

Description

This table presents the CRFs/CMFs for safety countermeasures that were identified as being the most suitable for Indiana based on the criteria presented in the Joint Transportation Research Program technical report, “Updating the Crash Modification Factors and Calibrating the IHSDM for Indiana”. The table contains 82 safety countermeasures spanning 16 different categories. For each countermeasure, the applicable areas type (urban and/or rural), facility type, and CRF/CMF values for various crash types and severities are presented. Finally, the state(s) where each study was conducted and the corresponding reference are provided in the table.

CRFs and CMFs Most Suitable for Indiana

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Access management	Install two-way left-turn lane (TWLTL)	Rural	Two-lane highways	Total	36.0	0.640	AR, CA, IL, NC (29)
				KABC	34.8	0.652	
				Rear-end	46.8	0.532	
Access management	Replace TWLTL with raised median	Urban	Principal arterials; minor arterials; collectors	Total	23	0.77	NV (24)
				PDO	33	0.67	
				KABC	21	0.79	
				Rear-end	19	0.81	
				Sideswipe	21	0.79	
				Angle	36	0.64	
				Head-on	47	0.53	
				Access management	Reduce driveway density by 1 driveway per mile*	Rural	
Four-lane highways	Total	0.4	0.996				
Access management	Reduce driveway density by 2 driveways per mile*	Rural	Two-lane highways	Total	4.5	0.955	TX (11)
			Four-lane highways	Total	0.7	0.993	
Access management	Reduce driveway density by 3 driveways per mile*	Rural	Two-lane highways	Total	6.7	0.933	TX (11)
			Four-lane highways	Total	1.1	0.989	
Access management	Reduce driveway density by 5 driveways per mile*	Urban	Principal arterials, minor arterials, or collectors with raised medians	Total	4.7	0.953	NV (24)
				PDO	3.5	0.965	
				KABC	2.9	0.971	
				Rear-end	1.5	0.985	
				Angle	4.3	0.957	
			Principal arterials, minor arterials, or collectors with TWLTLs	Total	4.4	0.956	
				PDO	4.6	0.954	
				KABC	1.3	0.987	
				Rear-end	3.8	0.962	
				Angle	4.1	0.959	
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	NV (24)
				PDO	6.9	0.931	
				KABC	5.7	0.943	
				Rear-end	3.0	0.970	
				Angle	8.3	0.917	
			Principal arterials, minor arterials, or collectors with TWLTLs	Total	8.6	0.914	
				PDO	9.0	0.910	
				KABC	2.6	0.974	
				Rear-end	7.4	0.926	
				Angle	8.1	0.919	

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Access management	Reduce driveway density by 15 driveways per mile*	Urban	Principal arterials, minor arterials, or collectors with raised medians	Total	13.4	0.866	NV (24)
				PDO	10.1	0.899	
				KABC	8.5	0.915	
				Rear-end	4.4	0.956	
				Angle	12.2	0.878	
			Principal arterials, minor arterials, or collectors with TWLTLs	Total	12.6	0.874	
				PDO	13.2	0.868	
				KABC	3.8	0.962	
				Rear-end	10.9	0.891	
				Angle	11.8	0.882	
Access management	Reduce driveway density by 20 driveways per mile*	Urban	Principal arterials, minor arterials, or collectors with raised medians	Total	17.5	0.825	NV (24)
				PDO	13.2	0.868	
				KABC	11.1	0.889	
				Rear-end	5.8	0.942	
				Angle	16.0	0.840	
			Principal arterials, minor arterials, or collectors with TWLTLs	Total	16.5	0.835	
				PDO	17.1	0.829	
				KABC	5.1	0.949	
				Rear-end	14.3	0.857	
				Angle	15.5	0.845	
Alignment	Flatten crest of curve	Rural	Arterials, collectors	Total	19.6	0.804	OH (19)
				KABC	51.2	0.488	

