MODULE DESCRIPTION
This module provides information on the safety concerns and precautions needed when using scaffolds.

OBJECTIVES
After completing this module, the participant will be able to:
- List and define the basic types of scaffolds.
- Name the five major hazards associated with working on scaffolds.
- Demonstrate a thorough understanding of the different kinds of fall protection equipment, as well as the different situations in which each type is required.
- Explain the regulations for safely working on scaffolds.
- Summarize the responsibilities of a competent person in relation to scaffolds.

MODULE OUTLINE
1. Introduction to Scaffolds
   - A scaffold is an elevated, temporary work platform. There are three basic types of scaffolds. They are:
     - **Supported scaffolds**: Supported scaffolds are platforms supported by legs, outrigger beams, brackets, poles, frames or similar rigid supports. The poles, legs, posts, frames, and uprights must be plumb and braced to prevent swaying and displacement.
     - **Suspended scaffolds**: A suspension scaffold contains one or more platforms suspended by ropes or other non-rigid means from an overhead structure. Examples of this scaffold type are: single-point, multi-point, multi-level, two-point, adjustable, boatswain’s chair, catenary, chimney hoist, continuous run, elevator false car, go-devils, interior hung, masons’, and stone setters.’
     - **Aerial lifts**: Aerial lists are vehicle-mounted aerial devices used to elevate employees, such as extensible boom platforms, articulated boom platforms, and vertical towers. These are sometimes referred to as “cherry pickers” or “boom trucks.”

2. Supported Scaffolds
   - Supported scaffolds with a height to base width ratio of more than 4:1 must be restrained by guying, tying, bracing, or an equivalent method.
   - Either the manufacturer’s recommendations or the following placements must be used for guys, ties, and braces:
- Install guys, ties, or braces at the closest horizontal member to the 4:1 height and repeat vertically with the top restraint no further than the 4:1 height from the top.
- Guys, ties, or braces should be placed vertically every 20 ft (6.1 m) or less for scaffolds less than 3 ft (0.91 m) wide, and every 26 ft (7.9 m) or less for scaffolds more than 3 ft (0.91 m) wide.
- Guys, ties, or braces should be placed horizontally at each end of the scaffold at intervals not to exceed 30 ft (9.1 m) from one end.

- Another important factor in support scaffolds is the support system itself. A supported scaffold’s poles, legs, posts, frames, and uprights must bear on base plates and mud sills, or other adequately firm foundations.
- These types of scaffolds can also be supported by forklifts and front-end loaders. Forklifts can only support platforms when the entire platform is attached to the fork and the forklift does not move horizontally when workers are on the platform. Front-end loaders and similar equipment can support scaffold platforms only when they’ve been specifically designed for such use by their manufacturer.
- Stilts can be used to increase the working level height of employees on a supported scaffold, however, this is only acceptable for large area scaffolds. When stilts are used, the existing guardrail must be increased in height equal to the height of the stilts.

3. Suspended Scaffolds

- Suspended scaffolds require that all support devices rest on surfaces capable of supporting at least four times the load imposed on them by the scaffold when operating at the rated load of the hoist, or at least one-and-a-half times the load imposed on them by the scaffold at the stall capacity of the hoist, whichever is greater.
- OSHA regulations are very detailed with regard to this specific scaffold type. Some of the OSHA regulations for scaffolds state that:
  - If an employee is more than 10 ft (3.1 m) above a lower level, guardrails, a personal fall arrest system, or both must protect them from falling.
  - When scaffold platforms are more than 24 inches (61 cm) above or below a point of access, ladders, ramps, walkways, or similar surfaces must be used.
  - When using direct access, its surface must not be more than 24 inches (61 cm) above or 14 inches (36 cm) horizontally from the platform.
  - When lanyards are connected to horizontal lifelines or structural members on single-point or two-point adjustable scaffolds, the scaffold must have automatic locking devices and additional independent support lines equal in number and strength to the suspension lines.
  - Emergency escape and rescue devices must not be used as working platforms, unless designed to function as suspension scaffolds or emergency systems.

4. Aerial Lift Scaffolds

- The final scaffold type is an aerial lift. This type of scaffold also has its own specific OSHA requirements which include:
  - Only authorized personnel can operate aerial lifts.
  - The manufacturer or an equivalent must certify any modifications.
- The insulated portion of the lift must not be altered to reduce its insulating value.
- Brakes must be set and outriggers used.
- Boom and basket load limits must not be exceeded.
- Devices can not be used to raise the employee above the basket floor.
- Those employees that use an aerial lift must wear personal fall arrest systems with the lanyard attached to the boom or basket.

