

Focus Four

Struck-By Hazards



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OSHAcademy Course 808 Study Guide

Focus Four– Struck-By Hazards

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Contact OSHAcademy to arrange for use as a training document.

This study guide is designed to be reviewed off-line as a tool for preparation to successfully complete OSHAcademy Course 808.

Read each module, answer the quiz questions, and submit the quiz questions online through the course webpage. You can print the post-quiz response screen which will contain the correct answers to the questions.

The final exam will consist of questions developed from the course content and module quizzes.

We hope you enjoy the course and if you have any questions, feel free to email or call:

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Introduction

Welcome to Focus Four – Struck-By Hazards for the construction industry. This is the third course covering the hazards described in our Construction Focus Four Hazards series. Please be sure to complete the series by also taking courses 806, 808, and 809. The Focus Four Hazards series was developed in support of the Occupational Safety and Health Administration (OSHA) Construction Outreach Program's effort to help educate workers in the construction industry about:

-) understanding the hazards they face; and
-) knowing what their employer's responsibilities are to protect workers from workplace hazards.

Construction is among the most dangerous industries in the country and construction inspections comprise 60% of OSHA's total inspections.

-) In 2013, preliminary data from the Bureau of Labor Statistics indicate there were 796 fatal on-the-job injuries to construction workers – more than in any other single industry sector and nearly one out of every five work-related deaths in the U.S. that year.
-) Also in 2013, private industry construction workers had a fatal occupational injury rate nearly three times that of all workers in the United States: 9.4 per 100,000 full-time equivalent construction workers vs. 3.2 for all workers.

Students completing the four courses in the Focus Four Hazards series will be able to recognize fall hazards, caught-in or-between hazards, struck-by hazards, and electrocution hazards employees face in the construction industry.

Specifically, once students complete the Focus Four Hazards series they will be able to:

-) Identify common focus four hazards.
-) Describe types of focus four hazards.
-) Protect themselves from focus four hazards.
-) Recognize employer requirements to protect workers from focus four hazards.

Module 1: What is a Struck-by Hazard?

Definition

Struck-by injuries are produced by forcible contact or impact between the injured person and an object or piece of equipment. It is important to point out that in construction, struck-by hazards can resemble caught-in or-between hazards.

To determine whether an event is a *Caught* event or a *Struck* event, ask yourself: Was it the impact of the object alone that caused the injury?

When the impact alone creates the injury, the event is considered as *Struck*. On the other hand, when the injury is created more as a result of crushing injuries between objects, the event is considered as *Caught*.

Struck-by hazards are categorized as follows:

-) struck-by flying object
-) struck-by falling object
-) struck-by swinging object
-) struck-by rolling object

Examples

Struck-by hazards in construction cause accidents such as the following:

-) Four workers were installing signs on a highway when a pick-up truck changed several lanes and entered the work area. The truck struck one of the workers, knocking him off the road and over a bridge rail. He fell approximately 18 feet and died.
-) Four workers were struck by an exterior wall while attempting to lift it in place. Three of the workers received bruises and contusions. One of the workers received a fractured leg and was hospitalized.
-) A construction inspector was crossing an equipment vehicle route at an interstate highway bridge construction site. He walked into the path of the end loader traveling

the route, was run over, and killed. The loader operator was unaware that he struck the inspector.

- J A worker was struck by the counterweight and revolving superstructure of an excavator when he walked between the excavator and a hillside.
- J Workers were pulling 60-foot sections of pipe out of a hole, using a hoist to stack them on the derrick floor. One of the workers let go of a pipe section before it was secured. As he bent over, the pipe swung around and struck him on the head, killing him.
- J A worker was maneuvering an overhead crane when a metal plate, weighing approximately 7,330 lbs., separated from the lifting clamp and fell, striking and killing the worker.

Statistics

Occupational fatalities caused by struck-by hazards are a serious concern. According to the Bureau of Labor Statistics (BLS) 2013 preliminary data, the category of “Contact with objects and equipment is 16% of the total 4,405 fatal work injuries. Of that, the sub-category of “Struck-by object” was 11% [more than two thirds].

In the table below, the 2008 numbers are given for “Crane-Related Deaths” which show when working with cranes, the struck-by death and injury count represents 28% of the total.

Causes of Construction Worker Crane-Related Deaths & Injuries, Jan. 1–Dec. 31, 2008*

Cause	# Incidents (%)	Deaths	Injuries
Crane collapses	34 (39%)	25	59
Overhead power line contacts	12 (14%)	10	8
Struck by crane load	12 (14%)	6	10

Struck by other crane parts	10 (11%)	6	7
Other causes*	20 (23%)	7	16
Total	88	54	100

* Includes 7 highway incidents, 6 falls, 3 caught in/between, 3 struck by non-crane falling objects and 1 struck by lightning incident

Struck-by Flying Object

Major Hazards:

Flying object hazard exists when something has been thrown, hurled, or is being propelled through space. It can include instances when a piece of material separates from a tool, machine or other equipment, striking a worker, resulting in injuries or fatality.

Also, a hazard exists if an object is ejected under power by a tool or equipment. An example of this would be a nail gun, which propels a nail from the gun by force; it is discharged. This force can be either pneumatic or powder-actuated. Powder-actuated tools are particularly hazardous due to the force behind the fastener. These fasteners are designed to go through wood, concrete and steel, and they can certainly go through a worker.

