Roadway Construction "Caught-In" Series
Crushed and Pinned Between Hazards:
Additional Instructor Background Information

According to the U.S. Occupational Safety and Health Administration (OSHA), "caught-in" or "caught-between" hazards are one of the leading causes of death and injury in the construction industry.[1] These incidents are defined as injuries resulting from a person being squeezed, caught, crushed, pinched, or compressed between two or more objects, or between parts of an object. Crushed-by and pinned between hazards occur when workers are pinned between equipment and a solid object, such as a wall or another piece of equipment; or between materials being stacked or stored and a solid object, such as a wall or another piece of equipment. These types of hazards can result in multiple broken bones, asphyxiation, or death.

TEACHING TIP: Discuss the case study example on the right. Ask the workers, "What went wrong?" "What should the employer have done differently?" "How should workers respond if asked to do something unsafe?"

Example: A 25-year-old truck driver was crushed and killed between the frame and dump box of a dump truck. Apparently, a safety "over-travel" cable attached between the truck frame and the dump box malfunctioned by catching on a protruding nut of an air brake cylinder. This prevented the dump box from being fully raised, halting its progress at a point where about 20 inches of space remained between it and the truck frame. The employee, apparently assuming that releasing the cable would allow the dump box to continue up-ward, reached between the rear dual wheels and over the frame, and disengaged the cable with his right hand. The dump box then dropped suddenly, crushing his head. The employee had only two months' experience at this type of work and had not received training or instruction in proper operating procedures.

Explain Lock Out/Tag Out (LOTO) Procedures: When working on or near equipment that is connected to an energy source, the equipment should be disconnected from that source, locked against reconnecting in the off position, and tagged to alert other workers that someone may be working on that equipment. A lock and tag are placed by each person working on the apparatus and no one may remove another's lock.

Graphic: ARTBA

The energy source may be electrical, mechanical, gravitational, thermal, hydraulic, pneumatic, or chemical. Some devices may contain "stored energy" such as:

- capacitors,
- springs,
- elevated components,
- rotating flywheels,
- hydraulic systems,
- air, gas, steam, water pressure, and
- piles that can shift.

Equipment with stored energy should be de-energized when not in use. For example, the bucket of an excavator should be lowered to the ground and pressure released before the operator leaves, even for a short period.

To properly shut down equipment and machines several steps should be followed: 1) Notify affected workers about the shutdown such as those who work on the machines or equipment or work in the area; 2) Shut off the power sources; 3) Apply locks and tags to the power sources so the machine/equipment cannot be started; 4) Test the apparatus to see if it is properly locked out by trying to start it. 5) After the repair or maintenance work is completed, remove all tools. 6)

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[1] OSHA Training Institute, "Struck-By Hazards Instructor Guide." https://www.osha.gov/sites/default/files/struckby_ig.pdf.

Notify any potentially exposed employees that the locks will be removed by the workers and the equipment will be restarted.

TEACHING TIP: Bring a multi-lock hasp and several tags and locks to demonstrate how a LOTO system works. Allow workers to lockout a piece of equipment; demonstrate how workers are responsible for removing their lock and tag. Show how this procedure prevents someone from starting the equipment while one is still working on it.

Blocking and Securing Objects: Machinery, materials, or other objects that may shift, cycle, or move unexpectedly must be secured to prevent caught-in/between incidents. In addition to an effective lockout/tagout program other steps must be taken to prevent injuries and fatalities, such as supporting raised equipment so it cannot fall and blocking the tires of trucks so they do not roll. Equipment should not be parked or stored in a raised position. Excavator buckets, forklift forks, and other lifting equipment must be lowered when not in use.

Stored materials must be stacked and secured in a way that prevents collapse. To increase awareness of pinning hazards, workers must be trained to watch for mobile equipment in their work area and ensure that they are never between moving equipment—such as rollers or dump trucks—and immovable structures, other vehicles, or stacked materials.

A good internal traffic control plan should be implemented to restrict traffic in the work area so only essential personnel are near moving trucks, equipment, and overhead loads. Separate pedestrian and vehicle traffic as much as possible. Train workers to identify areas where crushing hazards exist, so they can stay out of the zone of danger.

Safe Crane Rigging: Proper rigging is critical to a safe crane operation. According to the National Institute for Occupational Safety and Health (NIOSH), out of 40 crane-related fatalities, 24 were struck-by incidents from rigging failures.[2] All workers in the rigging process should be trained in inspection protocols and principles of safe rigging. Safe rigging helps to ensure that material will not shift or dislodge during a lift. Many variables determine if a load is rigged properly and should be understood by all workers in the lift zone.

"*Crushed and Pinned*" Toolbox Training Checklists

Look in All Directions and Be Alert for:

- Collapse hazards such as falling walls and scaffolds.
- Pinned and crushed hazards such as machinery that are not locked out or tagged out, rigging failures that could result in dropped loads, or moving equipment that can pin someone against a wall or other equipment.

Worker Precautions:

- Be aware of surroundings to prevent becoming trapped or crushed by an object.
- Use lock out/tag out (LOTO) when working on energized equipment; verify the machine is in zero energy state.
- Barricade open areas where workers might become trapped or crushed.
- Install adequate bracing, or rigging, to ensure that items do not fall or move unexpectedly.
- Always make eye contact with equipment operators and wait for a signal before approaching.
- Never walk behind any machinery.
- Stay out of the swing radius of any machinery.

[2] NIOSH, "Preventing Struck-by Injuries in Construction: Lift Zone Safety." https://blogs.cdc.gov/niosh-science-blog/2021/04/12/lift-zone-safety/

Employer Responsibilities:

- Ensure equipment has rollover protective structures (ROPS) to prevent tipping or rolling over with seatbelts in use.
- Prevent workers from being in pinch point areas of equipment.
- Prevent workers from being crushed by dropped or collapsing materials during construction and demolition work or high winds.
- Designate a competent person to ensure safe work practices are in use.
- Provide proper training for workers, including how to recognize and avoid hazards on-site.

TEACHING TIP: Ask participants to recall the last time they crushed a finger, such as being slammed in a door. Remind them of the pain associated with this common type of caught/crush injury. The pain of having a larger portion of the body crushed or pinned in an incident is likely to be many times more painful than a crushed finger. Remind them that the hazards discussed can easily happen if safe habits, practices, and cultures are not implemented on the job. Good safety practices can prevent pain, injury and even death.

Crushed and Pinned Between: Training Record Form

Eliminating Crushed and Pinned Between Hazards Toolbox Talk:
Common Hazards ♦ Lock Out/Tag Out ♦ Rolling or Tipping ♦ Overhead and Collapse

Company Name:	Date:

Instructor Name and Title:

Employee Name (*Please Print*)	**Employee Signature**
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"This material is based upon work supported by the U.S. Department of Transportation under Cooperative Agreement No. 693JJ31750001. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the Author(s) and do not necessarily reflect the view of the U.S. Department of Transportation. This material does not constitute a national standard, specification, or regulation."