



Scaffolding Safety

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Overview

Common Hazards Associated with All Scaffolds:

- 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.
- Electrocution, principally due to proximity of the scaffold to overhead power lines.

Why Is Scaffold Safety Important?

When OSHA revised its Scaffolds standard in 1996, Bureau of Labor Statistics studies showed that 25% of workers injured in scaffold accidents had received no scaffold safety training, and 77% of scaffolds were not equipped with guardrails.

OSHA estimates that informed employers and workers, in compliance with correct safety standards, can save as many as 50 lives and prevent 4,500 accidents every year.

What Is a Scaffold?

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

- Supported scaffolds, which consist of one or more platforms supported by rigid, load-bearing members, such as poles, legs, frames, outriggers, etc.
- Suspended scaffolds, which are one or more platforms suspended by ropes or other non-rigid, overhead support.
- Other scaffolds, principally manlifts, personnel hoists, etc., which are sometimes thought of as vehicles or machinery, but can be regarded as another type of supported scaffold.

Who Uses Scaffolds

Workers on scaffolds can be divided into two groups:

- Erectors/Dismantlers
- Users

Erectors/Dismantlers - Common Hazards

- Access
- Collapse
- Electrical
- Falls
- Instability
- Struck-by

Erectors and dismantlers are workers whose principal activity involves assembling and disassembling scaffolding before other work can commence, and after that work, or a portion of it, has been completed.

Training and Competent Person 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 competent person is defined as one who:

- Is capable of identifying existing and predictable hazards.
- Has authorization to take prompt corrective measures to eliminate them.

Requirements for Designing and Constructing Scaffolds:

Scaffolds must be designed by a qualified person and be constructed and loaded in accordance with that design. OSHA defines a qualified person as one who:

- Possesses a recognized degree, certificate, or professional standing.
- Has extensive knowledge, training and experience.
- Can solve or resolve problems related to the work or the project.

A qualified person must do adequate preplanning to assure the safe erection and use of the scaffold. Preplanning includes:

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

Other References:

- 29 CFR 1926.454, Training requirements. OSHA Standard.
- 29 CFR 1926.451(a)(6), General requirements. OSHA Standard.

Users**Common Hazards**

- Access
- Collapse
- Electrical
- Falls
- Struck-by

Scaffold users are those whose work requires them, at least some of the time, to be supported by scaffolding to access the area of a structure where that work is performed.

Training or Competent Person Requirements:

Employers are required by OSHA standards to have a qualified person provide training to each employee who performs work while on a scaffold. The training must enable employees to recognize the hazards associated with the type of scaffold being used and to understand the procedures to control or minimize those hazards.

OSHA defines a qualified person as one who:

- Possesses a recognized degree, certificate, or professional standing.
- Has extensive knowledge, training and experience.

Other References:

- 29 CFR 1926.454(a), Training requirements, OSHA Standard.
- 29 CFR 1926.451(f), General requirements: "Use", OSHA Standard.

Planking

According to Federal labor statistics, more scaffold accidents are attributed to planking giving way than any other cause. Additionally, almost 25% of workers receive no safety training for erecting scaffolds and installing work platforms.

The *planking* portion of OSHA's Scaffolding eTool is intended to address the need for specific and accurate information about arguably the single most critical scaffolding component: The lumber from which platforms are made.

- Lumber Grading
- Wood Condition
- Allowable Spans
- Allowable Deflection

Lumber Grading

Scaffold-grade lumber is meant to withstand forces not imposed on ordinary, construction-grade wood (which is only two-thirds the capacity of scaffold-grade). Using construction-grade lumber on a scaffold platform not only violates OSHA standards, but is also an unsafe practice and an invitation to a deadly accident.

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, $\frac{1}{14}$ 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*, and be identified by that agency or association's grade stamp (see examples below).



Grade stamp courtesy of Southern Pine Inspection Bureau

Figure 1. Grade stamp



Grade stamp courtesy of West Coast Lumber Inspection Bureau

Figure 2. 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.



Figure 3. Scaffold plank with grade stamps.

