

GEOMETRIC DESIGN STANDARDS FOR RURAL PRINCIPAL ARTERIAL SYSTEM (GS-1M)

	TERRAIN	DESIGN SPEED (km/h)	MINIMUM RADIUS (METERS)	(6)	MIN. WIDTH OF LANE	(1)		(2)		(3)	(4)	(5)
				STOPPING SIGHT DISTANCE (METERS)		MINIMUM WIDTH OF TOTAL SHOULDERS (Graded + Paved)		PAVED SHOULDER WIDTH		WIDTH OF DITCH (FRONT SLOPE)		
				MIN.		FILL	CUT	RT.	LT.			
FREEWAYS	LEVEL	110	502	220	3.6 m	5.2 m	4.3 m	3.6 m	1.2 m	3.6 m	CS-4B	2 THRU LANES SAME DIRECTION = 1.5m + PAVE. WIDTH + 4.3m 3 OR MORE THRU LANES SAME DIRECTION = 4.3m + PAVE. WIDTH + 4.3m
	ROLLING	100	394	185								
	MOUNTAINOUS	80	230	130								
OTHER PRINCIPAL ARTERIALS	LEVEL	110	502	220	3.6 m	3.9 m	3.0 m	2.4 m	1.2 m	3.0 m	CS-4 OR 4B	UNDIVIDED & DIVIDED 3 OR MORE THRU LANES SAME DIRECTION = 3.0m + PAVE. WIDTH + 3.0m
		100	394	185								
	ROLLING	100	394	185								
		80	230	130								
	MOUNTAINOUS	80	230	130								
		60	124	85								

GENERAL NOTES

Freeways - A design speed of 110 km/h should be used for Rural Freeways. Where terrain is mountainous a design speed of 100 km/h or 80 km/h, which is consistent with driver expectancy, may be used. All new and major reconstructed Interstate facilities will have a 110 km/h design speed unless a lower design speed is approved by the Location and Design Engineer and FHWA.

Other Principle Arterials - A design speed of 60 to 110 km/h should be used depending on terrain, driver expectancy and whether the design is constructed on new location or reconstruction of an existing facility. An important safety consideration in the selection of one of the lower design speeds in each range is to have a properly posted speed limit which is enforced during off peak hours.

Incorporated towns or other built-up areas, Urban Standard GS-5(M) may be used for design. "Built-up" is where there is sufficient development along the roadway that justifies a need to channelize traffic into and out of properties utilizing curb and gutter.

Standard TC-5.01R(M) (2001 AASHTO Green Book) super-elevation based on 8% maximum is to be used for all Rural Principle Arterials.

RELATIONSHIP OF MAXIMUM GRADES TO DESIGN SPEEDS								
TYPE OF TERRAIN	FREEWAYS				ARTERIALS			
	DESIGN SPEED (km/h)							
	80	100	110	60	80	100	110	
	GRADES (PERCENT) *							
LEVEL	4	3	3	5	4	3	3	
ROLLING	5	4	4	6	5	4	4	
MOUNTAINOUS	6	6	5	8	7	6	5	

Grades 1 percent steeper than the value shown may be used on Rural Freeways in extreme situations for one-way downgrades except in mountainous terrain.

Clear Zone and Recoverable Area information can be found in Appendix A(M), Section A-2(M) of the [Road Design Manual](#).

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

FOOTNOTES

- (1) Shoulder widths shown are for right shoulders and independently graded median shoulders with no additional width necessary for guardrail situation. On non-Interstate a 2.4 m 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 is less than 250 DDHV, the minimum width of total shoulder should be 4.6 m for fills and 3.6 m for cuts.
- (2) 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 is less than 250 DDHV, the minimum right paved shoulder width should be 3.0 m.
- (3) Ditch slopes to be 6:1 - 3.0 m and 3.6 m widths and 4:1 - 1.8 m width.
- (4) Additional or modified slope criteria to apply where shown on typical sections.
- (5) Vertical clearance at roadway underpasses for new and reconstructed bridges is to be 5.05 m (0.3 m additional clearance required for non-vehicular overpasses). 4.2m shoulder may be reduced to 3.0m minimum when truck traffic is less than 250 DDHV.
- (6) For intersection sight distance requirements, see [Appendix C, Table C-1-5](#).

