CHAPTER SEVEN

GEOMETRIC DESIGN TABLES

(New Construction/Reconstruction)

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Chapter Seven

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Chapter Seven

GEOMETRIC DESIGN TABLES
(New Construction/Reconstruction)

This chapter presents the Department's criteria for the design of new construction and reconstruction projects. The designer should consider the following in the use of the tables:

1. ***Functional Classification***. The selection of design values for new construction and reconstruction depends on the functional classification of the highway facility. This is discussed in Section 3-2. For Minor Arterial or Lower classifications see the State Standard Highway Design Guide.

2. ***Cross Section Elements***. The designer should realize that some of the cross section elements included in a table (e.g., median width) are not automatically warranted in the project design. The values in the tables will only apply after the decision has been made to include the 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 manual section references for greater insight into the design elements.

4. ***Footnotes.*** The tables 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 design tables.

GEOMETRIC DESIGN CRITERIA FOR FREEWAYS
(New Construction/Reconstruction)

Table 7-1

Design Element				Manual Section	Rural	Urban		
DESIGN CONTROLS	*Design Speed			3-4	70 mph	55-70 mph		
	Access Control			3-5	Controlled Access	Controlled Access		
	Level of Service			3-3	B	Desirable: B	Minimum: C	
CROSS SECTION ELEMENTS	*Lane Width			6-1	12'	12'		
	*Shoulder Width		Right	6-1	10'	10'		
			Left	6-1	4' (1)	4' (1)		
	Cross Slope		*Travel Lane	6-1	2.0%	2.0%		
			Shoulder	6-1	4.0%	4.0%		
	Auxiliary Lane Width (2)			6-1	12'	12'		
	Median Width			6-2	Depressed: (3)	Flush: 14' min. w/CMB	Depressed: (3)	
	*New and Rehabilitated Bridges		Structural Capacity	~	SEE BRIDGE PROGRAM	SEE BRIDGE PROGRAM		
			Minimum Width	~				
	*Existing Bridges to Remain in Place		Structural Capacity	~				
			Minimum Width	~				
	Clear Zone			10-1	(4)	(4)		
	Side Slopes	Cut	Front Slope	6-3	1:6	1:6		
			Depth of Ditch	6-3	(5)	(5)		
			Back Slope	6-3	1:2 (6)	4'2 (6)		
		Fill	0 - 20' Height	6-3	1:6/1:4 (hinged) (7)	1:6/1:4 (hinged) (7)		
			> 20' Height	6-3	1:2	1:2		
ALIGNMENT ELEMENTS	*Minimum Stopping Sight Distance (8)			4-1	730'	55 mph	60 mph	70 mph
						495'	570'	730'
	Decision Sight Distance (9)			4-1	1105'	1135'	1280'	1445'
	*Maximum Degree of Curve (e = 6.0%)			5-2	2° 45'	5° 15'	4° 15'	2° 45'
	*Superelevation Rate			5-2	Table 5-6 (e_{max} = 6.0%)	Table 5-6 (e_{max} = 6.0%)		
	*Horizontal Sight Distance			5-2	(10)	(10)		
	*Maximum Profile Grades (11)		Level	4-2	3%	4%	3%	3%
			Rolling	4-2	4%	5%	4%	4%
			Mountainous	4-2	5%	6%	6%	5%
	Minimum Profile Grades			4-2	Desirable: 0.25% Minimum: 0%	Desirable: 0.25% Minimum: 0%		
	*Minimum Vertical Clearance (12)		New and Replaced Overpassing Bridges	4-3	16'-6"			
			Existing Overpassing Bridges	4-3	16'-0"			

* Controlling design criteria (See Section 3-7).

GEOMETRIC DESIGN CRITERIA FOR FREEWAYS

(New Construction/Reconstruction)

Footnotes to Table 7-1

1. Shoulder Width (Left Shoulder). Where a concrete median barrier is used, the minimum left shoulder is 6' for freeways with two lanes in one direction. For all freeways with three or more lanes in one direction, it is desirable to use a 10' left shoulder.

2. Auxiliary Lane Shoulders. Shoulder widths adjacent to auxiliary lanes should equal the shoulder width normally provided adjacent to the travel lane.

3. Median Width (Depressed). Median widths for depressed sections should be determined by field conditions (see Figure 6-7).

4. Clear Zone. Clear zone will vary according to design speed, traffic volume and side slope. See Section 10-1.

5. Depth of Ditch. A rounded ditch section should be used unless hydraulic capacity warrants the use of a trapezoidal ditch. See Figure 6-7. Maintain the depth of ditch 1'below subgrade. If this criteria (1' below subgrade) determines the horizontal location of the ditch flow line, the calculated horizontal distance to the flow line will be rounded up to the next highest 6 inch increment.

6. Back Slope. The Department's typical practice is to place the toe of the back slope outside of the clear zone. See the typical section figures in Section 6-5 and the clear zone discussion in Section 10-1. In rock cuts, the back slope may be as steep as 4:1. See rock cut detail in Figure 6-7.

