Zero Fatalities: Applying the Roadway Safety Analysis Methodology in Utah

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Outline

• Background
• Data and Automation Tools
• Roadway Safety Analysis Methodology:
  1. Crash and Roadway Data Segmentation
  2. Statistical Network Screening of Roadway Data
  3. Report Compilation for Segments of Interest
• Summary
• Concluding Remarks
Background

• Goals:
  – Zero Fatalities
  – Identify “Hot Spots”
  – Project Prioritization
Background

• “Hot Spot Identification and Analysis”:
  – Utah Crash Prediction Model (UCPM)
  – Utah Crash Severity Model (UCSM)
  – Roadway Safety Analysis Reports (RSARs)

<table>
<thead>
<tr>
<th>UDOT-FHWA Scale</th>
<th>Injury Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-K</td>
<td>Fatal Injury: injury that results in death within 30 days of crash</td>
</tr>
<tr>
<td>4-A</td>
<td>Suspected Serious Injury: serious injury not resulting in fatality; incapacitating injury results from the crash</td>
</tr>
<tr>
<td>3-B</td>
<td>Suspected Minor Injury: minor injury evident at the scene of the crash, not serious injury or fatality</td>
</tr>
<tr>
<td>2-C</td>
<td>Possible Injury: injuries reported but not evident at the scene of the crash</td>
</tr>
<tr>
<td>1-O</td>
<td>No Apparent Injury: the person receive no bodily hard; property damage only (PDO)</td>
</tr>
</tbody>
</table>
Background

• Safety countermeasures:
  – NCHRP 500 Report volumes (23):
    • Aggressive driving, unlicensed drivers, collisions with trees, head-on collisions, unsignalized intersection collisions, etc.
  – “Countermeasures that Work”:
    • Alcohol and drug impaired driving, seat belts, speeding, distracted/drowsy, etc.
  – CMF Clearinghouse website
Background

- UDOT SafeMap web interface:
Data and Automation Tools

- UDOT Open Data and UDOT Traffic & Safety Division*:
  - Crash data*
  - AADT (truck AADT)
  - Functional class
  - Through lanes
  - Urban code
  - Speed limit
  - Horizontal curves*
  - Shoulder
  - Medians
  - Rumble strips
  - Walls
  - Barriers
  - Intersections
  - Sign face
  - Route grade
# Data and Automation Tools

<table>
<thead>
<tr>
<th>Data Field</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;ROUTE_ID&quot;</td>
<td>Contains four numeric digits with the route number and leading zeros</td>
</tr>
<tr>
<td>&quot;DIRECTION&quot;</td>
<td>Contains “P”, “N” or “X” corresponding to route direction</td>
</tr>
<tr>
<td>&quot;LABEL&quot;</td>
<td>Five digit code with the ROUTE_ID and DIRECTION fields joined</td>
</tr>
<tr>
<td>&quot;BEG_MILEPOINT&quot;</td>
<td>Beginning MP of the segment</td>
</tr>
<tr>
<td>&quot;END_MILEPOINT&quot;</td>
<td>Ending MP of the segment</td>
</tr>
</tbody>
</table>

### Speed Limit Critical Data Columns

<table>
<thead>
<tr>
<th>Heading</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route</td>
<td>Route ID: Route ID number with direction letter (i.e. 0089N)</td>
</tr>
<tr>
<td>Direction</td>
<td>Direction: Route direction (P, N)</td>
</tr>
<tr>
<td>Beg_MP</td>
<td>Beginning MP: The milepost where the sign appears</td>
</tr>
<tr>
<td>End_MP</td>
<td>End MP: The end milepost of the road segment</td>
</tr>
<tr>
<td>Speed_Limit</td>
<td>Speed Limit: number signifying the speed limit (in mph) of a particular segment.</td>
</tr>
</tbody>
</table>
Data and Automation Tools

Python Script

```python
# Environment Variables
arcpy.AddMessage("Environment Variables..." + " \n ")
arcpy.env.overwriteOutput=True
arcpy.env.workspace = os.path.join(folder,"SpatialJoin")
arcpy.AddMessage(arcpy.env.workspace + " \n ")

def SpatialJoinOTM_Excel (TargetFeature, RoadwayFeature)
arcpy.AddMessage("Spatial Join Data for " + ExcelName + " joined")
arcpy.SpatialJoin_analysis(TargetFeature, RoadwayFeature,
                          OutputFeature = ExcelName + " joined")

arcpy.AddMessage(" Exporting " + ExcelName + " excelFile = os.path.join(ExcelOutputFolder, "Barr")")
arcpy.TableToExcel_conversion(OutputFeature, ExcelName)

SpatialJoinOTM_Excel(SelectedSegments, Barriers, "Barr", SpatialJoinOTM_Excel/SelectedSegments, Layers, "Layer")
```

