Part C Quick Reference Guide

Photo: WSDOT

HSM1 Chapters 10-12, 18 (AASHTO 2010)

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Chapter 10: RURAL TWO-LANE TWO-WAY HIGHWAYS

Segments:

- Undivided rural two-lane, two-way roadway segments (2U)

Intersections

- Three-leg intersection with (Stop control on minor-road approaches) (3ST)
- Four-leg intersection with (Stop control on minor-road approaches) (4ST)
- Four-leg signalized intersection (4SG)

Chapter 11: RURAL MULTILANE HIGHWAYS

Segments

- Rural four-lane undivided segments (4U)
- Rural four-lane divided segments (4D)

Intersections

- Unsignalized
    - three-leg (Stop control on minor-road approaches) (3ST)
    - four-leg (Stop control on minor-road approaches) (4ST)
- Four-leg signalized intersection (4SG)

Chapter 12: URBAN AND SUBURBAN ARTERIALS

Segments

- Roadway Segments Two-lane undivided arterials (2U)
- Three-lane arterials including a center two-way left-turn lane (TWLTL) (3T)
- Four-lane undivided arterials (4U)
- Four-lane divided arterials (i.e., including a raised or depressed median) (4D)
- Five-lane arterials including a center TWLTL (5T)

Intersections

- Unsignalized
    - three-leg intersection (stop control on minor-road approaches) (3ST)
    - four-leg intersection (stop control on minor-road approaches) (4ST)
- Signalized
    - Three-leg intersections (3SG)
    - Four-leg intersection (4SG)

Frequently Used Acronyms

2U	Two-lane undivided roadway
3T	Three-lane roadway including a center two-way left-turn lane
4U	Four-lane undivided
4D	Four-lane divided roadways (for arterials it includes segments with a raised or depressed median)
5T	Five-lane roadways (for arterials it includes segments with a center TWLTL
3ST	3-leg STOP control (stop control on minor approach)
4ST	4-leg STOP control (stop control on minor approach)
3SG	3-leg signalized intersection
4SG	4-leg signalized intersection
SPF	Safety Performance Function
CMF	Crash Modification Factor
C	Calibration Factor
RLR	Red-light running
LTL	Left-turn lane
RTL	Right-turn lane
RHR	Roadside Hazard Rating
RTOR	Right-turn on red
TWLTL	Two-way left-turn lane
vpd	Vehicles Per Day

