Memorandum

U.S. Department
of Transportation

**Federal Highway
Administration**

Subject: **ACTION:** Design Standards for Projects on the National Highway System (2004 Green Book)

Date: February 23, 2005

From: /s/ Original Signed by
Dwight A. Horne
Director of Program Administration

Reply to
Attn. of: HIPA-20

To: Directors of Field Services
Resource Center Managers
Division Administrators
Federal Lands Highway Division Engineers

AASHTO has recently issued the Fifth Edition of *A Policy on Geometric Design of Highways and Streets* (2004 Green Book). The previous edition, known as the 2001 Green Book, was adopted by the Federal Highway Administration on February 12, 2002. Our office memorandum dated February 15, 2002, described how the 2001 Green Book should be applied as the design standard for all projects on the National Highway System (NHS).

The major change in the 2004 Green Book is revision of the superelevation section. The superelevation revisions and other minor changes are described in Attachment 1. It has been determined that the 2004 Green Book is in substantial conformance with the criteria in the adopted 2001 Green Book. States are therefore allowed to use either the 2001 or 2004 Green Book as the design standard for projects on the NHS.

At a later date, one copy of the 2004 Green Book will be furnished to each field office. Additional copies may be ordered from AASHTO by telephone, fax, mail, or website, see http://www.aashto.org/aashto/home.nsf/FrontPage for ordering information. The AASHTO member price applies to FHWA.

Attachment

BUCKLE UP AMERICA

Attachment 1

Changes in 2004 Green Book (as compared with 2001 Green Book)

1. The superelevation section has been revised as follows:

   - The topics in the section have been reworded and rearranged
   - The superelevation tables have been reformatted. In the 2001 Green Book the superelevation tables were formatted with radius in the left column and design speed across the top, enabling the user with these two pieces of information to find the recommended superelevation value in the body of the table. In the 2004 Green Book the superelevation tables are formatted with superelevation in the left column and design speed across the top, enabling the user to enter from the top with design speed, proceed down a column in the body of the table to curve radius, and find a recommended superelevation value in the left column.
   - The length of superelevation runoff has been moved from the superelevation table to a separate table in the discussion of transition design controls.
   - For low speed rural design (≤ 45 mph) the 2004 Green Book incorporates different friction factors which in turn results in slightly different superelevation rates. For example, given a design speed of 25 mph, radius of curve 500 feet, and maximum superelevation rate of 8%, the superelevation rate found in the 2004 Green Book would be 5.0%, compared to 5.3% in the 2001 Green Book. For high speed design (≥ 50 mph), the superelevation rates in the 2004 Green Book are almost identical to those in the 2001 Green Book.
   - For low speed urban streets, use of superelevation is optional, as it was in the 2001 Green Book. Where superelevation is used, the 2004 Green Book presents the superelevation rates in a new table and revised graph. The change in superelevation rates is similar to those for rural facilities

2. The terminology for M, middle ordinate of a horizontal curve, has been changed to HSO, horizontal sightline offset, to avoid conflict with a surveying term using M. This is a straight substitution of terms, no other changes were made in the text.

3. The technical corrections noted in the first and second printings of the 2001 Green Book have been incorporated in the 2004 Green Book. Those using the 2001 Green Book can find these technical corrections posted at http://downloads.transportation.org/Errata-GDHS-4.pdf .

American Association of
State Highway and
Transportation Officials

John R. Njord, President
Executive Director
Utah Department of Transportation

John Horsley
Executive Director

June 2004

Dear Customer:

Recently, we were made aware of some technical revisions made to the 4th Edition of *A Policy on Geometric Design of Highways and Streets, 2001,* or the *"*Green Book*"* as it is commonly called.

The revisions that were posted after the 2002 meeting of the Task Force on Geometric Design were incorporated into the Second Printing of the 4th Edition of the Green Book. To determine if you have a copy from the second printing, look at the title page of your book. The phrase "Second Printing" should appear just below "2001".

If your copy of the book or CD is from the second printing, then you will need to incorporate only those revisions posted after the 2003 meeting of the Task Force on Geometric Design in order to make your text both accurate and current.

If your copy is from the first printing of the book or CD, please incorporate all of the following revisions in your original text so that your edition is both accurate and current.

AASHTO staff sincerely apologizes for any inconvenience.

AASHTO Publications Staff
June 2004

Revisions posted after the July 2002 meeting of the Task Force on Geometric Design (to be incorporated into the first printing of *A Policy on Geometric Design of Highways and Streets,* 4th Edition, 2001)

Page	Exhibit	Existing Text	Correction Made
39	2-21	Path of front overhang indicates a radius of "13.07 m max [34.4 ft]."	Revised radius to read "10.49 m max [34.4 ft]."
40	2-22	Path of front overhang indicates a radius of "8.87 m max [25.5 ft]."	Revised radius to read "7.77 m max [25.5 ft]."
40	2-22	Path of right rear wheel indicates a radius of "2.78 m min [8.0 ft]."	Revised radius to read "2.44 m min [8.0 ft]."
73	2-30	Exhibit 2-30 is incorrect.	Replaced Exhibit 2-30. See attached.
113		Under Design Values, the 2nd sentence reads "…for wet pavements and for…"	Deleted "for wet pavements and."
145	3-14	In the Metric section, the Total (e/100 + f) value for a Design Speed of 20 km/h with an e of 8% reads "0.28."	Revised the value for Total (e/100 + f) to read "0.26."
145	3-14	In the Metric section, the Total (e/100 + f) value for a Design Speed of 130 km/h with an e of 8% reads "0.18."	Revised the value for Total (e/100 + f) to read "0.16."
145	3-14	In the US Customary section, the Limiting Value of "f " for a Design Speed of 25 mph with an e of 8% reads "0.185."	Revised the value for "f" to read "0.165."
145	3-14	In the US Customary section, the calculated radius for 45 mph with an e of 8% reads "502.0" and the rounded radius reads "500."	Revised the calculated radius to read "602.0" and the rounded radius to read "600."
145	3-14	In the US Customary section, the Total (e/100 + f) value for a Design Speed of 30 mph with an e of 10% reads "0.280."	Revised the value for Total (e/100 + f) to read "0.260."
145	3-14	In the US Customary section, the calculated radius for 70 mph with an e of 10% reads "1838.8" and the rounded radius reads "1840."	Revised the calculated radius to read "1638.8" and the rounded radius to read "1640."
145	3-14	In the US Customary section, the rounded radius for 50 mph with an e of 12% reads "845."	Revised the rounded radius to read "645."

Page	Exhibit	Existing Text	Correction Made
168	3-26	In US Customary section, the units in the 1st three columns are in metric (km/h, km/h, m).	Revised Design Speed units to (mph), Average Running Speed to (mph), and Minimum curve radius to (ft).
224	3-55	In the Metric section, the heading for the Case I column reads "with provision for passing a stalled vehicle."	Revised Case I to read "no provision for passing a stalled vehicle" so that it matches the US Customary heading.
244		In the 3rd full paragraph, the last line contains a critical length of 360 m [1200 ft].	Revised the critical length to read "350 m [1200 ft]."
244		In the 5th full paragraph, the last line contains a critical length of 300 m [1000 ft].	Revised the critical length to read "370 m [1250 ft]."
250		In the 3rd full paragraph on the page, the last line reads "…50 m [150 ft] long."	Revised the last line to read "…90 m [300 ft] long."
251		The 2nd line on the page reads "…at least 60 m [200 ft] long."	Revised the 2nd line to read "…at least 180 m [600 ft] long."
255		Item 3 in the center of the page reads "Where the critical length of grade exceeds the physical …"	Revised Item 3 to read "Where the critical length of grade is less than the physical …"
255		The last line of Item 3 in the center of the page references Exhibits 3-65 and 3-66.	Revised the exhibits referenced to Exhibits 3-63 and 3-64.
274	3-76	Exhibit 3-76. Design Controls …for Crest and Sag Vertical Curves.	Deleted "and Sag" from Exhibit title.
351		Insert additional text after 2nd paragraph and before Exhibit 4-15.	Inserted a new paragraph to read: "Shrubs, trees or ground covers are not very efficient in shielding sound because of their permeability to air flow. However, almost all buffer plantings offer some noise reduction and exceptionally wide and dense plantings may result in substantial reductions in noise levels. Even where the noise reduction is not considered significant, the aesthetic effects of the plantings will produce a positive effect."
389		Under Structures, the last paragraph refers to Chapter 9 in the 2nd sentence.	Revised the reference to read Chapter 10 so that the 2nd sentence reads, "For general discussion of structure widths, see Chapter 10."

Page	Exhibit	Existing Text	Correction Made
406	5-11	In the Metric section, Residential sidewalks indicate 5.5 lux.	Replaced “5.5 lux” with “2.2 lux.”
425		Under Cross Slope, the 2nd paragraph indicates a cross slope of 3 to 7 percent is desirable for low-type pavements.	Revised “3 to 7” to read “3 to 6” to match cross-slope discussion and Exhibit 4-4 in Chapter 4.
510	8-1	Footnote of Exhibit 8-1 reads “Grades 1% steeper than the value shown may be used for extreme cases in urban areas where development precludes the use of flatter grades and for one-way downgrades except in mountainous terrain.”	Changed footnote to read “Grades 1% steeper than the value shown may be provided in mountainous terrain or in urban areas with crucial right-of-way controls.”
567	9-8B	Divisional Island is missing from Exhibit 9-8B.	Added a Divisional Island on the through roadway to the right of the intersecting roadway in Exhibit 9-8B.
592	9-20	In the Metric section, for an angle of turn of 60 degrees for a WB-15 vehicle, the Asymmetric Offset reads “.06–2.0.”	Revised the Asymmetric Offset to read “0.6–2.0.”
593	9-20	In the US Customary section, for an angle of turn of 75 degrees, a P vehicle, the symmetric three-centered curve Curve radii reads “100-75-100.”	Revised the Curve radii to read “100-25-100.”
594	9-20	In the metric section, for an angle of turn of 120 degrees, a P vehicle, the symmetric three-centered curve Curve radii reads “30-60-30.”	Revised the Curve radii to read “30-6-30.”
601	9-22C	The US Customary caption of the exhibit shows a three-centered compound curve of 120 ft –140 ft –120 ft radii.	Revised the caption to read “120 ft – 40 ft – 120 ft.”
620	9-31	In the US Customary section for R = 20 ft, Case A, and a delta 150°, the d_2 is indicated as 12.2.	Revised the d_2 for R = 20 ft, Case A, and a delta of 150° to read 40.
629		Exhibit 3-43 is referenced in the 6th line of the 3rd paragraph on the page.	Changed the exhibit referenced to Exhibit 3-55.
641		Exhibit 9-40B is referenced in the 3rd line of the 1st paragraph on the page.	Changed the exhibit referenced to Exhibit 9-41B.
641		Exhibits 9-36 and 9-37 are referenced in the last line of the 4th paragraph on the page.	Changed the exhibits referenced to Exhibits 9-37 and 9-38.