FIGURE A - 1 - 1M*

* Rev. 1/09

GEOMETRIC DESIGN STANDARDS FOR RURAL MINOR ARTERIAL SYSTEM GS-2M)

TRAFFIC VOLUME	TERRAIN	DESIGN SPEED (km/h)	MINIMUM RADIUS (METERS)	(8)	(2)	(3)		(4)		(5)	(6)	(7)
				STOPPING SIGHT DISTANCE (METERS)		MIN. WIDTH OF TOTAL SHOULDER (GRADED & PAVED)	PAVED SHOULDER WIDTH	MIN. WIDTH OF LANE	FILL W/GR			
(1) ADT OVER 2000	LEVEL	110	502	220	3.6 m	3.9 m	3.0 m	2.4 m	1.2 m	3.0 m	CS-4, CS-4A OR CS-4C	3.0 m PLUS PAVEMENT WIDTH PLUS 3.0 m
		100	394	185								
	ROLLING	100	394	185								
		80	230	130								
	MOUNTAINOUS	80	230	130								
		60	124	85								
(1) ADT 1500 TO 2000	LEVEL	110	502	220	3.6 m	3.3 m	2.4 m	1.8 m	1.2 m	1.8 m	CS-4, CS-4A OR CS-4C	2.4 m PLUS PAVEMENT WIDTH PLUS 2.4 m
		100	394	185								
	ROLLING	100	394	185								
		80	230	130								
	MOUNTAINOUS	80	230	130								
		60	124	85								
(1) ADT 400 TO 1500	LEVEL	110	502	220	3.6 m	3.3 m	2.4 m	1.8 m	1.2 m	1.8 m	CS-4, CS-4A OR CS-4C	1.8 m PLUS PAVEMENT WIDTH PLUS 1.8 m
		100	394	185								
	ROLLING	100	394	185								
		80	230	130								
	MOUNTAINOUS	80	230	130								
		60	124	85								
CURRENT ADT UNDER 400	LEVEL	110	502	220	3.6 m	2.7 m	1.8 m	1.2 m	1.2 m	1.8 m	CS-4, CS-4A OR CS-4C	1.8 m PLUS PAVEMENT WIDTH PLUS 1.8 m
		100	394	185								
	ROLLING	100	394	185								
		80	230	130								
	MOUNTAINOUS	80	230	130								
		60	124	85								

GENERAL NOTES

Rural Minor Arterials are designed with design speeds of 80 to 110 km/h, dependent on terrain features and traffic volumes, and occasionally may be as low as 60 km/h in mountainous terrain.

In incorporated towns or other built-up areas, Urban Standard GS-6(M) may be used for design. "Built-up" is where there is sufficient development along the roadway that justifies a need to channelize traffic into and out of properties utilizing curb and gutter.

Standard TC-5.01R(M) (2001 AASHTO Green Book) superelevation based on 8% maximum is to be used for Rural Minor Arterials.

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

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

RELATIONSHIP OF MAXIMUM GRADES TO DESIGN SPEEDS				
TYPE OF TERRAIN	DESIGN SPEED (km/h)			
	60	80	100	110
GRADES (PERCENT)				
LEVEL	5	4	3	3
ROLLING	6	5	4	4
MOUNTAINOUS	8	7	6	5

For Passing Sight Distance Criteria See Current AASHTO Green Book.

FOOTNOTES

- (1) Use Design Year ADT for new construction and reconstruction projects (not applicable to R.R.R. projects or roads with ADT < 400) in accordance with Road Design Manual, Chapter 2A, "REQUEST FOR TRAFFIC DATA" and Form LD-104.
- (2) Lane width to be 3.6 m at all interchange locations. For projects not on the National Highway System, width of traveled way may remain at 6.6 m on reconstructed highways where alignment and safety records are satisfactory.
- (3) If graded median is used, the width of median shoulder is to be 2.4 m.
- (4) The Paved widths shown are the widths to be used if the Materials Division recommends the shoulders be paved or stabilized. When the mainline is 4 lanes (both directions) a minimum 2.4 m wide paved shoulder will be provided on the right of traffic and a minimum 1.2 m wide paved shoulder on the median side. Where the mainline is 6 or more lanes, both right and median paved shoulders will be 2.4 m in width. If paved shoulders are not recommended by the Materials Division the mainline pavement structure will be extended 0.3 m at the same slope into the shoulder to eliminate raveling of the pavement edge.
- (5) Ditch slopes to be 6:1 - 3.0 m width, 4:1 - 1.8 m width.
- (6) Additional or modified slope criteria to be applied where shown on typical sections.
- (7) Vertical clearance at roadway underpasses for new and reconstructed bridges is to be 5.05 m (0.3 m additional clearance required for non-vehicular overpasses).
- (8) For intersection sight distance requirements, see Appendix C, Table C-1-5.

