



Stairway and Ladder Safety

Stairways and ladders are a major source of injuries and fatalities among workers. OSHA estimates there are as many as 36 fatalities per year due to falls from stairways and ladders used in construction. This course is designed to provide both employers and employees with the knowledge needed to work safely on stairways and ladders.

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OSHAcademy Course 603 Study Guide

Stairway and Ladder Safety

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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 603.

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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Course Introduction

Stairways and ladders are a major source of injuries and fatalities among workers.

According to the Bureau of Labor and Statistics (2012), 14 percent of all work-related deaths are due to falls, with 20 percent of these deaths being related to the use of ladders. The Occupational Safety and Health Administration (OSHA) estimates there are more than 24,000 injuries and as many as 36 fatalities per year due to falls from stairways and ladders used in construction. Nearly half of these fall-related injuries are serious enough to require time off the job. These statistics are a sobering reminder of the dangers faced when work on or around ladders and stairways. More importantly, most, if not all, of these injuries and deaths could have been prevented.

The Ladder Standard

Let's take a look at the standard. OSHA Standard 29 CFR 1926.1053 was written for the construction industry, but the standard should be applied to all ladder use, regardless of the industry. Here are some of the general requirements of the standard that apply to all ladders, regardless of type:

-) Maintain ladders free of oil, grease and other slipping hazards.
-) Do not load ladders beyond their maximum intended load nor beyond their manufacturer's rated capacity.
-) Use ladders only for their designed purpose.
-) Use ladders only on stable and level surfaces unless secured to prevent accidental movement.
-) Do not use ladders on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental movement. Do not use slip-resistant feet as a substitute for exercising care when placing, lashing or holding a ladder upon slippery surfaces.
-) Secure ladders placed in areas such as passageways, doorways or driveways, or where they can be displaced by workplace activities or traffic to prevent accidental movement. Or use a barricade to keep traffic or activity away from the ladder.
-) Keep areas clear around the top and bottom of ladders.
-) Do not move, shift or extend ladders while in use.

-) Use ladders equipped with nonconductive side rails if the worker or the ladder could contact exposed energized electrical equipment.
-) Face the ladder when moving up or down.
-) Use at least one hand to grasp the ladder when climbing.
-) Do not carry objects or loads that could cause loss of balance and falling. When there are more than two points of access between levels, at least one point of access must be kept clear.
-) All stairway and ladder fall protection systems required by these rules must be installed and all duties required by the stairway and ladder rules must be performed before employees begin work that requires them to use stairways or ladders and their respective fall protection systems.

Here is the full OSHA standard for ladders and stairways:

https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10839

This course is designed to provide both employers and employees with the knowledge needed to work safely on stairways and ladders.

Module 1: Types of Ladders

Introduction

Ladders are often the first tool we choose when working at elevation. This may explain why more workers are injured in falls from ladders than from any other elevated surface - roofs, scaffolds, balconies, even stairs. Why do workers fall from ladders?

Most falls happen because workers select the wrong type of ladder for their job or they set up the ladder improperly and the ladder shifts or slips unexpectedly. Workers also fall when they're not working safely on the ladder - their foot slips, they lose their balance, they overreach, or something knocks the ladder over.

Scenario

A construction worker was removing aluminum siding while standing on an aluminum ladder on the west side of a house he and his two coworkers were remodeling. The ladder was positioned over a cyclone gate and fence of a neighboring home. It appears that while he was removing the siding, he lost his balance and fell. One of his coworkers heard the victim moan, and found his coworker's midsection folded over the gate. The victim's head and legs were not touching the ground. The ladder he was working from was standing against the house, still positioned over the gate. The victim rolled off the gate and landed on the ground. A neighbor heard the calls for help and called 911. The victim was transported to a local hospital where he was declared dead.

Investigation Findings

1. The ladder was not placed at a safe angle.
2. The ladder used did not have safety feet nor was the ladder secured.
3. It appeared that the gate was being used to help support the ladder. The moveable gate was not secured against movement.

Ask these questions before deciding on a ladder:

-) Will heavy items be held while on the ladder?
-) Does the elevated area require a long ladder that can be unstable?
-) Will work be performed at this height over an extended period of time?