Page	Exhibit	Existing Text	Correction Made
643		Exhibit 9-19 is referenced in the 10th line of the 2nd full paragraph on the page.	Changed the exhibit referenced to Exhibit 3-43.
646		Exhibit 3-26 is referenced in the 5th line of the 2nd full paragraph on the page.	Changed the exhibit referenced to Exhibit 3-43.
663		Exhibit 9-49B is referenced in the 1st line of the 4th full paragraph on the page.	Changed the exhibit referenced to Exhibit 9-50B.
664	9-54	The 1st line of the Note under the table reads "Time gaps are for a stopped vehicle to turn right or left…"	Deleted "right or" from the 1st line of the note.
664		1st paragraph, 3rd line reads "major road is 90 km/h [60 mph]…"	Revised the 3rd line to read "major road is 100 km/h [60 mph]…"
664		1st paragraph, 3rd line calculation reads "0.278(90)(7.5) = 187.7 or 190 m."	In the calculation, replaced "90" with "100" and "187.7 or 190" with "208.5 or 210 m."
664		2nd paragraph, 3rd line reads "200 m [704 ft]."	Revised dimension to read "223 m [706 ft]."
699	9-81	In the center of the exhibit, two dimensions are shown as "R = 30 m [50 ft]."	Revised the dimensions to read "R = 15 m [50 ft]."
700	9-82	In the center of the exhibit, two dimensions are shown as "R = 23 m [100 ft]."	Revised the dimensions to read "R = 23 m [75 ft]."
702		Exhibit 9-79 is referenced in the 5th line of the 4th full paragraph on the page.	Changed the exhibit referenced to Exhibit 9-78.
703		Exhibit 9-79 is referenced in the 3rd line of the 3rd paragraph on the page.	Changed the exhibit referenced to Exhibit 9-76.
703		Exhibit 9-79 is referenced in the 1st line of the 5th paragraph on the page.	Changed the exhibit referenced to Exhibit 9-81.
705		Exhibit 9-85 is referenced in the 1st line of the 4th full paragraph on the page.	Changed the exhibit referenced to Exhibit 9-86.
706		Exhibit 9-86 is referenced in the 2nd line of the 2nd paragraph on the page.	Changed the exhibit referenced to Exhibit 9-85.

Page	Exhibit	Existing Text	Correction Made
706		Exhibit 9-84 is referenced in the 12th line (last) of the 6th paragraph on the page.	Changed the exhibit referenced to Exhibit 9-87.
708	9-87	Five items in this exhibit are incorrect: (1) Point 1 is misplaced, (2) the dimension b is lower case, (3) a dimension for R_1 is incorrect, (4) several values for B are incorrect, and (5) the dimension line is missing for M.	Replaced Exhibit 9-87. See attached. Changed "b" to "B" in last sentence of 1st paragraph.
725	9-97	The note in the legend block refers to Exhibits 9-74, 9-77, 9-79, and 9-80.	Revised the note to read "Refer to Exhibits 9-77 through 9-83."
737		The last paragraph on the page refers to Exhibit 9-103 in the 3rd line.	Changed the reference to Exhibit 9-104.
738		In the Metric section of the equation table, the equation for d_H reads: $d_H = AV_v t + D + d_e$	Replaced the equation for d_H with: $d_H = AV_v t + \frac{BV_v^2}{a} + D + d_e$
738		In the definitions in the equation box, d_e = 3.0 m on the metric side and 10 ft on the US Customary side.	Changed the values in the equation box to d_e = 2.4 m and d_e = 8 ft on the appropriate sides of the equation box.
739	9-103	The equations for Metric and US Customary at the top of the exhibit are incorrect.	Replaced the equations at the top of the exhibit with the equations shown in the equation box on page 738. Changed the values in the equation box to d_e = 2.4 m and d_e = 8 ft on the appropriate sides of the equation box.
741	9-104	The values for d_H are incorrect. Incorrect values for d_e were used in the calculation (3.0 and 10 instead of 2.4 and 8).	Replaced the last line of Exhibit 9-104 with the following: Distance along highway from crossing, d_H (m) 15 25 38 53 70 90 112 136 162 191 222 255 291 Distance along highway from crossing, d_H (ft) 69 135 220 324 447 589 751 931
742	9-105	The equations for Metric and US Customary at the top of the exhibit contain an error.	Replaced the equations at the top of the exhibit with equations shown in the equation box on page 740.
838	10-60	Exhibit 10-60 is incorrect.	Replaced Exhibit 10-60. See attached.
839		In the 2nd paragraph on the page, the 2nd line references Exhibit 10-61.	Revised the reference to Exhibit 10-60.

Page	Exhibit	Existing Text	Correction Made
843	10-67	In the Metric section, the heading for the Case I column reads "with provision for passing a stalled vehicle."	Revised Case I to read "no provision for passing a stalled vehicle" so that it matches the US Customary heading.
852	10-71	In the metric section, under the column All Speeds, the second grouping of speeds reads "3 to 4% downgrade."	Revised the heading of the 2nd group of speeds to read "5 to 6% downgrade."
854	10-72A	The dimension line for 3.6 m [12 ft] should be shown from the right edge of the ramp to the projected right edge of the right freeway lane upstream from the ramp (similar to the way it is shown in Exhibit 10-72B).	Revised figure for Exhibit 10-72A. See attached.

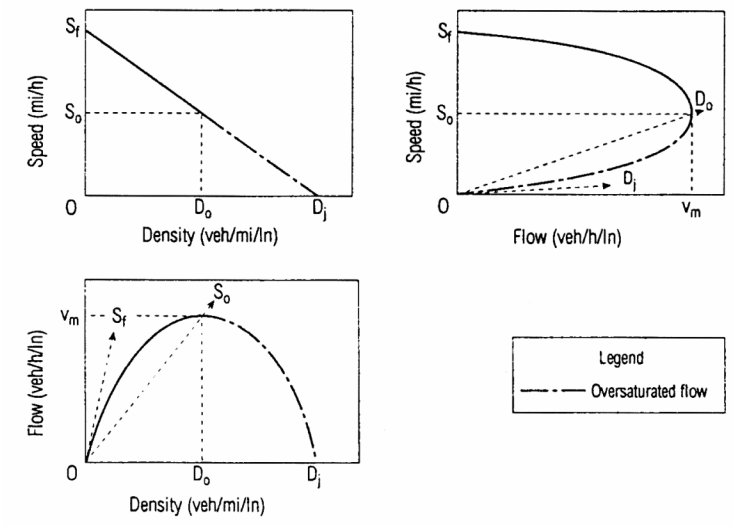


Exhibit 2-30. Generalized Speed-Volume-Density Relationships (15)

Metric							US Customary						
M width of median (m)	Dimensions in meters when						M width of median (ft)	Dimensions in feet when					
	R_1 = 30 m		R_1 = 50 m		R_1 = 70 m			R_1 = 90 ft		R_1 = 170 ft		R_1 = 230 ft	
	L	B	L	B	L	B		L	B	L	B	L	B
6.0	18.0	20.2	20.2	24.4	21.3	27.6	20	58	65	66	78	71	90
9.0	15.1	21.4	17.7	26.5	19.0	30.4	30	48	68	57	85	63	101
12.0	12.8	22.4	15.6	28.3	17.1	32.7	40	40	71	50	90	57	109
15.0	–	–	13.8	29.9	15.4	34.7	50	–	–	44	95	51	115
18.0	–	–	–	–	13.8	36.7	60	–	–	–	–	46	122
21.0	–	–	–	–	12.4	38.4	70	–	–	–	–	41	128

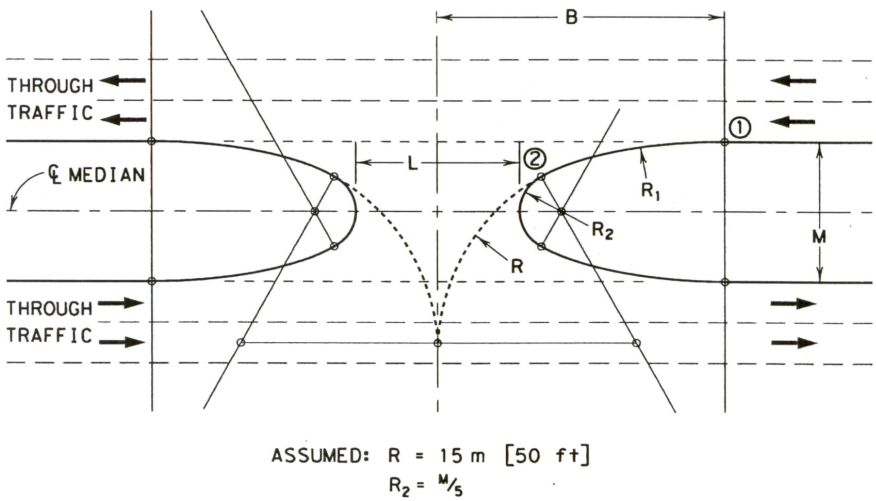


Exhibit 9-87. Above Minimum Design of Median Openings (Typical Bullet-Nose Ends)

