

GEOMETRIC DESIGN STANDARDS FOR URBAN PRINCIPAL ARTERIAL SYSTEM (GS-5)

	DESIGN SPEED (MPH)	MINIMUM RADIUS		(13) STOPPING SIGHT DISTANCE	MIN. WIDTH OF LANE	(1) MINIMUM WIDTH GRADED SHOULDERS		(2) PAVED SHOULDER WIDTH		(3) WIDTH OF DITCH (FRONT SLOPE)	(4) SLOPE	(7) NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES
		U	ULS	Min.		FILL W/GR	CUT & FILL	RT.	LT.			
FREEWAYS	70	1821'	-	730'	12'	15'	12'	10'	4'	12'	CS-4 OR CS-4B	2 THRU LANES SAME DIRECTION = 6' + PAVE. WIDTH + 12' 3 OR MORE THRU LANES SAME DIRECTION = 12' + PAVE. WIDTH + 12'
	60	1204'	-	570'								
	50	760'	-	425'								
OTHER PRINCIPAL ARTERIAL WITH SHOULDER DESIGN	60	1204'	-	570'	(12) 12'	13'	10'	8'	4'	10'	CS-4 OR CS-4E	UNDIVIDED & DIVIDED 3 OR MORE THRU LANES SAME DIRECTION = 10' + PAVE. WIDTH + 10'
	50	929'	-	425'								
	40	563'	593'	305'	(5)(6) (12) 11'							
	30	300'	273'	200'								
OTHER PRINCIPAL ARTERIAL WITH CURB & GUTTER	DESIGN SPEED (MPH)	MINIMUM RADIUS		STOPPING SIGHT DISTANCE	MIN. WIDTH OF LANE	(8) STANDARD CURB & GUTTER	BUFFER STRIP WIDTH	(9) MINIMUM SIDEWALK WIDTH	(10) SLOPE	(7) NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES		
	U	ULS	MIN.									
	60	1204'	-	570'	(12) 12'	CG-7	(11)	5'	2:1	SAME AS CURB TO CURB OF APPROACHES		
	50	929'	-	425'								
	45	732'	795'	360'	(5)(6) (12) 11'	CG-6						
40	563'	593'	305'									
30	300'	273'	200'									

GENERAL NOTES

Freeways - Urban Freeways should accommodate desired safe operating speeds during non-peak hours, but should not be so high as to exceed the limits of prudent construction, right of way and socioeconomic costs due to the large proportion of vehicles which are accommodated during periods of peak flow when lower speeds are necessary. The design speeds for Freeways should never be less than 50 mph.

On many Urban Freeways, particularly in suburban areas, a design speed of 60 mph or higher can be provided with little additional cost above that required for 50 mph design speed. The corridor of the mainline may be relatively straight and the character and location of interchanges may permit high speed design. Under these conditions, a design speed of 70 mph is most desirable because the higher design speeds are closely related to the overall quality and safety of the facility.

Other Principal Arterials - Design speeds for Urban Arterials generally range from 40 to 60 mph, and occasionally may be as low as 30 mph. The lower (40 mph and below) speeds apply in the central business district and intermediate areas. The higher speeds are more applicable to the outlying business and developing areas.

Standard TC-5.01R superelevation based on 8% maximum is to be used for all Freeways and other Principal Arterials with a design speed greater than or equal to 60 mph.

Standard TC-5.01U (Urban) superelevation based on 4% maximum is to be used on Other Principal Arterials with a design speed less than 60 mph.

RELATIONSHIP OF MAXIMUM GRADES TO DESIGN SPEEDS								
TYPE OF TERRAIN	FREEWAYS *				ARTERIALS			
	DESIGN SPEED (MPH)							
	50	60	70	30	40	45	50	60
GRADES (PERCENT)								
LEVEL	4	3	3	8	7	6	6	5
ROLLING	5	4	4	9	8	7	7	6
MOUNTAINOUS	6	6	5	11	10	9	9	8

* Grades 1 percent steeper than the value shown may be used on Urban Freeways for extreme cases in urban areas where development precludes the use of flatter grades and for one-way downgrades, except in mountainous terrain.

Standard TC-5.04ULS (Urban Low Speed) superelevation based on 2% maximum is to be used on Other Principal Arterials with a design speed less than or equal to 45 mph (45 mph = 7° maximum).

Clear Zone and Recoverable Area information can be found in Appendix A, Section A-2 of the Road Design Manual.

If medians are included, see Section 2E-3 of Chapter 2E of the Road Design Manual.

A minimum 30' width of surfacing or a minimum 30' face to face of curb is to be used within incorporated cities or towns to qualify for maintenance payments.

For guidelines on Interchange Ramp, see Standard GS-R.