-) Will working on a ladder require standing sideways or reaching?
-) Are there any obstructions preventing safe ladder use?

If the answer to any of these questions is “Yes,” then you may need to consider using something other than a ladder. If possible, bring in other equipment such as a scissor lift or scaffolding.

Portable Ladders

Portable ladders help you access a work area or provide support while you work. Portable ladders make getting to a work area easy, but they can increase the potential for falls if not used properly.

Portable ladders are versatile, economical, and easy to use. However, workers sometimes use them without thinking safety. The Bureau of Labor and Statistics reports that 20 percent of fatal falls at work occur from heights less than 15 feet (4.5 m), and 50 percent of fatal falls are from a height less than 35 feet (10.6 m).

Here are some OSHA requirements for using portable ladders:

-) The minimum clear distance between side rails for all portable ladders must be 11.5 inches (29 cm).
-) The rungs and steps of portable metal ladders must be corrugated, knurled, dimpled, coated with skid-resistant material or treated to minimize slipping.
-) Non-self-supporting and self-supporting portable ladders must support at least four times the maximum intended load; extra heavy-duty type 1A metal or plastic ladders must sustain 3.3 times the maximum intended load.
-) When portable ladders are used for access to an upper landing surface, the side rails must extend at least 3 feet (.9 m) above the upper landing surface. When such an extension is not possible, the ladder must be secured and a grasping device such as a grab rail must be provided to assist workers in mounting and dismounting the ladder.
-) A ladder extension must not deflect under a load that would cause the ladder to slip off its supports.

Types of Portable Ladders

We use ladders to do all sorts of tasks, so it's not surprising that many types of ladders are available. Let's look at the most common types.



Straight Ladder: The most common type of portable ladder. The length cannot exceed 30 feet. It is available in wood, metal and reinforced fiberglass. It supports only one worker.



Platform Ladder: It has a large stable platform near the top that supports only one worker. The length cannot exceed 20 feet.



Extension Ladder: Offers the most length in a general-purpose ladder. They have two or more adjustable sections. The sliding upper section must be on top of the lower section. It is made of wood, metal, or fiberglass. Maximum length depends on material and it supports only one worker.



Trestle Ladder: These have two sections that are hinged at the top and form equal angles with the base. They are used in pairs to support planks or staging. The rungs are not used as steps. The length cannot exceed 20 feet.



Tripod (Orchard) Ladder: These have a flared base and a single back leg that provides support on soft, uneven ground. The length cannot exceed 16 feet. Metal and reinforced fiberglass versions are available. It supports only one worker.



Double-Cleated Ladder: Use a double-cleated ladder with a center rail when ladders are the only way to enter or exit a working area that has more than 25 employees. You can also use this type of ladder to serve as simultaneous two-way traffic.



Standard Folding Ladder: Has flat steps, a hinged back and is not adjustable. Use only on firm, level surfaces. It is available in metal, wood, or reinforced fiberglass. It must have a metal spreader or locking arm and cannot exceed 20 feet. It only supports one worker.

It's important to choose the right ladder for the right job. Using a ladder for a task that it was not designed for may increase the risk of falling.

Check, Maintain and Store Ladders Well

Before using a ladder, a competent person must inspect the ladder for visible defects, such as broken or missing rungs. If a defective ladder is found, it must be immediately marked with a defective sign or clearly labeled with a "Do Not Use" sign. It should then be taken from service until it is completely repaired.