Using compressed air can also cause flying object hazards. Compressed air is commonly used to power tools and clean surfaces.

Examples:

-) A worker was removing a frozen bolt from the track of a caterpillar front end loader and was struck-by a bolt that entered his forehead.
-) A worker was freeing a pump component under pressure and was impaled by the pump component.
-) A worker was killed when a blast of compressed air from a gas pipeline struck him. A compressor was started to fill the pipeline with compressed air in an effort to push out a "pig." when the pipeline suddenly cleared, an employee was still in the way and was killed. Before the compressor was started the area should have been cleared.

) The victim was in the process of using an 8-foot step ladder to gain height to nail a strap onto a residential home single story construction project. The victim used a nail gun with a 3 ½ inch nail to affix the strap to the exterior wall. Using his right hand for the gun, he leaned over to the left and tried to place a nail into the strap. The nail ricocheted and hit him on the left side of his head just above the left ear. He fell to the ground and eventually passed out. Fellow workers transported him to the hospital. He died approximately two days later.

Practice Identifying Hazards

Try to identify the hazards in each picture on the following pages. Then continue to the next page to see if you correctly identified the hazards.





Answers: Now, let's take a look at the hazards. Did you correctly identify them?





Let's review an example of an actual accident:

Accident Type:	Struck by Nail
Weather Conditions:	N/A
Type of Company:	General Contractors
Size of Work Crew:	17
Union or Non-union:	Union
Worksite Inspection:	No
Designated Competent Person on Site:	No
Employer Safety and Health Program:	No
Training and Education for Employees:	No
Craft of Deceased Employee(s):	Carpenter
Age:	22
Sex:	Male
Time of the Job:	3:00 p.m.
Time at the Task:	Unknown



Description of Accident

A carpenter apprentice was killed when he was struck in the head by a nail that was fired from a powder-actuated tool. The tool operator, while attempting to anchor a plywood form in preparation for pouring a concrete wall, fired the gun causing the nail to pass through the hollow wall. The nail traveled some twenty-seven feet before striking the victim. The tool

operator had never received training in the proper use of the tool, and none of the employees in the area was wearing personal protective equipment.

What would you recommend?

Recommendations

-)] Institute a program for frequent and regular inspections of the job site, materials, and equipment by a competent person(s) ([1926.20\(b\)\(2\)](#)).
-)] Require employees exposed to the potential hazards associated with flying nails to use appropriate personal protective equipment. ([1926.100\(a\)](#) and [1926.102\(a\)\(1\)](#)).
-)] Train employees using powder actuated tools in the safe operation of the particular tool ([1926.302\(e\)\(2\)](#)).
-)] Train employees operating power actuated tools to avoid firing into easily penetrated materials ([1926.302\(e\)\(8\)](#)).

Struck-by Falling Object

Major Hazards:

A person is struck-by a falling object when crushed, pinned, or caught under an object that has fallen from above. This does not include the collapse of material or structures.

Examples:

-)] A worker was tearing down a transmission structure using a digger-derrick when a pole broke and struck him on the head.
-)] A worker was struck by a load of wall panels that fell off his truck.

-) Four workers rebuilding a bridge that had washed out by floods were injured when a crane boom cable broke, and the boom fell on them.
-) A worker was engaged in cutting an 8,000-lb boiler in sections with a cutting torch. The section being cut fell off allowing the remaining 5000-lb section, to flip over onto its bottom and land on the worker.
-) A worker was assisting a rigger who had attached a load to the block hook of a wheel mounted crane. The crane operator was positioned in the cab and waiting for the hand signal to make the lift. During this process, the jib of the crane fell from its stowed position on the boom and struck the worker. The worker died later at the scene. It was discovered that the pin used to secure the jib to the boom was missing thus allowing the jib to be displaced. The crane was not inspected prior to use.

Practice Identifying Hazards

Try to identify the hazards in each picture on the following pages. Then continue to the next page to see if you correctly identified the hazards.





Answers: Now, let's take a look at the hazards. Did you correctly identify them?



Let's review an example of an actual accident:

Accident Type:	Struck by Falling Object
Weather Conditions:	Clear
Type of Operation:	Transmission Tower Construction
Size of Work Crew:	4
Union or Non-union:	Union
Competent Safety Monitor on Site:	Yes
Safety and Health Program in Effect:	Yes
Worksite Inspected Regularly:	Yes
Training and Education Provided:	No
Employee Job Title:	Groundman (Framer)
Age & Sex:	24-Male
Experience at this Type of Work:	2 Years
Time on Project:	3 Days

Description of Accident

Ball and socket connectors are used to attach conductor stringing blocks to insulators on the arms of 90-foot metal towers of electrical transmission lines. Normally stainless steel cotter keys secure the ball and socket connector in place. In this case, however, black electrical tape was wrapped around the socket to keep the ball in place rather than a cotter key. The tape apparently stretched, and the ball came loose, dropping the stringing block approximately 90 feet onto the head of an employee below, one of a four-man erection crew.

What would you recommend?

Recommendations

- J Rigging and equipment must be regularly inspected and maintained in safe operating condition as required by general provisions of OSHA's construction ([29 CFR 1926.959](#)).
- J Employees must be instructed to recognize and avoid unsafe conditions. They must also be made aware of regulations that apply to the work and the work area, which eliminate safety and health hazards as required in the safety training and education section of OSHA's construction safety standards ([29 CFR 1926.21\(b\)\(2\)](#)).