MS Excel VBA

```vba
Option Explicit

Function checkRLibraries()
    ' The purpose of this function is to check if the:
    Dim n As Integer
    Dim RLibrary(1 To 6) As String
    RLibrary(1) = "MASS"
    RLibrary(2) = "mnormt"
    RLibrary(3) = "rjags"
    RLibrary(4) = "R2WinBUGS"
    RLibrary(5) = "arm"
    RLibrary(6) = "ggplot2"
    checkRLibraries = True

    For n = 1 To 6
        If FolderExists("C:\Program Files\R\R-3.2.3\Library") Then
            On Error Resume Next
            Call registry.RWrite("...
        End If
    Next n
```

---

Zero Fatalities: Applying the Roadway Safety Analysis Methodology in Utah

LTDOT
Keeping Utah Moving
Data and Automation Tools

**ArcMap GUI**

**MS Excel GUI**
Roadway Safety Analysis Methodology
1) Crash and Roadway Data Segmentation
Roadway Safety Analysis Methodology

2) Statistical Network Screening of Roadway Data
Roadway Safety Analysis Methodology

1) Crash Data
2) Combine Crash Data
3) Road Segment Database
4) Road Segmentation

1) Event Crash Data
2) Crash Location
3) CRAF Form
4) Vehicle Crash Data

1) Roadway
2) Functional Class
3) Urban Code
4) Number of Lanes
5) Speed Limit

1) UCPM Output (AC, Beginning)
2) UCPM Output (AT, Beginning)
3) UCPM Output (AT, End)
4) UCPM Output (AC, End)

1) Identify Problem Segments (UCPM)
2) Identify Problem Segments (UCSH)
3) Selected Problem Segments (UCPM-Out)
4) Selected Problem Segments (UCSH-Out)

1) Meta Material
2) Maps of UCPM Output
3) Maps of UCPM Output
4) Crash Database

1) Combine Report
2) Combine Report
3) Segment Roadway
4) Segment Database
5) Crash Data

1) Possible Countermeasure Evaluation
2) Personal Site User and Countermeasure Evaluation
3) Full “Roadway Safety Analysis” Report
4) Analysis Reports
5) Publish Reports

3) Report Compilation for Segments of Interest

Symbol Key

 BYU

Zero Fatalities: Applying the Roadway Safety Analysis Methodology in Utah

LTDOT Keeping Utah Moving
1) Crash and Roadway Data Segmentation

- Crash data:
  - Crash data
  - Crash location
  - Crash rollup (crash factors)
  - Vehicle crash data
1) Crash and Roadway Data Segmentation

- Roadway data:
  - AADT, functional class, urban code, number of lanes, speed limit

- Segmentation:
  - By attribute change
  - By length (e.g., 0.1 mile)
1) Crash and Roadway Data Segmentation

Roadway and Crash Data Preparation

- **ROADWAY DATA**
  - Import Data:
    - Historic AADT
    - Functional Class
    - Speed Limit
    - Sign Faces
    - Lanes
    - Urban Code
  - Data download link: UDOT Open Data Portal

- **CRASH DATA**
  - Import Data:
    - Crash Location
    - Crash Data
    - Crash Rollup
    - Crash Vehicle
  - Status

Reset
2) Statistical Network Screening of Roadway Data

- Merge roadway and crash data:
  - Select severities
- Model variable selection:
  - Horseshoe (step-wise)
  - Manual selection
2) Statistical Network Screening of Roadway Data

Select Road Segment and Crash Data Files:
- Road Segment Data
- Crash Data

Select Crash Severities to Summarize:
- Severity 5 (fatal injury crash)
- Severity 4 (incapacitating injury crash)
- Severity 3 (injury crash)
- Severity 2 (possible injury)
- Severity 1 (property damage only)

Summarize Crash Factors from Crash Rollup Data (Optional)

