

Appendix 7 ODOT's Approved Crash
Reduction Factors

DRAFT

General Notes: All Injury = Fatal, A, B & C

Orange = Special Condition CRF
Yellow = Not a traditional CRF value

Systemic or Hotspot	Countermeasure Number	Countermeasure	Crash Type	Injury, PDO or All	Service Life (Years)	Existing Intersection Traffic Control	Urban or Rural	CRF %	Range of CRF	Who's CRF?	CRF Justification	ADA Trigger
Hotspot	H1	Median U-Turn Intersection Treatment	All	All Injury	20	Signal or Non Signal	Either	30	30%	Synthesis of the Median U-Turn Intersection Treatment (FHWA-HRT-07-033)	3rd	
Hotspot	H2	Right Turn Lane on Single Major Road Approach: Unsignalized Intersection (3- or 4-leg)	All	All	20	Non Signal	Either	14	14 - 26%	HSM	1st	Likely
	H3	Right Turn Lane on Both Major Road Approaches: Unsignalized Intersection (3- or 4-leg)	All	All	20	Non Signal	Either	26	14 - 26%			Likely
Hotspot	H4	Right Turn Lane on Single Major Road Approaches: Signalized Intersection (3- or 4-leg)	All	All	20	Signal	Either	4	4 - 9%	HSM	1st	Likely
	H5	Right Turn Lane on Both Major Road Approaches: Signalized Intersection (3- or 4-leg)	All	All	20	Signal	Either	8	4 - 9%			Likely
Hotspot	H6	Channelized Right Turn Lane with Raised Median	All	All Injury	20	Signal or Non Signal	Either	35	25 - 50%	2007 Desktop Reference	3rd	Likely
Hotspot	H7	Left Turn Lane on Single Major Road Approach: Urban, Unsignalized Intersection (3-leg)	All	All	20	Non Signal	Urban	33	33 - 55%	HSM	1st	Likely
	H8	Left Turn Lane on Both Major Road Approaches: Urban, Unsignalized Intersection (4-leg)	All	All	20	Non Signal	Urban	47	47 - 58%			Likely
	H9	Left Turn Lane on Single Major Road Approach: Rural, Unsignalized Intersection (3-leg)	All	All	20	Non Signal	Rural	44	33 - 55%			
	H10	Left Turn Lane on Both Major Road Approaches: Rural, Unsignalized Intersection (4-leg)	All	All	20	Non Signal	Rural	48	47 - 58%			
Hotspot	H11	Left Turn Lane on Single Major Road Approach: Urban, Signalized Intersection (3-leg)	All	All	20	Signal	Urban	7	7 - 15%	HSM	1st	Likely
	H12	Left Turn Lane on Both Major Road Approaches: Urban, Signalized Intersection (4-leg)	All	All	20	Signal	Urban	19	17 - 48%			Likely
	H13	Left Turn Lane on Single Major Road Approach: Rural, Signalized Intersection (3-leg)	All	All	20	Signal	Rural	15	7 - 15%			Likely
	H14	Left Turn Lane on Both Major Road Approaches: Rural, Signalized Intersection (4-leg)	All	All	20	Signal	Rural	33	17 - 48%			Likely
Hotspot	H15	Channelized Left Turn Lane with Raised Median on All Approaches (3- or 4-leg)	All	All Injury	20	Signal or Non Signal	Either	27	4 - 27%	HSM	1st	Likely
Hotspot	H16	Install Roundabout from Minor Road Stop Control	All	All Injury	20	Non Signal	Either	82	19 - 82%	HSM	1st	Likely
Hotspot	H17	Install Roundabout from Signalized Intersection	All	All injury	20	Signal	Either	78	48 - 78%	HSM	1st	Likely
Hotspot	H18	Convert to All-Way Stop Control (From Urban 2-Way or Yield Control)	Angle	All	10	Non Signal	Urban	75	18 - 75%	HSM	1st	
	H19	Convert to All-Way Stop Control (From Rural 2-Way or Yield Control)	All	All	10	Non Signal	Rural	48	18 - 75%			