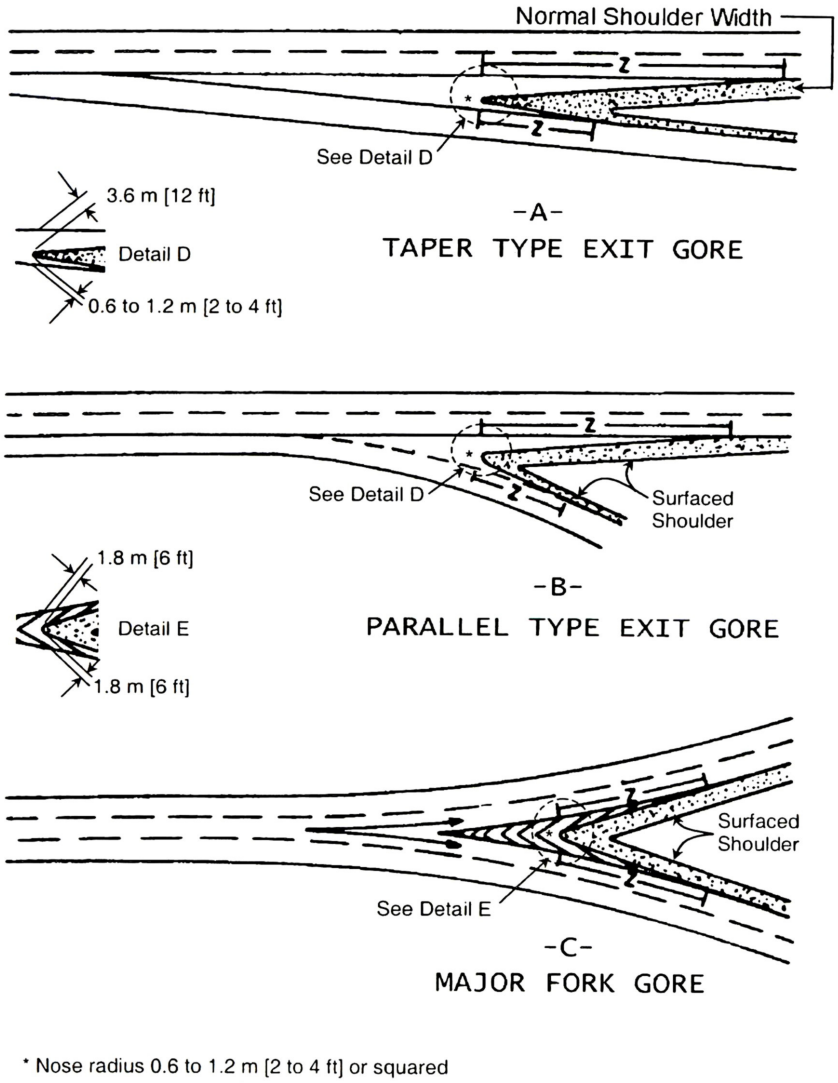


Exhibit 10-60. Typical Gore Details

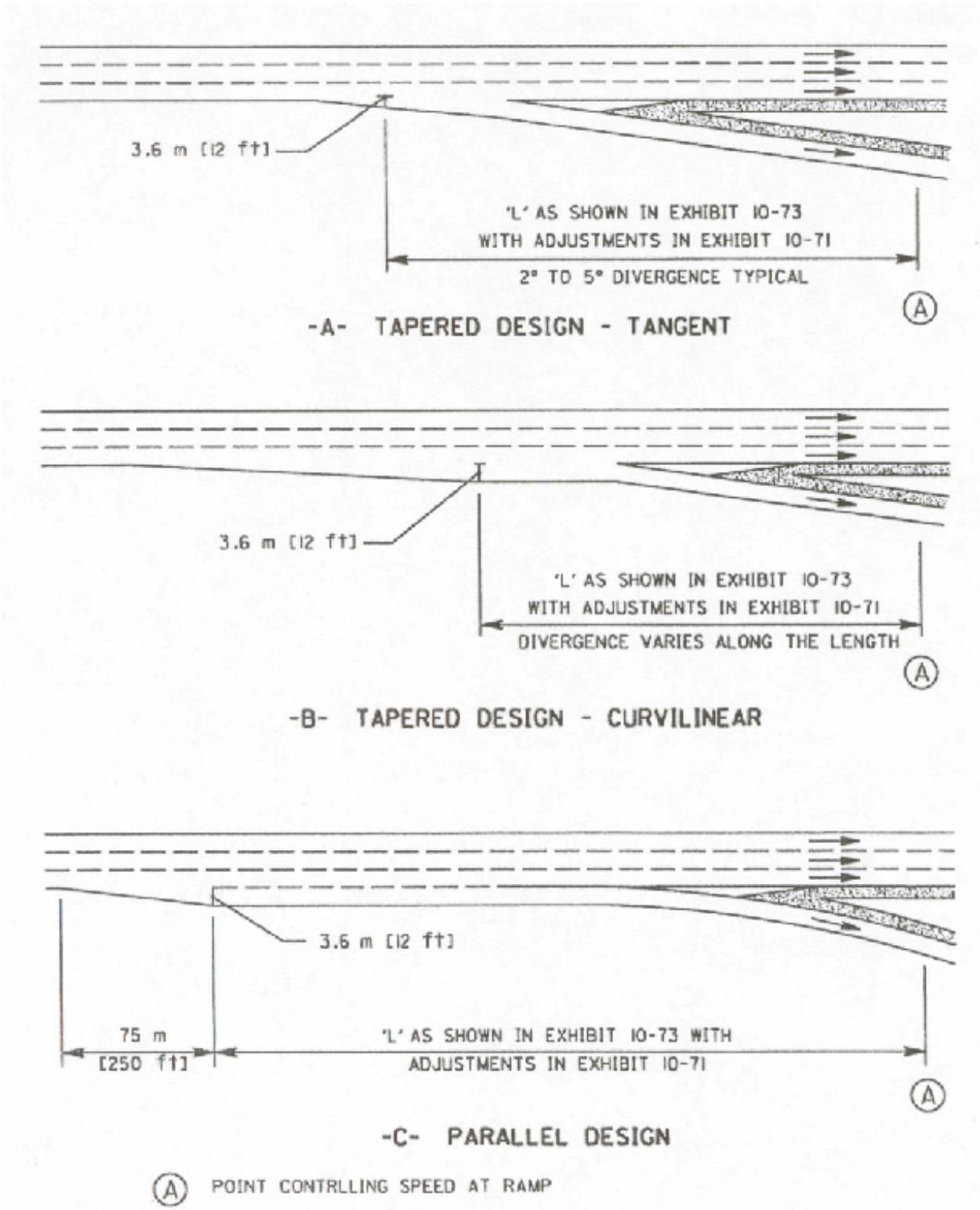


Exhibit 10-72. Exit Ramps—Single Lane

Additional revisions to be incorporated into the first printing of *A Policy on Geometric Design of Highways and Streets,* 4th Edition, 2001

Page	Exhibit	Existing Text	Correction Made
16	2-1 (Metric)	Footnotes in Exhibit 2-1 are out of order.	Reordered footnotes for Exhibit 2-1. See attached.
17	2-1 (US)	Footnotes in Exhibit 2-1 are out of order.	Reordered footnotes for Exhibit 2-1. See attached.
27	2-9	The Path of the Front Overhang indicates radius of "13.35 m max. [42.8 ft]."	Revised the radius to read "13.05 m max. [42.8 ft]." See attached.
34	2-16	Wheelbase of vehicle reads "19.42 m [65 ft]."	Revised the Wheelbase to read "19.81 m [65 ft]." See attached.
35	2-17	The overall length of the design vehicle is shown as 22.05 m [72.33 ft].	Revised overall length of the design vehicle to read "22.4 m [73.3 ft]." See attached.
58		4th paragraph, 8th line	Replaced "double" with "significantly higher than."
66		2nd full paragraph, 7th and 8th line	Changed "four" to "five" in line 7 and replaced "and" with a comma (,) in the 8th line.
250		3rd full paragraph, 13th line	Deleted "depending on the weight/power ratio of the appropriate truck." Added the new sentence, "Different curves would apply for trucks with other than a weight/power ratio of 120 kg/kW [200 lb/hp]."
271		In the equation box, the US Customary side reads L = …, m; S = …, m; h_1 = …, m and h_2 =…, m.	Replaced "m" with "ft."
358		In last sentence of 1st paragraph	Changed "total width" to "roadway width."
511		1st full paragraph, 2nd line	Inserted as a 2nd sentence "On urban routes with less than the 4.9-m [16-ft] clearance, the vertical clearance to sign trusses should be 0.3 m [1 ft] greater than the minimum clearance for other structures."
619–620	9-31	1st column in the Metric and the US Customary sections of the exhibit is not identified.	Inserted as the column heading: Angle of Intersection (Δ).

Page	Exhibit	Existing Text	Correction Made
637	9-40	Section Between P. T. and P.R.C. is incorrect.	Replaced illustration for Section Between P. T. and P.R.C. See attached.
643		Exhibit 9-43 is referenced in the 4th line of the 2nd full paragraph on the page.	Changed the exhibit referenced to Exhibits 9-43B and 9-43C.
696	9-76	The path for the WB-62 vehicle is not labeled for US Customary section.	Labeled the line in both Parts A and B of Exhibit 9-76 consisting of alternating long and short dashes as WB-62. See attached.
725	9-97	2nd Metric drawing does not contain a caption.	Added a caption – 1st line: "M = 5.4 m and over – Elongated taper"; 2nd line: "-B-". See attached.