Struck-by Swinging Object

Major Hazards:

When materials are mechanically lifted, they have the potential to swing and strike workers. As the load is lifted, the materials may swing, twist or turn. This movement can catch workers by surprise, and the swinging load could hit them. Windy conditions are especially hazardous because the load will swing more. Depending on where the worker is standing and the force behind the load, the worker may fall to another level after being struck and sustain even greater injuries. In addition to swinging, loads can slip from their riggings and strike workers. Loads must be rigged properly to prevent slippage.

When the source of injury has been referred to objects that are not free standing, they are attached at some point or are being held by the worker. This includes instances where a hinge-like motion retracts creating swinging motion in which the worker is struck-by a slamming or swinging motion.

Examples:

- J A worker was working within the swing radius of a barge-mounted crane used in dredging operations. He was hit and killed.
- J Two workers were instructed by their foreman to set up on a ground slab in the southeastern corner of a building. They were to land and place reinforcing steel using a crane. A truck crane was positioned at street level; 30 ft higher in elevation than the ground slab and approximately 162 ft from the landing area. The landing area was approximately 40 ft beyond the radius limit for the crane, as specified by the manufacturer. The 24 piece bundle of 28 1/2 ft long #9 rebar that was to be picked up and loaded onto the crane's hoist line was at street elevation, 50 ft in front of the crane. The operator made the pick-up and was swinging around and lowering it to his left using hand signals when the right pennant line broke at the yoke/bridle. The boom collapsed, striking one of the workers on the head and killing him.

Practice Identifying Hazards

Try to identify the hazards present in the picture below. Then continue to the next page to see if you correctly identified the hazards.



Answers: Now, let's take a look at the hazards. Did you correctly identify them?



Struck-by Rolling Object

Major Hazards:

Struck-by rolling object is when an object is rolling, moving, or sliding on the same level at which the worker is located. It includes instances in which the worker is struck or run over by a moving vehicle without being caught under it or instances in which the worker is struck-by a sliding object or equipment on the same level.

Examples:

-) While walking along the track, a worker was struck by an unmanned rail car at an airport.
-) A worker (security guard) was struck by a tractor trailer and dragged, resulting in fatal injuries.
-) A worker suffered fatal injuries after being struck by a moving semi-truck while loading/unloading freight.
-) A worker was performing repair operations on an impact attenuator and was struck by a truck.
-) A worker was flagging traffic and was struck by a truck.

-) A four-person ground crew was working with a mobile under-hung bridge crane. The crane ran over one of the crew members, who had walked too close to the wheel of the crane. The employee died from his injuries.

-) A worker was setting traffic cones for a paving project. A steel wheel roller was compressing the asphalt, and the traffic cones were being moved so that they would be in the path of the roller. The worker was injured when he was struck by an automobile. He was thrown over the hood of the car and into another lane of traffic, where he was struck by another automobile. He was dragged 141 ft by the second vehicle. He was pronounced dead at the hospital.

Questions: How can we protect ourselves from falling objects? What are the hazards? What are the results? What should we look for?

Practice Identifying Hazards

Try to identify the hazard(s) present in the picture below. Then continue to the next page to see if you correctly identified the hazard(s).



Answers: Now, let's take a look at the hazards. Did you correctly identify them?



Module 1 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. Struck-by injuries are caused by ____.**
 - a. making contact with charged electrical equipment
 - b. falling from great heights and making contact with the ground
 - c. forcible contact or impact between the injured person and an object or piece of equipment
 - d. a worker being crushed between a vehicle and a solid object

- 2. When the impact alone creates the injury, the event is considered as ____.**
 - a. struck
 - b. electrocution
 - c. caught-in
 - d. a fall

- 3. When an injury is created more as a result of crushing injuries between objects, the event is considered as ____.**
 - a. struck
 - b. electrocution
 - c. caught
 - d. a fall

- 4. Struck-by hazards are categorized by which four different types of objects?**
 - a. Flying, swimming, jumping, and rolling
 - b. Flying, falling, rolling, and swinging
 - c. Flying, falling, jumping, and swinging
 - d. Flying, swimming, rolling, and swinging

5. When materials are mechanically lifted, they have the potential to _____ and strike workers.

- a. Jump
- b. electrify
- c. swing
- d. melt

Module 2: Protecting Yourself from Struck-by Hazards

Heavy Equipment – Cranes, Excavators, and more

Properly securing any load with appropriate rigging is crucial to any lifting being done by machinery on the job-site. If the rigging fails, the results can cause serious injury and even death. Before any load is lifted all components of the rigging hardware should be evaluated to ensure they can withstand the forces of the load. There are also many other circumstances that you will need to be aware of when working around heavy equipment. Following the safe work practices listed below will greatly enhance your ability to remain safe while working around heavy equipment.

-) Guard all exposed gears, rotating shafts, pulleys, sprockets or other moving parts to prevent contact with employees.
-) Stay away from heavy equipment when it's operating – In fact, be alert to the location of all heavy equipment whether in use or not.
-) Be aware of the swing radius of cranes and backhoes and do not enter that zone.
-) Inspect all rigging equipment prior to each lift, this should include all slings, chains, ropes, and like materials used to support and lift materials.
-) Remove from service any defective equipment immediately.
-) Inspect all hooks, clamps, and other lifting accessories for their rated load.
-) Stay clear of lifted loads and never work under a suspended load.
-) The person responsible for signaling the crane operator needs to stay in visual contact with the operator and is trained to use the correct signals.
-) Beware of unbalanced loads.
-) Workers should confirm and receive acknowledgment from the heavy equipment operator that they are visible.
-) Drive equipment [or vehicles] on grades or roadways that are safely constructed and maintained.

