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# WORKPLACE SOLUTIONS

From the National Institute for Occupational Safety and Health

## Preventing Worker Injuries and Deaths from Backing Construction Vehicles and Equipment at Roadway Construction Worksites

### Summary

Workers on roadway construction worksites are exposed to possible injury and death from moving construction vehicles and equipment [NIOSH 2001].

The National Institute for Occupational Safety and Health (NIOSH) recommends that specific procedures and controls be in place at roadway construction worksites to help prevent injuries and deaths from backing construction vehicles and equipment.

### Description of Exposure

According to a Bureau of Labor Statistics review of the 962 fatal workplace injuries at road construction sites from 2003 to 2010, 443 were due to a worker being struck by a vehicle or mobile equipment [BLS 2013]. Workers were fatally struck 143 times by a vehicle or mobile equipment that was backing up. In 84 of these cases, the worker was fatally struck by a dump truck that was backing up.

Between 1992 and 2009, NIOSH and State partners investigated 36 deaths of

workers killed by backing construction vehicles or equipment on roadway construction worksites through the Fatality Assessment and Control Evaluation (FACE) Program.

### Case Study

In October 2006, a 28-year-old laborer was backed over by a tack truck (Figure 1) while working as a flagger on an asphalt resurfacing job in a residential roadway work zone. The victim was standing with his back to the reversing tack truck when a dump truck driver attempted to warn him by waving his arms. The tack truck struck the victim; the driver thought he had passed over a manhole cover and continued backing. The tack truck driver stopped when he saw the dump truck driver running and waving his arms in his mirror. Both drivers found the victim at the front of the tack truck lying face down on a man-hole cover on the ground [NIOSH 2007].

### Controls

NIOSH and State FACE investigations identified the following controls that employers, contractors, workers, and construction vehicle and equipment manufacturers should take to protect



**Figure 1.** FACE Case Study. Photograph courtesy of the North Carolina Occupational Safety and Health Administration [NIOSH 2007]

workers from injury while working around backing construction vehicles and equipment on roadway construction worksites.

### Employers, including Contractors, and Sub-Contractors

#### Standard Operating Procedures

- Develop, implement, and enforce standard operating procedures that address worker safety and minimize work to be performed near vehicles and equipment.

- Use equipment designed to minimize blind areas and equipment with proximity warning systems.
- Establish safe work practices for night work and backing equipment, requiring high visibility apparel.
- Design worksites to minimize backing vehicles and equipment [RWZSHCA 2005].
- Provide adequate oversight and supervision by a competent\* person.
- Ensure that drivers only back under the direction of a spotter.
- Ensure daily communication between the prime and subcontractors to discuss any changes or revisions in construction traffic flow.
- Channel construction vehicles and equipment away from workers using visual safety devices (retro reflective barrels, delineators, portable barricades, cones).
- Install signs to guide workers on foot with respect to traffic areas, vehicle flow, and worker-free zones.

## Compliance

- Ensure compliance with worker safety, traffic control, vehicle regulations, and consensus standards pertaining to work in roadway construction worksites.
  - 29 CFR 1926†, Subparts O and G
  - Manual on Uniform Traffic Control Devices [DOT 2009]
  - ANSI/ASSE A10.47-2009
  - ANSI/ISEA 207-2011
  - ANSI/ISEA 107-2010

## Equipment Operation and Servicing

- Ensure that construction vehicles and equipment operating onsite are maintained in safe operating condition at all times by developing and implementing the following:
  - A scheduled maintenance program for all roadway construction vehicles and equipment.
  - Safety features (reverse alarm, video cameras) installed in accordance with manufacturer's specifications, that operate as intended, and function properly.

\* Competent person is defined by OSHA as one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them.

† Code of Federal Regulations. See CFR in References.

- Inspection of all vehicles, equipment, and safety devices (brakes, lights, horns, and reverse alarms) at the beginning of each work shift. Defective vehicles, equipment, and safety devices should be immediately reported and removed from service until repairs are made.
- Installation of collision avoidance or proximity warning systems (radar and sonar devices, or tag-based systems that use personal electronic tags to detect a marker field generated by a transmitter on the vehicle) or monitoring technologies (video cameras and additional mirrors) on construction vehicles and equipment to increase the likelihood that equipment operators will detect workers on foot around their equipment.

