



# Scaffold Safety

Scaffolding can give employees an efficient and safe means to perform work. However, unsafe scaffolding procedures can cause injuries and even death. This course discusses the general requirements of scaffolding. It will also show employees that planning ahead for the erection, use, and dismantling of scaffolding can help prevent serious injuries.

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# OSHAcademy Course 604 Study Guide

## Scaffold Safety

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This study guide is designed to be reviewed off-line as a tool for preparation to successfully complete OSHAcademy Course 604.

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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**Contents**

Course Introduction ..... 1

Module 1: Scaffolding Basics ..... 2

    Introduction ..... 2

    Scenario..... 2

    What is a Scaffold?..... 2

    Scaffolding Terms..... 3

    Who Uses Scaffolds..... 6

        Training Requirements..... 6

    Scenario..... 7

    Module 1 Quiz..... 8

Module 2: Types of Scaffolding ..... 10

    Suspended Scaffolds ..... 10

        Two-Point Swing Stage ..... 10

        Single-Point Adjustable ..... 10

        Multi-Level ..... 11

    Good Foundation for Stability..... 11

        Support Structure ..... 12

    Scenario..... 13

    Bracing ..... 13

    Scenario..... 13

    Supported Scaffolds ..... 15

        Frame Scaffolds..... 15

        Mobile Scaffolds..... 16

Pump Jacks .....	16
Ladder Jack.....	17
Tube and Coupler.....	17
Module 2 Quiz.....	18
Module 3: General Requirements .....	19
Introduction .....	19
Competent Person .....	19
Guardrails are necessary on scaffolding to prevent accidents.....	20
Fall Protection.....	20
Scenario.....	20
Solutions to Common Scaffold Hazards.....	21
The worker in this picture is using fall protection to prevent accidents.....	21
Ladders or stairways are acceptable ways to reach scaffold platforms that are more than two feet above the access point.....	22
Photo courtesy: NIOSH/John Rekus.....	22
Access to Scaffolds .....	22
Final Words .....	22
Module 3 Quiz.....	23

## Course Introduction

Scaffolding can give people an efficient and safe means to perform work. It also has many applications. Scaffolding is used in construction, alteration, routine maintenance, and renovation. When properly erected and maintained, scaffolding provides workers a safe access to work areas, level and stable working platforms, and temporary storage for tools and materials.

However, unsafe scaffolding procedures can cause accidents, serious injuries and even death. Accidents involving scaffolding mainly involve workers falling, incorrect operating procedures, environmental conditions, and falling materials.

This course will discuss the general requirements of scaffolding, the basic parts of a scaffold as well as the different types of scaffolding. It will show employees that planning ahead for the erection, use and dismantling of scaffolding can decrease the potential for accidents and injuries. It will discuss the precautions to prevent these serious accidents and protect workers against fall injuries and death.

## Module 1: Scaffolding Basics

### Introduction

When scaffolds are not erected or used properly, fall hazards can occur. About 2.3 million construction workers frequently work on scaffolds. Protecting these workers from scaffold-related accidents would prevent an estimated 4,500 injuries and 50 fatalities each year.

### Scenario

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On October 12, 1993, a 53-year-old male mason was fatally injured when he fell approximately twelve feet from the second level of an unguarded tubular welded scaffold system. It is not known what the victim was doing at the time of the incident; however, a witness saw him walk to the edge of the scaffold and place his foot on a piece of iron scaffold bracing. He either tripped or lost his balance, and fell to the sand covered asphalt below. The victim was transported to the local hospital where he died approximately two hours later. Investigators concluded that in order to prevent similar future occurrences, employers should:

- ) Install guardrails on all open sides of scaffolds which are more than ten feet above ground.
- ) Ensure that scaffolding is properly erected, maintained, moved, dismantled and/or altered only under the supervision of a competent person.
- ) Develop and implement a comprehensive safety program that includes, but is not limited to, training in fall hazard recognition and the use of fall protection devices.

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### What is a Scaffold?

A scaffold is defined as an elevated, temporary work platform. There are three basic types of scaffolds:

1. Supported scaffolds, which consist of one or more platforms supported by rigid, load-bearing members, such as poles, legs, frames, outriggers, etc.



Supported Scaffold

2. Suspended scaffolds, which are one or more platforms suspended by ropes or other non-rigid, overhead support.



Suspended Scaffold

3. Other scaffolds, principally man lifts, personnel hoists, etc., which are sometimes thought of as vehicles or machinery, but can be regarded as another type of supported scaffold.