FOOTNOTES

- Shoulder widths shown are for right shoulders and independently graded median shoulders. An 8' graded median shoulder will be provided when the mainline is 4 lanes (both directions). For 6 or more lanes, the median shoulder provided will be the same as that shown for independent grading. On Freeways, if truck traffic exceeds 250 DDHV, the minimum width of graded shoulder should be 17' for fills and 14' for cuts.
- When the mainline is 6 or more lanes, the left paved shoulder width should be the same as the right paved shoulder. On Freeways, if truck traffic exceeds 250 DDHV, the right paved shoulder width should be 12', and on 6 or more lane Freeways, the left paved shoulder width should also be 12' if truck traffic exceeds 250 DDHV.
- Ditch slopes to be 6:1 - 10' and 12' widths and 4:1 - 6' width.
- Additional or modified slope criteria to apply where shown on typical sections.
- Minimum lane width to be 12' at all interchange locations.
- If heavy truck traffic is anticipated, an additional 1 foot width is desirable.
- Vertical clearance at roadway underpasses for new and reconstructed bridges is to be 16'-6" (1' additional clearance required for non-vehicular overpasses).
- Or equivalent City or Town design.
- Width of 8' or more may be needed in commercial areas.
- 3:1 and flatter slopes may be used when the right of way is behind the sidewalk (or sidewalk space) in residential or other areas where slopes will be maintained by the property owner.
- If a buffer strip is used between the back of curb and sidewalk, it should be 2' minimum.
- Situations having restrictions on trucks may allow the use of lanes 1 foot less in width.
- For intersection sight distance requirements see Appendix C, Table C-1-5.

FIGURE A - 1 - 5

GEOMETRIC DESIGN STANDARDS-URBAN MINOR ARTERIAL STREET SYSTEM (GS-6)

	DESIGN SPEED (MPH)	MINIMUM RADIUS		(12) STOPPING SIGHT DISTANCE	(11) MIN. WIDTH OF LANE	(3) STANDARD CURB & GUTTER	BUFFER STRIP WIDTH	(4) MINIMUM SIDEWALK WIDTH	(5) SLOPE	(6) NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES			
		U	ULS	Min.									
STREETS WITH CURB & GUTTER	60	1204'	-	570'	12'	CG-7	(10)	5'	2:1	SAME AS CURB TO CURB OF APPROACHES			
	50	929'	-	425'									
	45	732'	795'	360'									
	40	563'	593'	305'	(1)(2) 11'	CG-6							
	30	300'	273'	200'									
	DESIGN SPEED (MPH)	MINIMUM RADIUS		STOPPING SIGHT DISTANCE	MIN. WIDTH OF LANE	(7) MIN. WIDTH OF GRADED SHOULDERS		(8) PAVED SHOULDER WIDTH		(9) WIDTH OF DITCH (FRONT) SLOPE	(5) SLOPE	(6) NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES	
		U	ULS	MIN.		FILL W/GR	CUT & FILL	RT	LT				
STREETS WITH SHOULDER DESIGN	60	1204'	-	570'	12'	13'	10'	8'	4'	10'	2:1	10' + PAVEMENT WIDTH + 10'	
	50	929'	-	425'		(1)(2) 11'	11'	8'	6'	4'		6'	8' + PAVEMENT WIDTH + 8'
	40	563'	593'	305'									
	30	300'	273'	200'									

GENERAL NOTES

Design Speeds for Urban Arterials generally range from 40 to 60 mph and occasionally may be as low as 30 mph. The lower (40 mph and below) speeds apply in the central business district and intermediate areas. The higher speeds are more applicable to the outlying business and developing areas.

Standard TC-5.01R superelevation based on 8% maximum is to be used for 60 mph design speed.

Standard TC-5.01U (Urban) superelevation based on 4% maximum is to be used for design speeds less than 60 mph.

Standard TC-5.04ULS (Urban Low Speed) superelevation based on 2% maximum may be used for design speeds less than or equal to 45 mph (45 mph = 7° maximum).

Clear Zone and Recoverable Area information can be found in Appendix A, Section A-2 of the Road Design Manual.

If medians are included, see [Section 2E-3 of Chapter 2E](#) of the Road Design Manual.

A minimum 30' width of surfacing or a minimum 30' face to face of curb is to be used within incorporated cities or towns to qualify for maintenance payments.