FIGURE A - 1 - 2M*

* Rev. 1/09

GEOMETRIC DESIGN STANDARDS FOR RURAL COLLECTOR ROAD SYSTEM (GS-3M)

TRAFFIC VOLUME	TERRAIN	DESIGN SPEED (km/h)	MINIMUM RADIUS (METERS)	(9)	(2) MIN. WIDTH OF LANE	(3) (4) MIN. WIDTH OF GRADED SHOULDERS		(5) WIDTH OF DITCH (FRONT SLOPE)	(6) RECOMMENDED SLOPE	(7) (8) NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES
				STOPPING SIGHT DISTANCE (METERS)		FILL W/GR	CUT & FILL			
(1) ADT OVER 2000	LEVEL	100	394	185	3.6 m	3.3 m	2.4 m	3.0 m	CS-4, CS-4A, OR CS-4C	2.4 m PLUS PAVEMENT WIDTH PLUS 2.4m
	ROLLING	80	230	130				1.8 m		
	MOUNTAINOUS	60	124	85				1.8 m		
(1) ADT 1500 TO 2000	LEVEL	80	230	130	3.3 m	2.7 m	1.8 m	1.8 m	CS-4, CS-4A, OR CS-4C	1.2 m PLUS PAVEMENT WIDTH PLUS 1.2 m
	ROLLING	60	124	85				1.2 m		
	MOUNTAINOUS	50	83	65				1.2 m		
(1) ADT 400 TO 1500	LEVEL	80	230	130	3.3 m	2.4 m	1.5 m	1.8 m	CS-4, CS-4A, OR CS-4C	1.0 m PLUS PAVEMENT WIDTH PLUS 1.0 m
	ROLLING	60	124	85	3.0 m			1.2 m		
	MOUNTAINOUS	50	83	65	3.0 m			1.2 m		
CURRENT ADT UNDER 400	LEVEL	60	124	85	3.0 m	2.1 m	0.6 m	1.8 m	CS-1	0.6 m PLUS PAVEMENT WIDTH PLUS 0.6 m
	ROLLING	50	83	65				1.2 m		
	MOUNTAINOUS	30	29	35				1.2 m		

GENERAL NOTES

Geometric design features should be consistent with a design speed appropriate for the conditions.

Low design speeds (60 km/h and below) are generally applicable to highways with curvilinear alignment in rolling or mountainous terrain and where environmental conditions dictate.

High speed design (70 km/h and above) are generally applicable to highways in level terrain or where other environmental conditions are favorable.

Intermediate design speeds would be appropriate where terrain and other environmental conditions are a combination of those described for low and high speed.

The designer should strive for higher values than the minimum where conditions of safety dictate and costs can be supported.

In incorporated towns or other built-up areas, Urban Standard GS-7M may be used. "Built-up" is where there is sufficient development along the roadway that justifies a need to channelize traffic into and out of properties utilizing curb and gutter.

Standard TC-5.01R(M) (2001 AASHTO Green Book) superelevation based on 8% Maximum to be used for Rural Collectors.

Maximum grades of short length (less than 150 m), on one-way downgrades and on low-volume Rural Collectors may be 2 percent steeper.

TYPE OF TERRAIN	DESIGN SPEED (km/h)					
	30	50	60	80	100	110
	GRADES (PERCENT)					
LEVEL	7	7	7	6	5	4
ROLLING	10	9	8	7	6	5
MOUNTAINOUS	12	10	10	9	8	6

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

For Passing Sight Distance Criteria See Current AASHTO Green Book.

FOOTNOTES

- (1) Use Design Year ADT for new construction and reconstruction projects (not applicable to R.R.R. projects or roads with ADT < 400) in accordance with Road Design Manual, Chapter 2A, "REQUEST FOR TRAFFIC DATA" and Form LD-104.
- (2) Lane width to be 3.6 m at all interchange locations.
- (3) Provide 1.2 m wide paved shoulders when design year ADT exceeds 2000 VPD, with 5% or more truck and bus usage. All shoulders not being paved will have the mainline pavement structure extended 0.3 m on the same slope into the shoulder to eliminate raveling at the pavement edge.
- (4) When the mainline is four lanes with ADT >2000, a minimum paved shoulder width of 1.8 m right of traffic and 0.9 m left of traffic will be provided.
- (5) Ditch slopes to be 6:1 - 3.0 m width, 4:1 - 1.8 m width, 3:1 - 1.2 m width.
- (6) Additional or modified slope criteria to be applied where shown on typical sections.
- (7) 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.
- (8) Vertical clearance at roadway underpasses for new and reconstructed bridges is to be 5.05 m desirable and 4.45 m minimum (0.3 m additional clearance required for non-vehicular overpasses).
- (9) For intersection sight distance requirements, see [Appendix C, Table C-1-5](#).