- J Make sure all workers and other personnel are in the clear before using dumping or lifting devices.
- J Lower or block bulldozer and scraper blades, end loader buckets, dump bodies, etc., when not in use, and leave all controls in neutral position.
- J Haulage vehicles that are loaded by cranes, power shovels, loaders etc., must have a cab shield or canopy that protects the driver from falling materials.
- J Do not exceed a vehicle's rated load or lift capacity.
- J Do not carry personnel unless there is a safe place to ride.

There are also many things your employer must do to ensure your safety around heavy equipment as well, such as:

- J determining whether the ground is sufficiently level and firm to support the anticipated weight of hoisting equipment and associated loads;
- J assessing hazards within the work zone that would affect the safe operation of hoisting equipment such as, power lines and objects or personnel that would be within the swing radius of the hoisting equipment;
- J erecting barriers to mark the area covered by the rotating superstructure to warn workers of the danger zone;
- J ensuring equipment is in safe operating condition via required inspections;
- J complying with all manufacturer procedures regarding proper operational functions of equipment, including its use with attachments;
- J ensuring safe attachment of rigging devices such as shackles, hooks, eyebolts, spreader beams and slings, wedge socket and wire rope clips;
- J providing seat belts when required;
- J ensuring roadways and grades are maintained to accommodate the safe movement of equipment and vehicles; and

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-) ensuring all earthmoving/compacting equipment with obstructed view does not operate in reverse gear unless the equipment has a reverse signal alarm, or a worker has been designated to signal when it is safe.

To learn more about cranes and rigging safety please refer to [Appendix A](#).

Let's review an example of an actual accident:

Accident Type: Struck by Collapsing Crane Boom

Weather Conditions: Clear

Type of Company: General Contractor

Size of Work Crew: 9

Union or Non-union: Union

Worksite Inspections Conducted: Yes

Designated Competent Person on Site: Yes

Employer Safety Health Program: Yes

Training and Education for Employees: Yes

Craft of Deceased Employee(s):

1. Iron Worker
2. Management Trainee

Age & Sex:

1. Ironworker-35; male
2. Management Trainee-26; male

Time on the Job: 1 hour

Time on Task: 1 hour



Description of Accident

A crew of ironworkers and a crane operator were unloading a 20-ton steel slab from a low-boy trailer using a 50-ton crawler crane with 90-foot lattice boom. The operator was inexperienced on this crane and did not know the length of the boom. Further, no one had determined the load radius. During lifting, the load moved forward and to the right, placing a twisting force on the boom. The boom twisted under the load, swinging down, under and to the right. Two employees standing 30 feet away apparently saw the boom begin to swing and ran. The boom struck one of the employees - an ironworker - on the head, causing instant death. Wire rope struck the other -- a management trainee -- causing internal injuries. He died two hours later at a local hospital.

What would you recommend?

Recommendations

-) train and test operators to determine qualifications - [29 CFR 1926.21\(b\)\(2\)](#) and [29 CFR 1926.1427 ANSI B30.5 5-3.1.2](#)
-) require proper written procedures to ensure the method for lifting is within manufacturer's specifications - [29 CFR 1926.1417](#)

Motor Vehicles – Trucks, Cars, and More

Workers often deal with low lighting, low visibility, inclement weather, multiple vehicles, and numerous distractions at worksites. Moving construction vehicles and passing motor vehicle traffic can both cause problems for construction workers. Vehicle safety practices must be observed at construction sites to limit worker exposure to struck-by hazards such as struck-by swinging backhoes, struck-by falling/overturning vehicles, and struck-by trucks or cars.

To avoid these types of hazards, workers should:

-) wear seat belts when provided;
-) check vehicles before each shift to assure that all parts and accessories are in safe operating condition;
-) do not drive a vehicle in reverse gear with an obstructed rear view, unless it has an audible reverse alarm, or another worker signals that it is safe;
-) set parking brakes when vehicles and equipment are parked, and chock the wheels if they are on an incline;
-) all vehicles must have adequate braking systems and other safety devices;
-) use traffic signs, barricades or flaggers when construction takes place near public roadways; and
-) workers must be highly visible in all levels of light. Warning clothing, such as red or orange vests, are required, and if worn for night work, must be of reflective material.

) When working on or near any construction zone:

wear high-visibility reflective clothing;

-) do not put yourself at risk of being struck by a vehicle and do not get caught in a situation where there's no escape route;
-) do not direct traffic unless you are the flagger;
-) flaggers must be visible by both motorists and equipment operators;
-) check that necessary warning signs are posted;
-) never cross the path of a backing vehicle;
-) if equipment doesn't have a reverse signal alarm loud enough to be heard against the surrounding noise level, and the operator has an obstructed view to the rear, the employer will designate a worker to signal when it's safe to back up; and
-) follow "Exit" and "Entry" worksite traffic plan.

Flaggers and other workers on foot are at greater risk of exposure to being struck; therefore, they must be visible by both motorists and equipment operators.

