Caught in or Between Hazards

OSHA 30 Hour Construction
Identifying Caught In or Between Hazards & Preventative Measures
Understanding the OSHA “FOCUS FOUR”
Workplace Hazards
Caught in or Between Hazards

- Caught in or Between Hazards
- One of OSHA’s Construction Focus Four designed for
  - construction managers,
  - superintendents
  - foreman,
  - crew leaders,
  - employers, and
  - anyone with safety responsibilities.
- Engage in all interactive exercises to proceed through the training
Caught in or Between Hazards

Additional Resources
Online Resources
• OSHA eTools
• OSHA Publications
• OSHA Quick Cards
• OSHA Safety & Health Topic Page
• NIOSH Safety & Health Topic Page
• NIOSH Fatality Assessment and Control Evaluation (FACE) Program
• Electronic Library of Construction Occupational Safety & Health materials

LINK: link to Construction Focus Four: Caught in or Between Hazards
Introduction

Overview

• Provide information that highlights common construction hazards with a focus on Caught in or Between hazards.

• The lesson will focus on the following four areas:
  1. What is a Caught in or Between hazard?
  2. What are the common types of Caught in or Between hazards in construction?
  3. How can I protect myself from Caught in or Between hazards?
  4. What is my employer required to do to protect workers from Caught in or Between hazards?
Introduction

Learning Objectives

• After completing this training module you should be able to:
  – identify common Caught in or Between hazards;
  – describe types of Caught in or Between hazards;
  – protect yourself and employees from Caught in or Between hazards; and
  – recognize employer requirements to protect employees from Caught in or Between hazards.
Student Handouts

• Open by clicking on links provided.
• Include 10 Fatal Facts accident summary worksheets.
• Print handouts, if possible, for your review and future reference.
Introduction

Definitions

Struck By or Caught In/Between incident?:

• A Caught In/Between incident is when an injury is a result of the crushing force between two objects.

• A Struck By incident is when the impact alone creates an injury.
The workers on the left are working under a live load that could either fall from the forks or a mechanical failure could crush them between the load and the ground. Both of these photos depict unsafe behaviors that could lead to serious injuries or death.
What is a Hazard?
- A hazard is a situation or condition that has the potential to cause harm to
  - Life
  - Health
  - Property
  - Environment.
- Engineered controls protect us from known hazards.
- Dormant hazards can become active hazards when conditions change.
- Theoretical hazards are the hardest to recognize.
Definition of Theoretical (or “what if?”) Hazards

- A theoretical (what if?) hazard is a hazard that is not obvious and may take an event or series of events to occur.
- Example
  - A worker kneels down behind a load of materials to finish his job. Not a hazard in itself. BUT...“what if” a forklift came along and decided to move that load forward?
  - Now, suddenly, you have a dangerous caught in or between hazard, that wasn’t obvious 5 minutes earlier.
- This would be a theoretical hazard and one to which you must constantly pay attention not to fall prey!
Definitions

Competent Person

• Designate a competent person
  – OSHA defines a “competent person” 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 authorization to take prompt corrective measures to eliminate them.”
• Caught in or Between hazards 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.
  – This includes individuals who get caught or crushed in operating equipment, between other mashing objects, between a moving and stationary object, or between two or more moving objects.
Caught In or Between Hazards #1

- Caught In & Between Hazards account for
  - Nearly 100 deaths annually
  - 23% of all caught in or between deaths
  - 5% of all construction fatalities
  - 2+ Amputations every work day
  - Over 550 Amputations each year
  - 1,000’s of recordable and disabling injuries

DON’T LET YOURSELF BECOME ONE OF THESE STATISTICS!
### Caught In & Between Hazards #1

Fatalities by Caught in or Between Categories – 2008*:

1. Caught in or crushed in collapsing structure........................................... 30
2. Caught in or Compressed by equipment of objects................................. 24
3. Caught In or Crush By Collapsing Materials
   - Excavation or trenching cave-in............................................................. 16
4. Compressed or pinched by rolling, sliding, or shifting objects............. 13
5. Caught in running equipment or machinery............................................. 6
6. Uncategorized.................................................................................................. 3

*= COFI - Bureau of Labor Statistics
Caught in or Crushed in Collapsing Structures

• Census of Fatal Occupational Injuries (CFOI):
  – Compiles data on all fatal work related injuries
  – Caught in or crushed in collapsing structures continue to be a leading cause of death

• Collapse incidents typically result in serious injuries or death
Caught In or Between Hazards #1

Crane booms that are not adequately supported when the pins are removed during dismantling.

Do not work under the truss boom during dismantling.
Caught In or Between Hazards #1

Unstable footing on scaffold by using concrete block
Caught In or Between Hazards #1

- **Common Causes of Collapsing Structures:**
  - **Scaffolds:**
    - Improper construction
    - Cinder blocks or other similar materials must never be used to support a scaffold as they can collapse
    - Can only be erected, moved, dismantled or altered under the supervision of a competent person
    - The competent person selects and directs the workers who erect the scaffold
    - Erectors must be trained by a competent person on correct procedures and hazards of scaffold erection
    - Competent person must formally inspect and “approve for use” every scaffold system daily
Caught In or Between Hazards #1

• **Common Causes of Collapsing Structures:**
  - **Demolition Hazards:**
    • Improper planning of demo procedures or sequencing
    • Deviations from the structure's design introduced during construction,
    • Approved or unapproved modifications that altered the original design,
    • Materials hidden within structural members,
    • Unknown strengths or weaknesses of construction materials.
  - **All personnel must be trained and fully aware of these often hidden hazards in order to avoid injury.**
Caught In or Between Hazards #1

• **Common Causes of Collapsing Structures:**
  
  – *Floor and Wall Demolition:*
    
    • Workers not permitted in any area which can be adversely affected by demolition operations
    • Stand-alone walls higher than one story must have lateral bracing
    • Mechanical equipment shall not be used on floors or working surfaces unless rated for the imposed load.
    • Floors weakened by demolition operations shall be shored to safely maintain intended load
Caught In or Between Hazards #1

Responsibilities
Competent Person

• Competent person must be designated:
  – Training for scaffold erection;
  – Inspections of excavations, the adjacent areas, and protective systems;
  – Engineering survey prior to demolition of a structure (and any adjacent structure where workers may be exposed) to determine the condition of the framing, floors, and walls, and possibility of unplanned collapse;
  – Continuing inspections during demolition to detect hazards resulting from weakened or deteriorated floors, or walls, or loosened material.
Caught In or Between Hazards #2

Caught In or Compressed by Equipment or Objects

• Injuries are caused by being squeezed, crushed, pinched or compressed between two or more objects
• Typically caused by contact with machinery or equipment
• Preventable through:
  – Planning
  – Hazard Identification
  – Hazard Mitigations
Caught In or Between Hazards #2

Do not work between the frame and dump box of a dump truck

Truck box not blocked

Source: Indian River Community (now State) College
Caught In or Between Hazards #2

A worker could be caught between the wrecking ball and the dumpster.

The wrecking ball is loosely attached to arm; could come loose and strike operator’s cab.
Caught In or Between Hazards #2

Case Study

• Fatal Fact #38
  – An employee was driving a front-end loader up a dirt ramp onto a lowboy trailer.
  – The tractor tread began to slide off the trailer.
  – As the tractor began to tip, the operator, who was not wearing a seat belt, jumped from the cab.
  – As he hit the ground, the tractor’s rollover protective structure fell on top of him, crushing him.
Caught In or Between Hazards #2

Case Study

• Fatal Fact #38 – Inspection Findings and Recommendations
  – OSHA cited the employer for two serious violations and one other than serious violation.
  – Had the front-end loader been equipped with seat belts and had the employee worn them, he might not have been killed.