FIGURE A - 1 - 3M*

GEOMETRIC DESIGN STANDARDS FOR RURAL LOCAL ROAD SYSTEM (GS-4M)

TRAFFIC VOLUME	TERRAIN	DESIGN SPEED (km/h)	MINIMUM RADIUS (METERS)	(9) STOPPING SIGHT DISTANCE	(2) MIN. WIDTH OF SURFACING OR PAVEMENT	(3)(4)(5) MIN. WIDTH OF GRADED SHOULDERS		(6) WIDTH OF DITCH (FRONT SLOPE)	(7) RECOMMENDED SLOPE	(8) NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCE	
				MIN.		FILL W/GR	CUT & FILL				
(1) ADT OVER 2000	LEVEL	80	230	130	7.2 m	3.3 m	2.4 m	1.8 m	CS-4, 4A OR 4C	APPROACH ROADWAY WIDTH	
	ROLLING	60	124	85				1.2 m			CS-3, 3A OR 3B
	MOUNTAINOUS	50	83	65							
(1) ADT 1500 TO 2000	LEVEL	80	230	130	6.6 m	2.7 m	1.8 m	1.8 m	CS-4, 4A OR 4C	10 m PLUS PAVEMENT WIDTH PLUS 10 m	
	ROLLING	60	124	85				1.2 m			CS-3, 3A OR 3B
	MOUNTAINOUS	50	83	65							
(1) ADT 400 TO 1500	LEVEL	80	230	130	6.6 m	2.4 m	1.5 m	1.8 m	CS-4, 4A OR 4C	0.6 m PLUS PAVEMENT WIDTH PLUS 0.6 m	
	ROLLING	60	124	85	6.0 m			1.2 m			CS-3, 3A OR 3B
	MOUNTAINOUS	50	83	65							
CURRENT ADT 400 TO 250	LEVEL	60	124	85	5.4 m	2.1 m	0.6 m	1.8 m	CS-1		
	ROLLING	50	83	65				1.2 m			
	MOUNTAINOUS	30	29	35							
CURRENT ADT 250 TO 50	LEVEL	50	83	65	5.4 m	2.1 m	0.6 m	1.2 m	CS-1		
	ROLLING	50	83	65							
	MOUNTAINOUS	30	29	35							
CURRENT ADT UNDER 50	LEVEL	50	83	65	5.4 m	2.1 m	0.6 m	1.2 m	CS-1		
	ROLLING	30	29	35							
	MOUNTAINOUS	30	29	35							

GENERAL NOTES

Low design speeds are generally applicable to roads with winding alignment in rolling or mountainous terrain where environmental conditions dictate.

High design speeds are generally applicable to roads in level terrain or where other environmental conditions are favorable.

Intermediate design speeds would be appropriate where terrain and other environmental conditions are a combination of those described for low and high speed.

Standard TC-5.01R(M) (2001 AASHTO Green Book) superelevation based on 8% maximum is to be used.

In incorporated towns or other built-up areas, Urban Standard GS-8(M) may be used. "Built-up" is where there is sufficient development along the roadway that justifies a need to channelize traffic into and out of properties utilizing curb and gutter.

For Passing Sight Distance Criteria See Current AASHTO Green Book.

RELATIONSHIP OF MAXIMUM GRADES TO DESIGN SPEEDS					
TYPE OF TERRAIN	DESIGN SPEED (km/h)				
	30	50	60	80	100
GRADES (PERCENT)					
LEVEL	8	7	7	6	5
ROLLING	11	10	10	8	6
MOUNTAINOUS	16	14	13	10	--

