA FOR RURAL COLLECTOR, STATE ROUTE
(New Construction or Reconstruction)

Figure 53-3 (continued)

GEOMETRIC DESIGN CRITERIA FOR RURAL COLLECTOR, STATE ROUTE
(New Construction or Reconstruction)

Footnotes to Figure 53-3

(1) Design Forecast Year. If the DHV is less than 100 (based on a 20-year projection) the current AADT may be used for design.

(2) Design Speed. The minimum design speed should equal the minimum value from the table or the anticipated posted speed limit after construction, whichever is higher. The legal speed limit is 55 mph on a non-posted highway.

(3) Surface Type. The pavement-type selection will be determined by the INDOT Office of Pavement Engineering.

(4) Shoulder Width. The following will apply.
- a. The shoulder is paved to the front face of guardrail. The desirable guardrail offset is 2 ft from the effective usable-shoulder width. See Section 49-5.0 for more information.
- b. Usable-shoulder width is defined as the distance from the edge of the travel lane to the shoulder break point.
- c. If curbs are to be used, the criteria described in Figure 53-8 should be applied.

(5) Cross Slope (Travel Lanes). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(5A) Cross Slope (Shoulder). See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information.

(6) Auxiliary Lane (Shoulder Width). At a minimum, a 2-ft width may be used adjacent to an auxiliary lane.

(7) Clear Zone. The clear zone will vary according to design speed, traffic volume, side slopes, and horizontal curvature. See Section 49-2.0.

(8) Side Slope. Value is for new construction. See Sections 45-3.0 and 45-8.0 for more information. For a reconstruction project, see Section 49-3.0

(9) Foreslope. See Sections 49-2.0 and 49-3.0 for the lateral extent of the foreslope in a ditch section.

(10) Ditch Width. A V-ditch should be used in a rock cut. See Section 45-8.0.

(11) Backslope. The backslope for a rock cut will vary according to the height of the cut and the geotechnical requirements. See Section 45-8.0 for typical rock-cut sections.

GEOMETRIC DESIGN CRITERIA FOR RURAL COLLECTOR, STATE ROUTE
(New Construction or Reconstruction)

Footnotes to Figure 53-3 (continued)

(12) Structural Capacity (New or Reconstructed Bridge). The following will apply.
- a. HS-25 loading with Alternate Military Loading should be applied for each project with notice to proceed with design beginning September 1, 2004, through December 31, 2005.
- b. A State highway bridge within 15 mi of a Toll-Road gate must be designed for Toll-Road loading.
- c. A bridge on an Extra-Heavy-Duty Highway must be designed for the Michigan Train truck-loading configuration.
- d. See Chapter Sixty for additional information on the loading configurations.

(13) Width (New or Reconstructed Bridge). Minimum clear-roadway width is 30 ft. See Section 59-1.0 for more information on bridge width.

(14) Width (Existing Bridge to Remain in Place). Clear width will be at least equal to the approach traveled way width or the table value, whichever is greater.

(15) Vertical Clearance (Collector Under). Value includes an additional 6-in. allowance for future pavement overlays. Vertical clearance applies from usable edge to usable edge of shoulders.

(16) Vertical Clearance (Collector Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(17) Superelevation Rate. See Section 43-3.0 for value of superelevation rate based on design speed and radius.

(18) Horizontal Sight Distance. For a given design speed, the necessary middle ordinate will be determined by the radius and the sight distance which applies at the site. See Section 43-4.0.

(19) Maximum Grade. For a grade along a longitudinal distance of less than 480 ft (PVT to PVC), a one-way downgrade, or a road with AADT < 400, the maximum grade may be up to 2% steeper than the table value.

(20) Use 12 ft if V = 55 mph.

(21) Intersection Sight Distance. For a left turn onto a 2-lane roadway. P = Passenger car; SUT = single unit truck. See Figure 46-10G for values for a combination truck.

Design Element				Manual Section	2 Lanes			
Design Controls	Design-Year Traffic (AADT)			40-2.01	< 400	400 ≤ AADT < 1500	1500 ≤ AADT < 2000	≥ 2000
	Design Forecast Period			40-2.02	20 Years (2)			
	*Design Speed (mph) (3)	Level		40-3.0	35 – 55	50 - 55	50 - 55	60
		Rolling			30 - 55	35 - 55	35 - 55	50 - 55
	Access Control			40-5.0	None			
	Level of Service			40-2.0	Desirable: B; Minimum: C			
Cross Section Elements**	Travel Lane	*Width (4)		45-1.01	10 ft (4a)	11 ft	11 ft (4b)	12 ft
		Typical Surface Type		Chp. 52	Asphalt / Concrete			
	Shoulder	*Width Usable		45-1.02	Des: 4 ft Min: 2 ft (5)	Des: 6 ft Min: 4 ft	Des: 8 ft Min: 6 ft	Des: 10 ft Min: 8 ft
		*Width Paved (optional)		45-1.02	2 ft	4 ft	6 ft	8 ft
		Typical Surface Type		Chp. 52	Asphalt / Aggregate / Earth			
	Cross Slope	*Travel Lane (6)		45-1.01	2%			
		Shoulder (6A)		45-1.02	Paved Width ≤ 4 ft: 2%; Paved Width > 4 ft: 4% - 6% Asphalt; 6%-8% Aggregate; 8% Earth			
	Auxiliary Lane	Lane Width		45-1.03	10 ft		Desirable: 11 ft Minimum: 10 ft	Desirable: 12 ft Minimum: 10 ft
		Shoulder Width			Desirable: Same as Next to Travel Lane; Minimum: 2 ft			
	Clear Zone			49-2.0	(7)			
	Side Slopes (8)	Cut	Foreslope	45-3.0	Des: 6:1; Max: 4:1 (9)			
			Ditch Width		4 ft (10)			
			Backslope		4:1 for 20 ft; 3:1 Max. to Top (11)			
		Fill		45-3.0	Des: 6:1 to Clear Zone; Max: 3:1 to Toe			
Bridges**	New or Reconstructed Bridge	*Structural Capacity		Chp. 60	HL-93 (11A)			
		*Clear-Roadway Width (12)		45-4.01	Travelway + 4 ft	Travelway + 6 ft	Travelway + 8 ft	Full Paved Approach Width
	Existing Bridge to Remain in Place	*Structural Capacity		Chp. 72	HS-15			
		*Clear-Roadway Width (13)		45-4.01	22 ft	22 ft	24 ft	28 ft
	*Vertical Clearance (Collector Under)	New or Replaced Overpassing Bridge (14)		44-4.0	14.5 ft			
		Existing Overpassing Bridge			14 ft			
	Vertical Clearance (Collector Over Railroad) (15)			Chp. 69	23 ft			

Des: Desirable; Min: Minimum.

* Controlling design criterion.
** Selection of the cross section and bridge elements is based on the design-year traffic volume irrespective of the design speed.

GEOMETRIC DESIGN CRITERIA FOR RURAL COLLECTOR, LOCAL-AGENCY ROUTE
(New Construction or Reconstruction)

Figure 53-4

Design Element			Manual Section	2 Lanes					
Alignment Elements	Design Speed			30 mph	35 mph	45 mph	50 mph	55 mph	60 mph
	*Stopping Sight Distance		42-1.0	200 ft	250 ft	360 ft	425 ft	495 ft	570 ft
	Decision Sight Distance	Speed / path / direction change	42-2.0	450 ft	525 ft	675 ft	750 ft	865 ft	990 ft
		Stop Maneuver		220 ft	275 ft	395 ft	465 ft	535 ft	610 ft
	Passing Sight Distance		42-3.0	1090 ft	1280 ft	1625 ft	1835 ft	1985 ft	2135 ft
	Intersection Sight Distance, -3% to +3% (19)		46-10.0	P: 330 ft SUT: 420 ft	P: 390 ft SUT: 490 ft	P: 500 ft SUT: 630 ft	P: 630 ft SUT: 780 ft	P: 730 ft SUT: 890 ft	P: 840 ft SUT: 1020 ft
	*Minimum Radius (e=8%)		43-2.0	270 ft	410 ft	590 ft	750 ft	1000 ft	1290 ft
	*Superelevation Rate		43-3.0	emax = 8% (16)					
	*Horizontal Sight Distance		43-4.0	(17)					
	*Vertical Curvature (K-value)	Crest	44-3.0	19	29	61	84	114	151
		Sag		37	49	79	96	115	136
	*Maximum Grade (18)	Level	44-1.02	7%	7%	6%	6%	5.5%	5%
		Rolling		9%	8%	7%	7%	6.5%	6%
	Minimum Grade		44-1.03	Desirable: 0.5%; Minimum: 0.0%					

* Controlling design criterion. A deviation from such is a design exception, and is subject to approval. See Section 40-8.0.

A deviation from a controlling design criterion should be addressed in an approved design exception.

These criteria apply only to a federal-aid project.

