



FACE Fatal Facts



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Roadway Work Zones: Hazards to Workers on Foot

Since the first roadways were constructed in Washington State, they have required periodic maintenance and repair to ensure a safe and enjoyable motoring experience for the public. These roadways have also provided easy access for the installation and maintenance of above and below ground water, sewer, electric, gas, telephone, and cable TV utility lines. In order to maintain the integrity of these elements of our infrastructure, workers may be required to be on, above, or below the roadways or their right-of-ways.

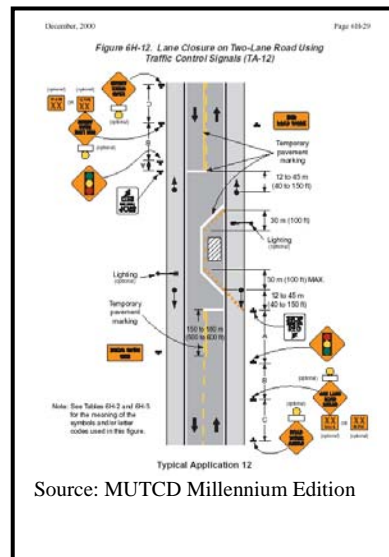
Between 1998 and 2003, sixteen Washington workers were killed while performing their work duties in roadway work zones. Fifteen of these workers were on foot at the time of the incidents. They were struck and killed by passing motor vehicles and by construction equipment and vehicles. The victims were performing work zone traffic control flagging, litter control, construction, maintenance, and utility related work. Fourteen of the sixteen victims were male. They ranged in age from 26 to 56. Of the fifteen victims working on foot at the time of the fatal incidents, eight were struck by construction vehicles and equipment that were within the work zone and seven were struck by passing vehicles intruding into the work zone. Dump trucks either pulling forward or backing up were responsible for seven fatalities.

What is a Roadway Work Zone?

There is no consensus definition of a roadway work zone, but for the purpose of this document, a roadway work zone is an area of a highway or street (including the shoulder area and beyond) where road construction, road maintenance, utility work, litter control and right-of-way maintenance activities are present. The work zone is the area between the first traffic warning sign or flashing lights on a work vehicle and the last traffic control device, as well as non-roadway (e.g., shoulders and drainages) and ancillary areas that serve as staging or support areas for the work zone (e.g., temporary batch plants). A work zone is typically marked by signs, channeling devices, barriers, pavement markings, and/or work vehicles.

This document highlights the hazards associated with road work zones by presenting five specific examples of fatal incidents, extracting common hazards found between the incidents, and then discussing recommendations for prevention.

The following tragic stories highlight the most frequent types of incidents where workers were struck by vehicles and equipment. These incidents include: passing motorist's vehicles intruding into work zones, work zone construction vehicles striking workers, vehicles striking traffic control flaggers, vehicles intruding beyond the road shoulder, and a worker caught between construction equipment and a vehicle.



Case 1 On March 30, 1998, a 26-year-old male tree planting crew member was killed when a van left the interstate highway and struck him. The victim was about 35 feet from the fog line of the roadway when the vehicle struck him.

Case 2 On October 18, 1999, a 45-year-old female construction traffic flagger died after being struck by a dump truck that was backing up in a residential road construction site. The victim was working with a construction company hired by the county to pave the residential street. The victim had been assigned to control traffic at a side street feeding the two-lane road being paved. A dump truck was in the process of backing down the road to drop its load into a paver when it struck and killed the victim. The dump truck's backup alarm was activated at the time.

Case 3 On February 22, 2000, a 41-year-old male traffic flagger was killed when an automobile traveling along a two-lane highway struck him. The victim was working as a traffic control flagger for a project where a roadside sign was being installed.

Case 4 On July 25, 2000, a 33-year-old male county public utility district lineman was killed when an automobile intruded into a roadway work zone and struck him. The victim was working on a county work crew that was installing a power pole alongside a rural county road. An automobile entered the work zone and left the roadway striking two workers. One worker was injured and the other died of his injuries ten days later.

Case 5 On March 21, 2001, a 34-year-old male construction worker was killed during a city street resurfacing project when he was caught between an asphalt planing machine (grinder) and a dump truck trailer. The asphalt planer was removing 2 inches of asphalt from the street in preparation for resurfacing. The victim was walking between the asphalt planer and the trailer of a dump truck when the planer jogged to avoid a manhole cover and crushed him between the planer and the trailer.