FOOTNOTES

- Use Design Year ADT for new construction and reconstruction projects (not applicable to R.R.R. projects or roads with ADT < 400) in accordance with Road Design Manual, Chapter 2A, "REQUEST FOR TRAFFIC DATA" and Form LD-104.
- Lane width to be 3.6 m at all interchange locations.
- In mountainous terrain or sections with heavy earthwork, the graded width of shoulder in cuts may be decreased by 0.6 m, but in no case shall the shoulder width be less than 0.6 m.
- Minimum shoulder slope shall be 8% on low side and same slope as pavement on high side (See St'd. GS-12).
- Provide 1.2 m wide paved shoulders when design year ADT exceeds 2000 VPD, with 5% or more truck and bus usage. All shoulders not being paved will have the mainline pavement structure extended 0.3 m on the same slope into the shoulder to eliminate raveling at the pavement edge.
- Ditch slopes to be 4:1 - 1.8 m width, 3:1 - 1.2 m width.
- Additional or modified slope criteria to be applied where shown on typical sections.
- Vertical clearance at roadway underpasses for new and reconstructed bridges is 5.05 m desirable and 4.45 m minimum (0.3 m additional clearance required for non-vehicular overpasses).
- For intersection sight distance requirements, see Appendix C, Table C-1-5.

FIGURE A - 1 - 4M*

* Rev. 1/09

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

	DESIGN SPEED (km/h)	MINIMUM RADIUS		(13) STOPPING SIGHT DISTANCE	MIN. WIDTH OF LANE	(1) MINIMUM WIDTH TOTAL SHOULDERS		(2) PAVED SHOULDER WIDTH		(3) WIDTH OR 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	110	502	-	220	3.6m	4.5m	3.6m	3.0m	1.2m	3.6m	CS-4 OR CS-4B	2 THRU LANES SAME DIRECTION - 1.8m + PAVE. WIDTH + 3.6m 3 OR MORE THRU LANES SAME DIRECTION - 4.2m + PAVE. WIDTH + 4.2m
	100	394	-	185								
	80	230	-	130								
OTHER PRINCIPAL ARTERIAL WITH SHOULDER DESIGN	100	394	-	185	(12) 3.6m	3.9m	3.0m	2.4m	1.2m	3.0m	CS-4 OR CS-4E	UNDIVIDED & DIVIDED 3 OR MORE THRU LANES SAME DIRECTION - 3.0m + PAVE. WIDTH + 3.0m 2 THRU LANES (DIVIDED) SAME DIRECTION - 1.8m + PAVE. WIDTH + 3.0m
	80	280	-	130								
	60	150	149	85	(5) (6) (12) 3.3m							
	50	99	94	65								
	DESIGN SPEED (km/h)	MINIMUM RADIUS		STOPPING SIGHT DISTANCE	MIN. WIDTH OF LANE	(8) STANDARD CURB & GUTTER (14)	BUFFER STRIP WIDTH	(9) MINIMUM SIDEWALK WIDTH	(10) SLOPE	(7) NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES		
		U	ULS	MIN.								
OTHER PRINCIPAL ARTERIAL WITH CURB & GUTTER	100	394	-	185	(12) 3.6m	CG-7	(11)	1.5m	2: 1	SAME AS CURB TO CURB OF APPROACHES		
	80	280	-	130								
	70	215	227	105								
	60	150	149	85	(5) (6) (12) 3.3m							
	50	99	94	65								

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 80 km/h.

On many Urban Freeways, particularly in suburban areas, a design speed of 100 km/h or higher can be provided with little additional cost above that required for 80 km/h 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 110 km/h 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 60 to 100 km/h, and occasionally may be as low as 50 km/h. The lower (60 km/h 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 (M) (Rural) (2001 AASHTO Green Book) super-elevation based on 8% maximum is to be used for all Freeways and is to be used for all other Principal Arterials with a design speed of 100 km/h.

* 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.

RELATIONSHIP OF MAXIMUM GRADES TO DESIGN SPEEDS									
TYPE OF TERRAIN	FREEWAYS*				ARTERIALS				
	DESIGN SPEED (km/h)								
	80	100	110	50	60	70	80	100	
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	

Standard TC-5.01U (M) (Urban) (2001 AASHTO Green Book) super-elevation based on 4% maximum is to be used on Other Principal Arterials with a design speed less than 100 km/h.

Standard TC-5.04ULS (M) (Urban Low Speed) (2004 AASHTO Green Book) super-elevation based on 2% maximum is to be used on Other Principal Arterials with a design speed less than or equal to 70 km/h.

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

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

A minimum 9.2 m width of surfacing or a minimum 9.2 m 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(M).