GEOMETRIC DESIGN CRITERIA FOR RURAL COLLECTOR, LOCAL-AGENCY ROUTE
(New Construction or Reconstruction)

Figure 53-4 (continued)

GEOMETRIC DESIGN CRITERIA FOR RURAL COLLECTOR, LOCAL-AGENCY ROUTE
(New Construction or Reconstruction)

Footnotes to Figure 53-4

(1) (Blank.)

(2) (Blank.)

(3) Design Speed. The minimum design speed should equal the minimum value or the anticipated posted speed limit after construction, whichever is greater. The legal speed limit is 55 mph on a non-posted highway.

(4) Travel-Lane Width. The following will apply.
- a. Use an 11-ft width if the design speed is 55 mph.
- b. Use a 12-ft width if the design speed is 55 mph.

(5) Shoulder Width. The following will apply.
- a. If guardrail is required, the minimum width is 4 ft.
- b. Usable-shoulder width is defined as the distance from the edge of the travel lane to the shoulder break point.
- c. If curbs are to be used, the criteria described in Figure 53-8 should be applied.

(6) Cross Slope (Travel Lanes). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(6A) Cross Slope (Shoulder). See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information.

(7) Clear Zone. The clear zone will vary according to design speed, traffic volume, side slopes, and horizontal curvature. See Section 49-2.0.

(8) Side Slope. Value is for new construction. See Sections 45-3.0 and 45-8.0 for more information. For a reconstruction project, see Section 49-3.0.

(9) Foreslope. See Sections 49-2.0 and 49-3.0 for the lateral extent of the foreslope in a ditch section.

(10) Ditch Width. A V-ditch should be used in a rock cut. See Section 45-8.0

(11) Backslope. The backslope for a rock cut will vary according to the height of the cut and the geotechnical requirements. See Section 45-8.0 for typical rock-cut sections.

GEOMETRIC DESIGN CRITERIA FOR RURAL COLLECTOR, LOCAL-AGENCY ROUTE
(New Construction or Reconstruction)

Footnotes to Figure 53-4 (continued)

(11A) Structural Capacity (New or Reconstructed Bridge). HS-25 loading with Alternate Military Loading should be applied for each project with notice to proceed with design beginning September 1, 2004, through December 31, 2005.

(12) Width (New or Reconstructed Bridge). The following will apply.

a. Where the approach roadway width (travelway plus shoulders) is surfaced, the surfaced width will be carried across the structure.
b. Each bridge longer than 100 ft will be analyzed individually. At a minimum, the roadway width will be the width of travel lanes plus a 3-ft right shoulder and a 3-ft left shoulder for AADT > 400.
c. See Section 59-1.0 for more information on bridge widths.

(13) Width (Existing Bridge to Remain in Place). Clear width will be at least equal to the approach traveled way width or the table value, whichever is greater. For a bridge longer than 100 ft, the value does not apply. The acceptability of such a bridge will be assessed individually.

(14) Vertical Clearance (Collector Under). Value includes an additional 6-in. allowance for future pavement overlays. Vertical clearance applies from usable edge to usable edge of shoulders.

(15) Vertical Clearance (Collector Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(16) Superelevation Rate. See Section 43-3.0 for value of superelevation rate based on design speed and radius.

(17) Horizontal Sight Distance. For a given design speed, the necessary middle ordinate will be determined by the radius and the sight distance which applies at the site. See Section 43-4.0.

(18) Maximum Grade. For a grade along a longitudinal distance of less than 480 ft (PVT to PVC), a one-way downgrade, or a road with AADT < 400, the maximum grade may be up to 2% steeper than the table value.

(19) Intersection Sight Distance. For a left turn onto a 2-lane roadway: P = Passenger car; SUT = single unit truck. See Figure 46-10G for value for a combination truck.

Design Element				Manual Section	2 Lanes					
Design Controls	Design-Year Traffic (AADT)			40-2.01	< 50	50 ≤ AADT < 250	250 ≤ AADT < 400	400 ≤ AADT < 1500	1500 ≤ AADT < 2000	≥ 2000
	Design Forecast Period			40-2.02	20 years					
	*Design Speed (mph) (3)	Level		40-3.0	30 – 55	30 – 55	35 – 55	50 – 55	50 – 55	50 – 55
		Rolling			30 – 55	30 – 55	30 – 55	35 – 55	35 – 55	35 – 55
	Access Control			40-5.0	None					
	Level of Service			40-2.0	Desirable: B; Minimum: D					
Cross Section Elements**	Travel Lane	*Width		45-1.01	10 ft	10 ft	10 ft (4a)	11 ft	11 ft (4b)	12 ft
		Typical Surface Type		Chp. 52	Asphalt / Concrete / Aggregate					
	Shoulder	*Width Usable		45-1.02	2 ft	2 ft	2 ft	6 ft (5)	6 ft	8 ft
		Typical Surface Type		Chp. 52	Asphalt / Aggregate / Earth					
	Cross Slope	*Travel Lane (6)		45-1.01	2%-3% Asphalt / Concrete; 6% Aggregate					
		Shoulder (6A)		45-1.02	Paved Width ≤ 4 ft: 2% - 3%; Paved Width > 4 ft: 4% - 6% Asphalt/Concrete; 6%-8% Aggregate; 8% Earth					
	Auxiliary Lane	Lane Width		45-1.03	Same as Travel Lane			Des: Same as Travel Lane; Min: 10 ft		
		Shoulder Width			Desirable: 4 ft; Minimum: 2 ft					
	Clear Zone			49-2.0	(7)					
	Side Slopes	Cut	Foreslope	45-3.0	4:1 (V ≥ 60) (8); 3:1 (V ≤ 50) (8)					
			Ditch Width		Des: 4 ft; Min: 0.0 ft					
			Backslope		4:1 (V ≥ 60); 3:1 (V ≤ 50) (9)					
		Fill	0-30 ft Height	45-3.0	Desirable: 4:1; Maximum: 3:1					
			>30 ft Height		3:1					
Bridges**	New or Reconstructed Bridge	*Structural Capacity		Chp. 60	HL-93 (9A)					
		*Clear-Roadway Width (10)		45-4.01	Travelway + 4 ft			Travelway + 6 ft		Full Paved Approach Width
	Existing Bridge to Remain in Place	*Structural Capacity		Chp. 72	HS-10	HS-15				
		*Clear-Roadway Width (11)		45-4.01	20 ft		22 ft		24 ft	28 ft
	*Vertical Clearance (Local Road Under)	New or Replaced Overpassing Bridge (12)		44-4.0	14.5 ft					
		Existing Overpassing Bridge			14 ft					
	Vertical Clearance (Local Road Over Railroad) (13)			Chp. 69	23 ft					

Des: Desirable. Min: Minimum.

* Controlling design criterion.
** Selection of the cross section and bridge elements is based on the design-year traffic volume irrespective of the design speed.

GEOMETRIC DESIGN CRITERIA FOR RURAL LOCAL ROAD
(New Construction or Reconstruction)

Figure 53-5

Design Element			Manual Section	2 Lanes						
Alignment Elements	Design Speed		----	20 mph	25 mph	30 mph	35 mph	45 mph	50 mph	55 mph
	*Stopping Sight Distance		42-1.0	115 ft	155 ft	200 ft	250 ft	360 ft	425 ft	495 ft
	Decision Sight Distance	Speed / Path / Direction Chg.	42-2.0	300 ft	375 ft	450 ft	525 ft	675 ft	750 ft	865 ft
		Stop Maneuver		130 ft	170 ft	220 ft	275 ft	395 ft	465 ft	535 ft
	Passing Sight Distance		42-3.0	710 ft	900 ft	1090 ft	1280 ft	1625 ft	1835 ft	1985 ft
	Intersection Sight Distance		46-10.0	220 ft	280 ft	330 ft	390 ft	500 ft	550 ft	610 ft
	*Minimum Radius (e=8%)		43-2.0	90 ft	180 ft	270 ft	590 ft	590 ft	750 ft	1000 ft
	*Superelevation Rate		43-3.0	e_{max}=8% (14)						
	*Horizontal Sight Distance		43-4.0	(15)						
	*Vertical Curvature (K-value)	Crest	44-3.0	7	12	19	29	61	84	114
		Sag		17	26	37	49	79	96	115
	*Maximum Grade	Level	44-1.02	8%	7%	7%	7%	7%	6%	5.5%
		Rolling		11%	11%	10%	9%	9%	8%	7%
	Minimum Grade		44-1.03	Desirable: 0.5%; Minimum: 0.0%						

* Controlling design criterion. A deviation from such is a design exception, and is subject to approval. See Section 40-8.0.

A deviation from a controlling design criterion should be addressed in an approved design exception.

These criteria apply only to a federal-aid project.

GEOMETRIC DESIGN CRITERIA FOR RURAL LOCAL ROAD
(New Construction or Reconstruction)

Figure 53-5 (continued)

GEOMETRIC DESIGN CRITERIA FOR RURAL LOCAL ROAD
(New Construction or Reconstruction)

Footnotes to Figure 53-5

(1) (Blank).

(2) (Blank).