Metric

Design Vehicle Type	Symbol	Dimensions (m)											
		Overall			Overhang								Typical Kingpin to Center of Rear Axle
		Height	Width	Length	Front	Rear	WB_1	WB_2	S	T	WB_3	WB_4	
Passenger Car	P	1.3	2.1	5.8	0.9	1.5	3.4	–	–	–	–	–	–
Single Unit Truck	SU	3.4-4.1	2.4	9.2	1.2	1.8	6.1	–	–	–	–	–	–
Buses													
Inter-city Bus (Motor Coaches)	BUS-12	3.7	2.6	12.2	1.8	1.9[a]	7.3	1.1	–	–	–	–	–
	BUS-14	3.7	2.6	13.7	1.8	2.6[a]	8.1	1.2	–	–	–	–	–
City Transit Bus	CITY-BUS	3.2	2.6	12.2	2.1	2.4	7.6	–	–	–	–	–	–
Conventional School Bus (65 pass.)	S-BUS 11	3.2	2.4	10.9	0.8	3.7	6.5	–	–	–	–	–	–
Large School Bus (84 pass.)	S-BUS 12	3.2	2.4	12.2	2.1	4.0	6.1	–	–	–	–	–	–
Articulated Bus	A-BUS	3.4	2.6	18.3	2.6	3.1	6.7	5.9	1.9[b]	4.0[b]	–	–	–
Trucks													
Intermediate Semitrailer	WB-12	4.1	2.4	13.9	0.9	0.8[a]	3.8	8.4	–	–	–	–	8.4
Intermediate Semitrailer	WB-15	4.1	2.6	16.8	0.9	0.6[a]	4.5	10.8	–	–	–	–	11.4
Interstate Semitrailer	WB-19*	4.1	2.6	20.9	1.2	0.8[a]	6.6	12.3	–	–	–	–	13.0
Interstate Semitrailer	WB-20**	4.1	2.6	22.4	1.2	1.4-0.8[a]	6.6	13.2-13.8	–	–	–	–	13.9-14.5
"Double-Bottom"-Semitrailer/Trailer	WB-20D	4.1	2.6	22.4	0.7	0.9	3.4	7.0	0.9[c]	2.1[c]	7.0	–	7.0
Triple-Semitrailer/ Trailers	WB-30T	4.1	2.6	32.0	0.7	0.9	3.4	6.9	0.9[d]	2.1[d]	7.0	7.0	7.0
Turnpike Double-Semitrailer/Trailer	WB-33D*	4.1	2.6	34.8	0.7	0.8[a]	4.4	12.2	0.8[e]	3.1[e]	13.6	–	13.0
Recreational Vehicles													
Motor Home	MH	3.7	2.4	9.2	1.2	1.8	6.1	–	–	–	–	–	–
Car and Camper Trailer	P/T	3.1	2.4	14.8	0.9	3.1	3.4	–	1.5	5.8	–	–	–
Car and Boat Trailer	P/B	–	2.4	12.8	0.9	2.4	3.4	–	1.5	4.6	–	–	–
Motor Home and Boat Trailer	MH/B	3.7	2.4	16.2	1.2	2.4	6.1	–	1.8	4.6	–	–	–
Farm Tractor[f]	TR	3.1	2.4-3.1	4.9[g]	–	–	3.1	2.7	0.9	2.0	–	–	–

Note: Since vehicles are manufactured in U.S. Customary dimensions and to provide only one physical size for each design vehicle, the values shown in the design vehicle drawings have been soft converted from numbers listed in feet, and then the numbers in this table have been rounded to the nearest tenth of a meter.

* = Design vehicle with 14.63 m trailer as adopted in 1982 Surface Transportation Assistance Act (STAA).

** = Design vehicle with 16.16 m trailer as grandfathered in with 1982 Surface Transportation Assistance Act (STAA).

[a] = This is overhang from the back axle of the tandem axle assembly.

[b] = Combined dimension is 5.91 m and articulating section is 1.22 m wide.

[c] = Combined dimension is typically 3.05 m.

[d] = Combined dimension is typically 3.05 m.

[e] = Combined dimension is typically 3.81 m.

[f] = Dimensions are for a 150–200 hp tractor excluding any wagon length.

[g] = To obtain the total length of tractor and one wagon, add 5.64 m to tractor length. Wagon length is measured from front of drawbar to rear of wagon, and drawbar is 1.98 m long.

- WB_1, WB_2, and WB_4 are the effective vehicle wheelbases, or distances between axle groups, starting at the front and working towards the back of each unit.
- S is the distance from the rear effective axle to the hitch point or point of articulation.
- T is the distance from the hitch point or point of articulation measured back to the center of the next axle or center of tandem axle assembly.

Exhibit 2-1. Design Vehicle Dimensions

US Customary

Design Vehicle Type	Symbol	Dimensions (ft)											
		Overall			Overhang								Typical Kingpin to Center of Rear Axle
		Height	Width	Length	Front	Rear	WB_1	WB_2	S	T	WB_3	WB_4	
Passenger Car	P	4.25	7	19	3	5	11	–	–	–	–	–	–
Single Unit Truck	SU	11-13.5	8.0	30	4	6	20	–	–	–	–	–	–
Buses													
Inter-city Bus (Motor Coaches)	BUS-40	12.0	8.5	40	6	6.3[a]	24	3.7	–	–	–	–	–
	BUS-45	12.0	8.5	45	6	8.5[a]	26.5	4.0	–	–	–	–	–
City Transit Bus	CITY-BUS	10.5	8.5	40	7	8	25	–	–	–	–	–	–
Conventional School Bus (65 pass.)	S-BUS 36	10.5	8.0	35.8	2.5	12	21.3	–	–	–	–	–	–
Large School Bus (84 pass.)	S-BUS 40	10.5	8.0	40	7	13	20	–	–	–	–	–	–
Articulated Bus	A-BUS	11.0	8.5	60	8.6	10	22.0	19.4	6.2[b]	13.2[b]	–	–	–
Trucks													
Intermediate Semitrailer	WB-40	13.5	8.0	45.5	3	2.5[a]	12.5	27.5	–	–	–	–	27.5
Intermediate Semitrailer	WB-50	13.5	8.5	55	3	2[a]	14.6	35.4	–	–	–	–	37.5
Interstate Semitrailer	WB-62*	13.5	8.5	68.5	4	2.5[a]	21.6	40.4	–	–	–	–	42.5
Interstate Semitrailer	WB-65** or	13.5	8.5	73.5	4	4.5-2.5[a]	21.6	43.4-45.4	–	–	–	–	45.5-47.5
"Double-Bottom"-Semitrailer/Trailer	WB-67D	13.5	8.5	73.3	2.33	3	11.0	23.0	3.0[c]	7.0[c]	23.0	–	23.0
Triple-Semitrailer/ Trailers	WB-100T	13.5	8.5	104.8	2.33	3	11.0	22.5	3.0[d]	7.0[d]	23.0	23.0	23.0
Turnpike Double-Semitrailer/Trailer	WB-109D*	13.5	8.5	114	2.33	2.5[e]	14.3	39.9	2.5[e]	10.0[e]	44.5	–	42.5
Recreational Vehicles													
Motor Home	MH	12	8	30	4	6	20	–	–	–	–	–	–
Car and Camper Trailer	P/T	10	8	48.7	3	10	11	–	5	19	–	–	–
Car and Boat Trailer	P/B	–	8	42	3	8	11	–	5	15	–	–	–
Motor Home and Boat Trailer	MH/B	12	8	53	4	8	20	–	6	15	–	–	–
Farm Tractor[f]	TR	10	8-10	16[g]	–	–	10	9	3	6.5	–	–	–

* = Design vehicle with 48 ft trailer as adopted in 1982 Surface Transportation Assistance Act (STAA).
** = Design vehicle with 53 ft trailer as grandfathered in with 1982 Surface Transportation Assistance Act (STAA).
a = This is overhang from the back axle of the tandem axle assembly.
b = Combined dimension is 19.4 ft and articulating section is 4 ft wide.
c = Combined dimension is typically 10.0 ft.
d = Combined dimension is typically 10.0 ft.
e = Combined dimension is typically 12.5 ft.
f = Dimensions are for a 150–200 hp tractor excluding any wagon length.
g = To obtain the total length of tractor and one wagon, add 18.5 ft to tractor length. Wagon length is measured from front of drawbar to rear of wagon, and drawbar is 6.5 ft long.

- WB_1, WB_2, and WB_4 are the effective vehicle wheelbases, or distances between axle groups, starting at the front and working towards the back of each unit.
- S is the distance from the rear effective axle to the hitch point or point of articulation.
- T is the distance from the hitch point or point of articulation measured back to the center of the next axle or center of tandem axle assembly.