FOOTNOTES

- (1) Shoulder widths shown are for right shoulders and independently graded median shoulders. A 2.4m 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 5.1m for fills and 4.2m for cuts.
- (2) 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 3.6 m, and on 6 or more lane Freeways, the left paved shoulder width should also be 3.6 m if truck traffic exceeds 250 DDHV.
- (3) Ditch slopes to be 6:1 - 3.0 m and 3.6 m widths and 4:1 - 1.8 m width.
- (4) Additional or modified slope criteria to apply where shown on typical sections.
- (5) Minimum lane width to be 3.6 m at all interchange locations.
- (6) If heavy truck traffic is anticipated, an additional 0.3 m width is desirable.
- (7) Vertical clearance at roadway underpasses for new and reconstructed bridges is to be 5.05 m (0.3 m additional clearance required for non-vehicular overpasses). 4.2m shoulder may be reduced to 3.0m minimum when truck traffic is less than 250 DDHV.
- (8) Or equivalent City or Town design.
- (9) Width of 2.4 m or more may be needed in commercial areas.
- (10) 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.
- (11) If a buffer strip is used between the back of curb and sidewalk, it should be 0.6 m minimum.
- (12) Situations having restrictions on trucks may allow the use of lanes 0.3m less in width.
- (13) For intersection sight distance requirements, see [Append., Table C-1-5](#).
- (14) Because Urban Principal Arterials are typically free-flowing, with higher operating speeds, Standard CG-7 is recommended for design speeds \geq 70 km/h. See current AASHTO "Green Book", Chapter 2.

FIGURE A - 1 - 5M

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

	DESIGN SPEED (km/h)	MINIMUM RADIUS		(12) STOPPING SIGHT DISTANCE	(11) MIN. WIDTH OF LANE	(3) STANDARD CURB & GUTTER (10)		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	100	394	-	185	3.6m	CG-7		(10)		1.5m	2: 1	SAME AS CURB TO CURB OF APPROACHES	
	80	280	-	130		CG-6							
	70	215	227	105	(1) (2) 3.3m								
	60	150	149	85									
	50	99	94	65									
	DESIGN SPEED (km/h)	MINIMUM RADIUS		STOPPING SIGHT DISTANCE	MIN. WIDTH OF LANE	(7) MINIMUM WIDTH GRADED SHOULDERS		(8) PAVED SHOULDER WIDTH		(9) WIDTH OR 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	100	394	-	185	3.6m	3.9m	3.0m	2.4m	1.2m	3.0m	2: 1	3.0m + PAVEMENT WIDTH + 3.0m	
	80	280	-	130	(1) (2) 3.3m	3.3m	2.4m	1.8m	1.2m	1.8m		2.4m + PAVEMENT WIDTH + 2.4m	
	60	150	149	85									
	50	99	94	65									

GENERAL NOTES

Design Speeds for Urban Arterials generally range from 60 to 80 km/h and occasionally may be as low as 50 km/h. The lower (60 km/h 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 (M) (2001 AASHTO Green Book) superelevation based on 8% maximum is to be used for 100 km/h design speed.

Standard TC-5.01U (M) (Urban) (2001 AASHTO Green Book) superelevation based on 4% maximum is to be used for design speeds less than 100 km/h.

Standard TC-5.04ULS (M) (Urban Low Speed) (2004 AASHTO Green Book) superelevation based on 2% maximum may be used for design speeds less than or equal to 70 km/h.

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

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

A minimum 9.2 m width of surfacing or a minimum 9.2 m face to face of curb is to be used within incorporated cities or towns to qualify for maintenance payments.

FOOTNOTES

- (1) Lane width to be 3.6 m at all interchanges or if design year ADT exceeds 2000.
- (2) If heavy truck traffic is anticipated, an additional 0.3 m width is desirable.
- (3) Or equivalent City or Town design.
- (4) A width of 2.4 m or more may be needed in commercial areas.
- (5) 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.
- (6) Vertical clearance at roadway underpasses for new and reconstructed bridges is to be 5.05 m (0.3 m additional clearance required for non-vehicular overpasses).
- (7) If graded median is used, the width of median shoulder is to be 2.4 m (See Standard GS-11 for shoulder design).
- (8) The Paved widths shown are the widths to be used if the Materials Division recommends the shoulders be paved or stabilized. When the mainline is 4 lanes (both directions) a minimum 2.4 m wide paved shoulder will be provided on the right of traffic and a minimum 1.2 m wide paved shoulder on the median side. Where the mainline is 6 or more lanes, both the right and median paved shoulders will be 2.4 m in width. If paved shoulders are not recommended by the Materials Division, the mainline pavement structure will be extended 0.3 m at the same slope into the shoulder to eliminate raveling of the pavement edge.
- (9) Ditch slope to be 6:1 - 3.0 m width and 4:1 - 1.8 m width.
- (10) If a buffer strip is used between the back of curb and sidewalk, it should be 0.6 m minimum.
- (11) Situations having restrictions on trucks may allow the use of lanes 0.3 m less in width.
- (12) For intersection sight distance requirements, see Appendix C, Table C-1-5.

