

BUREAU OF LOCAL ROADS AND STREETS MANUAL

August 2016

GEOMETRIC DESIGN TABLES

Chapter 32 <u>GEOMETRIC DESIGN TABLES</u> (New Construction/Reconstruction)

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Chapter 32 GEOMETRIC DESIGN TABLES (New Construction/Reconstruction)

32-1 GENERAL

This Chapter presents summary tables of the design criteria for the geometric design of local projects. They apply to new construction and reconstruction projects. The designer should consider the following in the use of these tables:

- <u>Functional Classification</u>. The selection of design values depends on the functional classification of the highway facility. Functional classification is discussed in <u>Section</u> <u>27-3</u>. The first step in the design process is to determine the functional classification of the proposed improvement. If the classification is unknown, contact the local Illinois Department of Transportation (IDOT) district office.
- 2. <u>Manual Section References</u>. These tables are intended to provide a concise listing of design values for easy use. However, the designer should review the *Manual* section reference for more information on the design elements.
- 3. <u>Footnotes</u>. The tables include many footnotes, which are identified by a number in parentheses (e.g., (3)). The information in the footnote is critical to the proper use of these design tables.
- 4. <u>Cross Section Elements</u>. 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.
- 5. <u>Bridge Elements</u>. Design criteria for bridge elements are provided in <u>Chapter 36</u>.
- 6. <u>Controlling Design Criteria</u>. Controlling design criteria are the elements judged to be the most critical indicators of highway safety and overall serviceability. The tables provide an asterisk to indicate controlling design criteria. <u>Section 27-7</u> discusses this in more detail and presents the process for approving design variances to controlling criteria.
- 7. <u>Local Public Agency (LPA) Criteria</u>. Illinois counties and cities may have developed their own geometric design criteria for local facilities. It may be acceptable to use the local agency criteria where there are conflicts with the criteria listed in this *Manual*. This decision will be made on a case-by-case basis or can be approved as an agency variance acceptable for all projects.

32-2 GEOMETRIC DESIGN CRITERIA

This Section presents the new construction/reconstruction geometric design criteria for various local facilities. Design criteria are provided for the following facilities:

- Figure 32-2A "Geometric Design Criteria for Rural Two-Lane Minor Arterials,"
- Figure 32-2B "Geometric Design Criteria for Rural Two-Lane Collectors,"
- Figure 32-2C "Geometric Design Criteria for Rural Two-Lane Local Roads,"
- Figure 32-2D "Geometric Design Criteria for Suburban Arterials,"
- Figure 32-2E "Geometric Design Criteria for Urban Two-Way Arterials,"
- Figure 32-2F "Geometric Design Criteria for Urban One-Way Arterials,"
- Figure 32-2G "Geometric Design Criteria for Urban Two-Way Collectors,"
- Figure 32-2H "Geometric Design Criteria for Urban One-Way Collectors," and
- Figure 32-2I "Geometric Design Criteria for Urban Local Streets."

For criteria on local rural two-lane principal arterials, the designer should review the criteria in <u>Chapter 47</u> of the *Bureau of Design and Environment (BDE) Manual*. Local rural two-lane principal arterial projects should be brought to early coordination for discussion.

	Design El	lement		Manual Section	Design Volume (Two-Way DHV) New Construction / Reconstruction DHV < 1050 (2)			
	Design Forecast Year			<u>27-6.02</u>	20 Y	ears		
0 _	Minimum	Le	vel	27 5 02	60 mph (3a)	100 km/h (3a)		
) Onti	Design Speed * (1a)	Rol	ling	<u>27-5.02</u>	55 mph (3a)	90 km/h (3a)		
gn ols	Access Control	Access Control			Controlled by F	Regulations (4)		
	Level of Service (LOS) *			<u>27-6.04</u>	(2		
	Traveled Way Width *	Traveled Way Width *			24'	7.2 m		
Q	Surface Type			Chapter <u>44</u>	High Type	Pavement		
ros	Shoulder Width *			21.1.00	10'	3.0 m		
s Se	Shoulder Type			<u>31-1.00</u>	4' Paved w/ Remainder Aggregate	1.2 m Paved w/ Remainder Aggregate		
ection	Auxilian (Longo *	Lane	Width	31-1 03	12'	3.6 m		
Elerr	Auxiliary Lanes	Shoulde	Shoulder Width		4' (Paved)	1.2 m (Paved)		
ient	Flush / TWLTL Widths			<u>31-1.05</u>	14'	4.2 m		
ŝ		Travel	Lane *		1.5% (5a)			
	Cross Slope	Shou	ulder	<u>31-1.08</u>	Paved 4% / Aggregate 6% (5b)			
		Rollove	r Factor		8	%		
			Front Slope		1V:	6H		
Roa		Cut Castian	Ditch Width		4' (6)	1.2 m (6)		
ıdway S	Side Slope (Maximum)	Cut Section	Back Slope	<u>31-2.03</u> 31-2.04	≤10' 1V:3H >10' 1V:2H (7)	<u><</u> 3.0 m 1V:3H >3.0 m 1V:2H (7)		
lop		Rock	k Cut	1	1V:0	.25H		
es		Fill Se	Fill Section		1V:6H to Cle 1V:3H (max) to	ear Zone (8) Toe of Slope (8)		
* Conti	colling design criteria (see Sec	tion 27-7)		<u>ا</u>)HV = Design Hourly Volume			

GEOMETRIC DESIGN CRITERIA FOR RURAL TWO-LANE MINOR ARTERIALS (New Construction/Reconstruction)

Figure 32-2A (US Customary / Metric)

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Footnotes:

- (1) <u>Design Criteria</u>. The criteria for the minimum cross-section elements allowed to remain in place (see <u>Chapter 33</u>) provided it is cost effective and the safety record is satisfactory.
- (2) <u>Traffic Volumes</u>. The design hourly volumes (DHV) assumes base conditions (except for 8% heavy vehicles) and a PHF = 1 for LOS shown. Adjust these values according to the actual factors. <u>Section 27-6</u> further discusses capacity methodology and traffic volumes.

(3) <u>Design Speed</u>.

- a. In rolling terrain, a minimum design speed of 55 mph (90 km/h) may be considered with study and justification.
- b. To determine the minimum design speed allowed to remain in place, consider the following:
 - i. Existing horizontal curves may remain in place provided they have a comfortable operating speed of 60 mph (100 km/h) (level) or 50 mph (80 km/h) (rolling) and there is no history of crashes.
 - Existing sag vertical curves may remain in place if they have a design speed of 50 mph (80 km/h) or greater and do not have a history of crashes. If not, reconstruct the sag vertical curve to a design speed of 60 mph (100 km/h).
 - Existing crest vertical curves may remain in place if they have a design speed of 50 mph (80 km/h) or greater and do not have a history of crashes. If not, reconstruct the crest vertical curve to a design speed of 60 mph (100 km/h).
 - iv. Consider the relationship between horizontal and vertical alignments simultaneously to obtain a desirable condition. <u>Chapter 33</u> of the *BDE Manual* discusses these relationships and their effect on aesthetics and safety.
- (4) <u>Access Control</u>. For bypass routes on new alignment, design the roadway with partial access control. See <u>Section 35-1</u> of the *BDE Manual*.
- (5) Cross Slopes.
 - a. Cross slopes for outside auxiliary lanes will be at least 2.0% and should be 0.5% greater than the adjacent travel lane.
 - b. Where an aggregate shoulder is part of the shoulder width, slope the aggregate portion of the shoulder at 6%.
- (6) <u>Ditch Bottom Width</u>. Provide a wider outside ditch bottom where detention storage of storm water is a consideration.
- (7) <u>Back Slope</u>. Where the height of cut exceeds 10 ft (3.0 m), consider using a 1V:2H back slope beyond the clear zone. Also, for heights of cut greater than 30 ft (9.0 m), consider the use of benching.
- (8) <u>Fill Slope</u>. For fill heights greater than 30 ft (9.0 m), use a 1V:2H uniform slope with a roadside barrier. Also, for heights greater than 30 ft (9.0 m), consider the use of benching.

GEOMETRIC DESIGN CRITERIA FOR RURAL TWO-LANE MINOR ARTERIALS (New Construction/Reconstruction)

Footnotes to Figure 32-2A

	Desire Fl	4		Manual		Design Vo	lume (ADT)		
	Design El	ement		Section	ADT < 400	400 to 750	750 to 2000	ADT > 2000	
	Design Forecast Year			<u>27-6.02</u>	Current		20 Years		
Con	Minimum	Le	vel	27 5 02	40 mph (1b)	50 mph (1b)	50 mph	60 mph	
sign	Design Speed * (1a)	Rol	ling	<u>27-5.02</u>	30 mph (1b)	40 mp	oh (1b)	50 mph	
•	Level of Service (LOS) *			<u>27-6.04</u>		(C		
	Traveled Way Width *			<u>31-1.01</u>	20'	2	2'	24' (2)	
Cro	Surface Type			Chapter <u>44</u>	Aggregate Surface or Bituminous Treated (3)		High Type Pavement		
oss Sec	Shoulder Width *			21.1.00	2' (4a)	4' (4b)	6' (4b)	8' (4b)	
	Shoulder Type			<u>31-1.00</u>	Turf or Agg	regate (5a)	Aggregate o	r Paved (5b)	
tion E	Auxiliary Lanes *	Lane	Width	21 1 02	10'	Desir Minim	ed 11' um 10'	Desired 12' Minimum 11'	
lemen		Shoulde	er Width	<u>31-1.03</u>	2'	4'	Desired 6' Minimum 4'	Desired 8' Minimum 4'	
Its		Travel Lane * (6a)			2.0% - 4% (6b)	1.5% - 2.0%			
	Cross Slope	Sho	ulder	<u>31-1.08</u>	Turf 5% - 8% / Ag	ggregate 4% - 6% Aggregate 4% -		6% / Paved 4%	
		Rollove	r Factor		10% 8		8%		
			Front Slope	_		1V:3H		1V:4H	
Roa		Cut Section	Ditch Width			Minim	num 2'		
tdway SI	Side Slope (Maximum)	Cut Section	Back Slope	<u>31-2.03</u> <u>31-2.04</u>	<u><</u> 10' 1V:3H (7) >10' 1V:2H (7)	≤10' 1V:3H >10' 1V:2H		<15' 1V:4H 15' - 25' 1V:3H >25' 1V:2H	
ope		Roci	k Cut			1V:0	.25H		
ö		Fill Se	ection		<u><</u> 6' 1V:3H >6' 1V:2H	<u><</u> 10' 1V:3H >10' 1V:2H		<u><</u> 25' 1V:4H >25' 1V:2H	
* Conti	olling design criteria (see Sec	tion 27-7).			ADT = Average Daily Tra	affic			

GEOMETRIC DESIGN CRITERIA FOR RURAL TWO-LANE COLLECTORS (New Construction/Reconstruction)

Figure 32-2B (US Customary)