Your employer is required to:

- ⌋ conduct a hazard assessment of the worksite using the job-site coordinator (supervisor or foreman) who should:
 - make a thorough assessment of potential worksite safety hazards,
 - plan for work being conducted in close proximity to a public road or highway and for the safe handling of intermittent roadway traffic stoppages, such as a truck entering a roadway, and
 - plan the entry and exit to and from the worksite to reduce exposure to traffic;
- ⌋ post-construction areas with legible traffic signs at points of hazard;
- ⌋ erect barricades that conform to the MUTCD;
- ⌋ place necessary warning signs along the road; and
- ⌋ all workers on site should have a safety and operations orientation.

General Safe Work Practices

As an employee, you are your own best advocate for keeping yourself safe. Below is a list of safe work practices to help you.

When working with **compressed air**:

- ⌋ reduce air pressure to 30 psi if used for cleaning, and use only with appropriate guarding and proper protective equipment; and
- ⌋ never clean clothing with compressed air.
- ⌋ When working with **hand tools**:
 - ⌋ do not use tools with loose, cracked or splintered handles; and
 - ⌋ do not use impact tools with mushroomed heads.

When working with **machines, such as jack hammers, pavement saws**:

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-) be sure to be trained on the safe operation of machinery;
-) inspect machinery and ensure all guards are in place and in working order;
-) protect feet, eyes, ears, and hands; and
-) wear hearing protection.

When performing **overhead work**:

-) secure all tools and materials;
-) use toeboards, screens, guardrails and debris nets;
-) barricade the area and post signs; and
-) be sure materials stored in buildings under construction are placed further than 6 feet of hoist way/floor openings and more than 10 feet from an exterior wall.

When working with **powder-actuated tools** you must be trained and licensed to operate them if required.

When working with **power tools, such as saws, drills, and grinders**:

-) be sure to be trained on how to safely use the power tool;
-) inspect tools before each use;
-) wear safety goggles;
-) operate according to manufacturer's instructions; and
-) ensure all required guards are in place.

When pushing or pulling **objects that may become airborne**:

-) stack and secure materials to prevent sliding, falling or collapse;
-) keep work areas clear; and

-) secure material against wind gusts.

Your employer is responsible for ensuring:

-) all hand tools are maintained in good condition;
-) the use of unsafe hand tools is not permitted (i.e., no sprung jaws on wrenches, no mushroomed heads, no splinters or cracks in wooden handles, no loose parts/heads of tools);
-) saws are equipped with guards and have a constant pressure switch that will shut off the power when the pressure is released;
-) safety guards are on all abrasive wheel bench and stand grinders;
-) only trained workers are allowed to operate powder-actuated tools;
-) all powder-actuated tools are tested daily before use and all defects discovered before or during use are corrected;
-) powder-actuated tools are not loaded until immediately before use and loaded tools are not left unattended;
-) compressed air used for cleaning purposes is reduced to less than 30 pounds per square inch (psi) and provide effective chip guarding and PPE;
-) all materials stored in tiers are secured to prevent sliding, falling, or collapsing; and
-) toeboards are erected along the edge of overhead walking/working surfaces.

Let's review an example of an actual accident:

A worker was cutting a 6-inch steel water pipe with a gas-powered abrasive wheel when the saw kicked back and struck the worker's face shield, resulting in a laceration and two fractures of the nose.

What would you recommend?

Below is a list of actions that could be taken to ensure an accident like this does not occur.

-) Wear safety glasses and face shields when working with these tools.
-) Make sure workers using powder-actuated tools have been trained. If not, they are a risk to everyone working nearby.
-) Never place hand or fingers over the front muzzle end of a powder-actuated tool and always hold the tool perpendicular to the work, ensuring the spall guard is in place.
-) Inspect tools to ensure protective guards are in place and in good condition.
-) Perform ring tests of grinding wheels to determine if they are intact.
-) Keep the cord behind the cut to prevent cutting the cord.
-) Never stand in line with the unprotected part of a grinding wheel, stand to the side and out of the plane of rotation during start-up. Always wear safety glasses and full-face shields.
-) Check electric tools for defects, such as missing grounding pins and cracked cases, before using.
-) Always use a GFCI.

Personal Protective Equipment (PPE)

Personal Protective Equipment must be worn and used in a manner that will make full use of its protective qualities. Personal protective equipment used incorrectly potentially exposes an employee to hazards, which defeats the reason for using PPE. Please refer to [Appendix B](#) to review a PPE checklist for workers.

Eye and face protection should be used based on anticipated hazards. Safety glasses or goggles should be worn any time work operations present an eye hazard. For example, safety glasses or goggles should be worn during welding, cutting, grinding, nailing (or when working with concrete and/or harmful chemicals or when exposed to flying particles).

Head protection (i.e., hard hats) should be used where there is a potential for objects falling from above, and bumps to the head from fixed objects. Hard hats should be routinely

When worn alone, face shields do not protect employees from impact hazards. Workers should use face shields in combination with safety spectacles or goggles, even in the absence of dust or potential splashes, for additional protection beyond that offered by spectacles or goggles alone.

inspected for dents, cracks or deterioration. Replace your hard hat after a heavy blow and ensure it is maintained and in good condition.

