Oregon Pedestrian and Bicycle Safety Implementation Plan
July 20, 2015

Matt Braughton
Outline

- Project Background
- Study Scope
- Methodology
- Countermeasures
- Implementation & Next Steps
Project Background

- ODOT has developed two statewide safety implementation plans
  - Roadway Departure
  - Intersections
- Pedestrian and Bicycle next highest priority in SHSP
- Pedestrian and bicycle crash frequency requires unique approach
  - Low frequency
  - Few proven countermeasures
  - Limited crash descriptors, exposure data, and inventory of facilities
- Identify and rank sites on all roads in Oregon with potential for crash reduction
  - $4 million pedestrian/bike safety funding in 2017

Photo source: ODOT
Project Goals and Objectives

- Reduce **fatalities and severe injuries** resulting from pedestrian and bicycle crashes
- Increase understanding of pedestrian and bicycle crash causes and locations
- Identify and rank potential sites for safety projects
  - **Data-informed** approach consistent with MAP 21
    
    “Highway safety improvement projects must be identified on the basis of crash experience, crash potential...or other data-supported means.”
    
    *(23 USC 148(c)(2)(B))*
  - **Systemic** method applied statewide
- Set framework that can be applied/improved annually
  - Data collection & management
  - Proven countermeasures

Photo source: ODOT
Study Scope

- Literature Review
  - Network Screening
  - Countermeasures

- Stakeholder Input
- Risk-Based Systemic Approach
  - Crash Analysis
  - Development of Risk Factors
1. Traditional
   - Implement many low-cost countermeasures where frequent and severe crashes were reported

2. Risk-based
   - Prioritize locations with potential for crash reduction based on presence of risk factors
Overview of Risk-Based Systemic Method

- **Identify Risk Factors**
  - Traffic and geometric characteristics present at fatal and severe-injury crash sites

- **Select and Prioritize Locations**
  - Segments exhibiting one or more risk factors

- **Develop Systemic Safety Projects**
  - Apply countermeasures to address risk factors at specific locations
Crash Analysis - Statewide Reported Pedestrian Crashes (2007-2011)

- **Total: 3,505**
  - Severe: 752 (21% of total)

- **State Highways**
  - Total: 658 (19%)
    - Severe: 211 (28%)

- **Non-State Highways**
  - Total: 1,052 (30%)
    - Severe: 222 (30%)

- **Portland Metro**
  - Total: 1,795 (51%)
    - Severe: 319 (42%)

- **Intersection**
  - **State Highways**
    - Total: 338 (10%)
      - Severe: 70 (9%)
  - **Non-State Highways**
    - Total: 520 (15%)
      - Severe: 77 (10%)
  - **Portland Metro**
    - Total: 1,098 (31%)
      - Severe: 137 (18%)

- **Segment**
  - **State Highways**
    - Total: 320 (9%)
      - Severe: 139 (19%)
  - **Non-State Highways**
    - Total: 532 (15%)
      - Severe: 145 (20%)
  - **Portland Metro**
    - Total: 697 (20%)
      - Severe: 182 (24%)

Identify Risk Factors
Select and Prioritize Locations
Develop Systemic Safety Projects
Crash Analysis – Example Pedestrian Trend

Reported Crashes on State Highway Segments in Urban Areas (2007-2011)

- Crossing between intersections: 46 crashes
  - Severe: 41 crashes
  - Non-Severe: 5 crashes
- No error: 32 crashes
  - Severe: 7 crashes
  - Non-Severe: 25 crashes
- Did not have right-of-way: 14 crashes
  - Severe: 12 crashes
  - Non-Severe: 2 crashes
- Other: 14 crashes
  - Severe: 11 crashes
  - Non-Severe: 3 crashes

Pedestrian Error

- Identify Risk Factors
- Select and Prioritize Locations
- Develop Systemic Safety Projects
Crash Analysis – Example Bicycle Trend

Reported Crashes on State Highway Segments in Urban Areas (2007-2011)

- **Identify Risk Factors**
- **Select and Prioritize Locations**
- **Develop Systemic Safety Projects**

![Bar chart showing crash types and their reported numbers.]

- **Angle**: 20 crashes
- **Head-On**: 10 crashes
- **Rear-End**: 5 crashes
- **Sideswipe-overtaking**: 10 crashes
- **Turning Movement**: 100 crashes
- **(blank)**: 5 crashes

Legend:
- Straight roadway
- Roadway and considered "located"
- Grade (vertical curve)
- Driveway or alley access
- Bridge structure (overpass and underpass included)
Pedestrian risk factors identified:

- Number of travel lanes along segments
- Presence of median on 4-lane roads
- Posted speed along segments
- Distance between signals or enhanced crossings
- Average Daily Traffic
- Presence of transit stop
- Number of fatalities or injuries resulting from a pedestrian crash
Bicycle risk factors identified:
- Number of driveways
- Number of lanes on major street at intersection
- Lack of bicycle facility on at least one approach at intersection
- Proximity to transit stop
- Average Daily Traffic
- Number of fatalities or injuries resulting from a bicycle crash
Network Development

- GIS data were aggregated into a linearly-referenced network
- To provide a consistent scale, the network was subdivided into $\frac{1}{10}$th of a mile segments
- Separate networks were developed for three levels of the road system
  - Urban State Network (Risk-Based and Traditional)
  - Rural State Network (Traditional)
  - Non-state Network (Traditional)
Risk-Based Network Screening