Exhibit 2-1. Design Vehicle Dimensions (Continued)

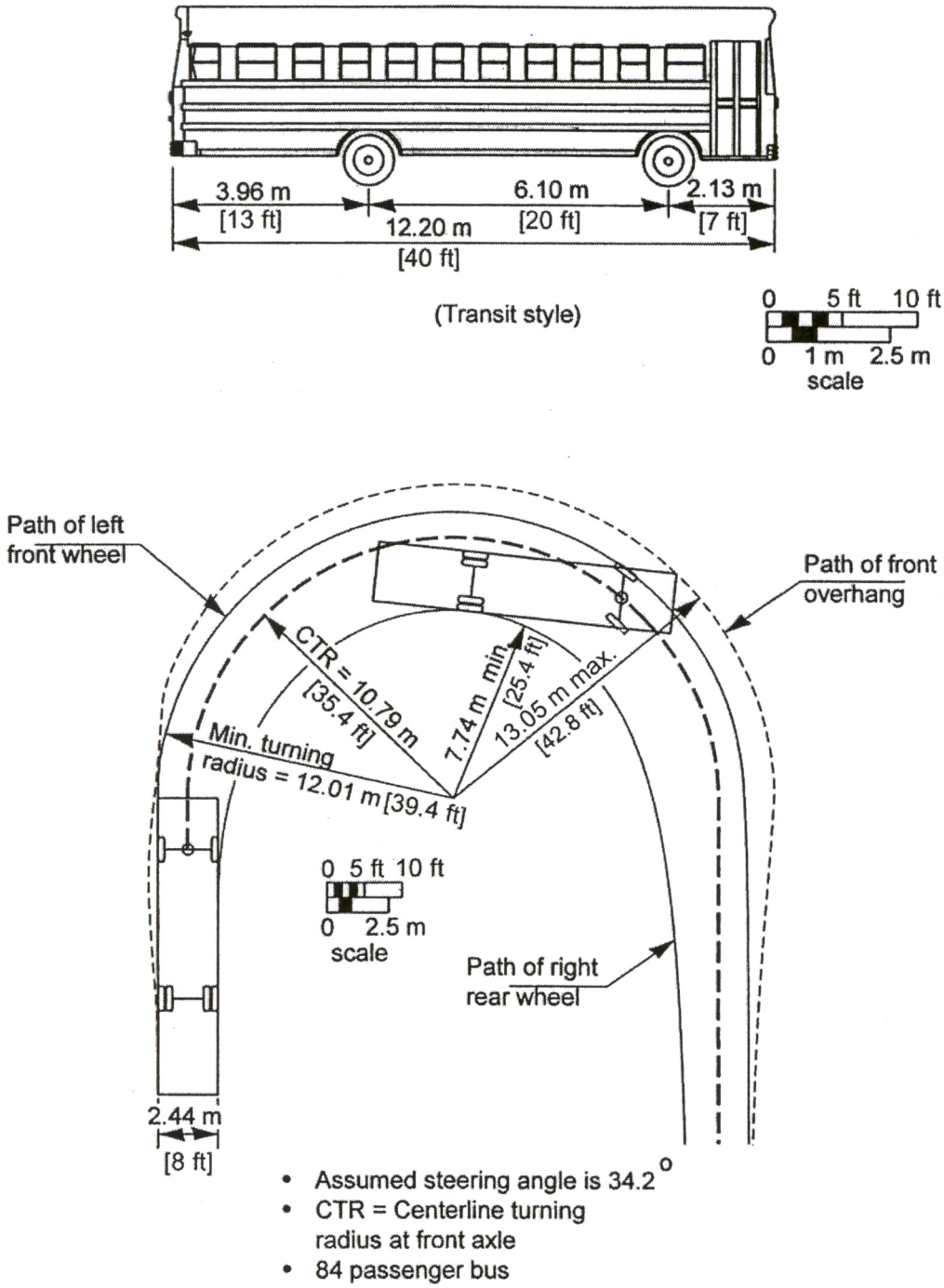


Exhibit 2-9. Minimum Turning Path for Large School Bus (S-BUS-12 [S-BUS-40]) Design Vehicle

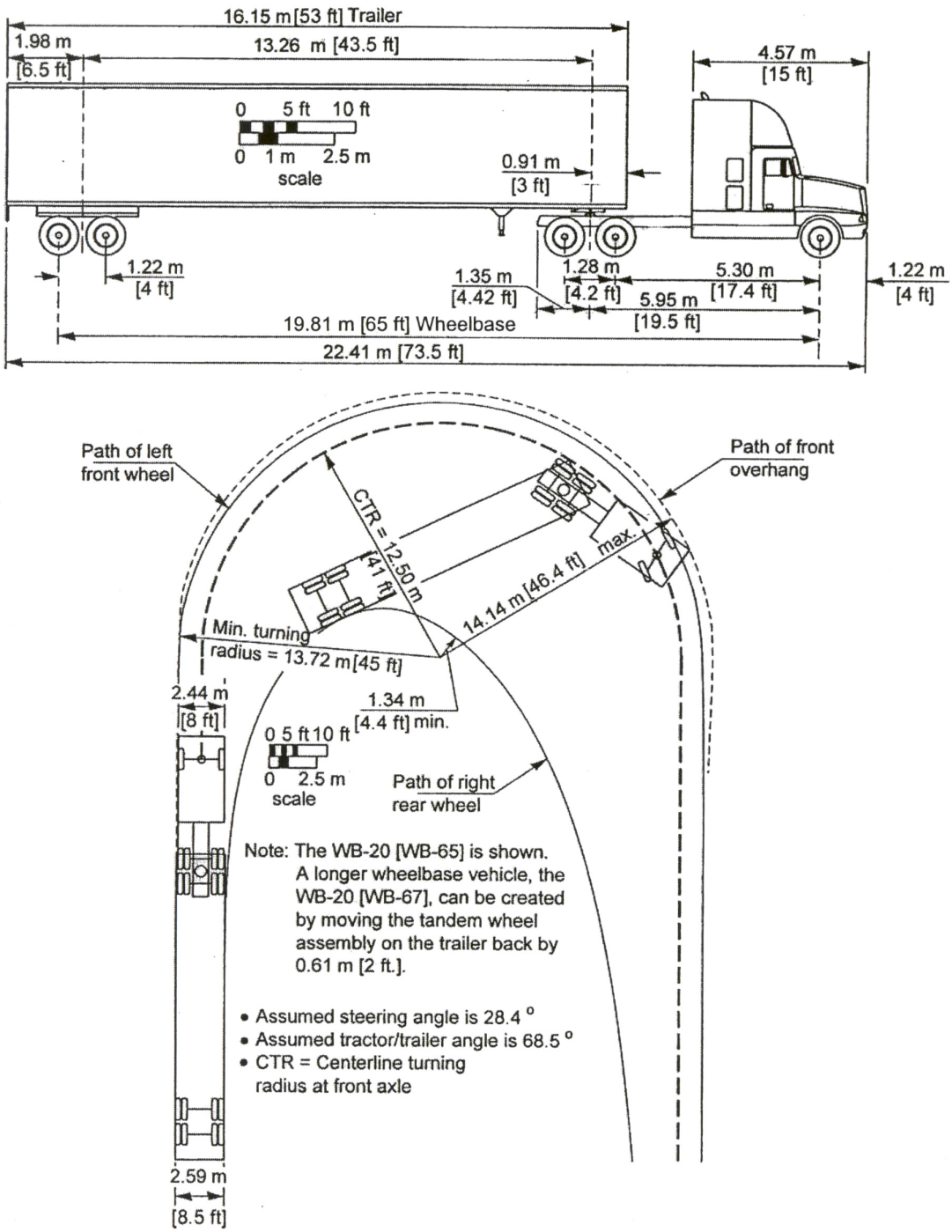


Exhibit 2-16. Minimum Turning Path for Interstate Semitrailer (WB-20 [WB-65 and WB-67]) Design Vehicle

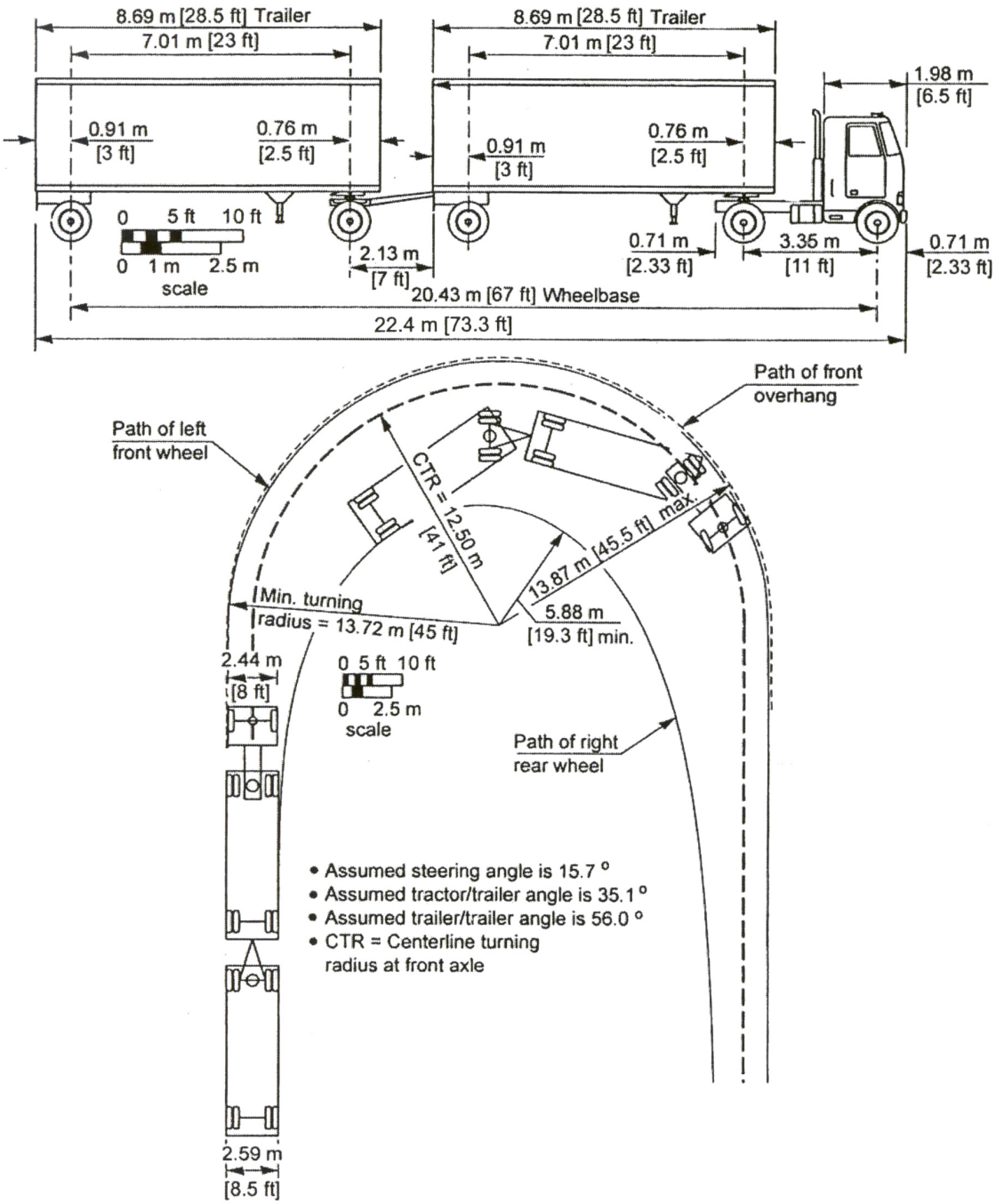


Exhibit 2-17. Minimum Turning Path for Double-Trailer Combination (WB-20D [WB-67D]) Design Vehicle