Controlling Hazards to Workers

The types of incidents can be separated into three primary types: 1) motor vehicle intrusion into the work zone, 2) vehicle/equipment incidents within the work zone, and 3) flagging activity. Control measures for these three incident types are detailed in the following information.

15 workers on foot were killed in Washington State roadway work zones from 1998 to 2003

7 of them were killed by intruding motor vehicles

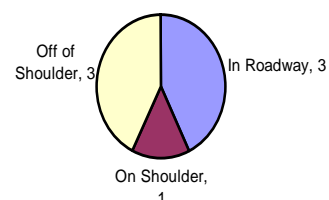
8 of them were killed by construction vehicles and equipment within the work zone

3 of them were working as flaggers

Controlling Work Zone Intrusions

Vehicle intrusion incidents occur when a vehicle, generally operated by the motoring public, enters the work zone and strikes a worker. Seven of the 15 worker fatalities on foot were due to vehicle work zone intrusion. In some of the incidents the driver of the vehicle was impaired. This fact highlights the need for controls that do not rely on the motorist's assessment and judgment of the situation, such as removing unnecessary people from the work zone and using protective barriers.

Work Zone Intrusion Incident Locations in Washington State, 1998-2003



The following section lists methods that can be used to prevent vehicle intrusion incidents from occurring. The control options are separated into selected “required” and “recommended” categories. The required controls presented are not all-inclusive and do not assure regulatory compliance. In some cases a particular control may be chosen instead of another due to issues of feasibility.

Selected Required Controls:

- Establish a Temporary Traffic Control Plan (TCP). Follow WAC 296-305, MUTCD¹ and WSDOT² guidelines for the specific roadway work zone.
- Channel and taper traffic into the appropriate lane or lanes well in advance of the work area.
- Use appropriate signage for the type of work zone activity.
- Workers must wear high-visibility safety clothing.
- Provide glare-free illumination for night work. Work vehicles should have appropriate beacons and light signals to ensure visibility.
- Traffic control supervisors should have training and certification in the control of traffic. It is advisable for project managers and engineers to have training in work zone traffic control plan design.

Recommended Controls:

- Close the road to traffic. Also, consider closing intersecting roads that would allow merging traffic to adversely affect worker safety in the work zone.
- Use impact-resistant protective barriers to separate traffic from workers. Place engineering controls such as Jersey barriers, a truck with rear-mounted impact attenuator, construction vehicles, or materials

between traffic lanes and work zone workers.

- Use approved remote mechanical flaggers or portable traffic signals.*
- Use audible warning/alarm systems to alert workers of intruding vehicles.*
- Reduce posted speed limit through work zones.
- Use law enforcement vehicles and personnel to alert motorists of work zone activity.
- Install temporary rumble strips along roadway.*
- Provide work zone training for all workers on-site.

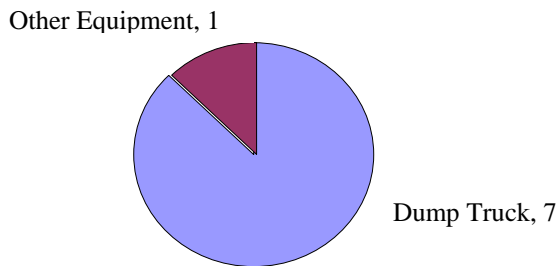
Important Processes for Prevention:

- Conduct a daily hazard assessment of the work site, including the hazards and changing conditions in the work zone.
- Workers should have a communication plan and an emergency exit strategy in the event of a vehicle intrusion.

Controlling Hazards within the Work Zone

Eight of the victims between 1998 and 2003 were killed by construction vehicles or heavy mobile construction equipment operating inside the work zone. In order to reduce the number of these types of incidents, workers on foot in the work zone need to be separated from vehicles and equipment as much as possible and communication maximized between all parties. Of the 8 victims, 5 were conducting road construction activities, 2 were working on utilities, and 1 was picking up litter. Seven of the eight victims were run over by dump trucks.

**Vehicles Involved in Incidents within
Work Zones in Washington State,
1998-2003**



Selected Required Controls:

- Ensure proper illumination when installing floodlights for night work. Lights should not cause glare problems.
- Designate a traffic control supervisor who is knowledgeable in traffic control procedures.
- Require all workers on foot to wear high-visibility safety apparel.
- Provide an observer for backing vehicles, who is not responsible for flagging activities.

and/or

- Backup collision avoidance systems may be able to alert drivers of workers on foot in their blind spots. (Figure on next page)*

Recommended Controls:

- Improved coordination and communication of hazardous conditions is needed to prevent incidents within the work zone. This can be accomplished, in part, by implementing an Internal Traffic Control Plan (ITCP).

