



# Oregon Roadway Departure Implementation Plan Update

**2009-2015**

## **Crash Data Analysis**



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## Oregon Roadway Departure Definition

Roadway departure crashes are those identified in the crash data as meeting the following criteria

-- table joins

CRASH.crash\_id = CRASH\_CAUSE\_EVNT.crash\_id  
-- matches "crash" & "crash events" to the same crash  
and CRASH.crash\_id = VHCL.crash\_id  
-- matches "crash" & "vehicles" to the same crash  
and VHCL.crash\_id = VHCL\_CAUSE\_EVNT.crash\_id  
-- matches "vehicles" & "vehicle events" to the same crash  
and VHCL.vhcl\_id = VHCL\_CAUSE\_EVNT.vhcl\_id  
-- matches "vehicles" & "vehicle events" to the same vehicle  
and VHCL.crash\_id = PARTIC.crash\_id  
-- matches "vehicles" and "participants" to the same crash  
and VHCL.vhcl\_id = PARTIC.vhcl\_id  
-- matches "vehicles" and "participants" to the same vehicle  
and PARTIC.crash\_id = PARTIC\_CAUSE\_ERR\_EVNT.crash\_id  
-- matches participants & errors to the same crash  
and PARTIC.partic\_id = PARTIC\_CAUSE\_ERR\_EVNT.partic\_id  
-- matches "participants" to their errors

-- crash is not intersectional nor intersection-related  
and CRASH.RD\_CHAR\_CD <> '1'  
and CRASH.ISECT\_REL\_FLG <> 1

-- participant is a driver  
and PARTIC.partic\_typ\_cd = '1'

-- crash is off road or involved a lane departure as specified below  
and (CRASH.OFF\_RDWY\_FLG = 1

    -- struck vehicle on other roadway  
    or CRASH.CRASH\_TYP\_CD = '1'

    -- fixed object crashes (excluding **pavement irregularities, expansion joint, overhead structures, vegetation, or other overhead objects, wire cables, or slides struck on-road**)  
    or (CRASH.CRASH\_TYP\_CD = '8'

        and VHCL\_CAUSE\_EVNT.vhcl\_evnt\_1\_cd not in ('049','063','064','067','073','074','118','127')  
        and VHCL\_CAUSE\_EVNT.vhcl\_evnt\_2\_cd not in ('049','063','064','067','073','074','118','127')  
        and VHCL\_CAUSE\_EVNT.vhcl\_evnt\_3\_cd not in ('049','063','064','067','073','074','118','127')  
        and CRASH\_CAUSE\_EVNT.crash\_evnt\_1\_cd not in ('049','063','064','067','073','074','118','127')  
        and CRASH\_CAUSE\_EVNT.crash\_evnt\_2\_cd not in ('049','063','064','067','073','074','118','127')  
        and CRASH\_CAUSE\_EVNT.crash\_evnt\_3\_cd not in ('049','063','064','067','073','074','118','127') )

    -- collision = sideswipe meeting  
    or CRASH.COLLIS\_TYP\_CD = '4'

-- collision type = "head on" when the vehicle crossed a median  
or (CRASH.COLLIS\_TYP\_CD = '2' and (VHCL.actn\_cd = '029' OR VHCL.actn\_cd = '033'))

-- error = "failed to maintain lane" or "ran off road"  
or (PARTIC\_CAUSE\_ERR\_EVNT.partic\_err\_1\_cd in ('080', '081')  
or PARTIC\_CAUSE\_ERR\_EVNT.partic\_err\_2\_cd in ('080', '081')  
or PARTIC\_CAUSE\_ERR\_EVNT.partic\_err\_3\_cd in ('080', '081')))

## Data Overview

**Table 1: Total and Rwd Crashes and Fatalities by Year**

Year	Crashes			Fatalities		
	Total	RwD	Percent	Total	RwD	Percent
2009	41,271	8,851	21%	377	233	62%
2010	44,093	8,674	20%	317	183	58%
2011	49,052	10,464	21%	331	191	58%
2012	49,798	10,268	21%	337	186	55%
2013	49,510	10,106	20%	313	159	51%
2014	51,245	9,984	19%	356	188	53%
2015 (K Only)	29,057	5,294	18%	445	221	50%
<b>Total</b>	<b>314,026</b>	<b>63,641</b>		<b>2,476</b>	<b>1,361</b>	

**Table 2: Total Crashes and Fatalities by Locality**

Locality	Crashes		Fatalities	
	Total	Percent	Total	Percent
State Rural	43,877	14%	978	39%
State Urban	85,527	27%	371	15%
<b>State Total</b>	<b>129,404</b>	<b>41%</b>	<b>1,349</b>	<b>54%</b>
Non-State Rural	29,016	9%	663	27%
Non-State Urban	155,606	50%	464	19%
<b>Non-State Total</b>	<b>184,622</b>	<b>59%</b>	<b>1,127</b>	<b>46%</b>
<b>Grand Total</b>	<b>314,026</b>	<b>100%</b>	<b>2,476</b>	<b>100%</b>

**Table 3: Roadway Departure Crashes and Fatalities by Locality**

Locality	RwD Crashes		RwD Fatalities	
	Total	%	Total	%
State Rural	22,079	35%	637	47%
State Urban	7,408	12%	84	6%
<b>State Total</b>	<b>29,487</b>	<b>46%</b>	<b>721</b>	<b>53%</b>
Non-State Rural	16,118	25%	486	36%
Non-State Urban	18,036	28%	154	11%
<b>Non-State Total</b>	<b>34,154</b>	<b>54%</b>	<b>640</b>	<b>47%</b>
<b>Grand Total</b>	<b>63,641</b>	<b>100%</b>	<b>1,361</b>	<b>100%</b>



## Curve Countermeasures

**Table 4: All Curve Severities**

Locality	Total RWD Crashes	Fatalities	Level A Injuries	Severity Fatal	Severity A-Injury
State Rural	6,916	224	568	3.239%	8.213%
Non-State Rural	7,049	255	630	3.618%	8.937%

## Curve Treatments – Level 1

**Table 5: Curve: Level 1: Non-State: Rural Crash Cluster**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	4	4	0%	144	1%
20 - 29	9	13	0%	359	3%
10 - 19	68	81	1%	1,215	9%
5 - 9	363	444	6%	3,451	25%
4	310	754	11%	4,691	34%
3	659	1,413	20%	6,668	48%
2	1,659	3,072	44%	9,986	72%
1	3,954	7,026	100%	13,940	100%
<b>Total</b>	<b>7,026</b>	<b>7,026</b>	<b>100%</b>	<b>13,940</b>	<b>100%</b>