7. Fill Slope (Height: 0-20'). See Figure 6-7 for an illustration of the 6:1/4:1 hinged fill slope. The hinge point will be placed at the subgrade intersection with the fill slope or at the clear zone distance, whichever is the greatest distance from the roadway. If a barrier is warranted on the fill slope (e.g., for roadside obstacles), use a 2:1 fill slope with guardrail. See Section 10-2 for roadside barrier warrants.

8. Minimum Stopping Sight Distance. If practical, values in the columns may be adjusted for grades (see Table 4-1).

9. Decision Sight Distance. The values provided are for a directional change (e.g., lane change) at the design speed. See Section 4-1 for decision sight distance values for other conditions.

10. Horizontal Sight Distance. For a given design speed, the necessary middle ordinate should be determined by the degree of curve and stopping sight distance (see Section 5-2).

11. Maximum Grades. Grades 1 percent steeper may be used in restricted urban areas where development precludes the use of flatter grades. Grades 1 percent steeper may also be used for one-way downgrades, except in mountainous terrain.

12. Minimum Vertical Clearance. The vertical clearances apply to the freeway passing under. For the 16'-6" clearance, 6" is provided for future resurfacing. The minimum vertical clearance is 17'-6" for the freeway passing under a new pedestrian bridge or new sign truss. The clearance is 17'-0" for the freeway passing under an existing pedestrian bridge or existing sign truss. A 22'-6" (±6") clearance, depending on actual site conditions, is required at railroad underpasses beneath the freeway.

    Note that "existing overpassing bridges" refers to any bridge work which does not require the total replacement of both the substructure and superstructure. For example, a bridge deck rehabilitation would be considered an existing overpassing bridge for the purpose of determining the minimum vertical clearance.

    The Bridge Program will make the final determination on the adequacy of existing or proposed vertical clearances

GEOMETRIC DESIGN CRITERIA FOR RURAL ARTERIALS
(New Construction/Reconstruction)

Table 7-2

Design Element			AADT (1) / DHV (1)	Manual Section	2 - Lane: Under 400	2 - Lane: 400 - 1500 / 100 - 200	2 - Lane: Over 1500 / 201 - 400	2 - Lane: Over 400	Multilane: Divided	Multilane: Undivided
DESIGN CONTROLS	*Design Speed (2)			3-4	55-60 mph				55-60 mph	
	Access Control			3-5	Entrance Control				Entrance Control	
	Level of Service			3-3	B				B	
CROSS SECTION ELEMENTS	*Lane Width (3a)			6-1	12' (3b)		12'		12'	
	*Shoulder Width (4)		Right	6-1	4'	6'	8'	8'-10'	10'	
			Left	6-1	N/A				4'	N/A
	Cross Slope		*Travel Lane	6-1	2.0%				2.0%	
			Shoulder	6-1	4.0%				4.0%	
	Auxiliary Lane Width (2)			6-1	12'				12'	
	Median Width			6-2	N/A				(6)	N/A
	*New and Rehabilitated Bridges		Structural Capacity	~	**SEE BRIDGE PROGRAM**				**SEE BRIDGE PROGRAM**	
			Minimum Width	~						
	*Existing Bridges to Remain in Place		Structural Capacity	~						
			Minimum Width	~						
	Clear Zone			10-1	(7)				(7)	
	Side Slopes	Cut	Front Slope	6-3	1:4				1:4	
			Depth of Ditch	6-3	(8)				(8)	
			Back Slope	6-3	1:2 (9)				1:2 (9)	
		Fill	0 - 15' Height	6-3	1:4 (10)				1:4 (10)	
			> 15' Height	6-3	1:2				1:2	
ALIGNMENT ELEMENTS	*Minimum Stopping Sight Distance (11)			4-1	50 mph		55 mph	60 mph		
					425'		495'	570'		
	Passing Sight Distance			4-1	1835'		1985'	2135'		
	Decision Sight Distance (12)			4-1	750'		865'	990'		
	*Maximum Degree of Curve (e = 6.0%)			5-2	6° 45'		5° 15'	4° 15'		
	*Superelevation Rate			5-2	Table 5-6 (e_{max} = 6.0%)					
	*Horizontal Sight Distance			5-2	(13)					
	*Maximum Profile Grades (14)		Level	4-2	4%		4%	3%		
			Rolling	4-2	5%		5%	4%		
			Mountainous	4-2	7%		6%	6%		
	Minimum Profile Grades			4-2	Desirable: 0.25%			Minimum: 0%		
	*Minimum Vertical Clearance (15)		New and Replaced Overpassing Bridges	4-3	Desirable: 16'-6"			Minimum: 16'-0"		
			Existing Overpassing Bridges	4-3	14'-0"					

* Controlling design criteria (See Section 3-7).

GEOMETRIC DESIGN CRITERIA FOR RURAL ARTERIALS
(New Construction/Reconstruction)

Footnotes to Table 7-2

1. Traffic Volumes. AADT and DHV values are projected to the design year, normally 20 years from the expected construction completion date.