CHAPTER 10 – RURAL Two-Way Two-Lane Highway Segments

Base Conditions	SPFs	Crash Modification Factors			Notes
Undivided rural two-lane, two-way road segment (2U) (p. 10-14 & 10-15) • Lane width: **12-ft** • Shoulder width: **6-ft** • Shoulder type: **Paved** • Horizontal curvature: **None** • Vertical curvature: **None** • Vertical grade: **Level** (-3% to 3%) • Driveway density: **5 driveways/mi**[1] • Centerline rumble strips; **None** • Passing lanes: **None** • Two-way left-turn lanes: **None** • Roadside Hazard Rating (RHR) = **3** • Lighting: **None** • Automated speed enforcement: **None**	Eq 10-6 (p.10-15)[2] AADT Range 0 to 17,800 vpd. (p.10-15) Overdispersion parameter: Eq. 10-7 (p.10-16) Default Crash type and severity distribution: Table 10-4 (p. 10-17)	CMF_{1r}	Lane Width (p. 10-23 to 10-25)	Table 10-8 (p.10-24)[3] Eq. 10-11 (p. 10-24)	Guidance on traffic volume estimation: p.10-15 Default distributions of **collision type** and **crash severity** for rural two-lane, two-way roadway segments Table 10-4 (p.10-17)
		CMF_{2r}	Shoulder Width and Type (p. 10-25 to 10-27)	Shoulder width: Table 10-9 (p.10-25)[4] Shoulder type: Table 10-10 (p. 10-26) Width and Type: Eq. 10-12 (p. 10-27)	
		CMF_{3r}	Horizontal Curves: Length, Radius, and Presence or Absence of Spiral Transitions (p. 10-27)	Eq. 10-13 (p. 10-27) (set CMF to 1 if CMF_{3r} less than 1)	
		CMF_{4r}	Horizontal Curves: Superelevation (Different than AASHTO Green Book) (p. 10-28)	SV < 0.01 (Eq. 10-14 (p. 10-28)) 0.01 ≤ SV < 0.02 (Eq. 10-15 (p. 10-28)) SV ≥ 0.02 (Eq. 10-16 (p. 10-28)) NOTE: SV = superelevation variance Difference between AASHTO superelevation value and actual superelevation (p.10-28)	
		CMF_{5r}	Grades (p. 10-28)	Table 10-11 (p. 10-28)	
		CMF_{6r}	Driveway Density (p. 10-28 to 10-29) ≤ 5 driveways per mile = CMF of 1.00	Eq. 10-17 (p. 10-28)	
		CMF_{7r}	Centerline Rumble Strips (p. 10-29)	See p.10-29	
		CMF_{8r}	Passing Lanes (p. 10-29)	See p.10-29	
		CMF_{9r}	Two-Way Left-Turn Lanes (p. 10-29 to 10-30)	Eq. 10-18 (p. 10-30) Proportion of driveway related crashes Eq. 10-19 (p. 10-30)	
		CMF_{10r}	Roadside Hazard Rating (RHR) (Roadside Design) (p. 10-30) (p. 13-59 to 13-63); Definitions: Table 13-25 (p. 13-15)	Eq. 10-20 (p. 10-30) See Chapter 13: (p.13-25 to 13-26; and 13-59 to 13-63).	
		CMF_{11r}	Lighting (p. 10-30 to 10-31)	Eq. 10-21 (p. 10-31) Table 10-12 (p. 10-31)	
		CMF_{12r}	Automated Speed Enforcement (p.10-31)	CMF = 0.93 All Crash Types	

[1] p.10-13: "for very short segment lengths (less than 0.5-mi)" facility or longer representative driveway density would be recommended to reduce the likelihood of using an "inflated value".
[2] Fig. 10-3 (p.10-16)
[3] Fig. 10-7 (p. 10-24)
[4] Fig. 10-8 (p. 10-26)

CHAPTER 10 – RURAL Two-Way Two-Lane Highway Intersections

Base Conditions	SPFs	Crash Modification Factors		
• Intersection skew angle: **0°** (See Fig. 14-5) • Left-turn lanes on mainline approaches: **None** (without stop control) • Right-turn lanes on mainline approaches: **None** (without stop control) • Lighting: **None**	***3ST***[5] - Eq 10-8 (p.10-18)[6] Overdispersion parameter "k" = 0.54 (p.10-18) AADT ranges: (p.10-18) • $AADT_{maj}$ 0 to 19,500 vpd • $AADT_{min}$ 0 to 4,300 vpd. ***4ST***[7] - Eq 10-9 (p.10-19)[8] Overdispersion parameter "k" = 0.24 (p.10-19) AADT ranges: (p.10-19) • $AADT_{maj}$ 0 to 14,700 vpd • $AADT_{min}$ 0 to 3,500 vpd. ***4SG***[9]- Eq 10-10 (p.10-20)[10] Overdispersion parameter "k"= 0.11 (p.10-20) AADT ranges: (p.10-20) • $AADT_{maj}$ 0 to 25,200 vpd • $AADT_{min}$ 0 to 12,500 vpd.	CMF_{1i}	Intersection Skew Angle (p. 10-31 & 10-32) See Fig. 14-5	3ST – Eq. 10-22 (p. 10-31) 4ST – Eq. 10-23 (p. 10-32) 4SG – CMF = 1.00 (p. 10-32)
		CMF_{2i}	Intersection Left-Turn Lanes (p. 10-32)	Table 10-13 (p. 10-32)
		CMF_{3i}	Intersection Right-Turn Lanes (p. 10-32 & 10-33)	Table 10-14 (p. 10-33)
		CMF_{4i}	Lighting (p. 10-33)	Eq. 10-24 (p. 10-33) Table 10-15 (p. 10-33)

[5] 3ST – 3-leg STOP controlled intersection with STOP control on the minor approach
[6] Fig. 10-4 (p.10-19)
[7] 4-leg STOP controlled intersection with STOP control on the minor approach
[8] Fig. 10-5 (p.10-20)
[9] 4SG – 4-leg signalized intersection
[10] Fig. 10-6 (p.10-21)

