WHAT **CRASH MITIGATION STRATEGY SHOULD I USE?**

The MnDOT Traffic Safety Fundamentals Handbook recommends Intersection Safety Strategies for unsignalized intersections:

- **LED STOP signs** provide increased visibility and awareness of the upcoming stop condition. Comments that indicate consideration of LED STOP signs:
  - “The driver just blew the STOP sign.”
  - “I just didn’t see the STOP sign.”
  - “People are always running that STOP sign.”

**LED STOP signs reduce crash frequency and severity by 10 to 13%**

- **Intersection Conflict Warning System (ICWS)** have dynamic flashing signs and detection that provide active warning about traffic on the major road, minor road, or both roads at the intersection. Comments that indicate the use of ICWS:
  - “He was stopped and just pulled out right in front of me like I wasn’t even there.”
  - “I didn’t see the car coming toward me and I pulled out.”
  - “I didn’t think the truck was that close.”
  - “I thought I could make it across before they got to the intersection.”

**ICWS reduce the occurrence and severity of crashes by 17 to 27%**

- Improve visibility of intersections by providing enhanced signing. This may include installing larger regulatory, warning, and guide signing and supplementary stop signs.
- Improve visibility of intersections by providing enhanced pavement markings, such as adding or widening stop bar on minor-road approaches, supplementary messages (i.e., STOP AHEAD).
- Clear sight triangles approaches to intersections; in addition to eliminating objects in the roadside, this may also include eliminating parking that restricts sight distance.
- Reduce the frequency and severity of intersection conflicts through geometric design improvements.
- Choose appropriate intersection traffic control to minimize crash frequency and severity (roundabout or all-way stop).
- Improve visibility of intersections by providing lighting (install or enhance) or red flashing beacons mounted on stop signs.
- Deploy mainline dynamic flashing beacons to warn drivers of entering traffic.

TYPES OF ICWS

**Major Road Only Warning**
warns major road drivers of traffic on the minor road.

**Minor Road Only Warning**
warns minor road drivers of traffic on the major road.

**Major and Minor Road Warning**
warns all drivers of traffic.

Flashers are active whenever a vehicle is in the corresponding activation zone.
### SYSTEM OPTIONS

<table>
<thead>
<tr>
<th>Controller</th>
<th>Passive LED STOP Sign</th>
<th>Active LED STOP Sign</th>
<th>Major Road Only System</th>
<th>Minor Road Only System</th>
<th>Major &amp; Minor Road Warning</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Controlled by Detector</td>
<td>Controlled by Detector</td>
<td>Controlled by Detector</td>
<td>Controlled by Detector</td>
<td>Signal Controller</td>
</tr>
</tbody>
</table>

#### Signs

- **LED STOP Signs**
  - on mainline
  - on major road
  - on minor road

- **ICWS Signs**
  - on mainline
  - on major road
  - on minor road

<table>
<thead>
<tr>
<th>Detection</th>
<th>No</th>
<th>Yes</th>
<th>Detect Minor Road Vehicles</th>
<th>Detect Major Road Vehicles</th>
<th>Detect all approaches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malfunction Detection</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Event Logging</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>System Cost</th>
<th>$2,000</th>
<th>$20,000</th>
<th>$50,000</th>
<th>$50,000</th>
<th>$100,000–$125,000</th>
</tr>
</thead>
</table>
## PLANNING FOR DESIGN

<table>
<thead>
<tr>
<th>Controller</th>
<th>Relay-Based or Simple Detector Control Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traffic Signal Controller</strong></td>
<td><strong>Data logging capability may be added to facilitate maintenance &amp; troubleshooting</strong></td>
</tr>
<tr>
<td>• Can be easily maintained by signal technicians</td>
<td>• Lower Reliability – Higher Down Time</td>
</tr>
<tr>
<td>• Staff needs to be trained to operate signal controllers</td>
<td></td>
</tr>
<tr>
<td>• High Reliability – Low Down Time</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Detection Options</th>
<th>Communication</th>
<th>Power</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Loop Detectors/“Microloops”</strong></td>
<td><strong>Wired</strong></td>
<td><strong>Commercial/Grid Power</strong></td>
<td><strong>Contracted Maintenance</strong></td>
</tr>
<tr>
<td>• Most reliable</td>
<td>• Most reliable</td>
<td>• Most reliable</td>
<td>• Agency able to utilize personnel with more expertise</td>
</tr>
<tr>
<td>• Requires wired connection</td>
<td>• Requires less routine maintenance</td>
<td>• May not be feasible if power is not accessible nearby</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Agency-Provided Maintenance</strong></td>
</tr>
<tr>
<td><strong>Non-Intrusive/Radar</strong></td>
<td><strong>Wireless</strong></td>
<td><strong>Solar Power/Battery</strong></td>
<td></td>
</tr>
<tr>
<td>• More options for wireless communication</td>
<td>• No underground utility location needed</td>
<td>• Requires regular battery maintenance &amp; replacement</td>
<td>• Agency staff can perform maintenance &amp; troubleshooting as needed</td>
</tr>
<tr>
<td>• Low-cost sensors may be unreliable</td>
<td>• Routine maintenance required</td>
<td>• More susceptible to damage/vandalism</td>
<td>• Does not rely on third parties</td>
</tr>
<tr>
<td>• Routine maintenance required</td>
<td></td>
<td>• Requires site with adequate sunlight for solar-powered systems</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Controller</strong></th>
<th><strong>Relay-Based or Simple Detector Control Method</strong></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Higher Initial Cost – Less Routine Maintenance</strong></th>
<th><strong>Lower Initial Cost – Higher Routine Maintenance</strong></th>
</tr>
</thead>
</table>

## Detection Options

- **Loop Detectors/“Microloops”**
  - Most reliable
  - Requires wired connection

- **Non-Intrusive/Radar**
  - More options for wireless communication
  - Low-cost sensors may be unreliable
  - Routine maintenance required

## Communication

- **Wired**
  - Most reliable
  - Requires less routine maintenance

- **Wireless**
  - No underground utility location needed
  - Routine maintenance required

## Power

- **Commercial/Grid Power**
  - Most reliable
  - May not be feasible if power is not accessible nearby

- **Solar Power/Battery**
  - Requires regular battery maintenance & replacement
  - More susceptible to damage/vandalism
  - Requires site with adequate sunlight for solar-powered systems

## Maintenance

- **Contracted Maintenance**
  - Agency able to utilize personnel with more expertise
  - Agency staff may need less system training

- **Agency-Provided Maintenance**
  - Agency staff can perform maintenance & troubleshooting as needed
  - Does not rely on third parties
RESOURCES:

LRRB
http://www.lrrb.org/

Full Report

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651-366-3800