**Table 6: Curve: Level 1: Non-State: Rural Calculation Data**

<b>Description</b>	MUTCD Minimum
<b>Crash Type Targeted</b>	RWD on curved alignment, failed to negotiate curve
<b>Severity (Fatal)</b>	0.036175
<b>Severity (Severe Injury)</b>	0.089374
<b>Segment Size</b>	1 minute Lat/Lon
<b>Saturation</b>	0.6
<b>Cost</b>	\$10,000
<b>Cost Unit</b>	1 minute Lat/Lon
<b>CMF</b>	0.7

**Table 7: Curve: Level 1: Non-State: Rural Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
3	1,413	6,668	848	\$8.48	200.04	7.24	17.88	\$1.17

## Curve Treatments – Level 2

**Table 8: Curve: Level 2: State: Rural Crash Cluster**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	11	11	0%	396	4%
20 - 29	14	25	1%	733	7%
10-19	124	149	4%	2,273	20%
5-9	465	614	15%	5,207	47%
4	276	890	22%	6,311	56%
3	454	1,344	34%	7,673	69%
2	864	2,208	55%	9,401	84%
1	1,779	3,987	100%	11,180	100%
<b>Total</b>	<b>3,987</b>	<b>3,987</b>	<b>100%</b>	<b>11,180</b>	<b>100%</b>

**Table 9: Curve: Level 2: State: Rural Calculation Data**

<b>Description</b>	MUTCD minimum plus oversize warning signs, warning sign doubled up-left and right, advisory speed plate, chevrons, fluorescent delineators with reflectorized sleeves
<b>Crash Type Targeted</b>	RwD on curved alignment OR failed to negotiate curve
<b>Severity (Fatal)</b>	0.032388664
<b>Severity (Severe Injury)</b>	0.082128398
<b>Segment Size</b>	0.5 mile
<b>Saturation</b>	0.7
<b>Cost</b>	\$5,000
<b>Cost Unit</b>	0.5 mile
<b>CMF</b>	0.7

**Table 10: Curve: Level 2: State: Rural Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
3	1,344	7,673	941	\$4.70	268.56	8.70	22.06	\$0.54

**Table 11: Curve: Level 2: Non-State: Rural Crash Cluster**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	4	4	0%	144	1%
20 - 29	9	13	0%	359	3%
10 - 19	68	81	1%	1,215	9%
5 - 9	363	444	6%	3,451	25%
4	310	754	11%	4,691	34%
3	659	1,413	20%	6,668	48%
2	1,659	3,072	44%	9,986	72%
1	3,954	7,026	100%	13,940	100%
<b>Total</b>	<b>7,026</b>	<b>7,026</b>	<b>100%</b>	<b>13,940</b>	<b>100%</b>

**Table 12: Curve: Level 2: Non-State: Rural Calculation Data**

<b>Description</b>	MUTCD minimum plus oversize warning signs, warning sign doubled up-left and right, advisory speed plate, chevrons, fluorescent delineators with reflectorized sleeves
<b>Crash Type Targeted</b>	RwD on curved alignment OR failed to negotiate curve
<b>Severity (Fatal)</b>	0.036175
<b>Severity (Severe Injury)</b>	0.089374
<b>Segment Size</b>	1 minute Lat/Lon
<b>Saturation</b>	0.7
<b>Cost</b>	\$10,000
<b>Cost Unit</b>	1 minute Lat/Lon
<b>CMF</b>	0.7

**Table 13: Curve: Level 2: Non-State: Rural Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
5	444	3,451	311	\$3.11	120.79	4.37	10.80	\$0.71

### Curve Treatments – Level 3

**Table 14: Curve: Level 3: State: Rural Crash Cluster**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	11	11	0%	396	4%
20 - 29	14	25	1%	733	7%
10-19	124	149	4%	2,273	20%
5-9	465	614	15%	5,207	47%
4	276	890	22%	6,311	56%
3	454	1,344	34%	7,673	69%
2	864	2,208	55%	9,401	84%
1	1,779	3,987	100%	11,180	100%
<b>Total</b>	<b>3,987</b>	<b>3,987</b>	<b>100%</b>	<b>11,180</b>	<b>100%</b>

**Table 15: Curve: Level 3: State: Rural Calculation Data**

<b>Description</b>	Level 2 plus: High-friction surface treatment (HFST), and/or dynamic flashers
<b>Crash Type Targeted</b>	RwD on curved alignment OR failed to negotiate curve
<b>Severity (Fatal)</b>	0.032388664
<b>Severity (Severe Injury)</b>	0.082128398
<b>Segment Size</b>	0.5 mile
<b>Saturation</b>	0.7
<b>Cost</b>	\$90,000
<b>Cost Unit</b>	0.5 mile
<b>CMF</b>	0.595

**Table 16: Curve: Level 3: State: Rural Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
16	41	1,007	29	\$2.58	47.58	1.54	3.91	\$1.68

**Table 17: Curve: Level 3: Non-State: Rural Crash Cluster**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	4	4	0%	144	1%
20 - 29	9	13	0%	359	3%
10 - 19	68	81	1%	1,215	9%
5 - 9	363	444	6%	3,451	25%
4	310	754	11%	4,691	34%
3	659	1,413	20%	6,668	48%
2	1,659	3,072	44%	9,986	72%
1	3,954	7,026	100%	13,940	100%
<b>Total</b>	<b>7,026</b>	<b>7,026</b>	<b>100%</b>	<b>13,940</b>	<b>100%</b>

**Table 18: Curve: Level 3: Non-State: Rural Calculation Data**

<b>Description</b>	Level 2 plus: High-friction surface treatment (HFST), and/or dynamic flashers
<b>Crash Type Targeted</b>	RwD on curved alignment OR failed to negotiate curve
<b>Severity (Fatal)</b>	0.036175
<b>Severity (Severe Injury)</b>	0.089374
<b>Segment Size</b>	1 minute Lat/Lon
<b>Saturation</b>	0.7
<b>Cost</b>	\$90,000
<b>Cost Unit</b>	1 minute Lat/Lon
<b>CMF</b>	0.595
<b>Notes</b>	Assumes one curve treatment for each minute of Lat/Lon

**Table 19: Curve: Level 3: Non-State: Rural Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
19	14	378	10	\$0.88	17.86	0.65	1.60	\$1.37

## Centerline Rumble Strip(e)s

**Table 20: Cross-centerline Crash Severities**

Locality	Total Rwd Crashes	Fatalities	Level A Injuries	Severity Fatal	Severity A-Injury
State Rural	9,159	316	805	3.450%	8.789%
Non-State Rural	8,415	193	684	2.294%	8.128%