• What accident prevention recommendations would you make?
  – “To provide seat belts in material handling equipment which has rollover protective structures.”
  – “Better instruction. Instruct employees to recognize and avoid unsafe conditions associated with their work.”
  – “Better control over operators. Permit only employees qualified by training or experience to operate equipment and machinery.”
Caught In or Crushed By Collapsing Materials:

• **Excavation or Trenching Cave-Ins**
  – One of the most hazardous construction activities
  – Cave-ins happen very quickly
  – Less than 4 minutes to live after a cave-in
  – 1 cubic yard of soil weighs 2700 pounds
  – All cave-in related deaths and injuries are preventable!

Safety Tip
Beware, trenches may also contain hazardous atmospheres, water, sewage, or chemicals and dangerous underground utilities.
Caught In or Between Hazards #3

1. Worker in an unprotected vertical wall trench is exposed to being totally engulfed by the trench if it collapses.

2. Next to a structure, previously disturbed soil!

3. Maximum travel distance to a ladder is 25 feet!

No protective systems in use- required over 5 feet!
Caught In or Between Hazards #3

Potential crushing hazard from overhead boulder.

Adequate protective system not used in this excavation.
Caught In or Between Hazards #3

Protections – Excavations

• Protect yourself on excavation sites
  – Do not work in an unprotected trench that is 5 feet or more deep.
  – Enter or exit a trench or excavation only by using a ladder, stairway or properly designed ramp that is placed within the protected area of the trench and no more than 25 feet of travel distance away.
  – Do not work outside of the confines of the protection system!

Safety tip: You must keep all spoils at least 2 feet from the edge of any excavation.
Caught In or Between Hazards #3

Cave-in Prevention Techniques:

- **Sloping.** If an excavation is less than 12 feet deep, sloping is a good option. The angle of the slope will be determined by the type of soil.

- **Benching.** Benching is a variation on sloping. It involves cutting the sides of the excavation to form one or more horizontal levels or steps with vertical or near-vertical surfaces between levels.

- **Shoring.** If an excavation is too deep or space is an issue, shoring may be an option. Shoring supports the sides of the excavation with horizontal, vertical, and cross braces.

- **Shielding.** A trench shield is a structure that can withstand a cave-in. It's used specifically for trenches. The shield can be an immovable structure, or it can be a portable one that's moved along as work progresses. Shielding can also be used in combination with sloping and benching.
Caught In or Between Hazards #3

Case Study

• Fatal Fact #22
  – An employee was installing a small diameter pipe in a trench 3 feet wide, 12-15 feet deep and 90 feet long.
  – The trench was not shored or sloped nor was there a box or shield to protect the employee.
  – Further, there was evidence of a previous cave-in.
  – The employee apparently reentered the trench, and a second cave-in occurred, burying him.
  – He was found face down in the bottom of the trench.
Caught In or Between Hazards #3

Case Study

- Fatal Fact #22 – Inspection Results and Recommendations
  - OSHA issued a citation for three serious violations of its construction standards.
  - Had the required support been provided for the trench, it might not have collapsed.

- What accident Prevention Recommendations would you make?
  - “Trench protection. Employers must shore, slope, or otherwise support the sides of trenches to prevent their collapse.”
  - “PPE. Employers must protect employees with adequate personal protective equipment.”
  - “You have to be able to get out of the trench. Employers must provide an adequate means of exit from trenches.”
  - Better training and instruction. Employees must be instructed to recognize and avoid unsafe conditions associated with their work.”
Caught In or Between Hazards #3

Case Study

• Fatal Fact #61
  – An employee was working in a trench 4 feet wide and 7 feet deep.
  – About 30 feet away a backhoe was straddling the trench.
  – The backhoe operator noticed a large chunk of dirt falling from the side wall behind the worker in the trench.
  – He called out a warning.
  – Before the worker could climb out, 6 to 8 feet of the trench wall had collapsed on him and covered his body up to his neck.
  – He suffocated before the backhoe operator could dig him out.
  – There were no exit ladders.
  – No sloping or shoring had been used in the trench.
Caught In or Between Hazards #3