2. Design Speed. For two-lane highways in mountainous terrain, a 50 mph design speed may be used. For all highways, the design speed should equal or exceed the anticipated posted or regulatory speed limit after construction.

3. Lane Widths. The following will apply:

   a. For a 50 mph design speed and for AADT under 400, lane widths may be 11' on two-lane highways.

   b. Existing 11'lanes on reconstructed highways may be retained if alignment and safety record are satisfactory.

4. Shoulder Width (Curbed Facilities). On rural arterials where curbs are provided, it is desirable to increase a proposed 4'or 6' shoulder by an additional 2'. Proposed 8'or 10' shoulders do not need to be adjusted when curbs are introduced.

5. Auxiliary Lane Shoulders. Shoulder widths adjacent to auxiliary lanes should be 4'desirable and 2'minimum.

6. Median Width. Where medians are warranted, the width should be determined by design requirements and field conditions.

7. Clear Zone. Clear zone will vary according to design speed, traffic volume and side slope. See Section 10-1.

8. Depth of Ditch. A "V" ditch section should be used unless hydraulic capacity warrants the use of a trapezoidal ditch. Maintain the depth of ditch 1' below subgrade. If this criteria (1' below subgrade) determines the horizontal location of the ditch flow line, the calculated horizontal distance to the flow line will be rounded up to the next highest 6" increment.

9. Back Slope. The Department's typical practice is to place the toe of the back slope outside of the clear zone. See the typical section figures in Section 6-5 and the clear zone discussion in Section 10-1. In rock cuts, the back slope may be as steep as 4:1. See rock cut detail in Figure 6-12.

10. Fill Slopes (0-15' Height). If guardrail is warranted for reasons other than the fill slope, use a 2:1 slope in combination with the guardrail rather than a 4:1 slope.

11. Minimum Stopping Sight Distance. If practical, values in the columns may be adjusted for grades (see Table 4-1).

12. Decision Sight Distance. The values provided are for a directional change (e.g., lane change) at the design speed. See Section 4-1 for decision sight distance values for other conditions.

13. Horizontal Sight Distance. For a given design speed, the necessary middle ordinate should be determined by the degree of curve and stopping sight distance (see Section 5-2).

14. Maximum Grades. Grades 1 percent steeper may be used on one-way downgrades on divided facilities.

15. Minimum Vertical Clearance. The vertical clearances apply to the arterial passing under. For the 16'-6" clearance, 6" is provided for future resurfacing. The minimum vertical clearance is 17'-6" for the arterial passing under a new sign truss. The clearance is 17'-0" for the arterial passing under an existing sign truss. A 22'-6" (±6") clearance, depending on actual site conditions, is required at railroad underpasses beneath the arterial.

    Note that "existing overpassing bridges" refers to any bridge work which does not require the total replacement of both the substructure and superstructure. For example, a bridge deck rehabilitation would be considered an existing overpassing bridge for the purpose of determining the minimum vertical clearance.

    The Bridge Program will make the final determination on the adequacy of existing or proposed vertical clearances

GEOMETRIC DESIGN CRITERIA FOR RURAL COLLECTOR ROADS
(New Construction/Reconstruction)

Table 7-3

Design Element			AADT (1)	Manual Section	Under 400	400 - 1500	1500 - 2000	Over 2000		
DESIGN CONTROLS	*Design Speed (2)		Level	3-4	40 mph	50 mph	50 mph	55-60 mph		
			Rolling	3-4	30 mph	40 mph	40 mph	50 mph		
			Mountainous	3-4	30 mph	30 mph	30 mph	40 mph		
	Access Control			3-5	Entrance Control					
	Level of Service			3-3	Desirable: B		Minimum: C			
CROSS SECTION ELEMENTS	*Lane Width			6-1	10'	11'	11'	12'		
	*Shoulder Width (3)			6-1	4'	6'	8'			
	Cross Slope		*Travel Lane	6-1	2.0%					
			Shoulder	6-1	Paved: 4.0%		Unpaved: 6.0%			
	Auxiliary Lane Width (4)			6-1	10'	11'				
	*New and Rehabilitated Bridges		Structural Capacity	~	SEE BRIDGE PROGRAM		SEE BRIDGE PROGRAM			
			Minimum Width	~						
	*Existing Bridges to Remain in Place		Structural Capacity	~						
			Minimum Width	~						
	Clear Zone			10-1	(5)					
	Side Slopes	Cut	Front Slope	6-3	1:3		1:4			
			Depth of Ditch	6-3	(6)					
			Back Slope	6-3	1:2 (7)					
		Fill	0 - 15' Height	6-3	1:3		1:4			
			> 15' Height	6-3	1:2 (8)					
ALIGNMENT ELEMENTS	*Minimum Stopping Sight Distance (9)			4-1	30 mph	35 mph	45 mph	50 mph	55 mph	60 mph
					200'	250'	360'	425'	495'	570'
	Passing Sight Distance			4-1	1090'	1280'	1625'	1835'	1985'	2135'
	Decision Sight Distance (10)			4-1	450'	525'	675'	750'	865'	990'
	*Maximum Degree of Curve (e = 6.0%)			5-2	21° 00'	15° 00'	8° 45'	6° 45'	5° 15'	4° 15'
	*Superelevation Rate			5-2	Table 5-6 (e_{max} = 6.0%)					
	*Horizontal Sight Distance			5-2	(11)					
	*Maximum Profile Grades		Level	4-2	7%	7%	7%	6%	6%	5%
			Rolling	4-2	9%	9%	8%	7%	7%	6%
			Mountainous	4-2	10%	10%	10%	9%	9%	8%
	Minimum Profile Grades			4-2	Desirable: 0.25%		Minimum: 0%			
	*Minimum Vertical Clearance (12)		New and Replaced Overpassing Bridges	4-3	Desirable: 15'-6"		Minimum: 15'-0"			
			Existing Overpassing Bridges	4-3	14'-0"					

