A Multi-State Pooled Fund Effort to Understand Intersection Crashes

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CH2M HILL
Agenda

- Intersection Decision Support (IDS) History and Background

- Rural Intersection Crash Characteristics

- IDS Pooled Fund Methodology
  - Challenges working with multiple states

- Highlights of Pooled Fund Findings
The Start of IDS

- FHWA + 3 State Consortium
  - Vehicle-Infrastructure Technology to Address Intersection Crashes

- California ➔ CALTRANS & Berkeley
  - Left Turn Across Path; esp. urban signals

- Virginia ➔ VDOT & VTTI
  - Sign Violations

- Minnesota ➔ Mn/DOT & Univ. of MN
  - Rural, minor-street crossing crashes
Minnesota’s Focus

- “Right Angle Crashes”
- Rural Expressways
- Unsignalized Intersections
  - Minor Street Stop Controlled
- Affordable Alternative to Traffic Signals
  - Preserve expressway mobility
Common Perception of Rural Right Angle Crashes

“Ran the STOP”
- Driver fails to recognize STOP sign
- May be a common at some locations
- Many countermeasures already available
Previous Research

- Approx 80% of thru-STOP crashes related to selection of insufficient gaps
  
  Najm, W.J., J.A. Koopmann and D.L. Smith
  “Analysis of Crossing Path Crash Countermeasure Systems.”

- Right Angle Crashes at 2-Lane/2-Lane Rural Thru-STOP Intersections

Source: Mn/DOT Crash Records, 1998 - 2000
Stopped, Pulled-Out Crash

- 100 Straight Crossing Path Crashes at thru-STOP Intersections

- Drivers stopped before entering the intersection
  - 62.1% = Driver looked but did not see vehicle
  - 19.6% = Driver misjudged the gap size or speed of approaching vehicle
  - 14.0% = Driver had an obstructed view
  - 4.4% = Roads were ice-covered

Examination of Unsignalized Intersection Straight Crossing Path Crashes and Potential IVHS Countermeasures
MN: Int. Above Critical Crash Rate

Crash and Severity Rates for Rural Thru-STOP Intersections

- Rural Thru-STOP
- Rural Expressway Thru-STOP (198)
- Rural Expressway Thru-STOP - Over Critical Crash Rate (23)

Source: Mn/DOT 2000 – 2002 Crash Data
MN: Crash Type Distribution

Crash Type Distribution for Rural Thru-STOP Intersections

- **Rural Thru-STOP**
- **Rural Expressway Thru-STOP (396)**
- **Rural Expressway Thru-STOP - Over Critical Crash Rate (23)**

<table>
<thead>
<tr>
<th>Crash Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>23%</td>
</tr>
<tr>
<td>Rear End</td>
<td>18%</td>
</tr>
<tr>
<td>Sideswipe</td>
<td>14%</td>
</tr>
<tr>
<td>Passing</td>
<td>9%</td>
</tr>
<tr>
<td>Left Turn</td>
<td>7%</td>
</tr>
<tr>
<td>Runoff Road</td>
<td>10%</td>
</tr>
<tr>
<td>Right Angle</td>
<td>36%</td>
</tr>
<tr>
<td>Headon</td>
<td>3%</td>
</tr>
<tr>
<td>Sideswipe Opposing</td>
<td>1%</td>
</tr>
<tr>
<td>Opposing</td>
<td>0.6%</td>
</tr>
<tr>
<td>Right Turn</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

Source: Mn/DOT 2000 – 2002 Crash Data
MN: 3 Candidate Intersections

Right Angle Crash Location

- Nearside (7) 22%
- Farside (25) 78%

At-Fault Driver Age

<table>
<thead>
<tr>
<th>Age</th>
<th>Actual</th>
<th>Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young (&lt;20)</td>
<td>22%</td>
<td>16%</td>
</tr>
<tr>
<td>21-64</td>
<td>66%</td>
<td>72%</td>
</tr>
<tr>
<td>Older (&gt;64)</td>
<td>10%</td>
<td>7%</td>
</tr>
<tr>
<td>Unknown</td>
<td>2%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Contributing Factors

- Ran the STOP (0) 0%
- Other (4) 13%
- Stopped, Pulled Out (28) 87%

- Weather, light, and road surface conditions not found to have large contributing factor.
Overview of Intersection Crash Characteristics

- Weather, road surface & light conditions tend not to be a factor
- Younger and older driver are over represented in crossing path crashes
- Problem appears to increase with increasing volume of traffic (availability vs. demand for gaps)

Typical Rural Intersection (4,100 Intersections)
- 57% Gap Related
- 28% Right Angle

Critical Intersections (23 Intersections)
- 80 - 90% Gap Related
- 53% Right Angle

Source: Mn/DOT 2000 – 2002 Crash Data

Crash Rate = 0.4 Crashes per MEV
Crash Rate > 0.8 to 3.0 Crashes per MEV
Methodology

- Begin with Entire State or Large Region

- Identify ≈30 High Frequency Crash Locations

- Select 5-7 with High Percentage of Crossing Path Crashes for Detailed Review

- Field Review and Coordination with State DOT to Select Location for Instrumentation
Challenges

- Different Analysis Years
  - Coordinate Analysis with Deployment of Mobile Surveillance System
- Number of Years
- Screening Method
  - Statewide ➔ Region ➔ Corridor ➔ Nominations
- Access to Officer Reports

**Goal was to be consistent with each state’s own process**
## Quick Summary of Candidate Intersections

<table>
<thead>
<tr>
<th></th>
<th>2-Lane</th>
<th>Expressway</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Intersections</td>
<td>13</td>
<td>25</td>
<td>38</td>
</tr>
<tr>
<td>Crossing Path Crashes</td>
<td>146</td>
<td>344</td>
<td>490</td>
</tr>
<tr>
<td>CPC as Percentage of All Crashes</td>
<td>61%</td>
<td>70%</td>
<td>67%</td>
</tr>
</tbody>
</table>
Crash Severity
(CPC at IDS Candidate Locations)
At-Fault Driver Age
(CPC at IDS Candidate Locations)
Crash Location
(CPC at IDS Candidate Locations)
% that were Stopped, Pulled Out
Crashes
(CPC at IDS Candidate Locations)
Other Recent Research

- **Iowa Study**
  - 30 rural expressway intersections
  - Seven intersections located on horizontal curves had different crash patterns.
    - Curves were a by-pass around a town, with the leg on the inside of the curve leading to the city and carrying a higher volume.
    - All crashes
      - 53% far-side; 30% near-side, 17% other (e.g., fixed object)
    - Crashes at 7 intersections in curve
      - Far-side, near-side, and other each nearly 33 percent.

- **Minnesota Study**
  - Crashes concentrated at intersections with near-by development...e.g., gas stations or restaurants
Summary

- High Crash Location in Every State
- Candidate Locations
  - Severity of Target Crashes above National Average
  - Old or Young Drivers Often Over-Represented as At-Fault Driver
  - Far-Side Crashes Frequent at Many Locations
  - Gap Selection Typically Accounts for at least 80% of Crossing Path Crashes