Your employer must do the following:

-) Pay for PPE as required by OSHA.
-) Provide and require the use of appropriate PPE in all operations where there is an exposure to hazardous conditions.
-) Ensure the adequacy of PPE including proper maintenance and sanitation.
-) Provide head protection (e.g., hard hats, helmets) whenever there is possible danger of head injuries from impact, flying or falling objects.
-) Provide eye and face protection when machines or operations present eye or face injury.
-) Provide workers involved in welding operations with filter lenses or plates of proper shade number.
-) Ensure eye, face, and head protective equipment meets ANSI requirements.

Training

To help protect you from struck-by hazards your employer must:

-) Train workers in the work zone to recognize hazards associated with the use of the equipment and any related duties that they are assigned to perform.
-) Ensure crane operators are qualified or certified according to OSHA standards.
-) Ensure signal person meets qualification requirements according to OSHA standards.

-) Instruct workers in the recognition and avoidance of unsafe conditions and the regulations applicable to his/her work environment to control or eliminate any hazards or other exposure to illness or injury.

-) Ensure qualified operators and riggers have been trained on rigging safety, such as:
 - know the weight [of load] the rigging is expected to support
 - know the capacity of the strength of the rigging (type and method of use)
 - retain the load – know which hitches work best for certain types of loads
 - control the load – know which hitches provide good load control and where the center of gravity of the load is

Let's review an example of an actual accident:

Accident Type:	Struck By
Weather Conditions:	Clear/Cool/Windy
Type of Operation:	Construction Maintenance
Size of Work Crew:	3
Collective Bargaining:	Yes
Competent Safety Monitor on Site:	No
Safety and Health Program in Effect:	No
Was the Worksite Inspected Regularly:	Inadequate*
Training and Education Provided:	No
Employee Job Title:	Laborer
Age & Sex:	33-Male
Experience at this Type of Work:	18 Weeks
Time on Project:	1 Day

Description of Accident

Employees were dismantling grain spouts at a grain elevator. Sections of the spout were connected by collars. A ten foot section of a spout weighing 600 pounds was being pulled through a vent hole by a 5-ton winch. As the spout was being pulled through the opening to the outside, the spout became wedged at the point where the collar was to pass through. Several employees used pry bars to free the collar which was under tension. The spout popped out of the vent striking and killing an employee who was standing beside the spout. Employer provided but did not require use of hard hats.

Inspection Results

As a result of its investigation, OSHA issued two citations alleging serious violations. The employee should have been able to recognize that this situation was hazardous. Additionally, the investigation revealed that this employee was not wearing personal protective equipment in this hazardous situation. Had he been wearing a hard hat this death might have been prevented.

What would you recommend?

Questions: How can we work safely around heavy equipment? How do we prevent struck-by incidents involving power tools?

Recommendations

Employees must be instructed in the recognition and avoidance of unsafe conditions. They must also be instructed in the regulations applicable to the work environment to control or eliminate any hazards or other exposure to illness or injury [[29 CFR 1926.21\(b\)\(2\)](#)].

Module 2 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. Among the list of ways workers can protect themselves when working on or near any construction zone, is to _____.**
 - a. direct traffic in and out of the work zone
 - b. work behind moving vehicles
 - c. wear high-visibility reflective clothing
 - d. walk quickly enough behind vehicles that are backing up in order to not get hit

- 2. Employers must protect workers from struck-by hazards by _____.**
 - a. Ensuring employees bring their own PPE to the worksite, whether adequate or not
 - b. Establishing guidelines that allow only contractors access in the crane work zone
 - c. Ensuring guards on tools and equipment are removed when it is absolutely necessary to get the job done
 - d. Providing PPE such as hard hats and safety glasses

- 3. Personal protective equipment used incorrectly _____.**
 - a. is better than nothing
 - b. potentially exposes an employee to hazards
 - c. won't hurt workers
 - d. will still likely protect employees from hazards

- 4. When working on or near any construction zone _____.**
 - a. flaggers must be visible by both motorists and equipment operators
 - b. it is acceptable for a worker to put themselves in a situation where there's no escape route
 - c. workers may cross the path of a backing vehicle
 - d. it is not necessary for workers to follow the "Exit" and "Entry" worksite traffic plan

- 5. To help protect you from struck-by hazards your employer must _____.**
- a. instruct workers in the recognition and avoidance of unsafe conditions
 - b. supply you with a full body harness
 - c. ensure you know how to report an injury
 - d. ensure you are on the worksite and productive even if you have not received appropriate safety training

Glossary

Attendant: An employee assigned to remain immediately outside the entrance to an enclosed or other space to render assistance as needed to employees inside the space.

Audible signal: a signal made by a distinct sound or series of sounds. Examples include, but are not limited to, sounds made by a bell, horn, or whistle.

Authorized person: a person approved or assigned by the employer to perform a specific type of duty or duties or to be at a specific location or locations at the jobsite.

Barricade: an obstruction to deter the passage of persons or vehicles.

Boom (equipment other than tower crane): an inclined spar, strut, or other long structural member which supports the upper hoisting tackle on a crane or derrick. Typically, the length and vertical angle of the boom can be varied to achieve increased height or height and reach when lifting loads. Booms can usually be grouped into general categories of hydraulically extendible, cantilevered type, latticed section, cable supported type or articulating type.

Boom (tower cranes): On tower cranes, if the "boom" (*i.e.*, principal horizontal structure) is fixed, it is referred to as a jib; if it is moveable up and down, it is referred to as a boom.

Builder: the builder/constructor of equipment.

Competent person: 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.

Construction work: work for construction, alteration, and/or repair, including painting and decorating.