* Controlling design criteria (See Section 3-7).

GEOMETRIC DESIGN CRITERIA FOR RURAL COLLECTOR ROADS
(New Construction/Reconstruction)

Footnotes to Table 7-3

1. Traffic Volumes. The AADT is determined for a future year, usually 20 years beyond the construction completion date.

2. Design Speed. Minimum values for design speed are presented. The designer should provide higher values where conditions allow. In addition, the design speed should equal or exceed the posted or regulatory speed limit of the completed facility.

3. Shoulder Width. The criteria refer to the paved shoulder width, if applicable, or to the graded shoulder width, if unpaved. The graded shoulder width is the distance between the edge of travel lane and the point of intersection of the shoulder slope and side slope.

   On rural collectors where curbs are provided, it is desirable to increase a proposed 4' or 6' shoulder by an additional 2'. Proposed 8' shoulders do not need to be adjusted when curbs are introduced.

4. Auxiliary Lane Shoulders. Shoulder widths adjacent to auxiliary lanes should be 4'desirable and 2'minimum.

5. Clear Zone. Clear zone will vary according to design speed, traffic volume and side slope. See Section 10-1.

6. Depth of Ditch. A "V" ditch section should be used unless hydraulic capacity warrants the use of a trapezoidal ditch. Maintain the depth of ditch 1' below subgrade. If this criteria (1' below subgrade) determines the horizontal location of the ditch flow line, the calculated horizontal distance to the flow line will be rounded up to the next highest 6" increment.

7. Back Slope. The Department's typical practice is to place the toe of the back slope outside of the clear zone. See the typical section figures in Section 6-5 and the clear zone discussion in Section 10-1. In rock cuts, the back slope may be as steep as 4:1. See rock cut detail in Figure 6-12.

8. Fill Slope (Height >15'). A 1.75:1 slope may be allowed to avoid significant right-of-way and/or environmental concerns.

9. Minimum Stopping Sight Distance. If practical, values in the columns may be adjusted for grades (see Table 4-1).

10. Decision Sight Distance. The values provided are for a directional change (e.g., lane change) at the design speed. See Section 4-1 for decision sight distance values for other conditions.

11. Horizontal Sight Distance. For a given design speed, the necessary middle ordinate should be determined by the degree of curve and stopping sight distance (see Section 5-2).

12. Minimum Vertical Clearance. The vertical clearances apply to the collector passing under. For the 15'-6" clearance, 6" is provided for future resurfacing. A 22'-6" (±6") clearance, depending on actual site conditions, is required at railroad underpasses beneath the collector.

    Note that "existing overpassing bridges" refers to any bridge work which does not require the total replacement of both the substructure and superstructure. For example, a bridge deck rehabilitation would be considered an existing overpassing bridge for the purpose of determining the minimum vertical clearance.

    The Bridge Program will make the final determination on the adequacy of existing or proposed vertical clearances

Design Element			AADT (1)	Manual Section	Under 250	250 - 400	400 - 1500	1500 - 2000	Over 2000	
DESIGN CONTROLS	*Design Speed (2)		Level	3-4	30 mph	35-45 mph	50 mph			
			Rolling	3-4	30 mph	30 mph	40 mph			
			Mountainous	3-4	20 mph	20 mph	30 mph			
	Access Control			3-5	Entrance Control					
	Level of Service			3-3	C					
CROSS SECTION ELEMENTS	*Lane Width			6-1	10'		<40 mph: 10' >40 mph: 11'	11'	12'	
	*Shoulder Width (3)			6-1	2' (3a)		6' (3b)	8'		
	Cross Slope		*Travel Lane	6-1	2.0%					
			Shoulder	6-1	Paved: 4.0%			Unpaved: 6.0%		
	Auxiliary Lane Width (4)			6-1	10'			11'		
	*New and Rehabilitated Bridges		Structural Capacity	~	SEE BRIDGE PROGRAM					
			Minimum Width	~						
	*Existing Bridges to Remain in Place		Structural Capacity	~						
			Minimum Width	~						
	Clear Zone			10-1	(5)					
	Side Slopes	Cut	Front Slope	6-3	1:3			1:4		
			Depth of Ditch	6-3	(6)					
			Back Slope	6-3	1:2 (7)					
		Fill	0 - 15' Height	6-3	1:3			1:4		
			> 15' Height	6-3	1:2 (8)					
ALIGNMENT ELEMENTS	*Minimum Stopping Sight Distance (9)			4-1	20 mph	25 mph	30 mph	40 mph	45 mph	50 mph
					115'	155'	200'	305'	360'	425'
	Passing Sight Distance			4-1	710'	900'	1090'	1470'	1625'	1835'
	Decision Sight Distance (10)			4-1	300'	375'	450'	600'	675'	750'
	*Maximum Degree of Curve (e= 6.0%)			5-2	49° 15'	30° 45'	21°00'	11° 15'	8° 45'	6° 45'
	*Superelevation Rate			5-2	Table 5-6 (e_{max} = 6.0%)					
	*Horizontal Sight Distance			5-2	(11)					
	Maximum Profile Grades		Level	4-2	8%	7%	7%	7%	7%	6%
			Rolling	4-2	11%	10%	10%	9%	9%	8%
			Mountainous	4-2	16%	15%	14%	12%	12%	10%
	Minimum Profile Grades			4-2	Desirable: 0.25%			Minimum: 0%		
	*Minimum Vertical Clearance (12)		New and Replaced Overpassing Bridges	4-3	Desirable: 15'-6"			Minimum: 15'-0"		
			Existing Overpassing Bridges	4-3	14'-0"					