**Table 21: Centerline Rumble Strip(e): State: Rural Crash Cluster**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	2	2	0%	60	1%
20 - 29	2	4	0%	111	1%
10-19	45	49	1%	668	6%
5-9	345	394	7%	2,769	24%
4	297	691	12%	3,957	35%
3	630	1,321	23%	5,847	51%
2	1,213	2,534	45%	8,273	72%
1	3,142	5,676	100%	11,415	100%
<b>Total</b>	<b>5,676</b>	<b>5,676</b>	<b>100%</b>	<b>11,415</b>	<b>100%</b>

**Table 22: Centerline Rumble Strip(e): State: Rural Calculation Data**

<b>Description</b>	Milled rumble strips on or near the centerline, with striping painted through or near millings.
<b>Crash Type Targeted</b>	Head-on, Sideswipe meeting, Cut corner on turn, Driving on wrong side of the road, Straddling or driving on wrong lanes, Failed to maintain lane, No physical barrier between opposing traffic on single road bed, Drove left of center on two-way road
<b>Severity (Fatal)</b>	0.034502
<b>Severity (Severe Injury)</b>	0.087892
<b>Segment Size</b>	0.5 mile
<b>Saturation</b>	0.8
<b>Cost</b>	\$1,800
<b>Cost Unit</b>	0.5 mile
<b>CMF</b>	0.56
<b>Notes</b>	Assume "failure to maintain lane" means "crossed centerline."

**Table 23: Centerline Rumble Strip(e): State: Rural Solution**

<b>Threshold Crash Level (6 Years)</b>	<b>Number of Sections</b>	<b>Number of Crashes in 6 Years (2009-2014)</b>	<b>Estimated Number of Improvements</b>	<b>Construction Costs (\$ Million)</b>	<b>Annual Targeted Crash Reduction</b>	<b>Annual Estimated Fatality Reduction</b>	<b>Annual Estimated Severe Injury Reduction</b>	<b>Cost/Life Saved (\$ Million)</b>
3	1,321	5,847	1,057	\$1.90	343.02	11.84	30.15	\$0.16

**Table 24: Centerline Rumble Strip(e): Non-State: Rural Crash Cluster**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	-	-	-	-	-
20 - 29	4	4	0%	93	0%
10-19	55	59	0%	762	4%
5-9	337	396	3%	2,784	15%
4	274	670	5%	3,880	21%
3	627	1,297	10%	5,761	31%
2	1,796	3,093	24%	9,353	50%
1	9,536	12,629	100%	18,889	100%
<b>Total</b>	<b>12,629</b>	<b>12,629</b>	<b>100%</b>	<b>18,889</b>	<b>100%</b>

**Table 25: Centerline Rumble Strip(e): Non-State: Rural Calculation Data**

<b>Description</b>	Milled rumble strips on or near the centerline, with striping painted through or near millings.
<b>Crash Type Targeted</b>	Head-on, Sideswipe meeting, Cut corner on turn, Driving on wrong side of the road, Straddling or driving on wrong lanes, Failed to maintain lane, No physical barrier between opposing traffic on single road bed, Drove left of center on two-way road
<b>Severity (Fatal)</b>	0.022935
<b>Severity (Severe Injury)</b>	0.081283
<b>Segment Size</b>	1 minute Lat/Lon
<b>Saturation</b>	0.4
<b>Cost</b>	\$3,600
<b>Cost Unit</b>	1 minute Lat/Lon
<b>CMF</b>	0.56
<b>Notes</b>	<ol style="list-style-type: none"> <li>1. Assume "failure to maintain lane" means "crossed centerline."</li> <li>2. Low saturation due to potential raveling of oil mat.</li> </ol>



**Table 26: Centerline Rumble Strip(e): Non-State: Rural Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
3	1,297	5,761	519	\$1.87	168.99	3.88	13.74	\$0.48

## Edge Line Rumble Strip(e)s

**Table 27: Ran off Road Crash Severities**

Locality	Total RWD Crashes	Fatalities	Level A Injuries	Severity Fatal	Severity A-Injury
State Rural	11,731	292	685	2.489%	5.839%
Non-State Rural	15,328	371	960	2.420%	6.263%

**Table 28: Edge Line Rumble Strip(e): State: Rural Crash Cluster**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	-	-	-	-	-
20 - 29	6	6	0%	146	1%
10-19	66	72	1%	939	6%
5-9	481	553	8%	3,872	27%
4	376	929	13%	5,376	37%
3	753	1,682	24%	7,635	52%
2	1,568	3,250	46%	10,771	74%
1	3,795	7,045	100%	14,566	100%
<b>Total</b>	<b>7,045</b>	<b>7,045</b>	<b>100%</b>	<b>14,566</b>	<b>100%</b>

**Table 29: Edge Line Rumble Strip(e): State: Rural Calculation Data**

<b>Description</b>	Milled rumble strips on or near the edge line, with striping painted through or near millings.
<b>Crash Type Targeted</b>	Ran off road
<b>Severity (Fatal)</b>	0.024891
<b>Severity (Severe Injury)</b>	0.058392
<b>Segment Size</b>	0.5 mile
<b>Saturation</b>	0.7
<b>Cost</b>	\$3,000
<b>Cost Unit</b>	0.5 mile
<b>CMF</b>	0.64
<b>Notes</b>	1. Assume "ran off road" means "ran off road right." 2. Shoulder widening may be required to install.

**Table 30: Edge Line Rumble Strip(e): State: Rural Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
3	1,682	7,635	1,177	\$3.53	320.67	7.98	18.72	\$0.44

**Table 31: Edge Line Rumble Strip(e): Non-State: Rural Crash Cluster**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	-	-	-	-	-
20 - 29	3	3	0%	65	0%
10-19	20	23	0%	296	2%
5-9	193	216	2%	1,420	9%
4	194	410	4%	2,196	14%
3	479	889	8%	3,633	24%
2	1,537	2,426	22%	6,707	44%
1	8,611	11,037	100%	15,318	100%
<b>Total</b>	<b>11,037</b>	<b>11,037</b>	<b>100%</b>	<b>15,318</b>	<b>100%</b>

**Table 32: Edge Line Rumble Strip(e): Non-State: Rural Calculation Data**

<b>Description</b>	Milled rumble strips on or near the edge line, with striping painted through or near millings.
<b>Crash Type Targeted</b>	Ran off road
<b>Severity (Fatal)</b>	0.024204
<b>Severity (Severe Injury)</b>	0.062630
<b>Segment Size</b>	1 minute Lat/Lon
<b>Saturation</b>	0.6
<b>Cost</b>	\$6,000
<b>Cost Unit</b>	1 minute Lat/Lon
<b>CMF</b>	0.64
<b>Note</b>	1. Assume "ran off road" means "ran off road right." 2. Shoulder widening may be required to install.