A scissor (or aerial lift) may be regarded as a suspended scaffold.

### Scaffolding Terms

It's important to know some of the common terms when dealing with scaffolding. For example, when an employee goes from one job site to another, knowing the proper scaffolding terms will improve communications and safety.

Here are the definitions for the most common terms, according to ANSI/ASSE A10.8-2011: Scaffolding Safety Requirements:

1. **Anchorage:** A secure point of attachment for lifelines, lanyard, deceleration devices or tiebacks.
2. **Base Plate:** A device used to distribute vertical load.
3. **Bearer:** A horizontal member of a scaffold upon which the platform unit rests and that may be supported by runners.
4. **Boatswains' Chair:** A suspended seat designed to accommodate one worker in a sitting position.
5. **Body Harness, Full:** Straps that are secured about an employee in a manner that distributes the arresting forces over at least the thighs, shoulders and pelvis with provisions for attaching a lanyard, lifeline or deceleration device.
6. **Brace:** A device that holds one scaffold member in a fixed position with respect to another member.
7. **Competent Person:** One who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous or dangerous to employees, and who has the authority to take prompt corrective measures to eliminate such hazards.
8. **Crossbraces:** Two diagonal scaffold members joined at their center to form an "X." Used between frames or uprights or both.
9. **Design Load:** The maximum intended load; that is, the total of all loads including the worker(s), material and the equipment placed on the unit.
10. **Electrical Ground:** A conducting connection between an electrical circuit or equipment and the area, or some conducting body that serves in place of the earth.
11. **Fall Protection:** A system designed to prevent or arrest a person's fall.
12. **Guardrail System:** A rail system erected along the open sides and ends of platforms. The rail system consists of a toprail and midrail and their supports.
13. **Guy:** A rope, chain or cable used to stabilize a vertical object.
14. **Hoist:** A device intended to be used to raise and lower a suspended scaffold. It may be either manually operated or power-operated.

15. **Lanyard:** A flexible line to secure the wearer of a full body harness to a lifeline, trolley line or a fixed anchor.
16. **Maximum Intended Load:** The total load of all workers, equipment, tools and materials.
17. **Midrail:** A rail approximately midway between the toprail and platform of a guardrail system.
18. **Open Sides and Ends:** That portion of a scaffold platform unit that is not protected by a guardrail system, crossbraces, vertical work surfaces or stirrups.
19. **Personal Fall Arrest System:** An assembly of components and subsystems used to arrest a person in a fall from a working height.
20. **Plank:** A wood board and fabricated component that serves as a platform unit.
21. **Plank (Metal):** A metal platform unit sized to support one or more workers or uniformly distributed loads. Metal planks would be similar dimensions as wood planks.
22. **Plank (Wood, Laminated):** A platform unit of glue-laminated wood whose method of manufacture and assigned design values contemplate flat use in a scaffolding application.
23. **Plank (Wood, Sawn):** A board of sawn lumber whose grading rules and assigned design values contemplate flat use in a scaffolding application.
24. **Platform:** A general term for an elevated work surface composed of one or more platform units.
25. **Qualified Person:** One who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training or experience has successfully demonstrated the ability to solve or resolve problems related to the subject matter, the work or the project.
26. **Rated Load:** The manufacturer's recommended maximum load.
27. **Runner:** A horizontal scaffold member that forms a tie between posts and may also support a bearer.
28. **Safety Screen:** A wire or plastic screening that protects the workers and passers-by below from dropped items.
29. **Scaffold:** A temporary elevated or suspended work unit and its supporting structure used for supporting worker(s) or materials, or both.

30. **Sill:** A footing (usually wood) which distributes the vertical loads to the ground or slab below.

31. **Tie:** A device used between scaffold component and the building or structure to enhance lateral stability.

32. **Toeboard:** A barrier secured along the sides and the ends of a platform unit to guard against the falling of material, tools and other loose objects.

33. **Toprail:** The uppermost horizontal rail of a guardrail system.

34. **Working Load:** Load imposed by persons, materials and equipment.

You can test your scaffolding vocabulary with an [online crossword puzzle](#). It requires an [Adobe Flash Player](#).

## Who Uses Scaffolds

Workers on scaffolds can be divided into two groups, erectors/dismantlers and users:

### 1. Erectors/Dismantlers

Erectors and dismantlers are those workers who are mainly responsible for assembling and disassembling scaffolding. This is done before other work can continue, and/or after work has been completed.

