

# Systematic versus Systemic

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Highway Safety



# What is systematic?

- Methodical in procedure or plan
- Marked by thoroughness and regularity
- Tends to be reactive

# What is systemic?

- Common to a system, affecting the body generally
- Most commonly used in medical field
- Tends to be proactive

# Example 1 - Medical





# Example 1 - Medical



# Example 1 - Medical

- Systematic: Prescribing medicine at the time of diagnosis of diabetes
- Systemic: Identifying the **risk factors** that contribute to diabetes (BMI, insulin sensitivity) and applying appropriate countermeasures (modified diet and exercise)

## Example 2 - Roadway Departure





# Example 2 - Roadway Departure





## Example 2 - Roadway Departure

- Systematic: Rank 2-lane rural roads by % of ROR crashes
- Systemic: Rank 2-lane rural roads by presence of risk-factors associated with ROR crashes
  - Degree of horizontal curvature
  - Lane width
  - Shoulder width
  - Density of curves
  - Speed differential between tangent segments and curves

# Example 3 - Intersection

- Systematic: Rank urban intersections by crash rate
- Systemic: Rank urban intersections by presence of risk factors
  - Intersection control
  - Left or right turn lanes
  - Left-turn signal phasing
  - RTOR
  - Photo enforcement
  - Speed

# More Info

- <http://safety.fhwa.dot.gov/systemic/>

 U.S. Department of Transportation  
Federal Highway Administration

Office of Safety

A Systemic Approach to Safety - Using Risk to Drive Action

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The systemic approach to safety involves widely implemented improvements based on high-risk roadway features correlated with specific severe crash types. The approach provides a more comprehensive method for safety planning and implementation that supplements and complements traditional site analysis. It helps agencies broaden their traffic safety efforts and consider risk as well as crash history when identifying where to make low cost safety improvement locations.

 **NO DEATHS**



# Louisiana's Experience

- Intersection Safety Action Plan
- Low-Cost Safety Improvements at Curves and Intersections
- Current Approach

# Intersection Safety Action Plan

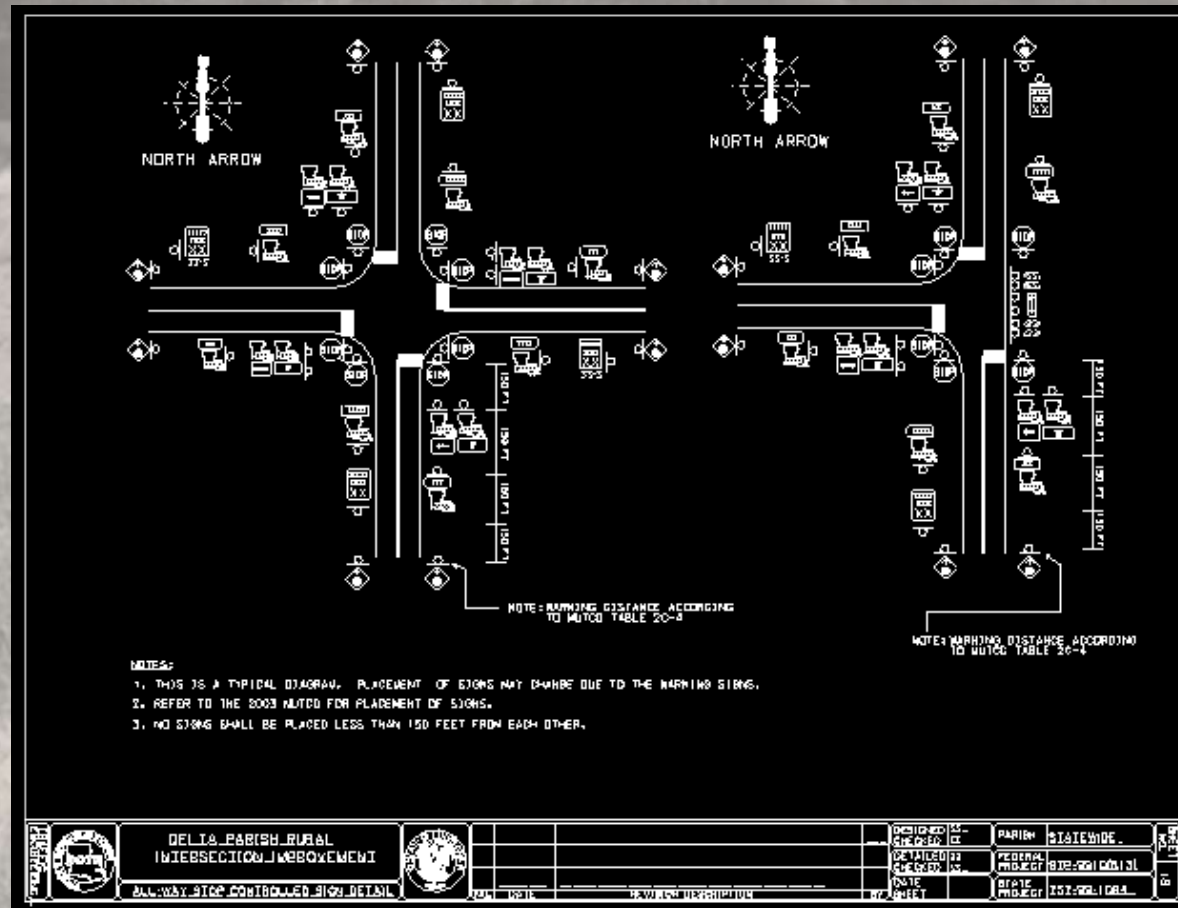
Process	Category	Number of Intersections	Construction Cost (\$ Million)	Enforcement, Education and EMS Costs (Annual \$ Thousand)	Estimated Annual Fatalities Reduced
Systematic	Intersection sign/marketing improvements - state	941	2.82		8.57
Systematic	Intersection sign/marketing improvements - local	73	0.23		0.19
Systematic	Signal improvements - state intersections	460	13.87		4.62
Systematic	Signal improvements - local intersections	64	1.92		0.88
Systematic	Detection control systems	70	3.5		1.00
Systematic	Pedestrian improvements	55	1.1		0.20
Systematic	Lighting	188	9.4		3.00
Systematic	Pavement friction improvements	106	5.3		1.80
Systematic	Red Light Running Enforcement Enhancements	820	0.3		2.10
Comprehensive	3E Corridors	8 corridors	4.0	.8	6.40
Comprehensive	3E Cities	4 cities	4.0	.8	3.40
Comprehensive	3E Parish	3 parishes	3.0	.6	2.30
Comprehensive	3E New Orleans	1 city	3.0	.6	2.10
Traditional	Roundabouts and left turn lanes	13	10.4		1.82
<b>Total</b>			<b>62.84</b>	<b>2.8</b>	<b>38.38</b>