CHAPTER 11 – Rural Multilane Highway Segments

<table>
<tr><th>Element</th><th>Base Conditions</th><th>SPFs</th><th>Crash Modification Factors</th></tr>
<tr>
<td>Undivided
rural four-lane roadway segments</td>
<td>Base Conditions: (p. 11-14)
• Lane width: 12-ft
• Shoulder width: 6-ft
• Shoulder type: Paved\
• Sideslopes: 1V:7H or flatter
• Lighting: None
• Automated speed enforcement: None</td>
<td>Undivided SPF: Eq. 11-7 (p. 11-15)[11]
Coefficients in Table 11-3 (p. 11-15)

Overdispersion parameter “k”
Eq. 11-8 (p.11-15)
Parameter “c” in Table 11-3 (p. 11-15)

Default Collision Type and Crash Severity distribution
Table 11-4 (p. 11-17)

AADT range
0 to 33,200 vpd (p. 11-15)</td>
<td>
<table>
<tr><th>CMF</th><th>CMF Description</th><th>CMF Equations and Tables</th></tr>
<tr><td>CMF_{1ru}</td><td>Lane width
(p. 11-26 to 11-27)</td><td>Eq. 11-13 (p. 11-26)
Table 11-11 (p. 11-26)[11]</td></tr>
<tr><td>CMF_{2ru}</td><td>Shoulder width and shoulder type
(p. 11-27 to 11-28)</td><td>Eq. 11-14 (p. 11-27)
Width - Table 11-12 (p. 11-27)[12]
Type - Table 11-13 (p. 11-28)</td></tr>
<tr><td>CMF_{3ru}</td><td>Sideslopes (p. 11-28)</td><td>Table 11-14 (p. 11-28)</td></tr>
<tr><td>CMF_{4ru}</td><td>Lighting (p. 11-28 to 11-29)</td><td>Eq. 11-15 (p. 11-28)
Table 11-15 (p. 11-29)</td></tr>
<tr><td>CMF_{5ru}</td><td>Automated speed enforcement
(p. 11-29)</td><td>See text (p. 11-29)
CMF = 0.83 All Crash Types</td></tr>
</table>
</td>
</tr>
<tr>
<td>Divided
roadway segments</td>
<td>Base Conditions: (p. 11-17)
• Lane width: 12-ft
• Right shoulder width 8-ft
• Median width 30-ft
• Lighting: None
• Automated speed enforcement: None</td>
<td>Divided SPF: Eq. 11-9 (p.11-18)[13]
with parameters in
Table 11-5 (p.11-18)

Overdispersion parameter: “k”
Eq. 11-10 (p.11-18)
Parameter “c” in Table 11-5 (p. 11-18)

Default Collision Type and Crash Severity distribution
Table 11-6 (p.11-20)

AADT range
0 to 89,300 vpd (p. 11-18)</td>
<td>
<table>
<tr><th>CMF</th><th>CMF Description</th><th>CMF Equations and Tables</th></tr>
<tr><td>CMF_{1rd}</td><td>Lane width (p. 11-29 to 11-30)</td><td>Eq. 11-16 (p. 11-29)
Table 11-16 (p. 11-30)[14]</td></tr>
<tr><td>CMF_{2rd}</td><td>Right shoulder width (p. 11-30 to 11-31)</td><td>Table 11-17 (p. 11-31)</td></tr>
<tr><td>CMF_{3rd}</td><td>Median width (p. 11-31)</td><td>Table 11-18 (p. 11-31)</td></tr>
<tr><td>CMF_{4rd}</td><td>Lighting (p. 11-31 to 11-32)</td><td>Eq. 11-17 (p. 11-31)
Table 11-19 (p. 11-32)</td></tr>
<tr><td>CMF_{5rd}</td><td>Automated speed enforcement
(p. 11-32)</td><td>See text (p. 11-32)</td></tr>
</table>
</td>
</tr>
</table>