Wood Condition

As wood ages and reacts to usage, it will begin to show *checks, splits and notches*. These will vary in degree depending on the loads a plank has carried, the weather it has been exposed to, how long it has been in use, etc.



Figure 4. Split in wood plank.

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.



Figure 5. Checks in wood plank.

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.



Figure 6. Notches in wood plank.

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.



Figure 7. Accumulated layers of paint and plaster on wood plank.

Allowable Spans

The *span* of a scaffold plank is the distance it runs between supports. The longer the span, the more deflection (bend) it will have, and therefore, the less its load-bearing capacity will be. For 2 x 10 (nominal) or 2 x 9 (rough) solid sawn wood planks, allowable spans for a given load are shown in the table below:

Maximum Intended Load	Maximum Permissible Span Using Full Thickness Lumber	Maximum Permissible Span Using Nominal Thickness Lumber
25 lbs./square foot	10 feet	8 feet
50 lbs./square foot	8 feet	6 feet
75 lbs./square foot	6 feet	--

Because nominal thickness lumber is not cut to its exact dimensions, nominal 2 x 10 is really more like 1½ x 9¼. As a result, it does not have the same load-bearing capacity of full thickness lumber.

For *fabricated planks and platforms*, maximum spans are to be recommended by the manufacturer based on the following table:

Rated Load Capacity	Intended Load
Light-duty	25 lbs. per square foot applied uniformly over the entire span area
Medium-duty	50 lbs. per square foot applied uniformly over the entire span area
Heavy-duty	75 lbs. per square foot applied uniformly over the entire span area
One-person	250 lbs. placed at the center of the span (total 250 lbs.)
Two-person	250 lbs. placed 18 inches to the left and right of the center of the span (total 500 lbs.)
Three-person	250 lbs. placed at the center of the span and 250 lbs. placed 18 inches to the left and right of the center of the span (total 750 lbs.)

Allowable Deflection

To assure that scaffold planking remains within its safe load-bearing capacity, it may not be allowed to deflect more than $\frac{1}{60}$ th of its span between supports. [29 CFR 1926.451(f)(16)] The table below shows how little deflection that is.

Span of Plank Between Supports	Calculation	Maximum Permissible Deflection
10 feet	120 inches/60 inches	2 inches
7 feet	84 inches/60 inches	1½ inches
5 feet	60 inches/60 inches	1 inch

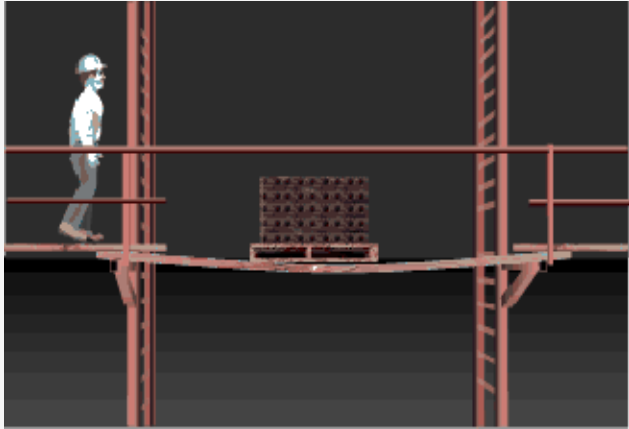
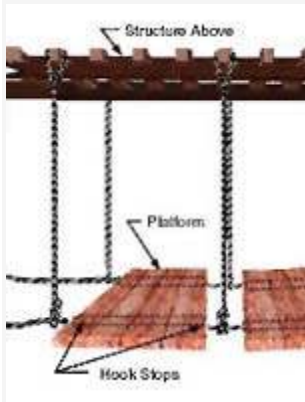


Figure 8. Animation. Illustrates the danger posed to workers by planking that has been overloaded.

Suspended Scaffolds

Suspended scaffolds are platforms suspended by ropes, or other non-rigid means, from an overhead structure. Because two-point scaffolds are the most common type of suspended scaffold, this eTool uses the Two-Point module to describe requirements that apply to all suspended scaffolds. Requirements specific to the other types are described only in their respective modules.