Controlling entity: an employer that is a prime contractor, general contractor, construction manager or any other legal entity which has the overall responsibility for the construction of the project--its planning, quality and completion.

Defect: any characteristic or condition which tends to weaken or reduce the strength of the tool, object, or structure of which it is a part.

Designated employee (designated person): An employee (or person) who is assigned by the employer to perform specific duties under the terms of this subpart and who has sufficient knowledge of the construction and operation of the equipment, and the hazards involved, to perform his or her duties safely.

Guarded: Covered, fenced, enclosed, or otherwise protected, by means of suitable covers or casings, barrier rails or screens, mats, or platforms, designed to minimize the possibility, under normal conditions, of dangerous approach or inadvertent contact by persons or objects.

Headache ball: a weighted hook that is used to attach loads to the hoist load line of the crane.

Hoist: a mechanical device for lifting and lowering loads by winding a line onto or off a drum.

Hoisting: the act of raising, lowering or otherwise moving a load in the air with equipment covered by this standard. As used in this standard, "hoisting" can be done by means other than wire rope/hoist drum equipment.

Hoisting equipment: commercially manufactured lifting equipment designed to lift and position a load of known weight to a location at some known elevation and horizontal distance from the equipment's center of rotation. "Hoisting equipment" includes but is not limited to cranes, derricks, tower cranes, barge-mounted derricks or cranes, gin poles and gantry hoist systems. A "come-a-long" (a mechanical device, usually consisting of a chain or cable attached at each end, that is used to facilitate movement of materials through leverage) is not considered "hoisting equipment."

Leading edge: the unprotected side and edge of a floor, roof, or formwork for a floor or other walking/working surface (such as deck) which changes location as additional floor, roof, decking or formwork sections are placed, formed or constructed.

Load: the object(s) being hoisted and/or the weight of the object(s); both uses refer to the object(s) and the load-attaching equipment, such as, the load block, ropes, slings, shackles, and any other ancillary attachment.

Multiple lift rigging: a rigging assembly manufactured by wire rope rigging suppliers that facilitates the attachment of up to five independent loads to the hoist rigging of a crane.

Operator: a person who is operating the equipment.

Procedures: instructions, diagrams, recommendations, warnings, specifications, protocols and limitations.

Qualified person: a person who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, successfully demonstrated the ability to solve/resolve problems relating to the subject matter, the work, or the project.

Rated capacity: the maximum working load permitted by the manufacturer under specified working conditions. Such working conditions typically include a specific combination of factors such as equipment configuration, radii, boom length, and other parameters of use.

Signs: the warnings of hazard, temporarily or permanently affixed or placed, at locations where hazards exist.

Signals: moving signs, provided by workers, such as flaggers, or by devices, such as flashing lights, to warn of possible or existing hazards.

Tags: temporary signs, usually attached to a piece of equipment or part of a structure, to warn of existing or immediate hazards.

Unprotected sides and edges: any side or edge (except at entrances to points of access) of a walking/working surface, for example a, floor, roof, ramp or runway, where there is no wall or guardrail system at least 39 inches (1.0 m) high.

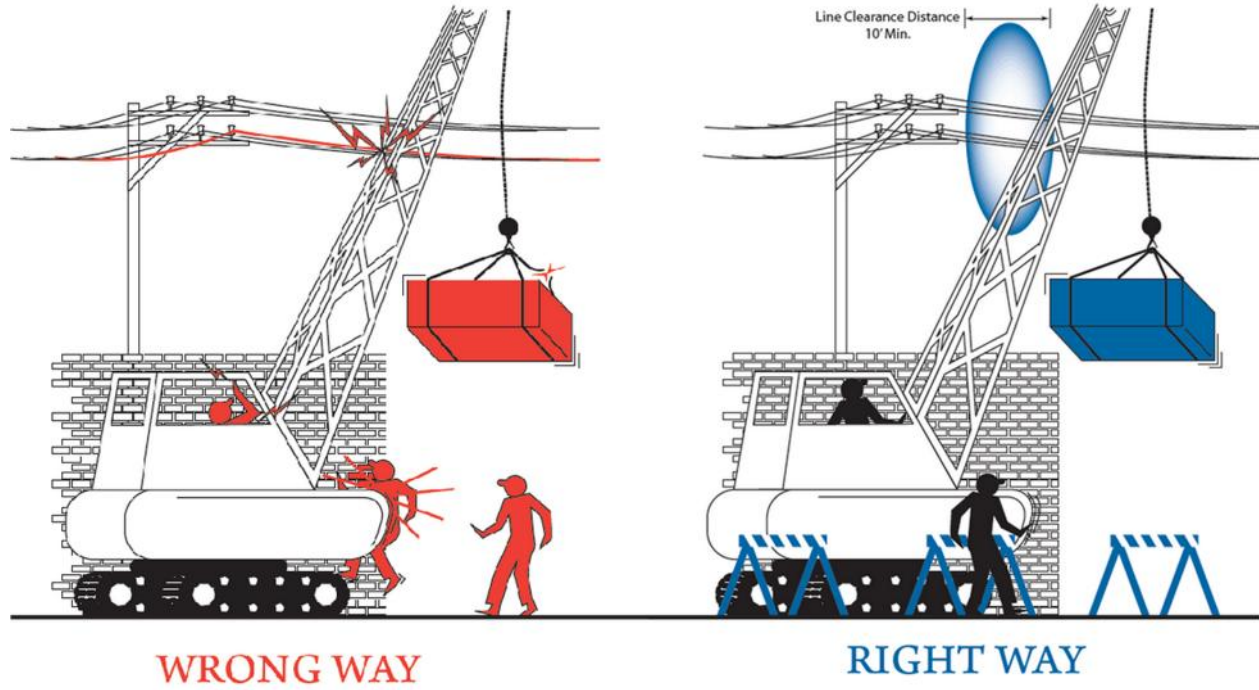
Source for definitions: [29 CFR 1926](#), i.e. OSHA's definitions for terms in the construction industry