**Table 33: Edge Line Rumble Strip(e): Non-State: Rural Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
4	410	2196	246	\$1.48	79.06	1.91	4.95	\$0.77

## Delineation

**Table 34: Dark Crash Severities**

Locality	Total Rwd Crashes	Fatalities	Level A Injuries	Severity Fatal	Severity A-Injury
State Rural	7,864	203	426	2.581%	5.417%
State Urban	1,459	22	70	1.508%	4.798%
Non-State Rural	6,156	178	502	2.891%	8.155%
Non-State Urban	4,026	37	142	0.919%	3.527%

**Table 35: Delineation: State: Rural Crash Cluster**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	-	-	-	-	-
20 - 29	1	1	0%	20	0%
10-19	16	17	0%	231	3%
5-9	188	205	5%	1,346	17%
4	212	417	10%	2,194	27%
3	445	862	20%	3,529	44%
2	999	1,861	43%	5,527	69%
1	2,492	4,353	100%	8,019	100%
<b>Total</b>	<b>4,353</b>	<b>4,353</b>	<b>100%</b>	<b>8,019</b>	<b>100%</b>

**Table 36: Delineation: State: Rural Calculation Data**

<b>Description</b>	Post mounted delineators, or center and edge pavement markings
<b>Crash Type Targeted</b>	Darkness-no street lights, Dawn (Twilight), Dusk (Twilight)
<b>Severity (Fatal)</b>	0.025814
<b>Severity (Severe Injury)</b>	0.054171
<b>Segment Size</b>	0.5 mile
<b>Saturation</b>	0.8
<b>Cost</b>	\$5,000
<b>Cost Unit</b>	0.5 mile
<b>CMF</b>	0.85
<b>Note</b>	Only considered locations where dark:total crash ratios were 5% (approx. 1 std. dev.) over the statewide average dark:total crash ratio.

**Table 37: Delineation: State: Rural Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
5	205	1346	164	\$0.82	26.92	0.69	1.46	\$1.18

**Table 38: Delineation: State: Urban Crash Cluster**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	-	-	-	-	-
20 - 29	-	-	-	-	-
10-19	1	1	0%	10	1%
5-9	20	21	3%	136	13%
4	28	49	8%	248	24%
3	55	104	17%	413	40%
2	134	238	40%	681	65%
1	363	601	100%	1,044	100%
<b>Total</b>	<b>601</b>	<b>601</b>	<b>100%</b>	<b>1,044</b>	<b>100%</b>

**Table 39: Delineation: State: Urban Calculation Data**

<b>Description</b>	Post mounted delineators, or center and edge pavement markings
<b>Crash Type Targeted</b>	Darkness-no street lights, Dawn (Twilight), Dusk (Twilight)
<b>Severity (Fatal)</b>	0.015079
<b>Severity (Severe Injury)</b>	0.047978
<b>Segment Size</b>	0.5 mile
<b>Saturation</b>	0.8
<b>Cost</b>	\$5,000
<b>Cost Unit</b>	0.5 mile
<b>CMF</b>	0.85
<b>Note</b>	Only considered locations where dark:total crash ratios were 5% (approx. 1 std. dev.) over the statewide average dark:total crash ratio.

**Table 40: Delineation: State: Urban Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
3	104	413	83	\$0.42	8.26	0.12	0.40	\$3.34

**Table 41: Delineation: Non-State: Rural Crash Cluster**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	-	-	-	-	-
20 - 29	1	1	0%	22	0%
10-19	15	16	0%	209	3%
5-9	104	120	2%	846	11%
4	96	216	4%	1,230	16%
3	224	440	8%	1,902	25%
2	693	1,133	21%	3,288	44%
1	4,225	5,358	100%	7,513	100%
<b>Total</b>	<b>5,358</b>	<b>5,358</b>	<b>100%</b>	<b>7,513</b>	<b>100%</b>

**Table 42: Delineation: Non-State: Rural Calculation Data**

<b>Description</b>	Post mounted delineators, or center and edge pavement markings
<b>Crash Type Targeted</b>	Darkness-no street lights, Dawn (Twilight), Dusk (Twilight)
<b>Severity (Fatal)</b>	0.028915
<b>Severity (Severe Injury)</b>	0.081546
<b>Segment Size</b>	1 minute Lat/Lon
<b>Saturation</b>	0.8
<b>Cost</b>	\$10,000
<b>Cost Unit</b>	1 minute Lat/Lon
<b>CMF</b>	0.85
<b>Note</b>	Only considered locations where dark:total crash ratios were 5% (approx. 1 std. dev.) over the statewide average dark:total crash ratio.

**Table 43: Delineation: Non-State: Rural Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
7	46	450	37	\$0.37	9.00	0.26	0.73	\$1.41

**Table 44: Delineation: Non-State: Urban Crash Cluster**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	2	2	0%	84	1%
20 - 29	17	19	0%	467	3%
10-19	106	125	2%	1,830	13%
5-9	407	532	7%	4,382	31%
4	246	778	10%	5,366	38%
3	402	1,180	16%	6,572	47%
2	1,070	2,250	30%	8,712	62%
1	5,341	7,591	100%	14,053	100%
<b>Total</b>	<b>7,591</b>	<b>7,591</b>	<b>100%</b>	<b>14,053</b>	<b>100%</b>

**Table 45: Delineation: Non-State: Urban Calculation Data**

<b>Description</b>	Post mounted delineators, or center and edge pavement markings
<b>Crash Type Targeted</b>	Darkness-no street lights, Dawn (Twilight), Dusk (Twilight)
<b>Severity (Fatal)</b>	0.00919
<b>Severity (Severe Injury)</b>	0.03527
<b>Segment Size</b>	1 minute Lat/Lon
<b>Saturation</b>	0.8
<b>Cost</b>	\$10,000
<b>Cost Unit</b>	1 minute Lat/Lon
<b>CMF</b>	0.85
<b>Note</b>	Only considered locations where dark:total crash ratios were 5% (approx. 1 std. dev.) over the statewide average dark:total crash ratio.