Catenary

Platform supported by two essentially horizontal and parallel ropes attached to structural members of a building. Additional vertical pickups may also provide support.



Float (ship)

Braced platform resting on two parallel bearers and hung from overhead supports by ropes of fixed length.



Interior Hung

Platform suspended from the ceiling or roof structure by fixed-length supports.



Multi-level

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



Multi-point Adjustable

Platform(s) suspended by more than two ropes from overhead supports and equipped with a means to permit the platform to be raised and lowered. Includes chimney hoists.



Needle Beam

A platform suspended from needle beams.



Single-point Adjustable

Platform suspended by one rope from an overhead support and equipped with a means to permit the platform to be moved to desired working levels.



Two-point (swing stage)

Platform supported by hangers (stirrups) suspended by two ropes from overhead supports and equipped with a means to permit the platform to be raised and lowered.

Supported Scaffolds Specialty and Other Scaffolds

Many scaffold types regulated by OSHA standards are rarely used, and designed for a very narrow and specific range of applications. Requirement for these specialty scaffolds are addressed on this page.

NOTE: The requirements on this page are specific only to the specialty scaffolds listed below.

- Plasterers', Decorators', and Large-Area Scaffolds
- Bricklayers' Square Scaffolds
- Horse Scaffolds
- Form Scaffolds and Carpenters' Bracket Scaffolds
- Roof Bracket Scaffolds
- Outrigger Scaffolds
- Window Jack Scaffolds
- Crawling Boards (Chicken Ladders)
- Step, Platform, and Trestle Ladder Scaffolds



Plasterer's, Decorators and Large-Area Scaffolds

General Requirements:

Scaffolds shall be constructed in accordance with the following paragraphs of this section, as appropriate [29 CFR 1926.452(d)]:

- a. Pole scaffolds
- b. Tube and coupler scaffolds
- c. Fabricated frame scaffolds

Non-mandatory Guidelines:

The guidelines for pole scaffolds, 29 CFR 1926 Subpart L Appendix A(2)(a), or tube and coupler scaffolds, 29 CFR 1926 Subpart L Appendix A(2)(b), may be applied. [29 CFR 1926 Subpart L Appendix A(2)(d)]

Bricklayers' Square Scaffold

Requirements:

- Scaffolds made of wood must be reinforced with gussets on both sides of each corner. [29 CFR 1926.452(e)(1)]
- Diagonal braces must:
 - Be installed on all sides of each square. [29 CFR 1926.452(e)(2)]
 - Be installed between squares on the rear and front sides of the scaffold.
 - Extend from the bottom of each square to the top of the next square. [29 CFR 1926.452(e)(3)]
- Scaffolds must [29 CFR 1926.452(e)(4)]:
 - Be constructed and arranged so that one square rests directly above the other.
 - Not exceed three tiers in height.
- The upper tiers must [29 CFR 1926.452(e)(4)]:
 - Stand on a continuous row of planks laid across the next lower tier.
 - Be nailed down or otherwise secured to prevent displacement.

Non-mandatory Guidelines:

Maximum Intended Load	50 pounds/foot ² [†]
Maximum Width	5 feet
Maximum Height	5 feet
Gussets	1 x 6 inches
Braces	1 x 8 inches
Legs	2 x 6 inches
Bearers (horizontal members)	2 x 6 inches

[†] The squares shall be set not more than 8 feet apart for light duty scaffolds and not more than 5 feet apart for medium duty scaffolds. [29 CFR 1926 Subpart L Appendix A (2)(e)]

Horse Scaffolds



Horse Scaffold

General Requirements:

- Scaffolds must not be more than 10 feet or two tiers in height, whichever is less. [29 CFR 1926.452(f)(1)]
- When horses are arranged in tiers:
 - Each horse must be placed directly over the horse in the tier below. [29 CFR 1926.452(f)(2)]
 - The legs of each horse must be nailed down or otherwise secured to prevent displacement. [29 CFR 1926.452(f)(3)]
 - Each tier must be crossbraced. [29 CFR 1926.452(f)(4)]