[11] Fig. 11-3 (p.11-16)
[11] Fig. 11-8 (p. 11-27)
[12] Fig. 11-9 (p. 11-28)
[13] Fig. 11-4 (p. 11-19)
[14] Fig. 11-10 (p. 11-30)

CHAPTER 11 – Rural Multilane Highway Intersections

<table>
<tr><th>Element</th><th>Base Conditions</th><th>SPFs</th><th>Crash Modification Factors</th></tr>
<tr>
<td>Three-leg stop-controlled intersection (3ST)

Four-leg stop-controlled intersections (4ST)</td>
<td>Base Conditions for 3ST & 4ST
• Intersection skew angle: 0°
• Intersection left-turn lanes: None, except on stop-controlled approaches
• Intersection right-turn lanes: None, except on stop-controlled approaches
• Lighting: None</td>
<td>3ST SPF: Eq. 11-11 (p.11-21):
• Coefficients and overdispersion parameter “k” Table 11-7 (p.11-22) [15]
• Crash type and severity distributions Table 11-9 (p. 11-24)
• AADT ranges
o AADTmaj 0 to 78,300 vpd
o AADTmin 0 to 23,000 vpd
Eq. 11-12 (p. 11-21) not recommended

4ST SPF: Eq. 11-11 (p.11-21):
• Coefficients a, b, & c and overdispersion parameter “k” Table 11-7 (p.11-22) [16]
• Crash type and severity distributions Table 11-9 (p. 11-24)
• AADT ranges
o AADTmaj 0 to 78,300 vp
o AADTmin 0 to 7,400 vpd
Eq. 11-12 (p. 11-21) not recommended</td>
<td>
<table>
<tr><th>CMF</th><th>CMF Description</th><th>CMF Equations and Tables</th></tr>
<tr><td>CMF_{1i}</td><td>Intersection Angle (discussion on p. 11-33 to 11-34) (sketch p. 11-33)</td><td>3ST:
• All crashes Eq. 11-18 (p. 11-33)
• Fatal & Injury Eq. 11-19 (p. 11-33)
4ST:
• All crashes Eq. 11-20 (p. 11-34)
• Fatal & Injury Eq. 11-21 (p. 11-34)</td></tr>
<tr><td>CMF_{2i}</td><td>Left-Turn Lane on Major Road (p.11-34)</td><td>Table 11-22 (p.11-34)</td></tr>
<tr><td>CMF_{3i}</td><td>Right-Turn Lane on Major Road (p.11-34 and 11-35)</td><td>Table 11-23 (p.11-35)</td></tr>
<tr><td>CMF_{4i}</td><td>Lighting (p.11-35)</td><td>Eq. 11-22 (p.11-35)
Table 11-24 (p.11-35)</td></tr>
</table>
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</tr>
<tr>
<td>Four-leg signalized intersections (4SG)

There is no signalized Three-leg intersection model</td>
<td>There are no base conditions for a 4SG intersection because there are no CMFs available for 4SG intersections.</td>
<td>4SG SPF: Eq. 11-11 (p.11-21):
• Coefficients and overdispersion parameter “k” Table 11-8 (p.11-22) [17]
• Crash type and severity distributions Table 11-9 (p. 11-24)

Eq. 11-12 (p.11-21) not recommended

AADT ranges:
• AADTmaj 0 to 43,500 vpd
• AADTmin 0 to 18,500 vpd</td>
<td>No CMFs are available</td>
</tr>
</table>

[15] Fig. 11-5 (p. 11-22)
[16] Fig. 11-6 (p. 11-23)
[17] Fig. 11-5 (p. 11-22)