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. According to the Bureau of Labor and Statistics, what percentage of fatal falls occurred in heights less than 35 feet?**
 - a. 35%
 - b. 50%
 - c. 75%
 - d. 20%

- 2. Non-self-supporting and self-supporting ladders must support at least _____ times the maximum intended load.**
 - a. 5
 - b. 4
 - c. 3
 - d. 6

- 3. The length of a straight ladder cannot exceed 20 feet.**
 - a. true
 - b. false

- 4. Which type of ladder should be used when workers need to enter and exit the working area at the same time?**
 - a. double-cleated ladder
 - b. tripod ladder
 - c. extension Ladder
 - d. standard Folding Ladder

- 5. When portable ladders are used for access to an upper landing surface, the side rails must extend at least _____ above the upper landing surface.**
- a. 2 feet
 - b. 3 feet
 - c. 4 feet
 - d. 5 feet

Module 2: General Requirements – Ladders

Introduction

Falls from portable ladders are one of the leading causes of occupational fatalities and injuries. Before using a ladder, read and follow all the labels and markings on the ladder. Make sure you avoid electrical hazards and look for overhead power lines before handling a ladder. Also, avoid using a metal ladder near power lines or exposed energized electrical equipment.

Here are some other general requirements:

-) Ladders must also be kept in a safe condition.
-) Keep the area around the top and bottom of a ladder clear.
-) Ensure rungs, cleats, and steps are level and uniformly spaced.
-) Use ladders only for their designated purpose.
-) Don't tie ladders together to make longer sections.
-) Don't use single rail ladders.
-) Don't load ladders beyond the maximum load for which they were built.

Securing Ladders

There is a significant risk of falling if portable ladders are not safely positioned each time they are used. Unsecured ladders can slip or shift due to the weight load or lack of friction between the ladder and contact points. It is very easy to lose your balance while getting on or off an unsteady ladder. Be sure to evaluate the situation; do not use a ladder on slippery surfaces unless it is secured or has slip-resistant feet.

Inspecting Ladders

It is important to inspect any ladder before it is put into use. If the ladder is damaged in any way, it must be removed from service and tagged until it is either repaired or thrown away.

Scenario

On August 3, 2010 a 23-year-old male laborer was electrocuted and two co-workers were severely shocked when the 32-foot aluminum ladder that was part of a ladder platform hoist came in contact with energized overhead power lines.

The victim and the two co-workers were in the process of raising the ladder from a horizontal position on the ground to a vertical position against a building. While raising the ladder to the vertical position, the workers lost their footing and the ladder fell towards and came in contact with energized overhead power lines. Two co-workers were shocked and thrown to the ground.

The victim was electrocuted and the ladder fell to the ground landing on top of him. Once the two co-workers regained mobility, they went to assist the victim. One of the coworkers placed a call for emergency medical services (EMS) and then placed a second call to the employer.

The local police arrived followed by EMS within minutes of the call. The victim was transported to a local hospital where he was pronounced dead.

Recommendations:

-) Eliminate the use of conductive tools and equipment, including ladders, in proximity to energized overhead power lines
-) Conduct job site surveys prior to the start of construction projects to identify potential hazards, such as energized overhead power lines, and implement appropriate control measures for these hazards.

Three-Point-Control vs. Three-Point-Contact

Three-Point-Contact

What is the difference between the three-point control method and the three-point contact method? The three-point control method requires a worker to use 3 limbs for reliable, stable support, while the three-point contact method requires a worker only depend upon 3 points of contact with the ladder. Using the stomach or palm are examples of unstable points of contact; these points of contact are unreliable and lead to a false sense of stability.

Though some argue leaning against a surface is acceptable as a point of contact, there is a significant problem with this assumption. For example, if a worker has both feet on a ladder while resting one palm on the roof (three-point contact) they will not be able to prevent a fall if both feet were to slip.

Because the three-point contact method does not require reliable, stable support, it is not the preferred method to use when on a ladder.

Three-Point-Control

On the other hand, the three-point-control method requires a worker to use three of his or her four limbs for reliable, stable support. This climbing strategy could prevent many of the ladder falls and deaths occurring throughout the United States and world. The three-point control method requires the worker to place his hand on the ladder in a way to support the full weight of the body if needed in an emergency. The breakaway force from a vertical rail is too great for a worker, male or female, to fully support their weight if only gripping with one hand. During a fall, the hand would slide down the bar until it contacts a rung on the ladder. The hand would most likely disconnect from the ladder when it collides with the rung. A vertical grip can only support approximately 50 percent of person's bodyweight.