# Intersection Safety Action Plan

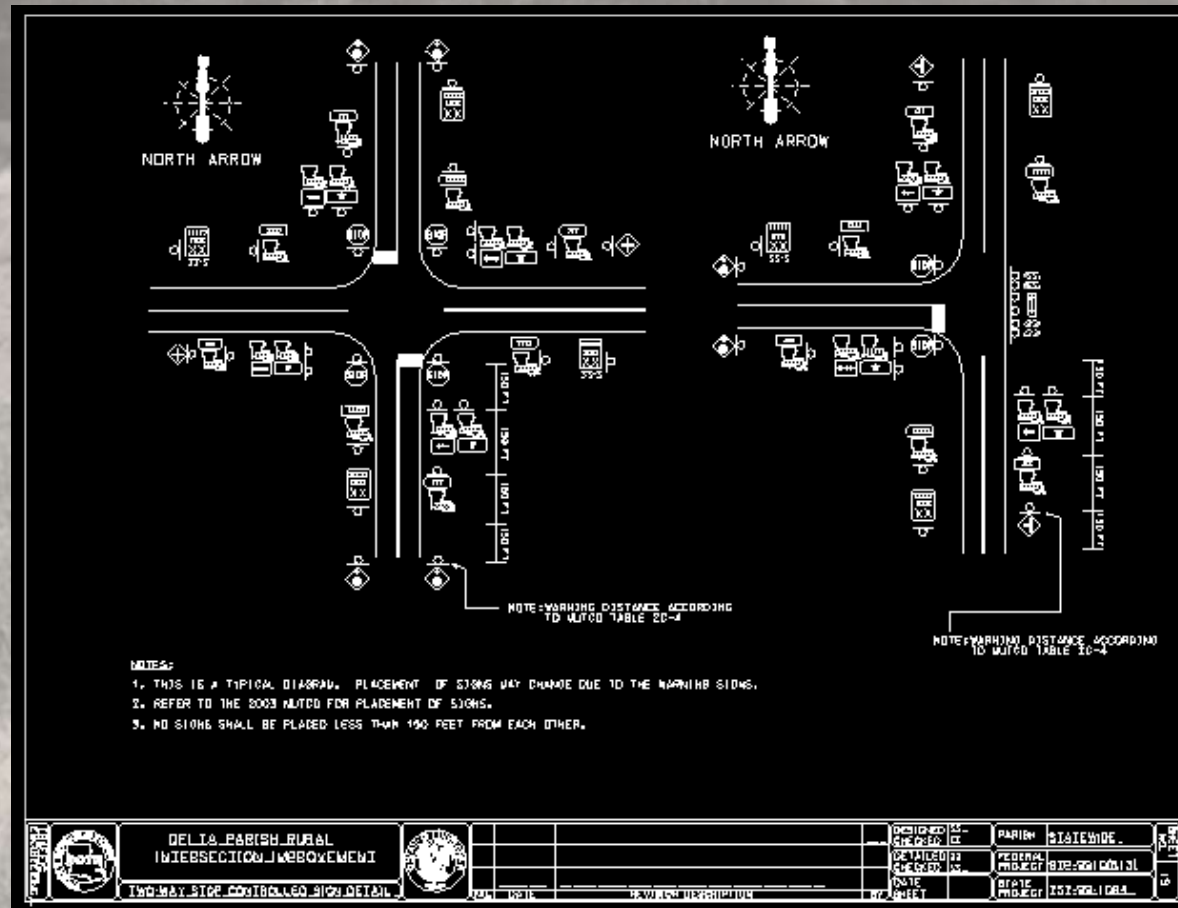
Category	Threshold Crash Level (Five Years)	Number of Statewide Crash Intersections	Number of Targeted Five-Year Crashes in the Intersections	Fatalities per 100 crashes	Annual Targeted Crash Reduction(2)	Annual Estimated Fatality Reduction
Enhanced Sign and Marking – Stop Rural State Intersections	5 crashes	579	5,372	1.87	260	4.86
Enhanced Sign and Marking –Stop Urban State Intersections	20 crashes	450	14,931	0.43	716	3.07
Enhanced Sign and Marking – Unknown Rural State Intersections	5 crashes	104	858	1.03	41	0.42
Enhanced Sign and Marking – Unknown Urban State Intersections	20 crashes	48	1,774	0.26	85	0.22
<b>Total</b>		1181			1102	8.57
(1) Assumes 80% of locations can be improved						
(2) A CRF of .3 is used						