5. Peripheral Scaffold Equipment
- Peripheral scaffold equipment, such as outriggers, tiebacks, suspension ropes, and hoists, also have specific guidelines.
  - **Outrigger beams**: (thrustouts) are the structural members of a suspension or an outrigger scaffolds that can provide support. They must be placed perpendicular to their bearing support.
  - **Tiebacks**: must be secured to structurally sound anchorage on the building or structure. A single tieback must be installed perpendicular to the face of the building or structure. Two tie-backs installed at opposing angles are required when a perpendicular tieback cannot be installed.
  - **Suspension ropes**: must be long enough to allow the scaffold to be lowered to the level below without the rope passing though the hoist. Additional safety requirements include:
    - Suspension ropes supporting adjustable suspension scaffolds must be large enough in diameter to provide sufficient surface area for the functioning of brake and hoist mechanisms.
    - Employers must replace wire rope in the following circumstances:
      1. When the rope has kinks.
      2. When the rope has six randomly broken wires in one rope lay or three broken wires in one strand in one lay.
      3. One third of the original diameter of the outside wires is lost.
      4. When heat damage is present.
      5. When the secondary brake has engaged the rope.
      6. Any other physical damage that impairs the function and strength of the rope.

6. Scaffold Hazard Prevention
- An estimated 2.3 million construction workers, or 65 percent of the construction industry, frequently work on scaffolds. Protecting these workers from scaffold-related accidents would prevent 4,500 injuries and 50 deaths every year.
- The five most common scaffold hazards are:
  - Falls from elevation caused by slipping, unsafe access, and lack of fall protection
  - Being struck by falling tools or debris
  - Electrocution from overhead power lines
  - Scaffold collapse from instability or overloading
  - Bad planking giving way
- All employees are trained by a qualified person to recognize these hazards and how to control or minimize them.
Training must include proper identification of:
- Fall hazards.
- Falling object hazards.
- Electrical hazards.
- Proper use of the scaffold type.
- Materials handling.

- To StartSafe and StaySafe when using scaffolds, scaffolds should be constructed and guarded correctly to prevent falls.
- Falls may occur:
  - When working on unguarded scaffold platforms.
  - While climbing on or off unguarded scaffold platforms.
  - When scaffold platforms or planks fall.

- Certain OSHA standards have been put in place to prevent each type of occurrence. The standards cover employers and platform construction requirements.
- Employers must provide fall protection for each employee on a scaffold more than 10ft (3.1m) above a lower level. This protection includes guardrail systems and personal fall arrest systems. Both fall arrest systems and guardrail systems must be used when working on both single- and two-point adjustable suspension scaffolds, and self-contained adjustable scaffolds that are supported by ropes.

- Guardrail System
  - To meet OSHA standards, and to adequately protect employees, guardrails should be installed along all open sides and ends of scaffolding before use. Guardrails should have top rails and mid rails. The top rails must be between 38 inches (0.97m) and 45 inches (1.2m) tall. Mid rails must be installed approximately half way between the top rail and the platform surface.
  - When the crosspoint or cross bracing is used as a top or mid rail, different requirements apply. When the crosspoint or cross bracing is used as a top rail, it must be between 38 inches (0.97m) and 48 inches (1.3m) above the work platform. When the crosspoint or cross bracing is used as a mid rail, it must be between 20 inches (0.5 m) and 30 inches (0.8 m) above the work platform.
  - Steel or plastic banding must not be used as top rails or mid rails.

- Personal Fall Arrest Systems
  - The second element of fall prevention is a personal fall arrest systems (PFAS). This system is used to arrest an employee’s fall when working from a level. It includes harnesses, components of the harness/belt (such as D-rings), snap hooks, lifelines, and anchorage points.
  - In general, personal fall arrest systems should be used on scaffolding when there are no guard rail systems. Specific scaffolding types that need personal fall arrest systems are: boatswain’s chair, catenary, float, needle beam, ladder jack, and pump jack. A PFAS should also be used when working from the boom/basket of an aerial lift.

- When working with scaffolds, overhead falling objects, overhead power lines, scaffold collapse, and bad planking can also form hazards.
- You can be hit by falling hand tools, debris, and other small objects. To prevent this, toeboards, screens, guardrails, debris nets, catch platforms, canopy structures, or barricades should be constructed. Also, employees must wear hard hats.
When working near overhead power lines, electrocution is a serious consideration. Scaffolds shall not be erected, used, dismantled, altered, or moved such that they, or any conductive material handled on them, might come within the OSHA-approved distance to exposed and energized power lines.

The final scaffold hazard is bad planking. The single most critical scaffolding component is the lumber from which the platform planks are made.