## Training Requirements

OSHA requires employers to provide training by a competent person to each employee who is involved in erecting and/or disassembling a scaffold.

A qualified person must do adequate preplanning to make sure the scaffold is erected properly.

Preplanning includes:

- ) Determining the type of scaffold necessary for the job,
- ) Determining the maximum load of the scaffold,
- ) Assuring a good foundation, and
- ) Avoiding electrical hazards.

## 2. Users

Scaffold users are those whose work requires them, at least some of the time, to be supported by scaffolding. Employers are required to have a qualified person provide training to each employee who uses the scaffold. The training must teach employees to recognize the hazards associated with the type of scaffold being used. They must also understand the procedures to control or minimize those hazards. Here are a few of the hazards:

- ) Falls from elevation, due to lack of fall protection;
- ) Collapse of the scaffold, caused by instability or overloading;
- ) Being struck by falling tools, work materials, or debris; and
- ) Electrocution, principally due to proximity of the scaffold to overhead power lines.

### Scenario

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In August, 1992, two workers were erecting an aluminum pump jack scaffold. As they were raising the second aluminum pole, the pole apparently contacted an overhead power line. The pole being raised was 29 feet 10 inches long and the line was 28 feet 10 inches high. The line was approximately 11 feet from the house. One employee died and the other suffered severe burns and was hospitalized. The surviving employee noted that he thought they had enough room to work around the power lines, which were not de-energized or shielded.

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## 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. \_\_\_\_\_ is a device used to distribute vertical load.
  - a. Anchorage
  - b. Base plate
  - c. Brace
  - d. Hoist
  
2. A scaffold is defined as an elevated, permanent work platform.
  - a. true
  - b. false
  
3. Which of the following is a device used between scaffold components to enhance lateral stability?
  - a. tie
  - b. runner
  - c. plank
  - d. crossbraces
  
4. A \_\_\_\_\_ consists of one or more platforms suspended by ropes.
  - a. aerial lift
  - b. personal hoist
  - c. suspended scaffold
  - d. supported scaffold

**5. Which of the following is a hazard when working on scaffolding?**

- a. falls from elevation
- b. collapse of the scaffold
- c. struck by falling tools
- d. All of the above are hazards

## Module 2: Types of Scaffolding

### Suspended Scaffolds

A suspension scaffold contains one or more platforms suspended by ropes or other non-rigid means from an overhead structure. Let's take a closer look at a few of the most common suspended scaffolds.

#### Two-Point Swing Stage

Two-point adjustable suspension scaffolds, also known as swing-stage scaffolds, are perhaps the most common type of suspended scaffold. Hung by ropes or cables connected to stirrups at each end of the platform, they are typically used by window washers on skyscrapers, but play a prominent role in high-rise construction as well.



Two-Point Swing Stage

#### Single-Point Adjustable

A single-point adjustable scaffold consists of a platform suspended by one rope from an overhead support and equipped with means to permit the movement of the platform to desired work levels. The most common among these is the scaffold used by window washers to clean the outside of a skyscraper (also known as a boatswain's chair).



Single-Point Adjustable

## Multi-Level

A multi-level scaffold is a two-point or multi-point adjustable suspension scaffold with a series of platforms at various levels resting on common stirrups.

### Good Foundation for Stability

It is impossible for a stable structure to be built upon a foundation that does not start out square and level. OSHA has standards that apply specifically to the steps that must be taken to assure a stable scaffold base.

In order to **assure stability**, supported scaffolds must be set on:

- ) Base plates,
- ) Mud sills, or
- ) Other adequate firm foundations.



Multi-Level

The pictures below illustrate the use of a **poor** foundation lacking a base plate (figure 1) compared to the **proper** foundation with the use of a base plate in figure 2.



Figure 1: Poor foundation-Shows scaffold end frames, which have no base plates, erected on the top of scrap wood and unstable cement blocks.



Figure 2: Proper foundation- Shows scaffold end frames equipped with adjustable screw legs and with base plates set on mud (wood) sills.

Supported scaffold poles, frames, uprights, etc. must be **plumb and braced to prevent swaying and displacement**. In general, a level is the easiest way to achieve the desired right angles.

### Support Structure

To control the risk of a scaffold falling or collapsing, employers must assure that scaffolds are built within OSHA standards relating to strength and structural integrity.

Scaffolds and scaffold components must be capable of supporting, without failure, **their own weight and at least 4 times their maximum intended load**.