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Alignment	Reduce the average grade rate by 1%*	Rural	Two-lane roads	PDO	2.0	0.980	IN (42)
				KABC	1.9	0.981	
Alignment	Reduce the average grade rate by 2%*	Rural	Two-lane roads	PDO	4.0	0.960	IN (42)
				KABC	3.8	0.962	
Alignment	Reduce the average grade rate by 3%*	Rural	Two-lane roads	PDO	6.0	0.940	IN (42)
				KABC	5.7	0.943	
Alignment	Reduce the average grade rate by 4%*	Rural	Two-lane roads	PDO	7.9	0.921	IN (42)
				KABC	7.5	0.925	
Alignment	Reduce the average grade rate by 5%*	Rural	Two-lane roads	PDO	9.7	0.903	IN (42)
				KABC	9.3	0.907	
Alignment	Reduce the average degree of curve by 1 degree*	Rural	Two-lane roads	PDO	1.9	0.981	IN (42)
				KABC	2.9	0.971	
Alignment	Reduce the average degree of curve by 2 degrees*	Rural	Two-lane roads	PDO	3.8	0.962	IN (42)
				KABC	5.7	0.943	
Alignment	Reduce the average degree of curve by 3 degrees*	Rural	Two-lane roads	PDO	5.7	0.943	IN (42)
				KABC	8.4	0.916	
Alignment	Reduce the average degree of curve by 4 degrees*	Rural	Two-lane roads	PDO	7.5	0.925	IN (42)
				KABC	11.1	0.889	
Alignment	Reduce the average degree of curve by 5 degrees*	Rural	Two-lane roads	PDO	9.3	0.907	IN (42)
				KABC	13.6	0.864	
Highway lighting	Install lighting on a roadway segment	Urban and rural	Not specified	Nighttime	20.0	0.80	Not specified (17)
				Nighttime KABC	29.0	0.71	
Highway lighting	Install lighting at a signalized intersection	Urban	Not specified	Daytime	-3.0	1.03	MN (6)
				Nighttime	3.0	0.97	
		Rural	Not specified	Daytime	2.0	0.98	
				Nighttime	2.0	0.98	
Highway lighting	Install lighting at a stop-controlled intersection	Urban	Not specified	Daytime	-5.0	1.05	MN (6)
				Nighttime	9.0	0.91	
		Rural	Not specified	Daytime	-9.0	1.09	
				Nighttime	-7.0	1.07	
Highway lighting	Install lighting at an interchange	Urban and rural	Arterials, collectors	Total	50.4	0.496	OH (19)
				KABC	26.0	0.74	

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Intersection geometry	Add a left-turn lane on one major approach to a signalized intersection	Urban	Three-leg intersections	Total	7.0	0.930	IA, IL, LA, MN, NE, NC, OR, VA (18)
			Four-leg intersections	Total	10.0	0.900	
		Rural	Three-leg intersections	Total	15.0	0.850	
			Four-leg intersections	Total	18.0	0.820	
Intersection geometry	Add a left-turn lane on one major approach to an unsignalized intersection	Urban	Three-leg intersections	Total	33.0	0.670	IA, IL, LA, MN, NE, NC, OR, VA (18)
			Four-leg intersections	Total	27.0	0.730	
		Rural	Three-leg intersections	Total	44.0	0.560	
			Four-leg intersections	Total	28.0	0.720	
Intersection geometry	Add a right-turn lane on one major approach to a signalized intersection	Urban	Four-leg intersections	Total	4.0	0.960	IA, IL, LA, MN, NE, NC, OR, VA (18)
Intersection geometry	Add a right-turn lane on one major approach to an unsignalized intersection	Rural	Four-leg intersections	Total	14.0	0.860	IA, IL, LA, MN, NE, NC, OR, VA (18)
Intersection geometry	Convert diamond interchange to diverging diamond interchange (DDI)	Urban	Principal arterial, other freeways and expressways	Total	33	0.67	KY, MO, NY, TN (20)
				Injury	41	0.59	
				Angle	67	0.33	
				Rear-end	36	0.64	
				Sideswipe	-27	1.27	
				Single-vehicle	24	0.76	
Intersection geometry	Convert intersection on low-speed road to a roundabout	Urban and rural	Intersections where all approaches are low-speed (less than 45 mph)	Total	-9.9	1.099	WI (31)
				KABC	52.7	0.473	
Intersection geometry	Convert intersection on high-speed road to a roundabout	Urban and rural	Intersections where at least one approach is high-speed (45 mph or greater)	Total	34.1	0.659	WI (31)
				KABC	49.4	0.506	
Intersection geometry	Convert intersection to a single-lane roundabout	Urban and rural	Intersections with low- and high-speed approaches	Total	36.0	0.640	WI (31)
				KABC	18.2	0.818	
Intersection geometry	Convert intersection to a multilane roundabout	Urban and rural	Intersections with low- and high-speed approaches	Total	-6.2	1.062	WI (31)
				KABC	63.3	0.367	
Intersection geometry	Convert two-way stop-controlled intersection to a roundabout	Urban	Intersections on two- or four-lane roads	Total	27.0	0.73	CA, CO, CT, FL, KS, MD, ME, MI, MO, MS, NV, OR, SC, UT, VT, WA WI (31,33)
				KABC	58.1	0.419	
		Rural	Intersections on two- or four-lane roads	Total	48.2	0.518	
				KABC	61.2	0.388	

