Elevating Safety on Rural Roads

The Local Road Safety Plan

Kimley-Horn
Why Worry about Rural Road Safety?

“In 2012, 19% of the US population lived in rural areas but rural road fatalities accounted for 54% of all fatalities. Even with reductions in the number of fatalities on the roadways, the fatality rate in rural areas is 2.4 times higher than the fatality rate in urban areas.”

FHWA – Office of Traffic Safety

“In Iowa, more than 50% of K&A crashes occurred on rural roads from 2004-2013, resulting in crash rates on rural roads more than twice that of state-maintained roads.”

Iowa Local Road Safety Plans (Phase 1)
Who can Improve Rural Road Safety?
LRSP Background and Purpose

What is an LRSP?

- Proactive safety improvements based on risk factor assessment
- Define a focused plan for practitioners to make informed, prioritized safety decisions
- Use results of the analysis to leverage and apply for safety funding

Goal – Proactive safety improvement projects that can be implemented by the County
LRSPs per the Feds:

“The systemic approach to safety involves widely implemented improvements based on high-risk roadway features correlated with specific severe crash types.

The approach provides a more comprehensive method for safety planning and implementation that supplements and complements traditional site analysis.

It helps agencies broaden their traffic safety efforts and consider risk as well as crash history when identifying where to make low cost safety improvements.”

FHWA – Office of Traffic Safety
Where have LRSPs been done?

- Minnesota (2009 - 2013)
- North Dakota (2012-2015)
- Iowa (2015 – ongoing)

Under Development in:
- Nebraska
- Kansas
- FHWA (for 4 counties)
LRSPs Phase 1 - Iowa

1. Buchanan
2. Cerro Gordo
3. Clinton
4. Hamilton
5. Keokuk
6. Marshall
7. Mills
8. Monona
9. Montgomery
10. Plymouth
11. Wapello
12. Winneshiek
LRSP Project Overview

- Gather Background Information
- Data Collection
- Data Analysis
- Countermeasure Selection
- Develop Projects
- Workshops
- Develop LRSPs
Gather Background Information

- Review Safety Literature/Research
  - Iowa SHSP
  - County safety policies/documents
  - National best practices

- Data Requests from each County
  - Stop signs
  - Curve chevrons
  - Centerline rumble strips
  - Edgeline and/or shoulder rumble strips
  - Transverse rumble strips
  - 911 address database
Gather Background Information

- Survey on driver-related emphasis areas
Data Collection

- 10 years of crash data (from DOT)
- GIS database with roadway features (from DOT)
- Roadside risk assessment (conducted as part of the project)
Additional Data Analysis

- County Engineer chooses up to 3 additional analysis. Examples:
  - Map of weather-related crashes
  - Map of crashes by time of day
  - Younger driver summary crash data summary (time of day, day of week, severity)
  - Impaired driving crash data summary (time of day, day of week, severity)
Countermeasure Selection

- Emphasis on practical, low-cost and proven countermeasures
  - NCHRP 500
  - NHTSA
  - FHWA Proven Countermeasures
  - Towards Zero Deaths
  - CMF Clearinghouse

- Countermeasures selected by a data-driven approach

- Develop LRSP brochure to gain involvement from the 5E’s of safety at the workshop
LOCAL ROAD SAFETY PLANS

Develop Projects

GIS data → Risk factor ranking → Decision tree

→ Project sheets

County Input
Risk Factors and Ranking

Identification of systemic safety improvements

- Risk factors can include
  - Roadway features
  - Intersection features
  - Traffic volumes

- Ranking of intersections, curves and roadway segments conducted for the risk factors
- Rankings not conducted for primary roads, city streets or secondary unpaved roads
Decision Trees

- Develop decision trees to aid in systematic selection of safety improvement projects for each intersection, curve or roadway segment.
## Develop Project Sheets

### Project Location and Agency Contact Information

- **Project Name**: Re-HABILITATE BLACKSBURGWY and Co Rd VICKASYNDI HEDRICK RY Intervention
- **Agency Name**: Wood County
- **Contact Person**: Name
- **E-mail**: e-mail@county.org

### Location Description

- **Four Points**: 1, 2, 3, 4
- **Zoomed Map**: Image

### Brief Crash Data Summary for the Location

- **Critical Factors**: Factors 1 and 2
- **Right-Lane Minimum**: Lane 1

### Opinion of Probable Cost for the Identified Improvements

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Quantity</th>
<th>Unit</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadway</td>
<td>1</td>
<td>km</td>
<td>$1,200</td>
</tr>
<tr>
<td>Signage</td>
<td>1</td>
<td></td>
<td>$2,500</td>
</tr>
<tr>
<td>Sidewalk</td>
<td>1</td>
<td></td>
<td>$3,500</td>
</tr>
</tbody>
</table>

### Additional Information/Notes

- **Observation**: Observation notes
- **Warning Signs**: Warning signs placed

### Opinion of Probable Construction Cost Disclaimer

Opinion of Probable Construction Cost Disclaimer:

- **Kinhorn limit cost**: $1,500
- **Contractor limits**: $2,500

### Project Location Map Sources

- **CIS, DigitData, USDA, AR, 3D Digital, DigitalGlobe, USGS, US, VA, WA, WIC, and the GIS User Community**

# Local Road Safety Plans

## Project Sheet Layout

### Icon Displaying Project Type (Intersection, Curve, or Segment)

- **Intersection, Curve, or Segment**: Icon

### Unique GPS Identification Number

- **ID Number**: 123456

### Key Emphasis Area Crashes that the Project is anticipated to Address (from the Iowa Strategic Highway Safety Plan)

- **Crashes Addressed**
- **Intersections**: 10
- **Segments**: 5

### Other Information at this Location that is Important for Developing the Recommendations within the Decision Tree

- **Important Information**

### Opinion of Probable Cost Disclaimer, Project Description Form Disclaimer, and Project Location Map Sources

- **Disclaimer**
- **Form Disclaimer**
- **Map Sources**

---

**Note**: The analysis and recommendations are based on the latest available data and should be updated as new information becomes available.
Workshops

- Iowa LRSP – Phase 1
  - 24 Workshops (2 in each county)
  - 8,000+ miles traveled
  - 79 Individuals involved
    - County Engineers/Staff
    - County Sheriff
    - County Fire
    - DOT representatives
    - State Patrol Troopers
    - School Board Members
    - County Board of Directors
    - Local Media
LOCAL ROAD SAFETY PLANS

Develop LRSPs

Intersections
Intersections – Risk Factors

- Volume
- Intersections within curves
- Skewed approach
- Access management
- K or A crash history
- On-street parking
## Intersections – Example of Risk Factor Scoring

<table>
<thead>
<tr>
<th>Int.</th>
<th>DEV</th>
<th>Within Curve</th>
<th>Skew</th>
<th>Access Mgmt.</th>
<th>K or A Crash</th>
<th>On-Street Parking</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>#2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>#3</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>#4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>#5</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>#6</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>#7</td>
<td>8</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>#8</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>9</td>
</tr>
</tbody>
</table>
LOCAL ROAD SAFETY PLANS

Intersections – Example Risk Factor Score Map

Legend

Intersection Score
- 10+
- 8-9
- 5-7
- 2-4
- 0-1

Roadways
- State Roads
- County Paved Roads
- County Unpaved Roads
- Corporation Limits
## Intersections – Countermeasures and CMFs

<table>
<thead>
<tr>
<th>Safety Countermeasure</th>
<th>CMF</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intersection Control Evaluation (ICE)</td>
<td>varies</td>
<td>varies</td>
</tr>
<tr>
<td>Destination Lighting</td>
<td>0.62</td>
<td>$8,000</td>
</tr>
<tr>
<td>All-Way Stop Warrant Analysis and Converting Two-Way Stop to All-Way Stop</td>
<td>0.52</td>
<td>$5,000</td>
</tr>
<tr>
<td>Upgrade Signs and Pavement Markings (Paved Approach)</td>
<td>0.4 – 0.69 “Stop Ahead” 0.751 – 0.909 “New Stop Sign”</td>
<td>$2,000/leg</td>
</tr>
<tr>
<td>Upgrade Signs (Unpaved Approach)</td>
<td>0.751 – 0.909 “New Stop Sign”</td>
<td>$600/leg</td>
</tr>
<tr>
<td>Install Second Stop Sign and Stop Ahead Signs</td>
<td>CMF not defined</td>
<td>$1,200/leg</td>
</tr>
<tr>
<td>Beacon on All Stop Signs</td>
<td>CMF not defined</td>
<td>$2,500/sign</td>
</tr>
<tr>
<td>Transverse Rumble Strips on All or Minor Approaches</td>
<td>0.785</td>
<td>$1,000/leg</td>
</tr>
<tr>
<td>Clear and Grub</td>
<td>CMF not defined</td>
<td>$1,500/leg</td>
</tr>
</tbody>
</table>
LOCAL ROAD SAFETY PLANS
Intersections – Potential Improvements

Note: All Improvements Shall Conform with the Latest Version of the MUTCD and/or Applicable Standards
PROJECT: Intersection Control Evaluation

One or more K or A crash
AND
DEV > 5,000
AND
All approaches county maintained?

No

Total DEV > 4,500
AND
Minor ADT > 500
AND
One or more crash?

Yes

Are all approaches paved?

No

Major ADT = Minor ADT (within 10%)
AND
One or more right angle, rear-end, or turning crash?

No

Destination lighting not installed
AND
Major ADT > 1,000
AND
Minor ADT > 200?