Notice: A progress screen will be given as the crash data is summarized

Create Input Data for Statistical Analysis

Select Input File, Iterations, and Burn-In Iterations:
- Input File: J:/groups/udot2015/2_Model_Execution_in_R/RGUI/UCPM
- R Code for Analysis: J:/groups/udot2015/2_Model_Execution_in_R/RGUI/UCSM
- Iterations: 50000 (100000 for full, 10000 for test)
- Burn-In Iterations: 5000 (5% to 10% of iterations)

Indicate Variable Selection Process:
- Manual Variable Selection
  - 38: Total Crashes
  - 39: Severe Crashes
  - 40: Pedestrian Involved
  - 41: Bicyclist Involved
  - 42: Motorcycle Involved
  - 43: Improper Restraint
  - 44: Unrestrained
  - 45: DUI
  - 46: Aggressive Driving
  - 47: Distracted Driving
  - 48: Drowsy Driving

Start Statistical Analysis
2) Statistical Network Screening of Roadway Data

- Analyze output:
2) Statistical Network Screening of Roadway Data

- UCPM output interpretation:
  - Compare predicted and actual number of crashes
  - High percentile = "hot spots"

UCPM Normalizing Index = Perc
2) Statistical Network Screening of Roadway Data

• UCSM output interpretation:
  – Compare predicted severe crash rate to actual severe crash rate
  – High percentile and high difference = “hot spot”

\[ UCSM \text{ Normalizing Index} = \text{Perc} \times \text{Diff} \]
2) Statistical Network Screening of Roadway Data

- Hierarchical ranking:
  - Statewide rank
  - Region rank
  - County rank

- Categorical ranking:

<table>
<thead>
<tr>
<th>Route Label</th>
<th>Beginning MP</th>
<th>End MP</th>
<th>County</th>
<th>UDOT Region</th>
<th>State Rank</th>
<th>Region Rank</th>
<th>County Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>0089P</td>
<td>388.438</td>
<td>389.123</td>
<td>DAVIS</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0015P</td>
<td>250.923</td>
<td>253.557</td>
<td>UTAH</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0089P</td>
<td>415.425</td>
<td>415.994</td>
<td>WEBER</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>0015P</td>
<td>292.596</td>
<td>293.634</td>
<td>SALT LAKE</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0089P</td>
<td>369.036</td>
<td>369.532</td>
<td>SALT LAKE</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>0015X</td>
<td>312.319</td>
<td>313.275</td>
<td>SALT LAKE</td>
<td>2</td>
<td>55</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>0089P</td>
<td>371.471</td>
<td>372.037</td>
<td>SALT LAKE</td>
<td>2</td>
<td>56</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>0089P</td>
<td>233.46</td>
<td>238.035</td>
<td>SANPETE</td>
<td>4</td>
<td>57</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>0080P</td>
<td>146.876</td>
<td>150.724</td>
<td>SUMMIT</td>
<td>2</td>
<td>58</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td>0126P</td>
<td>8.738</td>
<td>9.126</td>
<td>WEBER</td>
<td>1</td>
<td>59</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>0089P</td>
<td>470.371</td>
<td>471.607</td>
<td>CACHE</td>
<td>1</td>
<td>60</td>
<td>19</td>
<td>1</td>
</tr>
</tbody>
</table>
2) Statistical Network Screening of Roadway Data
2) Statistical Network Screening of Roadway Data

- Select segments of interest:
  - Top 40 in the State
  - Top 30 in a Region
  - Top 20 in a County
  - Planned corridor maintenance/rehabilitation
3) Report Compilation for Segments of Interest

- Spatial roadway characteristics:
  - Downloaded
  - Derived
- Spatially join crash and roadway characteristics with segments of interest (i.e., “hot spots”)
3) Report Compilation for Segments of Interest

- Create Roadway Safety Analysis Reports (RSARs):
3) Report Compilation for Segments of Interest

- Segment identification and roadway characteristics:

<table>
<thead>
<tr>
<th>Road Name:</th>
<th>UC Model Used:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Direction:</td>
<td>State Rank:</td>
</tr>
<tr>
<td>Beginning, Ending MP:</td>
<td>Rank, Region:</td>
</tr>
<tr>
<td>Length (miles):</td>
<td>Rank, County:</td>
</tr>
<tr>
<td>Dates of Data Source:</td>
<td>Date of Analysis:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function Class:</th>
<th>AADT:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Thru Lanes:</td>
<td>Speed Limit (MPH):</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MPs</th>
<th>Median</th>
<th>IPM</th>
<th>SPM</th>
<th>Shoulder</th>
<th>Grade</th>
<th>Curve</th>
<th>Lanes</th>
<th>Wall/Barrier</th>
<th>Rumble</th>
</tr>
</thead>
</table>