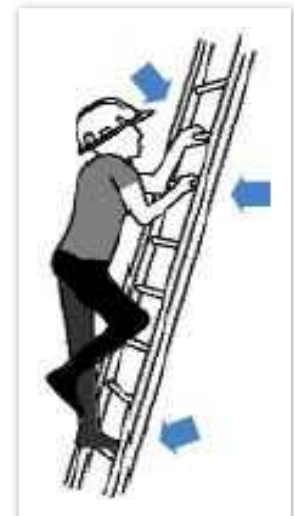
If a worker, using the three-point control method, has both feet on the ladder and is gripping a horizontal rung (three-point control), they are much less likely to fall if both of their feet were to slip. When a worker uses a horizontal grip, it allows for about a 75 percent to 94 percent increase in breakaway force. This compares to using a vertical grip, which allows the worker to hold their bodyweight and prevent a fall.

There are seven conditions for using three-point control while working from ladders. They include:

1. Work only for short periods of time
2. Use light tools and materials designed for single-hand use
3. Make sure the ladder is stabilized
4. Keep the ladder at the lowest height possible



NIOSH Interactive Ladder Safety Application for Smartphones



3-Point-Contact

5. Make sure belly button remains between side rails
6. Keep both feet at the same level
7. Maintain a horizontal one-hand grip (power grip).

Keeping three-point-control for good support is critical while a worker is climbing, moving or working at an elevation.

It is important to note, the three-point control method is not a substitution for the use of fall protection equipment.

Ladder Angle

A non-self-supporting ladder should have a set-up angle of about 75 degrees — a 4:1 ratio of the ladder's working length to set-back distance.

Here's how to achieve it: Stand at the base of the ladder with your toes touching the rails. Extend your arms straight out in front of you. If the tips of your finger just touch the rung nearest your shoulder level, the angle of your ladder has a 4:1 ratio.

The National Institute for Occupational Safety and Health (NIOSH) has developed an easy-to-use interactive ladder safety application for smart phones. The NIOSH Ladder Safety application features a multimodal indicator, which uses visual and sound signals to assist the user in positioning an extension ladder at an optimal angle. Furthermore, the application provides graphic-oriented interactive reference materials, safety guidelines and checklists for extension ladder selection, inspection, accessorizing, and use. The application is intended to help a wide range of ladder users, employers, and safety professionals, with their ladder-related safety needs.

Here is a link to download the phone application:

Android: <http://www.cdc.gov/niosh/topics/falls/AndroidLadderSafetyUsersManual.html>

Apple iOS: <http://www.cdc.gov/niosh/topics/falls/iOSLadderSafetyUsersManual.html>

Scenario

On January 13, 2007, a 43-year-old male carpenter was injured when he fell from a ladder that slipped away from the drip edge of a house. The victim positioned the fiberglass extension ladder diagonally across the inside corner of the roof to secure a 2-inch by 4-inch piece of wood to the fascia under the drip edge to protect the drip edge. The ladder's safety feet were in an up position on the frozen soil. He called to his coworker to hold the ladder while he accessed the roof area. The coworker stood underneath the ladder and held rung #5 with his right hand and rung #7 with his left hand. The victim climbed the ladder holding the wood, to either rung #8 or #9 when the base of the ladder slipped away from the house. The falling ladder struck the coworker on his shoulder and arm and knocked him to the ground. The decedent fell to the coworker's left and landed on his back. Emergency crews transported the victim to the hospital where he died six days later.



Recommendations:

-) Employers should ensure that ladders are used in accordance with the requirements of existing safety standards and good standard practice.
-) Employers should develop and implement a comprehensive written safety program.
-) Construction employers should conduct a daily hazard assessment to determine if environmental working conditions have changed or will change. They should inform their employees of their findings and how the changing conditions may affect the work to be performed.
-) Employers should consider having at least one person on the jobsite certified in First Aid/CPR, should strongly consider having an individual certified as a Medical First Responder or Emergency Medical Technician (EMT), and hold at least semi-annual workplace rescue/first aid practices.

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. **You can use a metal ladder around power lines or exposed energized electrical equipment.**
 - a. True, but **ONLY** if there isn't any other option to get the work done.
 - b. False, you should NEVER use a metal ladder in this circumstance.