Non-mandatory Guidelines:

Maximum Intended Load (light duty)	25 pounds/foot ² †
Maximum Intended Load (medium duty)	50 pounds/foot ² †
Bearers (light duty)	2 x 4 inches
Bearers (medium duty)	3 x 4 inches
Legs	2 x 4 inches
Longitudinal Bracing Between Legs	1 x 6 inches
Gusset Braces at Top of Legs	1 x 8 inches
Half Diagonal Braces	2 x 4 inches

† Horses shall be spaced not more than 8 feet apart for light-duty loads, and not more than 5 feet apart for medium-duty loads. [29 CFR 1926 Subpart L Appendix A (2)(f)]

Form Scaffolds and Carpenters' Bracket Scaffold

General Requirements:

- Each bracket, except those for wooden bracket-form scaffolds, must be attached to the supporting framework or structure by one or more of the following [29 CFR 1926.452(g)(1)]:
 - Nails
 - A metal stud attachment device
 - Welding
 - Hooking over a secured structural supporting member, with the form wales either:
 - Bolted to the form
 - Or secured by snap ties or tie bolts extending through the form.
 - Securely anchored
 - Or (for carpenters' bracket scaffolds only) by a bolt extending through to the opposite side of the structure's wall.
- Wooden bracket-form scaffolds must be an integral part of the form panel. [29 CFR 1926.452(g)(2)]
- Folding-type metal brackets, when extended for use, must be either [29 CFR 1926.452(g)(3)]:
 - Bolted
 - Secured with a locking-type pin

Non-mandatory Guidelines:

- Brackets are triangular-shaped frames made of either [29 CFR 1926 Subpart L Appendix A (2)(g)(1)]:
 - Wood with a cross-section not less than 2 x 3 inches.
 - Or structural angle iron measuring 1¼ inch x 1¼ inch x ¼ inch.
- Bolts used to attach brackets to structures must not be less than ⅝ inch in diameter. [29 CFR 1926 Subpart L Appendix A (2)(g)(2)]
- Maximum bracket spacing is 8 feet on centers. [29 CFR 1926 Subpart L Appendix A (2)(g)(3)]
- No more than two employees may occupy any given 8 feet of a bracket or form scaffold at any one time. [29 CFR 1926 Subpart L Appendix A (2)(g)(4)]
- Tools and materials may not exceed 75 pounds in addition to the employees. [29 CFR 1926 Subpart L Appendix A (2)(g)(4)]

Wooden Figure-Four Scaffolds

[29 CFR 1926 Subpart L Appendix A (2)(g)(5)]

Maximum Intended Load	25 pounds/foot ²
Uprights	2 x 4 inches or 2 x 6 inches
Bearers (two)	1 x 6 inches
Braces	1 x 6 inches
Maximum Length of Bearers (unsupported)	3 feet 6 inches

- Outrigger bearers shall consist of two pieces of 1 x 6 inch lumber nailed on opposite sides of the vertical support. [29 CFR 1926 Subpart L Appendix A (2)(g)(5)(i)]

- Bearers for wooden figure-four scaffolds must [29 CFR 1926 Subpart L Appendix A (2)(g)(5)(ii)]:
 - Be braced and secured to prevent tipping or turning.
 - Not project more than 3 feet 6 inches from the outside of the form support.
- The knee or angle brace must:
 - Intersect the bearer at least 3 feet from the form.
 - Be at approximately a 45° angle.
- The lower end of the knee or angle brace must be nailed to a vertical support. [29 CFR 1926 Subpart L Appendix A (2)(g)(5)(ii)]

Metal Bracket Scaffolds

[29 CFR 1926 Subpart L Appendix A (2)(g)(6)]

Maximum Intended Load	25 pounds/foot ²
Uprights	2 x 4 inches
Bearers	As designed
Braces	As designed

Wooden Bracket Scaffolds

[29 CFR 1926 Subpart L Appendix A (2)(g)(7)]