RELATIONSHIP OF MAXIMUM GRADES TO DESIGN SPEEDS					
TYPE OF TERRAIN	DESIGN SPEED (MPH)				
	30	40	45	50	60
	GRADES (PERCENT)				
LEVEL	8	7	6	6	5
ROLLING	9	8	7	7	6
MOUNTAINOUS	11	10	9	9	8

FOOTNOTES

- (1) Lane width to be 12' at all interchanges or if design year ADT exceeds 2000.
- (2) If heavy truck traffic is anticipated, an additional 1' width is desirable.
- (3) Or equivalent City or Town design.
- (4) A width of 8' or more may be needed in commercial areas.
- (5) Slopes 3:1 and flatter may be used when the right of way is behind the sidewalk (or sidewalk space) in residential or other areas where slopes will be maintained by the property owner.
- (6) Vertical clearance at roadway underpasses for new and reconstructed bridges is to be 16'-6" (1' additional clearance required for non-vehicular overpasses).
- (7) If graded median is used, the width of median shoulder is to be 8'.
- (8) The Paved widths shown are the widths to be used if the Materials Division recommends the shoulders be paved. When the mainline is 4 lanes (both directions) a minimum 8' wide paved shoulder will be provided on the right of traffic and a minimum 4' wide paved shoulder on the median side. Where the mainline is 6 or more lanes, both right and median paved shoulders will be 8' in width. If paved shoulders are not recommended by the Materials Division the mainline pavement structure will be extended 1' at the same slope into the shoulder to eliminate raveling of the pavement edge.
- (9) Ditch slope to be 6:1 - 10' width and 4:1 - 6' width.
- (10) If a buffer strip is used between the back of curb and sidewalk, it should be 2' minimum.
- (11) Situations having restrictions on trucks may allow the use of lanes 1' less in width.
- (12) For intersection sight distance requirements see [Appendix C, Table C-1-5](#).

FIGURE A - 1 - 6

GEOMETRIC DESIGN STANDARDS FOR URBAN COLLECTOR STREET SYSTEM (GS-7)

	DESIGN SPEED (MPH)	MINIMUM RADIUS		(11) STOPPING SIGHT DISTANCE	(1) (2) MIN. WIDTH OF LANE	(3) STANDARD CURB & GUTTER	BUFFER STRIP WIDTH	(4) MINIMUM SIDEWALK WIDTH	(5) SLOPE	(8)(9) NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES
		U	ULS	Min.						
STREETS WITH CURB & GUTTER	50	929'	-	425'	12'	CG-7	(10)	5'	2:1	SAME AS CURB TO CURB OF APPROACHES
	45	730'	795'	360'						
	40	563'	593'	305'	(1)(2) 11'	CG-6				
	30	300'	273'	200'						
	DESIGN SPEED (MPH)	MINIMUM RADIUS		STOPPING SIGHT DISTANCE	(1)(2) MIN. WIDTH OF LANE	(7) MINIMUM WIDTH GRADED SHOULDERS		(10) WIDTH OF DITCH (FRONT) SLOPE	(5) SLOPE	(8)(9) NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES
		U	ULS	MIN.		FILL W/GR.	CUT & FILL			
STREETS WITH SHOULDER DESIGN	50	929'	-	425'	12'	11'	8'	6'	2:1	8' + PAVEMENT WIDTH + 8'
	40	563'	593'	305'						(1)(2) 11'
	30	300'	273'	200'						

GENERAL NOTES

A minimum design speed of 30 mph or higher should be used for collector streets, depending on available right of way, terrain, adjacent development and other area controls.

In the typical street grid, the closely spaced intersections usually limit vehicular speeds and thus make the effect of design speed of less significance. Nevertheless, the longer sight distances and curve radii commensurate with design speeds higher than the value indicated result in safer highways and should be used to the extent practicable.

Standard TC-5.01U (Urban) superelevation based on 4% maximum.

Standard TC-5.04ULS (Urban-Low Speed) superelevation based on 2% maximum may be used with a design speed of 45 mph or less (45 MPH = 7° maximum).

A minimum 30' width of surfacing or a minimum 30' curb to curb is to be used within incorporated cities or towns to qualify for maintenance payments.

Clear zone and Recoverable Area information can be found in Appendix A, Section A-2 of the Road Design Manual.

FOOTNOTES

- (1) 12' when ADT exceeds 2000'. Where feasible, lanes should be 12' wide in industrial areas; however, where available or attainable right of way imposes severe limitations, 10' lanes can be used in residential areas and 11' lanes can be used in industrial areas.
- (2) Lane width to be 12' at all interchange locations.
- (3) Or equivalent City or Town Design.
- (4) A width of 8' or more may be needed in commercial areas.
- (5) 3:1 and flatter slopes may be used when right of way is behind the sidewalk (or sidewalk space) in residential or other areas where the slopes will be maintained by the property owner.
- (6) Ditch slopes to be 4:1 - 6' width and 3:1 - 4' width.
- (7) When Design year ADT exceeds 2000 VPD, with greater than 5% total truck and bus usage: Provide 4' wide paved shoulders when the graded shoulder is 5' wide or greater or provide 3' wide paved shoulders when the graded shoulder is 4' wide. All shoulders not being paved will have the mainline pavement structure extended 1', on the same slope, into the shoulder to eliminate raveling at the pavement edge.
- (8) Where the approach roadway width (traveled way plus shoulder) is surfaced, that surfaced width shall be carried across all structures if that width exceeds the width shown in this table.
- (9) Vertical clearance at roadway underpasses for new and reconstructed bridges is to be 16'-6" desirable and 14'-6" minimum (1' additional clearance required for non-vehicular overpasses).
- (10) If a buffer strip is used between the back of curb and sidewalk, it should be 2' minimum.
- (11) For intersection sight distance requirements see [Appendix C, Table C-1-5](#).