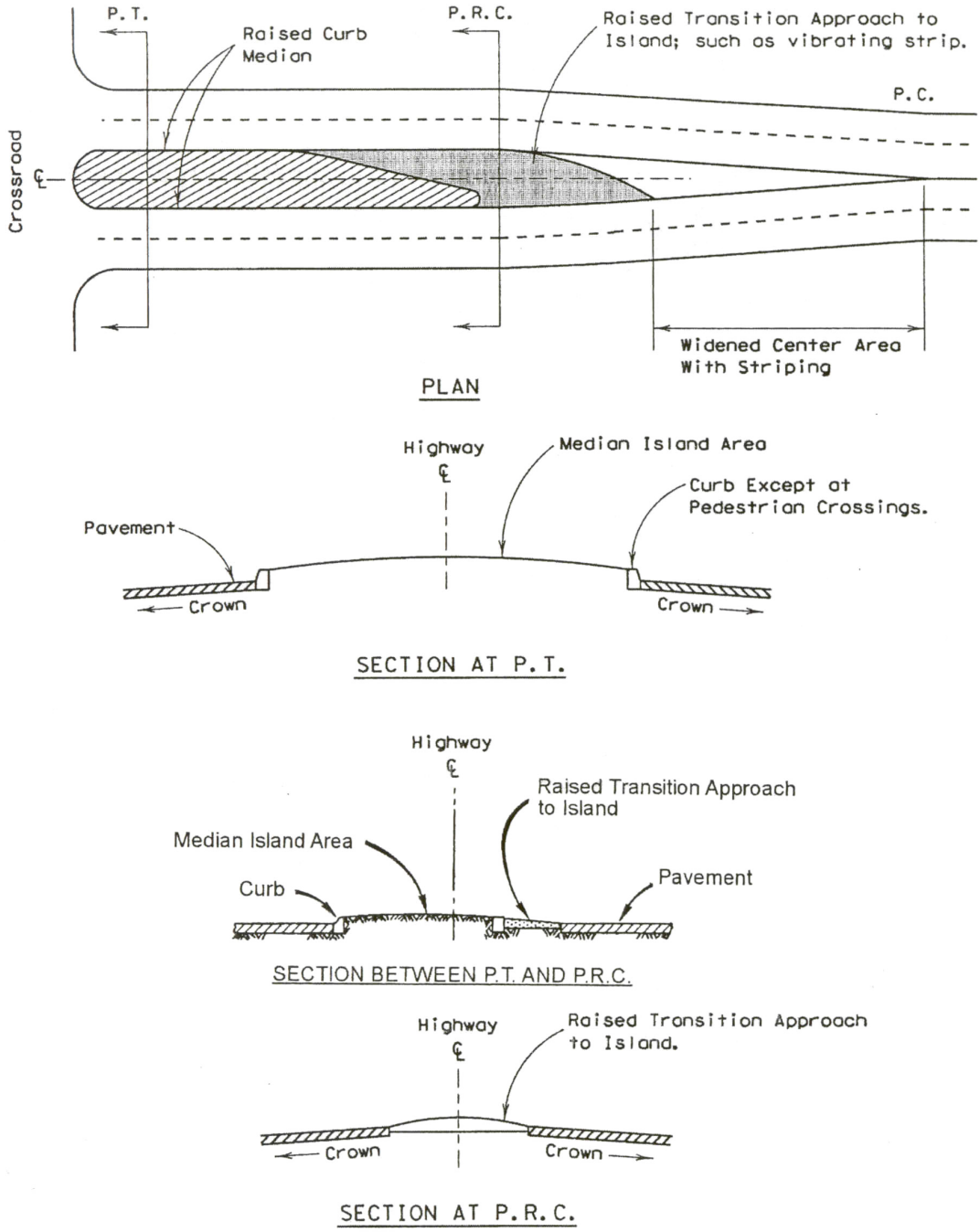
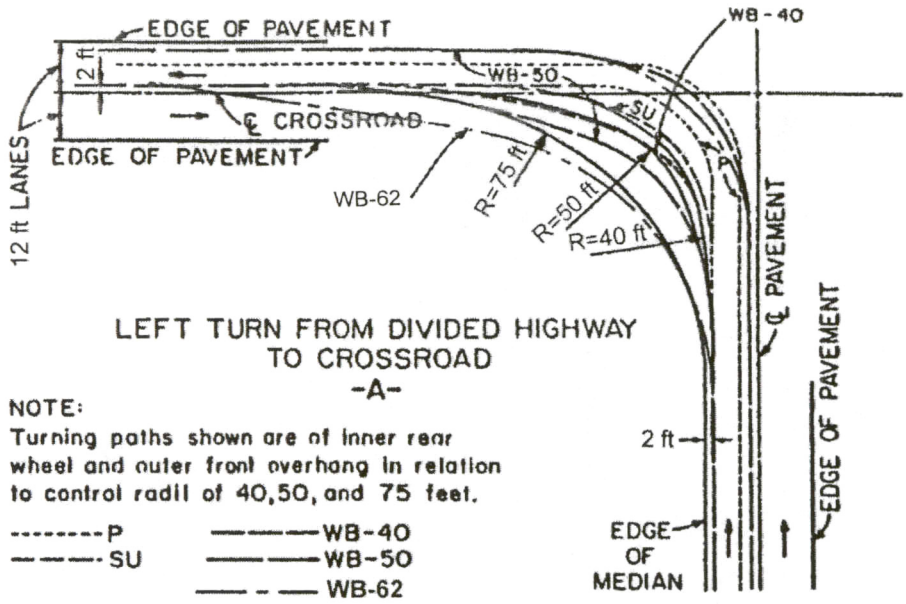
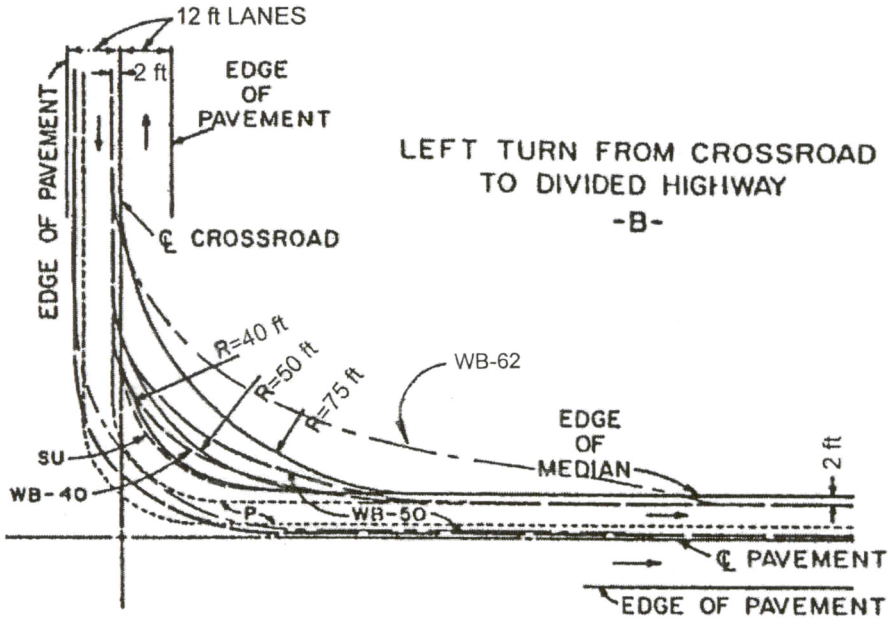


Exhibit 9-40. Details of Divisional Island Design





US Customary

Exhibit 9-76. Control Radii at Intersections for 90-Degree Left Turns (Continued)