Hotspot	H20	Install Urban Traffic Signal	Angle	All	20	Non Signal	Urban	67	-143 - 77%	HSM	1st	Likely
		Install Urban Traffic Signal	Rear End	All	20	Non Signal	Urban	-143	-143 - 77%			Likely
	H21	Install Rural Traffic Signal	Angle	All	20	Non Signal	Rural	77	-58 - 77%			Likely
		Install Rural Traffic Signal	Rear End	All	20	Non Signal	Rural	-58	-58 - 77%			Likely
Hotspot	H22	Convert 4-Leg Intersection to Two 3-Leg Intersections (Minor St ADT is 15-30% of Total Entering Traffic)	All	All injury	20	Non Signal	Either	25	10 - 33%	HSM	1st	Likely
	H23	Convert 4-Leg Intersection to Two 3-Leg Intersections (Minor St ADT is 30% + of Total Entering Traffic)	All	All Injury	20	Non Signal	Either	33	10 - 33%			Likely
Systemic or Hotspot	Countermeasure Number	Countermeasure	Crash Type	Injury, PDO or All	Service Life (Years)	Existing Intersection Traffic Control	Urban or Rural	CRF %	Range of CRF	Who's CRF?	CRF Justification	ADA Trigger
Hotspot	H24	Install Rural Median Acceleration Lane	All	All Injury	20	Non Signal	Rural	45	20 - 79%	Clearinghouse (not in HSM)	3rd	
Hotspot	H25	Install Lighting at Intersection	Night	All Injury	20	Signal or Non Signal	Either	38	31 - 38%	HSM	1st	Likely
Hotspot	H26	Install Lighting on a Roadway Segment	Night	All Injury	20	None - Roadway	Either	28	17 - 29%	HSM	1st	
Hotspot	H27	Install Any Type of Median Barrier	All	All Injury	20	None - Roadway	Either	30	-24 - 43%	HSM	1st	Likely
Hotspot	H28	Install New Guardrail (Not Median Barrier Application)	Run off the Road	All Injury	20	None - Roadway	Either	47	44 - 47%	Clearinghouse (not in HSM)	2nd	
Hotspot	H29	Install Two Way Left Turn Lane on 2-Lane Road	Rear End	All	20	None - Roadway	Either	39	-5 - 53.1%	Clearinghouse (not in HSM)	2nd	
Hotspot	H30	Reduce Urban Driveways from 48 to 26 - 48 per mile	All	All Injury	20	None - Roadway	Urban	29	25 - 31%	HSM	1st	Likely
	H31	Reduce Urban Driveways from 26 - 48 to 10 - 24 per mile	All	All Injury	20	None - Roadway	Urban	31	25 - 31%			Likely
	H32	Reduce Urban Driveways from 10 - 24 to less than 10 per mile	All	All injury	20	None - Roadway	Urban	25	25 - 31%			Likely

Hotspot	H33	Provide a Raised Median, Urban 2-Lane Road	All	All injury	20	None - Roadway	Urban	39	39%	HSM	1st	Likely
	H34	Provide a Raised Median, Urban Multi-Lane Road	All	All injury	20	None - Roadway	Urban	22	0 - 22%			Likely
	H35	Provide a Raised Median, Rural Multi-Lane Road	All	All injury	20	None - Roadway	Rural	12	0 - 22%			Likely
Hotspot	H36	Install Traversable Median (4 ft. or more)	All	All	20	None - Roadway	Either	12	12 - 30%	ODOT 2005 APM	3rd	Likely
Hotspot	H37	Install Passing Lane or Climbing Lane on Rural, 2-Lane Roadway	All	All Injury	20	None - Roadway	Rural	25	25 - 35%	HSM (not rated)	1st	
Hotspot	H38	Widen Rural Paved Lane Width by 1 foot	All	All	20	None - Roadway	Rural	5	5%	Clearinghouse (not in HSM)	2nd	
Hotspot	H39	Flatten Horizontal Curve (Increase Radius)	All	All	20	None - Roadway	Either	See table	15 - 78%	Clearinghouse (not in HSM)	3rd	