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Intersection geometry	Convert all-way stop-controlled intersection to a roundabout	Urban and rural	Intersections on two- or four-lane roads	Total	-7.4	1.074	CA, CO, CT, FL, KS, MD, ME, MI, MO, MS, NV, OR, SC, UT, VT, WA WI (31,33)
				KABC	8.7	0.913	
Intersection geometry	Convert signalized intersection to a roundabout	Urban	Intersections on two- or four-lane roads	Total	12.4	0.876	CA, CO, CT, FL, IN, KS, MD, ME, MI, MO, MS, NC, NV, NY, OR, SC, UT, VT, WA, WI (15,31,33)
				KABC	66.1	0.339	
		Rural	Intersections on two- or four-lane roads	Total	26.2	0.738	
				KABC	71.5	0.285	
Intersection geometry	Convert a non-controlled or yield-controlled intersection to a roundabout	Urban and rural	Intersections on two- or four-lane roads	Total	-24.2	1.242	WI (31)
				KABC	100.0	0	
Intersection geometry	Convert two-way stop-controlled intersection to J-turn intersection	Rural	Intersections of four-lane divided, high-speed roads and minor roads	Total	34.8	0.652	MO (8)
				KABC	53.7	0.463	
Intersection geometry	Improve left-turn lane offset to create positive offset	Urban and rural	Four-leg intersections	Total	33.8	0.662	WI (30)
				KABC	35.6	0.644	
				Left-turn	38.0	0.62	
				Rear-end	31.7	0.683	
Intersection geometry	Improve intersection sight distance	Urban and rural	Not specified	Total	33.0	0.67	Based on AK, AZ, CA, IA, KY, MO (13)
				Right-angle	21.0	0.79	Based on AZ, MO, MN (13)
				Left-turn	13.0	0.87	Based on AZ, MO (13)
				Sideswipe	43.0	0.57	Based on AK, MO (13)
Intersection traffic control	Change left-turn phasing on one approach from permitted to protected/permitted phasing	Urban	Four-leg intersections	Total	-8.1	1.081	NC, Toronto (39)
				KABC	0.5	0.995	
				Left-turn	7.5	0.925	
				Rear-end	-9.4	1.094	
Intersection traffic control	Change left-turn phasing on more than one approach from permitted to protected/permitted phasing	Urban	Four-leg intersections	Total	4.2	0.958	NC, Toronto (39)
				KABC	8.6	0.914	
				Left-turn	21.3	0.787	
				Rear-end	-5.0	1.050	

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Intersection traffic control	Change left-turn phasing from permitted or permitted/protected to protected-only phasing	Urban	Signalized intersections	Total	1	0.99	NC (17)
				Left-turn	99	0.01	
Intersection traffic control	Supplement left-turn phasing from at least one permitted approach with flashing yellow arrow	Urban	Four-leg intersections	Total	24.7	0.753	NC, OR, WA (39)
				Left-turn	36.5	0.635	
Intersection traffic control	Change left-turn phasing from protected/permitted to flashing yellow arrow	Urban	Four-leg intersections	Total	7.8	0.922	NC, OR, WA (39)
				Left-turn	19.4	0.806	
Intersection traffic control	Change left-turn phasing from protected to flashing yellow arrow	Urban	Four-leg intersections	Total	-33.8	1.338	NC, OR, WA (39)
				Left-turn	-124.2	2.242	
Intersection traffic control	Convert two-way stop control to all-way stop control	Urban and rural	Four-leg intersections	Total	68	0.32	NC (34)
				KABC	77	0.23	
				Frontal impact	75	0.25	
				Ran stop sign	15	0.85	
Intersection traffic control	Improve signal visibility	Urban	Four-leg intersections on three- to four-lane roads	Daytime PDO	9.9	0.901	British Columbia (9)
				Daytime KABC	-0.4	1.004	
				Nighttime PDO	13.3	0.867	
				Nighttime KABC	9.8	0.902	
Intersection traffic control	Increase yellow change interval (1.0 seconds)	Urban	Three- and four-leg intersections	Total	-14.1	1.141	CA, MD (39)
				KABC	-7.3	1.073	
				Rear-end	6.6	0.934	
				Angle	-7.6	1.076	
Intersection traffic control	Increase all-red clearance interval (average of 1.1 seconds)	Urban	Three- and four-leg intersections	Total	20.2	0.798	CA, MD (39)
				KABC	13.7	0.863	
				Rear-end	19.6	0.804	
				Angle	3.4	0.966	
Intersection traffic control	Increase yellow interval (average of 0.8 seconds) and add all-red interval (average of 1.2 seconds)	Urban	Three- and four-leg intersections	Total	1.0	0.990	CA, MD (39)
				KABC	-2.0	1.020	
				Rear-end	-11.7	1.117	
				Angle	3.9	0.961	

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Intersection traffic control	Install transverse rumble strips on approaches to stop-controlled intersection	Rural	Three-leg intersections on major collectors	Total	-22.3	1.223	IA, MN (38)
				PDO	-28.4	1.284	
				KA	59	0.41	
			Four-leg intersections on major collectors	Total	-6.6	1.066	
				PDO	-13.8	1.138	
				KA	34.8	0.652	
Intersection traffic control	Install new traffic signal at previously stop-controlled intersection	Urban	Three-leg intersections	KABC	14	0.86	CA, FL, MD, VA, WI, Toronto (25)
				Right-angle KABC	34	0.66	
				Rear-end KABC	-50	1.5	
			Four-leg intersections	KABC	23	0.77	
				Right-angle KABC	67	0.33	
				Rear-end KABC	-38	1.38	
		Rural	Three- and four-leg intersections	Total	44	0.56	CA, MN (17)
				Right-angle	77	0.23	
				Rear-end	-58	1.58	
				Left-turn	60	0.40	
Intersection traffic control	Replace standard stop sign with flashing LED stop sign	Urban and rural	Two-lane highways	Right-angle	41.5	0.585	MN (7)
Intersection traffic control	Retime signal change intervals to Institute of Transportation Engineers (ITE) standards	Urban	Four-leg intersections	Total	8	0.92	NY (32)
				KABC	12	0.88	
				Rear-end	-12	1.12	
				Rear-end KABC	-8	1.08	
				Angle	4	0.96	
				Angle KABC	-6	1.06	
				Vehicle/bicycle and vehicle/pedestrian	37	0.63	
				Vehicle/bicycle and vehicle/pedestrian KABC	37	0.63	