(3) Design Speed. The minimum design speed should equal the minimum value or the anticipated posted speed limit after construction, whichever is greater. The legal speed limit is 55 mph on a non-posted highway.

(4) Travel Lane Width. The following will apply.
- a. Use 11-ft lanes where V ≤ 50 mph.
- b. Use 12-ft lanes where V ≥ 55 mph.

(5) Shoulder Width. The following will apply.
- a. For 400 ≤ AADT < 1500, the shoulder width may be 4 ft.
- b. Usable-shoulder width is defined as the distance from the edge of the travel lane to the shoulder break point.
- c. If curbs are to be used, the criteria described in Figure 53-9 should be applied.

(6) Cross Slope (Travel Lanes). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(6A) Cross Slope (Shoulder). See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information.

(7) Clear Zone. The clear zone will vary according to design speed, traffic volume, side slopes, and horizontal curvature. See Section 49-2.0. For a design speed of lower than 50 mph, a 10-ft clear zone may be used.

(8) Foreslope. See Sections 49-2.0 and 49-3.0 for the lateral extent of the foreslope in a ditch section.

(9) Backslope. The backslopes for a rock cut will vary according to the height of the cut and the geotechnical requirements.

(9A) Structural Capacity (New or Reconstructed Bridge). HS-25 loading with Alternate Military Loading should be applied for each project with notice to proceed with design beginning September 1, 2004, through December 31, 2005.

GEOMETRIC DESIGN CRITERIA FOR RURAL LOCAL ROAD
(New Construction or Reconstruction)

Footnotes to Figure 53-5 (continued)

(10) Width (New or Reconstructed Bridge). A bridge longer than 100 ft will be analyzed individually. At a minimum, the roadway width will be the width of travel lanes plus a 3-ft right shoulder and a 3-ft left shoulder for AADT > 2000. Where shoulders are paved, it is desirable to provide the full approach-roadway width. See Section 59-1.0 for more information on bridge width.

(11) Width (Existing Bridge to Remain in Place). Minimum roadway width of 2 ft narrower than the value may be used on a road with few trucks. The clear-roadway width should be at least the same width as the approach travelway. For a one-lane bridge, the width may be 18 ft. For a bridge longer than 100 ft, the value does not apply. The acceptability of each such bridge will be assessed individually.

(12) Vertical Clearance (Local Road Under). Value includes an additional 6-in. allowance for future pavement overlays. Vertical clearance applies from usable edge to usable edge of shoulders.

(13) Vertical Clearance (Local Road Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under highway.

(14) Superelevation Rate. See Section 43-3.0 for value of superelevation rate based on design speed and radius.

(15) Horizontal Sight Distance. For a given design speed, the necessary middle ordinate will be determined by the radius and the sight distance which applies at the site. See Section 43-4.0.

Design Element				Manual Section	Design Value (By Type of Area)		
					Suburban	Intermediate	Built-Up
Design Controls	Design Forecast Period			40-2.02	20 Years	20 Years	20 Years
	Design Speed (mph) (1)			40-3.0	Curbed: 45-55 Uncurbed: 50-60	Curbed: 40-50 Uncurbed: 50-60	Curbed: 30-35
	Access Control			40-5.0	Partial Control / None	None	None
	Level of Service			40-2.0	Des: B; Min: C	Des: C; Min: D	Des: C; Min: D
	On-Street Parking			45-1.04	None	Optional (2)	Optional (2)
Cross Section Elements	Travel Lane	*Width (3)		45-1.01	Curbed: 12 ft Uncurbed: 12 ft	Curbed: Des.: 12 ft; Min.: 11 ft Uncurbed: Des.: 12 ft; Min.: 11 ft	Curbed: Des.: 12 ft; Min.: 10 ft
		Typical Surface Type (4)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	*Curb Offset (5)			45-1.02	2 ft	2 ft	2 ft
	Shoulder	*Paved Width (6)		45-1.02	Curbed, Rt. Des: 10 ft; Min 2 ft Curbed, Lt. Des: 4 ft; Min 2 ft Uncurbed, Rt.: 10 ft; Lt.: 4 ft	Curbed, Rt. Des: 8 ft; Min 2 ft Curbed, Lt. Des: 4 ft; Min 2 ft Uncurbed, Rt.: 8 ft; Lt.: 4 ft	Right: 6 ft; Left: 4 ft
		Typical Surface Type (4)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	Cross Slope	*Travel Lane (7)		45-1.01	2%	2%	2%
		Shoulder (7A)		45-1.02	Paved Width ≤ 4 ft: 2%; Paved Width > 4 ft: 4%	Paved Width ≤ 4 ft: 2%; Paved Width > 4 ft: 4%	Paved Width ≤ 4 ft: 2%; Paved Width > 4 ft: 4%
	Auxiliary Lane	Lane Width		45-1.03	Des: 12 ft; Min: 11 ft	Des: 12 ft; Min: 11 ft	Des: 12 ft; Min: 10 ft
		Curb Offset (8)			1 ft	1 ft	1 ft
		Shoulder Width			Des: 10 ft; Min: 2 ft	Des: 8 ft; Min: 2 ft	Des: 6 ft; Min: 2 ft
		Typical Surface Type (4)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	TWLTL Lane Width			46-5.0	Des: 16 ft; Min. 14 ft	Des: 16 ft; Min: 14 ft	Des: 14 ft; Min: 12 ft
	Parking Lane Width			45-1.04	N/A	Des: 12 ft; Min: 10 ft (9)	Des: 12 ft; Min: 10 ft (9)
	Median Width	Depressed		45-2.0	26.5 ft – 50 ft	N/A	N/A
		Raised Island			Des: 18 ft; Min: 13 ft (10)	Des: 18 ft; Min: 4 ft (10)	Des: 18 ft; Min: 4 ft (10)
		Flush / Corrugated			Des: 16 ft; Min: 13 ft (10)	Des: 16 ft; Min: 4 ft (10)	Des: 16 ft; Min: 4 ft (10)
	Sidewalk Width (11)			45-1.06	5 ft with 5-ft Buffer (Des)	5 ft with 5-ft Buffer (Des)	Varies; 6 ft Min
	Bicycle-Lane Width (12)			51-7.0	Curbed: 5 ft Uncurbed: Shld Width +4 ft	Curbed: 5 ft Uncurbed: Shoulder Width +4 ft	Curbed: 5 ft
	Clear Zone			49-2.0	(13)	(13)	(13)
	Typical Curbing Type (where used) (14)			45-1.05	Sloping / Vertical	Sloping / Vertical	Sloping / Vertical
	Side Slopes (Uncurbed) (15)	Cut	Foreslope	45-3.0	6:1 (16)	6:1 (16)	N/A
			Ditch Width		4 ft (17)	4 ft (17)	N/A
			Backslope		4:1 for 20 ft; 3:1 Max. to Top (18)	4:1 for 20 ft; 3:1 Max. to Top (18)	N/A
		Fill			6:1 to Clear Zone; 3:1 Max. to Toe	6:1 to Clear Zone; 3:1 Max. to Toe	N/A
	Side Slopes (Curbed)	Cut (Backslope)		45-3.0	(19)	(19)	(19)
		Fill			12:1 for 12 ft; 3:1 Max. to Toe	12:1 for 12 ft; 3:1 Max. to Toe	12:1 for 12 ft; 3:1 Max. to Toe
	Median Slopes (Depressed)			45-2.0	Des: 8:1; Max: 5:1	N/A	N/A

* Controlling design criterion. Des: Desirable. Min: Minimum.

GEOMETRIC DESIGN CRITERIA FOR URBAN ARTERIAL, 4 OR MORE LANES
(New Construction or Reconstruction)