Cranes and Rigging

Properly securing any load with appropriate rigging is crucial to any lifting being done by machinery on the job-site. If the rigging fails, the results can cause serious injury and even death. Before any load is lifted all components of the rigging hardware should be evaluated to ensure they can withstand the forces of the load.

Follow these safe work practices

1. Guard all exposed gears, rotating shafts, pulleys, sprockets or other moving parts to prevent contact with employees.
2. Guard or block the swing radius of the crane to restrict and prevent employees from entering into and being struck by the machine.
3. Inspect all rigging equipment prior to each lift, this should include all slings, chains, ropes, and like materials used to support and lift materials.
4. Remove from service any defective equipment immediately.
5. Be sure to inspect all hooks, clamps, and other lifting accessories for their rated load.
6. Clearly communicate to all employees on site that no one is permitted to work under loads.
7. Be sure the person responsible for signaling the crane operator stays in visual contact with the operator and has been trained to use the correct signals.



Courtesy of Construction Safety Council – www.buildsafe.org

Appendix B

PPE for Workers Checklist	
Protection	Typical Operations of Concern
Eye 	Sawing, cutting, drilling, sanding, grinding, hammering, chopping, abrasive blasting, punch press operations, pouring, mixing, painting, cleaning, siphoning, dip tank operations, dental and health care services, battery charging, installing fiberglass insulation, compressed air or gas operations, etc.
Face 	Pouring, mixing, painting, cleaning, siphoning, dip tank operations, welding, pouring molten metal, smithing, baking, cooking, drying, cutting, sanding, grinding, hammering, chopping, pouring, mixing, etc.
Head 	Work stations or traffic routes located under catwalks or conveyor belts, construction, trenching, utility work, construction, confined space operations, building maintenance, building maintenance, utility work, construction, wiring; work on or near communications, computer, or other high tech equipment; arc or resistance welding, etc.
Feet 	Construction, plumbing, smithing, building maintenance, trenching, utility work, grass cutting, building maintenance; utility work; construction; wiring; work on or near communications, computer, or other high tech equipment; arc or resistance welding, welding, foundry work, casting, smithing, demolition, explosives manufacturing, grain milling, spray painting, abrasive blasting, work with highly flammable materials, etc.
Hands 	Grinding, sanding, sawing, hammering, material handling, pouring, mixing, painting, cleaning, siphoning, dip tank operations, healthcare and dental services, welding, pouring molten metal, smithing, baking, cooking, drying, building maintenance; utility work; construction; wiring; work on or near communications, computer, or other high tech equipment; arc or resistance welding; etc.
Body 	Pouring, mixing, painting, cleaning, siphoning, dip tank operations, machining, sawing, battery charging, installing fiberglass insulation, compressed air or gas operations, cutting, grinding, sanding, sawing, glazing, material handling, welding, pouring molten metal, smithing, baking, cooking, drying, pouring, mixing, painting, cleaning, siphoning, dip tank operations, etc.
Hearing 	Machining, grinding, sanding, work near conveyors, pneumatic equipment, generators, ventilation fans, motors, punch and brake presses, etc.

Endnotes

1. OSHA Training Institute. (2011). Construction Focus Four: Struck-By Hazards. Instructor Guide. Retrieved from: https://www.osha.gov/dte/outreach/construction/focus_four/
 - Bureau of Labor Statistics (BLS) website <http://www.bls.gov>
 - Centers for Disease Control and Prevention (CDC)/The National Institute for Occupational Safety and Health (NIOSH) website <http://www.cdc.gov/niosh>
 - Construction Hazard Awareness, by the University of Alabama Continuing Studies Environmental and Industrial Programs website <http://alabamasafestate.ua.edu>
 - Construction Safety Council website <http://www.buildsafe.org>
 - Electronic Library of Construction Occupational Safety and Health (eLCOSH), by The Center for Construction Research and Training [CPWR], with funding by NIOSH website <http://www.cpwr.com/rp-elcosh.html>
 - Eye and Face Protection eTool. <http://www.osha.gov>
 - McCann, Michael of CPWR - The Center for Construction Research and Training based on BLS data, as presented at 2010 Crane and Rigging Conference May 27, 2010
 - Occupational Safety and Health Administration (OSHA) website <http://www.osha.gov>
 - Susan Harwood Grant from OSHA materials:
 - Number SH-16591-07-06-F-11 – International Union of Operating Engineers National Training Fund Focus Four
 - Number SH-16586-07-06-F-36 – National Council for Occupational Safety and Health, Chapel Hill, NC, Construction Safety and Health “Struck-by” Hazards Grantee module
 - Number SH-17792-08-60-F-48 – Compacion Foundation
 - The Construction Chart Book (CPWR, 2007) available online at <http://www.cpwr.com/rp-chartbook.html>