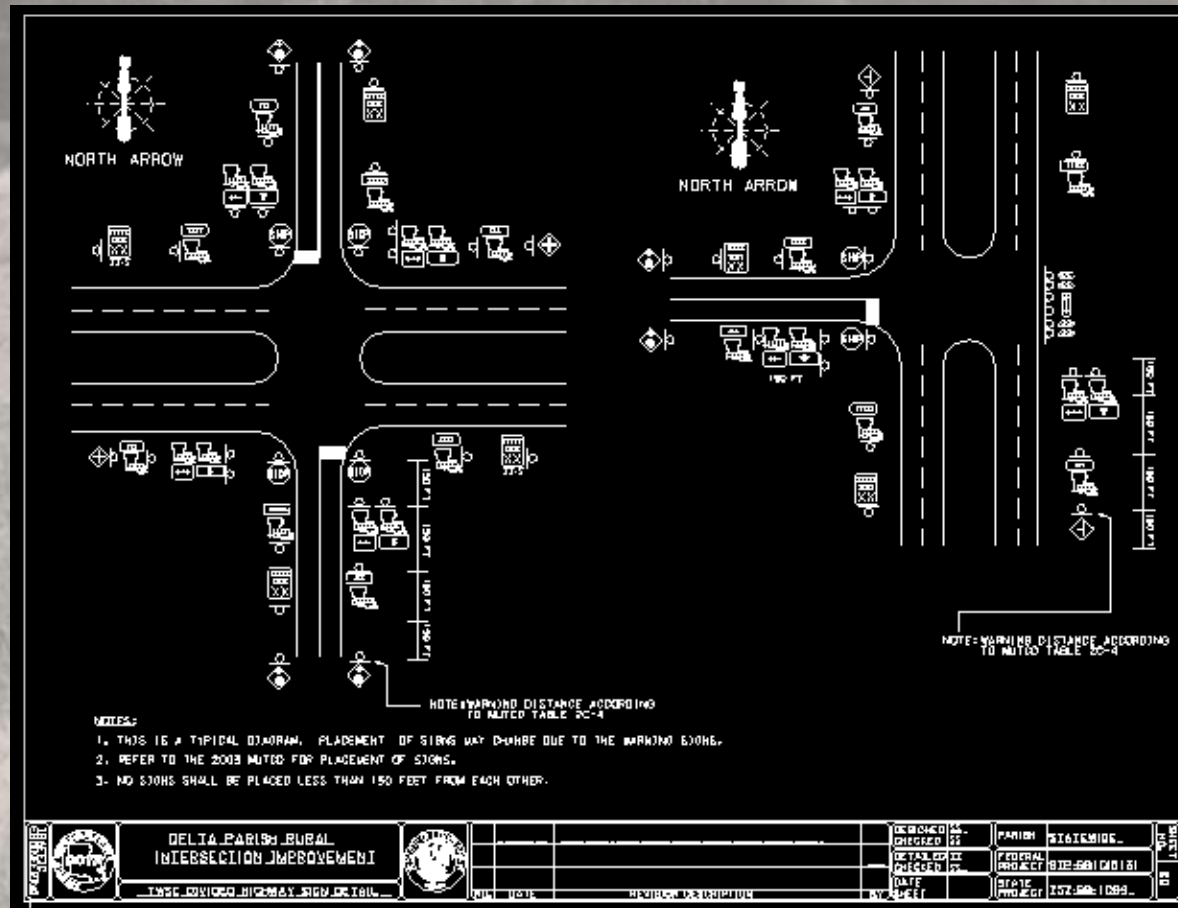
# AWSC 2-lane



# TWSC 2-lane

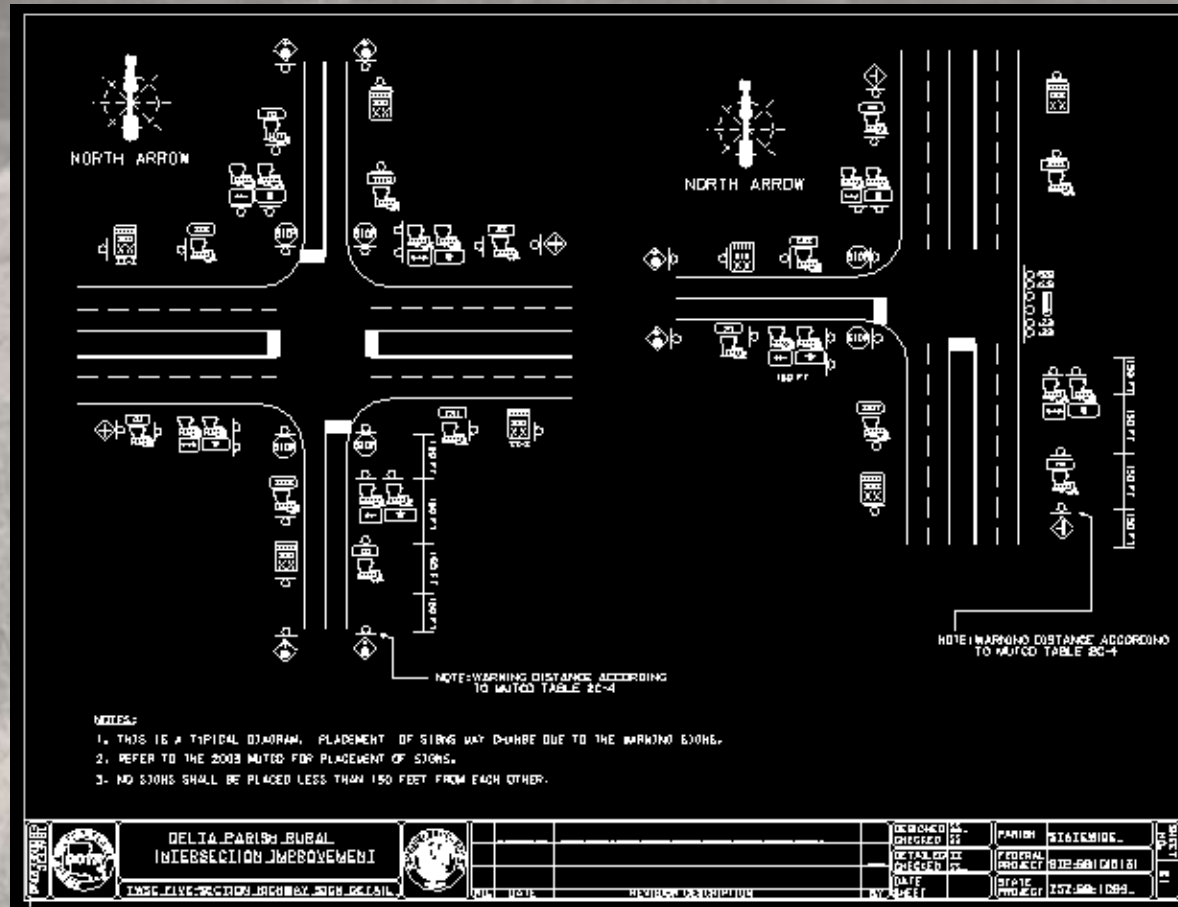


# TWSC 4-lane divided

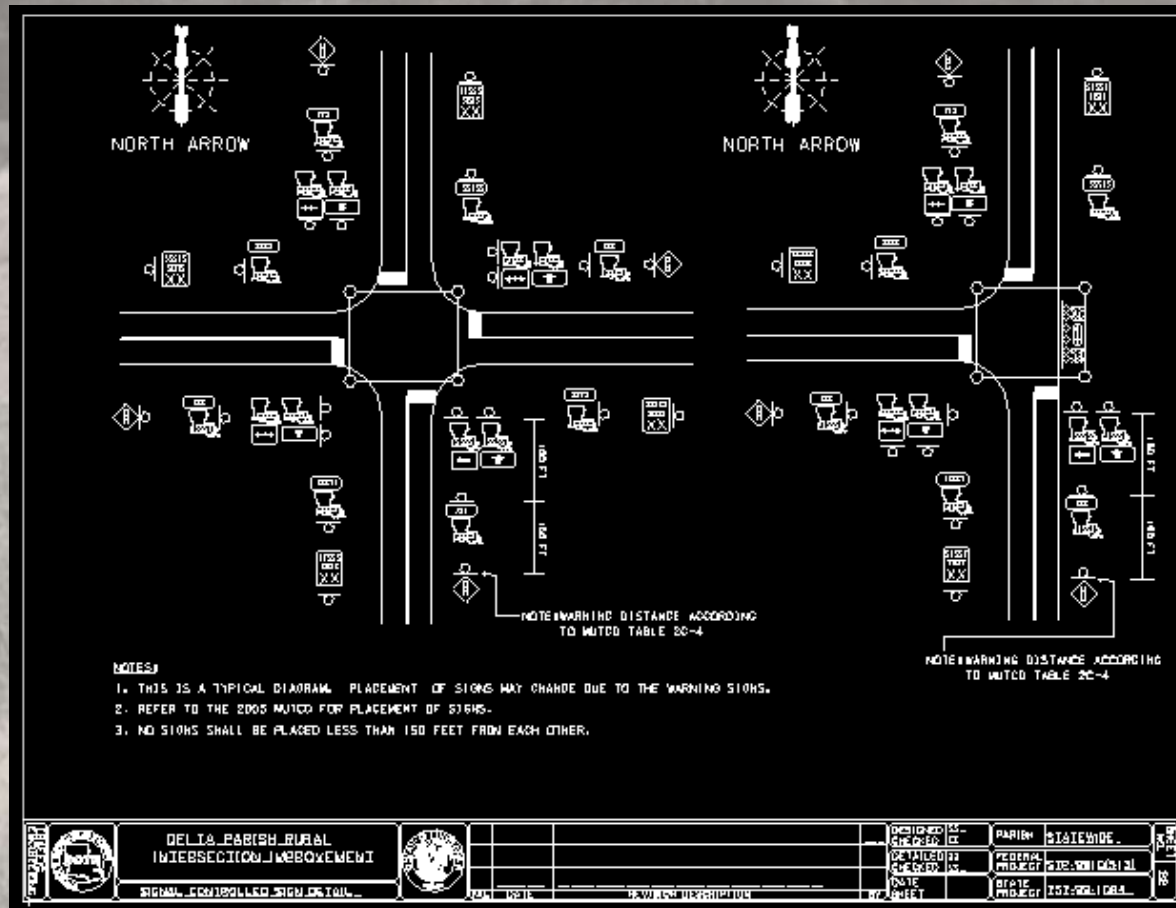




# TWSC 5-lane



# Signalized 2-lane



# Intersection Safety Action Plan

- Implemented at 205 intersections
- Evaluation being conducted by MRI Global



# Lessons Learned

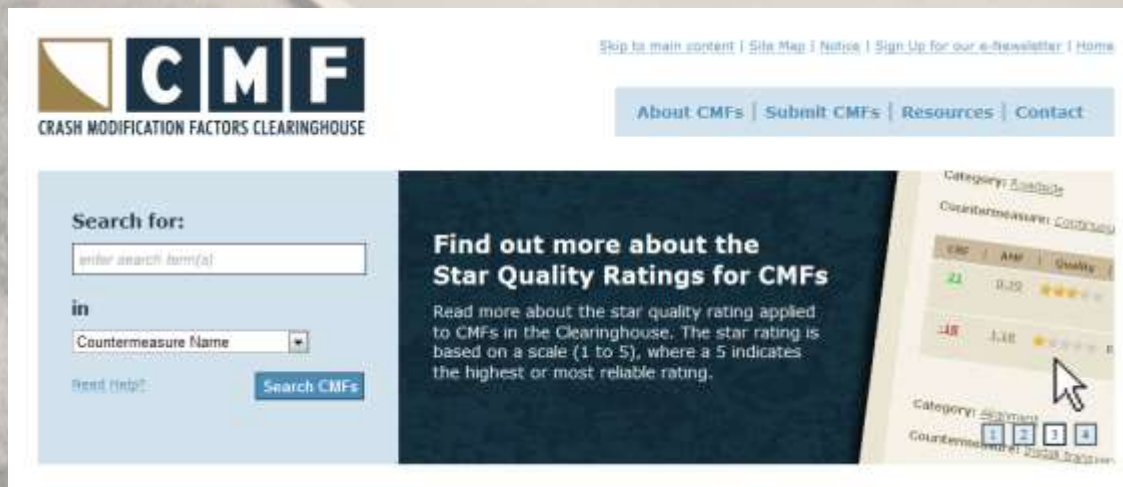
- We can quantify the expected reduction in crashes!
- Typical plan sheets do not provide enough specific information
- Signs not always doubled up
- Signs not always replaced with larger sign
- Exceptions not documented

# Low-Cost Safety Improvements

- Curve locations selected based on:
  - Minimum number of crashes = 5
  - 50% Roadway Departure
- Intersection included if within the same roadway segment (min. 5 crashes per year)
- Site specific plan sheet for each location:
  - 969 curves
  - 114 intersections

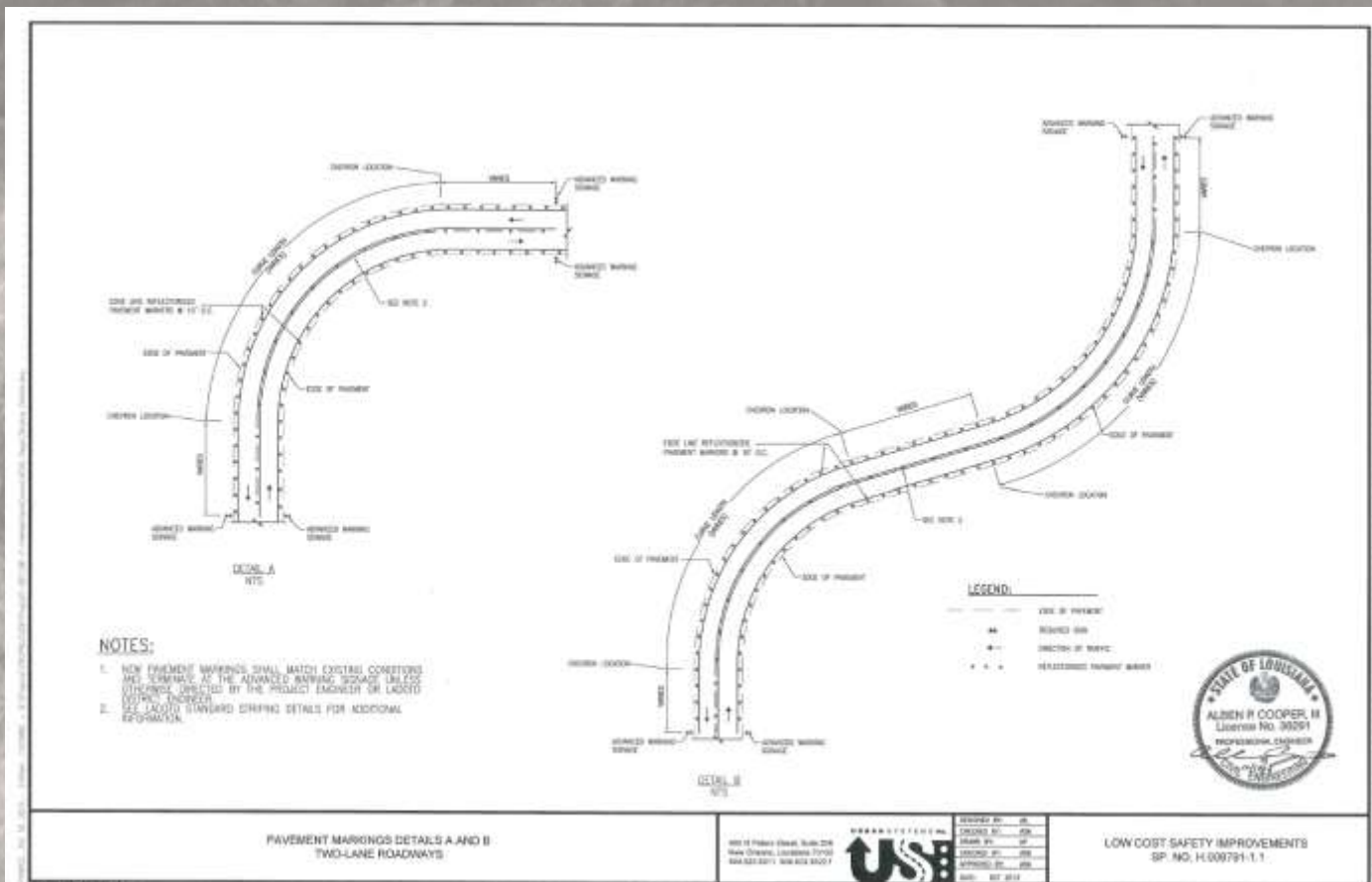
# Low-Cost Safety Improvements

- 6" Edge lines (CMF = 0.825)
- Chevron & Curve Warning signs (CMF = 0.592)
- High Friction Surface Treatment (CMF = 0.76)
- Advance street name



The screenshot shows the CMF Clearinghouse website interface. At the top left is the logo for CMF (Crash Modification Factors Clearinghouse). To the right of the logo are navigation links: "Skip to main content", "Site Map", "Notice", "Sign Up for our e-newsletter", and "Home". Below the logo is a search section with a "Search for:" label, a text input field containing "enter search term(s)", a "in" label, a dropdown menu for "Countermeasure Name", a "Read (help):" link, and a "Search CMFs" button. To the right of the search section is a dark blue box with the heading "Find out more about the Star Quality Ratings for CMFs" and a paragraph of text explaining the star rating system. Further right is a preview of a search result table with columns for "Category", "Countermeasure", "CMF", "AMP", and "Quality". The table shows two entries: one with a green star and a CMF of 0.75, and another with a red star and a CMF of 0.18. A mouse cursor is pointing at the second entry. At the bottom right of the screenshot is the "DESTINATION ZERO DEATHS" logo.