Yes

PROJECT:
Destination lighting, all-way stop warrant analysis, upgrade signs and pavement markings, beacon on all stop signs, transverse rumble strips on all approaches, clear and grub

No

PROJECT:
Upgrade signs and pavement markings, transverse rumble strips on minor approaches, clear and grub

Yes

PROJECT:
Destination lighting, install second stop sign and stop ahead sign, upgrade signs and pavement markings, transverse rumble strips on minor approaches, clear and grub
LOCAL ROAD SAFETY PLANS

Intersections – Example Recommendation Map

Legend
- Orange: County-County/County-Other Intersections with Project Recommendations
- Green: County-State Intersections with Project Recommendations

Roadways
- Black: State Roads
- Gray: County Paved Roads
- Light Gray: County Unpaved Roads
- Yellow: Corporation Limits
Intersections – Example Site Specific Countermeasures

• Left-turn lanes
• Right-turn lanes
• Realign intersection approaches to reduce skew
• Restrict or eliminate turning maneuvers by providing channelization or closing median openings
• Provide intersection conflict warning system (ICWS)
Curves
Curves – Risk Factors

- Volume
- Curve radius
- Shoulder width
- Access management
- K or A crash
## Curves – Countermeasures and CMFs

<table>
<thead>
<tr>
<th>Safety Countermeasure</th>
<th>CMF</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curve Chevrons</td>
<td>0.75 – 0.96</td>
<td>$3,500/curve</td>
</tr>
<tr>
<td>Advance Warning Signs and Speed Advisory Plaques</td>
<td>0.585 – 0.606 (when installed in conjunction with curve chevrons)</td>
<td>$1,500/curve</td>
</tr>
<tr>
<td>New Pavement Markings</td>
<td>0.825</td>
<td>$2,000/mile</td>
</tr>
<tr>
<td>Clear and Grub</td>
<td>CMF not defined</td>
<td>$5,000 - $20,000/mile</td>
</tr>
<tr>
<td>Edgeline Rumble Strips</td>
<td>0.61 – 0.67</td>
<td>$2,000/mile</td>
</tr>
<tr>
<td>Pave 2-ft Shoulder with Safety Edge</td>
<td>0.75 – 0.99 “Pave Shoulder” 0.769 – 0.962 “Safety Edge”</td>
<td>$65,000/mile</td>
</tr>
<tr>
<td>Centerline Rumble Strips</td>
<td>0.55 – 0.91</td>
<td>$1,000/mile</td>
</tr>
</tbody>
</table>
Curves – Potential Improvements

- Edgeline Rumble Strips
- Centerline Rumble Strips
- Curve Chevrons
- Clear and Grub within 15 feet of Each Side of Road
- New Pavement Markings: Edgelines and Centerlines
- Pave Shoulder with Safety Edge

Note: All Improvements Shall Conform with the latest version of the MUTCD and/or Applicable Standards.
Curves – Example Site Specific Improvements

- Additional curve signage
- Retroreflective strips on chevron posts
- Transverse rumble strips prior to curve
- Superelevation correction
- High Friction Surface Treatment
- Delineate roadside hazards with retroreflective markers
- Flattening and widening foreslopes
Segments
Segments – Risk Factors

- Volume
- Access management
- Lane departure crashes
- Pavement condition and friction
- Roadside risks
- Pavement and shoulder width
- Curves
### Segments – Countermeasures and CMFs

<table>
<thead>
<tr>
<th>Safety Countermeasure</th>
<th>CMF</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wider (6-inch) Pavement Markings</td>
<td>0.825</td>
<td>$2,000/mile</td>
</tr>
<tr>
<td>Clear and Grub</td>
<td>CMF not defined</td>
<td>$5,000 - $20,000/mile</td>
</tr>
<tr>
<td>Edgeline Rumble Strips</td>
<td>0.61 – 0.67</td>
<td>$2,000/mile</td>
</tr>
<tr>
<td>Pave 2-ft Shoulder with Rumble Strips</td>
<td>0.75 – 0.99 “Pave Shoulder” 0.61 – 0.67 “Edge Rumble Strip”</td>
<td>$65,000/mile</td>
</tr>
<tr>
<td>Centerline Rumble Strips</td>
<td>0.55 – 0.91</td>
<td>$1,000/mile</td>
</tr>
<tr>
<td>Road Diet (4- to 3-lane conversion)</td>
<td>0.53 – 0.812</td>
<td>$15,000/mile</td>
</tr>
</tbody>
</table>
Segments – Potential Countermeasures

New Pavement Markings:
- Edgelines
- Centerlines

Edgeline Rumble Strips

Clear and Grub within 15 feet of Each Side of Road

Centerline Rumble Strips

Pave Shoulder with Safety Edge

Note: All Improvements Shall Conform with the Latest Version of the MUTCD and/or Applicable Standards
Segments – Site Specific Countermeasures

- Provide safer slopes and ditches
- Modify horizontal alignment
- Remove/relocate objects in hazardous locations
Summary of Iowa LRSPs Phase 1

- 12 Counties
- 11,000 miles of roadway
- 3,600 intersections
- 1,200 curves
- $66M in short-term, low-cost safety improvements at 569 locations
Let’s Elevate Safety on Rural Roads

Thank you

Chris Poole, PE (Project Manager)
Iowa DOT Safety Programs Engineer
Chris.Poole@dot.iowa.gov

Devin Moore, PE, PTOE
Devin.Moore@Kimley-Horn.com

Molly O’Brien, PE, PTOE (Project Manager)
Molly.OBrien@Kimley-Horn.com