Hotspot	H40	Flatten Crest Vertical Curve	All	All	20	None - Roadway	Either	20	20 - 51%	Clearinghouse (not in HSM)	2nd	
Hotspot	H41	Improve Superelevation Variance (SV) on Rural Curves (Between 0.01 and 0.02)	All	All	20	None - Roadway	Rural	CRF = -600*(SV - 0.01)	N/A	HSM	1st	
	H42	Improve Superelevation Variance (SV) on Rural Curves (More than 0.02)	All	All	20	None - Roadway	Rural	CRF = -300*SV	N/A			
Hotspot	H43	Convert from Urban Two-Way to One-Way Traffic	All	All	20	None - Roadway	Urban	47	47%	Clearinghouse (not in HSM)	3rd	
Hotspot	H44	Increase Pavement Friction by Installing High Friction Surface Treatment - Curves Application	Wet Road	All	10	None - Roadway	Either	52	20 - 68%	Clearinghouse (not in HSM) - 3 to 4 stars	2nd	
Hotspot	H45	Install Urban Variable Speed Limit Signs	All	All	10	None - Roadway	Urban	8	8%	Clearinghouse (not in HSM)	2nd	
	H46	Install Rural Variable Speed Limit Signs	All	All	10	None - Roadway	Rural	20	20 - 30%	Zarean, M., Pisano, P., Dirnberger, K., and Robinson, M. (1999) Variable Speed Limit Systems: The-State-Of-The-Practice. Proceedings of the 1999 Rural Advanced Technology & Transportation Systems Conference, Flagstaff, AZ.	3rd	
Hotspot	H47	Install Individual Changeable Speed Warning Signs	All	All	10	None - Roadway	Either	41	41%	Clearinghouse (not in HSM)	3rd	
Hotspot	H48	Convert 4-Lane Roadway to 3-Lane Roadway with Center Turn Lane (Road Diet)	All	All	20	None - Roadway	Urban	29	29%	HSM	1st	Likely
Hotspot	H49	Install Truck Escape Ramp	Truck	All	20	None - Roadway	Either	20	33 - 75%	2007 Desktop Reference	3rd	
Systemic or Hotspot	Countermeasure Number	Countermeasure	Crash Type	Injury, PDO or All	Service Life (Years)	Existing Intersection Traffic Control	Urban or Rural	CRF %	Range of CRF	Who's CRF?	CRF Justification	ADA Trigger
Intersection Systemic	I1	Install Lighting at Intersection	Night	All Injury	20	Signal or Non Signal	Either	38	31 - 38%	HSM	1st	Likely
Intersection Systemic	I2	Improve Signal Hardware: Lenses, Reflectorized Back plates, Size, and Number	All	All	20	Signal	Either	20% for 2 Countermeasures from List 25% for 3-4 Countermeasures from List 30% for 5-6 Countermeasures from List	0 - 46%	Caltrans/Intersection Implementation Plan/Engineering Judgment	4th	
Intersection Systemic	I3	Replace Doghouse with Flashing Yellow Arrow Signal Heads	Left Turning	All	20	Signal	Either	25	25%	ODOT Systemic Worksheet	4th	
Intersection Systemic	I4	Replace Urban Permissive or Protected/Permissive Left Turns to Protected Only	Left Turning	All	20	Signal	Urban	99	6 - 99%	HSM	1st	
Intersection Systemic	I5	Replace Urban Permissive Left Turns to Protected/Permissive	Left Turning	All Injury	20	Signal	Urban	16	6 - 99%	HSM	1st	
Intersection Systemic	I6	Install Adaptive Signal Timing of Urban Traffic Signals	All	All	10	Signal	Urban	17	17%	Estimation of the Safety Effects of an Adaptive Traffic Signal Control System (2015)	3rd	
Intersection Systemic	I7	Install Actuated Advance Warning Dilemma Zone Protection System at High Speed Signals (Microwave Detection)	All	All	10	Signal	Either	8	0 - 43.6%	Clearinghouse (not in HSM)	2nd	