Case Study

• Fatal Fact #61 – Inspection Findings and Recommendations
  – OSHA issued citations alleging three serious violations.
Compressed or Pinched by Rolling, Sliding, or Shifting Objects Hazards:

• Beware when working around machinery or moving objects

• Most injuries are attributable to human error

• Ensure:
  – Adequate machine guarding is in place, or
  – Lockout & Tagout is used and zero energy verified
  – Stored energy is dissipated
Caught In or Between Hazards #4

Employee could be caught between track of dozer and wall

This does not pose any immediate caught between hazard.
Caught-in hazards occur when a worker could be caught inside of or in between different objects.
Caught In or Between Hazards #4

Compressed or Pinched by Rolling, Sliding, or Shifting Objects

• You can be pinned between
  – Equipment and a solid object, such as a wall or another piece of equipment
  – Materials being stacked or stored and a solid object, such as a wall or another piece of equipment
  – Shoring and construction materials in a trench

• These types of hazards can result in multiple lacerations, broken bones, asphyxiation, or death.

Link: http://www.osha.gov/pls/imis/accidentsearch.html
Caught In or Between Hazards #4

Case Study

• Fatal Fact #50
  – A contractor was operating a backhoe when an employee attempted to walk between the swinging superstructure of the backhoe and a concrete wall.
  – The employee approached the backhoe from the operator’s blind side
  – The superstructure crushed him against the wall.
Caught In or Between Hazards #4

Case Study

• Fatal Fact #50 – Inspection Findings and Recommendations
  – OSHA issued two citations to the employer: Failure to train and to erect barricades.
  – Accident Prevention Recommendations
    1. Instruct each employee on the danger of passing between swinging superstructures of large construction equipment and solid objects at the demolition site [29 CRF 1926.21(b)(2)].
    2. Provide each employee employment and place of employment that are free from recognized hazards causing or likely to cause death or serious physical harm to his employees [OSH Act Sec. 5(a)(1)].
Caught in Running Equipment or Machinery

- Young and inexperienced workers most at risk
- Exposure to unguarded or inadequately guarded machines is leading cause
- 100% preventable by conducting pre-task hazard assessment
- Ensure adequate machine guarding is in place or Lockout & Tagout the equipment before starting work.
Caught In or Between Hazards #5

Unguarded belt and pulley: A worker can get hand and/or clothing caught in the running nip point.
Caught In or Between Hazards #5

Gloves, long sleeve shirts, jewelry, or loose fitting clothing can be hazardous if caught in moving parts.
Caught In or Between Hazards #5

Caught in Machinery

• When machines or power tools
  – Are not properly guarded, workers can get their clothing or body parts caught in the machines.
  – Are not Locked & Tagged Out (de-energized and verified), they can start up automatically, causing injury or death.
  – Have inadequate guards in place, they pose serious hazards.
Caught In or Between Hazards #5

Don’t Let This Happen to You!!
Caught In or Between Hazards #5

Incomplete Guarding

Proper Guarding
Caught In or Between Hazards #5

Machinery & Equipment

• Most construction sites use machinery and equipment that have moving or rotating parts.
• All exposed moving parts must have safety guards in place to prevent inadvertent contact during operation.
• All moving or energized equipment must be properly guarded or de-energized during maintenance or repair to prevent injuries.