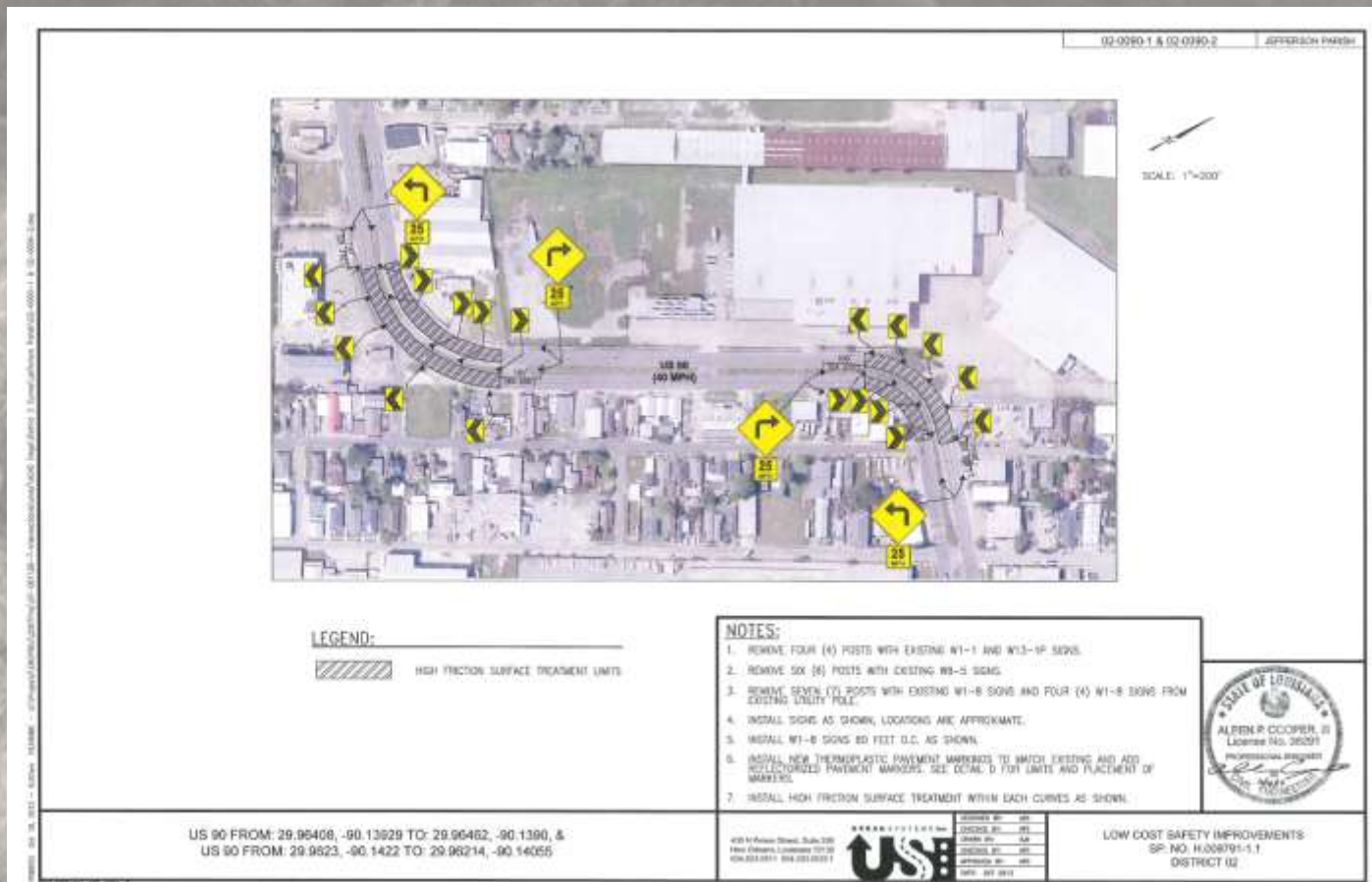
# Low-Cost Safety Improvements



**DESTINATION  
 ZERO  
 DEATHS**



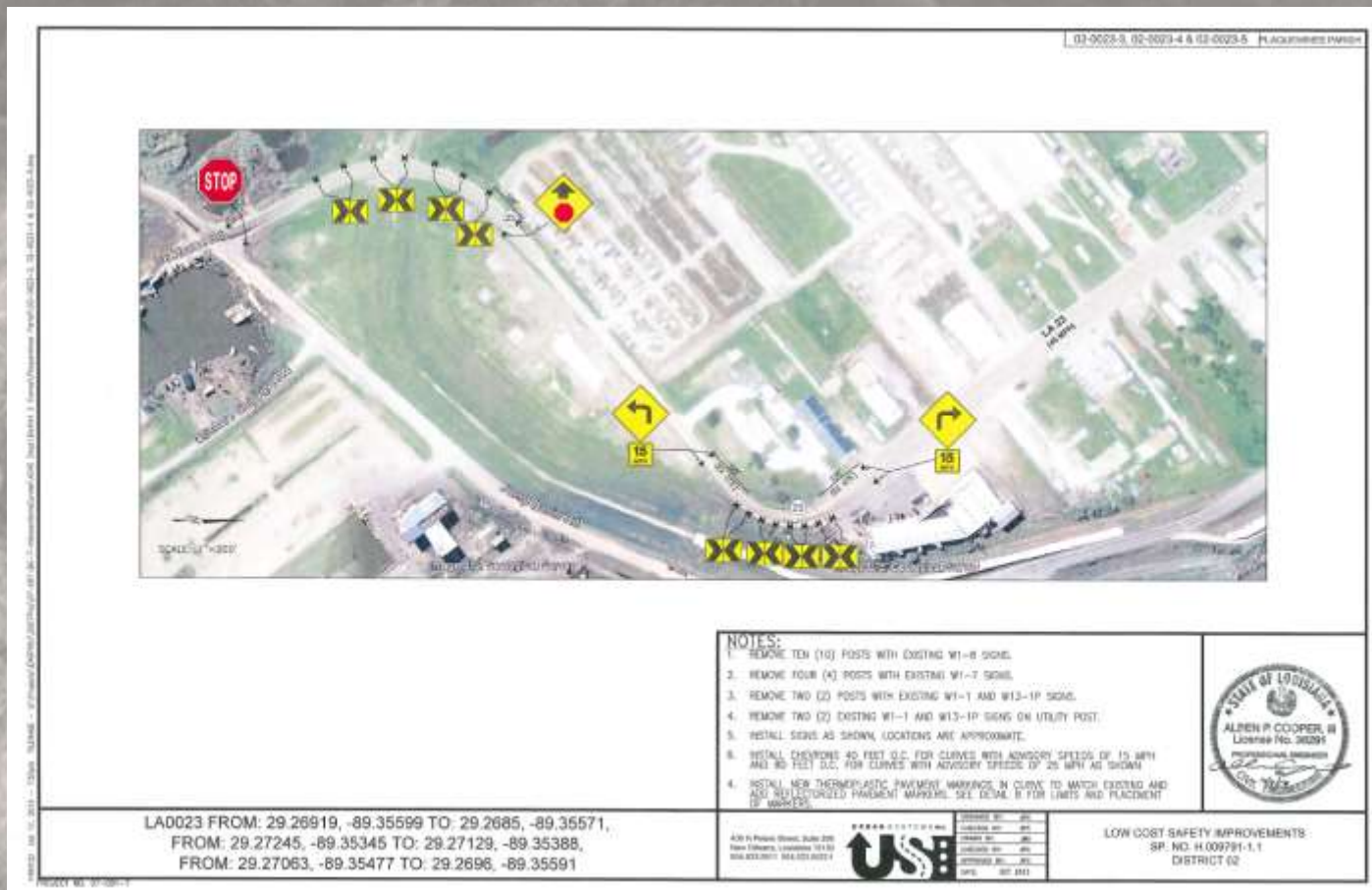
# Low-Cost Safety Improvements



# Low-Cost Safety Improvements



# Low-Cost Safety Improvements





# Low-Cost Safety Improvements

- H.009791 – District 61
- H.011233 – District 02
- H.011234 – District 62
- September letting
- LaSET for evaluation



# Lessons Learned



# Current Approach

- ▶ SHSP Infrastructure and Operations Emphasis Area Action Plan – Strategy 2
  - Program, design and construct safety improvements on state highways and local roadways through a systemic (risk-based) safety analysis for roadway departure and intersections.

# Current Approach

## • Strategy 2

- Action Step 2.1 – Identify the roadway safety risk factors.
- Action Step 2.2 – Identify locations for systemic safety improvements.
- Action Step 2.3 – Identify appropriate countermeasures, develop an implementation process and prioritize locations.
- Action Step 2.4 – Implement appropriate countermeasures
- Action Step 2.5 – Track and evaluate safety performance



# AS 2.1 & AS 2.2

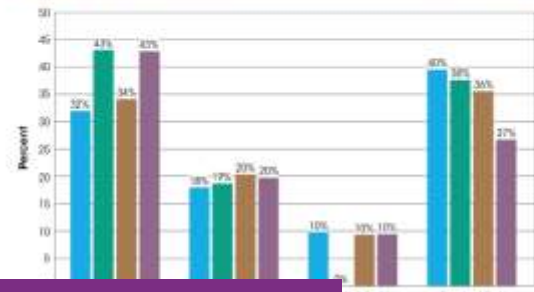
## Systemic Safety Project Selection Tool

U.S. Department of Transportation  
Federal Highway Administration

Safe Roads for a Safer Future  
Investment in roadway safety pays best

systemic countermeasures with demonstrated crash reductions will be systematically implemented at the signalized corners. Corridor and Large Arterial signs, larger signs, variable speed, buslan delineation, and entrance lanes.

Figure 1. Thurston County Analysis of Shoulder Type and Width for Risk Factor Selection



## South Carolina Case Study: Systematic Intersection Improvements



of shoulders greater than 4 feet, while only 27 percent of all reviewed shoulders less than 4 feet accounted for more than 30 percent of severe crashes. Crashes on shoulders less than 4 feet exceeded 10 percent (38 percent to 27 percent = 11 percent), any

feasible approach to identifying errors for improvement prior to a project. Upon completion of the systemic analysis, Thurston County is using the results as documentation for the request. The WSDOT is using the systemic countermeasures identified through the systemic analysis and implementable by a local agency with limited funding and staffing. The systemic safety planning process is that the experience provided County Safety Planning (CSP) activities.