BUREAU OF LOCAL ROADS & STREETS GEOMETRIC DESIGN TABLES

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	Desire El			Manual		Design Vol	lume (ADT)		
	Design Ele	ement		Section	ADT < 400	400 to 750	750 to 2000	ADT > 2000	
	Design Forecast Year			<u>27-6.02</u>	Current	20 Years			
Des	Minimum	Lev	vel	27 5 02	60 km/h (1b)	80 km/h (1b)	80 km/h	100 km/h	
sign trols	Design Speed * (1a)	Rol	ling	27-5.02	50 km/h (1b)	60 km	/h (1b)	80 km/h	
	Level of Service (LOS) *			<u>27-6.04</u>		(0		
	Traveled Way Width *			<u>31-1.01</u>	6.0 m	6.6	δ m	7.2 m (2)	
Cro	Surface Type			Chapter <u>44</u>	Aggregate Surface or Bituminous Treated (3)		High Type Pavement		
SSC	Shoulder Width *			21.1.06	600 mm (4a)	1.2 m (4b)	1.8 m (4b)	2.4 m (4b)	
Sect	Shoulder Type			<u>31-1.00</u>	Turf or Agg	regate (5a)	Aggregate o	or Paved (5b)	
tion E	Auxiliary Lanes *	Lane	Width	<u>31-1.03</u>	3.0 m	Desire Minimu	d 3.3 m m 3.0 m	Desired 3.6 m Minimum 3.3 m	
lemen		Shoulde	er Width		600 mm	1.2 m	Desired 1.8 m Minimum 1.2 m	Desired 2.4 m Minimum 1.2 m	
Its		Travel La	ne * (6a)		2.0% - 4% (6b)	1.5% - 2.0%			
	Cross Slope	Shou	ulder	<u>31-1.08</u>	Turf 5% - 8% / Ag	ggregate 4% - 6% Aggregate 4% -		6% / Paved 4%	
		Rollove	r Factor		10	1%	8	%	
			Front Slope			1V:3H		1V:4H	
Roa			Ditch Width			Minimum	i 600 mm		
adway SI	Side Slope (Maximum)	Cut Section	Back Slope	<u>31-2.03</u> <u>31-2.04</u>	<u><</u> 3.0 m 1V:3H (7) >3.0 m 1V:2H (7)	<u><</u> 3.0 m >3.0 m	1V:3H 1V:2H	<4.5 m 1V:4H 4.5 - 7.5 m 1V:3H >7.5 m 1V:2H	
ope		Rock	c Cut			1V:0	.25H		
ŭ		Fill Se	ection		<u><</u> 1.8 m 1V:3H >1.8 m 1V:2H	<u><</u> 3.0 m >3.0 m	1V:3H 1V:2H	<u><</u> 7.5 m 1V:4H >7.5 m 1V:2H	

ADT = Average Daily Traffic

GEOMETRIC DESIGN CRITERIA FOR RURAL TWO-LANE COLLECTORS (New Construction/Reconstruction)

Figure 32-2B (Metric)

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Footnotes:

- (1) <u>Design Speed</u>.
 - A rural collector may pass through a relatively built-up area. In these sections, a lower design speed may be selected with justification. However, the selected design speed should not be less than 30 mph (50 km/h). Consider the following:
 - i. For low to moderate density areas, the design speed may be reduced 5 mph to 10 mph (10 km/h) below the listed design speed.
 - ii. For moderate to high density areas, the design speed may be reduced 10 mph to 15 mph (10 km/h to 20 km/h) below the listed design speed.
 - b. For rural bridge projects, the design speed may be increased to the posted or regulatory speed limit to avoid a deficient NBIS rating for approach roadway alignment appraisal. All elements of the project will be designed to the chosen design speed. The chosen design speed will be certified by the County Engineer.
- (2) <u>Traveled Way Width</u>. On a reconstruction project, an existing 22 ft (6.6 m) traveled way width may be maintained where the alignment and safety records are satisfactory.
- (3) <u>Surface Type</u>. A high-type pavement is desirable.
- (4) <u>Shoulder Width</u>.
 - a. Where roadside barriers are included, provide a minimum offset of 4 ft (1.2 m) from the edge of the traveled way to the roadside barrier. When the 4 ft (1.2 m) width cannot be met because of a proposed or an existing bridge width (see <u>Section 36-5</u>), <u>Section 35-4</u> shall be followed to flare the roadside barrier until the 4 ft (1.2 m) width is met or until the length of need is exceeded.
 - b. Where the rural collector passes through a moderate to high density area, the shoulder width may be 4 ft (1.2 m). This width may include the width of Type B gutter or the gutter flag with curb and gutter at the outside edge of the shoulder.
- (5) Shoulder Type.
 - a. Aggregate shoulders may consist of a nominal 4 in (100 mm) thickness where the ADT is less than 750 vehicles/day.
 - For ADT's > 750 vehicles/day, an aggregate shoulder should be a minimum thickness of 6 in (150 mm) Type A shoulders.
- (6) Cross Slopes.
 - a. Cross slopes for outside auxiliary lanes will be at least 2.0% and should be 0.5% greater than the adjacent travel lane. Inside auxiliary lane cross slopes are sloped at 1.5% to 2.0% with high-type pavements.
 - b. Use 1.5% to 2.0% with high-type pavement.
- (7) <u>Back Slopes</u>. For isolated restricted right-of-way, the back slope may be 1V:2H for cut depths of 0 ft to 10 ft (0 m to 3 m) or 1V:1.5H for cut depths greater than 10 ft (3 m).

GEOMETRIC DESIGN CRITERIA FOR RURAL TWO-LANE COLLECTORS (New Construction/Reconstruction)

Footnotes to Figure 32-2B

	Decise El	omont		Manual	Design Volume (ADT)				
	Design El	ement		Section	ADT < 250	250 to 400	400 to 750	750 to 2000	ADT > 2000
•	Design Forecast Year			<u>27-6.02</u>	Cur	rrent	20 Years		
Con	Minimum	Le	vel	27 5 02	30 mph (1c/d)	40 mph (1d)	50 mph		
sign trols	Design Speed * (1)	Ro	ling	27-5.02	30 mph (1b-d)	30 mph (1d)		40 mph (1d)	
0,	Level of Service (LOS) *		<u>27-6.04</u>			D			
	Traveled Way Width *			<u>31-1.01</u>	18 (2a)	20'	2	2'	24' (2b)
C	Surface Type		Chapter <u>44</u>	Aggregat or Bituminou	e Surface is Treated (3)	I	High Type Paveme	nt	
ross	Shoulder Width *			31 1 06	2' ((4a)	4' (4b)	6' (4b)	8' (4b)
Se	Shoulder Type		<u>31-1.00</u>	Turf	Turf or Agg	regate (5a)	Aggregate, Pav	ed, or Comb. (5b)	
ction	Auxiliary Lanes *	Lane	Width	21.1.02	N/A	10'	Desired 11' Minimum 10'		Desired 12' Minimum 11'
Eleme		Should	er Width	<u>31-1.03</u>	N/A	2'	Desired 4' Minimum 2'	Desired 6' Minimum 4'	Desired 8' Minimum 4'
ents		Travel Lane *		2.4		4% (6b)		1.5% - 2.0%	-
	Cross Slope (6a)	Sho	ulder	<u>31-1.08</u>	Turf 5% - 8%	Turf 5% - 8% / Ag	ggregate 4% - 6%	Aggregate 4% - 6% / Paved 4%	
		Rollove	Rollover Factor		10%		8%		3%
			Front Slope		1V:3H (7a)		1V:3H		1V:4H
R			Ditch Width		Desired 2'		Minim	num 2'	
oadway Slo	Side Slope (Maximum)	Cut Section	Back Slope	k Slope <u>31-2.03</u> <u>31-2.04</u>	<u>≤</u> 10' 1V:3H >10' 1V:2H (7a/b)	≤10' 1V:3H >10' 1V:2H (7b)	<u>≤</u> 10' >10'	1V:3H 1V:2H	<15' 1V:4H 15 - 25' 1V:3H >25' 1V:2H
opes		Roc	k Cut	1		-	1V:0.25H		-
		Fill S	ection		<u><</u> 6' ´ >6' `	1V:3H 1V:2H	<u><</u> 10' >10'	1V:3H 1V:2H	<u><</u> 25' 1V:4H >25' 1V:2H
* Cor	ntrolling design criteria (see <mark>Se</mark>	ction 27-7)		-	ADT = Average Da	ily Traffic			-

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

Figure 32-2C (US Customary)

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BUREAU OF LOCAL ROADS & STREETS GEOMETRIC DESIGN TABLES

	Design El			Manual	Design Volume (ADT)				
	Design El	ement		Section	ADT < 250	250 to 400	400 to 750	750 to 2000	ADT > 2000
	Design Forecast Year			<u>27-6.02</u>	Cur	rent	20 Years		
Des Con	Minimum	Le	vel	27 5 02	50 km/h (1c/d)	60 km/h (1d)		80 km/h	
sign trols	Design Speed * (1)	Rol	ling	<u>27-5.02</u>	50 km/h (1b-d)	50 km/h (1d)		60 km/h (1d)	
0,	Level of Service (LOS) *		<u>27-6.04</u>			D			
	Traveled Way Width *			<u>31-1.01</u>	5.4 m (2a)	6.0 m	6.6	6 m	7.2 m (2b)
c	Surface Type		Chapter 44	Aggregat or Bituminou	e Surface s Treated (3)	1	High Type Pavemer	ıt	
ross	Shoulder Width *			31 1 06	0.6 m	n (4a)	1.2 m (4b)	1.8 m (4b)	2.4 m (4b)
s Se	Shoulder Type		<u>31-1.00</u>	Turf	Turf or Agg	gregate (5a)	Aggregate, Pave	ed, or Comb. (5b)	
ction	Auxiliary Lanes *	Lane	Width	21 1 02	N/A	3.0 m	Desire Minimu	d 3.3 m m 3.0 m	Desired 3.6 m Minimum 3.0 m
Eleme		Shoulde	er Width	<u>31-1.03</u>	N/A	0.6 m	Desired 1.2 m Minimum 0.6 m	Desired 1.8 m Minimum 1.2 m	Desired 2.4 m Minimum 1.2 m
ents		Travel Lane *			2.0% - 4% (6b)			1.5% - 2.0%	
	Cross Slope (6a)	Sho	Shoulder		Turf 5% - 8%	Turf 5% - 8% / Ag	5% - 8% / Aggregate 4% - 6% Aggregate 4%		6% / Paved 4%
		Rollover Factor			10%		8	8%	
			Front Slope		1V:3H (7a)		1V:3H		1V:4H
고			Ditch Width		Desired 0.6 m		Minimu	m 0.6 m	
oadway Slo	Side Slope (Maximum)	Cut Section	Back Slope	<u>31-2.03</u> <u>31-2.04</u>	≤3.0 m 1V:3H >3.0 m 1V:2H (7a/b)	<u><</u> 3.0 m 1V:3H >3.0 m 1V:2H (7b)	<u>≤</u> 3.0 m 1V:3H >3.0 m 1V:2H		<4.5 m 1V:4H 4.5 - 7.5 m 1V:3H >7.5 m 1V:2H
pes		Rock	c Cut				1V:0.25H		
		Fill Section			<u>≤</u> 1.8 m >1.8 m	1V:3H 1V:2H	<u>≤</u> 3.0 m 1V:3H <u>≤</u> 7 >3.0 m 1V:2H >7		<u><</u> 7.5 m 1V:4H >7.5 m 1V:2H
* Contr	olling design criteria (see Sect	tion 27-7).			ADT = Average Dai	ly Traffic			