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
ITS and advanced technology	Install actuated advance intersection warning system at high-speed intersection	Urban and rural	Four-lane high-speed divided highways (major road)	Total	8.2	0.918	NE (2)
				KABC	11.3	0.887	
				Rear-end	1.2	0.988	
				Right-angle	43.6	0.564	
ITS and advanced technology	Install changeable horizontal curve speed warning signs	Rural	Two-lane highways	Total	5.0	0.95	AZ, FL, IA, OH, OR, TX, WA (16)
ITS and advanced technology	Install variable speed limit signs	Urban	Principal arterial interstates	Total	8.0	0.92	MO (5)
ITS and advanced technology	Install "Vehicle Entering When Flashing" (VEWF) system with advance post mounted signs on major approach and loops on minor approach	Urban and rural	Highways with 35-55 mph mainline approach speeds	Total	32	0.68	NC (35)
				KABC	27	0.73	
				Target (angle, head-on, left-turn, and right-turn)	32	0.68	
Pavement	Improve pavement condition from poor (critical condition index below 60) to good (critical condition index above 70)	Rural	Two-lane highways	Total	-3.0	1.03	VA (46)
				KABC	26.0	0.74	
Pedestrians	Construct pedestrian bridge or tunnel	Urban	Not specified	Pedestrian	86	0.14	Based on AK, AZ, KY, MO (13)
Pedestrians	Install High intensity Activated crossWalk (HAWK) at intersection	Urban	Crossings of four- to six-lane roads	Total	29	0.71	AZ (12)
				KA	15	0.85	
				Pedestrian	69	0.31	
Pedestrians	Install sidewalk	Urban	Not specified	Pedestrian	74	0.26	Based on AK, AZ, KY, MO, OK (13)
Railroads	Build grade-separated crossing	Urban and rural	Not specified	Total	39	0.61	Based on IA (13)
Railroads	Eliminate railroad crossing	Urban and rural	Not specified	Total	75	0.25	Based on IA (13)
Railroads	Install gates at crossings with signs	Urban and rural	Arterials, collectors, local roads	Total	93	0.07	Canada (26)

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Railroads	Upgrade signs to flashing lights	Urban and rural	Arterials, collectors, local roads	Total	77	0.23	Canada (26)
Roadside	Increase median width from 10 feet to 20 feet	Rural	Four-lane divided highways	Multiple vehicle	9	0.91	CA, KY, MN (40)
Roadside	Increase median width from 10 feet to 30 feet	Rural	Four-lane divided highways	Multiple vehicle	17	0.83	CA, KY, MN (40)
Roadside	Increase median width from 10 feet to 40 feet	Rural	Four-lane divided highways	Multiple vehicle	25	0.75	CA, KY, MN (40)
Roadside	Increase median width from 10 feet to 50 feet	Rural	Four-lane divided highways	Multiple vehicle	32	0.68	CA, KY, MN (40)
Roadside	Increase median width from 10 feet to 60 feet	Rural	Four-lane divided highways	Multiple vehicle	38	0.62	CA, KY, MN (40)
Roadside	Increase median width from 10 feet to 70 feet	Rural	Four-lane divided highways	Multiple vehicle	43	0.57	CA, KY, MN (40)
Roadside	Increase median width from 10 feet to 80 feet	Rural	Four-lane divided highways	Multiple vehicle	49	0.51	CA, KY, MN (40)
Roadside	Install guardrail	Urban and rural	Not specified	Total	11	0.890	Based on AZ, IA, IN, KY, MO (13)
				BC	40	0.600	
				KA	65	0.350	
				Run-off-the-road	30	0.700	
Roadside	Install cable median barrier (high-tensioned) on depressed median of 50 feet wide or wider	Rural	Principal arterial interstates	Multiple-vehicle, opposite direction (cross median, frontal and opposing direction sideswipe, head-on)	96	0.04	IN (45)
				Single-vehicle crashes (fixed object, run-off-the-road)	-72	1.72	