**Table 46: Delineation: Non-State: Urban Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
7	278	3,014	222	\$2.22	60.28	0.55	2.13	\$4.01

## Tree Removal/Shielding

**Table 47: Tree Crash Severities**

Locality	Total Rwd Crashes	Fatalities	Level A Injuries	Severity Fatal	Severity A-Injury
State Rural	1,999	127	218	6.353%	10.905%
Non-State Rural	2,680	172	343	6.418%	12.799%

**Table 48: Tree Removal/Shielding: State: Rural Crash Cluster**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	-	-	-	-	-
20 - 29	-	-	-	-	-
10-19	-	-	-	-	-
5-9	3	3	0%	18	1%
4	11	14	1%	62	3%
3	60	74	4%	242	11%
2	249	323	19%	740	35%
1	1,366	1,689	100%	2,106	100%
<b>Total</b>	<b>1,689</b>	<b>1,689</b>	<b>100%</b>	<b>2,106</b>	<b>100%</b>



**Table 49: Tree Removal/Shielding: State: Rural Calculation Data**

<b>Description</b>	Clearing and grubbing trees to clear zone width, or shielding culturally sensitive trees with guardrail.
<b>Crash Type Targeted</b>	Fixed object or other object AND, Tree, stump or shrubs, Tree branch or other vegetation overhead, etc.
<b>Severity (Fatal)</b>	0.063532
<b>Severity (Severe Injury)</b>	0.109055
<b>Segment Size</b>	0.5 mile
<b>Saturation</b>	0.8
<b>Cost</b>	\$12,500
<b>Cost Unit</b>	0.5 mile
<b>CMF</b>	0.5

**Table 50: Tree Removal/Shielding: State: Rural Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
3	74	242	59	\$0.74	16.13	1.02	1.76	\$0.72

**Table 51: Tree Removal/Shielding: Non-State: Rural Crash Cluster**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	-	-	-	-	-
20 - 29	-	-	-	-	-
10-19	-	-	-	-	-
5-9	12	12	0%	66	2%
4	20	32	1%	146	3%
3	73	105	3%	365	8%
2	368	473	13%	1,101	25%
1	3,308	3,781	100%	4,409	100%
<b>Total</b>	<b>3,781</b>	<b>3,781</b>	<b>100%</b>	<b>4,409</b>	<b>100%</b>

**Table 52: Tree Removal/Shielding: Non-State: Rural Calculation Data**

<b>Description</b>	Clearing and grubbing trees to clear zone width, or shielding culturally sensitive trees with guardrail.
<b>Crash Type Targeted</b>	Fixed object or other object AND, Tree, stump or shrubs, Tree branch or other vegetation overhead, etc.
<b>Severity (Fatal)</b>	0.064179
<b>Severity (Severe Injury)</b>	0.127985
<b>Segment Size</b>	1 minute Lat/Lon
<b>Saturation</b>	0.8
<b>Cost</b>	\$25,000
<b>Cost Unit</b>	1 minute Lat/Lon
<b>CMF</b>	0.5

**Table 53: Tree Removal/Shielding: Non-State: Rural Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
4	32	146	26	\$0.64	9.73	0.62	1.25	\$1.02

## Utility Pole Removal/Shielding

**Table 54: Utility Pole Crash Severities**

Locality	Total Rwd Crashes	Fatalities	Level A Injuries	Severity Fatal	Severity A-Injury
State Urban	717	18	43	2.510%	5.997%
State Rural	341	6	20	1.760%	5.865%
Non-State Rural	1,280	36	71	2.813%	5.547%
Non-State Urban	1,412	20	66	1.416%	4.674%

**Table 55: Utility Pole Removal/Shielding: State: Rural Crash Cluster**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	-	-	-	-	-
20 - 29	-	-	-	-	-
10-19	-	-	-	-	-
5-9	4	4	1%	24	4%
4	4	8	1%	40	6%
3	13	21	4%	79	12%
2	62	83	15%	203	31%
1	458	541	100%	661	100%
<b>Total</b>	<b>541</b>	<b>541</b>	<b>100%</b>	<b>661</b>	<b>100%</b>

**Table 56: Utility Pole Removal/Shielding: State: Rural Calculation Data**

<b>Description</b>	Relocating utility poles outside the clear zone, or shielding close-proximity poles with guardrail.
<b>Crash Type Targeted</b>	Fixed object or other object AND, Pole – type unknown, Pole – power or telephone
<b>Severity (Fatal)</b>	0.025105
<b>Severity (Severe Injury)</b>	0.059972
<b>Segment Size</b>	0.5 mile
<b>Saturation</b>	0.4
<b>Cost</b>	\$100,000
<b>Cost Unit</b>	0.5 mile
<b>CMF</b>	0.5
<b>Notes</b>	4% saturation due to difficulty in negotiating and moving utilities.

**Table 57: Utility Pole Removal/Shielding: State: Rural Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
6	4	24	2	\$0.16	0.80	0.02	0.05	\$7.97

**Table 58: Utility Pole Removal/Shielding: State: Urban Crash Cluster**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	-	-	-	-	-
20 - 29	-	-	-	-	-
10-19	-	-	-	-	-
5-9	-	-	-	-	-
4	1	1	0%	4	1%
3	9	10	4%	31	10%
2	35	45	18%	101	34%
1	199	244	100%	300	100%
<b>Total</b>	<b>244</b>	<b>244</b>	<b>100%</b>	<b>300</b>	<b>100%</b>

**Table 59: Utility Pole Removal/Shielding: State: Urban Calculation Data**

<b>Description</b>	Relocating utility poles outside the clear zone, or shielding close-proximity poles with guardrail.
<b>Crash Type Targeted</b>	Fixed object or other object AND, Pole – type unknown, Pole – power or telephone
<b>Severity (Fatal)</b>	0.017595
<b>Severity (Severe Injury)</b>	0.058651
<b>Segment Size</b>	0.5 mile
<b>Saturation</b>	0.4
<b>Cost</b>	\$100,000
<b>Cost Unit</b>	0.5 mile
<b>CMF</b>	0.5
<b>Notes</b>	4% saturation due to difficulty in negotiating and moving utilities.

