CMF/CRF Table Update –

For Use on Safety Projects on the State Highway System in Indiana

CRF Update Sub-Committee:

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Description

Crash Reduction Factors (CRFs) and Crash Modification Factors (CMFs) are values used to determine the effect that certain countermeasures have on crash frequency at a location. CRFs and CMFs can be specified for different area types (rural, urban, suburban, etc.), facility characteristics (speed, cross section elements, etc.), crash types (total crashes, injury crashes only, etc.) and other variables. CRF's represent the percentage reduction in crashes expected from a countermeasure, while CMFs are factors applied to the existing number of crashes to obtain the expected number of crashes after the countermeasure is implemented. For example, a CRF of 0.3 indicates a crash reduction of 30%, which corresponds to a CMF of 0.7.

The CRFs/CMFs for safety countermeasures in the tables below were identified by the CRF Update Sub-Committee as most suitable for Indiana. The CRFs were selected to ensure the recommendations are up-to-date and reliable to use during the project scoring process. Selection criteria looked at the study rating on the CMF Clearinghouse to ensure reliability, recency to verify the data was as up-to-date results as possible, and a review of the study report to ensure the applicability of a given CRF. The CRFs selected were determined by the committee to be the most reliable alternative for the given category. The recommended CRFs for some countermeasures may be context sensitive, so care should be taken to ensure that the countermeasure description, area type, and facility are relevant to a given location.

If no recommendation for a specific countermeasure or location is provided, the sub-committee could not identify reliable data for these types of projects. The CMF Clearinghouse may be reviewed to search for newer information. CRFs/CMFs rated less than 3 stars have been determined to be less reliable and likely should not be used for scoring. Contact the Traffic Safety Office if no relevant CRF for a proposed countermeasure can be located.

Category	Countermeasure	Area Type	Facility Type	Crash Type	CRF	CMF	Reference Number (CMF ID)
TWSC to AWSC	Convert two-way stop to all-way stop (no flashers)	Rural	Any	KABC	72.4	0.276	18 (3131)
				Total	60.7	0.393	18 (3130)
TWSC to Signal	Install new traffic signal at previously stop-controlled intersection	Urban	Three-leg intersection	KABC	14.0	0.86	14
			Four-leg intersection	KABC	23.0	0.77	
	Convert two-way stop to signal without turn lane (3-leg)	Rural or Suburban	3 Legs, 35-45 MPH	Total	21.2	0.788	19 (Study 444)
			3 Legs, 50-55 MPH	Total	37.5	0.625	
	Convert two-way stop to signal without turn lanes (4-leg)	Rural or Suburban	4 Legs, 35-45 MPH	KABC	46.5	0.535	
				Total	48.7	0.513	
			4 Legs, 50-55 MPH	KABC	33.5	0.665	
				Total	26.9	0.731	
	Convert two-way stop to signal with added turn lanes (3 Legs)	Rural or Suburban	35-45 MPH	KABC	62.9	0.371	
				Total	54.7	0.453	
			50-55 MPH	KABC	38.8	0.612	
				Total	32.8	0.672	
	Convert two-way stop to signal with added turn lanes (4 Legs)	Rural or Suburban	35-45 MPH	KABC	62.0	0.38	
				Total	48.3	0.517	
			50-55 MPH	KABC	47.3	0.527	
				Total	40.2	0.598	
Left Turn Lanes	Install neutral offset left turn lanes on major approaches at signalized intersection	Any	35-45 MPH	KABC	35.3	0.647	19 (Study 444)
			50-55 MPH	KABC	22.0	0.78	
	Install left turn lanes on BOTH major approaches at a signalized intersection	Urban	Four-Leg Intersection	Total	19.0	0.81	9 (270)
		Rural	Four-Leg Intersection	Total	33.0	0.67	9 (4648)