Intersection Systemic	I8	Install Flashing Beacons as Advance Warning at Intersections (Not Coordinated with Signal Timing)	All	All	10	Signal or Non Signal	Either	13	10.2 -13.3%	2007 Desktop Reference	3rd	
Intersection Systemic	I9	Install Actuated/Coordinated Flashing Beacons as Advance Warning for Signalized Intersections	Rear End	All	10	Signal	Either	36	36 - 62%	Clearinghouse (not in HSM)	3rd	
Intersection Systemic	I10	Increase Triangle Sight Distance	All	All Injury	10	Signal or Non Signal	Either	48	11 - 56%	Clearinghouse (not in HSM)	2nd	
Intersection Systemic	I11	Increase Pavement Friction by Installing High Friction Surface Treatment - Intersection or Segment Application	Wet Road	All	10	Signal or Non Signal	Either	57	17 - 57%	Clearinghouse (not in HSM)	2nd	
Intersection Systemic	I12	Improve Intersection Warning: Stop Ahead Pavement Markings, Stop Ahead Signs, Larger Signs, Additional Stop Signs and/or Other Intersection Warning or Regulatory Signs	All	All	10	Non Signal	Either	20% for 1-2 Countermeasures from List 25% for 3-4 Countermeasures from List 30% for 5-7 Countermeasures from List	11 - 55%	Caltrans/Intersection Implementation Plan/ODOT Engineering Judgment	4th	
Intersection Systemic	I13	Provide Flashing Beacons at All-Way Stop Controlled Intersections	Angle	All	10	Non Signal	Either	28	5 - 58%	HSM	1st	
	I14	Provide Flashing Beacons at Minor Road Stop Controlled Intersections	Angle	All	10	Non Signal	Either	13	5 - 58%			
Intersection Systemic	I15	Provide Actuated Flashing Beacons Triggered by Approaching Vehicles at Unsignalized Intersections	All	All	10	Non Signal	Either	27	27	Clearinghouse (not in HSM) 5-star	2nd	
Intersection Systemic	I16	Install Transverse Rumble Strips on Stop Controlled Approach(es)	All	Fatal/A	10	Non Signal	Either	25	-36 - 33%	Clearinghouse (not in HSM)	2nd	
Intersection Systemic	I17	Install 6 ft. or greater Raised Divider on Stop Approach (Splitter Island)	All	All	20	Non Signal	Either	15	15%	Low-Cost Safety Enhancements for Stop-Controlled and Signalized Intersections	3rd	
Systemic or Hotspot	Countermeasure Number	Countermeasure	Crash Type	Injury, PDO or All	Service Life (Years)	Existing Intersection Traffic Control	Urban or Rural	CRF %	Range of CRF	Who's CRF?	CRF Justification	ADA Trigger
Bike/Ped Systemic	BP1	Install Pedestrian Countdown Timer(s)	Pedestrian	All	20	Signal	Either	70	0 - 70%	Clearinghouse (not in HSM)	2nd	
Bike/Ped Systemic	BP2	Provide Intersection Lighting (Bike & Ped)	P & B Night	All Injury	20	Signal or Non Signal or None - Roadway	Either	42	42%	HSM	1st	Likely
Bike/Ped Systemic	BP3	Install Urban Leading Pedestrian or Bicycle Interval at Signalized Intersection	P & B	All	10	Signal	Urban	37	37 - 45%	Clearinghouse (not in HSM)	2nd	
Bike/Ped Systemic	BP4	Install No Pedestrian Phase Feature with Flashing Yellow Arrow	Pedestrian	All	20	Signal	Either	43	43%	Accident Analysis & Prevention (Chen)	3rd	