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Roadside	Install concrete median barrier	Rural	Interstates	Single-vehicle	-120	2.2	CO, IL, IN, MO, NY, OH, OR, WA (41)
				Multiple-vehicle, same direction	20	0.8	
				Multiple-vehicle opposite direction	100	0	
Roadside	Change in sideslope from 1V:3H to 1V:4H	Rural	Not specified	PDO	29	0.71	Not specified (10)
				KABC	42	0.58	
Roadside	Change in sideslope from 1V:4H to 1V:6H	Rural	Not specified	PDO	24	0.76	Not specified (10)
				KABC	22	0.78	
Roadside	Remove or relocate fixed objects outside of clear zone	Urban and rural	Arterials, collectors	Total	38.2	0.618	OH (19)
				KABC	38.1	0.619	
Road diet	Re-stripe four-lane undivided road to three-lane (with TWLTL)	Urban	Minor arterials	Total	29	0.71	CA, IA, WA (17)
Roadway delineation	Add no passing striping	Rural	Not specified	Total	53	0.47	Based on MT (13)
				Head-on	40	0.60	Based on KY, MO (13)
				Sideswipe	40	0.60	
Roadway delineation	Install centerline rumble strips	Urban	Two-lane roads	Target (head-on, opposite-direction sideswipe)	40	0.60	CA, CO, DE, MD, MN, OR, PA, WA (43)
				Target KABC	64	0.36	
		Rural	Two-lane roads	Total	9	0.91	
				KABC	12	0.88	
				Target	30	0.70	
Target KABC	44	0.56					
Roadway delineation	Install shoulder rumble strips	Rural	Two-lane roads	Run-off-the-road	15	0.85	MN, MO, PA (43)
				Run-off-the-road KABC	29	0.71	
			Freeways	Run-off-the-road	11	0.89	
				Run-off-the-road KABC	16	0.84	

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Roadway delineation	Install centerline plus shoulder rumble strips	Rural	Two-lane roads	Total	18.6	0.814	KY, MI, MO, PA (21,23)
				KABC	22.9	0.771	
				Head-on	36.8	0.632	
				Run-off-the-road	25.8	0.742	
				Opposite-direction sideswipe	23.3	0.767	
Roadway delineation	Install edgeline pavement markings on curves	Rural	Two-lane highways	Total	25.9	0.741	TX (44)
				Run-off-the-road	11.0	0.89	
				Speed-related (nighttime)	3.7	0.963	
Roadway delineation	Install edgeline pavement markings on tangent sections	Rural	Two-lane highways	Total	6.1	0.939	TX (44)
				Run-off-the-road	13.4	0.866	
				Speed-related (nighttime)	3.4	0.966	

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Roadway delineation	Install raised pavement markers	Rural	Two-lane highways with AADT 0-5000, curve radius R => 1640 ft	Nighttime	-16	1.16	IL, NJ, NY, PA (4)
			Two-lane highways with AADT 5001-15000, curve radius R => 1640 ft	Nighttime	1	0.99	
			Two-lane highways with AADT 15001-20000, curve radius R => 1640 ft	Nighttime	24	0.76	
			Two-lane highways with AADT 0-5000, curve radius R < 1640 ft	Nighttime	-43	1.43	
			Two-lane highways with AADT 5001-15000, curve radius R < 1640 ft	Nighttime	-26	1.26	
			Two-lane highways with AADT 15001-20000, curve radius R < 1640 ft	Nighttime	-3	1.03	
		MO, NY, PA, WI (4)	Four-lane freeways with AADT <= 20000	Nighttime	-13	1.13	
				Four-lane freeways with AADT 20001-60000	Nighttime	6	0.94
				Four-lane freeways with AADT > 60000	Nighttime	33	0.67
		Segments	Increase in number of through lanes by 1 lane*	Urban	Multilane	PDO	61.3
			KABC	66.5	0.335		
Segments	Convert two-lane roadway to four-lane divided roadway	Urban	Before: Two-lane roadway After: Four-lane divided roadway	Total	65.9	0.341	FL (1)
				PDO	64.9	0.351	
				KABC	63.3	0.367	
		Rural	Before: Two-lane roadway After: Four-lane divided roadway	Total	28.8	0.712	
				PDO	30.9	0.691	
				KABC	45.1	0.549	