## CMF CRASH MODIFICATION FACTORS CLEARINGHOUSE

Search for:

in:

Find help!

### Find out more about the Star Quality Ratings for CMFs

Read more about the star quality rating applied to CMFs in the Clearinghouse. The star rating is based on a scale (1 to 5), where a 5 indicates the highest or most reliable rating.

U.S. Department of Transportation  
Federal Highway Administration

## Safety Program

U.S. Department of Transportation  
Federal Highway Administration

http://safety.fhwa.dot.gov



# Target Classification

Highway Class	Tot Acc	Fatal Acc	Injury Acc	PDO Acc	Num Fatalities	Num Injured
	2020	1	605	1414	1	914
A-Rural 2-lane cnt trn	23	0	8	15	0	20
B-Urban 2-lane cnt trn	1104	1	321	782	1	504
C-Rural 4-lane cnt trn	346	4	118	224	4	214
D-Urban 4-lane cnt trn	16806	39	4500	12267	41	7187
E-Rural 6-lane	5	0	0	5	0	0
F-Urban 6-lane	8365	6	1980	6379	6	3082
G-Rural 6-lane I-state	916	10	257	649	12	404
H-Urban 6-lane I-state	13183	52	3839	9292	56	6557
I-Urban other freeway	7699	5	2163	5531	5	3578
S-Service/Frontage	555	5	165	385	6	262
X-Exit/Ramp	861	0	216	645	0	324
1-Rural 2-lane	27418	531	11126	15761	593	17310
2-Rural 4-lane	552	11	179	362	15	325
3-Rural 4-lane div	3393	46	1312	2035	49	2216
4-Rural 4-lane I-state	7012	88	2271	4653	106	4021
5-Urban 2-lane	39234	218	12414	26602	239	20061
6-Urban 4-lane	16249	33	4363	11853	37	7166
7-Urban 4-lane div	27642	77	7635	19930	82	12393
8-Urban 4-lane I-state	14424	111	4018	10295	131	6617
Total	187807	1238	57490	129079	1384	93155

# Target Crash Type

Type of Collision	Tot Acc	Fatal Acc	Injury Acc	PDO Acc	Num Fatalities	Num Injured
	12	0	3	9	0	4
Non Coll	16628	353	6868	9407	372	9085
Rear End	4406	20	1805	2581	20	3414
Head on	549	100	341	108	127	997
Rt Angle	1078	21	486	571	31	944
Left Turn-e	745	1	283	461	1	520
Left Turn-f	462	5	246	211	6	508
Left Turn-g	183	1	52	130	1	88
Right Turn-h	90	0	22	68	0	48
Right Turn-i	55	0	9	46	0	14
S Swipe(sd)	869	4	209	656	4	317
S Swipe(od)	1096	13	407	676	17	772
Other	2	0	0	2	0	0
Other	1243	13	395	835	14	599
Total	27418	531	11126	15761	593	17310