**TIP:** A scaffold can be overloaded by removing the braces, which causes the weight on the scaffold to be distributed to fewer structural members. Even if they are "in the way," braces should not be removed while work is being performed on a scaffold!

### Scenario

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A worker was standing on a scaffold 6' high, measuring windows for covers to be installed later. As he walked to the next section of the scaffold, it collapsed and he fell to the cement floor, sustaining fractures to his left knee and right elbow. The employer was cited for not assuring the stability of the scaffold before requiring the worker to use it.

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### Bracing

Frames and panels must be connected by **cross, horizontal, or diagonal braces**, alone or in combination, which secure vertical members together laterally. Also, as frames are stacked, cross braces must be of such length as will automatically keep the scaffold **plumb, level, and square**. All of the brace connections **MUST** be secured to prevent dislodging.

The pictures below illustrate both a poor attempt at securing cross bracing (figure 3) compared to the proper attempt in figure 4.



Figure 3: Poor attempt at securing cross bracing with wire.



Figure 4: Proper attempt at securing cross bracing with wire.

On October 21, 1989, a 37-year-old male painter died when the platform he was working from fell 65 feet inside a municipal water storage tank. The victim was a member of a three-man crew that was using an improvised suspension scaffold to paint the interior of the 68-foot-tall, 32-foot-diameter water tank. The scaffold consisted of an aluminum ladder used as a platform and secured to steel "stirrups" made of steel bar stock bent into a box shape and attached to each end of the ladder. Wire cables from each stirrup ran to a common tie-off point. A cable from this common tie-off was rigged to a block and tackle used from ground level to raise and lower the platform. The block and tackle supporting the system was secured to a vertical steel pipe on top of the tank with a cable that was fashioned into a loop by U-bolting the dead ends of a piece of wire rope.

The victim had been painting from one end of this scaffold while wearing a safety belt and lanyard attached to an independent lifeline. When the victim finished painting, he unhooked his lanyard from his lifeline and moved along the ladder platform to a position where he could hand his paint spray gun to the foreman (who was at the top of the tank). As the foreman took the spray gun, he heard a "pop" and saw the scaffold and the victim fall 65 feet to the floor of the tank.

Investigation of the incident revealed that the two U-bolts on the loop of cable supporting the block and tackle had loosened enough to allow the cable ends to slip through, causing the scaffold to fall. This particular rig had been used without incident every day for two weeks before this fatal fall.

The National Institute for Occupational Safety and Health (NIOSH) recommends the following measures to prevent serious injuries and fatal falls while working from suspension scaffolds:

- ) Comply with the current and proposed OSHA regulations for working with scaffolds.
  - ) Assure that design and construction of scaffolds conform to OSHA requirements.
  - ) Shield scaffold suspension ropes and body belt or harness system droplines (lifelines) from hot or corrosive processes, and protect them from sharp edges or abrasion.
  - ) Inspect all scaffolds, scaffold components, and personal fall protection equipment before each use.
  - ) Provide personal fall protection equipment and make sure that it is used by all workers on suspension scaffolds.
-

- 
- J Use structurally sound portions of buildings or other structures to anchor droplines for body belt or harness systems and tiebacks for suspension scaffold support devices. Droplines and tiebacks should be secured to separate anchor points on structural members.
  - J Provide proper training for all workers who use any type of suspension scaffold or fall protection equipment.
- 

### Supported Scaffolds

Supported scaffolds consist of one or more platforms supported by outrigger beams, brackets, poles, legs, uprights, posts, frames, or similar rigid support.

### Frame Scaffolds

Fabricated frame scaffolds are the most common type of scaffold because they are versatile, economical, and easy to use. They are frequently used in one or two tiers by residential contractors, painters, etc., but their modular frames can also be stacked several stories high for use on large-scale construction.



Frame scaffolds are the most common type of scaffold because they are easy to use.

## Mobile Scaffolds

Mobile scaffolds are a type of supported scaffold set on wheels or casters. They are designed to be easily moved and are commonly used for things like painting and plastering, where workers must frequently change position.



Mobile scaffolds are set on wheels or casters.