**Table 60: Utility Pole Removal/Shielding: State: Urban Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
4	1	4	0	\$0.04	0.13	0.00	0.01	\$17.05

**Table 61: Utility Pole Removal/Shielding: Non-State: Rural Crash Cluster**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	-	-	-	-	-
20 - 29	-	-	-	-	-
10-19	-	-	-	-	-
5-9	4	4	0%	26	3%
4	3	7	1%	38	4%
3	11	18	2%	71	7%
2	64	82	10%	199	21%
1	767	849	100%	966	100%
<b>Total</b>	<b>785</b>	<b>785</b>	<b>100%</b>	<b>1,140</b>	<b>100%</b>

**Table 62: Utility Pole Removal/Shielding: Non-State: Rural Calculation Data**

<b>Description</b>	Relocating utility poles outside the clear zone, or shielding close-proximity poles with guardrail.
<b>Crash Type Targeted</b>	Fixed object or other object AND, Pole – type unknown, Pole – power or telephone
<b>Severity (Fatal)</b>	0.028125
<b>Severity (Severe Injury)</b>	0.055469
<b>Segment Size</b>	0.5 mile
<b>Saturation</b>	0.4
<b>Cost</b>	\$100,000
<b>Cost Unit</b>	0.5 mile
<b>CMF</b>	0.5
<b>Notes</b>	4% saturation due to difficulty in negotiating and moving utilities.

**Table 63: Utility Pole Removal/Shielding: Non-State: Rural Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
7	2	14	1	\$0.08	0.47	0.01	0.03	\$6.10

**Table 64: Utility Pole Removal/Shielding: Non-State: Urban Crash Cluster**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	-	-	-	-	-
20 - 29	-	-	-	-	-
10-19	-	-	-	-	-
5-9	13	13	1%	78	4%
4	18	31	2%	150	8%
3	46	77	5%	288	15%
2	158	235	15%	604	32%
1	1,292	1,527	100%	1,896	100%
<b>Total</b>	<b>1,527</b>	<b>1,527</b>	<b>100%</b>	<b>1,896</b>	<b>100%</b>

**Table 65: Utility Pole Removal/Shielding: Non-State: Urban Calculation Data**

<b>Description</b>	Relocating utility poles outside the clear zone, or shielding close-proximity poles with guardrail.
<b>Crash Type Targeted</b>	Fixed object or other object AND, Pole – type unknown, Pole – power or telephone
<b>Severity (Fatal)</b>	0.014164
<b>Severity (Severe Injury)</b>	0.046742
<b>Segment Size</b>	1 minute Lat/Lon
<b>Saturation</b>	0.4
<b>Cost</b>	\$100,000
<b>Cost Unit</b>	1 minute Lat/Lon
<b>CMF</b>	0.5
<b>Notes</b>	4% saturation due to difficulty in negotiating and moving utilities.

**Table 66: Utility Pole Removal/Shielding: Non-State: Urban Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
8	2	16	1	\$0.08	0.53	0.01	0.02	\$10.59

## High-Friction Surface Treatment

**Table 67: Wet Crash Severities**

Locality	Total RWD Crashes	Fatalities	Level A Injuries	Severity Fatal	Severity A-Injury
State Rural	4,700	109	298	2.319%	6.340%

**Table 68: High Friction Surface Treatment: State: Rural Crash Clusters**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	3	3	0%	95	1%
20 - 29	7	10	0%	262	4%
10-19	33	43	1%	672	11%
5-9	159	202	6%	1,610	25%
4	113	315	9%	2,062	32%
3	242	557	16%	2,788	44%
2	651	1,208	34%	4,090	64%
1	2,304	3,512	100%	6,394	100%
<b>Total</b>	<b>3,512</b>	<b>3,512</b>	<b>100%</b>	<b>6,394</b>	<b>100%</b>

**Table 69: High Friction Surface Treatment: State: Rural Calculation Data**

<b>Description</b>	Calcined bauxite applied with epoxy binder.
<b>Crash Type Targeted</b>	Wet
<b>Severity (Fatal)</b>	0.023191
<b>Severity (Severe Injury)</b>	0.063404
<b>Segment Size</b>	0.5 mile
<b>Saturation</b>	0.5
<b>Cost</b>	\$85,000
<b>Cost Unit</b>	0.5 mile
<b>CMF</b>	0.25
<b>Notes</b>	<p>1. Only considered locations where wet:total crash ratios were 5% (approx. 1 std. dev.) over the statewide average wet:total crash ratio.</p> <p>2. One half mile sections are identified for improvement locations, but the improvement will only be a 1,500 foot section, which assumes an average curve length including 300 feet on each approach.</p> <p>3. Ice, snow, and slush crashes not considered.</p>

**Table 70: High Friction Surface Treatment: State: Rural Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
8	2	16	1	\$0.08	0.53	0.01	0.02	\$10.59

## Alcohol Enforcement and Education

**Table 71: Alcohol-Involved Crash Severities**

Locality	Total Rwd Crashes	Fatalities	Level A Injuries	Severity Fatal	Severity A-Injury
State Rural	2,417	550	635	22.755%	26.272%
State Urban	1,128	103	149	9.131%	13.209%
Non-State Rural	2,692	422	737	15.676%	27.377%
Non-State Urban	4,050	158	322	3.901%	7.951%



**Table 72: Alcohol Enforcement and Education: State: Rural Crash Clusters**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	-	-	-	-	-
20 - 29	-	-	-	-	-
10-19	-	-	-	-	-
5-9	3	3	0%	15	1%
4	4	7	0%	31	2%
3	32	39	3%	127	8%
2	180	219	15%	487	29%
1	1,206	1,425	100%	1,693	100%
<b>Total</b>	<b>1,425</b>	<b>1,425</b>	<b>100%</b>	<b>1,693</b>	<b>100%</b>

**Table 73: Alcohol Enforcement and Education: State: Rural Calculation Data**

<b>Description</b>	Targeted visual enforcement, and education/media.
<b>Crash Type Targeted</b>	Alcohol Involved
<b>Severity (Fatal)</b>	0.227555
<b>Severity (Severe Injury)</b>	0.262722
<b>Segment Size</b>	0.5 mile
<b>Saturation</b>	0.4
<b>Cost</b>	\$20,000
<b>Cost Unit</b>	0.5 mile
<b>CMF</b>	0.8

**Table 74: Alcohol Enforcement and Education: State: Rural Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
5	3	15	1	\$0.02	0.20	0.05	0.05	\$0.53

**Table 75: Alcohol Enforcement and Education: State: Urban Crash Clusters**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	-	-	-	-	-
20 - 29	-	-	-	-	-
10-19	-	-	-	-	-
5-9	4	4	1%	25	3%
4	3	7	1%	37	5%
3	34	41	7%	139	17%
2	92	133	21%	323	39%
1	496	629	100%	819	100%
<b>Total</b>	<b>629</b>	<b>629</b>	<b>100%</b>	<b>819</b>	<b>100%</b>