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

Figure 32-2C (Metric)

- (1) <u>Design Speed</u>.
 - a. A rural local road may pass through a relatively built-up area. In these areas, for highway projects with no bridges, a lower design speed may be selected with justification. However, the selected design speed should not be less than 20 mph (30 km/h). Consider the following:
 - i. For low to moderate density areas, the design speed may be reduced 5 mph to 10 mph (10 km/h) below the listed design speed.
 - ii. For moderate to high density areas, the design speed may be reduced 10 mph to 15 mph (10 km/h to 20 km/h) below the listed design speed.
 - b. For highway projects with no bridges with ADT's less than 50 vehicles/day, the design speed may be 20 mph (30 km/h).
 - c. For projects constructed with no bridges, other than Federal funds on the district road system with ADT's less than 150 vehicles/day, no design speed is required.
 - d. For rural bridge projects, minimum design speed shall be as determined by the ADT. However, the design speed may be increased to the posted or regulatory speed limit to avoid a deficient NBIS rating for approach roadway alignment appraisal. All elements of the project will be designed to the chosen design speed. The chosen speed will be certified by the County Engineer.
- (2) Traveled Way Width.
 - a. For projects constructed with other than Federal funds on the district road system with ADT's less than 150 vehicles/day, the minimum width is 16 ft (4.8 m).
 - b. On a reconstruction project, an existing 22 ft (6.6 m) traveled way may be maintained where the alignment and safety records are satisfactory.
- (3) <u>Surface Type</u>. A high-type pavement may be provided.
- (4) Shoulder Width.
 - a. Where roadside barriers are included, provide a minimum offset of 4 ft (1.2 m) from the edge of the traveled way to the roadside barrier. When the 4 ft (1.2 m) width cannot be met because of a proposed or an existing bridge width (see <u>Section 36-5</u>), <u>Section 35-4</u> shall be followed to flare the roadside barrier until the 4 ft (1.2 m) width is met or until the length of need is exceeded.
 - b. Where the rural local road passes through a moderate to high density area, the shoulder width may be 4 ft (1.2 m). This width may include the width of Type B gutter or the gutter flag with curb and gutter at the edge of the shoulder.
- (5) Shoulder Type.
 - a. Aggregate shoulders may consist of a nominal 4 in (100 mm) thickness where the ADT is less than 750 vehicles/day.
 - b. For ADT's > 750 vehicles/day, an aggregate shoulder should be a minimum thickness of 6 in (150 mm) Type A shoulders.
- (6) <u>Cross Slopes</u>.
 - a. Cross slopes for outside auxiliary lanes will be at least 2.0% and should be 0.5% greater than the adjacent travel lane.
 - b. Use 1.5% to 2.0% for high-type pavement.
- (7) Side Slopes.
 - a. For district road systems constructed with other than Federal funds, front slopes may be 1V:2H and back slopes may be 1V:1.5H.
 - b. For isolated restricted right-of-way, the back slope may be 1V:2H for cut depths of 0 ft to 10 ft (0 m to 3 m) or 1V:1.5H for cut depths greater than 10 ft (3 m).

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

Footnotes to Figure 32-2C

Decime Element	Manual	Design Volume (DHV)					
Desig	n Element	Section	Two-Way DHV < 1250 (1)	Two-Way DHV 1250 - 2050 (1)	Two-Way DHV 2050 - 2900 (1)		
Highway Type			TWS-2	TWS-4	TWS-6		
Design Forecast Year		<u>27-6.02</u>		20 Years			
Design Speed * (2)		<u>27-5.02</u>		40 mph – 50 mph			
Level of Service (LOS) *		<u>27-6.04</u>		С			
	Number of Travel Lanes	<u>31-1.02</u>	2	4	6		
Traveled Way	Traveled Way Width *	<u>31-1.01</u>		12'			
navoloa may	Traveled Lane Width (Shared with Bicycles)	<u>42-3.02</u>		See Section 42-3.02			
Chauldar Width * (2)	Right	21.1.00		8' Paved			
Shoulder width " (3)	Left	<u>31-1.06</u>	N/A	6' (4' F	Paved)		
Auxiliary Lanes *	Lane Width	<u>31-1.03</u>	Single Left & Right 12' Dual Lefts & Rights 24'				
	Shoulder / Curb Type and Width		9	Shoulder 4' and/or B-6.24 CC&G (4	4)		
Cross Slope (5a)	Travel Lane (Minimum) *	<u>31-1.08</u>		1.5% - 2.0%			
	Auxiliary Lane		(5b)				
	Flush		N/A	Range	4' to 14'		
Median Width	Flush (TWLTL)	<u>31-1.05</u>	Desired 12' Range 10' to 14'				
	Traversable		N/A	1	6'		
	Raised Curb		N/A	1:	8'		
Sidewalk Width		<u>31-2.02</u>		Desired 5' / Minimum 4'			
	Cut Section (Uncurbed)			1V:4H			
Side Siope (Maximum)	Rock Cut	<u>31-2.03</u>		1V:0.25H			
	Fill Section (Uncurbed)			1V:4H			
	Concrete Surface / Traversable		N/A	1.5	5%		
Median Slope	Flush / TWLTL Surface	<u>31-1.05</u>		1.5%			
	Grass/ Landscape Surface		N/A	5% (Towa	ards C&G)		
	Highway Type Design Forecast Year Design Speed * (2) Level of Service (LOS) Traveled Way Shoulder Width * (3) Auxiliary Lanes * Cross Slope (5a) Median Width Side Slope (Maximum) Median Slope	Design Forecast YearDesign Speed * (2)Level of Service (LOS) *Traveled Service (LOS) *Traveled WayTraveled WayTraveled WayTraveled WayShoulder Width *Traveled Lane Width (Shared with Bicycles)Shoulder Width *(3)Besting Lanes *Cross Slope (5a)Median WidthSide Slope (Maximum)Side Slope (Maximum)Side Slope (Maximum)Median SlopeFlush Traveled Curb Flush TravelsMedian SlopeFlush TWLTL Surface Flush TWLTL SurfaceFlush Lane Surface TraversableFlush TWLTL SurfaceFlush Lane Surface TraversableFlush TWLTL SurfaceFlush Lane Surface TraversableFlush Lane Surface TraversableFlush TWLTL SurfaceFlush Lane Surface TraversableFlush Lane Surface TraversableFlush Lane Surface TraversableFlush TWLTL SurfaceFlush Lane Surface TraversableFlush Lane Surface TraversableFlush Lane Surface TraversableFlush Lane Surface TraversableFlush Lane S	Design FlementManual SectionHighway TypeDesign Forecast Year27-6.02Design Speed* (2)27-5.02Level of Service (LOS)*27-6.04Traveled Service (LOS)*27-6.04Traveled Vay Width *31-1.02Traveled Way31-1.02Traveled Way Width *31-1.01Traveled Uane Width42-3.02Shoulder Width *(3)1-1.06Shoulder Width *(3)1-1.06Muniber of Travel Lane Width31-1.06Auxiliary Lanes *Shoulder / Curb Type and WidthAuxiliary Lanes *Travel Lane WidthShoulder / Curb Type and Width31-1.03Flush31-1.06Flush (TMLTL)31-1.06Median WidthFlush (TWLTL)Side Slope (Maximum)Sile Subpe Fill Section (Uncurbed)Side Slope 	Design Forecast YearYearTwo-Way DHV < 1250 (1)Highway TypeTWS-2Design Forecast Year27-6.02Design Speed* (2)27-5.02Level of Service (LOS)*27-6.04Traveled Way31-1.022Traveled Way31-1.01Traveled Way Width *31-1.01Traveled Uane Width (Shared with Bicycles)42-3.02Shoulder Width *(3)Right31-1.06Auxiliary Lanes *Lane Width31-1.08Shoulder / Curb Type and Width31-1.08Cross Slope (5a)Travel Lane (Minimum)*31-1.08Flush (TWLTL)31-1.08Median WidthFlush (TWLTL)31-1.08Side WidthSite Slope (Maximum)Site SlopeSide Slope (Maximum)Concrete Surface / Traversable Flush / TWLTL Surface31-2.03Median SlopeFlush / TWLTL Surface31-2.03Median SlopeFlush / TWLTL Surface31-1.05Median SlopeFlush / TWLTL Surface31-1.05Median SlopeFlush / TWLTL Surface31-1.05Median SlopeFlush / TWLTL Surface31-1.05	$\besign Volume (DHV) \\ \hline \besign Volume (DHV$		

DHV = Design Hourly Volume / TWS = Two-Way Street

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

Figure 32-2D (US Customary)