Maximum Intended Load	25 pounds/foot ²
Uprights	2 x 4 inches or 2 x 6 inches
Bearers	2 x 6 inches
Maximum Scaffold Width	3 feet 6 inches
Braces	1 x 6 inches

Roof Bracket Scaffold

General Requirements:

- Scaffold brackets must be constructed to [29 CFR 1926.452(h)(1)]:
 - Fit the pitch of the roof.
 - Provide a level of support for the platform.
- Brackets must be anchored in place by nails unless it is impractical to use nails. [29 CFR 1926.452(h)(2)]
- When nails are not used, brackets must be secured with first-grade manila rope of at least ¾-inch diameter, or equivalent. [29 CFR 1926.452(h)(2)]

Outrigger Scaffold

General Requirements:

- Outrigger beams must be [29 CFR 1926.452(i)(4)]:
 - Secured in place to prevent movement.
 - Securely braced at the fulcrum point to prevent tipping.
- The inboard end of outrigger beams must be:

- Not less than 1½ times the length of the outboard end, measured from the fulcrum point to the extreme anchorage point. [29 CFR 1926.452(i)(1)]
- Securely anchored either by [29 CFR 1926.452(i)(5)]:
 - Braced struts bearing against sills in contact with the overhead beams or ceiling.
 - Tension members secured to the floor joists underfoot.
 - Or both
- The fulcrum point of outrigger beams must rest on secure bearings at least 6 inches in each horizontal dimension. [29 CFR 1926.452(i)(3)]
- Outrigger beams fabricated in the shape of an I-beam or channel beam must be placed so that the web section is vertical. [29 CFR 1926.452(i)(2)]
- The entire supporting structure must be securely braced to prevent any horizontal movement. [29 CFR 1926.452(i)(6)]
- To prevent their displacement, platform units must be [29 CFR 1926.452(i)(7)]:
 - Nailed
 - Bolted or
 - Otherwise secured to outriggers
- Scaffolds and scaffold components must be [29 CFR 1926.452(i)(8)]:
 - Designed by a registered professional engineer.
 - Constructed and loaded in accordance with that design.

Window Jack Scaffold

General Requirements:

- Scaffolds must be securely attached to the window opening. [29 CFR 1926.452(l)(1)]
- Scaffolds must be used only for working at the window opening through which the jack is placed. [29 CFR 1926.452(l)(2)]
- Window jacks must not be used to support planks or other elements of scaffolding placed between one window jack and another. [29 CFR 1926.452(l)(3)]

Non-mandatory Guidelines:

- Not more than one employee at a time may occupy a window jack scaffold. [29 CFR 1926 Subpart L Appendix A (2)(l)]

Crawling Boards (Chicken Ladders)

General Requirements:

- Crawling boards must extend from the roof peak to the eaves when used in roof construction, repair, or maintenance. [29 CFR 1926.452(m)(1)]
- Crawling boards must be secured to the roof by [29 CFR 1926.452(m)(2)]:
 - Ridge hooks
 - Or by means that provide equivalent strength and durability.

Non-mandatory Requirements:

- Crawling boards must be not less than 10 inches wide and 1 inch thick. [29 CFR 1926 Subpart L Appendix A (2)(m)]
- Cleats on crawling boards must [29 CFR 1926 Subpart L Appendix A (2)(m)]:
 - Be equal in length to the width of the board.
 - Be spaced at equal intervals not to exceed 24 inches.
 - Have a minimum cross-sectional area of 1 x 1½ inches.

Step, Platform, and Trestle Ladder Scaffold**General Requirements:**

- Scaffold platforms must be placed no higher than the second-highest rung or step of the ladder supporting the platform. [29 CFR 1926.452(n)(1)]
- All ladders used in step, platform and trestle ladder scaffolds must:
 - Meet the requirements of 29 CFR 1926 Subpart X (Stairways and Ladders), except that job-made ladders are not permitted. [29 CFR 1926.452(n)(2)]
 - Be prevented from slipping by how they are [29 CFR 1926.452(n)(3)]:
 - Placed
 - Fastened
 - Or equipped
- Scaffolds must not be bridged one to another. [29 CFR 1926.452(n)(4)]