Bike/Ped Systemic	BP5	Install Urban Green Bike Lanes at Conflict Points	Bicycle	All	10	Signal or Non Signal or None - Roadway	Urban	39	39%	Clearinghouse (not in HSM) & ODOT ARTS Transition	3rd	
Bike/Ped Systemic	BP6	Install Bike Box at Conflict Points	Bicycle	All	10	Signal	Either	35	35%	2007 Desktop Reference	3rd	
Bike/Ped Systemic	BP7	Install Pedestrian Refuge Island	Pedestrian	All	20	Non Signal or None - Roadway	Either	31	26 - 31%	NCHRP 841	2nd	Likely
Bike/Ped Systemic	BP8	Install Rectangular Rapid Flashing Beacon (2-Lane Road)	Pedestrian	All	20	Non Signal or None - Roadway	Either	10	10 - 56%	ODOT Engineering Judgment	4th	
	BP9	Install Rectangular Rapid Flashing Beacon without Median (3-Lane or More Roadway)	Pedestrian	All	20	Non Signal or None - Roadway	Either	10	10 - 56%			
	BP10	Install Rectangular Rapid Flashing Beacon with Median (3-Lane or More Roadway)	Pedestrian	All	20	Non Signal or None - Roadway	Either	56	10 - 56%			
Bike/Ped Systemic	BP11	Install Continental Crosswalk Markings and Advance Pedestrian Warning Signs at Uncontrolled Locations	Pedestrian	All	10	Non Signal or None - Roadway	Either	15	15%	Low-Cost Safety Enhancements for Stop-Controlled and Signalized Intersections	3rd	
Bike/Ped Systemic	BP12	Install Curb Ramps and Extensions with a Marked Crosswalk and Pedestrian Warning Signs	Pedestrian	All	20	Non Signal or None - Roadway	Either	37	37%	2007 Desktop Reference	3rd	

Bike/Ped Systemic	BP13	Install Advance Pedestrian or Bicycle Warning Signs	P & B	All	10	Non Signal or None - Roadway	Either	5	5 - 15%	ODOT Systemic Worksheet / 2007 Desktop Reference	3rd	
Bike/Ped Systemic	BP14	Install Pedestrian Signal	P & B	All	20	Non Signal or None - Roadway	Either	55	15 - 69%	Caltrans / 2007 Desktop Reference	3rd	Likely
Bike/Ped Systemic	BP15	Install Pedestrian Hybrid Beacon	P & B	All	20	Non Signal or None - Roadway	Urban	55	55 - 69%	NCHRP 841	2nd	Likely
Bike/Ped Systemic	BP16	Convert 4-Lane Roadway to 3-Lane Roadway with Center Turn Lane (Road Diet)	All	All	20	None - Roadway	Urban	29	29%	HSM	1st	Likely
Bike/Ped Systemic	BP17	Install Bike Signal	Bicycle	All	20	Signal	Either	45	45%	MUTCD Interim Approval	3rd	
Bike/Ped Systemic	BP18	Install Bike Lanes	Bicycle	All	20	None - Roadway	Either	36	0 - 53%	Caltrans / 2007 Desktop Reference	3rd	
Bike/Ped Systemic	BP19	Install Cycle Tracks	Bicycle	All injury	20	None - Roadway	Urban	59	59 - 74%	Clearinghouse (not in HSM)	2nd	Likely
Bike/Ped Systemic	BP20	Install Buffered Bike Lanes	Bicycle	All injury	20	None - Roadway	Urban	47	N/A	ODOT Engineering Judgment	4th	
Systemic or Hotspot	Countermeasure Number	Countermeasure	Crash Type	Injury, PDO or All	Service Life (Years)	Existing Intersection Traffic Control	Urban or Rural	CRF %	Range of CRF	Who's CRF?	CRF Justification	ADA Trigger
Roadway Departure Systemic	RD1	Increase Distance to Rural Roadside Obstacle from 3 ft. (1 m) to 16 ft. (5 m)	All	All	20	None - Roadway	Rural	22	22 - 44%	HSM	1st	
	RD2	Increase Distance to Rural Roadside Obstacle from 16 ft. (5 m) to 30 ft. (9 m)	All	All	20	None - Roadway	Rural	44	22 - 44%			