CHAPTER 12 – Urban and Suburban Arterial Segments

Project element	Collision Types	Base Conditions	SPFs	Crash Modification Factors			Special Notes
Roadway segment types (p. 12-17) and AADT Ranges (p. 12-17 & 12-18) 2-lane Undivided **(2U)** AADT range 0 to 32,600 vpd 3-lane with Two-way left-turn lane (TWLTL) **(3T)** AADT range 0 to 32,900 vpd 4-lane Undivided **(4U)** AADT range 0 to 40,100 vpd 4-lane Divided **(4D)** AADT range 0 to 66,000 vpd 5-lane with center Two-way left-turn lane (TWLTL) **(5T)** AADT range 0 to 53,800 vpd	multiple-vehicle non-driveway collisions	• On-street parking: **None** • Roadside fixed objects: **None** • Median width (divided facilities): **15-ft** • Lighting: **None** • Automated speed enforcement: **None**	**(Total)** Eq. 12-10 (p. 12-18)[18] Coefficients & "k" Table 12-3 (p. 12-19) **(FI)** Eq. 12-11 (p. 12-20) **(PDO)** Eq. 12-12 (p. 12-20) Table 12-4 (p. 12-20)	CMF_{1r}	On-Street Parking (p. 12-40)	Eq. 12-32 (p. 12-40) Table 12-19 (p. 12-40)	
				CMF_{2r}	Roadside Fixed Objects (p.12-40 and 12-41)	Eq. 12-33 (p. 12-40) Fixed object offset factor Table 12-20 (p. 12-41) Proportion of fixed-object crashes) Table 12-21 (p. 12-41)	
	multiple-vehicle driveway-related collisions		**(Total)** Eq 12-16 (p. 12-22)[19] Coefficients & "k" Table 12-7 (p. 12-24) **(FI)** Eq 12-17 (p. 12-27) **(PDO)** Eq 12-18 (p. 12-27)	CMF_{3r}	Median Width (p. 12-41 to 12-42)	Table 12-22 (p. 12-42)	• Driveway types and definitions (in paragraph). (p. 12-23) • Only unsignalized driveways are counted. Signalized driveways are analyzed as signalized intersections. (p. 12-22) • "Commercial sites with no restriction on access along an entire property frontage are generally counted as two driveways." (p. 12-23)
				CMF_{4r}	Lighting (p. 12-42)	Eq. 12-34 (p. 12-42) Table 12-23 (p. 12-42)	
				CMF_{5r}	Automated Speed Enforcement (p. 12-43)	Discussion on p.12-43	
	single-vehicle crashes		**(Total)**Eq. 12-13 (p. 12-20)[20] Coefficients & "k" Table 12-5 (p. 12-21) **(FI)** Eq. 12-14 (p. 12-21) **(PDO)** Eq. 12-15 (p. 12-21) Table 12-6 (p. 12-22)				
	vehicle-pedestrian collisions		Vehicle-Pedestrian SPF: Eq. 12-19 (p. 12-27) Table 12-8 (p. 12-27)				"All vehicle-pedestrian collisions are considered to be fatal-and-injury crashes." (p. 12-27)
	vehicle-bicycle collisions		Vehicle-Bicycle SPF: Eq. 12-20 (p. 12-27) Table 12-9 (p. 12-28)				

LT = left-turn lane; RT = right-turn lane; RLR = red-light running; RTOR = right turn on red

[18] Fig. 12-3 (p. 12-19)
[19] Fig 12-5 (p. 12-24), Fig 12-6 (p. 12-25), Fig 12-7 (p. 12-25), Fig 12-8 (p. 12-26). Fig 12-9 (p. 12-26)
[20] Fig 12-4 (p. 12-22)