Figure 53-6

Design Element			Manual Section	Design Value (By Type of Area)				
				Suburban	Intermediate	Built-Up		
Bridges	New or Reconstructed Bridge	*Structural Capacity (20)	Ch. 60	HL-93	HL-93	HL-93		
		*Clear-Roadway Width(21)	45-4.01	Uncurbed: Full Paved Approach Width Curbed: Full Approach Curb-to-Curb Width				
	Existing Bridge to Remain in Place	*Structural Capacity	Ch. 72	HS-20	HS-20	HS-20		
		*Clear-Roadway Width	45-4.01	Uncurbed: Travelway Plus 2 ft on Each Side; Curbed: Full Approach Curb-to-Curb Width				
	*Vertical Clearance (Arterial Under) (22)	New or Replaced Overpassing Bridge (22a)	44-4.0	16.5 ft	16.5 ft (22b)	16.5 ft (22b)		
		Existing Overpassing Bridge		14 ft	14 ft	14 ft		
		Sign Truss / Pedestrian Bridge (22a)		New: 17.5 ft; Existing: 17 ft	New: 17.5ft; Existing: 17 ft	New: 17.5 ft; Existing: 17 ft		
	Vertical Clearance (Arterial over Railroad) (23)		Ch. 69	23 ft				
Alignment Elements	Design Speed			30 mph	35 mph	45 mph	50 mph	55 mph
	*Stopping Sight Distance		42-1.0	200 ft	250 ft	360 ft	425 ft	495 ft
	Decision Sight Distance	Speed / Path / Direction Change	42-2.0	U: 620 ft SU: 535 ft	U: 720 ft SU: 625 ft	U: 930 ft SU: 800 ft	U: 1030 ft SU: 890 ft	U: 1135 ft SU: 980 ft
		Stop Maneuver		490 ft	590 ft	800 ft	910 ft	1030 ft
	Intersection Sight Distance, -3% to +3% (28)		46-10.0	P: 355 ft SUT: 450 ft	P: 415 ft SUT: 525 ft	P: 530 ft SUT: 675 ft	P: 665 ft SUT: 825 ft	P: 770 ft SUT: 950 ft
	*Minimum Radius for e_{max} =4% / 6%		43-2.0	260 ft/ 240 ft (24a)	420ft / 390 ft (24a)	600 ft / 550 ft (24a)	750 ft (24b)	1000 ft (24b)
	*Superelevation Rate (25)		43-3.0	Up to e_{max} = 6%			e_{max}=8%	
	*Horizontal Sight Distance		43-4.0	(26)				
	*Vertical Curvature (K-value)	Crest	44-3.0	19	29	61	84	114
		Sag		37	49	79	96	115
	*Maximum Grade (27)	Level	44-1.02	8%	7%	6.5%	6%	5.5%
		Rolling		9%	8%	7.5%	7%	6.5%
	Minimum Grade		44-1.03	Desirable: 0.5% Minimum: 0.3% (Curbed); 0.0% (Uncurbed)				

U: Urban; SU: Suburban.

* Controlling design criterion. A deviation from such is a design exception, and is subject to approval. See Section 40-8.0.

These criteria apply to a route either on or off the National Highway System, regardless of funding source.

GEOMETRIC DESIGN CRITERIA FOR URBAN ARTERIAL, 4 OR MORE LANES
(New Construction or Reconstruction)

Figure 53-6 (Continued)

GEOMETRIC DESIGN CRITERIA FOR URBAN ARTERIAL, 4 OR MORE LANES
(New Construction or Reconstruction)

Footnotes to Figure 53-6

(1) Design Speed. The minimum design speed should equal the minimum value, the anticipated posted speed limit after construction, or the legal speed limit on a non-posted highway. The legal speed limit in an urban district is 30 mph. Based on an engineering study, the design speed may be raised to an absolute maximum of 55 mph.

(2) On-Street Parking. In general, on-street parking is discouraged.

(3) Travel-Lane Width. For an arterial on the National Truck Network, the right lane must be 12 ft in width.

(4) Surface Type. The pavement-type selection will be determined by the INDOT Office of Pavement Engineering.

(5) Curb Offset. The curb offset (for both left and right sides) should be 2 ft. Vertical curbs introduced intermittently should be offset 2 ft. A continuous curb used along a median or channelizing island may be offset 1 ft.

(6) Shoulder Width. The value applies to the paved-shoulder width. The following will also apply.
- a. For an uncurbed section, the shoulder is paved to the front face of guardrail. The desirable guardrail offset is 2 ft from the effective usable-shoulder width. See Section 49-5.0 for more information.
- b. For an uncurbed section, a desirable additional 1 ft of compacted aggregate will be provided.
- c. For a curbed section, the curb offset is included in the paved shoulder width.

(7) Cross Slope (Travel Lane). Cross slopes of 1.5% are acceptable for an existing bridge to remain in place.

(7A) Cross Slope (Shoulder). See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information.

(8) Curb Offset for Auxiliary Lane. In a curbed section, the offset may be zero.

(9) Parking Lane. Where a parking lane will be used as a travel lane during peak hours or may be converted to a travel lane in the future, the width should be equal to the travel lane width plus a 1-ft offset to the curb (if present). The cross slope for a parking lane is typically 1% steeper than that of the adjacent travel lane.

(10) Minimum Median Width. The criteria assume the presence of a mountable curb with a 0-ft curb offset.

(11) Sidewalk Width. A buffer of less than 2 ft wide is not permitted. If no buffer is provided, the sidewalk width should be 6 ft.

(12) Bicycle-Lane Width. The value is in addition to the width of a parking lane, if present. See Section 51-7.0 for additional details.

(13) Clear Zone. The following will apply.
- a. Facility with Vertical Curbs. The clear zone will be measured from the edge of travel lane or will be to the right-of-way line, whichever is less. No clear zone is required where there is 24-h parking.
- b. Facility with Sloping Curbs or without Curbs. The clear zone will vary according to design speed, traffic volume, side slopes, and horizontal curvature.
- c. Curbed Facility. There should be an appurtenance-free area as measured from the gutter line of any curb.
- d. Value. See Section 49-2.0 for specific clear-zone value.

Footnotes to Figure 53-6 (continued)

(14) Curbing Type. Vertical curbs may only be used with design speed 45 mph or lower.

(15) Side Slope (Uncurbed). Value is for new construction. See Sections 45-3.0 and 45-8.0 for more information. For a reconstruction project, see Section 49-3.0.

(16) Foreslope. See Sections 49-2.0 and 49-3.0 for the lateral extent of the foreslope in a ditch section.

(17) Ditch Width. A V-ditch should be used in a rock cut. See Section 45-8.0.

(18) Backslope. The backslope for a rock cut will vary according to the height of the cut and the geotechnical requirements. See Section 45-8.0 for typical rock-cut sections.

(19) Side Slope (Curbed) Cut. A shelf or sidewalk will be present immediately behind the curb before the toe of the backslope. The minimum width of a shelf will be 6 ft. Where a sidewalk is present, the toe of the backslope will be 1 ft beyond the edge of sidewalk. See Section 45-3.0 for more information.

(20) Structural Capacity (New or Reconstructed Bridge). The following will apply.
- a. HS-25 loading with Alternate Military Loading should be applied for each project with notice to proceed with design beginning September 1, 2004, through December 31, 2005.
- b A State-highway bridge within 15 mi of a Toll-Road gate must be designed for Toll-Road loading.
- c. A bridge on an Extra-Heavy-Duty Highway must be designed for the Michigan Train truck loading configuration.
- d. See Chapter Sixty for additional information on the loading configurations.

(21) Width (New or Reconstructed Bridge). See Section 59-1.0 for more information on bridge width.

(22) Vertical Clearance (Arterial Under Railroad). The following will apply.
- a. Value includes an additional 6-in. allowance for future pavement overlays.
- b. In a highly urbanized area, a minimum clearance of 14 ft may be provided if there is at least one route with a 16-ft clearance.
- c. Vertical clearance applies from usable edge to usable edge of shoulders.

(23) Vertical Clearance (Arterial Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(24) Minimum Radius. The following will apply:
- a. Based on e_{max} = 4% or 6% and low-speed urban street conditions.
- b. Based on e_{max} = 8% and open-road conditions.

(25) Superelevation Rate. See Section 43-3.0 for values of superelevation rate based on design speed and radius. See Section 43-3.0 and the INDOT *Standard Drawings* for information on superelevation requirements.

(26) Horizontal Sight Distance. For a given design speed, the necessary middle ordinate will be determined by the radius and the sight distance which applies at the site. Sometimes the stopping-sight-distance value for a truck will apply. See the discussion in Section 43-4.0.

(27) Where adjacent sidewalks are present, the maximum desirable grade is 5%.

(28) Intersection Sight Distance. For a left turn onto a two-way, 4-lane undivided roadway: P = Passenger car; SUT = single unit truck. See Figure 46-10G for value for a combination truck.