* Controlling design criteria (See Section 3-7).

GEOMETRIC DESIGN CRITERIA FOR RURAL LOCAL ROADS
(New Construction/Reconstruction)

Table 7-4

GEOMETRIC DESIGN CRITERIA FOR RURAL LOCAL ROADS
(New Construction/Reconstruction)

Footnotes to Table 7-4

1. Traffic Volumes. The AADT is determined for a future year, usually 20 years beyond the construction completion date.

2. Design Speed. Minimum values for design speed are presented. The designer should provide higher values where conditions allow. In addition, the design speed should equal or exceed the posted or regulatory speed limit of the completed facility.

3. Shoulder Width. The criteria refer to the paved shoulder width, if applicable, or to the graded shoulder width, if unpaved. The graded shoulder width is the distance between the edge of travel lane and the point of intersection of the shoulder slope and side slope. The following will also apply to shoulder widths:

   a. The minimum shoulder width is 4' if guardrail is used.
   b. In restricted locations (e.g., mountainous terrain), a shoulder width of 5'may be used.

   On rural local roads where curbs are provided, it is desirable to increase a proposed 4' or 6' shoulder by an additional 2'.

4. Auxiliary Lane Shoulders. Shoulder widths adjacent to auxiliary lanes should be 4' desirable and 2' minimum.

5. Clear Zone. Clear zone will vary according to design speed, traffic volume and side slope. See Section 10-1.

6. Depth of Ditch. A "V" ditch section should be used unless hydraulic capacity warrants the use of a trapezoidal ditch. Maintain the depth of ditch 1' below subgrade. If this criteria (1' below subgrade) determines the horizontal location of the ditch flow line, the calculated horizontal distance to the flow line will be rounded up to the next highest 6" increment.

7. Back Slope. For 4:1 front slopes, the Department's typical practice is to place the toe of the back slope outside of the clear zone. See the typical section figures in Section 6-5 and the clear zone discussion in Section 10-1. In rock cuts, the back slope may be as steep as 4:1. See rock cut detail in Figure 6-12.

8. Fill Slope (Height >15'). A 1.75:1 slope may be allowed to avoid significant right-of-way and/or environmental concerns.

9. Minimum Stopping Sight Distance. If practical, values in the columns may be adjusted for grades (see Table 4-1).

10. Decision Sight Distance. The values provided are for a directional change (e.g., lane change) at the design speed. See Section 4-1 for decision sight distance values for other conditions.

11. Horizontal Sight Distance. For a given design speed, the necessary middle ordinate should be determined by the degree of curve and stopping sight distance (see Section 5-2).

12. Minimum Vertical Clearance. The vertical clearances apply to the local road passing under. For the 15-6" clearance, 6" is provided for future resurfacing. A 22'-6" (±6") clearance, depending on actual site conditions, is required at railroad underpasses beneath the local road.

    Note that "existing overpassing bridges" refers to any bridge work which does not require the total replacement of both the substructure and superstructure. For example, a bridge deck rehabilitation would be considered an existing overpassing bridge for the purpose of determining the minimum vertical clearance.

