A SYSTEMIC APPROACH TO ROADWAY SAFETY

Laura Slusher, PE  Indiana LTAP / HELPERS
Overview

- Project background
- The systemic approach
- Project parameters and results
- Countermeasures
- Next steps
Project Background

- ASAP* grant from FHWA
- Student researcher for summer

What did we want to target?
- Focus on rural and/or local roads
- Focus on fatal and injury crashes
- Emerging trends in roadway safety
- Proven results in other states
- Data driven

*Accelerating Safety Activities Program
Fatal Crashes 2009
Fatal Crashes 2010
## Fatal Crash Types

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadway Departure</td>
<td>213</td>
<td>189</td>
<td>210</td>
</tr>
<tr>
<td>Angle/Left-Turn</td>
<td>80</td>
<td>65</td>
<td>60</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>25</td>
<td>19</td>
<td>23</td>
</tr>
<tr>
<td>Rear-End</td>
<td>18</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>Animal</td>
<td>0</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Backing</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

*(local and rural roads only)*
Fatal crash locations are random

Fatal crash types are not
Why Systemic?

- Traditional “hot spot” analysis
  - Based on crash rate/frequency
  - Can favor high volume roadways

- Systemic
  - Implemented based on high-risk roadway features that are correlated with particular crash types, rather than crash frequency.

- Best Approach: Combination of both!
Systemic Approach Elements

- Identify crash pattern
- Identify common high-risk characteristics
- Select countermeasures
- Implement across several locations
Roadway Departure

- “A non-intersection crash that occurs after a vehicle crosses an edge line or a center line, or otherwise leaves the traveled way”
- Roadway Departure crashes are the most common rural crash type
- Emphasis area of the 2010 Indiana Strategic Highway Safety Plan (SHSP)
Roadway Departure

- These crashes produce half of all severe outcome crashes and nearly two out of three fatal crashes.
Systemic Approach Elements

- Identify crash pattern
- Identify common high-risk characteristics
- Select countermeasures
- Implement across several locations
Roadway Departure

- The roadway feature most commonly associated with roadway departure crashes
Horizontal Curves

- Crash rate in curves is 3 times higher
- More than 25% of fatal crashes occur in curves
- Effective, low cost solutions
Systemic Curve Study

- Proactive look at a potentially hazardous roadway element
- Data-driven approach
- Identify curves most likely to produce a fatal or serious injury crash, i.e. a “high-risk” curve
- Identify potential improvements for those curves
- Researched other states
Systemic Curve Study

- Researched other states
  - Surveyed other LTAP centers
  - Responses from 8 states
    - 5 already doing systemic improvements
    - 2 developing systemic programs
    - 1 planning on doing systemic in future
Systemic Curve Study

- Analyzed data from three counties with highest number of fatal and injury crashes in curves
  - Crash data
  - Roadway characteristics data
    - Curve Radius
    - Length of Curve
    - Roadway width
    - Shoulder width
    - Proximity to other curves
    - Presence of driveways/intersections
    - Visual Trap
Visual Trap
**Study Results**

- Distinct trends noticed in north and south
- 88% of curves have a radius <600 feet
Study Results

- Distinct trends noticed in north and south
- 96% of curves have a length <400 feet
Study Results

Typical high-risk curves in southern Indiana
Study Results

- Results consistent with other studies

![Graph showing crash rate vs. radius with 85th% tangent speed = 60 mph, Fatal + Injury, and Fatal + Injury + PDO curves.](image)
## Study Results

<table>
<thead>
<tr>
<th>Roadway Condition</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark Roadway Crashes</td>
<td>46%</td>
</tr>
<tr>
<td>Wet Roadway Crashes</td>
<td>32%</td>
</tr>
<tr>
<td>Wet/Standing Water Crashes</td>
<td>25%</td>
</tr>
<tr>
<td>Snow/Ice-Covered Roadway Crashes</td>
<td>7%</td>
</tr>
</tbody>
</table>
Systemic Approach Elements

- Identify crash pattern
- Identify common high-risk characteristics
- Select countermeasures
- Implement across several locations
Countermeasures

- Keep them on road...
  - Warning
  - Guidance
  - Friction Surface
- If that doesn’t work...
  - Recovery Area
  - Address fixed objects
Countermeasures

- Example from Iowa
- 30x36 chevrons
- 40% reduction in all crashes
- 57% reduction in night crashes
- Significant reduction in crash severity
Countermeasures

- Add friction surface treatment
  - 50% reduction in wet road crashes (NYSDOT)
  - 20% reduction in all crashes (NYSDOT)

- Install chevrons and curve warning signs
  - 51% reduction of wet road crashes (CMF Clearinghouse)
  - 34% reduction in nighttime crashes (CMF Clearinghouse)
  - 41% reduction in all crashes (CMF Clearinghouse)
  - Benefit/Cost ratio of 8:1 (CT and WA)
Systemic Approach Elements

- Identify crash pattern
- Identify common high-risk characteristics
- Select countermeasures
- Implement across several locations
Curve Crashes
- Highest percentage in south
- Lowest percentage in north
On average, 45% of the curve crashes are on 10% of the roads.

- 6 southern counties
  - 10 roads
  - 60 miles
Next Steps – for us

- Continue study
- Look for counties interested in reducing their horizontal curve crashes
Next Steps – for you

- Look for high-risk curves in your area
- Target these for reviews, improvements

Simple, low-cost measures can really make a difference.

Think like a visitor!
For more direction

- Laura Slusher
  765-494-7038
  lslusher@purdue.edu

- FHWA
  http://safety.fhwa.dot.gov/roadway_dept/horicurves
  http://safety.fhwa.dot.gov/provencountermeasures

- INDOT Office of Traffic Safety
  http://www.in.gov/indot/2357.htm

- Indiana LTAP HELPERS
  http://rebar.ecn.purdue.edu/ltap1/Helpers