RELATIONSHIP OF MAXIMUM GRADES TO DESIGN SPEEDS					
TYPE OF TERRAIN	DESIGN SPEED (km/h)				
	50	60	70	80	100
	GRADES (PERCENT)				
LEVEL	8	7	6	6	5
ROLLING	9	8	7	7	6
MOUNTAINOUS	11	10	9	9	8

FIGURE A - 1 - 6M*

* Rev. 1/09

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

	DESIGN SPEED (km/h)	MINIMUM RADIUS		(11) STOPPING SIGHT DISTANCE	MIN. WIDTH OF LANE	(3) STANDARD CURB & GUTTER (10)	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	80	280	-	130	3.6m	CG-7	(10)	1.5m	2: 1	SAME AS CURB TO CURB OF APPROACHES
	70	215	227	105						
	60	150	149	85	(1) (2)	CG-6				
	50	99	94	65	3.3m					
	DESIGN SPEED (km/h)	MINIMUM RADIUS		STOPPING SIGHT DISTANCE	MIN. WIDTH OF LANE	(7) MINIMUM WIDTH GRADED SHOULDERS		(10) WIDTH OR DITCH (FRONT SLOPE)	(5) SLOPE	(8) (9) NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES
		U	ULS			MIN.	FILL W/GR			
STREETS WITH SHOULDER DESIGN	80	280	-	130	3.6m	3.3m	2.4m	1.8m	2: 1	2.4m + PAVEMENT WIDTH + 2.4m
	60	150	149	85	(1) (2)					
	50	99	94	65	3.3m	2.1m	1.2m	1.2m	1.2m + PAVEMENT WIDTH + 1.2m	

GENERAL NOTES

A minimum design speed of 50 km/h 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 (M) (Urban) (2001 AASHTO Green Book) superelevation based on 4% maximum.

Standard TC-5.04ULS (M) (Urban-Low Speed) (2004 AASHTO Green Book) superelevation based on 2% maximum may be used with a design speed of 70 km/h or less.

A minimum 9.2 m width of surfacing or a minimum 9.2 m 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 (M), Section A-2(M) of the Road Design Manual.

Maximum grades of short lengths (less than 150 m) and one-way down grades may be 2% steeper.

FOOTNOTES

- (1) 3.6m when Design year ADT exceeds 2000. Where feasible, lanes should be 3.6m in industrial areas; however, where available or attainable R/W imposes severe limitations 3.3m lanes can be used in industrial areas., 3.0m lanes can be used in residential areas, based upon design speed and traffic volumes. (See AASHTO Green Bk., Exhibit 6-5).
- (2) Lane width to be 3.6 m at all interchange locations.
- (3) Or equivalent City or Town Design.
- (4) A width of 2.4 m 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 - 1.8 m width and 3:1 - 1.2 m width.
- (7) When Design year ADT exceeds 2000VPD, with greater than 5% total truck and bus usage: Provide 1.2 m wide paved shoulders when the graded shoulder is 1.5 m wide or greater or provide 1 m wide paved shoulders when the graded shoulder is 1.2 m wide. All shoulders not being paved will have the mainline pavement structure extended 0.3 m, on the same slope, into the shoulder to eliminate raveling at the pavement edge (See Standard GS-11 for shoulder design).
- (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 5.05 m desirable and 4.45 m minimum (0.3 m additional clearance required for non-vehicular overpasses).
- (10) If a buffer strip is used between the back of curb and sidewalk, it should be 0.6 m 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