Design Element				Manual Section	Design Value (By Type of Area)		
					Suburban	Intermediate	Built-up
Design Controls	Design Forecast Period			40-2.02	20 Years	20 Years	20 Years
	*Design Speed (mph) (1)			40-3.0	Curbed: 35-55 Uncurbed: 40-55	Curbed: 35-55 Uncurbed: 40-50	Curbed: 30 - 35
	Access Control			40-5.0	Partial Control / None	None	None
	Level of Service			40-2.0	Des: B; Min: C	Des: C; Min: D	Des: C; Min: C
	On-Street Parking			45-1.04	None	Optional (2)	Optional (2)
Cross Section Elements	Travel Lane	*Width (3)		45-1.01	Curbed: 12 ft Uncurbed: 12 ft	Curbed: Des.: 12 ft; Min.: 11 ft Uncurbed: 12 ft	Curbed: Des.: 12 ft; Min.: 11 ft
		Typical Surface Type (4)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	*Curb Offset (5)			45-1.02	2 ft	2 ft	2 ft
	Shoulder	*Paved Width (6)		45-1.02	Curbed Des: 10 ft; Min. 2 ft Uncurbed: 10 ft	Curbed: Des: 8 ft; Min: 2 ft Uncurbed: 8 ft;	6 ft
		Typical Surface Type (4)		Ch 52.	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	Cross Slope	*Travel Lane (7)		45-1.01	2%	2%	2%
		Shoulder (7A)		45-1.02	4%	4%	4%
	Auxiliary Lane	Lane Width		45-1.03	Des: 12 ft; Min: 11 ft	Des: 12 ft; Min: 11 ft	Des: 11 ft; Min: 10 ft
		Curb Offset (8)			1 ft	1 ft	1 ft
		Shoulder Width			Des: 10 ft; Min: 2 ft	Des: 8 ft; Min: 2 ft	Des: 6 ft; Min: 2 ft
		Typical Surface Type (4)		Chp. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	TWLTL Lane Width			46-5.0	Des: 16 ft; Min. 14 ft	Des: 16 ft; Min: 14 ft	Des: 14 ft; Min: 12 ft
	Parking-Lane Width			45-1.04	N/A	Des: 12 ft; Min: 10 ft (9)	Des: 12 ft; Min: 10 ft (9)
	Sidewalk Width (10)			45-1.06	5 ft with 5-ft Buffer (Des)	5 ft with 5-ft Buffer (Des)	Varies; 6 ft Min
	Bicycle-Lane Width (11)			51.7.0	Curbed: 5 ft Uncurbed: Shld. Width +4 ft	Curbed: 5 ft Uncurbed: Shoulder Width +4 ft	Curbed: 5 ft
	Clear Zone			49-2.0	(12)	(12)	(12)
	Typical Curbing Type (where used) (13)			45-1.05	Sloping / Vertical	Sloping / Vertical	Sloping / Vertical
	Side Slopes (Uncurbed) (14)	Cut	Foreslope	45-3.0	6:1 (15)	6:1 (15)	N/A
			Ditch Width		4 ft (16)	4 ft (16)	N/A
			Backslope		4:1 for 20 ft; 3:1 Max. to Top (17)	4:1 for 20 ft; 3:1 Max. to Top (17)	N/A
		Fill			6:1 to Clear Zone; 3:1 Max. to Toe	6:1 to Clear Zone; 3:1 Max. to Toe	N/A
	Side Slopes (Curbed)	Cut (Backslope)		45-3.0	(18)	(18)	(18)
		Fill			12:1 for 12 ft; 3:1 Max. to Toe	12:1 for 12 ft; 3:1 Max. to Toe	12:1 for 12 ft; 3:1 Max. to Toe

*Controlling design criterion. Des: Desirable; Min. Minimum.

GEOMETRIC DESIGN CRITERIA FOR URBAN ARTERIAL, 2 LANES
(New Construction or Reconstruction)

Figure 53-7

Design Element			Manual Section	Design Value (By Type of Area)				
				Suburban	Intermediate	Built-Up		
Bridges	New or Reconstructed Bridge	*Structural Capacity (19)	Ch. 60	HL-93	HL-93	HL-93		
		*Clear-Roadway Width(20)	45-4.01	Uncurbed: Full Paved Approach Width Curbed: Full Approach Curb-to-Curb Width				
	Existing Bridge to Re-Main in Place	*Structural Capacity	Ch. 72	HS-20	HS-20	HS-20		
		*Clear-Roadway Width	45-4.0	Uncurbed: Travelway Plus 2 ft on Each Side; Curbed: Full Approach Curb-to-Curb Width				
	*Vertical Clearance (Arterial Under) (21)	New or Replaced Overpassing Bridge (21a)	44-4.0	16.5 ft	16.5 ft (21b)	16.5 ft (21b)		
		Existing Overpassing Bridge		14 ft	14 ft	14 ft		
		Sign Truss / Pedestrian Bridge (21a)		New: 17.5 ft; Existing: 17 ft	New: 17.5 ft; Existing: 17 ft	New: 17.5 ft; Existing: 17 ft		
	Vertical Clearance (Arterial over Railroad) (22)		Ch. 69	23 ft				
Alignment Elemets	Design Speed			30 mph	35 mph	45 mph	50 mph	55 mph
	*Stopping Sight Distance		42-1.0	200 ft	250 ft	360 ft	425 ft	495 ft
	Decision Sight Distance	Speed / Path / Direction Change	42-2.0	U: 620 ft SU: 535 ft	U: 720 ft SU: 625 ft	U: 930 ft SU: 800 ft	U: 1030 ft SU: 890 ft	U: 1135 ft SU: 980 ft
		Stop Maneuver		490 ft	590 ft	800 ft	910 ft	1030 ft
	Intersection Sight Distance, -3% to +3% (27)		46-10.0	P: 330 ft SUT: 420 ft	P: 390 ft SUT: 490 ft	P: 500 ft SUT: 630 ft	P: 630 ft SUT: 780 ft	P: 730 ft SUT: 890 ft
	*Minimum Radius for e_{max} = 4% / 6%		43-2.0	260 ft/ 240 ft (23 a)	420 ft / 390 ft (23a)	600 ft / 550 ft (23a)	750 ft (23b)	1000 ft (23b)
	*Superelevation Rate (24)		43-3.0	Up to e_{max}=6%			e_{max}=8%	
	*Horizontal Sight Distance		43-4.0	(25)				
	*Vertical Curvature (K-value)	Crest	44-3.0	19	29	61	84	114
		Sag		37	49	79	96	115
	*Maximum Grade	Level	44-1.02	8%	7%	6.5%	6%	5.5%
		Rolling		9%	8%	7.5%	7%	6.5%
	Minimum Grade (26)		44-1.03	Desirable: 0.5% Minimum: 0.3% (Curbed); 0.0% (Uncurbed)				

U: Urban; SU: Suburban.

* Controlling design criterion. A deviation from such is a design exception, and is subject to approval. See Section 40-8.0.

These criteria apply to a route on or off the National Highway System, regardless of funding source.

GEOMETRIC DESIGN CRITERIA FOR URBAN ARTERIAL, 2 LANES
(New Construction or Reconstruction)

Figure 53-7 (Continued)

GEOMETRIC DESIGN CRITERIA FOR URBAN ARTERIAL, 2 LANES
(New Construction or Reconstruction)

Footnotes to Figure 53-7

(1) Design Speed. The minimum design speed should equal the minimum value, the anticipated posted speed limit after construction or the legal speed limit on a non-posted highway. The legal speed limit in an urban district is 30 mph. Based upon an engineering study, the design speed may be raised to an absolute maximum of 55 mph.

(2) On-Street Parking. In general, on-street parking is discouraged.

(3) Travel-Lane Width. For an arterial on the National Truck Network, lane widths must be 12 ft.

(4) Surface Type. The pavement-type selection will be determined by the INDOT Office of Pavement Engineering.

(5) Curb Offset. The curb offset should be 2 ft. Vertical curbs introduced intermittently should be offset 2 ft. A continuous curb used along a median or channelizing island may be offset 1 ft.

(6) Shoulder Width. The value applies to the paved-shoulder width. The following will also apply.
- a. For an uncurbed section, the shoulder is paved to the front face of guardrail. The desirable guardrail offset is 2 ft from the effective usable shoulder width. See Section 49-5.0 for more information.
- b. For an uncurbed section, a desirable additional 1 ft of compacted aggregate will be provided.
- c. For a curbed section, the curb offset is included in the paved-shoulder width.

(7) Cross Slope (Travel Lane). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(7A) Cross Slope (Shoulder). See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information.

(8) Curb Offset for Auxiliary Lane. In a curbed section, the offset may be zero.

(9) Parking Lane. Where the parking lane will be used as a travel lane during peak hours or may be converted to a travel lane in the future, the width should be equal to the travel lane width plus a 1-ft offset to the curb (if present). The cross slope for a parking lane is typically 1% steeper than that of the adjacent travel lane.

(10) Sidewalk Width. A buffer of less than 2 ft wide is not permitted. If no buffer is provided, the sidewalk width should be 6 ft.

(11) Bicycle-Lane Width. The value is in addition to the width of a parking lane, if present. See Section 51-7.0 for additional details.

(12) Clear Zone. The following will apply.
- a. Facility with Vertical Curbs. The clear zone will be measured from the edge of travel lane or will be to the right-of-way line, whichever is less. No clear zone is required where there is 24-h parking.
- b. Facility with Sloping Curbs or without Curbs. The clear zone will vary according to design speed, traffic volume, side slopes, and horizontal curvature.
- c. Curbed Facility. There should be an appurtenance-free area as measured from the gutter line of a curb.
- d. Value. See Section 49-2.0 for specific clear-zone value.

Footnotes to Table 53-7 (continued)

(13) Curbing Type. Vertical curbs may only be used with design speed 45 mph or lower.

(14) Side Slope (Uncurbed). Value is for new construction. See Sections 45-3.0 and 45-8.0 for more information. For a reconstruction project, see Section 49-3.0.

(15) Foreslope. See Sections 49-2.0 and 49-3.0 for the lateral extent of the foreslope in a ditch section.

(16) Ditch Width. A V-ditch should be used in a rock cut. See Section 45-8.0.

(17) Backslope. The backslope for a rock cut will vary according to the height of the cut and the geotechnical requirements. See Section 45-8.0 for typical rock-cut sections.

(18) Side Slope (Curbed) Cut. A shelf or sidewalk will be present immediately behind the curb before the toe of the backslope. The minimum width of a shelf will be 6 ft. Where a sidewalk is present, the toe of the backslope will be 2 ft beyond the edge of sidewalk. See Section 45-3.0 for more information.