Category	Countermeasure	Area Type	Facility Type	Crash Type	CRF	CMF	Reference Number (CMF ID)
Left Turn Lanes	Install a left turn lane on ONE major approach to a signalized intersection	Urban	Three-Leg Intersection	Total	7.0	0.93	9 (4644)
			Four-Leg Intersection	Total	10.0	0.90	9 (262)
	Install a left turn lane on ONE major approach to a signalized intersection	Rural	Three-Leg Intersection	Total	15.0	0.85	9 (4643)
			Four-Leg Intersection	Total	18.0	0.82	9 (4647)
	Install left turn lanes on BOTH major approaches at an unsignalized intersection	Urban	Four-Leg Intersection	Total	47.0	0.53	9 (269)
		Rural	Four-Leg Intersection	Total	48.0	0.52	9 (268)
	Install a left turn lane on ONE major approach to an unsignalized intersection	Urban	Three-Leg Intersection	Total	33.0	0.67	9 (254)
			Four-Leg Intersection	Total	27.0	0.73	9 (261)
		Rural	Three-Leg Intersection	Total	44.0	0.56	9 (253)
			Four-Leg Intersection	Total	28.0	0.72	9 (260)
	Improve left turn lane offsets to create positive offsets	Urban and Rural	Four-leg intersection	KABC	35.6	0.644	16
				Total	33.8	0.662	
Right Turn Lanes	Install right turn lanes on BOTH major approaches to a signalized intersection	Rural or Urban	Four-leg intersection	Total	8.0	0.92	9 (290)
	Install right turn lane on one major approach to a signalized intersection	Rural or Urban	Three- or Four-leg intersection	Total	4.0	0.96	9 (286)

Category	Countermeasure	Area Type	Facility Type	Crash Type	CRF	CMF	Reference Number (CMF ID)
Right Turn Lanes	Install right turn lanes on BOTH major approaches to an unsignalized intersection	Rural or Urban	Four-leg intersection	Total	26.0	0.74	9 (289)
	Install right turn lane on one major approach to an unsignalized intersection	Rural or Urban	Three- or Four-leg intersection	Total	14.0	0.86	9 (285)
Roundabout	Convert all-way stop to a roundabout	Any	Any	KABC	36.4	0.636	3 (4878)
				Total	-2.6	1.026	3 (4877)
	Convert two-way stop to a roundabout	Rural	Any	KABC	87.0	0.13	17 (230)
				Total	71.0	0.29	17 (229)
		Suburban	Single Lane	KABC	78.0	0.22	17 (238)
				Total	78.0	0.22	17 (239)
		Suburban	Multilane	KABC	68.0	0.32	17 (241)
				Total	19.0	0.81	17 (240)
		Urban	Single Lane	KABC	78.0	0.22	17 (234)
				Total	39.0	0.61	17 (233)
	Convert signal to a roundabout	Any	Single Lane	KABC	54.9	0.451	20 (4257)
				Total	26.5	0.735	20 (4256)
		Any	Multilane	KABC	71.2	0.288	20 (4255)
				Total	19.1	0.809	20 (4254)
	Convert stop-controlled interchange to dogbone roundabout	Any	Any	KABC	64.9	0.351	4 (11130)
				Total	39.6	0.604	4 (11132)
	Convert signalized interchange to dogbone roundabout	Any	Any	KABC	40.6	0.594	4 (11146)
				Total	4.6	0.954	4 (11166)

Category	Countermeasure	Area Type	Facility Type	Crash Type	CRF	CMF	Reference Number (CMF ID)
Roundabout w/ Grade Separation	Convert at-grade signalized intersection to dogbone roundabout interchange	Urban	Any # of lanes	KABC	84.0	0.16	22
				Total	64.0	0.36	
Reduced Conflict Intersection (RCI)	Convert Two-Way stop to RCI	Rural	Multilane Arterial	KABC	85.2	0.148	10
				Total	73.7	0.263	
Restricted Crossing U-Turn (RCUT)	Convert signalized intersection to an RCUT	Any	Any	KABC	37.0	0.63	11
				Total	29.0	0.71	11 (9985)
Boulevard Left	Convert intersection to boulevard left turn	Any	Any	KABC	31.0	0.69	6
				Total	32.0	0.68	
Diverging Diamond Interchange (DDI)	Convert diamond interchange to diverging diamond interchange	Any	Any	KABC	44.2	0.558	2 (10762)
				Total	14.2	0.858	2 (10761)
Displaced Left Turn (DLT)	Convert a conventional signalized intersection to a continuous flow intersection (CFI) with parallel right turn lanes (slip lanes)	Any	3-legs	KABC	20.3	0.797	5 (11620)
				Total	14.1	0.859	5 (11619)
	Convert a conventional signalized intersection to a continuous flow intersection (CFI) with parallel right turn lanes (slip lanes)	Any	4-legs	KABC	28.3	0.717	5 (11625)
				Total	32.6	0.674	5 (11624)
	Convert a conventional signalized intersection to a continuous flow intersection (CFI) with standard right turn lanes	Any	3 or 4 legs	KABC	-2.9	1.029	5 (11595)
				Total	-15.6	1.156	5 (11594)