## Vehicle and Equipment Operators

- Inspect your vehicle, equipment, and safety devices (reverse alarm, mirrors, and windows) at the beginning of each shift and report any deficiencies to your supervisor or employer; remove any defective equipment from service until repairs are made.
- Ensure mirrors and windows are functioning, in good condition, clean and properly adjusted.
- Be aware of equipment and vehicle blind areas and watch for workers.
- Use and maintain contact (visually, verbally, or by hand signals) with a spotter when backing any vehicle or equipment [WDOLI 2007]. If contact with the spotter is lost, STOP immediately.

## Communication

Develop, implement, and test the method(s) of communication that will be used during operations. At the start of each shift, review communications signals (verbal, hand signals, flags) between spotters, machine operators, truck drivers, and workers on foot. Prohibit the use of personal cellular phones and head phones or similar items that could pose a distraction [VDOLI 2009]. Provide two-way radios to personnel who coordinate vehicular and equipment activity within the worksite.

## Training

- Develop, implement, and enforce a comprehensive safety and training program in the workers' primary language and at the appropriate literacy level, that includes the following information.
  - Targeted training on the operator's visual limits of the specific equipment being used on the site, and provided

to both equipment operators, and workers required to work on foot near the equipment blind areas [NIOSH 2009; ISO 2006].

- Standard operating procedures that minimize exposure of workers on foot to moving construction vehicles and equipment.
- Daily pre-work safety meetings to discuss the work to be performed, safety hazards, safe work procedures, and the method of communicating changes in the work plan.

## Workers

### Workers on Foot

- Always wear high visibility apparel that is appropriate for your job task and work environment [ANSI/ISEA 2010].
- Be aware of equipment and vehicle blind areas and avoid being near these areas.
- Confirm communications signals with an operator and do not approach until the operator gives acknowledgment.
- Be aware of equipment travel paths and avoid standing or walking in these areas.
- LISTEN for reverse signal alarms in the area.
- Do not rely solely on one safety practice, always be aware of your surroundings and ensure that workers are aware of you.

### Construction Vehicles and Equipment Manufacturers

- Minimize the hazards of blind areas of construction vehicles and equipment.
  - Reduce the blind areas during the design of new models.
  - Incorporate video cameras and proximity warning technology to help monitor the presence of workers in blind areas.
  - Include collision avoidance technology on equipment.
  - Specify in the owner's manual any upgrades or changes in lever, button, or pedal locations from model to model and the locations of blind areas on the equipment.

### After Market Installers

- Ensure that safety equipment is installed in accordance with the manufacturer's specifications and operates as intended.

## Acknowledgments

The principal contributors to this publication were Nancy T. Romano and Virgil J. Casini, NIOSH Division of Safety Research (DSR). Statistical and development assistance was provided by Suzanne Marsh, David Fosbroke, and Jennifer Lincoln, DSR. Todd Ruff, formerly Spokane Research Laboratory, gave consultation on work zone safety measures.

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## For More Information

For more information on improving motorist, workers, and pedestrian safety in roadway work zones, visit the National Work Zone Information Clearinghouse at [www.workzone-safety.org](http://www.workzone-safety.org). The OSHA Preventing Backovers Topic Page at [www.osha.gov/doc/topics/backover/](http://www.osha.gov/doc/topics/backover/).

For further guidance on preventing worker injuries and deaths from backing construction vehicles and equipment at roadway construction worksites, visit the NIOSH Safety and Health Topic Page on Highway Work Zones at [www.cdc.gov/niosh/topics/highwayworkzones/](http://www.cdc.gov/niosh/topics/highwayworkzones/).

The information in this document is based on investigative reports from the NIOSH Fatality Assessment and Control Evaluation Program and data from the Bureau of Labor For information about the NIOSH FACE Program or to subscribe to receive FACE Reports visit [www.cdc.gov/niosh/face/](http://www.cdc.gov/niosh/face/).

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• **DHHS (NIOSH) Publication No. 2014-125**