**Developing and Implementing an
Internal Traffic Control Plan (ITCP):**

- Design the flow of equipment and vehicles to minimize backing within

What is an internal traffic control plan (ITCP)?

An internal traffic control plan is a tool that project managers can use to coordinate the flow of construction vehicles, equipment, and workers operating in close proximity within the activity area, so that the safety of the workers can be ensured.³

National Institute for Occupational Safety and Health (NIOSH)

the work zone and while entering and exiting.

- Establish “no backing zones” and “pedestrian free zones.”
- Use spotters during backing operations and to direct vehicles
- Restrict access points into the work zone for vehicles and equipment.
- Restrict workers on foot in the work zone to only those areas necessary to carry out the job at hand.
- Develop diagrams showing the designated movement of construction workers and vehicles in the work zone.
- Employers need to have a continuing process for the evaluation, identification, correction, and communication of hazardous conditions for workers within the changing work zone.

**Recommendations to Complement
an ITCP:**

- Train employees to develop, prepare and implement an ITCP.
- Two-way radios should be provided to flaggers, ground crews, and all vehicle and equipment operators in the work zone.
- Train all site workers (employees and subcontractors) to recognize and communicate to one another about the hazards associated with moving vehicles and equipment in the work zone. This should include flaggers, ground construction personnel, and vehicle and equipment operators.

Steps in Preparing an ITCP

- 1) Review the Traffic Control Plan and other documents.
- 2) Determine the sequence of construction.
- 3) Draw a specific layout of the workspace, including vehicles, equipment, and personnel.
- 4) Apply the principles of safe traffic control.
- 5) Locate utilities, determine locations for storing materials and equipment, and locate staging and parking areas for workers and visitors.
- 6) Prepare notes for the diagram regarding on-site personnel and equipment, reference other documents, and injury reduction measures, including pedestrian-free areas and equipment operating rules such as speed limits.

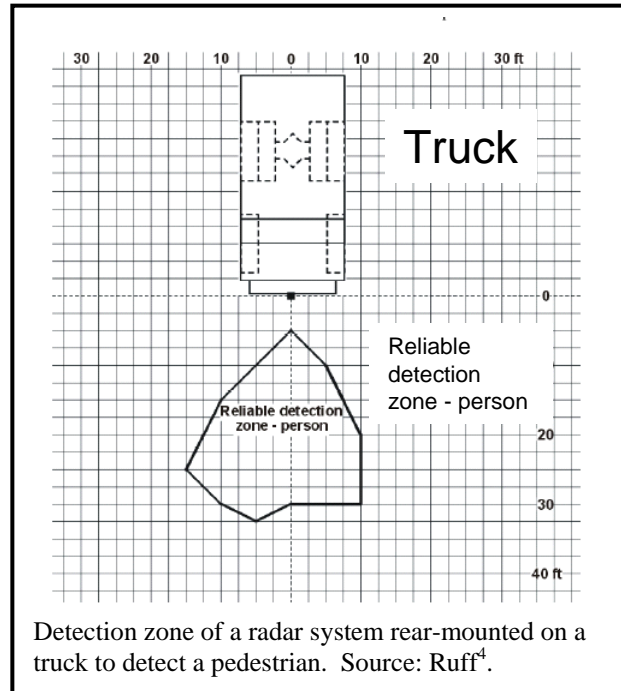
Controlling Hazards to Flaggers

Flaggers have been involved in both intrusion and internal vehicle-related incidents and merit their own recommendations. Flaggers should be used only when other methods of traffic control are inadequate to direct or control traffic and to ensure the safety of work zone workers and the motoring public.

Selected Required Controls:

- Flaggers must be properly trained and certified.
- Use positive protective barriers or vehicles to protect flaggers when feasible.
- Flagger safety must be included in the site planning and set up process.
- Escape routes should be established in the event of a vehicle intrusion.
- Provide flaggers with portable radio communication devices.
- Only designated and trained flaggers should attempt to control traffic.

- Flaggers and other work zone workers should be physically separated from passing vehicles.
- Locate flagger stations with adequate consideration of site distance and speed.



Further Injury Prevention Measures

- The employer is responsible for tailoring an Accident Prevention Program (APP) to the particular needs of the work area and the work being performed.
- Ensure that the APP is clearly and effectively communicated and that supervisors make certain that employees are working safely according to the APP.
- Hold pre-construction safety meetings, including all sub-contractors.
- Conduct daily job site meetings.
- Include employees in walk or drive through hazard identification of the work zone if safe to do so.