		Manual		Design Volume (DHV)			
Desig	n Element	Section	Two-Way DHV < 1250 (1)	Two-Way DHV 1250 - 2050 (1)	Two-Way DHV 2050 - 2900 (1)		
Highway Type			TWS-2	TWS-2 TWS-4 TWS-6			
Design Forecast Year		<u>27-6.02</u>		20 Years			
Design Speed * (2)		<u>27-5.02</u>		60 km/h – 80 km/h			
Level of Service (LOS) *		<u>27-6.04</u>		С			
	Number of Travel Lanes	<u>31-1.02</u>	2	4	6		
Traveled Way	Traveled Way Width *	<u>31-1.01</u>		3.6 m			
	Traveled Lane Width (Shared with Bicycles)	<u>42-3.02</u>		See Section 42-3.02			
Shouldor Width * (2)	Right	21.1.06		2.4 m Paved			
	Left	<u>31-1.06</u>	N/A	1.8 m (1.2	m Paved)		
Auxiliary Lanes *	Lane Width	<u>31-1.03</u>	Single Left & Right 3.6 m Dual Lefts & Rights 7.2 m				
	Shoulder / Curb Type and Width		Sho	oulder 1.2 m and/or B-15.60 CC&C	G (4)		
Cross Slope (52)	Travel Lane (Minimum) *	<u>31-1.08</u>		1.5% - 2.0%			
C1033 Clope (3a)	Auxiliary Lane		(5b)				
	Flush		N/A	Range 1.2	m to 4.2 m		
Median Width	Flush (TWLTL)	<u>31-1.05</u>	Desired 3.6 m Range 3.0 m to 4.2 m				
	Traversable		N/A	4.8	m		
	Raised Curb		N/A	5.5	m		
Sidewalk Width		<u>31-2.02</u>		Desired 1.5 m / Minimum 1.2 m			
	Cut Section (Uncurbed)			1V:4H			
Side Siope (Maximum)	Rock Cut	<u>31-2.03</u>	1V:0.25H				
(Fill Section (Uncurbed)			1V:4H			
	Concrete Surface / Traversable		N/A	1.5	5%		
Median Slope	Flush / TWLTL Surface	<u>31-1.05</u>		1.5%			
	Grass/ Landscape Surface		N/A	5% (Towa	irds C&G)		
	Highway Type Design Forecast Year Design Speed * (2) Level of Service (LOS) Traveled Way Shoulder Width * (3) Auxiliary Lanes * Cross Slope (5a) Median Width Side Slope (Maximum) Median Slope	Design Forecast YearDesign Forecast YearDesign Speed* (2)Level of Service (LOS)*Level of Service (LOS)Traveled VayTraveled WayTraveled WayMumber of Travel LanesTraveled Way Width *Traveled Uape Width (Shared with Bicycles)Shoulder Width*(3)Bhoulder Width*(3)Cross Slope (5a)Median WidthSidewalk WidthSide Slope (Maximum)Side Slope (Maximum)Side Slope (Maximum)Median SlopeFlush TraversableFlush CutFlush CutFlush CutFill Section (Uncurbed)Flush TraversableFlush TraversableFlush Slope (Maximum)Flush TraversableFlush	Design ElementManual SectionHighway TypeDesign Forecast Year27-6.02Design Speed* (2)27-5.02Level of Service (LOS)*27-6.04Traveled Service (LOS)*27-6.04Traveled Vay Width *31-1.02Traveled Way Width *31-1.01Traveled Way Width *31-1.01Traveled Way Width *31-1.01Traveled Lane Width (Shared with Bicycles)42-3.02Shoulder Width *(3)1-LeftAuxiliary Lanes *1-Lane WidthShoulder / Curb Type and Width31-1.03Shoulder / Curb Type and Width31-1.03Shoulder / Curb Type and Width31-1.03Shoulder / Curb Type and Width31-1.03Flush Curb31-1.03Median WidthFlush (TWLTL)Flush (TWLTL)31-1.02Side Slope (Maximum)51-2.03Side Slope (Maximum)51-2.03Fill Section (Uncurbed)31-2.03Fill Section (Uncurbed)31-2.03Fill Section (Uncurbed)31-2.03Fill Section (Uncurbed)51-2.03Fill Sect	Design Element Manual Section Image: Two-Way DHV < 1250 (1) Highway Type TWO-2000 (1) Design Forecast Year 27-6.02 Design Speed* (2) 27-6.02 Level of Service (LOS)* 27-6.02 Traveled Way 31-1.02 2 Traveled Way Width* 31-1.01 Traveled Way Width* 31-1.01 Shoulder Width (3) 42-3.02 Shoulder Width*(3) Shoulder Vidth (3) 19-1.06 N/A Auxiliary Lanes* Shoulder / Curb Type and Width 31-1.08 Travel Lane Width 31-1.08 N/A Auxiliary Lane (Minimur) 31-1.08 Travel Lane (Minimur) 31-1.08 Median Width Flush (TWLTL) Median Width Flush (TWLTL) N/A Sidee Slope (Maximur) Gut Section (Uncurbed) N/A Side Slope (Maximur) Fills Section	Design Flement Manual Section Two-Way DHV < 1250 (1) Two-Way DHV < 1250 (1) Highway Type TWS-2 TWS-4 Design Forecast Year 27.502 60 km/h = 80 km/h Level of Service (LOS) 27.502 60 km/h = 80 km/h Level of Service (LOS) 27.502 60 km/h = 80 km/h Traveled Vay 31.102 2 4 Traveled Way 31.102 2 4 Traveled Lane Width 31.102 See Section 42-3.02 Shoulder Width * (S) 42.302 See Section 42-3.02 See Section 42-3.02 Shoulder Width * (S) Left 31.102 N/A 1.8 m(1.2 Auxiliary Lane * 1.104 1.8 m(1.2 1.8 m(1.2 Shoulder / Curb Type and Width 31.102 N/A 1.8 m(1.2 Gross Slope (Sa) Travel Lane (Minimum)* 31.102 1.5 % - 2.0 % Median Width Flush (TWLTL) 31.102 N/A Range 3.0 m to 4.2 m Median Width Flush (TWLTL) 31.102		

DHV = Design Hourly Volume / TWS = Two-Way Street

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

Figure 32-2D (Metric)

Footnotes:

- (1) <u>Traffic Volumes</u>. The design hourly volumes (DHV) are calculated using a PHF = 1.0; these values may be adjusted using local peak-hour factors. For more information, see the *Highway Capacity Manual (HCM)*.
- (2) Design Speed. A 60 mph (100 km/h) design speed may be considered in open-suburban areas.
- (3) <u>Shoulder Width</u>.
 - a. Concrete Curb & Gutter (CC&G) may be placed on the outside edge of the shoulder, especially if sidewalks will be placed along the shoulder. The gutter flag may be included in the shoulder width.
 - b. Where the design speed is 45 mph (70 km/h) or less, the shoulder may be replaced with a B-6.24 (B-15.60) CC&G.
- (4) <u>Auxiliary Lane</u>. Under restricted conditions, the gutter width adjacent to the edge of the turn lane may be narrowed or eliminated adjacent to a 12 ft (3.6 m) turn lane.
- (5) Cross Slope.
 - a. Use 2.0% minimum cross slopes for travel lanes not adjacent to the crown.
 - b. Curbed left-turn lanes may be sloped at 1.5% to 2.0% away from the median. Two Way Left Turn Lane (TWLTL) and flush left-turn lanes are sloped at the same rate as the adjacent traveled way. Cross slopes for outside auxiliary lanes will be at least 2.0% and desirably should be 0.5% greater than the adjacent travel lane.

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

Footnotes for Figure 32-2D

			Manual		Design Volume (DHV)			
	Desig	n Element	Section	Two-Way DHV < 1250 (1)	Two-Way DHV 1250 - 2050 (1)	Two-Way DHV 2050 - 2900 (1)		
0	Highway Type			TWS-2	TWS-4	TWS-6		
Des	Design Forecast Year		<u>27-6.02</u>		20 Years			
ign trol	Design Speed *		<u>27-5.02</u>		30 mph – 40 mph			
s –	Level of Service (LOS)	* (2)	<u>27-6.04</u>	С				
		Number of Travel Lanes	<u>31-1.02</u>	2	4	6		
		Travel Lane	<u>31-1.01</u>	Desired 12' Minimum 11' (3)	Desire Minimu	ed 12' um 11'		
	Surface Width *	Travel Lane (Shared with Bicycles)	<u>42-3.02</u>		See Section 42-3.02			
Cro		Parking Lane (4)	<u>31-1.04</u>		Desired 10' Minimum 8'			
oss Sect		Auxiliary Lane	<u>31-1.03</u>	Single Dual Le	Single Left & Right – Desired 12' / Minimum 11' Dual Lefts & Rights – Desired 24' / Minimum 22'			
ecti	Cross Slope	Travel Lane (Minimum) *	31-1.08	1.5% - 2.0%	1.5% - 2	.0% (5a)		
on		Auxiliary Lanes	<u>31-1.00</u>	2.0% (5b)	(5	b)		
Eler	Outside Curb and Gutt	er Type	<u>31-1.07</u>	B-6.12, B-6.18, or B-6.24 CC&G (6)				
nen		Flush		N/A	N/A Range 4' to 14'			
Its	Median Width	Flush (TWLTL)	31-1.05	Desired 12' Range 10' to 14'				
		Traversable		N/A	10	6'		
		Raised Curb] [N/A	18	8'		
	Sidewalk Width (7)		<u>31-2.02</u>		Desired 5' / Minimum 4'			
	Obstruction Free Zone	* (8)	<u>35-2</u>		1.5'			
R		Cut Section (Curbed)						
oad	Side Slope (9) (Maximum)	Rock Cut	<u>31-2.03</u>					
wa	(maximani)	Fill Section (Curbed)] [
y SI		Concrete Surface / Traversable		N/A	1.5	5%		
ope	Median Slope	Flush / TWLTL Surface	<u>31-1.05</u>		1.5%			
Š	-	Grass/ Landscape Surface		N/A	5% (Towa	ards C&G)		

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* Controlling design criteria (see Section 27-7).

DHV = Design Hourly Volume / TWS = Two-Way Street

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

Figure 32-2E (US Customary)

BUREAU OF LOCAL ROADS & STREETS GEOMETRIC DESIGN TABLES

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			Manual		Design Volume (DHV)		
	Desig	n Element	Section	Two-Way DHV < 1250 (1)	Two-Way DHV 1250 - 2050 (1)	Two-Way DHV 2050 - 2900 (1)	
0	Highway Type			TWS-2	TWS-4	TWS-6	
Des	Design Forecast Year		<u>27-6.02</u>	20 Years			
ign trol	Design Speed *		<u>27-5.02</u>		50 km/h – 60 km/h		
~ ~	Level of Service (LOS)	* (2)	<u>27-6.04</u>		С		
		Number of Travel Lanes	<u>31-1.02</u>	2	4	6	
		Travel Lane	<u>31-1.01</u>	Desired 3.6 m Minimum 3.3 m (3)	Desirec Minimur	l 3.6 m n 3.3 m	
	Surface Width *	Travel Lane (Shared with Bicycles)	<u>42-3.02</u>		See Section 42-3.02		
Cro		Parking Lane (4)	<u>31-1.04</u>				
oss So		Auxiliary Lane	<u>31-1.03</u>	Single Let Dual Lefts	ft & Right – Desired 3.6 m / Minim s & Rights – Desired 7.2 m / Minim	um 3.3 m num 6.6 m	
ecti	Cross Slope	Travel Lane (Minimum) *	31-1.08	1.5% - 2.0%	1.5% - 2	.0% (5a)	
on		Auxiliary Lanes	<u>31-1.00</u>	2.0% (5b)	(5)	0)	
Eler	Outside Curb and Gutt	er Type	<u>31-1.07</u>	B-15.30, B-15.45, or B-15.60 CC&G (6)			
nen		Flush		N/A	Range 1.2 m to 4.2 m		
ts	Median Width	Flush (TWLTL)	<u>31-1.05</u>	Desired 3.6 m Range 3.0 m to 4.2 m			
		Traversable		N/A	4.8	m	
		Raised Curb		N/A	5.5	m	
	Sidewalk Width (7)		<u>31-2.02</u>		Desired 1.5 m / Minimum 1.2 m		
	Obstruction Free Zone	* (8)	<u>35-2</u>		450 mm		
R		Cut Section (Curbed)					
oad	Side Slope (9) (Maximum)	Rock Cut	<u>31-2.03</u>				
Iwa	(Waxinani)	Fill Section (Curbed)					
y SI		Concrete Surface / Traversable		N/A	1.5	5%	
ope	Median Slope	Flush / TWLTL Surface	<u>31-1.05</u>		1.5%		
Šť		Grass/ Landscape Surface		N/A	5% (Towa	rds C&G)	

DHV = Design Hourly Volume / TWS = Two-Way Street

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

Figure 32-2E (Metric)

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BUREAU OF LOCAL ROADS & STREETS GEOMETRIC DESIGN TABLES

Footnotes:

- (1) <u>Traffic Volumes</u>. The design hourly volumes (DHV) are calculated using a PHF = 1.0; these values may be adjusted using local peak-hour factors. For more information, see the *Highway Capacity Manual*.
- (2) Level of Service (LOS). A LOS D may be used in heavily developed sections of metropolitan areas.
- (3) <u>Surface Width</u>. The minimum surface width is 30 ft (9.0 m) face-of-curb to face-of-curb.
- (4) <u>Parking Lane Width</u>. The desirable width of the parking lane is 10 ft (3.0 m) and includes the gutter width. If the parking lane may be used as future travel lane, the 10 ft (3.0 m) width should be in addition to the gutter width. An 8 ft (2.4 m) width may be used where it is unlikely the parking lane will be used as through or turning lane in the future.
- (5) Cross Slope.
 - a. Use 2.0% minimum cross slopes for travel lanes not adjacent to the crown.
 - b. Curbed left-turn lanes may be sloped at 1.5% to 2.0% away from the median. Two Way Left Turn Lane (TWLTL) and flush left-turn lanes are sloped at the same rate as the adjacent traveled way. Cross slopes for outside auxiliary lanes will be at least 2.0% and desirably should be 0.5% greater than the adjacent travel lane.
- (6) <u>Gutter Width</u>. Under restricted conditions, the gutter width adjacent to the edge of a 12 ft (3.6 m) turn lane may be eliminated.
- (7) <u>Sidewalk Width</u>. Include a 2 ft to 3 ft (600 mm to 1.0 m) buffer strip between the curb and sidewalk. For sidewalks without a buffer strip, a minimum 6 ft (1.8 m) sidewalk width behind the curb must be provided.
- (8) <u>Obstruction-Free Zone</u>. Distance is measured from the face of the curb. Hazards behind curbs should be located outside of the clear zone shown for uncurbed roadways as discussed in <u>Section 35-2.02(f)</u>.
- (9) <u>Side Slopes</u>. Side slopes to be determined on a case-by-case basis considering roadside development and right-of-way restrictions.