RELATIONSHIP OF MAXIMUM GRADES TO DESIGN SPEEDS				
TYPE OF TERRAIN	DESIGN SPEED (MPH)			
	30	40	45	50
	GRADES (PERCENT)			
LEVEL	9	9	8	7
ROLLING	11	10	9	8
MOUNTAINOUS	12	12	11	10

Maximum grades of short lengths (less than 500 ft.) and one-way down grades may be 2% steeper.

FIGURE A - 1 - 7

GEOMETRIC DESIGN STANDARDS FOR URBAN LOCAL STREET SYSTEM (GS-8)

	DESIGN SPEED (MPH)	MINIMUM RADIUS		(1) MAXIMUM PERCENT OF GRADE	(11) STOPPING SIGHT DISTANCE	(2) MIN. WIDTH OF LANE	(3) STANDARD CURB & GUTTER	(4) BUFFER STRIP WIDTH	(5) MINIMUM SIDEWALK WIDTH	(6) SLOPES	(9) (10) NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES
		U	ULS								
STREETS WITH CURB & GUTTER	30	300'	273'	15	200'	10'	CG-6	(10)	5'	2:1	SAME AS CURB TO CURB OF APPROACHES
	20	127'	92'		125'						
	DESIGN SPEED (MPH)	MINIMUM RADIUS		(1) MAXIMUM PERCENT OF GRADE	STOPPING SIGHT DISTANCE	(2) MIN. WIDTH OF LANE	(7) MINIMUM WIDTH GRADED SHOULDERS		(8) WIDTH OF DITCH (FRONT) SLOPE	(6) SLOPES	(9) NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES
STREETS WITH SHOULDER DESIGN	30	300'	273'	15	200'	10'	FILL W/GR.	CUT & FILL	4'	3:1	4' + PAVEMENT WIDTH + 4'
	20	127'	92'		125'		7'	4'			

GENERAL NOTES

Design Speed is not a major factor for local streets. For consistency in design elements, design speeds ranging from 20 to 30 mph may be used, depending on available right of way, terrain, adjacent development and other area controls.

In the typical street grid, the closely spaced intersections usually limit vehicular speeds, making the effect of a design speed of less significance.

Design speeds exceeding 30 mph in residential areas may require longer sight distances and increased curve radii, which would be contrary to the basic function of a local street.

Standard TC-5.01U (Urban) superelevation based on 4% maximum.

Standard TC-5.04ULS (Urban Low Speed) superelevation based on 2% maximum may be used with a design speed of 45 mph or less (45 mph = 7° maximum).

A minimum 30' width of surfacing or a minimum 30' curb to curb is to be used within incorporated cities or towns to qualify for maintenance payments.

FOOTNOTES

- (1) Grades in commercial and industrial areas should be less than 8 percent; desirably, less than 5 percent.
- (2) Where feasible, lanes should be 11' wide and in industrial areas should be 12' wide; however, where available or attainable right of way imposes severe limitations, 9' lanes can be used in residential areas and 11' lanes can be used in industrial areas.
- (3) Or equivalent City or Town design.
- (4) The minimum buffer strip width with no sidewalk or sidewalk space is to be 5'.
- (5) A width of 8' or more may be needed in commercial areas.
- (6) 3:1 and flatter slopes may be used when the right of way is behind the sidewalk (or sidewalk space) in residential or other areas where slopes will be maintained by the property owner.
- (7) When Design year ADT exceeds 2000 VPD, with greater than 5% total truck and bus usage:
Provide 4' wide paved shoulders when the graded shoulder is 5' wide or greater or provide 3' wide paved shoulders when the graded shoulder is 4' wide. All shoulders not being paved will have the mainline pavement structure extended 1', on the same slope, into the shoulder to eliminate raveling at the pavement edge.
- (8) Ditch slopes to be 3:1 - 4' width.
- (9) Vertical clearance at roadway underpasses for new and reconstructed bridges is to be 16'-6" desirable and 14'-6" minimum (1' additional clearance required for non-vehicular overpasses).
- (10) If a buffer strip is used between the back of curb and sidewalk, it should be 2' minimum.
- (11) For intersection sight distance requirements see [Appendix C, Table C-1-5](#).

FIGURE A - 1 - 8