- Pre-qualify contractors and subcontractors based on their use of safety processes and past safety performance (WISHA/OSHA compliance record and worker's compensation claim rate or modification factor).

Getting Help

WISHA Consultation Program

Washington State
Department of Labor and Industries
<http://www.LNI.wa.gov/Safety/KeepSafe/Assistance/Consultation>

Everett (Region 1, Northwest Washington)
425-290-1300

Seattle (Region 2, King County)
206-515-2800

Tacoma (Region 3, Pierce, Kitsap, Clallam, and Jefferson Counties)
253-596-3800

Olympia (Region 4, Southwest Washington)
360-902-5799

East Wenatchee (Region 5, Central and Southeastern Washington)
509-886-6500

Spokane (Region 6, Eastern Washington)
509-324-2600

WISHA Policy & Technical Services

Tumwater Central Office – Safety
360-902-5640

Other Resources

- National Work Zone Safety Information Clearinghouse.
<http://wzsafety.tamu.edu/> or call (888) 447-5556.
- Signaling Flaggers: WAC 296-155-305 Signaling Flaggers.
<http://www.lni.wa.gov/wisha/topics/flagger.htm>

- Accident Prevention Program: WAC 296-155-110 Accident Prevention Program.
<http://www.lni.wa.gov/Safety/Rules/Find/WACNumber/default.htm>
- Warning Signs: WAC 296-155-300 Accident Prevention Signs and Tags.
<http://www.lni.wa.gov/rules/wacs.htm>
- High-visibility Apparel: WAC 296-155-200 General Requirements.
<http://www.lni.wa.gov/Safety/Rules/Find/WACNumber/default.htm>
- Washington State Department of Transportation, Work Zone Safety Homepage. <http://www.wsdot.wa.gov/biz/trafficoperations/workzone/default.htm>
- National Institute for Occupational Safety and Health (NIOSH).
<http://www.cdc.gov/niosh/injury/traumazone.html>
- Motor Vehicles on Construction Sites: WAC 296-155-610.
<http://www.lni.wa.gov/Safety/Rules/Find/WACNumber/default.htm>

References

1. Manual on Uniform Traffic Control Devices (MUTCD) 2003, 2003 Edition, Part 6 Temporary Traffic Control, U.S. Department of Transportation, Federal Highway Administration, Office of Transportation Operations, HOTO, Room 3408, Washington, DC 20590,
<http://mutcd.fhwa.dot.gov/>
2. Work Zone Traffic Control Guidelines, May 2000, Washington State Department of Transportation, field Operations Service Support Center, M54-44,
<http://www.wsdot.wa.gov/fasc/EngineeringPublications/Manuals/Workzone.pdf>.
3. Pratt, Stephanie G., Fosbroke, David E., Marsh, Suzanne M. Building Safer Highway Work Zones: Measures to Prevent Worker Injuries From Vehicles and Equipment. Cincinnati, OH. National Institute for Occupational

Safety and Health, April 2001, DHHS (NIOSH) Publication No. 2001-128. <http://www.cdc.gov/niosh/2001128.html>,

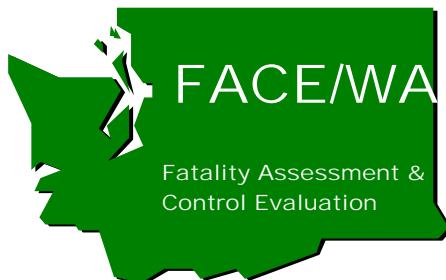
4. Ruff, T., Test Results of Collision Warning Systems on Off-Highway Dump Trucks: Phase 2, NIOSH, 2001 Feb :1-21, <http://www.cdc.gov/niosh/mining/pubs/pdfs/2001-100.pdf>.

*Please Note: The use of any traffic control safety device should meet Washington State Department of Transportation, WISHA, and MUTCD guidelines and requirements. The employer should also review the use of these devices with the manufacturer for appropriate application in and around road work zones.

FACE Fatal Facts

Produced by the **Washington State Fatality Assessment & Control Evaluation (FACE) Program**, which is managed by the Safety and Health Assessment and Research for Prevention (SHARP) Program. *The information contained in this fact sheet is for informational purpose only. It is not meant to fully represent or replace any local, state or federal laws or standards.*

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