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

Footnotes for Figure 32-2E

			Manual	Design Volume (DHV)				
	Desig	n Element	Section	One-Way DHV < 1300 (1)	One-Way DHV 1300 - 1850 (1)	One-Way DHV > 1850 (1)		
	Highway Type			OWS-2 OWS-3 OWS-4				
Con	Design Forecast Year		<u>27-6.02</u>		20 Years			
trols	Design Speed *		<u>27-5.02</u>		30 mph – 40 mph			
••	Level of Service (LOS)	* (2)	<u>27-6.04</u>		С			
		Number of Travel Lanes	<u>31-1.02</u>	2	3	4		
	Surface Width *	Travel Lane	<u>31-1.01</u>	Desired 12' Minimum 11'				
Cros		Travel Lane (Shared with Bicycles)	<u>42-3.02</u>	See Section 42-3.02				
ss Sec		Parking Lane (3)	<u>31-1.04</u>	Desired 10' Minimum 8'				
tion E		Auxiliary Lane	<u>31-1.03</u>	Single Dual Le	Left & Right – Desired 12' / Minin efts & Rights – Desired 24' / Minir	num 11' num 22'		
lem	Cross Slopa	Travel Lane (Minimum) *	21 1 09		1.5% (4a)			
ents	Closs Slope	Auxiliary Lanes	<u>31-1.00</u>	2.0% (4b)	(4	b)		
	Outside Curb and Gutt	er Type	<u>31-1.07</u>	B-6.12, B-6.18, or B-6.24 CC&G (5)				
	Sidewalk Width (6)		<u>31-2.02</u>		Desired 5' / Minimum 4'			
	Obstruction Free Zone * (7)		<u>35-2</u>	1.5'				
Ro		Cut Section (Curbed)						
lope	Side Slope (8) (Maximum)	Rock Cut	<u>31-2.03</u>					
iay is		Fill Section (Curbed)						

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DHV = Design Hourly Volume / OWS = One-Way Street

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

Figure 32-2F (US Customary)

			Manual		Design Volume (DHV)			
	Desig	n Element	Section	One-Way DHV < 1300 (1)	One-Way DHV 1300 - 1850 (1)	One-Way DHV > 1850 (1)		
	Highway Type			OWS-2 OWS-3 OWS-4				
Des Cont	Design Forecast Year	Design Forecast Year			20 Years			
ign trols	Design Speed *		<u>27-5.02</u>		50 km/h – 60 km/h			
••	Level of Service (LOS)	* (2)	<u>27-6.04</u>		С			
		Number of Travel Lanes	<u>31-1.02</u>	2	3	4		
	Surface Width *	Travel Lane	<u>31-1.01</u>	Desired 3.6 m Minimum 3.3 m				
Cros		Travel Lane (Shared with Bicycles)	<u>42-3.02</u>		See Section 42-3.02			
ss Sec		Parking Lane (3)	<u>31-1.04</u>	Desired 3.0 m Minimum 2.4 m				
tion E		Auxiliary Lane	<u>31-1.03</u>	Single Le Dual Lefts	ft & Right – Desired 3.6 m / Minim s & Rights – Desired 7.2 m / Minim	um 3.3 m num 6.6 m		
lem	Cross Slopa	Travel Lane (Minimum) *	31 1 09	1.5% (4a)				
ents	Closs Slope	Auxiliary Lanes	<u>31-1.00</u>	2.0% (4b)	(4b) (4b)			
	Outside Curb and Gutt	er Type	<u>31-1.07</u>	B-15.30, B-15.45, or B-15.60 CC&G (5)				
	Sidewalk Width (6)		<u>31-2.02</u>		Desired 1.5 m / Minimum 1.2 m			
	Obstruction Free Zone	* (7)	<u>35-2</u>		450 mm			
Ro S		Cut Section (Curbed)						
adw Iope	Side Slope (8) (Maximum)	Rock Cut	<u>31-2.03</u>					
'ay 's	, ,	Fill Section (Curbed)						

DHV = Design Hourly Volume / OWS = One-Way Street

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

Figure 32-2F (Metric)

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BUREAU OF LOCAL ROADS & STREETS GEOMETRIC DESIGN TABLES

Footnotes:

- (1) <u>Traffic Volumes</u>. The design hourly volumes (DHV) are calculated using a PHF = 1.0; these values may be adjusted using local peak-hour factors. For more information, see the *Highway Capacity Manual*.
- (2) Level of Service (LOS). A LOS D may be used in heavily developed sections of metropolitan areas.
- (3) <u>Parking Lane Width</u>. The desirable width of the parking lane is 10 ft (3.0 m) and includes the gutter width. If the parking lane may be used as a future travel lane, the 10 ft (3.0 m) width should be in addition to the gutter flag. An 8 ft (2.4 m) width may be used where it is unlikely the parking lane will be used as through or turning lane in the future.
- (4) Cross Slope.
 - a. Use 2.0% minimum cross slopes for travel lanes not adjacent to the crown.
 - b. Cross slopes for outside auxiliary lanes will be at least 2.0% and desirably should be 0.5% greater than the adjacent travel lane.
- (5) <u>Gutter Width</u>. Under restricted conditions, the gutter width adjacent to the edge of a 12 ft (3.6 m) turn lane may be eliminated.
- (6) <u>Sidewalk Width</u>. Include a 2 ft to 3 ft (600 mm to 1.0 m) buffer strip between the curb and sidewalk. For sidewalks without a buffer strip, a minimum 6 ft (1.8 m) sidewalk width behind the curb must be provided.
- (7) <u>Obstruction-Free Zone</u>. Distance is measured from the face of the curb. Hazards behind curbs should be located outside of the clear zone shown for uncurbed roadways as discussed in <u>Section 35-2.02(f)</u>.
- (8) <u>Side Slopes</u>. Side slopes are determined on a case-by-case basis considering roadside development and rightof-way restrictions.

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

Footnotes for Figure 32-2F

					Design Volume (ADT / DHV)				
	Desig	n Element	Manual Section	Two-Way ADT < 5000	Two-Way ADT <u>≥</u> 5000 and DHV < 1400 (1)	Two-Way DHV 1400 - 2400 (1)			
	Highway Type			TΜ	/S-2	TWS-4			
Des	Design Forecast Year		<u>27-6.02</u>	Current	Current 20 Years				
ign trols	Design Speed * (2)		<u>27-5.02</u>	30 mph	30 mph –	- 40 mph			
•	Level of Service (LOS)	*	<u>27-6.04</u>		Desired C / Minimum D				
		Number of Travel Lanes	<u>31-1.02</u>		2	4			
		Travel Lane	<u>31-1.01</u>	Desired 11' Minimum 10'	Desired 12' Minimum 10' (3)	Desired 12' Minimum 10'			
	Surface Width *	Travel Lane (Shared with Bicycles)	<u>42-3.02</u>						
Cross		Parking Lane (4)	<u>31-1.04</u>	Minimum 8'	m 8' Desired 10' Minimum 8'				
; Secti		Auxiliary Lane	<u>31-1.03</u>	Desired 11' Minimum 10'	ed 12' um 10'				
on	Cross Slope	Travel Lane (Minimum) *	31-1.08	1.5%	- 2.0%	1.5% - 2.0% (5a)			
Elen	Closs Slope	Auxiliary Lanes	<u>31-1.00</u>		(5b)				
nent	Outside Curb and Gutt	er Type	<u>31-1.07</u>	E	3-6.12, B-6.18, or B-6.24 CC&G (6	;)			
ŝ		Flush		Ν	I/A	4'			
	Median Width	Flush (TWLTL)	<u>31-1.05</u>		Desired 12' Range 10' to 14'				
	Sidewalk Width (7)		<u>31-2.02</u>		Desired 5' / Minimum 4'				
	Obstruction Free Zone	* (8)	<u>35-2</u>		1.5'				
s Ro		Cut Section (Curbed)							
adv Iope	Side Slope (9) (Maximum)	Rock Cut	<u>31-2.03</u>						
/ay ∍s	(Fill Section (Curbed)							

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* Controlling design criteria (see <u>Section 27-7</u>).

ADT = Average Daily Traffic / DHV = Design Hourly Volume / TWS = Two-Way Street

GEOMETRIC DESIGN CRITERIA FOR URBAN TWO-WAY COLLECTORS (New Construction/Reconstruction)

Figure 32-2G (US Customary)

August 2016

					Design Volume (ADT / DHV)			
	Desig	n Element	Manual Section	Two-Way ADT < 5000	Two-Way ADT <u>≥</u> 5000 and DHV < 1400 (1)	Two-Way DHV 1400 - 2400 (1)		
	Highway Type			TW	/S-2	TWS-4		
Des	Design Forecast Year		<u>27-6.02</u>	Current	20 Years			
trols	Design Speed * (2)		<u>27-5.02</u>	50 km/h	50 km/h -	- 60 km/h		
	Level of Service (LOS)	*	<u>27-6.04</u>		Desired C / Minimum D			
		Number of Travel Lanes	<u>31-1.02</u>	:	2	4		
		Travel Lane	<u>31-1.01</u>	Desired 3.3 m Minimum 3.0 m	Desired 3.6 m Minimum 3.0 m (3)	Desired 3.6 m Minimum 3.0 m		
	Surface Width *	Travel Lane (Shared with Bicycles)	<u>42-3.02</u>		See Section 42-3.02			
Cross		Parking Lane (4)	<u>31-1.04</u>	Minimum 2.4 m	Desired Minimur	l 3.0 m n 2.4 m		
: Sect		Auxiliary Lane	<u>31-1.03</u>	Desired 3.3 m Minimum 3.0 m	Desired Minimur	l 3.6 m n 3.0 m		
ion	Cross Slopo	Travel Lane (Minimum) *	21 1 08	1.5% - 2.0% 1.5% - 2.0% (5a)				
Eler	Closs Slope	Auxiliary Lanes	<u>31-1.00</u>		(5b)			
nen	Outside Curb and Gutt	er Type	<u>31-1.07</u>	B-1	15.30, B-15.45, or B-15.60 CC&G	(6)		
ts		Flush		Ν	/Α	1.2 m		
	Median Width	Flush (TWLTL)	<u>31-1.05</u>		Desired 3.6 m Range 3.0 m to 4.2 m			
	Sidewalk Width (7)		<u>31-2.02</u>		Desired 1.5 m / Minimum 1.2 m			
	Obstruction Free Zone	* (8)	<u>35-2</u>		450 mm			
Ro S		Cut Section (Curbed)						
adw Iope	Side Slope (9) (Maximum)	Rock Cut	<u>31-2.03</u>					
/ay }s		Fill Section (Curbed)						