Zero Fatalities: Applying the Roadway Safety Analysis Methodology in Utah
### 3) Report Compilation for Segments of Interest

- **Micro-analysis of crash data:**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Crash ID</th>
<th>MP</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
<th>Factor 5</th>
<th>Factor 6</th>
<th>Factor 7</th>
<th>Factor 8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

  **Segment Total**

<table>
<thead>
<tr>
<th>Crash ID</th>
<th>MP</th>
<th>First Harmful Event</th>
<th>Manner of Collision</th>
<th>Event Sequence</th>
<th>Most Harmful Event</th>
<th>Vehicle Maneuver</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Zero Fatalities: Applying the Roadway Safety Analysis Methodology in Utah
3) Report Compilation for Segments of Interest

- Possible countermeasures:
  - Based on top 8 crash factors
  - Auto-populated from NCHRP 500 series reports
  - List narrowed down by analyst

- Historical perspective, current conditions:
  - Site visit
  - Internet tools (Google Earth, Roadview Explorer)
  - Communicate with experts
3) Report Compilation for Segments of Interest

Roadway Safety Analysis Report

Introduction
The purpose of this report is to summarize and present preliminary results from a safety-specific micro analysis on an identified set of segments of interest. This report includes classification of the roadway segment and sub-segments, micro-analysis of the crash data, site visit notes, and a list of possible countermeasures.

Segment Identification and Roadway Characteristics

<table>
<thead>
<tr>
<th>Table 1: Segment Meta Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Name:</td>
</tr>
<tr>
<td>DC Model Road:</td>
</tr>
<tr>
<td>I001M</td>
</tr>
<tr>
<td>Road Direction:</td>
</tr>
<tr>
<td>South 38364</td>
</tr>
<tr>
<td>Beginning Ending Mph:</td>
</tr>
<tr>
<td>Number of Lanes:</td>
</tr>
<tr>
<td>Date of Analysis:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2: Segment Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Speed:</td>
</tr>
<tr>
<td>Number of Lanes:</td>
</tr>
<tr>
<td>Speed Limit (Mph):</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3: Roadway Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
</tr>
<tr>
<td>Number of Lanes</td>
</tr>
<tr>
<td>Speed Limit (Mph)</td>
</tr>
</tbody>
</table>

Micro-Analysis of Crash Data

Crash Data Summary

<table>
<thead>
<tr>
<th>Table 4: Crash Count and Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crash Type</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>11/18/2015</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 5: Top 20 Crash Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crash ID</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>10349772</td>
</tr>
<tr>
<td>10349781</td>
</tr>
<tr>
<td>10349785</td>
</tr>
<tr>
<td>10349786</td>
</tr>
<tr>
<td>10349787</td>
</tr>
<tr>
<td>10349788</td>
</tr>
<tr>
<td>10349789</td>
</tr>
<tr>
<td>10349790</td>
</tr>
<tr>
<td>10349791</td>
</tr>
</tbody>
</table>

Event Sequence (4) Most Hazardous Event Vehicle Maneuver Not Applicable

- Operating Motor Vehicle
- Straight Ahead, Straight Ahead, Turning Left, Turning Right
- Stepped in Traffic Lane, Turning Left, Turning Right
- Operating Motor Vehicle
- Straight Ahead, Turning Left, Turning Right
- Stepped in Traffic Lane, Turning Left, Turning Right
- Operating Motor Vehicle
- Straight Ahead, Straight Ahead, Turning Left, Turning Right
- Stepped in Traffic Lane, Turning Left, Turning Right
- Operating Motor Vehicle
Zero Fatalities: Applying the Roadway Safety Analysis Methodology in Utah

Introduction
The purpose of this report is to summarize and present preliminary results from a safety-specific micro-modes segment of interest. This report includes identification of the roadway segment and sub-segments, micro-modes, site visit notes, and a list of possible countermeasures.