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Segments	Convert 12 foot lanes and 6 foot shoulders to 11 foot lanes and 7 foot shoulders	Rural	Two-lane highways	Run-off-the-road, head-on, sideswipe	10	0.90	PA (14)
Segments	Convert 12 foot lanes and 6 foot shoulders to 10 foot lanes and 8 foot shoulders	Rural	Two-lane highways	Run-off-the-road, head-on, sideswipe	62	0.38	PA (14)
Segments	Convert 12 foot lanes and 6 foot shoulders to 12 foot lanes and 5 foot shoulders	Rural	Two-lane highways	Run-off-the-road, head-on, sideswipe	13	0.87	PA (14)
Segments	Convert 12 foot lanes and 6 foot shoulders to 11 foot lanes and 6 foot shoulders	Rural	Two-lane highways	Run-off-the-road, head-on, sideswipe	16	0.84	PA (14)
Segments	Convert 12 foot lanes and 6 foot shoulders to 10 foot lanes and 7 foot shoulders	Rural	Two-lane highways	Run-off-the-road, head-on, sideswipe	-96	1.96	PA (14)
Segments	Convert 12 foot lanes and 6 foot shoulders to 12 foot lanes and 4 foot shoulders	Rural	Two-lane highways	Run-off-the-road, head-on, sideswipe	-4	1.04	PA (14)
Segments	Convert 12 foot lanes and 6 foot shoulders to 11 foot lanes and 5 foot shoulders	Rural	Two-lane highways	Run-off-the-road, head-on, sideswipe	-6	1.06	PA (14)
Segments	Convert 12 foot lanes and 6 foot shoulders to 10 foot lanes and 6 foot shoulders	Rural	Two-lane highways	Run-off-the-road, head-on, sideswipe	25	0.75	PA (14)
Segments	Convert 12 foot lanes and 6 foot shoulders to 12 foot lanes and 3 foot shoulders	Rural	Two-lane highways	Run-off-the-road, head-on, sideswipe	-11	1.11	PA (14)
Segments	Convert 12 foot lanes and 6 foot shoulders to 11 foot lanes and 4 foot shoulders	Rural	Two-lane highways	Run-off-the-road, head-on, sideswipe	-14	1.14	PA (14)
Segments	Convert 12 foot lanes and 6 foot shoulders to 10 foot lanes and 5 foot shoulders	Rural	Two-lane highways	Run-off-the-road, head-on, sideswipe	-22	1.22	PA (14)
Segments	Convert 12 foot lanes and 6 foot shoulders to 12 foot lanes and 2 foot shoulders	Rural	Two-lane highways	Run-off-the-road, head-on, sideswipe	-16	1.16	PA (14)
Segments	Convert 12 foot lanes and 6 foot shoulders to 11 foot lanes and 3 foot shoulders	Rural	Two-lane highways	Run-off-the-road, head-on, sideswipe	-19	1.19	PA (14)
Segments	Convert 12 foot lanes and 6 foot shoulders to 10 foot lanes and 4 foot shoulders	Rural	Two-lane highways	Run-off-the-road, head-on, sideswipe	-20	1.20	PA (14)

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Segments	Convert 12 foot lanes and 6 foot shoulders to 12 foot lanes and 1 foot shoulders	Rural	Two-lane highways	Run-off-the-road, head-on, sideswipe	-85	1.85	PA (14)
Segments	Convert 12 foot lanes and 6 foot shoulders to 11 foot lanes and 2 foot shoulders	Rural	Two-lane highways	Run-off-the-road, head-on, sideswipe	-12	1.12	PA (14)
Segments	Convert 12 foot lanes and 6 foot shoulders to 10 foot lanes and 3 foot shoulders	Rural	Two-lane highways	Run-off-the-road, head-on, sideswipe	-13	1.13	PA (14)
Segments	Convert 12 foot lanes and 6 foot shoulders to 12 foot lanes and 0 foot shoulders*	Urban	Urban and suburban arterials	Total	-42.7	1.427	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 12 foot lanes and 1 foot shoulders*	Urban	Urban and suburban arterials	Total	-34.5	1.345	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 12 foot lanes and 2 foot shoulders*	Urban	Urban and suburban arterials	Total	-26.7	1.267	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 12 foot lanes and 3 foot shoulders*	Urban	Urban and suburban arterials	Total	-19.4	1.194	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 12 foot lanes and 4 foot shoulders*	Urban	Urban and suburban arterials	Total	-12.6	1.126	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 12 foot lanes and 5 foot shoulders*	Urban	Urban and suburban arterials	Total	-6.1	1.061	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 12 foot lanes and 7 foot shoulders*	Urban	Urban and suburban arterials	Total	5.8	0.942	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 12 foot lanes and 8 foot shoulders*	Urban	Urban and suburban arterials	Total	11.2	0.888	IL (22)

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Segments	Convert 12 foot lanes and 6 foot shoulders to 12 foot lanes and 9 foot shoulders*	Urban	Urban and suburban arterials	Total	16.3	0.837	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 12 foot lanes and 10 foot shoulders*	Urban	Urban and suburban arterials	Total	21.1	0.789	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 10 foot lanes and 0 foot shoulders*	Urban	Urban and suburban arterials	Total	-270.5	3.705	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 10 foot lanes and 1 foot shoulders*	Urban	Urban and suburban arterials	Total	-248.4	3.484	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 10 foot lanes and 2 foot shoulders*	Urban	Urban and suburban arterials	Total	-227.6	3.276	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 10 foot lanes and 3 foot shoulders*	Urban	Urban and suburban arterials	Total	-208	3.08	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 10 foot lanes and 4 foot shoulders*	Urban	Urban and suburban arterials	Total	-189.6	2.896	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 10 foot lanes and 5 foot shoulders*	Urban	Urban and suburban arterials	Total	-172.3	2.723	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 10 foot lanes and 6 foot shoulders*	Urban	Urban and suburban arterials	Total	-156	2.56	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 10 foot lanes and 7 foot shoulders*	Urban	Urban and suburban arterials	Total	-140.7	2.407	IL (22)