ADT = Average Daily Traffic / DHV = Design Hourly Volume / TWS = Two-Way Street

GEOMETRIC DESIGN CRITERIA FOR URBAN TWO-WAY COLLECTORS (New Construction/Reconstruction)

Figure 32-2G (Metric)

BUREAU OF LOCAL ROADS & STREETS GEOMETRIC DESIGN TABLES

Footnotes:

- (1) <u>Travel Volumes</u>. The design hourly volumes (DHV) are calculated using a PHF = 1.0; these values may be adjusted using local peak-hour factors. For more information, see the *Highway Capacity Manual*.
- (2) Design Speed. A 45 mph (70 km/h) design speed may be used in fringe areas and outlying business districts.
- (3) <u>Surface Width</u>. The minimum surface width is 30 ft (9.0 m) face-of-curb to face-of-curb.
- (4) Parking Lane. The minimum width of the parking lane is 8 ft (2.4 m) and includes the gutter width.
- (5) Cross Slope.
 - a. Use 2.0% minimum cross slopes for travel lanes not adjacent to the crown.
 - b. Curbed left-turn lanes may be sloped at 1.5% to 2.0% away from the median. Two Way Left Turn Lane (TWLTL) and flush left-turn lanes are sloped at the same rate as the adjacent traveled way. Cross slopes for outside auxiliary lanes will be at least 2.0% and desirably should be 0.5% greater than the adjacent travel lane.
- (6) <u>Gutter Width</u>. Under restricted conditions, the gutter width adjacent to the edge of a 12 ft (3.6 m) turn lane may be eliminated.
- (7) <u>Sidewalk Width</u>. Include a 2 ft to 3 ft (600 mm to 1.0 m) buffer strip between the curb and sidewalk. For sidewalks without a buffer strip, a minimum 6 ft (1.8 m) sidewalk width behind the curb must be provided.
- (8) <u>Obstruction-Free Zone</u>. Distance is measured from the face of the curb. Hazards behind curbs should be located outside of the clear zone shown for uncurbed roadways as discussed in <u>Section 35-2.02(f)</u>.
- (9) <u>Side Slopes</u>. Side slopes are determined on a case-by-case basis considering roadside development and rightof-way restrictions.

GEOMETRIC DESIGN CRITERIA FOR URBAN TWO-WAY COLLECTORS (New Construction/Reconstruction)

Footnotes for Figure 32-2G

					Design Volume (ADT / DHV)	
	Desig	n Element	Manual Section	One-Way ADT < 5000	One-Way ADT <u>></u> 5000 and DHV < 1450 (1)	One-Way DHV 1450 - 2150 (1)
	Highway Type			Ol	WS-2	OWS-3
Des Cont	Design Forecast Year		<u>27-6.02</u>	Current	20 Y	ears
ign trols	Design Speed * (2)		<u>27-5.02</u>	30 mph	30 mph –	- 40 mph
0,	Level of Service (LOS)	*	<u>27-6.04</u>		Desired C / Minimum D	
		Number of Travel Lanes	<u>31-1.02</u>		2	3
	Surface Width *	Travel Lane	<u>31-1.01</u>	Desired 11' Minimum 10'	Desired 12' Minimum 10' (3)	Desired 12' Minimum 10'
Cros		Travel Lane (Shared with Bicycles)	<u>42-3.02</u>			
s Sec		Parking Lane (4)	<u>31-1.04</u>	Minimum 8'	Desire Minim	ed 10' um 8'
tion E		Auxiliary Lane	<u>31-1.03</u>	Desired 11' Minimum 10'	Desire Minimu	ed 12' um 10'
lem	Cross Slopa	Travel Lane (Minimum) *	21 1 09	1.5%	b - 2.0%	1.5% - 2.0% (5a)
ents	Closs Slope	Auxiliary Lanes	<u>31-1.00</u>		(5b)	
0,	Outside Curb and Gutte	er Type	<u>31-1.07</u>		B-6.12, B-6.18, or B-6.24 CC&G (6	i)
	Sidewalk Width (7)		<u>31-2.02</u>		Desired 5' / Minimum 4'	
	Obstruction Free Zone	* (8)	<u>35-2</u>		1.5'	
Ro SI		Cut Section (Curbed)				
adw	Side Slope (9) (Maximum)	Rock Cut	<u>31-2.03</u>			
iay is	(· · ····,	Fill Section (Curbed)				

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ADT = Average Daily Traffic / DHV = Design Hourly Volume / OWS = One-Way Street

GEOMETRIC DESIGN CRITERIA FOR URBAN ONE-WAY COLLECTORS (New Construction/Reconstruction)

Figure 32-2H (US Customary)

					Design Volume (ADT / DHV)	
	Desig	n Element	Manual Section	One-Way ADT < 5000	One-Way ADT ≥ 5000 and DHV < 1450 (1)	One-Way DHV 1450 - 2150 (1)
	Highway Type			OW	/S-2	OWS-3
Des	Design Forecast Year		<u>27-6.02</u>	Current	20 Y	ears
ign	Design Speed * (2)		<u>27-5.02</u>	50 km/h	- 60 6m/h	
••	Level of Service (LOS)	*	<u>27-6.04</u>		Desired C / Minimum D	
		Number of Travel Lanes	<u>31-1.02</u>		2	3
	Surface Width *	Travel Lane	<u>31-1.01</u>	Desired 3.3 m Minimum 3.0 m	Desired 3.6 m Minimum 3.0 m (3)	Desired 3.6 m Minimum 3.0 m
Cros		Travel Lane (Shared with Bicycles)	<u>42-3.02</u>			
s Sec		Parking Lane (4)	<u>31-1.04</u>	Minimum 2.4 m	Desire	ed 3.0 um 2.4
tion E		Auxiliary Lane	<u>31-1.03</u>	Desired 3.3 m Minimum 3.0 m	Desired Minimur	1 3.6 m m 3.0 m
lem	Cross Slopa	Travel Lane (Minimum) *	21 1 08	1.5%	- 2.0%	1.5% - 2.0% (5a)
ents	Closs Slope	Auxiliary Lanes	<u>31-1.00</u>		(5b)	
.,	Outside Curb and Gutt	er Type	<u>31-1.07</u>	B-1	15.30, B-15.45, or B-15.60 CC&G	(6)
	Sidewalk Width (7)		<u>31-2.02</u>		Desired 1.5 m / Minimum 1.2 m	
	Obstruction Free Zone	* (8)	<u>35-2</u>		450 mm	
Ro SI		Cut Section (Curbed)				
adw	Side Slope (9) (Maximum)	Rock Cut	<u>31-2.03</u>			
iay is		Fill Section (Curbed)				

ADT = Average Daily Traffic / DHV = Design Hourly Volume / OWS = One-Way Street

GEOMETRIC DESIGN CRITERIA FOR URBAN ONE-WAY COLLECTORS (New Construction/Reconstruction)

Figure 32-2H (Metric)

Footnotes:

- (1) <u>Traffic Volumes</u>. The design hourly volumes (DHV) are calculated using a PHF = 1.0; these values may be adjusted using local peak-hour factors. For more information, see the *Highway Capacity Manual*.
- (2) <u>Design Speed</u>. A 45 mph (70 km/h) design speed may be used in fringe areas and outlying business districts.
- (3) <u>Surface Width</u>. The minimum surface width is 30 ft (9.0 m) face-of-curb to face-of-curb.
- (4) Parking Lane. The minimum width of the parking lane is 8 ft (2.4 m) and includes the gutter width.
- (5) Cross Slope.
 - a. Use 2.0% for lanes away from the crown.
 - b. For turn lanes use 2.0% or greater. If the turn lane is adjacent to the crown, use 1.5%.
- (6) <u>Gutter Width</u>. Under restricted conditions, the gutter width adjacent to the edge of the turn lane may be eliminated adjacent to a 12 ft (3.6 m) lane.
- (7) <u>Sidewalk Width</u>. Include a 2 ft to 3 ft (600 mm to 1.0 m) buffer strip between the curb and sidewalk. For sidewalks without a buffer strip, a minimum 6 ft (1.8 m) sidewalk width behind the curb must be provided.
- (8) <u>Obstruction-Free Zone</u>. Distance is measured from the face of the curb. Hazards behind curbs should be located outside of the clear zone shown for uncurbed roadways as discussed in <u>Section 35-2.02(f)</u>.
- (9) <u>Side Slopes</u>. Side slopes are determined on a case-by-case basis considering roadside development and rightof-way restrictions.

GEOMETRIC DESIGN CRITERIA FOR URBAN ONE-WAY COLLECTORS (New Construction/Reconstruction)

Footnotes for Figure 32-2H

	Decim	n Element	Manual		Design Volume (ADT)				
	Desig	n Element	Section	ADT < 1000	1000 - 5000	ADT > 5000			
	Highway Type				TWS-2 / OWS-2				
Des Con	Design Forecast Year		<u>27-6.02</u>	Ci	Current 20 Year				
sign trols	Design Speed *		<u>27-5.02</u>	30 mph (1)	30 mph (1) 30 mph				
0 7	Level of Service (LOS)	*	<u>27-6.04</u>		D				
		Number of Travel Lanes	<u>31-1.02</u>		2				
		Travel Lane *	<u>31-1.01</u>	Minimum 10'	Minimum 11'	Minimum 12' (2)			
Cros	Surface Width *	Travel Lane (Shared with Bicycles)	<u>42-3.02</u>		See Section 42-3.02				
ss S		Parking Lane (3)	<u>31-1.04</u>		Minimum 8'				
ection		Auxiliary Lane	<u>31-1.03</u>	10'	Desired 11' Minimum 10'	Desired 12' Minimum 10'			
Ele	Cross Slans	Travel Lane (Minimum) *	21.1.00		1.5% - 2.0%				
mei	Cross Slope	Auxiliary Lanes	<u>31-1.00</u>		(4)				
nts	Outside Curb and Gutt	er Type	<u>31-1.07</u>		B-6.12, B-6.18, or B-6.24 CC&G (5	5)			
	Sidewalk Width		<u>31-2.02</u>		Desired 5' / Minimum 4'				
	Obstruction Free Zone	* (6)	<u>35-2</u>		1.5'				
Ro S		Cut Section (Curbed)							
adw	Side Slope (7) (Maximum)	Rock Cut	<u>31-2.03</u>						
/ay ;s		Fill Section (Curbed)							

ADT = Average Daily Traffic / TWS = Two-Way Street / OWS = One-Way Street

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

Figure 32-2I (US Customary)