**TIP:** Machinery that has unguarded moving parts are Major Hazards with the potential to cause very serious injury and death.
Caught In or Between Protections
Protected Machinery

• Use machinery that is properly guarded.
  – Never remove a safety guard when a tool is being used.
  – Hazardous moving parts of power tools and equipment need to be safeguarded.
  – For example, belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or moving parts of equipment must be guarded if such parts are exposed to contact by workers.
  – Be sure to avoid wearing loose clothing or jewelry that can be caught in moving parts.
Caught In or Between Hazards #5

Case Study

• Fatal Fact # 18 – Accident Description
  – A three-man crew was installing an underground telephone cable in a residential area.
  – They had just completed a bore hole under a driveway using a horizontal boring machine.
  – The bore hole rod had been removed from the hole.
  – While the rod was still rotating, the operator straddled it and stooped over to pick it up.
  – His trouser leg became entangled in the rotating rod and he was flipped over.
  – He struck tools and materials, sustaining fatal injuries.
Caught In or Between Hazards #5

Case Study

• Fatal Fact # 18 – Inspection Results and Recommendations
  – OSHA issued one citation for one alleged serious violation of its construction standards.

TIP: Properly guarding your equipment can prevent similar fatalities.
Responsibilities

Employer Responsibilities

• Provide guards on power tools and other equipment with moving parts.
• Support, secure, and otherwise safeguard equipment with parts that workers could be caught between.
• Take measures to prevent workers from being crushed by heavy equipment that could tip over.
• Take measures to prevent workers from being pinned between equipment and a solid object.
Responsibilities

Employer Responsibilities

• Provide protection for workers during trenching and excavation work.
• Provide means to avoid the collapse of structures and scaffolds.
• Provide means to avoid workers being crushed by collapsing walls during demolition or other construction activities.
• Designate a competent person.
• Provide effective safety training for workers.
Employer Responsibilities

Ensure the following

- Equipment, such as belts, gears, shafts, pulleys, is guarded.
- Points of operation – where the work is actually performed on the materials – are guarded.
- Power saws maintain a point-of-operation guard.
- Employees are adequately trained and are following all safety rules and procedures.
Responsibilities

Employee Responsibilities

• Follow all safety procedures at all times.
• Report all unsafe conditions and behaviors.
• Identify safety issues proactively.
• Take responsibility for your safety and the safety of you co-workers.
• Work safe because your loved ones depend on you.
Caught in or Between Injuries

Examples

- Fingers, hands, arms or legs can be caught in moving belts or parts such as hoists or conveyors.
- Workers underneath or inside machinery could be crushed or trapped without proper energy controls.
- Body parts, clothing, hair and jewelry can be caught in operating equipment.
- Zero-energy state must be verified before any work can begin on any equipment that contains or has the potential to contain hazardous energies.
Caught in or Between Injuries

Examples

• A truck, forklift, crane, or other vehicle/equipment, if operated improperly, could trap a worker between another vehicle, equipment, and a wall, dock or permanent fixture.
• Access doors and hatches of trash bins can catch, pinch or sever hand & fingers.
• Materials stored on pallets can crush feet or hands when they are being handled by a grade-all or forklift.
• Slings, wire rope, straps and chains can trap fingers and hands between them and the load when they are placed under.
• Personnel lifts, such as boom and scissor lifts can crush or trap hands, fingers and personnel against a building or other fixed object.
• Excavations or trenches can collapse and trap workers during a cave in.
Caught In or Between Injuries

Prevention

• Be familiar with the equipment to know where the pinch, shear, wrap, and crush points are located, as well as the pull-in areas.

• Always shut down equipment before doing repairs or inspecting equipment.

• Chock the wheels on any equipment that can roll.

• Never work under equipment supported only by a hydraulic or mechanical jack. Always use a stand or block for secured support.

• Use the cylinder safety bleeds to release stored energy on equipment with hydraulic cylinders.
Caught In or Between Injuries

Prevention

• Ensure all safety guards are in place and properly secured at all times.
• When connecting equipment, stand to the side, and remain clearly visible to the driver.
• Never enter or place your limbs in a pinch point, unless it is 100% safe to do so.
• Take extra caution when working around equipment that uses belts, pulleys, chains, gears, couplings or any other exposed rotating equipment.
• Utilizing Roll Over Protective Structures and seatbelts at all times.
Caught In or Between Injuries

Protections

Protect yourself from being pinned between equipment, materials, or other objects.