Segment Identification and Roadway Characteristics

Table 1: Segment Metadata

<table>
<thead>
<tr>
<th>Road Name:</th>
<th>SR-68</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Direction:</td>
<td>Single</td>
</tr>
<tr>
<td>Beginning Ending MPs:</td>
<td>11,640</td>
</tr>
<tr>
<td>Length (miles):</td>
<td>2.061</td>
</tr>
<tr>
<td>Dates of Data:</td>
<td>2010-2014</td>
</tr>
<tr>
<td>Date of Analysis:</td>
<td>7/26/2016</td>
</tr>
</tbody>
</table>

Table 2: Segment Characteristics

<table>
<thead>
<tr>
<th>Function Class:</th>
<th>Minor Arterial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Lane:</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 3: Roadway Characteristics

<table>
<thead>
<tr>
<th>MP's</th>
<th>Median</th>
<th>EPM</th>
<th>SPM</th>
<th>Shoulder</th>
<th>Grade</th>
<th>Curve</th>
<th>Lanes</th>
</tr>
</thead>
<tbody>
<tr>
<td>11,640</td>
<td>21.17</td>
<td>10.52</td>
<td>Asphalt</td>
<td>4 ft</td>
<td>Class D</td>
<td>2 Lane</td>
<td></td>
</tr>
</tbody>
</table>

Micro-Analysis of Crash Data

Crash Data Summary

Table 4: Crash Count and Severity

<table>
<thead>
<tr>
<th>Predicted Number of Crashes</th>
<th>Total Crashes on Roadway</th>
<th>Severity 5 (Fatal)</th>
<th>Severity 4 (Incap. Injury)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.8</td>
<td>0.3</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 5: Top 8 Crash Factors

<table>
<thead>
<tr>
<th>Urban County</th>
<th>Roadway Geometry Related</th>
<th>Single Vehicle</th>
<th>Overturned Rollover</th>
<th>Roadway Departure</th>
<th>Motorcycle Involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>33/33</td>
<td>22/33</td>
<td>23/33</td>
<td>24/33</td>
<td>24/33</td>
<td>14/33</td>
</tr>
</tbody>
</table>

Historical Perspective, Current Conditions, Site Visit Notes

It was observed that the 12-mile segment of SR-68, located south of Saratoga Springs, UT, is a two-lane highway. There are no rumble strips in the centerline or on the shoulder. There is approximately 2 feet of asphalt on the shoulder of the roadway. According to Roadview Explorer, there have been no apparent changes to the geometry or features of the roadway in recent years, other than a portion of the road segment being repaved in 2012.

In a site visit conducted on 7/26/2016, it was observed that there were many horizontal curves along the roadway, with some rolling effect in the vertical transition. While the site visit was done during the day, it was noted that the curves may not be visible during the night time. Driving at the posted speed limit through the curves created a "roller coaster" effect. It was also observed the shoulder of the road has not been well maintained. Weeds have been growing into the shoulder, which may make it hard for vehicles to pull over or get back onto the road.

Figure 1: SR-68 in Mosida, Utah

Possible Countermeasures

The following is a list of possible countermeasure related to the top 8 crash factors listed in Table 5. The countermeasures listed were compiled using the countermeasures from the NCHRP 500 Report volumes. [(P) = Proven (T) = Tried (E) = Experimental (NA) = Data not available.]

- Design safer slopes and ditches to prevent rollovers (P)
- Eliminate shoulder drop-offs (shoulder treatment) (E)
- Improve access to safe stopping and resting areas (T)
- Increase public awareness of risks of not wearing seat belts (T)
- Install centerline rumble strips (T)
- Install shoulder rumble strips (P)
- Modify horizontal alignments (P)
- Provide adequate sight distance for expected speeds (P)
- Provide advance warning of unexpected changes in horizontal alignments (T)
- Widen and/or pave shoulder (shoulder treatment) (F)
- Widen the roadway (P)

Safety Problem Summary

This segment has a very low AADT but high number of crashes. Most of the accidents are rollovers. Also, there are a large amount of rollover accidents and accidents with a single vehicle involved attributed to the many curves on this segment. Some of the possible contributing factors are geometry, speed and improper restraint.
Summary
Concluding Remarks

• New automation tools and GUls:
  – Improved interface to access tools
  – Runtime of tools decreased
  – “Critical Data Columns”

• Three User’s Manuals created for each part:
  1. Crash and roadway data segmentation
  2. Statistical network screening of roadway data
  3. Report compilation for segments of interest
Concluding Remarks

• Future research includes:
  – Continued development of Roadway Safety Analysis methodology:
    • Statewide analysis of intersections
    • Statewide analysis of horizontal curves
    • Implement in other states
  – Contribute to safety countermeasures effectiveness research
  – Expand GIS tools for crash analysis
Concluding Remarks

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Questions

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