    The Bridge Program will make the final determination on the adequacy of existing or proposed vertical clearances

GEOMETRIC DESIGN CRITERIA FOR URBAN ARTERIAL ROADS/STREETS (New Construction/Reconstruction)

Table 7-5

Design Element			Manual Section	2-Lane		Multi-lane (Divided/Undivided)	
				With Curb	Without Curb	With Curb	Without Curb
DESIGN CONTROLS	* Design Speed (1)		3-4	40-45 mph	30-45 mph	40-45 mph	45-50 mph
	Access Control		3-5	Entrance Control		Entrance Control	
	Level of Service		3-3	C		C	
	On-Street Parking		6-1	(2)		(2)	
CROSS SECTION ELEMENTS	*Lane Width		6-1	12'		12'	
	*Shoulder Width/Curb Offset	Right	6-1	8'	8'	Des: 10' Min: 2'	10'
		Left	6-1	N/A		Des: 4' Min: 1'	4'
	Cross Slope	*Travel Lane	6-1	2.0%		2.0%	
		Shoulder/Curb Offset (4)	6-1	4.0%		4.0%	
	Auxiliary Lane Width (5)		6-1	Desirable: 12'	Minimum: 11'	Desirable: 12'	Minimum: 11'
	CTWLT Lane Width (6)		8-5	V>30: 14'	V≤30: 12'	V>30: 14'	V≤30: 12'
	Parking Lane Width (7)		6-1	Desirable: 12'	Minimum: 10'	Desirable: 12'	Minimum: 10'
	Sidewalk Width (8)		6-1	5' Minimum		5' Minimum	
	Median Width		6-2	N/A		N/A	
	*New and Rehabilitated Bridges	Structural Capacity	~	SEE BRIDGE PROGRAM		SEE BRIDGE PROGRAM	
		Minimum Width	~				
	*Existing Bridges to Remain in Place	Structural Capacity	~				
		Minimum Width	~				
	Clear Zone		10-1	(10)		(10)	
	Side Slopes		6-3	See Figure 6-11	See Table 7-2	See Figure 6-10	See Table 7-2
ALIGNMENT ELEMENTS	*Minimum Stopping Sight Distance (11)		4-1	40 mph	45 mph		50 mph
				305'	360'		425'
	Passing Sight Distance		4-1	1470'	1625'		1835'
	Decision Sight Distance (12)		4-1	825'	930'		1030'
	*Maximum Degree of Curve		5-2	11° 30' (e_{max} = 4.0%)	8° 45' (e_{max} = 6.0%)		6° 45' (e_{max} = 6.0%)
	*Superelevation Rate		5-2	Fig. 5-11 (e_{max} = 4.0%)	Table 5-6 (e_{max} = 6.0%)		Table 5-6 (e_{max} = 6.0%)
	*Horizontal Sight Distance		5-2	(13)			
	Maximum Profile Grades	Level	4-2	8%	6%		6%
		Rolling	4-2	9%	7%		7%
		Mountainous	4-2	11%	9%		9%
	Minimum Profile Grades		4-2	Curbed: Desirable~0.5%; Min.~0.25%		Uncurbed: Desirable~0.25%; Min.~0%	
	*Minimum Vertical Clearance (14)	New and Replaced Overpassing Bridges	6-4	Desirable: 16'-6"		Minimum: 16'-0"	
		Existing Overpassing Bridges	6-4	14'-0"			

* Controlling design criteria (See Section 3-7).

GEOMETRIC DESIGN CRITERIA FOR URBAN ARTERIALS
(New Construction/Reconstruction)

Footnotes to Table 7-5

1. Design Speed. A design speed of 30 mph may be used in restricted built-up areas. The design speed should equal or exceed the anticipated posted or regulatory speed limit of the completed facility.

2. On-Street Parking. The decision to provide on-street parking will be made on a case-by-case basis. See Section 6-1 for more information.

3. Travel Lane Cross Slope. On undivided multilane highways with curbs and where the shoulder width is less than 4', both outside travel lanes will have a cross slope of 3.0% to provide more drainage.

4. Cross Slope (Curb Offset). For curb offsets (shoulder width less than 4'), the cross slope will be the same as the cross slope of the adjacent travel lane.

5. Auxiliary Lane Shoulders. Shoulder widths/curb offsets adjacent to auxiliary lanes should be 4' desirable and 2' minimum or the same as is adjacent to the travel lane, whichever is less.

6. CTWLT Lane Width. In industrial areas with large truck traffic turning frequently, the desirable CTWLT lane width is 16'for all design speeds.

7. Parking Lanes. 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 12'. Cross slopes for parking lanes should be 4.0%.

8. Sidewalk Width. Where roadside appurtenances are located within the sidewalk, the minimum width should be 7'. In built-up areas, the sidewalk is often paved between the curb and building line.

9. Median Widths (Between Edges of Travel Lanes). The following will apply:

   a. Widths for flush medians should range between 2' and 6'.

   b. Widths for raised medians should range between 6' and 18'. An 18' width should be used where there are frequent left-turn lanes along the arterial to provide sufficient space for turn lanes.

   c. Widths for depressed medians should be determined by design requirements and field conditions.

   d. See Section 6-2 for more discussion.

10. Clear Zone. Clear zone will vary according to design speed, traffic volume, side slope and other factors. See Section 10-1.

11. Minimum Stopping Sight Distance. If practical, values in the columns may be adjusted for grades (see Table 4-1).

12. Decision Sight Distance. The values provided are for a directional change (e.g., lane change) at the design speed. See Section 4-1 for decision sight distance values for other conditions.

13. Horizontal Sight Distance. For a given design speed, the necessary middle ordinate should be determined by the degree of curve and stopping sight distance (see Section 5-2).