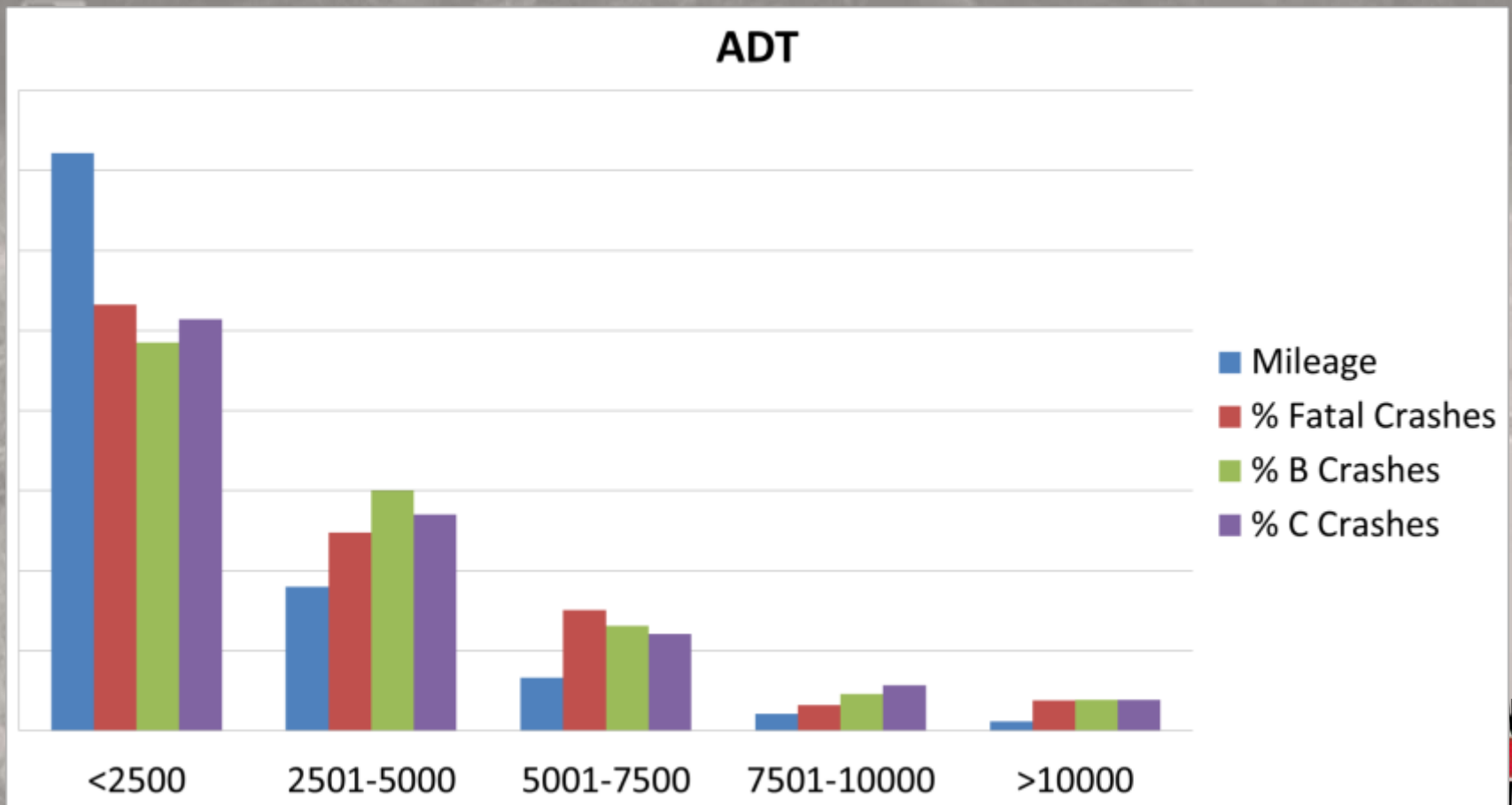


# Target Crash Type

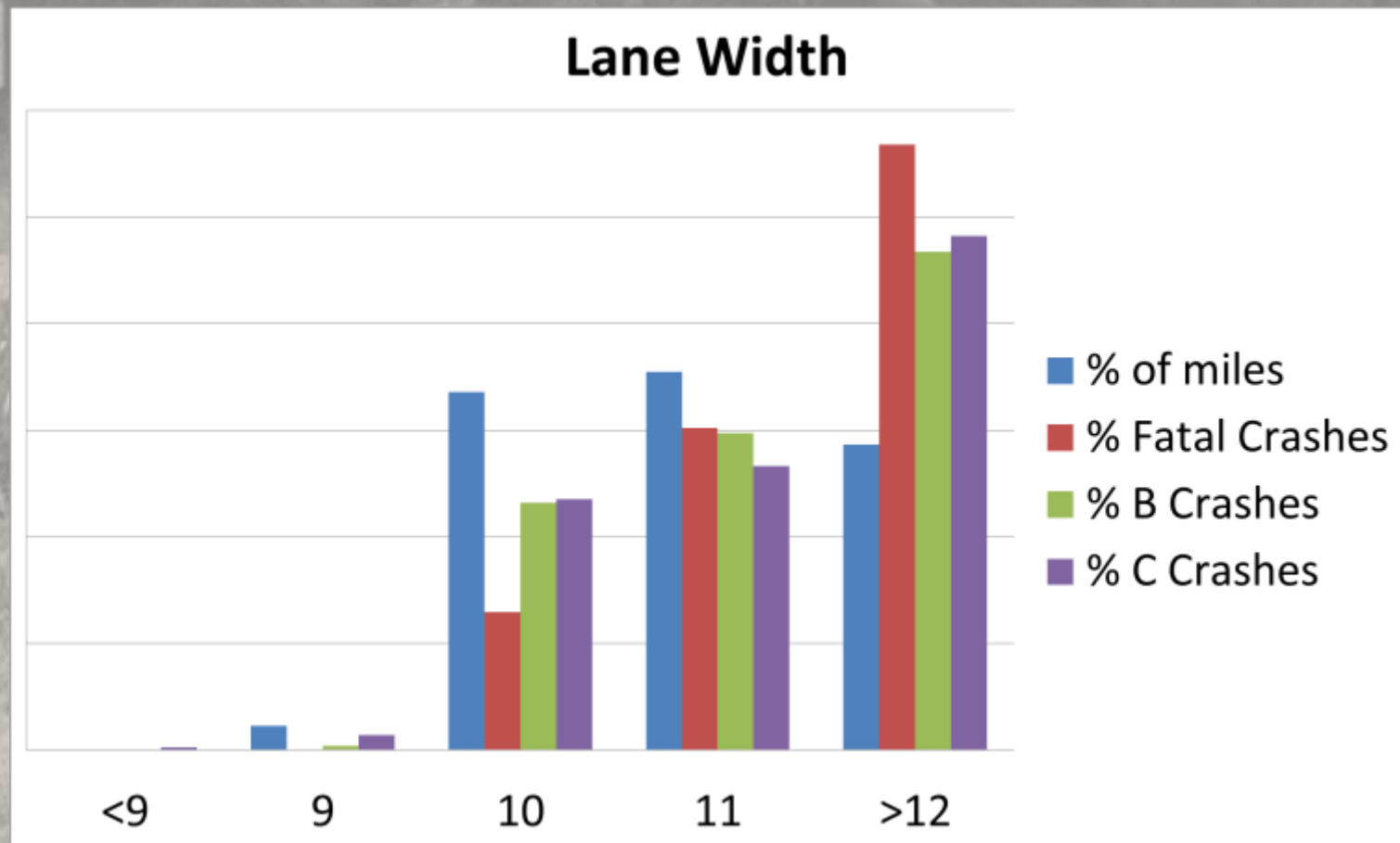
Type of Accident	Tot Acc	Fatal Acc	Injury Acc	PDO Acc	Num Fatalities	Num Injured
Run off rd	12117	316	5897	5904	331	7807
Overturn on rd	140	2	90	48	2	102
Coll wt ped	102	22	75	5	22	82
Coll wt veh	610	2	217	391	3	297
Coll wt pk car	5	0	3	2	0	3
Coll wt train	6	4	1	1	6	4
Coll wt bicycle	3	0	2	1	0	3
Coll wt animal	2301	2	228	2071	3	311
Coll wt fix obj	575	2	185	388	2	232
Coll wt other obj	301	1	58	242	1	88
Non Col on Rd	468	2	112	354	2	156
Total	16628	353	6868	9407	372	9085