## Pump Jacks

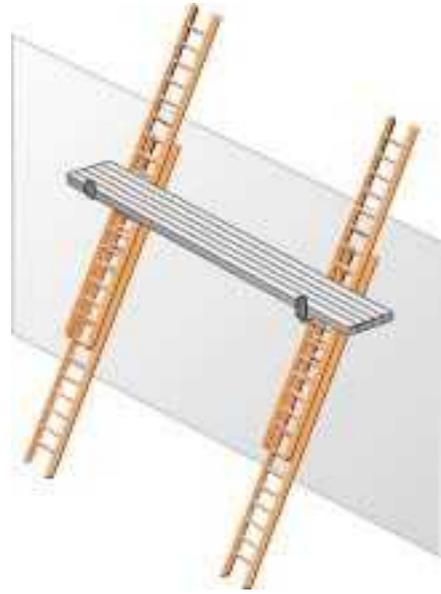
Pump jacks are a uniquely designed scaffold consisting of a platform supported by moveable brackets on vertical poles. The brackets are designed to be raised and lowered in a manner similar to an automobile jack. Pump jacks are appealing for certain applications because they are easily adjusted to variable heights, and are relatively inexpensive.



Pump jacks consist of a platform supported by moveable brackets on vertical poles.

## Ladder Jack

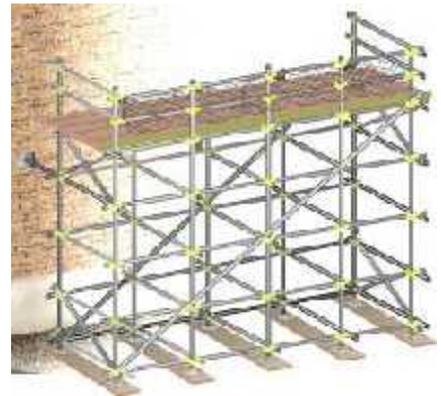
A ladder jack scaffold is a simple device consisting of a platform resting on brackets attached to a ladder. Ladder jacks are primarily used in light applications because of their portability and cost effectiveness.



Ladder jacks consist of a platform resting on brackets attached to a ladder.

## Tube and Coupler

Tube and coupler scaffolds are so-named because they are built from tubing connected by coupling devices. Due to their strength, they are frequently used where heavy loads need to be carried, or where multiple platforms must reach several stories high. Their versatility, which enables them to be assembled in multiple directions in a variety of settings, also makes them hard to build correctly.



Tube and coupler scaffolds are built from tubing connected to coupling devices.

## 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. \_\_\_\_\_ is the most common type of suspended scaffold.
  - a. Single-point adjustable
  - b. Two-point swing stage
  - c. Aerial lift
  - d. Multi-level
  
2. To assure stability, supported scaffolds must be set on:
  - a. base plates
  - b. mud sills
  - c. unstable ground
  - d. both (a) and (b)
  
3. How much weight should scaffolds be capable of supporting?
  - a. own weight and at least 4 times their maximum load
  - b. own weight and at least 2 times their maximum load
  - c. own weight and at least 6 times their maximum load
  - d. own weight and at least 3 times their maximum load
  
4. Which of the following supported scaffold is the most common?
  - a. frame scaffold
  - b. mobile scaffold
  - c. pump jacks
  - d. ladder jacks
  
5. Tube and coupler scaffolds are used where heavy loads must be carried.
  - a. true
  - b. false

## Module 3: General Requirements

### Introduction

When OSHA revised its scaffolds standard back in 1996, the Bureau of Labor and Statistics (BLS) showed that 25% of workers injured in scaffold accidents had not received any scaffold training. Also, 77% of scaffolds were not equipped with guardrails to keep workers safe.

OSHA estimates that informing scaffold workers about the safety precautions while working on scaffolding can save as many as 60 lives and prevent 4,500 accidents every year.

In a recent BLS study, 72% of workers injured in scaffold accidents say the accident was caused by either planking or support giving way, or to the employee slipping or being struck by a falling object.

This module will take a closer look at the general requirements that will help prevent these accidents and others while working on or around scaffolding.

### Competent Person

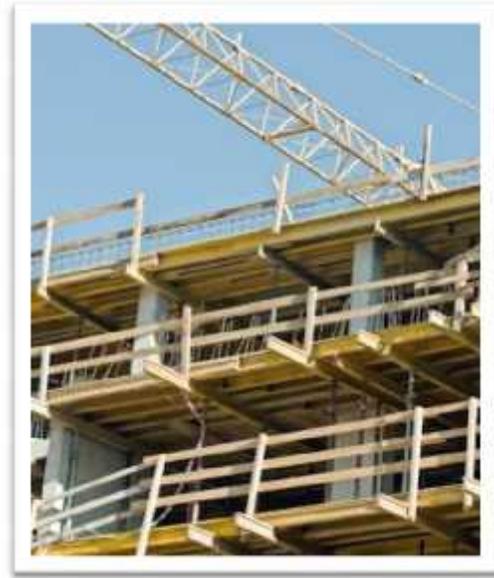
According to OSHA, a **competent person** means “one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.”