14. Minimum Vertical Clearance. The vertical clearances apply to the arterial passing under. For the 16'-6" clearance, 6" is provided for future resurfacing. The minimum vertical clearance is 17'-6" for the arterial passing under a new pedestrian bridge or new sign truss. The clearance is 17'-0" for the arterial passing under an existing pedestrian bridge or existing sign truss. A 22'-6" (±6") clearance, depending on actual site conditions, is required at railroad underpasses beneath the arterial.

    Note that "existing overpassing bridges" refers to any bridge work which does not require the total replacement of both the substructure and superstructure. For example, a bridge deck rehabilitation would be considered an existing overpassing bridge for the purpose of determining the minimum vertical clearance.

    The Bridge Program will make the final determination on the adequacy of existing or proposed vertical clearances.

GEOMETRIC DESIGN CRITERIA FOR URBAN COLLECTOR ROADS/STREETS
(New Construction/Reconstruction)

Table 7-6

Design Element			Manual Section	With Curb		Without Curb
DESIGN CONTROLS	* Design Speed (1)		3-4	30-45 mph		
	Access Control		3-5	Entrance Control		
	Level of Service		3-3	C		
	On-Street Parking		6-1	(2)		
CROSS SECTION ELEMENTS	*Lane Width (3)		6-1	Desirable: 12'		Minimum: 11'
	*Shoulder Width/Curb Offset		6-1	Desirable: 8' Minimum: 6'		Desirable: 8' Minimum 6'
	Cross Slope	*Travel Lane	6-1	2.0%		
		Shoulder/Curb Offset (4)	6-1	4.0%		
	Auxiliary Lane Width (5)		6-1	Desirable: Same as lane width		Minimum: 10'
	Parking Lane Width		6-1	Desirable: 10'		Minimum: 7'
	Sidewalk Width (6)		6-1	5' Minimum		
	*New and Rehabilitated Bridges	Structural Capacity	~	**SEE BRIDGE PROGRAM**		**SEE BRIDGE PROGRAM**
		Minimum Width	~			
	*Existing Bridges to Remain in Place	Structural Capacity	~			
		Minimum Width	~			
	Clear Zone		10-1	(7)		
	Side Slopes		6-3	See Figure 6-11		See Table 7-4
ALIGNMENT ELEMENTS	*Minimum Stopping Sight Distance (8)		4-1	30 mph	35 mph	45 mph
				200'	250'	360'
	Passing Sight Distance		4-1	1090'	1280'	1625'
	Decision Sight Distance (9)		4-1	620'	720'	930'
	*Minimum Radius of Curve (e = 4.0%)		5-2	24° 45'	16° 30'	11° 30'
	*Superelevation Rate		5-2	Figure 5-11 (e_{max} = 4.0%)		
	*Horizontal Sight Distance		5-2	(10)		
	Maximum Profile Grades	Level	4-2	9%	9%	8%
		Rolling	4-2	11%	10%	9%
		Mountainous	4-2	12%	12%	11%
	Minimum Profile Grades		4-2	Curbed: Desirable~0.5%; Min.~0.25%		Uncurbed: Desirable~0.25%; Min.~0%
	*Minimum Vertical Clearance (11)	New and Replaced Overpassing Bridges	6-4	Desirable: 15'-6"		Minimum: 15'-0"
		Existing Overpassing Bridges	6-4	14'-0"		

* Controlling design criteria (See Section 3-7).

GEOMETRIC DESIGN CRITERIA FOR URBAN COLLECTOR ROADS/STREETS
(New Construction/Reconstruction)

Footnotes to Table 7-6

1. Design Speed. The design speed should equal or exceed the anticipated posted or regulatory speed limit of the completed facility.

2. On-Street Parking. The decision to provide on-street parking will be made on a case-by-case basis. See Section 6-1 for more information.

3. Lane Width. In industrial areas, lanes should be 12' wide. In residential areas in restricted locations, lanes may be 10' wide.

4. Cross Slope (Curb Offset). For curb offsets (shoulder width less than 4'), the cross slope will be the same as the cross slope of the travel lane.

5. Auxiliary Lane Shoulders. Shoulder widths/curb offsets adjacent to auxiliary lanes should be 4' desirable and 2' minimum or the same as is adjacent to the travel lane, whichever is less.

6. Sidewalk Width. Where roadside appurtenances are located within the sidewalk, the minimum width should be 7'. In built-up areas, the sidewalk is often paved between the curb and building line.

7. Clear Zone. Clear zone will vary according to design speed, traffic volume, side slope and other factors. See Section 10-1.

8. Minimum Stopping Sight Distance. If practical, values in the columns may be adjusted for grades (see Table 4-1).

9. Decision Sight Distance. The values provided are for a directional change (e.g., lane change) at the design speed. See Section 4-1 for decision sight distance values for other conditions.

10. Horizontal Sight Distance. For a given design speed, the necessary middle ordinate should be determined by the degree of curve and stopping sight distance (see Section 5-2).