**Table 76: Alcohol Enforcement and Education: State: Urban Calculation Data**

<b>Description</b>	Targeted visual enforcement, and education/media.
<b>Crash Type Targeted</b>	Alcohol Involved
<b>Severity (Fatal)</b>	0.091312
<b>Severity (Severe Injury)</b>	0.132092
<b>Segment Size</b>	0.5 mile
<b>Saturation</b>	0.4
<b>Cost</b>	\$20,000
<b>Cost Unit</b>	0.5 mile
<b>CMF</b>	0.8

**Table 77: Alcohol Enforcement and Education: State: Urban Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
6	4	25	2	\$0.03	0.33	0.03	0.04	\$1.05

**Table 78: Alcohol Enforcement and Education: Non-State: Rural Crash Clusters**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	-	-	-	-	-
20 - 29	-	-	-	-	-
10-19	-	-	-	-	-
5-9	13	13	1%	78	4%
4	18	31	2%	150	8%
3	46	77	5%	288	15%
2	158	235	15%	604	32%
1	1,292	1,527	100%	1,896	100%
<b>Total</b>	<b>1,527</b>	<b>1,527</b>	<b>100%</b>	<b>1,896</b>	<b>100%</b>

**Table 79: Alcohol Enforcement and Education: Non-State: Rural Calculation Data**

<b>Description</b>	Targeted visual enforcement, and education/media.
<b>Crash Type Targeted</b>	Alcohol Involved
<b>Severity (Fatal)</b>	0.156761
<b>Severity (Severe Injury)</b>	0.273774
<b>Segment Size</b>	1 minute Lat/Lon
<b>Saturation</b>	0.8
<b>Cost</b>	\$20,000
<b>Cost Unit</b>	1 minute Lat/Lon
<b>CMF</b>	0.8

**Table 80: Alcohol Enforcement and Education: Non-State: Rural Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
4	8	38	6	\$0.13	1.01	0.16	0.28	\$0.81

**Table 81: Alcohol Enforcement and Education: Non-State: Urban Crash Clusters**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	-	-	-	-	-
20 - 29	-	-	-	-	-
10-19	-	-	-	-	-
5-9	23	23	1%	128	4%
4	22	45	2%	216	7%
3	63	108	4%	405	13%
2	269	377	15%	943	31%
1	2,129	2,506	100%	3,072	100%
<b>Total</b>	<b>2,506</b>	<b>2,506</b>	<b>100%</b>	<b>3,072</b>	<b>100%</b>

**Table 82: Alcohol Enforcement and Education: Non-State: Urban Calculation Data**

<b>Description</b>	Targeted visual enforcement, and education/media.
<b>Crash Type Targeted</b>	Alcohol Involved
<b>Severity (Fatal)</b>	0.039012
<b>Severity (Severe Injury)</b>	0.079506
<b>Segment Size</b>	1 minute Lat/Lon
<b>Saturation</b>	0.8
<b>Cost</b>	\$20,000
<b>Cost Unit</b>	1 minute Lat/Lon
<b>CMF</b>	0.8

**Table 83: Alcohol Enforcement and Education: Non-State: Urban Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
5	23	128	18	\$0.37	3.41	0.13	0.27	\$2.76

## Speed Enforcement and Education

**Table 84: Speed-Involved Crash Severities**

Locality	Total Rwd Crashes	Fatalities	Level A Injuries	Severity Fatal	Severity A-Injury
State Rural	11,215	247	635	2.202%	5.662%
State Urban	2,778	30	107	1.080%	3.852%
Non-State Rural	7,975	235	682	2.947%	8.552%
Non-State Urban	5,082	75	213	1.476%	4.191%

**Table 85: Speed Enforcement and Education: State: Rural Crash Clusters**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	2	2	0%	64	1%
20 - 29	10	12	0%	286	3%
10-19	55	67	1%	982	9%
5-9	390	457	9%	3,410	30%
4	265	722	14%	4,470	40%
3	534	1,256	24%	6,072	54%
2	1,128	2,384	45%	8,328	74%
1	2,884	5,268	100%	11,212	100%
<b>Total</b>	<b>5,268</b>	<b>5,268</b>	<b>100%</b>	<b>11,212</b>	<b>100%</b>

**Table 86: Speed Enforcement and Education: State: Rural Calculation Data**

<b>Description</b>	Targeted visual enforcement, and education/media.
<b>Crash Type Targeted</b>	Speed Involved, Driver in excess of posted speed
<b>Severity (Fatal)</b>	0.022024
<b>Severity (Severe Injury)</b>	0.056621
<b>Segment Size</b>	0.5 mile
<b>Saturation</b>	0.4
<b>Cost</b>	\$20,000
<b>Cost Unit</b>	0.5 mile
<b>CMF</b>	0.85

**Table 87: Speed Enforcement and Education: State: Rural Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
18	19	414	8	\$0.15	4.14	0.09	0.23	\$1.67

**Table 88: Speed Enforcement and Education: State: Urban Crash Clusters**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	1	1	0%	32	1%
20 - 29	3	4	0%	107	4%
10-19	20	24	2%	356	13%
5-9	94	118	9%	944	34%
4	60	178	14%	1,184	43%
3	118	296	23%	1,538	56%
2	235	531	41%	2,008	73%
1	749	1,280	100%	2,757	100%
<b>Total</b>	<b>1,280</b>	<b>1,280</b>	<b>100%</b>	<b>2,757</b>	<b>100%</b>

**Table 89: Speed Enforcement and Education: State: Urban Calculation Data**

<b>Description</b>	Targeted visual enforcement, and education/media.
<b>Crash Type Targeted</b>	Speed Involved, Driver in excess of posted speed
<b>Severity (Fatal)</b>	0.010799
<b>Severity (Severe Injury)</b>	0.038517
<b>Segment Size</b>	0.5 mile
<b>Saturation</b>	0.4
<b>Cost</b>	\$20,000
<b>Cost Unit</b>	0.5 mile
<b>CMF</b>	0.85

**Table 90: Speed Enforcement and Education: State: Urban Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
18	6	145	2	\$0.05	1.45	0.02	0.06	\$3.07

**Table 91: Speed Enforcement and Education: Non-State: Rural Crash Clusters**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	-	-	-	-	-
20 - 29	2	2	0%	41	1%
10-19	14	16	0%	223	3%
5-9	97	113	2%	828	10%
4	113	226	4%	1,280	16%
3	242	468	8%	2,006	25%
2	707	1,175	21%	3,420	43%
1	4,555	5,730	100%	7,975	100%
<b>Total</b>	<b>5,730</b>	<b>5,730</b>	<b>100%</b>	<b>7,975</b>	<b>100%</b>