(19) Structural Capacity (New or Reconstructed Bridge). The following will apply.
- a. HS-25 loading with Alternate Military Loading should be applied for each project with notice to proceed with design beginning September 1, 2004, through December 31, 2005.
- b. A State-highway bridge within 15 mi of a Toll-Road gate must be designed for Toll-Road loading.
- c. A bridge on an Extra-Heavy-Duty Highway must be designed for the Michigan Train truck loading configuration.
- d. See Chapter Sixty for additional information on the loading configurations.

(20) Width (New or Reconstructed Bridge). See Section 59-1.0 for more information on bridge width.

(21) Vertical Clearance (Arterial Under Railroad). The following will apply.
- a. Value includes an additional 6-in. allowance for future pavement overlays.
- b. In a highly urbanized area, a minimum clearance of 14 ft may be provided if there is at least one route with a 16-ft clearance.
- c. Vertical clearance applies from usable edge to usable edge of shoulder.

(22) Vertical Clearance (Arterial Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(23) Minimum Radius. The following will apply:
- a. Based on e_{max} = 4% or 6% and low-speed urban street conditions.
- b. Based on e_{max} = 8% and open-road conditions.

(24) Superelevation Rate. See Section 43-3.0 for value of superelevation rate based on design speed and radius. See Section 43-3.0 and the INDOT *Standard Drawings* for information on superelevation requirements.

(25) Horizontal Sight Distance. For a given design speed, the necessary middle ordinate will be determined by the radius and the sight distance which applies at the site. Sometimes the stopping-sight-distance value for a truck will apply. See the discussion in Section 43-4.0.

(26) Where adjacent sidewalks are present, the maximum desirable grade is 5%.

(27) Intersection Sight Distance. For a left turn onto a 2-lane roadway: P = Passenger car; SUT = single unit truck. See Figure 46-10G for value for a combination truck.

Design Element				Manual Section	Design Value (By Type of Area)		
					Suburban	Intermediate	Built-Up
Design Controls	Design Forecast Period			40-2.02	20 Years	20 Years	20 Years
	*Design Speed (mph) (2)			40-3.0	Curbed: 30 - 50 Uncurbed: 30 - 50	Curbed: 30 - 45 Uncurbed: 30 - 45	Curbed: 30 - 35
	Access Control			40-5.0	None	None	None
	Level of Service			40-2.0	Desirable: C; Minimum: D	Desirable: C; Minimum: D	Desirable: C; Minimum: D
	On-Street Parking			45-1.04	Optional (3)	Optional (3)	Optional (3)
Alignment Elements	Travel Lane	*Width (4)		45-1.01	Curbed: Des: 12 ft; Min: 11 ft Uncurbed: Des: 12 ft; Min: 11 ft	Curbed: Des: 12 ft; Min: 11 ft Uncurbed: Des: 12 ft; Min: 11 ft	Curbed: Des: 12 ft; Min: 10 ft
		Typical Surface Type (5)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	*Curb Offset (6)			45-1.02	2 ft	2 ft	2 ft
	Shoulder	*Paved Width (7)		45-1.02	Curbed Des: 8 ft; Min. 2 ft Uncurbed: 8 ft	Curbed: Des: 6 ft; Min: 2 ft Uncurbed: 6 ft	8 ft
		Typical Surface Type (5)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	Cross Slope	*Travel Lane (8)		45-1.01	2%	2%	2%
		Shoulder (8A)		45-1.02	4%	4%	2%
	Auxiliary Lane	Lane Width		45-1.03	Des: 12 ft; Min: 11 ft	Des: 12 ft; Min: 10 ft	Des: 12 ft; Min: 10 ft
		Curb Offset			Des: 1 ft; Min: 0.0 ft	Des: 1 ft; Min: 0.0 ft	Des: 1 ft; Min: 0.0 ft
		Shoulder Width			Des: 8 ft; Min: 2 ft	Des: 6 ft; Min: 2 ft	Des: 4 ft; Min: 2 ft
		Typical Surface Type (5)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	TWLTL Lane Width			46-5.0	Des: 16 ft; Min: 12 ft	Des: 14 ft; Min: 12 ft	Des: 14 ft; Min: 12 ft
	Parking-Lane Width (1)			45-1.04	Des: 11 ft; Min: 8 ft	Des: 11 ft; Min: 8 ft	Des: 11 ft; Min: 8 ft
	Median Width	Raised Island		45-2.0	Des: 18 ft; Min: 4 ft (9)	Des: 18 ft; Min: 4 ft (9)	Des: 18 ft; Min: 4 ft (9)
		Flush / Corrugated			Des: 16 ft; Min: 4 ft (9)	Des: 16 ft; Min: 4 ft (9)	Des: 16 ft; Min: 4 ft (9)
	Sidewalk Width (10)			45-1.06	5 ft with 5 ft Buffer (Des)	5 ft with 5 ft Buffer (Des)	Varies, 6 ft Min
	Bicycle-Lane Width (11)			51-7.0	Curbed: 5 ft Uncurbed: Shld. Width +4 ft	Curbed: 5 ft Uncurbed: Shld. Width +4 ft	Curbed: 5 ft
	Clear Zone			49-2.0	(12)	(12)	(12)
	Typical Curbing Type (where used) (13)			45-1.05	Sloping / Vertical	Sloping / Vertical	Sloping / Vertical
	Side Slopes (Uncurbed) (14)	Cut	Foreslope	45-3.0	Des: 6:1; Max: 4:1 (15)	Des: 6:1; Max: 4:1 (15)	N/A
			Ditch Width		4 ft (16)	4 ft (16)	N/A
			Backslope		4:1 for 4 ft; 3:1 Max. to Top (17)	4:1 for 4 ft; 3:1 Max. to Top (17)	N/A
		Fill			Des: 6:1 to Clr Zone; 3:1 Max to Toe Max: 4:1 to Clr Zone; 3:1 Max to Toe	Des: 6:1 to Clr Zone; 3:1 Max to Toe Max: 4:1 to Clr Zone; 3:1 Max to Toe	N/A
	Side Slopes (Curbed)	Cut(Backslope)		45-3.0	(18)	(18)	(18)
		Fill (19)			12:1 for 12 ft; 3:1 Max to Toe	12:1 for 12 ft; 3:1 Max to Toe	12:1 for 12 ft; 3:1 Max to Toe

* Controlling design criterion. Des: Desirable; Min: Minimum.

GEOMETRIC DESIGN CRITERIA FOR URBAN COLLECTOR
(New Construction or Reconstruction)

Figure 53-8

Design Element			Manual Section	Design Value (By Type of Area)			
				Suburban	Intermediate		Built-Up
Bridges	New or Reconstructed Bridge	*Structural Capacity (20)	Ch. 60	HL-93	HL-93		HL-93
		*Clear-Roadway Width(21)	45-4.01	Uncurbed: Full Paved Approach Width Curbed: Full Approach Curb-to-Curb Width			
	Existing Bridge to Remain in Place	*Structural Capacity	Ch. 72	HS-20	HS-20		HS-20
		*Clear-Roadway Width	45-4.01	Uncurbed: Travelway Plus 2 ft on Each Side Curbed: Full Approach Curb-to-Curb Width			
	*Vertical Clearance (Collector) (22)	New or Replaced Overpassing Bridge (22)	44-4.0	14.5 ft	14.5 ft		14.5 ft
		Existing Overpassing Bridge		14 ft	14 ft		14 ft
	Vertical Clearance (Collector over Railroad) (23)		Ch. 69	23 ft			
Alignment Element	Design Speed			30 mph	35 mph	45 mph	50 mph
	*Stopping Sight Distance		42-1.0	200 ft	250 ft	360 ft	425 ft
	Decision Sight Distance	Speed / Path / Direction Change	42-2.0	U: 620 ft SU: 535 ft	U: 720 ft SU: 625 ft	U: 930 ft SU: 800 ft	U: 1030 ft SU: 890 ft
		Stop Maneuver		490 ft	590 ft	800 ft	910 ft
	Intersection Sight Distance, -3% to +3% (28)		46-10.0	P: 330 ft SUT: 420 ft	P: 390 ft SUT: 490 ft	P: 500 ft SUT: 630 ft	P: 630 ft SUT: 780 ft
	*Minimum Radius for e_{max} = 4% / 6%		43-2.0	270 ft / 250 ft (24a)	430 ft / 400 ft (24a)	610 ft / 560 ft (24a)	760 ft (24b)
	*Superelevation Rate (25)		43-3.0	Up to e_{max} = 6%			e_{max} = 8%
	*Horizontal Sight Distance		43-4.0	(26)			
	*Vertical Curvature (K-value)	Crest	44-3.0	19	29	61	84
		Sag		37	49	79	96
	*Maximum Grade (27)	Level	44-1.02	9%	9%	8%	7%
		Rolling		11%	10%	9%	8%
	Minimum Grade		44-1.03	Desirable: 0.5% Minimum: 0.3% (Curbed); 0.0% (Uncurbed)			

U: Urban; SU: Suburban.