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Segments	Convert 12 foot lanes and 6 foot shoulders to 10 foot lanes and 8 foot shoulders*	Urban	Urban and suburban arterials	Total	-126.3	2.263	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 10 foot lanes and 9 foot shoulders*	Urban	Urban and suburban arterials	Total	-112.8	2.128	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 10 foot lanes and 10 foot shoulders*	Urban	Urban and suburban arterials	Total	-100.1	2.001	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 11 foot lanes and 0 foot shoulders*	Urban	Urban and suburban arterials	Total	-14.2	1.142	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 11 foot lanes and 1 foot shoulders*	Urban	Urban and suburban arterials	Total	-10.4	1.104	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 11 foot lanes and 2 foot shoulders*	Urban	Urban and suburban arterials	Total	-6.8	1.068	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 11 foot lanes and 3 foot shoulders*	Urban	Urban and suburban arterials	Total	-3.3	1.033	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 11 foot lanes and 4 foot shoulders*	Urban	Urban and suburban arterials	Total	0.1	0.999	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 11 foot lanes and 5 foot shoulders*	Urban	Urban and suburban arterials	Total	3.4	0.966	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 11 foot lanes and 6 foot shoulders*	Urban	Urban and suburban arterials	Total	6.6	0.934	IL (22)

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Segments	Convert 12 foot lanes and 6 foot shoulders to 11 foot lanes and 7 foot shoulders*	Urban	Urban and suburban arterials	Total	9.7	0.903	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 11 foot lanes and 8 foot shoulders*	Urban	Urban and suburban arterials	Total	12.6	0.874	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 11 foot lanes and 9 foot shoulders*	Urban	Urban and suburban arterials	Total	15.5	0.845	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 11 foot lanes and 10 foot shoulders*	Urban	Urban and suburban arterials	Total	18.3	0.817	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 13 foot lanes and 0 foot shoulders*	Urban	Urban and suburban arterials	Total	-23.8	1.238	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 13 foot lanes and 1 foot shoulders*	Urban	Urban and suburban arterials	Total	-16.8	1.168	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 13 foot lanes and 2 foot shoulders*	Urban	Urban and suburban arterials	Total	-10.1	1.101	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 13 foot lanes and 3 foot shoulders*	Urban	Urban and suburban arterials	Total	-3.8	1.038	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 13 foot lanes and 4 foot shoulders*	Urban	Urban and suburban arterials	Total	2.1	0.979	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 13 foot lanes and 5 foot shoulders*	Urban	Urban and suburban arterials	Total	7.6	0.924	IL (22)

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Segments	Convert 12 foot lanes and 6 foot shoulders to 13 foot lanes and 6 foot shoulders*	Urban	Urban and suburban arterials	Total	12.9	0.871	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 13 foot lanes and 7 foot shoulders*	Urban	Urban and suburban arterials	Total	17.9	0.821	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 13 foot lanes and 8 foot shoulders*	Urban	Urban and suburban arterials	Total	22.5	0.775	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 13 foot lanes and 9 foot shoulders*	Urban	Urban and suburban arterials	Total	26.9	0.731	IL (22)
Segments	Convert 12 foot lanes and 6 foot shoulders to 13 foot lanes and 10 foot shoulders*	Urban	Urban and suburban arterials	Total	31.1	0.689	IL (22)
Segments	Extend on-ramp acceleration lane by 30 meters (about 100 feet)	Urban and rural	Grade-separated junctions	Total	11	0.89	Not specified (10)
Segments	Extend off-ramp deceleration lane by 30 meters (about 100 feet)	Urban and rural	Grade-separated junctions	Total	7	0.93	Not specified (10)
Segments	Install passing relief lane	Rural	Two-lane highways	Total	33	0.67	MI (3)
				KABC	29	0.71	
				Target (head-on, rear-end, run-off-the-road, sideswipe)	47	0.53	
				Peak month (June, July, August)	46	0.54	
				Off-peak month	28	0.72	

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Segments	Increase lane width by 1 foot*	Urban	Two-lane roads	PDO	6.6	0.934	IN (42)
				KABC	14.2	0.858	
			Multilane roads	PDO	2.0	0.980	
				KABC	14.1	0.859	
		Rural	Two-lane roads	PDO	8.2	0.918	
				KABC	7.4	0.926	
			Multilane roads	PDO	17.7	0.823	
				KABC	21.2	0.788	
Segments	Increase lane width by 2 feet*	Urban	Two-lane roads	PDO	12.7	0.873	IN (42)
				KABC	26.3	0.737	
			Multilane roads	PDO	4.0	0.960	
				KABC	26.2	0.738	
		Rural	Two-lane roads	PDO	15.7	0.843	
				KABC	14.3	0.857	
			Multilane roads	PDO	32.2	0.678	
				KABC	37.9	0.621	
Segments	Increase lane width by 3 feet*	Urban	Two-lane roads	PDO	18.4	0.816	IN (42)
				KABC	36.8	0.632	
			Multilane roads	PDO	6.0	0.940	
				KABC	36.6	0.634	
		Rural	Two-lane roads	PDO	22.6	0.774	
				KABC	20.7	0.793	
			Multilane roads	PDO	44.2	0.558	
				KABC	51.1	0.489	
Segments	Increase lane width by 4 feet*	Urban	Two-lane roads	PDO	23.8	0.762	IN (42)
				KABC	45.7	0.543	
			Multilane roads	PDO	7.9	0.921	
				KABC	45.6	0.544	
		Rural	Two-lane roads	PDO	28.9	0.711	
				KABC	26.6	0.734	
			Multilane roads	PDO	54.0	0.460	
				KABC	61.5	0.385	
Shoulder treatment	Increase right shoulder width by 1 foot*	Urban	Two-lane roads	PDO	1.7	0.983	IN (42)
			Multilane roads	PDO	1.6	0.984	
		Rural	Two-lane roads	PDO	2.3	0.977	
				KABC	2.8	0.972	
			Multilane roads	PDO	4.0	0.960	
				KABC	4.0	0.960	