**Table 92: Speed Enforcement and Education: Non-State: Rural Calculation Data**

<b>Description</b>	Targeted visual enforcement, and education/media.
<b>Crash Type Targeted</b>	Speed Involved, Driver in excess of posted speed
<b>Severity (Fatal)</b>	0.029467
<b>Severity (Severe Injury)</b>	0.085517
<b>Segment Size</b>	1 minute Lat/Lon
<b>Saturation</b>	0.8
<b>Cost</b>	\$20,000
<b>Cost Unit</b>	1 minute Lat/Lon
<b>CMF</b>	0.85

**Table 93: Speed Enforcement and Education: Non-State: Rural Solution**

Threshold Crash Level (6 Years)	Number of Sections	Number of Crashes in 6 Years (2009-2014)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
11	12	183	10	\$0.19	3.66	0.11	0.31	\$1.78

**Table 94: Speed Enforcement and Education: Non-State: Urban Crash Clusters**

Crashes per Section	Number of Sections	Cumulative		Cumulative	
		Sections	Percent	Crashes	Percent
> 50	-	-	-	-	-
30 - 49	-	-	-	-	-
20 - 29	-	-	-	-	-
10-19	7	7	0%	87	2%
5-9	55	62	2%	412	8%
4	68	130	4%	684	13%
3	163	293	8%	1,173	23%
2	510	803	22%	2,193	43%
1	2,889	3,692	100%	5,082	100%
<b>Total</b>	<b>3,692</b>	<b>3,692</b>	<b>100%</b>	<b>5,082</b>	<b>100%</b>

**Table 95: Speed Enforcement and Education: Non-State: Urban Calculation Data**

<b>Description</b>	Targeted visual enforcement, and education/media.
<b>Crash Type Targeted</b>	Speed Involved, Driver in excess of posted speed
<b>Severity (Fatal)</b>	0.014758
<b>Severity (Severe Injury)</b>	0.041913
<b>Segment Size</b>	1 minute Lat/Lon
<b>Saturation</b>	0.8
<b>Cost</b>	\$20,000
<b>Cost Unit</b>	1 minute Lat/Lon
<b>CMF</b>	0.85



**Table 96: Speed Enforcement and Education: Non-State: Urban Solution**

<b>Threshold Crash Level (6 Years)</b>	<b>Number of Sections</b>	<b>Number of Crashes in 6 Years (2009- 2014)</b>	<b>Estimated Number of Improvements</b>	<b>Construction Costs (\$ Million)</b>	<b>Annual Targeted Crash Reduction</b>	<b>Annual Estimated Fatality Reduction</b>	<b>Annual Estimated Severe Injury Reduction</b>	<b>Cost/Life Saved (\$ Million)</b>
11	5	67	4	\$0.08	1.34	0.02	0.06	\$4.05

## Solutions Summary

**Table 97: Summary of Solutions**

Countermeasure	Threshold Crash Level (6 Years)	Number of Crashes in 6 Years (2009-14)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Cost/Life Saved (\$ Million)
State								
Curve treatment - Level 2	3	7,673	941	\$4.70	268.56	8.70	22.06	\$0.54
Curve treatment - Level 3	16	1,007	29	\$2.58	47.58	1.54	3.91	\$1.68
Centerline Rumble Stripes	3	5,847	1,057	\$1.90	343.02	11.84	30.15	\$0.16
Edge Line Rumble Strip(e)s	3	7,635	1,177	\$3.53	320.67	7.98	18.72	\$0.44
Delineation - Rural	5	1,346	164	\$0.82	26.92	0.69	1.46	\$1.18
Delineation - Urban	3	413	83	\$0.42	8.26	0.12	0.40	\$3.34
Tree Removal/Shielding	3	242	59	\$0.74	16.13	1.02	1.76	\$0.72
Utility Pole Removal/Shielding - Rural	6	24	2	\$0.16	0.80	0.02	0.05	\$7.97
Utility Pole Removal/Shielding - Urban	4	4	0	\$0.04	0.13	0.00	0.01	\$17.05
High Friction Surface Treatment (HFST)	11	582	17	\$1.45	36.38	0.84	2.31	\$1.71
Alcohol Enforcement - Rural	5	15	1	\$0.02	0.20	0.05	0.05	\$0.53
Alcohol Enforcement - Urban	6	25	2	\$0.03	0.33	0.03	0.04	\$1.05
Speed Enforcement - Rural	18	414	8	\$0.15	4.14	0.09	0.23	\$1.67
Speed Enforcement - Urban	18	145	2	\$0.05	1.45	0.02	0.06	\$3.07

Countermeasure	Threshold Crash Level (6 Years)	Number of Crashes in 6 Years (2009-14)	Estimated Number of Improvements	Construction Costs (\$ Million)	Annual Targeted Crash Reduction	Annual Estimated Fatality Reduction	Annual Estimated Severe Injury Reduction	Annual Estimated Cost/Life Saved (\$ Million)
<b>Non-State</b>								
Curve treatment - Level 1	3	6,668	848	\$8.48	200.04	7.24	17.88	\$1.17
Curve treatment - Level 2	5	3,451	311	\$3.11	120.79	4.37	10.80	\$0.71
Curve treatment - Level 3	19	378	10	\$0.88	17.86	0.65	1.60	\$1.37
Centerline Rumble Stripes	3	5,761	519	\$1.87	168.99	3.88	13.74	\$0.48
Edge Line Rumble Strip(e)s	4	2,196	246	\$1.48	79.06	1.91	4.95	\$0.77
Delineation - Rural	7	450	37	\$0.37	9.00	0.26	0.73	\$1.41
Delineation - Urban	7	3,014	222	\$2.22	60.28	0.55	2.13	\$4.01
Tree Removal/Shielding	4	146	26	\$0.64	9.73	0.62	1.25	\$1.02
Utility Pole Removal/Shielding - Rural	7	14	1	\$0.08	0.47	0.01	0.03	\$6.10
Utility Pole Removal/Shielding - Urban	8	16	1	\$0.08	0.53	0.01	0.02	\$10.59
Alcohol Enforcement - Rural	4	38	6	\$0.13	1.01	0.16	0.28	\$0.81
Alcohol Enforcement - Urban	5	128	18	\$0.37	3.41	0.13	0.27	\$2.76
Speed Enforcement - Rural	11	183	10	\$0.19	3.66	0.11	0.31	\$1.78
Speed Enforcement - Urban	11	67	4	\$0.08	1.34	0.02	0.06	\$4.05
<b>Total</b>				<b>\$36.57</b>	<b>1,751</b>	<b>53</b>	<b>135</b>	<b>\$0.69</b>