CHAPTER 12 – Urban and Suburban Arterial Intersections

Project element	Collision Types	Base Conditions	SPFs	Crash Modification Factors			Special Notes
Intersections (p. 12-28) and AADT ranges (p. 12-29) Three-leg Stop controlled **(3ST)**: AADT ranges AADT$_{maj}$: 0 to 45,700 vpd AADT$_{min}$: 0 to 9,300 vpd Four-leg Stop controlled **(4ST)**: AADT ranges AADT$_{maj}$: 0 to 46,800 vpd AADT$_{min}$: 0 to 5,900 vpd Three-leg Signal controlled **(3SG)**: AADT ranges AADT$_{maj}$: 0 to 58,100 vpd AADT$_{min}$: 0 to 16,400 vpd Four-leg Signal controlled **(4SG)**: AADT ranges AADT$_{maj}$: 0 to 67,700 vpd AADT$_{min}$: 0 to 33,400 vpd **4SG** Pedestrian models (p. 12-29) AADT ranges • AADT$_{maj}$: 80,200 vpd • AADT$_{min}$: 49,100 vpd • PedVol: 34,200 pedestrians/day crossing all 4 legs combined	Multiple-Vehicle Collisions	Vehicle Crashes at signalized and non-signalized intersections • Left-Turn lanes on approaches: **None** (p.12-43)Left-Turn signal phasing: **Permissive** (p. 12-43 to 12-44) • Right-Turn lanes on approaches: **None** (p. 12-44) • Right-Turn On Red (RTOR): **Permitted** (p. 12-44) • Lighting: **None** (12-45) • RLR cameras: **None** (p. 12-45 to 12-46) Vehicle-pedestrian collisions at signalized intersections • Bus stops (within 1000-ft of intersection): **None** (p.12-46) • Schools (within 1000-ft of intersection): **None** (p.12-46) • Alcohol sales establishments (within 1000-ft of intersection): **None** (p.12-47)	**(Total)** Eq.12-21[21] (p.12-29) • Coefficients a, b, & c and overdispersion parameter "k" Table 12-10 (p.12-30) **(FI)** Eq. 12-22 (p.12-29) **(PDO)** Eq. 12-23 (p.12-29) Table 12-11 (p.12-32)	CMF$_{1i}$	Intersection Left-Turn Lanes (p. 12-43)	Table 12-24 (p.12-43)	
				CMF$_{2i}$	Intersection Left-Turn Signal Phasing (p.12-43 to 12-44) (CMF =1 for unsignalized intersections)	Table 12-25 (p.12-44)	
	Single vehicle crashes		**(Total)** Eq. 12-24[22] (p.12-32) • Coefficients a, b, & c and overdispersion parameter "k" Table 12-12 (p.12-33) **3SG** & **4SG** **(FI)** Eq. 12-25 (p.12-33) **(PDO)** Eq. 12-26 (p.12-33) **3ST** & **4ST** **(FI)** Eq. 12-27 (p.12-36) Crash Type Distribution Table 12-13 (p.12-36)	CMF$_{3i}$	Intersection Right-Turn Lanes (p. 12-44)	Table 12-26 (p.12-44)	
				CMF$_{4i}$	Right-Turn-on-Red (p. 12-44)	Eq. 12-35 (p.12-44)	
				CMF$_{5i}$	Lighting (p. 12-45)	Eq. 12-36 (p.12-45) Table 12-27 (p.12-45)	
				CMF$_{6i}$	Red-Light Cameras (p. 12-45 to 12-46)	Eq. 12-37 (p.12-45) Proportion of Right-angles Eq. 12-38 (p.12-45) Proportion of rear-ends Eq. 12-39 (p.12-45)	
	Vehicle-Pedestrian Collisions		*Signalized Intersections:* • Eqs. 12-28 and 12-29 (p.12-36) • Coefficients a, b, c, d, & e and overdispersion parameter "k" Table 12-14 (p. 12-37) *Stop-Controlled Intersections*: • Use Eq. 12-30 (p. 12-38) • Table 12-16 (p. 12-38)	CMF$_{1p}$	Bus Stops (within 1,000 ft.) (p. 12-46)	Table 12-28 (p.12-46)	Count or estimates of pedestrian crossing volumes based on general level of pedestrian activity with Table 12-15 (p. 12-37) for use with Eq. 12-29 (p. 12-36)
				CMF$_{2p}$	Schools (within 1,000 ft.) (p. 12-46)	Table 12-29 (p.12-46)	
				CMF$_{3p}$	Alcohol Sales Establishments (within 1,000 ft.) (p. 12-47)	Table 12-30 (p.12-47)	
	Vehicle-Bicycle Collisions		*Signals and Stop-Controlled:* Eq. 12-31 (p. 12-38) Table 12-17 (p.12-38)				

[21] Fig 12-10(p. 12-30), 12-11(p. 12-31), 12-12(p. 12-31), 12-13(p. 12-32)
[22] Fig 12-14 (p. 12-34), 12-15(p. 12-34), 12-16(p. 12-35), 12-17(p. 12-35)

Chapter 18: FREEWAYS

Safety Performance Functions (SPFs) for Freeway Segments - Section 18.6.1, Page 18-24