FIGURE A - 1 - 7M*

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

	DESIGN SPEED (km/h)	MINIMUM RADIUS (METERS)		(1) MAX. PERCENT OF GRADE	(11) STOPPING SIGHT DISTANCE (METERS)	(2) MIN. WIDTH OF LANE	(3) STANDARD CURB & GUTTER	(4) BUFFER STRIP WIDTH	(5) MIN. SIDEWALK WIDTH	(6) SLOPE	(9) (10) NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES
		U	ULS								
STREETS WITH CURB & GUTTER	50	99	94	15	58m	3.0m	CG-6	(10)	1.5m	2:1	SAME AS CURB TO CURB OF APPROACHES
	30	34	24		30m						
	DESIGN SPEED (km/h)	MINIMUM RADIUS (METERS)		(1) MAX. PERCENT OF GRADE	STOPPING SIGHT DISTANCE (METERS)	(2) MIN. WIDTH OF LANE	(7) MIN. WIDTH GRADED SHOULDERS		(8) WIDTH OF DITCH (FRONT) SLOPE	SLOPE	(9) NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES
		U	ULS				FILL W/GR.	CUT & FILL			
STREETS WITH SHOULDER DESIGN	50	99	94	15	58m	3.0m	2.1 m	1.2 m	1.2 m	3:1	1.2 m + PAVEMENT WIDTH +1.2 m
	30	34	24		30m						

GENERAL NOTES

Design Speeds is not a major factor for local streets. For consistency in design elements, design speeds ranging from 30 to 50 km/h 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 50 km/h 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 (M) (Urban) (2001 AASHTO Green Book) superelevation based on 4% maximum.

Standard TC-5.04ULS (M) (Urban Low Speed) (2004 AASHTO Green Book) superelevation based on 2% maximum may be used with a design speed of 70 km/h or less.

A minimum 9.2 m width of surfacing or a minimum 9.2 m 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 3.3 m wide and in industrial areas should be 3.6 m wide; however, where available or attainable right of way imposes severe limitations, 2.7 m lanes can be used in residential areas and 3.3 m 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 1.5 m.
- (5) Widths of 2.4 m 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 1.2 m wide paved shoulders when the graded shoulder is 1.5 m wide or greater or provide 1 m wide paved shoulders when the graded shoulder is 1.2 m wide. All shoulders not being paved will have the mainline pavement structure extended 0.3 m, on the same slope, into the shoulder to eliminate raveling at the pavement edge (See Standard GS-12 for shoulder design).
- (8) Ditch slopes to be 3:1 - 1.2 m width.
- (9) Vertical clearance at roadway underpasses for new and reconstructed bridges is to be 5.05 m desirable and 4.45 m minimum (0.3 m additional clearance required for non-vehicular overpasses).
- (10) If a buffer strip is used between the back of curb and sidewalk, it should be 0.6 m minimum.
- (11) For intersection sight distance requirements, see [Appendix C, Table C-1-5](#).

FIGURE A - 1 - 8M*

GEOMETRIC DESIGN STANDARDS FOR SERVICE ROADS (GS-9M)

(1) DEAD END SERVICE ROADS UNDER 25 VPD								
PROPERTIES SERVED	DESIGN SPEED (km/h)	MINIMUM RADIUS (METERS)	STOPPING SIGHT DISTANCE (METERS)	(2) MINIMUM TRAVELED WAY WIDTH	MINIMUM WIDTH OF SHOULDER		(3) WIDTH OF DITCH (FRONT SLOPE)	SLOPES
					FILL W/GR.	CUT & FILL		
1	20	10	40	3.6m	1.2m	0.6m	0.9m	(4)
OVER 1	30	29	70	4.2m	1.5m			

GENERAL NOTES

The minimum design speed for service roads should be 30 km/h except for one lane service roads serving one property which may have a minimum design speed of 20 km/h.

Standard TC-5.01R (M) superelevation based on 8% maximum to be used (See 2001 AASHTO "Green Book").

For Passing Sight Distance Criteria See Current AASHTO Green Book.

FOOTNOTES

- (1) For through service roads and dead end service roads with over 25 VPD, use Standards shown for Local Roads and Streets (See Standard GS-12).
- (2) Under adverse conditions, intermittent shoulder sections or turnouts for passing may be required (see page 411, 2004 AASHTO "Green Book").
- (3) Ditch slope to be 3:1.
- (4) Slopes to be same as mainline when service road is parallel to or otherwise visible from the mainline. For other cases slopes should be in accordance with standards for Local Roads and Streets.

RELATIONSHIP OF MAXIMUM GRADES TO DESIGN SPEEDS				
TYPE OF TERRAIN	DESIGN SPEED (km/h)			
	20	30	50	60
	GRADES (PERCENT)			
LEVEL	8	8	7	7
ROLLING	12	11	10	9
MOUNTAINOUS	18	16	14	12

FIGURE A - 1 - 9M*

* Rev. 1/09