Advanced Technologies for Improving Work Zone Safety

Alabama Transportation Conference
Montgomery, FL
February 9, 2022

Work Zone Effects on Traffic Crash Risk

<table>
<thead>
<tr>
<th>Time Period</th>
<th>No Work Activity Occurring</th>
<th>Work Activity w/o Lane Closure</th>
<th>Work Activity with Lane Closure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daytime</td>
<td>+13%</td>
<td>+31%</td>
<td>+66%</td>
</tr>
<tr>
<td>Nighttime</td>
<td>+24%</td>
<td>+58%</td>
<td>+61%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nighttime lane closures when no queues are present: +27%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nighttime lane closures when queues are present: +471%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fatal Worker Injuries at Road Construction Sites (Bureau of Labor Statistics)

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Vehicle Intrusions into the Work Space</th>
<th>Vehicle Impacts Outside of the Work Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daytime</td>
<td>64%</td>
<td>36%</td>
</tr>
<tr>
<td>Nighttime</td>
<td>88%</td>
<td>12%</td>
</tr>
</tbody>
</table>

When and Where Do These Vehicle-Worker Accidents Occur?

Contributors to Vehicle-Worker Accidents

- Impaired (drunk, drugged, drowsy, distracted) drivers
- Speed differentials/queuing adjacent to work activities
- Deliberate intrusions into the work space

Advanced Technologies to Improve Work Zone Safety

- Reducing Traffic Crashes
- Smart Work Zone Technologies
- Connected Work Zone Technologies
- Reducing Worker-Vehicle Accidents
- Advanced Positive Protection Technologies
- Advanced Work Zone Intrusion Technologies
- Connected Worker Technologies
**Smart Work Zones**

- Queue Warning
- Real-Time Traveler Information
- Dynamic Late Merge (i.e., Zipper Merge)
- Variable Speed Limits
- Automated Speed Enforcement
- Access Point Warning

**Queue Warning**

- 55% reduction in crashes when queues are present
- 60-80% reduction in injury crashes

**Real-Time Traveler Information**

- Provide travel times/delay warnings
- Enable route choices

**Variable Speed Limits**

- Automated (based on traffic, road, and/or weather conditions)
- Manual (based on work activity, other needs)
- Coordination with enforcement is a challenge

**Dynamic Late Merge (Zipper)**

- Reduce queue jumping
- Improve merge point operation
- Activated only when queues are present

**Automated Speed Enforcement**

- Programs active in several states
- Requires legislation to implement

---

**Advanced Technologies to Improve Work Zone Safety**
Effectiveness is dependent upon:

- type of work operation
- navigational app usage

Connected/Automated Work Zone Warnings

Mobile Barriers

Positive Protection: TMAs

Automated Truck-Mounted Attenuators

Advanced Technologies to Improve Work Zone Safety
Work Zone Intrusion Alarms

- Trajectory monitoring
- Self-calibrating
- Vehicle-based or self-contained systems

Connected Worker Systems

- Monitor worker presence and locations
- Monitor hazards
- Activate real-time warnings to traffic
- Generate haptic and audible warnings to workers

Questions?

Gerald Ullman
(979) 317-2142
g-Ullman@tti.tamu.edu