

# Work Zone Accidents Happen for a Number of Reasons

The Bureau of Labor Statistics revised the system used to code event and source data in 2010, resulting in a break in series; the data presented here is for 2011-2015.

- Transportation events accounted for 73% of roadway work zone fatal occupational injuries during the 5-year period. In 61% of these transportation events, the worker was struck by a vehicle in the work zone.
- Backing vehicles accounted for 64 of the 240 worker deaths in a work zone for which the direction of travel was recorded.
- Pickup trucks and SUVs accounted for 95 worker deaths at road construction sites from 2011-2015, followed by semi-trucks(91), automobiles(88), machinery(87) and dumb trucks(62).

One bright spot: In Illinois, work zone deaths decreased about 5% during the same period and by 34% from 2016-2017. Illinois officials said that a statewide education campaign and fewer road projects helped drive deaths down from 46 in 2015 to 29 in 2017. According to Illinois Department of Transportation (IDOT) Secretary Randy Blankenhorn, 80% of work zone fatalities are drivers, not construction workers.

# Work Zone Intrusion Systems

SYSTEM	DESCRIPTION	COMPONENTS	EFFECTIVENESS
<b>Sequential Warning Light</b>	Provide drivers with directions, especially at night, when lane closures might be not be expected.	<ul style="list-style-type: none"> <li>•Traffic Cone</li> <li>•Wireless Transmission</li> <li>•LED Light</li> <li>•Battery</li> </ul>	The device was reported to be effective in reducing vehicles' speed in the closed lane 1000 feet upstream of the lane closure.
<b>Smart Drum System</b>	Issues warning to motorists approaching slower work zone areas	<ul style="list-style-type: none"> <li>•Smart Drum</li> <li>•Drum Supervisor</li> <li>•Site Supervisor</li> </ul>	This system was found to reduce driving speed by 1.7 mph or 5 percent from the baseline.
<b>Automated Speed Enforcement</b>	Detect speeding vehicles and enforce speed compliance	<ul style="list-style-type: none"> <li>•Cameras</li> <li>•Radar</li> <li>•Communications</li> </ul>	The system was reported to be effective in reducing speed limit violations and improving safety. The mean speed decreased by 23.7% when photo radar speed enforcement system was active.
<b>Advance Warning and Risk Evasion (AWARE)</b>	Applies threat detection and tracking methodology to calculate speed of approaching vehicle, location and predicted path.	<ul style="list-style-type: none"> <li>•Pneumatic Tubes or Infrared Beams</li> </ul>	One hundred percent success rate in triggering flashing light and alarm components.
<b>Worker Alert System (WAS)</b>	Personal safety devices trigger audible and vibrating alerts when an intruding vehicle is detected.	<ul style="list-style-type: none"> <li>•Trigger Hose</li> <li>•Signal Operator</li> <li>•Personal Safety Devices</li> </ul>	This technology was found to be effective and relatively easy to set up and remove.
<b>Automated Truck-Mounted Attenuator (ATMA)</b>	Especially useful in curbing intrusions into work zones where workers are engaged in traffic-control setup or removal activities and are constantly on the move	<ul style="list-style-type: none"> <li>•Lead vehicle equipped with onboard computer, digital compass, transceiver and GPS receiver</li> <li>•Follower vehicle equipped with impact attenuator and uses information transmitted by lead vehicle to navigate</li> </ul>	Anticipated to be effective in protecting workers in mobile work zones.