# Risk Factor Identification

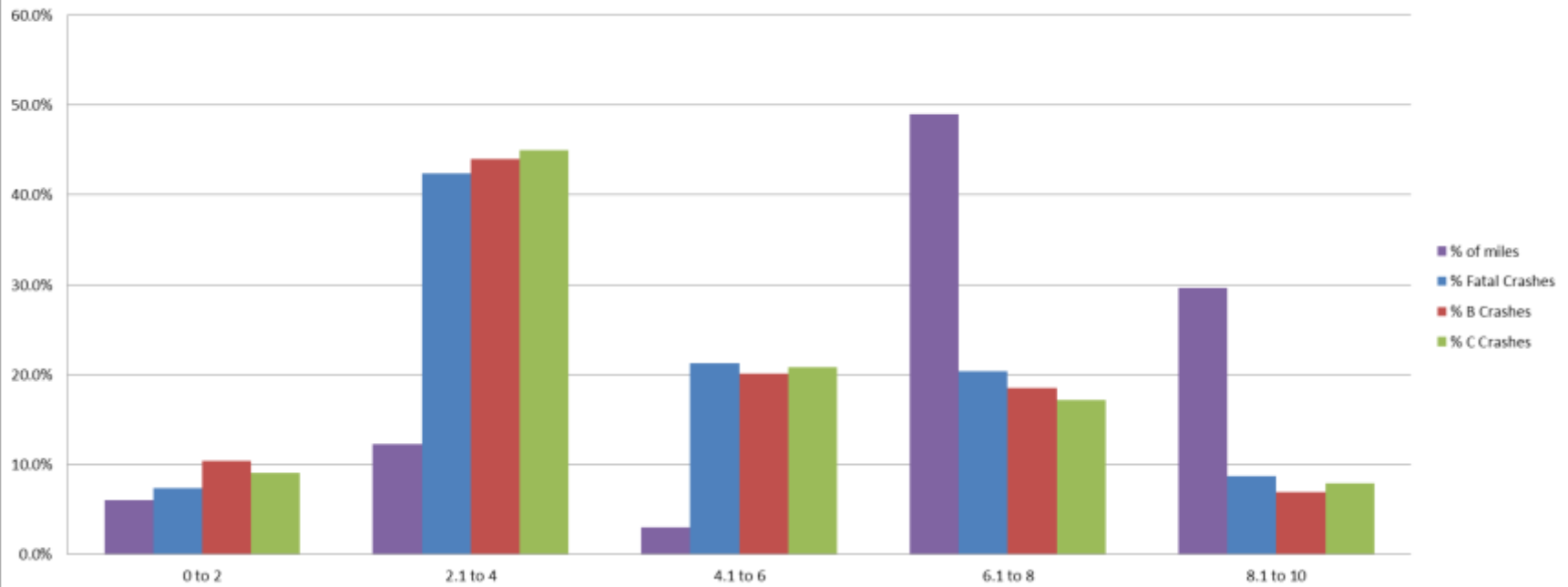


# Risk Factor Identification



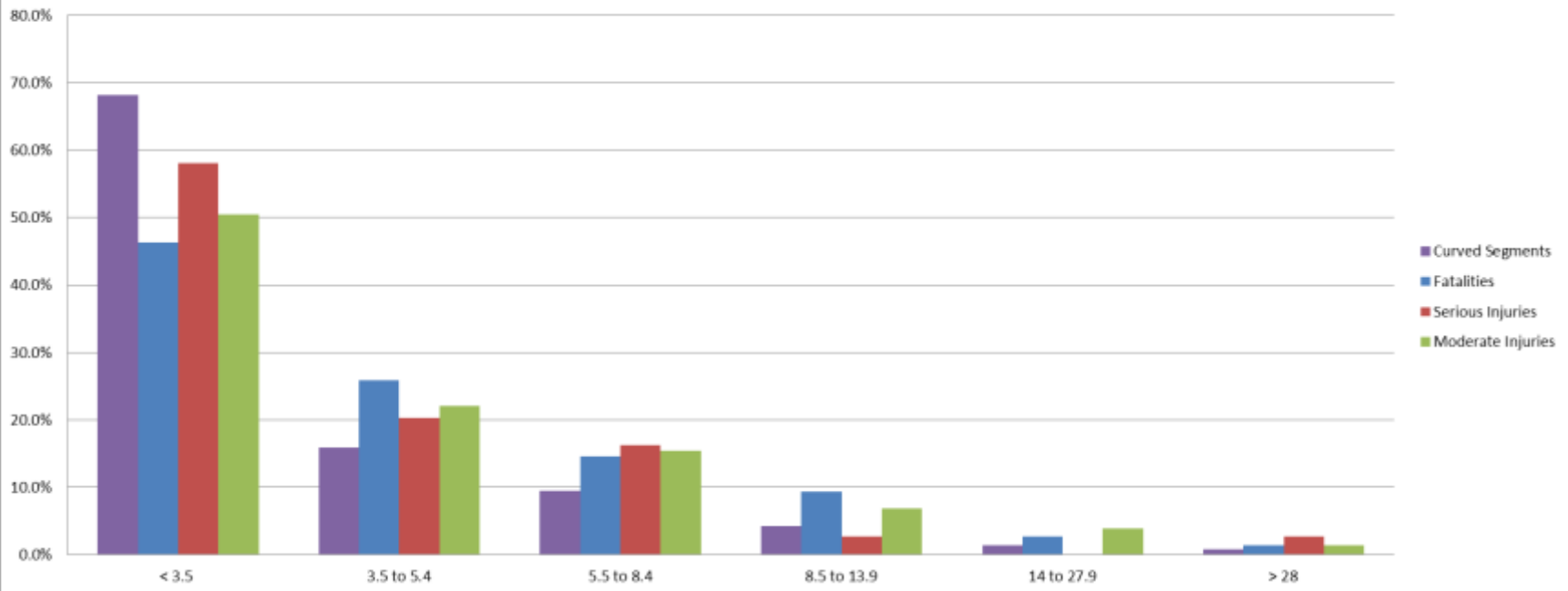
# Risk Factor Identification

Shoulder Width



# Risk Factor Identification

Degree of Curve





# Location Identification

- 2-lane rural roadways (state-maintained)
- ADT Range 2500 – 7500
- Lane width = 12' or greater
- Shoulder width between 2' and 6'
  - 457 miles meet these criteria
- Degree of curve  $> 3.5$  (Radius  $< 1640'$ )
  - 300 candidate curves
  - Still need to remove sites in H.009791, H.011233 and H.011234

# Next Steps

- Action Step 2.3 – Identify appropriate countermeasures, develop an implementation process and prioritize locations.
  - Near-term
  - Latest research will drive countermeasure selection
- Action Step 2.4 – Implement appropriate countermeasures.
  - Mid-term
  - Consultant to develop site-specific plan sheets for FFY 14-15 letting (hopeful)
- Action Step 2.5 – Track and evaluate safety performance.
  - Long-term
  - 3 years of after data needed

## Action Step 2.5

- Development of Evaluation Tool, LaSET

Questions?

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