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Shoulder treatment	Increase right shoulder width by 2 feet*	Urban	Two-lane roads	PDO	3.5	0.965	IN (42)
			Multilane roads	PDO	3.1	0.969	
		Rural	Two-lane roads	PDO	4.6	0.954	
				KABC	5.4	0.946	
			Multilane roads	KABC	7.9	0.921	
Shoulder treatment	Increase right shoulder width by 3 feet*	Urban	Two-lane roads	PDO	5.1	0.949	IN (42)
			Multilane roads	PDO	4.7	0.953	
		Rural	Two-lane roads	PDO	6.8	0.932	
				KABC	8.0	0.920	
			Multilane roads	KABC	11.6	0.884	
Shoulder treatment	Increase right shoulder width by 4 feet*	Urban	Two-lane roads	PDO	6.8	0.932	IN (42)
			Multilane roads	PDO	6.2	0.938	
		Rural	Two-lane roads	PDO	8.9	0.911	
				KABC	10.6	0.894	
			Multilane roads	KABC	15.2	0.848	
Shoulder treatment	Increase left/inside shoulder width by 1 foot*	Urban	Multilane roads	KABC	18.5	0.815	IN (42)
		Rural	Multilane roads	PDO	4.3	0.957	
				KABC	6.7	0.933	
Shoulder treatment	Increase left/inside shoulder width by 2 feet*	Urban	Multilane roads	KABC	33.6	0.664	IN (42)
		Rural	Multilane roads	PDO	8.5	0.915	
				KABC	13.0	0.870	
Shoulder treatment	Increase left/inside shoulder width by 3 feet*	Urban	Multilane roads	KABC	45.9	0.541	IN (42)
		Rural	Multilane roads	PDO	12.4	0.876	
				KABC	18.9	0.811	
Shoulder treatment	Increase left/inside shoulder width by 4 feet*	Urban	Multilane roads	KABC	56.0	0.440	IN (42)
		Rural	Multilane roads	PDO	16.2	0.838	
				KABC	24.3	0.757	
Signs	Install chevron signs on horizontal curves	Rural	Two-lane highways	Total	4.3	0.957	WA (37)
				KABC	16.4	0.836	
				Lane departure	5.9	0.941	
				Nighttime	24.5	0.755	
				Nighttime lane departure	22.1	0.779	

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Signs	Increase retroreflectivity of stop signs	Urban and rural	Three- and four-leg stop-controlled intersections	Total	1.2	0.988	CT, SC (28)
				KABC	6.7	0.933	
				Right-angle	-1.2	1.012	
				Rear-end	-2.2	1.022	
				Nighttime	4.4	0.956	
				Daytime	-0.1	1.001	
Signs	Install flashing beacons at stop-controlled intersections	Urban	Two-lane highways	Angle	-12	1.12	NC, SC (36)
		Rural	Two-lane highways	Angle	16	0.84	
Speed management	Lower posted speed by 15-20 mph	Urban and rural	Nonlimited access highways	Total	6	0.94	AZ, CA, CO, CT, DE, ID, IL, IN, ME, MD, MA, MI, MS, NE, NJ, NM, OH, OK, TN, TX, VA, WV (27)
Speed management	Lower posted speed by 10 mph	Urban and rural	Nonlimited access highways	Total	4	0.96	AZ, CA, CO, CT, DE, ID, IL, IN, ME, MD, MA, MI, MS, NE, NJ, NM, OH, OK, TN, TX, VA, WV (27)
Speed management	Lower posted speed by 5 mph	Urban and rural	Nonlimited access highways	Total	-17	1.17	AZ, CA, CO, CT, DE, ID, IL, IN, ME, MD, MA, MI, MS, NE, NJ, NM, OH, OK, TN, TX, VA, WV (27)
Speed management	Raise posted speed by 5 mph	Urban and rural	Nonlimited access highways	Total	8	0.92	AZ, CA, CO, CT, DE, ID, IL, IN, ME, MD, MA, MI, MS, NE, NJ, NM, OH, OK, TN, TX, VA, WV (27)
Speed management	Raise posted speed by 10-15 mph	Urban and rural	Nonlimited access highways	Total	15	0.85	AZ, CA, CO, CT, DE, ID, IL, IN, ME, MD, MA, MI, MS, NE, NJ, NM, OH, OK, TN, TX, VA, WV (27)
Speed management	Set appropriate speed limit	Urban and rural	Not specified	Total	28	0.72	Based on KY, MO, MT (13)

*CRF/CMF given in the form of a function in the CMF Clearinghouse or in the report/paper. For this table, the CRFs/CMFs have been discretized for various levels of the safety countermeasure. The user is referred to the source (provided by the reference number) for the original functional form.

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