2. **The following is a component of the 3-point-control method:**
 - a. requires a worker to use three limbs for reliable and stable support
 - b. requires a worker only depend on three points of contact with the ladder
 - c. requires the worker to place his hand on the ladder to support the full weight of the body
 - d. both (a) and (c)

3. **A non-self-supporting ladder should have a set-up angle of about 60 degrees.**
 - a. true
 - b. false

4. **A non-self-supporting ladder should be set-up at a 4:1 angle.**
 - a. true
 - b. false

5. **Which choice below is a condition for using three-point control while working from ladders?**
 - a. keep both feet at the same level
 - b. keep feet on different rungs of the ladder
 - c. maintain a **vertical** one-handed grip
 - d. all of the above

Module 3: General Requirements – Stairways

Introduction

The rules covering stairways depend on how and when the stairs are used. For example, there are requirements for stairs used during construction and stairs used temporarily during construction.

Stairways Used During Construction

The following requirements apply to all stairways used during construction:

-) Stairways that will not be a permanent part of the structure on which construction work is performed must have landings at least 30 inches deep and 22 inches wide (76 x 56 cm) at every 12 feet (3.7 m) or less of vertical rise.
-) Stairways must be installed at least 30 degrees, and no more than 50 degrees, from the horizontal.
-) Variations in riser height or stair tread depth must not exceed 1/4 inch in any stairway system, including any foundation structure used as one or more treads of the stairs.
-) Where doors or gates open directly onto a stairway, a platform must be provided that is at least 20 inches (51 cm) in width beyond the swing of the door.
-) Metal pan landings and metal pan treads must be secured in place before filling.
-) All stairway parts must be free of dangerous projections such as protruding nails.
-) Slippery conditions on stairways must be corrected.
-) Spiral stairways that will not be a permanent part of the structure may not be used by workers.

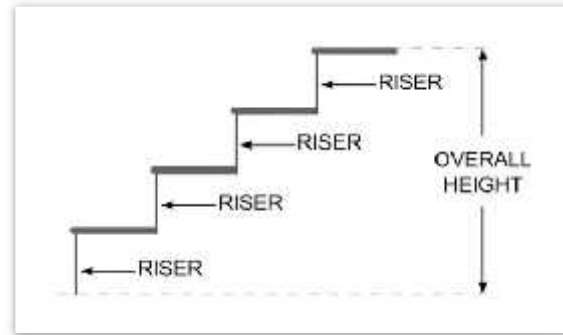
Temporary Stairways Used During Construction

The following requirements apply to all temporary stairways used during construction:

-) Except during construction of the actual stairway, stairways with metal pan landings and treads must not be used where the treads and/or landings have not been filled in with concrete or other material, unless the pans of the stairs and/or landings are temporarily

filled in with wood or other material. All treads and landings must be replaced when worn below the top edge of the pan.

-) Except during construction of the actual stairway, skeleton metal frame structures and steps must not be used (where treads and/or landings are to be installed at a later date) unless the stairs are fitted with secured temporary treads and landings.



Count the total number of risers (vertical distance) on the stairway to determine if a stair rail is required.

-) Temporary treads must be made of wood or other solid material and installed the full width and depth of the stair.

Stair Rail Requirements

The following general requirements apply to all stair rails:

-) Stairways with four or more risers or rising more than 30 inches (76 cm) in height— whichever is less— stair rails must be installed along each unprotected side or edge. When the top edge of a stair rail system also serves as a handrail, the height of the top edge must be no more than 37 inches (94 cm) nor less than 36 inches (91.5 cm) from the upper surface of the stair rail to the surface of the tread.
-) Stair rails installed after March 15, 1991, must not be less than 36 inches (91.5 cm) in height.
-) Top edges of stair rail systems used as handrails must not be more than 37 inches (94 cm) high nor less than 36 inches (91.5 cm) from the upper surface of the stair rail system to the surface of the tread. (If installed before March 15, 1991, not less than 30 inches [76 cm]).
-) Stair rail systems and handrails must be surfaced to prevent injuries such as punctures or lacerations and to keep clothing from snagging.
-) Ends of stair rail systems and handrails must be built to prevent dangerous projections, such as rails protruding beyond the end posts of the system.