BUREAU OF LOCAL ROADS & STREETS GEOMETRIC DESIGN TABLES

	Dooig	n Element	Manual		Design Volume (ADT)			
	Desig	n Element	Section	ADT < 1000	1000 - 5000	ADT > 5000		
	Highway Type				TWS-2 / OWS-2			
Des	Design Forecast Year		<u>27-6.02</u>	Cur	Current			
sign trols	Design Speed *		<u>27-5.02</u>	50 km/h (1) 50 km/h				
	Level of Service (LOS)	*	<u>27-6.04</u>		D			
		Number of Travel Lanes	<u>31-1.02</u>		2			
		Travel Lane *	<u>31-1.01</u>	Minimum 3.0 m	Minimum 3.3 m	Minimum 3.6 m (2)		
Cros	Surface Width *	Travel Lane (Shared with Bicycles)	<u>42-3.02</u>	See Section 42-3.02				
s S		Parking Lane (3)	<u>31-1.04</u>		Minimum 2.4 m			
ection		Auxiliary Lane	<u>31-1.03</u>	3.0 m	Desired 3.3 m Minimum 3.0 m	Desired 3.6 m Minimum 3.0 m		
Ele	Cross Slans	Travel Lane (Minimum) *	21.1.00		1.5% - 2.0%			
mei	Cross Slope	Auxiliary Lanes	<u>31-1.00</u>		(4)			
nts	Outside Curb and Gutt	er Type	<u>31-1.07</u>	B-1	5.30, B-15.45, or B-15.60 CC&G	(5)		
	Sidewalk Width		<u>31-2.02</u>		Desired 1.5 m / Minimum 1.2 m			
	Obstruction Free Zone	* (6)	<u>35-2</u>		450 mm			
Ro S	Cut Section (C	Cut Section (Curbed)						
adw Iope	Side Slope (7) (Maximum)	Rock Cut	<u>31-2.03</u>					
/ay }s	(Fill Section (Curbed)						

ADT = Average Daily Traffic / TWS = Two-Way Street / OWS = One-Way Street

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

Figure 32-2I (Metric)

32-2-26

BUREAU OF LOCAL ROADS & STREETS GEOMETRIC DESIGN TABLES

Footnotes:

- (1) <u>Design Speed</u>. A 20 mph (30 km/h) design speed may be used where the posted speed limit is 20 mph.
- (2) <u>Surface Width</u>. The minimum surface width is 30 ft (9.0 m) face-of-curb to face-of-curb.
- (3) Parking Lane. The minimum width of the parking lane is 8 ft (2.4 m) and includes the gutter width.
- (4) <u>Cross Slope</u>. Use 2.0% minimum for lanes away from the crown.
- (5) <u>Curb and Gutter</u>. Under restricted conditions, the gutter width adjacent to the edge of an 11 ft (3.3 m) turn lane may be eliminated. A shallow gutter may be used in place of CC&G.
- (6) <u>Obstruction-Free Zone</u>. Distance is measured from the face of the curb. Hazards behind curbs should be located outside of the clear zone shown for uncurbed roadways as discussed in <u>Section 35-2.02(f)</u>.
- (7) <u>Side Slopes</u>. Side slopes are determined on a case-by-case basis considering roadside development and rightof-way restrictions.

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

Footnotes for Figure 32-2I

August 2016

32-3 ALIGNMENT CRITERIA

This Section presents the new construction/reconstruction alignment criteria for various rural and urban facilities based on design speed. Alignment tables are provided for the following:

- Figure 32-3A "Alignment Criteria for Rural Two-Lane Highways,"
- Figure 32-3B "Alignment Criteria for Suburban/Urban Arterials," and
- Figure 32-3C "Alignment Criteria for Urban Collectors/Local Streets."

B											
Design Ele	ment	Section	20 mph	25 mph	30 mph	35 mph	40 mph	45 mph	50 mph	55 mph	60
Stopping Sight Distance (SSE)) *	<u>28-1</u>	115'	155'	200'	250'	305'	360'	425'	495'	5
Passing Sight Distance (PSD))	<u>28-2</u>	710'	900'	1090'	1280'	1470'	1625'	1835'	1985'	21
Intersection Sight Distance *	(1)	<u>28-3</u>	225'	280'	335'	390'	445'	500'	555'	610'	6
	e _{max} = 8%		76'	134'	214'	314'	444'	587'	758'	960'	12
Minimum Radii *	e _{max} = 6%	<u>29.2.03</u>	81'	144'	231'	340'	485'	643'	833'	1060'	13
-	e _{max} = 4%		86'	154'	250'	371'	533'	711'	926'	1190'	15
Maximum Superelevation Rat	e *	<u>29-3.01</u>		F	Paved 8% / A	Aggregate 49	%			8%	
	e _{max} = 8%		141'	150'	159'	169'	179'	194'	209'	222'	2
Superelevation Transition Length (2)	e _{max} = 6%	<u>29-3.02</u>	111'	118'	125'	133'	142'	153'	165'	176'	18
/ortical Cuprature	e _{max} = 4%		81'	87'	92'	98'	104'	112'	121'	129'	1
Vertical Curvature (K-values based on SSD) *	Crest	<u>30-2.01</u>	7	12	19	29	44	61	84	114	1
	Sag	<u>30-2.02</u>	17	26	37	49	64	79	96	115	1
Vertical Curvature (K-values based on PSD)	Crest	<u>30-2.01</u>	180	289	424	585	772	943	1203	1407	16
Maximum Grado * (3)	Level	30 1 02	8%	8% 7%				6	%	5	
	Rolling	<u>30-1.02</u>	11%	10%	9	%	8	%	7	%	6
Minimum Grade		<u>30-1.03</u>				Desirable	0.5% / Minir	mum 0.0%			
 * Controlling design criteria (see <u>Section 27-7</u>). (1) <u>Intersection Sight Distance</u>. Table values are for passenger cars at a stop-controlled intersection on a level grade based on the design speed for the major road. Increase these distances 10% for grades > 3.0% on the minor road. (2) <u>Superelevation Transition Length</u>. Superelevation transition rates will vary according to design speed, radii, and superelevation rates. Table values are based on the grade based based based based on the grade based on the grade based based based based based on the grade based based based based based on the grade based based											
(3) <u>Maximum Grade</u> .	the given design spee	d, maximum si	uperelevation	n rate, 11 ft	travel lanes,	and a 1.5%	cross slope	for the norm	al crown seo	tion.	
	a a manual second from	assighting as a galler									

a. Grades 1.0% steeper may be used for existing roadways to remain in place.

Grades 1.0% to 2.0% steeper may be used on local roads and low-volume rural collectors (ADT < 400). b.

ALIGNMENT CRITERIA FOR RURAL TWO-LANE HIGHWAYS

Figure 32-3A (US Customary)

Manual				0	esign Spee	d			
Manual Section 28-1 28-2 28-3 29.2.03 29-3.01 29-3.02 30-2.01 30-2.01 30-2.01 30-2.01 30-2.01	20 mph	25 mph	30 mph	35 mph	40 mph	45 mph	50 mph	55 mph	60 mph
<u>28-1</u>	115'	155'	200'	250'	305'	360'	425'	495'	570'
<u>28-2</u>	710'	900'	1090'	1280'	1470'	1625'	1835'	1985'	2135'
<u>28-3</u>	225'	280'	335'	390'	445'	500'	555'	610'	665'
	76'	134'	214'	314'	444'	587'	758'	960'	1200'
<u>29.2.03</u>	81'	144'	231'	340'	485'	643'	833'	1060'	1330'
	86'	154'	250'	371'	533'	711'	926'	1190'	1500'
<u>29-3.01</u>		Paved 8% / Aggregate 4% 8%							
	141'	150'	159'	169'	179'	194'	209'	222'	232'
<u>29-3.02</u>	111'	118'	125'	133'	142'	153'	165'	176'	184'
	81'	87'	92'	98'	104'	112'	121'	129'	135'
<u>30-2.01</u>	7	12	19	29	44	61	84	114	151
<u>30-2.02</u>	17	26	37	49	64	79	96	115	136
<u>30-2.01</u>	180	289	424	585	772	943	1203	1407	1628
20 1 02	8%			7%			6	%	5%
<u>30-1.02</u>	11%	% 10% 9% 8% 7%						%	6%
<u>30-1.03</u>	Desirable 0.5% / Minimum 0.0%								

Design Speed

32-3-2

Design El	mont	Manual				Design	Speed			
Design Ele	ement	Section	30 km/h	40 km/h	50 km/h	60 km/h	70 km/h	80 km/h	90 km/h	100 km/h
Stopping Sight Distance (SSI	D) *	<u>28-1</u>	35 m	50 m	65 m	85 m	105 m	130 m	160 m	185 m
Passing Sight Distance (PSD))	<u>28-2</u>	200 m	270 m	345 m	410 m	485 m	540 m	615 m	670 m
ntersection Sight Distance * (1)		<u>28-3</u>	65 m	85 m	105 m	130 m	150 m	170 m	190 m	210 m
	e _{max} = 8%		20 m	41 m	73 m	113 m	168 m	229 m	304 m	394 m
Minimum Radii *	e _{max} = 6%	<u>29.2.03</u>	21 m	43 m	79 m	123 m	184 m	252 m	336 m	437 m
	e _{max} = 4%		22 m	47 m	86 m	135 m	203 m	280 m	375 m	492 m
Maximum Superelevation Ra	te *	<u>29-3.01</u>		Paved 8% / Aggregate 4%						
	e _{max} = 8%		42 m	45 m	47 m	52 m	57 m	63 m	67 m	71 m
Superelevation Transition Length (2)	e _{max} = 6%	<u>29-3.02</u>	33 m	35 m	37 m	41 m	45 m	50 m	53 m	56 m
···	e _{max} = 4%		25 m	26 m	27 m	30 m	33 m	36 m	39 m	41 m
Vertical Curvature	Crest	<u>30-2.01</u>	2	4	7	11	17	26	39	52
(K-values based on SSD) *	Sag	<u>30-2.02</u>	6	9	13	18	23	30	38	45
Vertical Curvature (K-values based on PSD)	Crest	<u>30-2.01</u>	46 84 138 195 272 338				438	520		
Maximum Grado * (3)	Level	30 1 02	8%		7%			6	%	5%
	Rolling	<u>30-1.02</u>	11%	10%	9%	8	%	7%		6%
Minimum Grade		<u>30-1.03</u>			De	esirable 0.5%	/ Minimum 0.0)%		

- Intersection Sight Distance. Table values are for passenger cars at a stop-controlled intersection on a level grade based on the design speed for the major road. (1) Increase these distances 10% for grades > 3.0% on the minor road.
- (2) Superelevation Transition Length. Superelevation transition rates will vary according to design speed, radii, and superelevation rates. Table values are based on the minimum radii for the given design speed, maximum superelevation rate, 3.3 m travel lanes, and a 1.5% cross slope for the normal crown section.
- Maximum Grade. (3)

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- Grades 1.0% steeper may be used for existing roadways to remain in place. а.
- Grades 1.0% to 2.0% steeper may be used on local roads and low-volume rural collectors (ADT < 400). b.