- Example of risk-based correlation between risk factor and crash frequency
- Driveway locations in orange, crash locations in blue
Segments were scored based on the number of risk factors present

- Some risk factors carry higher point value than others
- Scoring based on risk factors on the segment

Consecutive segments with high scores were aggregated into project corridors
Risk-Based Site Prioritization

Segments were scored based on the number of risk factors present

- Some risk factors carry higher point value than others
- Scoring based on risk factors on the segment

Aggregate consecutive segments with high scores into project corridors

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Data</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>How many driveways or alleys are located on the corridor?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Score Methodology

1 point if at least 1 signal is located on the segment or within 100’ of the segment
2 points if segment is an undivided 4-lane segment
1 point for segments with 1 transit stop located on the segment or within 100’ of the segment; 2 points for 2 or more transit stops
2 points awarded for the lack of bicycle facility on the left side of the road
2 points awarded for the lack of bicycle facility on the right side of the road
2 points for AADT between 12,000 and 18,000; 4 points awarded for AADT above 18,000
2 points for posted speed limit of 35 or 40 mph; 4 points for posted speed limits above 40 mph
2 points awarded for segments with 1 driveway; 3 points for segments with 2-3 driveways; 4 points for segments with 4 to 8 driveways; 5 points for segments with more than 8 driveways

*All crash history should reflect the latest five years of available data.
Traditional Method Site Prioritization

Traditional

- Identify corridors with highest frequency of severe-injury and fatal crashes for the entire state
- Scoring based on total number of severe-injury and fatalities along the segment
- Segments were aggregated into project corridors based on proximity and prioritized by overall score
Prioritized Corridor Maps – R4 Pedestrian Example

Identify Risk Factors
Select and Prioritize Locations
Develop Systemic Safety Projects
Systemic Countermeasures

- Countermeasures evaluated based on
  - Documented effectiveness
  - Ease of implementation
  - Relative cost

- Countermeasure toolbox developed with input from stakeholders and project management team

- Includes several FHWA Proven Safety Countermeasures

Graphic source: FHWA
### Example Countermeasures – Pedestrian

<table>
<thead>
<tr>
<th>Crash Countermeasures by Area Type and Traffic Control</th>
<th>Relative Construction Cost</th>
<th>Relative Ease of Implementation</th>
<th>Countermeasure Effectiveness*</th>
<th>Relative Reliability of CMF</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Locations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Signalized</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lighting</td>
<td>2</td>
<td>2</td>
<td>0.58</td>
<td>1</td>
</tr>
<tr>
<td>Right-turn channelization island</td>
<td>2</td>
<td>2</td>
<td>Reduces conflict points</td>
<td>N/A</td>
</tr>
<tr>
<td>Signal Timing - Install countdown signals</td>
<td>1</td>
<td>1</td>
<td>0.45</td>
<td>2</td>
</tr>
<tr>
<td>Signal Timing - Leading pedestrian/bicyclist interval</td>
<td>1</td>
<td>1</td>
<td>0.63</td>
<td>2</td>
</tr>
<tr>
<td>Signal Timing - Modify left-turn phasing</td>
<td>1</td>
<td>1</td>
<td>Reduces conflict points</td>
<td>N/A</td>
</tr>
<tr>
<td>Vehicle turning movement restrictions</td>
<td>1</td>
<td>2</td>
<td>Reduces conflict points</td>
<td>N/A</td>
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<tr>
<td><strong>Unsignalized</strong></td>
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<td></td>
<td></td>
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<tr>
<td>Enhanced crossing treatment</td>
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<td>0.58</td>
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<tr>
<td>Lighting</td>
<td>2</td>
<td>2</td>
<td>0.58</td>
<td>1</td>
</tr>
<tr>
<td>Reduce curb radii</td>
<td>2</td>
<td>2</td>
<td>Reduces speed</td>
<td>N/A</td>
</tr>
</tbody>
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*Countermeasure Effectiveness:*
- 0.58: Moderately effective
- 0.45: Slightly effective
- 0.63: Highly effective
- N/A: Not applicable

**Identify Risk Factors**
**Select and Prioritize Locations**
**Develop Systemic Safety Projects**
### Example Countermeasures – Bicycle

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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Signalized</strong></td>
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<tr>
<td>Bike detection</td>
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<td>Accounts for human factors</td>
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<tr>
<td>Lighting</td>
<td>2</td>
<td>2</td>
<td>0.58</td>
<td>1</td>
</tr>
<tr>
<td>Pavement markings</td>
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<td>1</td>
<td>Accounts for human factors</td>
<td>N/A</td>
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<td>Right-turn channelization island</td>
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Implementation Plan Content

- Prioritizes bicycle and pedestrian corridors for safety improvements
  - Risk-based prioritization for State Highways in urban areas
  - Traditional prioritization for all roadways (State and Non-State)
- Countermeasure Toolbox to assist in determining safety improvements
Implementation Plan Benefits

- Directs funding/staff resources to locations with greatest potential for crash reduction
- Allows region/local agency flexibility to select countermeasures
- Informs educational and enforcement efforts
Improving the Plan

Opportunities to improve data:
- Consistency across jurisdictional boundaries
- Broader spatial coverage
- Crash reporting details for pedestrian and bicycle crashes
- Exposure data

Evaluate Effectiveness of Implementation

Enforcement and Education
Questions?

Contact

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Plan available online at:
http://www.oregon.gov/ODOT/HWY/TS/Pages/Bicycle_Pedestrian_Safety.aspx or search “Oregon bicycle pedestrian safety implementation”