Per OSHA standards, scaffold planking is to be scaffold-grade lumber. This type of lumber is meant to withstand forces not imposed on ordinary, construction-grade wood (which is only two-thirds the capacity of scaffold-grade). The quality of scaffold-grade lumber is measured by:

- The number of rings per inch (6 or more)
- The slope of the grain (1 inch to the side for every 16 inches along the length of the board for Douglas Fir, 1/4 for Southern Pine)
- The number of defects, such as knots and notches.

Solid sawn wood used for scaffold planks should follow the grading rules of a recognized lumber grading association or an independent lumber inspection agency. This wood can be identified by that agency or association's grade stamp.

Such organizations and their grading rules must be certified by the Board of Review of the American Lumber Standard Committee, per the U.S. Department of Commerce.

Another part of the OSHA standard is the condition of the planking. If a piece of wood has splitting, checking, notching, accumulated layers, or mudsill use, it should not be used as part of the scaffold. If a piece of wood has any of the following signs, it should not be used as part of the scaffold.

- **Split Wood**: Planks with splits (cracks that go clear through the wood) more than a few inches in length should not remain in service, as they may no longer maintain the necessary load-bearing capacity.
- **Checked Wood**: Planks with checks (cracks that are on the surface only and do not go clear through the wood) should be watched, as the checks may develop into splits over time.
- **Notched Wood**: Notches (small checks on the ends of a plank) should also be watched over time, as they can lengthen and deepen until they become splits.
- **Accumulated Layers**: Scaffold planks that have accumulated layers of paint, plaster, etc. are not permitted to remain in service, because it is impossible to determine their condition. Dangerous splits may be hidden underneath these coatings.
- **Mudsill use**: If a scaffold plank has been used as a mudsill, it should not be returned to service on a platform. Moisture from standing water, as well as point-loading from the scaffold legs, may have weakened it, making it unable to bear the weight that will be placed on it.

7. **Scaffold Construction**

- The height of a scaffold should be more than four times its minimum base dimension unless guys, ties, or braces are used. OSHA also has defined construction standards for:
  - Capacity.
  - Platform construction.
  - Access.
• OSHA scaffold capacity requirements are as follows:
  - Each scaffold and scaffold component must be able to support, without failure, its own weight plus 4 times the maximum intended load applied or transmitted or transferred to it.
  - A qualified person must design the scaffolds, which are to be loaded in accordance with that design.
  - Scaffolds and scaffold components must not be loaded in excess of their maximum intended loads or rated capacities, whichever is less.
  - Load-carrying timber members should be a minimum of 1,500 lb-f/in² construction grade lumber.

• The second point in proper construction is the scaffold platform. Each platform must be planked and decked as fully as possible with the space between the platform and uprights not more than 1 inch (2.5 cm) wide.
• The space must not exceed 9.5 inches (24.1 cm) when side brackets or odd-shaped structures result in a wider opening between the platform and the uprights.
• Each platform and walkway must be at least 18 inches (46 cm) wide and guardrails and/or personal fall arrest systems must be used within 9.5 inches along at least one side of the walkway.
• Additionally, the platform must not deflect more than 1/60 of the span when loaded and the scaffold planking must be able to support, without failure, its own weight and at least four times the intended load.
• Also, there shouldn’t be large gaps in the front edge of the platform, and each platform should overlap at least 12 inches over the supports unless they are tied down to prevent movement. The front edges of all platforms should extend at least 6 inches past a support unless they are properly guarded.
• If scaffold platforms are more than 2 feet (0.6 m) above or below a point of access, they must provide scaffold access. Scaffolds should not be accessed using crossbraces.
• Direct access is acceptable when the scaffold is not more than 14 inches (36 cm) horizontally and not more than 24 inches (61 cm) vertically from the other surfaces.
• The permitted scaffold access types are:
  - Ladders, such as portable, hook-on, attachable, or stairway ladders.
  - Stair towers.
  - Ramps and walkways.
  - Integral prefabricated frames.
  - Other scaffolds, structures, or hoists.
• Scaffolds should not be accessed using crossbraces.

8. Scaffold Workers
• When working with scaffolds, the three types of workers that are involved with identifying hazardous conditions, training employees, inspecting components, evaluating connections, designing scaffolds, and erecting and dismantling scaffolds are a competent person, a qualified person, and an engineer.
  - **A competent person**: A competent person is one who is capable of identifying existing and predictable hazards, in the surroundings or working conditions, that are unsanitary, hazardous, or dangerous to employees.
person has the authorization to take prompt corrective measures to eliminate these hazards.

- **A qualified person**: A qualified person is one who by having a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience has successfully demonstrated their ability to solve or resolve problems related to the subject matter, the work, or the project.

- **An engineer**: An engineer is a person who is a registered professional engineer who designs supported and suspension scaffolds.