11. Minimum Vertical Clearance. The vertical clearances apply to the collector passing under. For the 15'-6" clearance, 6" is provided for future resurfacing. A 22'-6" (±6") clearance, depending on actual site conditions, is required at railroad underpasses beneath the collector.

    Note that "existing overpassing bridges" refers to any bridge work which does not require the total replacement of both the substructure and superstructure. For example, a bridge deck rehabilitation would be considered an existing overpassing bridge for the purpose of determining the minimum vertical clearance.

    The Bridge Program will make the final determination on the adequacy of existing or proposed vertical clearances.

GEOMETRIC DESIGN CRITERIA FOR URBAN LOCAL ROADS/STREETS
(New Construction/Reconstruction)

Table 7-7

Design Element			Manual Section	With Curb		Without Curb
DESIGN CONTROLS	* Design Speed (1)		3-4	20-30 mph		
	Access Control		3-5	Entrance Control		
	Level of Service		3-3	C		
	On-Street Parking		6-1	(2)		
CROSS SECTION ELEMENTS	*Lane Width		6-1	Desirable: 11'		Minimum: 10'
	*Shoulder Width/Curb Offset		6-1	2'-6'		4'-6'
	Cross Slope	*Travel Lane	6-1	2.0%		
		Shoulder/Curb Offset (3)	6-1	4.0%		
	Auxiliary Lane Width (4)		6-1	Desirable: 11'		Minimum: 10'
	Parking Lane Width		6-1	Desirable: 9'		Minimum: 7'
	Sidewalk Width (5)		6-1	5' Typical		
	*New and Rehabilitated Bridges	Structural Capacity	~	**SEE BRIDGE PROGRAM**		**SEE BRIDGE PROGRAM**
		Minimum Width	~			
	*Existing Bridges to Remain in Place	Structural Capacity	~			
		Minimum Width	~			
	Clear Zone		10-1	(6)		
	Side Slopes		6-3	See Figure 6-11		See Table 7-4
ALIGNMENT ELEMENTS	*Minimum Stopping Sight Distance (7)		4-1	20 mph	25 mph	30 mph
				115'	155'	200'
	Passing Sight Distance		4-1	710'	900'	1090'
	Decision Sight Distance (8)		4-1	420'	520'	620'
	*Maximum Degree of Curve (e = 4.0%)		5-2	72° 45'	40° 00	24° 45'
	*Superelevation Rate		5-2	Figure 5-12 (e_{max} = 4.0%)		
	*Horizontal Sight Distance		5-2	(9)		
	Maximum Profile Grades	Residential	4-2	10%		
		Commercial/Industrial	4-2	5%		
	Minimum Profile Grades		4-2	Curbed: Desirable~0.5%; Min.~0.25% Uncurbed: Desirable~0.25%; Min.~0%		
	*Minimum Vertical Clearance (10)	New and Replaced Overpassing Bridges	6-4	Desirable: 15'-6"		Minimum: 15'-0"
		Existing Overpassing Bridges	6-4	14'-0"		

* Controlling design criteria (See Section 3-7).

GEOMETRIC DESIGN CRITERIA FOR URBAN LOCAL ROADS/STREETS
(New Construction/Reconstruction)

Footnotes to Table 7-7

1. Design Speed. The design speed should equal or exceed the anticipated posted or regulatory speed limit of the completed facility.

2. On-Street Parking. The decision to provide on-street parking will be made on a case-by-case basis. See Section 6-1 for more information.

3. Cross Slope (Curb Offsets). For curb offsets (shoulder width less than 4'), the cross slope will be the same as the cross slope of the travel lane.

4. Auxiliary Lane Shoulders. Shoulder widths/curb offsets adjacent to auxiliary lanes should be 4' desirable and 2' minimum or the same as is adjacent to the travel lane, whichever is less.

5. Sidewalk Width. Where roadside appurtenances are located within the sidewalk, the minimum width should be 7'. In built-up areas, the sidewalk is often paved between the curb and building line.

6. Clear Zone. Clear zone will vary according to design speed, traffic volume, side slope and other factors. See Section 10-1.

7. Minimum Stopping Sight Distance. If practical, values in the columns may be adjusted for grades (see Table 4-1).

8. Decision Sight Distance. The values provided are for a directional change (e.g., lane change) at the design speed. See Section 4-1 for decision sight distance values for other conditions.

9. Horizontal Sight Distance. For a given design speed, the necessary middle ordinate should be determined by the degree of curve and stopping sight distance (see Section 5-2).

10. Minimum Vertical Clearance. The vertical clearances apply to the local road/street passing under. For the 15'-6" clearance, 6" is provided for future resurfacing. A 22'-6" (±6") clearance, depending on actual site conditions, is required at railroad underpasses beneath the local road/street.

    Note that "existing overpassing bridges" refers to any bridge work which does not require the total replacement of both the substructure and superstructure. For example, a bridge deck rehabilitation would be considered an existing overpassing bridge for the purpose of determining the minimum vertical clearance.

    The Bridge Program will make the final determination on the adequacy of existing or proposed vertical clearances