In addition,

-)] Unprotected sides and edges of stairway landings must have standard 42-inch (1.1 m) guardrail systems.
-)] Intermediate vertical members, such as balusters used as guardrails, must not be more than 19 inches (48 cm) apart.
-)] Other intermediate structural members, when used, must be installed so that no openings are more than 19 inches (48 cm) wide.

Handrail Requirements

Requirements for handrails are as follows:

-)] Handrails and top rails of the stair rail systems must be able to withstand, without failure, at least 200 pounds (890 n) of weight applied within 2 inches (5 cm) of the top edge in any downward or outward direction, at any point along the top edge.
-)] Handrails must not be more than 37 inches (94 cm) high nor less than 30 inches (76 cm) from the upper surface of the handrail to the surface of the tread.
-)] Handrails must provide an adequate handhold for employees to grasp to prevent falls.
-)] Temporary handrails must have a minimum clearance of 3 inches (8 cm) between the handrail and walls, stair rail systems and other objects.
-)] Stairways with four or more risers or that rise more than 30 inches (76 cm) in height—whichever is less—must have at least one handrail.
-)] Winding or spiral stairways must have a handrail to prevent use of areas where the tread width is less than 6 inches (15 cm).

Mid Rail Requirements

Mid rails, screens, mesh, intermediate vertical members or equivalent intermediate structural members must be provided between the top rail and stairway steps to the stair rail system. When mid rails are used, they must be located midway between the top of the stair rail system and the stairway steps.

Stairs and 3-Point Control

Applying three-point control to stairs requires two continuous handrails to allow a constant grip while moving up and down the stairway. Arms and hands should be free of materials, enabling them to support the full body weight if necessary. Stairs, such as those found on ships, can be very steep and present a serious fall hazard.

Let's get to your final module quiz! Also, there is a glossary of terms following the quiz!

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. **Stairways must be installed at LEAST _____ degrees.**
 - a. 20
 - b. 50
 - c. 30
 - d. 10

2. **Stairways that have four or more risers MUST have a stair rail.**
 - a. false
 - b. true

3. **Handrails must be able to withstand, without failure, how many pounds of weight applied with 2 inches of the top edge in any downward or outward direction?**
 - a. 300
 - b. 250
 - c. 200
 - d. 175

4. **Stair rails installed after March 15th, 1991 must not be less than _____ in height.**
 - a. 30 inches
 - b. 33 inches
 - c. 36 inches
 - d. 38 inches

5. **Stairways must be installed at no more than _____ from the horizontal.**
 - a. 40 degrees
 - b. 45 degrees
 - c. 50 degrees
 - d. 55 degrees

Glossary

Cleat — a ladder crosspiece of rectangular cross section placed on edge upon which a person may step while ascending or descending a ladder.

Double-cleat ladder — a ladder with a center rail to allow simultaneous two-way traffic for employees ascending or descending.

Failure — Load refusal, breakage or separation of components.

Fixed ladder — a ladder that cannot be readily moved or carried because it is an integral part of a building or structure.

Handrail — a rail used to provide employees with a handhold for support.

Job-made ladder — a ladder that is fabricated by employees, typically at the construction site; non-commercially manufactured.

Load refusal — the point where the structural members lose their ability to carry the load.

Point of access — all areas used by employees for work-related passage from one area or level to another.

Portable ladder — a ladder that can be readily moved or carried.

Riser height — the vertical distance from the top of a tread or platform/landing to the top of the next higher tread or platform/landing.

Side-step fixed ladder — a fixed ladder that requires a person to get off at the top to step to the side of the ladder side rails to reach the landing.

Single-cleat ladder — a ladder consisting of a pair of side rails connected together by cleats, rungs or steps.

Stair rail system — a vertical barrier erected along the unprotected sides and edges of a stairway to prevent employees from falling to lower levels.

Temporary service stairway — a stairway where permanent treads and/or landings are to be filled in at a later date.

Tread depth — the horizontal distance from front to back of a tread, excluding nosing, if any.