ALIGNMENT CRITERIA FOR RURAL TWO-LANE HIGHWAYS

Figure 32-3A (Metric)

August 2016

Dosign El	omont	Manual				Design Speed			
Design En	ement	Section	30 mph	35 mph	40 mph	45 mph	50 mph	55 mph	60 mph
Stopping Sight Distance (SS	D) *	<u>28-1</u>	200'	250'	305'	360'	425'	495'	570'
Intersection Sight Distance *	(1)	<u>28-3</u>	335'	390'	445'	500'	555'	610'	665'
	e _{max} = 6% (Open Roadway)	29.2.03	231' (2)	340' (2)	485' (2)	643' (2)	833'	1060'	1330'
Minimum Radii *	e _{max} = 4% (Open Roadway)	20.2.00	250'	371'	533'	711'	926'	1190'	1500'
Maximum Superelevation Ra	e _{max} = 4% (Low speed)	<u>29-4.03</u>	250'	371'	533'	711'			
Maximum Superelevation Ra	ite *	<u>29-3.01</u>		4%	(3)				
	e _{max} = 6% (4a) (Open Roadway)	20-3.02	125'	133'	142'	153'	165'	176'	184'
Superelevation Transition Length	e _{max} = 4% (4b) (Open Roadway)	23-3.02	92'	98'	104'	112'	121'	129'	135'
	e _{max} = 4% (4b) (Low speed)	<u>29-4.04</u>	89'	95'	99'	107'			
Vertical Curvature	Crest	<u>30-2.01</u>	19	29	44	61	84	114	151
(K-values based on SSD) *	Sag	<u>30-2.02</u>	37	49	64	79	96	115	136
Mawimum Orada *	Level	20.4.02	8%	7	%	60	%	5'	%
	Rolling	<u>30-1.02</u>	9%	9% 8%		79	%	6'	%
Minimum Grade		<u>30-1.03</u>		Desi	rable 0.5% / Mir	nimum 0.3% (w	ith Curb and G	utter)	

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- (1) <u>Intersection Sight Distance</u>. Table values are for passenger cars at a stop-controlled intersection on a level grade based on the design speed for the major road. Increase these distances 10% for grades > 3.0% on the minor road.
- (2) <u>Minimum Radii</u>. For urban streets with design speeds less than 50 mph, use e_{max} = 4% (low speed).
- (3) <u>Superelevation Rate</u>. For urban/suburban reconstruction projects, existing horizontal curves may remain in place with a superelevation rate up to 6.0%.
- (4) <u>Superelevation Transition Length</u>. Superelevation transition rates will vary according to design speed, radii, and superelevation rates.
 - a. Values are based on the minimum radii for the given design speed, maximum superelevation rate of 6.0%, 12 ft travel lanes, and a 1.5% cross slope for the normal crown section.
 - b. Values are based on the minimum radii for the given design speed, maximum superelevation rate of 4.0%, 11 ft travel lanes, and a 1.5% cross slope for the normal crown section.

ALIGNMENT CRITERIA FOR SUBURBAN / URBAN ARTERIALS

Figure 32-3B (US Customary)

32-3-4

Dosign El	amont	Manual			Design	Speed			
Design En	ement	Section	50 km/h	60 km/h	70 km/h	80 km/h	90 km/h	100 km/h	
Stopping Sight Distance (SSI	D) *	<u>28-1</u>	65 m	85 m	105 m	130 m	160 m	185 m	
Intersection Sight Distance *	(1)	<u>28-3</u>	105 m	130 m	150 m	170 m	190 m	210 m	
	e _{max} = 6% (Open Roadway)	20.2.02	79 m (2)	123 m (2)	184 m (2)	252 m	336 m	437 m	
Minimum Radii *	e _{max} = 4% (Open Roadway)	29.2.03	86 m	135 m	203 m	280 m	375 m	492 m	
	e _{max} = 4% (Low speed)	<u>29-4.03</u>	86 m	135 m	203 m				
Maximum Superelevation Ra	te *	<u>29-3.01</u>		4% (3)			6%		
	e _{max} = 6% (4a) (Open Roadway)	20.2.02	37 m	41 m	45 m	50 m	53 m	56 m	
Superelevation Transition Length	e _{max} = 4% (4b) (Open Roadway)	<u>29-3.02</u>	27 m	30 m	33 m	36 m	39 m	41 m	
	e _{max} = 4% (4b) (Low speed)	<u>29-4.04</u>	28 m	30 m	33 m				
Vertical Curvature	Crest	<u>30-2.01</u>	7	11	17	26	39	52	
(K-values based on SSD) *	Sag	<u>30-2.02</u>	12	17	23	30	38	45	
Maximum Orada *	Level	20.4.02	8%	7%	6%		5%		
	Rolling	<u>30-1.02</u>	9%	8%	7	%	6%		
Minimum Grade		<u>30-1.03</u>		Desirable	0.5% / Minimum (0.3% (with Curb a	nd Gutter)		

- (1) <u>Intersection Sight Distance</u>. Table values are for passenger cars at a stop-controlled intersection on a level grade based on the design speed for the major road. Increase these distances 10% for grades > 3.0% on the minor road.
- (2) <u>Minimum Radii</u>. For urban streets with design speeds less than 80 km/h, use $e_{max} = 4\%$ (low speed).
- (3) <u>Superelevation Rate</u>. For urban/suburban reconstruction projects, existing horizontal curves may remain in place with a superelevation rate up to 6.0%.
- (4) <u>Superelevation Transition Length</u>. Superelevation transition rates will vary according to design speed, radii, and superelevation rates.
 - a. Values are based on the minimum radii for the given design speed, maximum superelevation rate of 6.0%, 3.6 m travel lanes, and a 1.5% cross slope for the normal crown section.
 - b. Values are based on the minimum radii for the given design speed, maximum superelevation rate of 4.0%, 3.3 m travel lanes, and a 1.5% cross slope for the normal crown section.

ALIGNMENT CRITERIA FOR SUBURBAN / URBAN ARTERIALS

Figure 32-3B (Metric)

August 2016

Design El	amont	Manual			Design	Speed		
Design En	ement	Section	20 mph	25 mph	30 mph	35 mph	40 mph	45 mph
Stopping Sight Distance (SSI	D) *	<u>28-1</u>	115'	155'	200'	250'	305'	360'
Intersection Sight Distance *	(1)	<u>28-3</u>	225'	280'	335'	390'	445'	500'
Minimum Radii *	e _{max} = 4% (Low speed)	<u>29-4.03</u>	86'	154'	250'	371'	533'	711'
Minimum Radii w/ Normal Crown (Low speed)			105'	194'	324'	495'	736'	1000'
Maximum Superelevation Ra	<u>29-3.01</u>		4%					
Superelevation Transition Length (3)	e _{max} = 4% (Low speed)	<u>29-4.04</u>	74'	71'	89'	95'	99'	107'
Vertical Curvature	Crest	<u>30-2.01</u>	7	12	19	29	44	61
(K-values based on SSD) *	Sag	<u>30-2.02</u>	17	26	37	49	64	79
Maximum Crada * (4)	Level	20 1 02			9%			8%
Maximum Grade (4)	<u>30-1.02</u>	12	.%	11%	10)%	9%	
Minimum Grade 30-1.03 Desirable 0.5% / Minimum 0.3% (with Curb and Gutter)				nd Gutter)				

- (1) <u>Intersection Sight Distance</u>. Table values are for passenger cars at a stop-controlled intersection on a level grade based on the design speed of the major road. Increase these values 10% for grades > 3.0% on the minor road.
- (2) <u>Superelevation Rate</u>. For reconstruction projects, existing horizontal curves may remain in place with a superelevation rate up to 6.0%.
- (3) <u>Superelevation Transition Length</u>. Superelevation transition rates will vary according to design speed, radii, and superelevation rates. Table values are based on the minimum radii for the given design speed, maximum superelevation rate, 11 ft travel lanes, and a 1.5% cross slope for the normal crown section.

(4) Maximum Grade.

- a. Collectors. Grades 1.0% to 2.0% steeper may be used on low-volume collectors and on grades less than 500 ft in length.
- b. Local. Grades on local residential streets should be less than 15.0%.

ALIGNMENT CRITERIA FOR URBAN COLLECTORS / LOCAL STREETS

Figure 32-3C (US Customary)

32-3-6

Design Element		Manual Section	Design Speed				
			30 km/h	40 km/h	50 km/h	60 km/h	70 km/h
Stopping Sight Distance (SSD) *		<u>28-1</u>	35 m	50 m	65 m	85 m	105 m
Intersection Sight Distance * (1)		<u>28-3</u>	65 m	85 m	105 m	130 m	150 m
Minimum Radii *	e _{max} = 4% (Low speed)	29-4.03	22 m	47 m	86 m	135 m	203 m
Minimum Radii w/ Normal Crown (Low speed)			27 m	59 m	113 m	183 m	286 m
Maximum Superelevation Rate * (2)		<u>29-3.01</u>	4%				
Superelevation Transition Length (3)	e _{max} = 4% (Low speed)	<u>29-4.04</u>	22 m	25 m	28 m	30 m	33 m
Vertical Curvature (K-values based on SSD) *	Crest	<u>30-2.01</u>	2	4	7	11	17
	Sag	<u>30-2.02</u>	6	9	13	18	23
Maximum Grade * (4)	Level	<u>30-1.02</u>	9%				8%
	Rolling		12%		11%	10%	9%
Minimum Grade		<u>30-1.03</u>	Desirable 0.5% / Minimum 0.3% (with Curb and Gutter)				

- (1) <u>Intersection Sight Distance</u>. Table values are for passenger cars at a stop-controlled intersection on a level grade based on the design speed of the major road. Increase these values 10% for grades > 3.0% on the minor road.
- (2) <u>Superelevation Rate</u>. For reconstruction projects, existing horizontal curves may remain in place with a superelevation rate up to 6.0%.
- (3) <u>Superelevation Transition Length</u>. Superelevation transition rates will vary according to design speed, radii, and superelevation rates. Table values are based on the minimum radii for the given design speed, maximum superelevation rate, 3.3 m travel lanes, and a 1.5% cross slope for the normal crown section.

(4) Maximum Grade.

- a. Collectors. Grades 1.0% to 2.0% steeper may be used on low-volume collectors and on grades less than 150 m in length.
- b. Local. Grades on local residential streets should be less than 15.0%.

ALIGNMENT CRITERIA FOR URBAN COLLECTORS / LOCAL STREETS

Figure 32-3C (Metric)

32-3-7

32-4 ACRONYMS

This is a summary of the acronyms used within this chapter.

American Association of State Highway and Transportation Officials					
Average Daily Traffic					
Bureau of Design and Environment					
Curb & Gutter					
Concrete Curb & Gutter					
Design Hourly Volume					
Highway Capacity Manual					
Illinois Department of Transportation					
Local Public Agency					
One Way Street					
Passing Sight Distance					
Stopping Sight Distance					
Two Way Left Turn Lane					
Two Way Street					

32-4-1

32-5 REFERENCES

- 1. A Policy on Geometric Design of Highways and Streets, AASHTO, 2011.
- 2. HCM 2010 Highway Capacity Manual, TRB, 2010
- 3. <u>Chapter 47</u> "Rural Two-Lane / Multilane State Highways (New Construction / Reconstruction)", *BDE Manual*, IDOT.