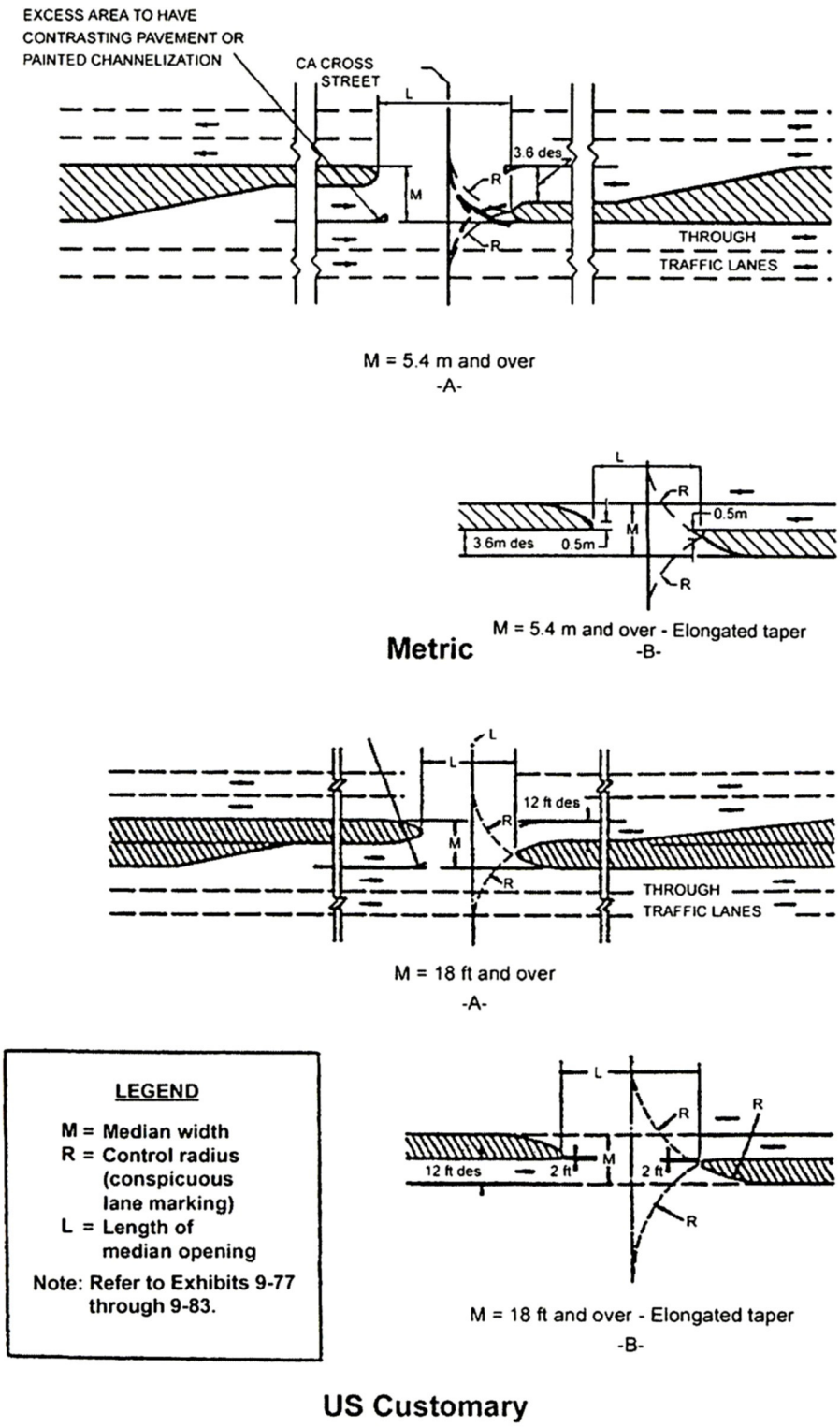


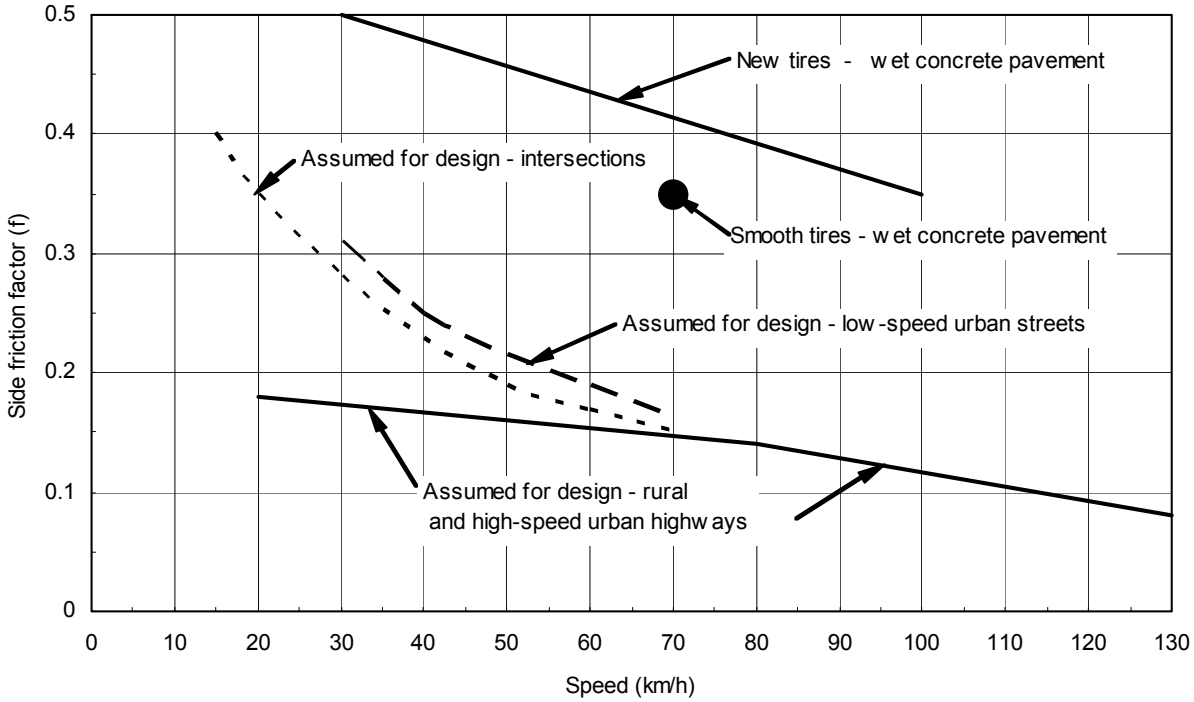
Exhibit 9-97. Median Left-Turn Design for Median Width in Excess of 5.4 m [18 ft]

Revisions posted after the July 2003 meeting of the Task Force on Geometric Design (to be incorporated into both the first and second printings of *A Policy on Geometric Design of Highways and Streets,* 4th Edition, 2001)

Page	Exhibit	Existing Text	Correction Made
137	3-11	The line labeled "Assumed for design—rural and high-speed urban highways" was plotted with incorrect values.	Revised Exhibit 3-11. See attached.
188		The sentence that begins on the 4th line of the 1st paragraph reads "For an approximate guide, however, the minimum vertical curve length in meters [feet] can be used as numerically equal to the design speed in kilometers per hour [equal to the design speed in miles per hour]."	Revised the sentence to read "For an approximate guide, however, the minimum vertical curve length in meters [feet] can be used as numerically equal to 0.2 times the design speed in kilometers per hour [equal to the design speed in miles per hour]."
400		In the section on Alleys, the last sentence of 3rd paragraph reads "less than 2 percent."	Revised the value to 0.2 percent.
589–590	9-19	In both the Metric and the US Customary tables, the tapers are missing for the first three vehicles for the 105- and 120-degree turns.	Revised the tables to show that the tapers for 105-degree turns should be 8:1, 10:1, and 10:1 for P, SU, and WB-12 (WB-40), respectively, and that the tapers for 120-degree turns should be 10:1, 10:1, and 8:1 for P, SU, and WB-12 (WB-40), respectively. See attached.
631		The first sentence of the second paragraph states that "Elongated or divisional islands should be not less that 1 m [4 ft] wide and . . ."	Changed "1 m" to "1.2 m."
718		Under Deceleration Length, the first paragraph contains incorrect values for deceleration lengths.	In the first paragraph under Deceleration Length, replace the text from the colon to end of sentence with the following: for design speeds of 50, 60, 70, 80, and 90 km/h [30, 40, 45, 50, and 55 mph], the limiting deceleration lengths of auxiliary lane are 50, 70, 95, 120, and 150 m [170, 275, 340, 410, and 485 ft], respectively (15).

739	9-103	The definition of terms under the formulas contained errors and omissions.	The formulas at the top of Exhibit 9-103 should be identical to those on the previous page. Replaced all definitions of terms under the formulas with the definition of terms from page 738. See attached.
834		The paragraph numbered 3 refers to Exhibit 9-43.	Revised the reference to Exhibit 9-44.
842		The second bullet contained errors in the 6th and 8th lines.	Revised “6.6 m [22 ft]” to “6.4 m [21 ft] in the 6th line. Revised “4.8 m [16 ft]” to “4.8 m [15 ft]” in the 8th line.

METRIC



US CUSTOMARY

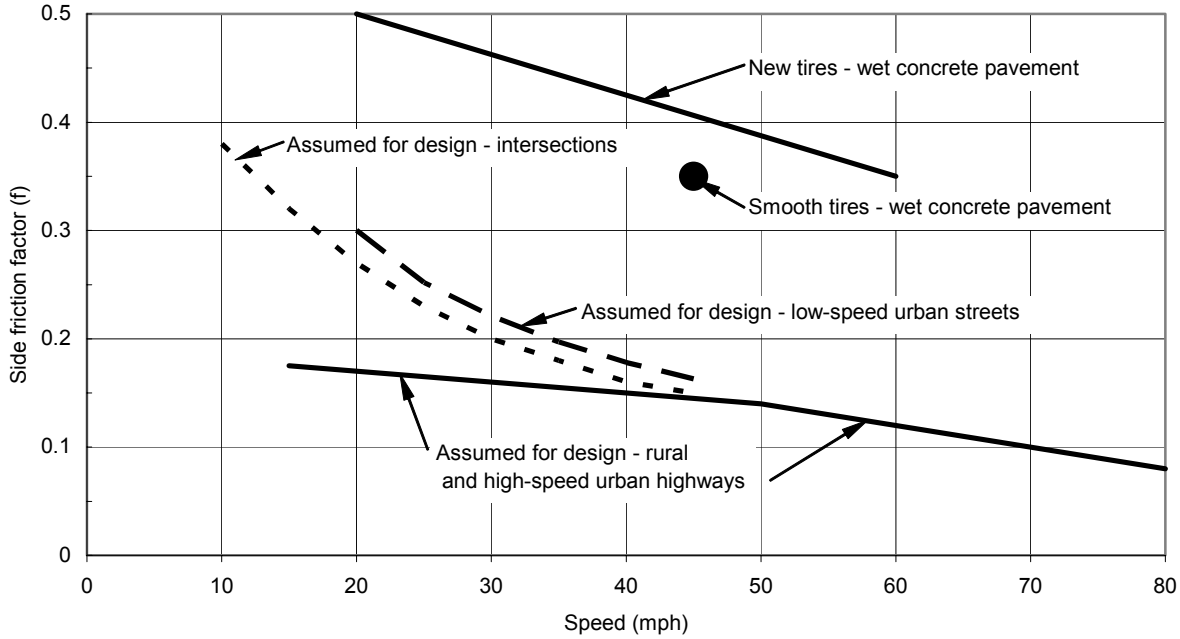


Exhibit 3-11. Comparison of Side Friction Factors Assumed for Design of Different Types of Facilities