Applicable AADT Volume Ranges – Table 18-4, Page 18-24

Area Type	Cross Section (Number of through lanes) (x)	Applicable AADT Volume Range (vehicles/day)
Rural	4	0 to 73,000
	6	0 to 130,000
	8	0 to 190,000
Urban	4	0 to 110,000
	6	0 to 180,000
	8	0 to 270,000
	10	0 to 310,000

Multiple-Vehicle Crashes
- Base Conditions – Page 18-25
- Safety Performance Function (SPF) – Equations 18-15 AND 18-16, Page 18-25
  - Graphical Representation of SPFs – Page 18-26
- Regression Coefficients & Overdispersion Factor - Table 18-5, Page 18-26
- Overdispersion Parameter – Equation 18-17, Page 18-27
- Crash Type Distribution – Table 18-6, Page 18-27

Single-Vehicle Crashes
- Base Conditions – Page 18-27
- Safety Performance Function (SPF) – Equations 18-18 AND 18-16, Page 18-25
- Graphical Representation of SPFs – Page 18-28
- Regression Coefficients & Overdispersion Factor – Table 18-7, Page 18-28
- Overdispersion Parameter – Equation 18-19, Page 18-29
- Crash Type Distribution – Table 18-8, Page 18-29

Crash Modification Factors (CMFs) for Freeway Segments - Section 18.7.1, Page 18-35

Horizontal Curve – $CMF_{1,w,x,y,z}$
- Applicable SPFs – Page 18-35
- Crash Modification Factor (CMF) – Equation 18-24, Page 18-35
- Coefficients - Table 18-14, Page 18-36

Lane Width – $CMF_{2,w,x,y,fi}$
- Applicable SPFs – Page 18-36
- Crash Modification Factor (CMF) – Equation 18-25, Page 18-36
- Coefficients - Table 18-15, Page 18-37

Inside Shoulder Width – $CMF_{3,w,x,y,z}$
- Applicable SPFs – Page 18-37
- Crash Modification Factor (CMF) – Equation 18-26, Page 18-37
- Coefficients - Table 18-16, Page 18-37

Median Width – $CMF_{4,w,x,y,z}$
- Applicable SPFs – Page 18-37
- Crash Modification Factor (CMF) – Equation 18-27, Page 18-38
- When median barrier is present, continuous, and centered
  - W_{icb} - Equation 18-50, Page 18-52
  - P_{ib} - Equation 18-51, Page 18-52
- Coefficients - Table 18-17, Page 18-38

Median Barrier – *$CMF_{5,w,x,y,z}$*
- Applicable SPFs – Page 18-38
- Crash Modification Factor (CMF) – Equation 18-28, Page 18-38
  - When Median Barrier is present, continuous, and adjacent to one roadbed
    - W_{icb} - Equation 18-48, Page 18-51
    - P_{ib} - Equation 18-49, Page 18-51
- Coefficients - Table 18-18, Page 18-39

High Volume – *$CMF_{6,w,x,y,z}$*
- Applicable SPFs – Page 18-39
- Crash Modification Factor (CMF) – Equation 18-29, Page 18-39
- Coefficients - Table 18-19, Page 18-40

Lane Change – *$CMF_{7,fs,ac,mv,z}$*
- Applicable SPFs – Page 18-40
- Crash Modification Factor (CMF) – Equations 18-30 to 18-34, Pages 18-40 to 18-41
- Coefficients - Table 18-20, Page 18-42

Outside Shoulder Width – *$CMF_{8,fs,ac,sv,z}$*
- Applicable SPFs – Page 18-42
- Crash Modification Factor (CMF) – Equation 18-35, Page 18-42
- Coefficients - Table 18-21, Page 18-43

Shoulder Rumble Strips – *$CMF_{9,fs,ac,sv,fi}$*
- Applicable SPFs – Page 18-43
- Crash Modification Factor (CMF) – Equations 18-36 AND 18-37, Page 18-43
- Coefficients – There are no coefficients for this CMF

Outside Clearance – *$CMF_{10,fs,ac,sv,fi}$*
- Applicable SPFs – Page 18-44
- Crash Modification Factor (CMF) – Equation 18-38, Page 18-44
  - When the Median is Depressed with Some Barrier Present
    - W_{icb} - Equation 18-52, Page 18-52
    - P_{ib} - Equation 18-53, Page 18-52
- Coefficients - There are no coefficients for this CMF