* Controlling design criterion. A deviation from such is a design exception, and is subject to approval. See Section 40-8.0.

These criteria apply regardless of funding source.

GEOMETRIC DESIGN CRITERIA FOR URBAN COLLECTOR
(New Construction or Reconstruction)

Figure 53-8 (Continued)

GEOMETRIC DESIGN CRITERIA FOR URBAN COLLECTOR
(New Construction or Reconstruction)

Footnotes to Figure 53-8

(1) Parking Lane. In a residential area, a parallel parking lane of 7 to 8 ft width should be provided on one or both sides of the street. In a commercial or industrial area, parking-lane width should range from 8 to 11 ft, and lanes should usually be provided on both sides of the street. The minimum value may only be used if the lane is not intended for use as a travel lane in a restricted condition. Where a curb-and-gutter section is used, the gutter-pan width may be considered as part of the parking-lane width. Where practical, the parking-lane width should be in addition to the gutter-pan width.

(2) Design Speed. The minimum design speed should equal the minimum value, the anticipated posted speed limit after construction, or the legal speed limit on a non-posted highway. The legal speed limit in an urban district is 30 mph. Based upon an engineering study, the design speed may be raised to an absolute maximum of 55 mph.

(3) On-Street Parking. In general, on-street parking is discouraged.

(4) Travel-Lane Width. In an industrial area, a 12-ft width should be used. Where right-of-way is restricted, an 11-ft width may be used in an industrial area, or a 10-ft width may be used in a residential area. On a multi-lane facility in a built-up area, the minimum width is 10 ft.

(5) Surface Type. The pavement-type selection will be determined by the INDOT Office of Pavement Engineering.

(6) Curb Offset. The curb offset should be 2 ft. Vertical curbs introduced intermittently should be offset 2 ft. A continuous curb used along a median or channelizing island may be offset 1 ft.

(7) Shoulder Width. The value applies to paved-shoulder width. The following will also apply.

a. For an uncurbed section, the shoulder is paved to the front face of guardrail. The desirable guardrail offset is 2 ft from the effective usable shoulder width. See Section 49-5.0 for more information.
b. For an uncurbed section, a desirable additional 1 ft of compacted aggregate will be provided.
c. For a curbed section, the curb offset is included in the paved-shoulder width.

(8) Cross Slope (Travel Lane). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(8A) Cross Slope (Shoulder). See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information.

(9) Minimum Median Width. The criteria assume the presence of mountable curbs with a 0-ft curb offset.

(10) Sidewalk Width. A buffer of less than 2 ft wide is not permitted. If no buffer is provided, the sidewalk width should be 6 ft.

(11) Bicycle-Lane Width. The width is in addition to the width of a parking lane, if present. See Section 51-7.0 for additional details.

(12) Clear Zone. The following will apply.

a. Facility with Vertical Curbs. The clear zone will be measured from the edge of travel lane or will be to the right-of-way line, whichever is less. No clear zone is required where there is 24-h parking.
b. Facility with Sloping Curbs or without Curbs. The clear zone will vary according to design speed, traffic volume, side slopes, and horizontal curvature.
c. Curbed Facility. There should be an appurtenance-free area as measured from the gutter line of a curb.
d. Value. See Section 49-2.0 for specific clear-zone value.

Footnotes to Figure 53-8 (continued)

(13) Curbing Type. Vertical curbs may only be used with a design speed 45 mph or lower.

(14) Side Slopes (Uncurbed). Value is for new construction. See Sections 45-3.0 and 45-8.0 for more information. For a reconstruction project, see Section 49-3.0.

(15) Foreslope. See Sections 49-2.0 and 49-3.0 for the lateral extent of the foreslope in a ditch section.

(16) Ditch Width. A V-ditch should be used in a rock cut. See Section 45-8.0.

(17) Backslope. The backslope for a rock cut will vary according to the height of the cut and the geotechnical requirements. See Section 45-8.0 for typical rock-cut sections.

(18) Side Slope (Curbed) Cut. A shelf or sidewalk will be present immediately behind the curb before the toe of the backslope. The minimum width of a shelf will be 6 ft. Where a sidewalk is present, the toe of the backslope will be 1 ft beyond the edge of sidewalk. See Section 45-3.0 for more information.

(19) Side Slope (Curbed) Fill. If no sidewalks are present or planned, the lateral extent of the 12:1 slope may be reduced to 4 ft.

(20) Structural Capacity (New or Reconstructed Bridge). The following will apply.
a. HS-25 loading with Alternate Military Loading should be applied for each project with notice to proceed with design beginning Sept. 1, 2004, through Dec. 31, 2005.
b. A State-highway bridge within 15 mi of a Toll-Road gate must be designed for Toll-Road loading.
c. A bridge on an Extra-Heavy-Duty Highway must be designed for the Michigan Train truck loading configuration.
d. See Chapter Sixty for additional information on the loading configurations.

(21) Width (New or Reconstructed Bridge). See Section 59-1.0 for more information on bridge width.

(22) Vertical Clearance (Collector Under Railroad). Value includes an additional 6-in. allowance for future pavement overlays. Vertical clearance applies from usable edge to usable edge of shoulder.

(23) Vertical Clearance (Collector Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(24) Minimum Radius. The following will apply.
a. Based on e_{max} = 4% or 6% and low-speed urban street conditions.
b. Based on e_{max} = 8% and open-road conditions.

(25) Superelevation Rate. See Section 43-3.0 for value of superelevation rate based on design speed and radius. See Section 43-3.0 and the INDOT *Standard Drawings* for information on superelevation requirements.

(26) Horizontal Sight Distance. For a given design speed, the necessary middle ordinate will be determined by the radius and the sight distance which applies at the site. See the discussion in Section 43-4.0.

(27) Maximum Grade. For a grade along a longitudinal distance of less than 500 ft (PVT to PVC), a one-way downgrade, or a road with AADT < 400, the maximum grade may be up to 2% steeper than the table value. Where adjacent sidewalks are present, the maximum desirable grade is 5%.

(28) Intersection Sight Distance. For a left turn onto a 2-lane roadway: P = Passenger car; SUT = single unit truck. See Figure 46-10G for value for a combination truck.

Design Element				Manual Section	Design Value (By Type of Area)		
					Suburban	Intermediate	Built-Up
Design Controls	Design Forecast Period			40-2.02	20 Years	20 Years	20 Years
	*Design Speed (mph) (2)			40-3.0	Curbed: 30 - 40 Uncurbed: 30 - 45	Curbed: 30 - 40 Uncurbed: 30 - 40	Curbed: 25 - 40
	Access Control			40-5.0	None	None	None
	Level of Service			40-2.0	Desirable: C; Minimum: D	Desirable: C; Minimum: D	D
	On-Street Parking			45-1.04	Optional (3)	Optional (3)	Optional (3)
Cross Section Elements	Travel Lane	*Width (4)		45-1.01	Curbed: 11 ft Uncurbed: 11 ft	Curbed: 10 ft Uncurbed: 11 ft	Curbed: 10 ft
		Typical Surface Type		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	*Curb Offset (5)			45-1.02	2 ft	2 ft	2 ft
	Shoulder	*Usable Width		45-1.02	Curbed Des: 4 ft; Min. 2 ft Uncurbed: Des: 4 ft; Min. 2 ft	Curbed Des: 4 ft; Min. 2 ft Uncurbed: Des: 4 ft; Min. 2 ft	Des: 4 ft; Min: 2 ft
		Typical Surface Type		Ch. 52	Asphalt / Concrete / Aggregate / Earth	Asphalt / Concrete / Aggregate / Earth	Asphalt / Concrete / Aggregate / Earth
	Cross Slope	*Travel Lane (6)		45-1.01	2%	2%	2%
		Shoulder		45-1.02	2%-6% Asph. / Conc.; 6%-8% Aggr.; 8% Earth	2%-6% Asph. / Conc.; 6%-8% Aggr.; 8% Earth	2%-6% Asph. / Conc.; 6%-8% Aggr.; 8% Earth
	Auxiliary Lane	Lane Width		45-1.03	Des: 11 ft; Min: 10 ft	Des: 11 ft; Min: 10 ft	Des: 10 ft; Min: 9 ft
		Curb Offset			Des: 1 ft; Min: 0.0 ft	Des: 1 ft; Min: 0.0 ft	Des: 1 ft; Min: 0.0 ft
		Shoulder Width			Des: 4 ft; Min: 2 ft	Des: 4 ft; Min: 2 ft	Des: 4 ft; Min: 2 ft
		Typical Surface Type		Ch. 52	Asphalt / Concrete / Aggregate / Earth	Asphalt / Concrete / Aggregate / Earth	Asphalt / Concrete / Aggregate / Earth
	Parking-Lane Width (1)			45-1.04	Des: 9 ft; Min: 8 ft	Des: 9 ft; Min: 8 ft	Des: 9 ft; Min: 8 ft
	Sidewalk Width (7)			45-1.06	5 ft with 5-ft Buffer (Des)	5 ft with 5-ft Buffer (Des)	Varies, 6 ft Min
	Bicycle-Lane Width (8)			51-7.0	Curbed: 5 ft Uncurbed: Shld. Width +4 ft	Curbed: 5 ft Uncurbed: Shld. Width +4 ft	Curbed: 5 ft
	Clear Zone			49-2.0	(9)	(9)	(9)
	Typical Curbing Type (where used) (9c)			45-1.05	Vertical / Sloping	Vertical / Sloping	Vertical / Sloping
	Side Slopes (Uncurbed)	Cut	Foreslope	45-3.0	3:1 Max	3:1 Max	N/A
			Ditch Width		Des: 4 ft; Min: 0.0 ft	Des: 4 ft; Min: 0.0 ft	N/A
			Backslope		3:1 Max (10)	3:1 Max. (10)	N/A
		Fill			3:1 Max	3:1 Max.	N/A
	Side Slopes (Curbed)	Cut (Backslope)		45-3.0	(11)	(11)	(11)
		Fill (12)			12:1 for 12 ft; 3:1 Max to Toe	12:1 for 12 ft; 3:1 Max to Toe	12:1 for 12 ft; 3:1 Max to Toe

Des: Desirable; Min: Minimum.