Roadway Departure Systemic	RD3	Flatten Rural Side Slopes	All	All	20	None - Roadway	Rural	See table	3 - 15%	HSM	1st	
Roadway Departure Systemic	RD4	Increase Pavement Friction by Installing High Friction Surface Treatment - Intersection or Segment Application	Wet Road	All	10	None - Roadway	Either	57	20 - 68%	Clearinghouse (not in HSM)	2nd	
Roadway Departure Systemic	RD5	Provide Safety Edge for Rural Pavement Edge Drop-Off	All	All	10	None - Roadway	Rural	6	5-15%	Clearinghouse (not in HSM)	2nd	
Roadway Departure Systemic	RD6	Install RECOMMENDED Chevron Signs on Rural Horizontal Curves	Run Off The Road	All injury	10	None - Roadway	Rural	16	4 - 25%	Clearinghouse (not in HSM)	2nd	
Roadway Departure Systemic	RD7	Install REQUIRED Chevron Signs on Rural Horizontal Curves (Ballbanking and Revised Speed Riders Included)	Run Off The Road	All injury	10	None - Roadway	Rural	16	16%	Engineering Judgment	4th	
Roadway Departure Systemic	RD8	Install Oversized, Doubled Up and/or Fluorescent Yellow Sheeting for Advance Curve Warning Signs	Run Off The Road	All	10	None - Roadway	Either	20	20%	Clearinghouse (not HSM)/Engineering Judgment	4th	
Roadway Departure Systemic	RD9	Provide Static Combination Horizontal Alignment/Advisory Curve Warning Sign	All	All injury	10	None - Roadway	Either	13	13 - 29%	HSM	1st	
Roadway Departure Systemic	RD10	Install Advance Curve Warning Flashers (Curve Warning Signs Exist)	Curve Crashes	All	10	None - Roadway	Either	10	10%	Update of Florida CRF's and Countermeasures to Improve the Development of District Safety Improvement Projects (2005)	3rd	
Roadway Departure Systemic	RD11	Install Dynamic Speed Feedback Sign for Curves	All	All	10	None - Roadway	Rural	5	5%	Clearinghouse (not in HSM) - 5 stars	3rd	
Roadway Departure Systemic	RD12	Install Raised or Recessed Pavement Markers	Night	All	10	None - Roadway	Either	15	15%	Roadway Departure Implementation Plan / ARTS Transition	4th	
Roadway Departure Systemic	RD13	Install Post-Mounted Delineators (Curve Application)	Curve crashes at Night	All	10	None - Roadway	Either	30	0 - 30%	2007 Desktop Reference	3rd	
Roadway Departure Systemic	RD14	Install Edgeline Striping (Tangent and/or Curve Application)	Run off the Road	All	10	None - Roadway	Rural	11	11 - 13%	Clearinghouse (not in HSM)	2nd	

Roadway Departure Systemic	RD15	Install Centerline Rumble Strips	All	All Injury	10	None - Roadway	Rural	12	9 - 45%	Clearinghouse (not in HSM)	2nd	
Roadway Departure Systemic	RD16	Install Shoulder Rumble Strips	Run off the Road	All	10	None - Roadway	Either	22	16 - 42%	Clearinghouse (not in HSM)	1st	
Roadway Departure Systemic	RD17	Install Profiled Line Pavement Markings	Night & Wet Road	All	5	None - Roadway	Either	9	0 - 9%	FHWA-HRT-17-075	4th	
Roadway Departure Systemic	RD18	Install Widen Paved Shoulder by 1 ft.	All	All	20	None - Roadway	Either	6	3 - 6%	Clearinghouse (not in HSM)	2nd	
	RD19	Install Widen Paved Shoulder by 2 ft.	All	All	20	None - Roadway	Either	13	5 - 13%			
	RD20	Install Widen Paved Shoulder by 3 ft.	All	All	20	None - Roadway	Either	18	6 - 18%			