A competent person must oversee the scaffold selection, erection, use, movement, alteration, dismantling, maintenance and inspection. Employers will need to make sure only trained and experienced personnel are working on the scaffold. On the other hand, employees will need to be knowledgeable about the type of scaffolding to be used in various work environments, and the proper care and use of fall protection equipment.

Employee training should focus on the proper erection, handling, use, inspection, removal and care of the scaffolds. Training must also include the installation of fall protection, such as guardrails.

## Fall Protection

Guardrails must be installed on all scaffold platforms in accordance with required standards and at least consist of top rails, midrails and toeboards (if more than 10 feet above the ground or floor).



Guardrails are necessary on scaffolding to prevent accidents.

## Scenario

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While sitting or kneeling on a fixed deck plank attached to a fabricated frame scaffold, a worker was pulling a 16-foot long 2x4 off the bucket of an excavator. There were no guardrails at the working level. When the other end of the 2x4 slipped off the bucket, the employee did not let go of his end, and was pulled off the deck. He fell 16 feet to the ground, sustaining facial fractures and other injuries.

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Workers on suspended scaffolds must use a fall protection system to protect them against scaffold failure. This system will usually consist of a full body harness, lanyard, rope grab, independent vertical lifeline and an independent lifeline anchorage. Remember, fall protection is only as good as its anchorage. The anchorage points are independent points on structures where lifelines are securely attached. These points must be able to support at least 5,000 pounds per employee.

## Solutions to Common Scaffold Hazards

There are several things an employee can do to protect themselves from the common hazards mentioned in Module 1:

- ) Scaffold must be sound, rigid and sufficient to carry its own weight plus four times the maximum intended load without settling or displacement. It must be erected on solid footing.
- ) Unstable objects, such as barrels, boxes, loose bricks or concrete blocks must not be used to support scaffolds or planks.
- ) Scaffold must not be erected, moved, dismantled or altered except under the supervision of a competent person.
- ) Scaffold accessories such as braces, brackets, trusses, screw legs or ladders that are damaged or weakened from any cause must be immediately repaired or replaced.
- ) Scaffold platforms must be tightly planked with scaffold plank grade material or equivalent.
- ) Synthetic and natural rope used in suspension scaffolding must be protected from heat-producing sources.
- ) Employees must be instructed about the hazards of using diagonal braces as fall protection.
- ) Scaffold should be accessed by using ladders and stairwells.
- ) Scaffolds must be at least 10 feet from electric power lines at all times.



The worker in this picture is using fall protection to prevent accidents.

## Access to Scaffolds

Workers must have safe access to scaffolds and scaffold platforms. They can use ladders or stairways to reach a platform that is more than two feet above or below the access point.

Here are some other examples to access a scaffold safely:

- ) Integral prefabricated scaffold access frames
- ) Direct access from another scaffold
- ) Personnel hoists
- ) Ramps
- ) Walkways



Ladders or stairways are acceptable ways to reach scaffold platforms that are more than two feet above the access point.

*Photo courtesy: NIOSH/John Rekus*

## Final Words

Having a solid foundation in the basics of scaffolding is important to help reduce the likelihood of an accident. Supervisors and employees have an obligation to make sure scaffolding is being used correctly and safely onsite.

It's time for the last module quiz. You can then take the final exam when you are ready!

### Module 3 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. A \_\_\_\_\_ must oversee the scaffold selection, erection, use, movement, alteration, and inspection.**
  - a. qualified person
  - b. competent person
  - c. supervisor
  - d. onsite employee
  
- 2. Guardrails must be installed on all scaffold platforms.**
  - a. true
  - b. false
  
- 3. Which of the following is something an employee can do to protect themselves from scaffolding hazards?**
  - a. Don't use unstable objects to support scaffolds or planks.
  - b. Scaffold doesn't need to be accessed by using ladders and stairwells.
  - c. Scaffolds must be at least 15 feet from power lines.
  - d. Employees don't need to receive training.
  
- 4. Stairways need to be used to reach a platform that is more than \_\_\_\_\_ below or above the access point.**
  - a. 5 feet
  - b. 2 feet
  - c. 6 feet
  - d. 3 feet

**5. Scaffolds must be at least \_\_\_\_\_ feet from electrical power lines at all times.**

- a. 5
- b. 10
- c. 7
- d. 20