* Controlling design criterion.

GEOMETRIC DESIGN CRITERIA FOR URBAN LOCAL STREET
(New Construction or Reconstruction)

Figure 53-9

Design Element			Manual Section	Design Value (By Type of Area)				
				Suburban	Intermediate	Built-Up		
Bridges	New or Reconstructed Bridge	*Structural Capacity	Ch. 60	HL-93 (12A)	HL-93 (12A)	HL-93 (12A)		
		*Clear-Roadway Width	45-4.01	Curbed: Full Approach Curb-to-Curb Width Uncurbed: (13)				
	Existing Bridge to Remain in Place	*Structural Capacity	Ch. 72	HS-20	HS-20	HS-20		
		*Clear-Roadway Width	45-4.01	Existing Width (14)				
	*Vertical Clearance (Local Under) (15)	New or Replaced Overpassing Bridge (15)	44-4.0	14.5 ft	14.5 ft	14.5 ft		
		Existing Overpassing Bridge		14 ft	14 ft	14 ft		
	Vertical Clearance (Local over Railroad) (16)		Ch. 69	23 ft				
Alignment Elements	Design Speed			20 mph	25 mph	30 mph	35 mph	45 mph
	*Stopping Sight Distance	Desirable	42-1.0	115 ft	155 ft	200 ft	250 ft	360 ft
	Decision Sight Distance	Speed / Path / Direction Change	42-2.0	U: 415 ft SU: 360 ft	U: 515 ft SU: 445 ft	U: 620 ft SU: 535 ft	U: 720 ft SU: 625 ft	U: 930 ft SU: 800 ft
		Stop Maneuver		300 ft	430 ft	490 ft	590 ft	800 ft
	Intersection Sight Distance, -3% to +3% (22)		46-10.0	P: 220 ft SUT: 280 ft	P: 280 ft SUT: 350 ft	P: 330 ft SUT: 420 ft	P: 390 ft SUT:490 ft	P: 500 ft SUT: 630 ft
	*Minimum Radius		43-2.0	70 ft (17)	140 ft (17)	260 ft (17)	420 ft (17)	600 ft (17)
	*Superelevation Rate (18)		43-3.0	e_{max} = 4%				
	*Horizontal Sight Distance		43-4.0	(19)				
	*Vertical Curvature (K-value)	Crest	44-3.0	7	12	19	29	61
		Sag		17	26	37	49	79
	*Maximum Grade (20)	Level	44-1.02	10%	10%	10%	9%	8%
		Rolling		15%	11%	11%	10.5%	10%
	Minimum Grade		44-1.03	Desirable: 0.5%; Minimum: 0.3% (Curbed) (21) 0.0% (Uncurbed)				

U: Urban; SU: Suburban.

* Controlling design criterion. A deviation from such is a design exception, and is subject to approval. See Section 40-8.0.

These criteria apply only to a federal-aid project.

GEOMETRIC DESIGN CRITERIA FOR URBAN LOCAL STREET
(New Construction or Reconstruction)

Figure 53-9 (Continued)

GEOMETRIC DESIGN CRITERIA FOR URBAN LOCAL STREET
(New Construction or Reconstruction)

Footnotes to Figure 53-9

(1) Parking Lane. In a residential area, the minimum width is 7 ft. In a commercial or industrial area the minimum width is 8 ft. Where curb-and-gutter sections are used, the gutter width should be considered part of the parking lane width.

(2) Design Speed. The minimum design speed should equal the minimum value, the anticipated posted speed limit after construction, or the legal speed limit on a non-posted highway. The legal speed limit in an urban district is 30 mph. Based upon an engineering study, the design speed may be raised to an absolute maximum of 55 mph.

(3) On-Street Parking. In general, on-street parking is discouraged.

(4) Travel-Lane Width. In a restricted area and where there are few trucks, a width of 1 ft narrower than the value may be used, but the total width may not be less than 10 ft. In an industrial area, a 12-ft width should be used. In a residential area, a 26-ft roadway (curb face to curb face) consisting of one 12-ft travel lane and two 7-ft parking lanes is used. In an industrial area, a 12-ft width is desirable and an 11-ft width is minimum.

(5) Curb Offset. The curb offset should be 2 ft. For a curbed section, the curb offset is included in the paved-shoulder width.

(6) Cross Slope (Travel Lane). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(7) Sidewalk Width. A buffer of less than 2 ft wide is not permitted. If no buffer is provided, the sidewalk width should be 6 ft.

(8) Bicycle-Lane Width. The value is in addition to the width of a parking lane, if present. See Section 51-7.0 for additional details.

(9) Clear Zone. The following will apply.
- a. Facility with Vertical Curbs. The clear zone will be measured from the edge of travel lane or will be to the right-of-way line, whichever is less. No clear zone is required where there is 24-h parking.
- b. Facility with Sloping Curbs or without Curbs. The clear zone will vary according to design speed, traffic volume, side slopes, and horizontal curvature.
- c. Curbed Facility. There should be an appurtenance-free area as measured from the gutter line of a curb. Vertical curbs may only be used with design speed 45 mph or lower.
- d. Value. See Section 49-2.0 for specific clear-zone values.

(10) Backslope. The backslope for a rock cut will vary according to the height of the cut and the geotechnical requirements. See the INDOT *Standard Drawings* for typical rock-cut sections.

(11) Side Slope (Curbed) Cut. A shelf or sidewalk will be present immediately behind the curb before the toe of the backslope. The minimum width of a shelf is 6 ft. Where a sidewalk is present, the toe of the backslope will be 1 ft beyond the edge of sidewalk. See Section 45-3.0 for more information.

GEOMETRIC DESIGN CRITERIA FOR URBAN LOCAL STREET
(New Construction or Reconstruction)

Footnotes to Figure 53-9 (continued)

(12) Side Slope (Curbed) Fill. If no sidewalks are present or planned, the lateral extent of the 12:1 slope may be reduced to 4 ft.

(12A) Structural Capacity (New or Reconstructed Bridge). HS-25 loading with Alternate Military Loading should be applied for each project with notice to proceed with design beginning September 1, 2004, through December 31, 2005.

(13) Width (New or Reconstructed Bridge) Uncurbed. The following will apply.

Volume	Minimum Clear Width
0 < AADT < 400	Travelway + 2 ft each side
400 ≤ AADT < 2000	Travelway + 3 ft each side
AADT ≥ 2000	Approach Roadway Width (Travelway plus Shoulders)

(14) Width (Existing Bridge to Remain in Place). If the width of an existing bridge is less than the approach travelway width, consideration should be given to widening the bridge. For such a bridge of length greater than 200 ft, the minimum shoulder width on the right and the left sides is 3.5 ft.

(15) Vertical Clearance (Local Street Under Railroad). Value includes an additional 6-in. allowance for future pavement overlays. Vertical clearance applies from usable edge to usable edge of shoulder.

(16) Vertical Clearance (Local Street Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(17) Minimum Radius. This is based on e_{max}=4% and low-speed urban street conditions.

(18) Superelevation Rate. See Section 43-3.0 for value of superelevation rate based on design speed and radius. See Section 43-3.0 for information on superelevation requirements.

(19) Horizontal Sight Distance. For a given design speed, the necessary middle ordinate will be determined by the radius and the sight distance which applies at the site. See the discussion in Section 43-4.0.

(20) Maximum Grade. In a residential area, the maximum grade should not exceed 15%. In an industrial or commercial area, the maximum grade should not exceed 8%.

(21) Flat Terrain. In very flat terrain and where no drainage outlet is available, a gutter grade as low as 0.2% may be used.

(22) Intersection Sight Distance. For a left turn onto a 2-lane roadway: P = Passenger car; SUT = single unit truck. See Figure 46-10G for value for a combination truck.