Systematic Safety Improvements

ASCE-ASHE Annual Statewide Conference

Mike Manthey, PE, PTOE & Skye Gentile, PE
Systematic Safety Improvements

Mike Manthey, PE, PTOE
Rumble Strips

- Shoulder Rumble Strips
- Center Line Rumble Strips
- Rumble Strips
  - Profile Thermoplastic
  - Stripe Material in Rumble Strip
  - Raised Markers
  - Transverse Rumble Strips
Flexible Delineators

- Advantages
- Spacing
- Sheeting
Sign Replacement

- Improved Reflectivity
- Better Durability
- Larger Legend
- More Readable Fonts
Striping Improvements

- Increased Reflectivity
- Life Cycle Costs
- Durability
- Less Cost to Maintain
Countdown Signal Heads

- Better Pedestrian Information
- Driver Information
- Safety
Barrier and Medians

- Eliminates Many Cross Over Crashes

- Types
  - Medians
  - Low Profile Barrier
  - Concrete
  - Cable
Clear Zone Improvements

- Tree Removal
- Sign Relocation
- Barrier Protection
- Slope Reduction
Lighting

- Very Cost Effective Safety Improvement
- Pedestrian Safety
- Types of Lighting
  - LPS
  - HPS
  - LED
Reflective Pavement Markers

- System Wide Application
- Areas With Snow
- Effective Guidance in Rain
Photo Enforcement

- Controversial/Politics
- Speed Control
- Red Light Running
- Speed Feedback Signs
Guardrail End Treatments

- BCT Replacement
- Crash Attenuators
- Application Type
In Lane Pavement Markings

- Additional Guidance for Driver
- Supplement To Signs
- Minimizes Weaving
Friction Material

- FHWA Information
- Utilized on Curves
- Application for Bridges
Shoulder Widening

- More Forgiveness in Clear Zone
- Fairly Costly
- Less Than Standard
Roundabouts

- History
- Public Perception
- Crash Reduction
Crash Modification Factors

Skye Gentile, PE
Highway Safety Manual (HSM)

- Method of Quantifying Safety
- From Planning to Design
- Analyze Existing Conditions and Introduce Improvement Countermeasures
Predictive Method

- Means for Estimating the “Expected Average Crash Frequency” for a Roadway Corridor or Intersection
  - Existing Site with Existing Conditions
  - Existing Site and Alternative Conditions
  - New Site under Future Conditions
Safety Performance Function (SPF)

- Two-Lane Rural Highways
- Rural Multilane Highways
- Urban and Suburban Arterials
Crash Modification Factor (CMF)

- Specific to Each Roadway Feature
- HSM Part D
- CMF Clearinghouse (cmfclearinghouse.org)
  - Star Rating 1-5 (2 or lower – less reliable)
- Rank Mitigation Measures
- Crash Reduction Factor (CRF)
  - CRF = 100 x (1 – CMF)
NDOT Project Example

- Project Location: SR 427/I-80 Interchange in Fernley, Nevada
- Parsons Performed an Engineering Study Providing a Number of Suggested Improvement Alternatives
### NDOT Project Example

- **CMFs determined for each alternative**
  - **NOTE:** CMFs not available for every improvement

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Recommendation</th>
<th>Associated Countermeasure Description</th>
<th>Source</th>
<th>Crash Type</th>
<th>Severity</th>
<th>CMF</th>
<th>CRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2a</td>
<td>Construct one-lane roundabout</td>
<td>Conversion of two-way stop-controlled intersection into single- or multi-lane roundabout</td>
<td>CMF Clearinghouse Evaluation of Roundabout Safety; Qin et al., 2013</td>
<td>All</td>
<td>All</td>
<td>0.75</td>
<td>25%</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>All</td>
<td>Fatal, Serious Injury, Minor Injury</td>
<td>0.65</td>
<td>35%</td>
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<tr>
<td>A2c</td>
<td>Provide eastbound left turn lane on the west leg of the intersection</td>
<td>Install left-turn lane</td>
<td>CMF Clearinghouse A full Bayes multivariate intervention model with random parameters among matched pairs for before-after safety evaluation; El-Basyouny and Sayed, 2011</td>
<td>All</td>
<td>Fatal, Serious Injury, Minor Injury</td>
<td>0.79</td>
<td>21%</td>
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<tr>
<td>A2e</td>
<td>Install street light on the southeast corner</td>
<td>Install intersection illumination</td>
<td>Highway Safety Manual, 2010 pp. 14-29</td>
<td>Nighttime</td>
<td>Injury</td>
<td>0.62</td>
<td>38%</td>
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<td>A2f/B4</td>
<td>Install High Mast Lighting poles, Install additional lighting for westbound off-ramp</td>
<td>Install lighting at interchanges</td>
<td>CMF Clearinghouse Development of Crash Reduction Factors; Hovey and Chowdhury, 2005</td>
<td>All</td>
<td>All</td>
<td>0.50</td>
<td>50%</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>All</td>
<td>Fatal, Serious Injury, Minor Injury</td>
<td>0.74</td>
<td>26%</td>
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<td>B1</td>
<td>Replace existing impact attenuator</td>
<td>Install crash cushions at fixed roadside features</td>
<td>Highway Safety Manual, 2010 pp. 13-25</td>
<td>Fixed Object</td>
<td>Fatal</td>
<td>0.31</td>
<td>69%</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fixed Object</td>
<td>Injury</td>
<td>0.31</td>
<td>69%</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>Fixed Object</td>
<td>PDO</td>
<td>0.54</td>
<td>46%</td>
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<tr>
<td>B2</td>
<td>Install new exit advisory speed sign, Install improved chevron signing</td>
<td>Install combination horizontal alignment/advisory speed signs</td>
<td>Highway Safety Manual, 2010 pp. 13-30</td>
<td>All</td>
<td>Injury</td>
<td>0.87</td>
<td>13%</td>
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<td>B3</td>
<td>Install improved chevron signing</td>
<td>Install chevron signs on horizontal curves</td>
<td>CMF Clearinghouse Safety Evaluation of Improved Curve Delineation; Srinivasan et al., 2009</td>
<td>Non-intersection</td>
<td>All</td>
<td>0.96</td>
<td>4%</td>
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</tbody>
</table>

**Confidential Information**
Questions?

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