• Be aware at all times of the equipment around you and stay a safe distance from it.
• Never place yourself between moving materials and an immovable structure, vehicle, or stacked materials.
• Make sure that all loads carried by equipment are stable and secured.
• Stay out of the swing radius or cranes and other equipment.
• Wear a seatbelt, if required, to avoid being thrown from a vehicle and potentially be crushed by the vehicle if it tips over.
Caught In or Between Injuries

Training

Make sure you have the proper training.

• This includes training on the equipment and hazards of your job so that you can do your work safely.

• Resources if unsure of the required training
  o Discuss training requirements with your supervisor or company safety coordinator.
  o OSHA’s website or previous “Online Resources” page
Caught In or Between Responsibilities

Make Safe

Support, secure, or otherwise make safe

- Bulldozer and scraper blades, end-loader buckets, dump bodies, and similar equipment must be blocked or fully lowered when being repaired or not in use.
Caught In or Between Responsibilities

Equipment Tip Overs
Take measures to prevent

• Workers being crushed by heavy equipment that can tip over.
• The best way to prevent workers from being crushed by heavy equipment that can tip over is to prevent tipping in the first place. For example, cranes can tip over if the load capacity is exceeded, or the ground is not level or too soft.
• Employers must designate a competent person to inspect crane operations to identify working conditions that are hazardous to workers, including ensuring that the support surface is firm and able to support the load.
Caught In or Between Responsibilities

Equipment Tip Overs

• Material-handling equipment must be equipped with rollover protective structures.
  - OSHA standards require that motor vehicles, forklifts, and earthmoving equipment be equipped with seat belts.
  - Employers must require their use.
  - The use of seat belts will prevent workers from being thrown from a vehicle or equipment, and subsequently being crushed when the vehicle or equipment tips over.
Caught In or Between Responsibilities

Proactive Measures

• Measures must be taken
  – To prevent workers from being pinned between equipment and a solid object.
  – For example, a worker being pinned between
    • A wall or another piece of equipment
    • Materials being stacked or stored and a solid object
    • Shoring and construction materials in a trench
Caught In or Between Responsibilities

Proactive Measures

• Other example situations

  • During demolition operations, when balling or clamming is being performed, only the personnel absolutely necessary to the work must be allowed in the work area.

  • Employers must make sure that proper bracing is used between heavy plates used as shoring in a trench.

  • Employers must carefully arrange the path of travel when loading/unloading, stacking, and storing materials so that no workers will be caught between materials and moving equipment, or between materials and a wall.
Caught In or Between Responsibilities

Trenching/Excavation

• Workers must be protected during trenching and excavation work.
  – OSHA standards on trenching and excavation require employers to designate a competent person to inspect the trenching operations.
  – The competent person must be trained in and knowledgeable about soils classification, the use of protective systems, and the requirements of the OSHA standard.
  – The competent person must be capable of identifying hazards, and authorized to immediately eliminate hazards.
Caught In or Between Responsibilities

Trenching/Excavation

• Employers must make sure
  – All excavations and trenches 5 feet deep or more, but less than 20 feet, are protected by: sloping or benching, trench box or shield, or shoring, and that there are adequate means of access and egress from the excavation.
  – If an excavation is more than 20 feet deep, a professional engineer must design the system to protect the workers.
  – Equipment or materials that could fall or roll into excavations must be protected against. This could include spoils that could fall into the trench and bury the workers.
Summary

• During this lesson
  – You have been given an overview of common Caught In or Between hazards, ways to protect yourself, and what employers must do to protect workers from these hazards.
Summary

References/Sources

- OSHA Website
- BLS Website
- CDC/NIOSH Website
- The Construction Chart Book (CPWR, 2007)
- Central New York COSH, 2007, Construction Safety & Health Caught In or Between hazards.
- CDC/NIOSH in partnership with The Center for Construction Research and Training