Category	Countermeasure	Area Type	Facility Type	Crash Type	CRF	CMF	Reference Number (CMF ID)
Intersection Skew	Intersection skew angle compared to 90 degrees	Rural	3-leg	Total	**3-leg intersections** $CMF_{Flex-form} = [1 + \sin(skew)]^{0.890} \times e^{-0.014 * skew}$ Where: • skew: intersection skew angle (degrees) • sin: function to return sine of the angle		12 (11273)
	Intersection skew angle compared to 90 degrees	Rural	4-leg	Total	**4-leg intersections** $CMF_{Flex-form} = [1 + \sin(skew)]^{0.997} \times e^{-0.010 * skew}$ Where: • skew: intersection skew angle (degrees) • sin: function to return sine of the angle		12 (11275)
	Change skew angle from between 17-27 degrees to 90 degrees.	Rural	3-leg	Total	18.0	0.83	12 (11277)
	Change skew angle from greater than 27 degrees to 90 degrees.	Rural	3-leg	Total	23.0	0.77	12 (11278)
	Change skew angle from between 17-27 degrees to 90 degrees.	Rural	4-leg	Total	38.6	0.614	12 (11279)
Access Management	Install TWLTL (two-way left turn lane) on a four-lane road	Urban and Suburban	Four-lane highways	Total	29.9	0.701	21 (10375)

Category	Countermeasure	Area Type	Facility Type	Crash Type	CRF	CMF	Reference Number (CMF ID)
Access Management	Install TWLTL (two-way left turn lane) on a two-lane road	Any	Two-lane highways	Total	20.3	0.797	15 (2341)
				KABC	26.1	0.739	15 (2346)
	Convert 4-lane undivided road to 2-lanes plus TWLTL	Urban	Four-lane highways	Total	44.0	0.560	1 (7828)
				KABC	37.0	0.630	1 (7829)
	Replace TWLTL with raised median	Urban	Principal arterials; minor arterials; collectors	Total	23.0	0.77	13 (2514)
				KABC	21.0	0.79	13 (2519)
	Reduce driveway density by 1 driveway per mile*	Rural	Two-lane highways	Total	2.3	0.977	7
			Four-lane highways	Total	0.4	0.996	
	Reduce driveway density by 2 driveways per mile*	Rural	Two-lane highways	Total	4.5	0.955	
			Four-lane highways	Total	0.7	0.993	
	Reduce driveway density by 3 driveways per mile*	Rural	Two-lane highways	Total	6.7	0.933	
			Four-lane highways	Total	1.1	0.989	
	Reduce driveway density by 5 driveways per mile*	Urban	Principal arterials, minor arterials, or collectors with raised medians	KABC	2.9	0.971	13
				Total	4.7	0.953	
			Principal arterials, minor arterials, or collectors with TWLTLs	KABC	1.3	0.987	
				Total	4.4	0.956	

Category	Countermeasure	Area Type	Facility Type	Crash Type	CRF	CMF	Reference Number (CMF ID)
Access Management	Reduce driveway density by 10 driveways per mile*	Urban	Principal arterials, minor arterials, or collectors with raised medians	Total	9.2	0.908	13
				KABC	5.7	0.943	
			Principal arterials, minor arterials, or collectors with TWLTLs	Total	8.6	0.914	
				KABC	2.6	0.974	
	Reduce driveway density by 15 driveways per mile*	Urban	Principal arterials, minor arterials, or collectors with raised medians	Total	13.4	0.866	
				KABC	8.5	0.915	
			Principal arterials, minor arterials, or collectors with TWLTLs	Total	12.6	0.874	
				KABC	3.8	0.962	
	Reduce driveway density by 20 driveways per mile*	Urban	Principal arterials, minor arterials, or collectors with raised medians	Total	17.5	0.825	13
				KABC	11.1	0.889	
			Principal arterials, minor arterials, or collectors with TWLTLs	Total	16.5	0.835	
				KABC	5.1	0.949	

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