Outside Barrier – *$CMF_{11,fs,ac,sv,z}$*
- Applicable SPFs – Page 18-44
- Crash Modification Factor (CMF) – Equation 18-39, Page 18-44
  - When there is Some Barrier Present on the Outside
    - W_{icb} - Equation 18-55, Page 18-53
    - P_{ib} - Equation 18-56, Page 18-53
- Coefficients - Table 18-22, Page 18-45

Safety Performance Factors (SPFs) for Speed-Change Lanes – Section 18.6.2 Page 18-29

Ramp-Entrance Speed-Change Lane Crashes
- Base Conditions – Page 18-30
- Safety Performance Function (SPF) – Equation 18-20, Page 18-30
- Graphical Representation of SPFs – Page 18-31
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Ramp-Exit Speed-Change Lane Crashes
- Base Conditions – Page 18-30
- Safety Performance Function (SPF) – Equation 18-22, Page 18-32
- Graphical Representation of SPFs – Page 18-33
- Regression Coefficients & Overdispersion Factor - Table 18-11, Page 18-33
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- Crash Type Distribution – Table 18-12, Page 18-34

Crash Modification Factors (CMFs) for Speed-Change Lanes - Section 18.7.2, Page 18-45

Horizontal Curve – $CMF_{1, w,x,y,z}$
- Applicable SPFs – Page 18-45
- Crash Modification Factor (CMF) – Equation 18-40, Page 18-45
- Coefficients - Table 18-23, Page 18-45

Lane Width – $CMF_{2, w,x,y,fi}$
- Applicable SPFs – Page 18-46
- Crash Modification Factor (CMF) – Equation 18-41, Page 18-46
- Coefficients - There are no coefficients for this CMF

Inside Shoulder Width – $CMF_{3, w,x,y,z}$
- Applicable SPFs – Page 18-46
- Crash Modification Factor (CMF) – Equation 18-42, Page 18-46
- Coefficients - Table 18-24, Page 18-46

Median Width – $CMF_{4, w,x,y,z}$
- Applicable SPFs – Page 18-47
- Crash Modification Factor (CMF) – Equation 18-43, Page 18-47
- When median barrier is present, continuous, and centered
  - W_{icb} - Equation 18-50, Page 18-52
  - P_{ib} - Equation 18-51, Page 18-52
- Coefficients - Table 18-25, Page 18-47

Median Barrier – $CMF_{5, w,x,y,z}$
- Applicable SPFs – Page 18-47
- Crash Modification Factor (CMF) – Equation 18-44, Page 18-48
  - When Median Barrier is present, continuous, and adjacent to one roadbed
  - W_{icb} - Equation 18-48, Page 18-51
  - P_{ib} - Equation 18-49, Page 18-51
- Coefficients - Table 18-26, Page 18-48

High Volume – $CMF_{6, w,x,y,z}$
- Applicable SPFs – Page 18-48
- Crash Modification Factor (CMF) – Equation 18-45, Page 18-48
- Coefficients - Table 18-27, Page 18-48

Ramp Entrance – $CMF_{12, sc, nEN, at, z}$
- Applicable SPFs – Page 18-49
- Crash Modification Factor (CMF) – Equation 18-46, Page 18-49
- Coefficients - Table 18-28, Page 18-49

Ramp Exit – $CMF_{13, sc,nEX, at, z}$
- Applicable SPFs – Page 18-49
- Crash Modification Factor (CMF) – Equation 18-47, Page 18-50
- Coefficients - Table 18-29, Page 18-50

Severity Distribution Functions (SDFs) Freeway Segments AND Speed-Change Lanes - Section 18.8, Page 18-53

General Form Severity Distribution – Equation 18-58, Page 18-53

Specific Severity Distributions

Fatal (K) –	Equation 18-59, Page 18-54
Serious Injury (A) –	Equation 18-60, Page 18-54
Evident Injury (B) –	Equation 18-61, Page 18-54
Possible Injury (C) -	Equation 18-62, Page 18-54
V_j -	Equation 18-63, Page 18-54
Coefficients -	Table 18-30, Page 18-55