Metric						US Customary					
Angle of turn (degrees)	Design vehicle	Simple curve radius (m)	Simple curve radius with taper			Angle of turn (degrees)	Design vehicle	Simple curve radius (ft)	Simple curve radius with taper		
			Radius (m)	Offset (m)	Taper H:V				Radius (ft)	Offset (ft)	Taper H:V
75	P	11	8	0.6	10:1	75	P	35	25	2.0	10:1
	SU	17	14	0.6	10:1		SU	55	45	2.0	10:1
	WB-12	–	18	0.6	15:1		WB-40	–	60	2.0	15:1
	WB-15	–	20	1.0	15:1		WB-50	–	65	3.0	15:1
	WB-19	–	43	1.2	20:1		WB-62	–	145	4.0	20:1
	WB-20	–	43	1.3	20:1		WB-67	–	145	4.5	20:1
	WB-30T	–	26	1.0	15:1		WB-100T	–	85	3.0	15:1
	WB-33D	–	42	1.7	20:1		WB-109D	–	140	5.5	20:1
90	P	9	6	0.8	10:1	90	P	30	20	2.5	10:1
	SU	15	12	0.6	10:1		SU	50	40	2.0	10:1
	WB-12	–	14	1.2	10:1		WB-40	–	45	4.0	10:1
	WB-15	–	18	1.2	15:1		WB-50	–	60	4.0	15:1
	WB-19	–	36	1.3	30:1		WB-62	–	120	4.5	30:1
	WB-20	–	37	1.3	30:1		WB-67	–	125	4.5	30:1
	WB-30T	–	25	0.8	15:1		WB-100T	–	85	2.5	15:1
	WB-33D	–	35	0.9	15:1		WB-109D	–	115	2.9	15:1
105	P	–	6	0.8	8:1	105	P	–	20	2.5	8:1
	SU	–	11	1.0	10:1		SU	–	35	3.0	10:1
	WB-12	–	12	1.2	10:1		WB-40	–	40	4.0	10:1
	WB-15	–	17	1.2	15:1		WB-50	–	55	4.0	15:1
	WB-19	–	35	1.0	15:1		WB-62	–	115	3.0	15:1
	WB-20	–	35	1.0	15:1		WB-67	–	115	3.0	15:1
	WB-30T	–	22	1.0	15:1		WB-100T	–	75	3.0	15:1
	WB-33D	–	28	2.8	20:1		WB-109D	–	90	9.2	20:1

Exhibit 9–19. Edge-of-Traveled-Way Designs for Turns at Intersections (Continued)

Metric						US Customary					
Angle of turn (degrees)	Design vehicle	Simple curve radius (m)	Simple curve radius with taper			Angle of turn (degrees)	Design vehicle	Simple curve radius (ft)	Simple curve radius with taper		
			Radius (m)	Offset (m)	Taper H:V				Radius (ft)	Offset (ft)	Taper H:V
120	P	–	6	0.6	10:1	120	P	–	20	2.0	10:1
	SU	–	9	1.0	10:1		SU	–	30	3.0	10:1
	WB-12	–	11	1.5	8:1		WB-40	–	35	5.0	8:1
	WB-15	–	14	1.2	15:1		WB-50	–	45	4.0	15:1
	WB-19	–	30	1.5	15:1		WB-62	–	100	5.0	15:1
	WB-20	–	31	1.6	15:1		WB-67	–	105	5.2	15:1
	WB-30T	–	20	1.1	15:1		WB-100T	–	65	3.5	15:1
	WB-33D	–	26	2.8	20:1		WB-109D	–	85	9.2	20:1
135	P	–	6	0.5	10:1	135	P	–	20	1.5	10:1
	SU	–	9	1.2	10:1		SU	–	30	4.0	10:1
	WB-12	–	9	2.5	15:1		WB-40	–	30	8.0	15:1
	WB-15	–	12	2.0	15:1		WB-50	–	40	6.0	15:1
	WB-19	–	24	1.5	20:1		WB-62	–	80	5.0	20:1
	WB-20	–	25	1.6	20:1		WB-67	–	85	5.2	20:1
	WB-30T	–	19	1.7	15:1		WB-100T	–	65	5.5	15:1
	WB-33D	–	25	2.6	20:1		WB-109D	–	85	8.5	20:1
150	P	–	6	0.6	10:1	150	P	–	18	2.0	10:1
	SU	–	9	1.2	8:1		SU	–	30	4.0	8:1
	WB-12	–	9	2.0	8:1		WB-40	–	30	6.0	8:1
	WB-15	–	11	2.1	6:1		WB-50	–	35	7.0	6:1
	WB-19	–	18	3.0	10:1		WB-62	–	60	10.0	10:1
	WB-20	–	19	3.1	10:1		WB-67	–	65	10.2	10:1
	WB-30T	–	19	2.2	10:1		WB-100T	–	65	7.3	10:1
	WB-33D	–	20	4.6	10:1		WB-109D	–	65	15.1	10:1

Exhibit 9–19. Edge-of-Traveled-Way Designs for Turns at Intersections (Continued)

Metric

$$d_H = AV_v t + \frac{BV_v^2}{a} + D + d_e$$

$$d_T = \frac{V_T}{V_V}\left[(A)V_v\, t + \frac{BV_v^2}{a} + 2D + L + W\right]$$

where:

A	=	constant = 0.278
B	=	constant = 0.039
d_H	=	sight-distance leg along the highway allows a vehicle proceeding to speed V_v to cross tracks even though a train is observed at a distance d_T from the crossing or to stop the vehicle without encroachment of the crossing area (m)
d_T	=	sight-distance leg along the railroad tracks to permit the maneuvers described as for d_H (m)
V_v	=	speed of the vehicle (km/h)
V_T	=	speed of the train (km/h)
t	=	perception/reaction time, which is assumed to be 2.5 s (This is the same value used in Chapter 3 to determine the stopping sight distance.)
a	=	driver deceleration, which is assumed to be 3.4 m/s^2 (This is the same value used in Chapter 3 to determine stopping sight distance.)
D	=	distance from the stop line or front of the vehicle to the nearest rail, which is assumed to be 4.5 m
d_e	=	distance from the driver to the front of the vehicle, which is assumed to be 2.4 m
L	=	length of vehicle, which is assumed to be 20 m
W	=	distance between outer rails (for a single track, this value is 1.5 m)

Adjustments must be made for skewed crossings.
Assumed flat highway grades adjacent to and at crossings.

US Customary

$$d_H = AV_v t + \frac{BV_v^2}{a} + D + d_e$$

$$d_T = \frac{V_T}{V_V}\left[(A)V_v\, t + \frac{BV_v^2}{a} + 2D + L + W\right]$$

where:

A	=	constant = 1.47
B	=	constant = 1.075
d_H	=	sight-distance leg along the highway allows a vehicle proceeding to speed V_v to cross tracks even though a train is observed at a distance d_T from the crossing or to stop the vehicle without encroachment of the crossing area (ft)
d_T	=	sight-distance leg along the railroad tracks to permit the maneuvers described as for d_H (ft)
V_v	=	speed of the vehicle (mph)
V_T	=	speed of the train (mph)
t	=	perception/reaction time, which is assumed to be 2.5 s (This is the same value used in Chapter 3 to determine the stopping sight distance.)
a	=	driver deceleration, which is assumed to be 11.2 ft/s^2.. (This is the same value used in Chapter 3 to determine stopping sight distance.)
D	=	distance from the stop line or front of the vehicle to the nearest rail, which is assumed to be 15 ft
d_e	=	distance from the driver to the front of the vehicle, which is assumed to be 8 ft
L	=	length of vehicle, which is assumed to be 65 ft
W	=	distance between outer rails (for a single track, this value is 5 ft)

Adjustments must be made for skewed crossings.
Assumed flat highway grades adjacent to and at crossings.

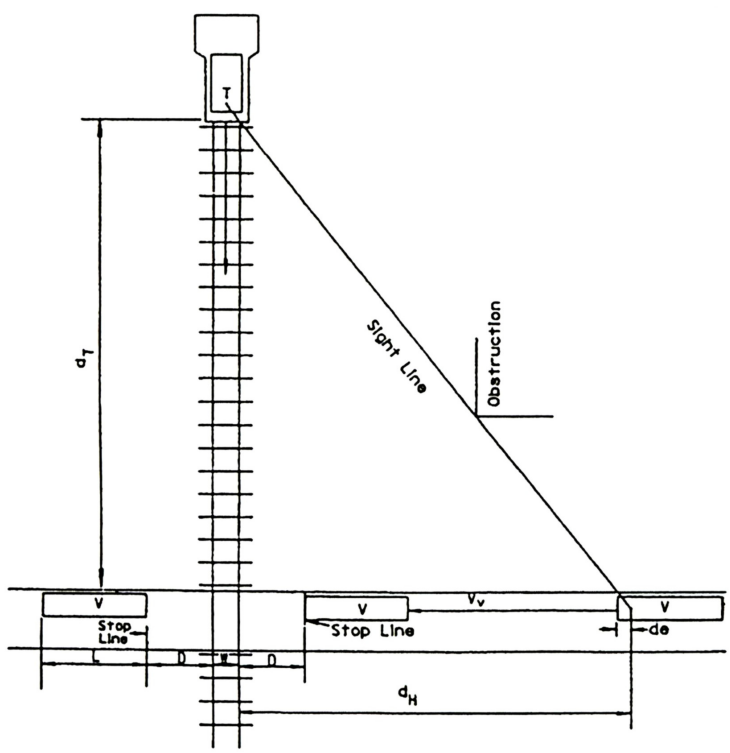


Exhibit 9-103. Case A: Moving Vehicle to Safely Cross or Stop at Railroad Crossing