Intrusion Alarm	Attach to cones and barrels and give off a loud blast when the cone or barrel is knocked over	<ul style="list-style-type: none"> <li>•Traffic Barrel</li> <li>•SonoBlaster</li> </ul>	The alarm's sound volume and duration were satisfactory during normal traffic conditions for distances of at least 200 feet, including when ear protection was worn, but no conclusion would be made about hearing the alarm during jackhammer operations.
WAZE	This web-based navigation app provides advance auditory warning to motorists about the presence of a work zone ahead.	<ul style="list-style-type: none"> <li>•Smartphone</li> </ul>	The auditory in-vehicle warning helps motorists (especially those who are distracted or drowsy) to become more cautious about an upcoming work zone.
iCone	Provide information about work zone such as location of the end of queue, travel time through work zone, speeds at the taper, or speeds at another location where worker or motorist safety may be a concern.	<ul style="list-style-type: none"> <li>•Traffic Barrel</li> <li>•Electronic components: GPS antenna, radar transducer, modem, antenna, mounting plate, sealing plate and a controller board</li> <li>•Battery</li> </ul>	iCone matched with a message board provides advance warnings such as DELAY or SLOWED TRAFFIC and ensures more regulated traffic flow through the work zones.
Connected Vests	It senses when a vehicle is entering a work zone then alerts the worker wearing the vest, as well as the oncoming driver of the vehicle.	<ul style="list-style-type: none"> <li>•DSRC embedded into a pocket inside the worker's vest</li> <li>•Onboard DSRC unit</li> </ul>	Uses haptic, visual and auditory alerts to make the motorists aware about upcoming work zone and the workers about the hazards caused by vehicle intrusions.
Queue Warning	Provide warnings to drivers about stopped or slow traffic to reduce the risk of rear-end collisions.	<ul style="list-style-type: none"> <li>•Traffic Data</li> <li>•CMS</li> <li>•Communications</li> </ul>	TxDOT deployed an innovative end-of-queue warning system at more than 200 nighttime lane-closure operations. There was 18-45% reduction in crashes deployed at locations compared with an estimated number of crashes considering the system had not been deployed.

<b>Variable Speed Limit (VSL)</b>	Dynamically adjust the speed limit to smooth traffic through work zones and finally improve mobility and/or safety	<ul style="list-style-type: none"> <li>•Traffic Data</li> <li>•VSL CMS</li> <li>•Communications</li> </ul>	The system was removed to be effective in increasing throughput and speedlimit compliance and decreasing travel time. Statistical results indicated the mean speed increased and speed variance decreased on weekends during evening peak hours.
<b>Real-Time Traveler Information</b>	Provide Congestion delay, and alternative route information	<ul style="list-style-type: none"> <li>•Traffic data</li> <li>•CMS</li> <li>•Communications</li> </ul>	The system was reported to be effective in preventing and reducing rear-end collisions and enhancing congestion management. However, no quantitative benefit of the system was reported.
<b>Automated Flagger Assistance Device (AFAD)</b>	Minimize flaggers' direct exposure to traffic by controlling the flagging device away from traffic.	<ul style="list-style-type: none"> <li>•Stop/slow sign mounted on a trailer or movable cart</li> <li>•Red/yellow lens and a mechanically gated arm</li> </ul>	The overall assessment of AFADs from workers and drivers is positive, and they are effective at a wide range of traffic volumes.
<b>Rumble Strips</b>	Provide both an audible warning and physical vibration to alert drivers as the vehicle tires traverse the rumble strips	<ul style="list-style-type: none"> <li>•Performed thermoplastic</li> <li>•Pavement marking tape</li> <li>•Adhesive</li> <li>•Manually adhesive</li> <li>•Portable reusable rumble strips</li> </ul>	The device was reported to be effective in reducing vehicle speed by up to 10 mph. It may effectively alert drivers to an upcoming change ahead.
<b>Positive Protection</b>	Physically prevent vehicles and pedestrians traveling through work zones from entering space occupied by workers, equipment, materials or roadside hazards	<ul style="list-style-type: none"> <li>•Mobile barrier trailer</li> <li>•Portable Concrete barriers</li> <li>•Ballast-filled barriers</li> <li>•Steel barriers</li> <li>•Moveable concrete barriers</li> <li>•Shadow vehicles with attenuators</li> <li>•Vehicle arresting systems</li> </ul>	Limited research is available as to the effectiveness, however portable concrete barriers have several positive functions to protect workers as identified by the AASHTO Roadside Design Guide. Movable concrete barriers were reported to reduce work zone congestion and delay. Workers were found to be safer and more efficient behind the mobile barrier trailer .