

Fall Protection Guidelines in Construction

A Publication Provided by:



**HEALTH AND SAFETY
CONSULTATION PROGRAM**
COLORADO STATE UNIVERSITY

1681 Campus Delivery
Fort Collins, CO 80523
(970) 491-6151
email: ohss@colostate.edu
web: <http://osha.colostate.edu>

INTRODUCTION

In the construction industry within the U.S., falls are the leading cause of worker fatalities. Each year, on average, between 150 and 200 workers are killed and more than 100,000 are injured as a result of falls at construction sites.

OSHA has recognized this high probability for serious injuries due to falls and has implemented a comprehensive regulation to help reduce fall hazards. This regulation is 29 CFR 1926.501 thru 503 (Fall Protection).

This informational booklet is intended to provide a generic, non-exhaustive overview of

the fall protection regulations. This publication does not alter or determine compliance responsibilities, which are set forth in the OSHA Standards themselves.

WHAT DOES THE FALL PROTECTION STANDARD COVER ?

The fall protection standard covers most construction workers except those inspecting, investigating, or assessing workplace conditions prior to the actual start of work or after all work has been completed.

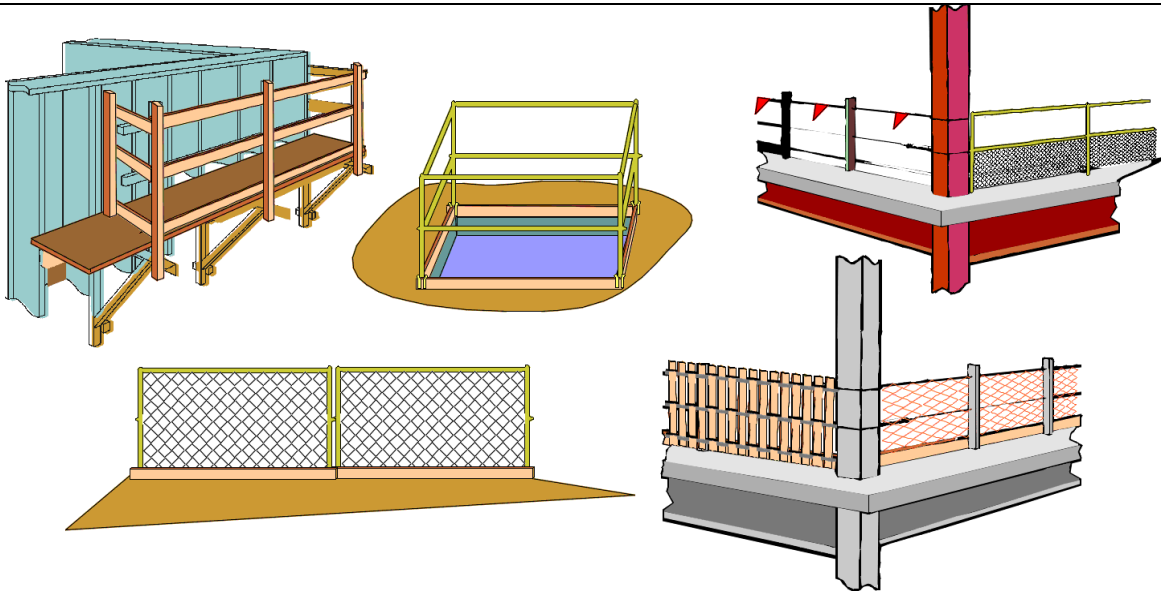
The standard identifies areas or activities where fall protection is needed. These include, but are not limited to; ramps, runways, excavations, hoist areas, holes, formwork, leading edge work, unprotected sides and edges, overhead bricklaying, roofing work, pre-cast concrete erection, wall openings, residential construction, and other elevated walking/working surfaces.

The fall protection standard sets a uniform threshold height of six (6) feet, thereby providing consistent protection. This means that construction employers must protect their employees from fall hazards whenever an affected employee is six (6) feet or more above a lower level.

Under the fall protection standard, employers are able to select fall protection measures best suited for the type of work being performed. Fall protection generally can be provided through the use of:

- guardrail systems,
- safety net systems,
- personal fall arrest systems,
- positioning device systems, and
- warning line systems.

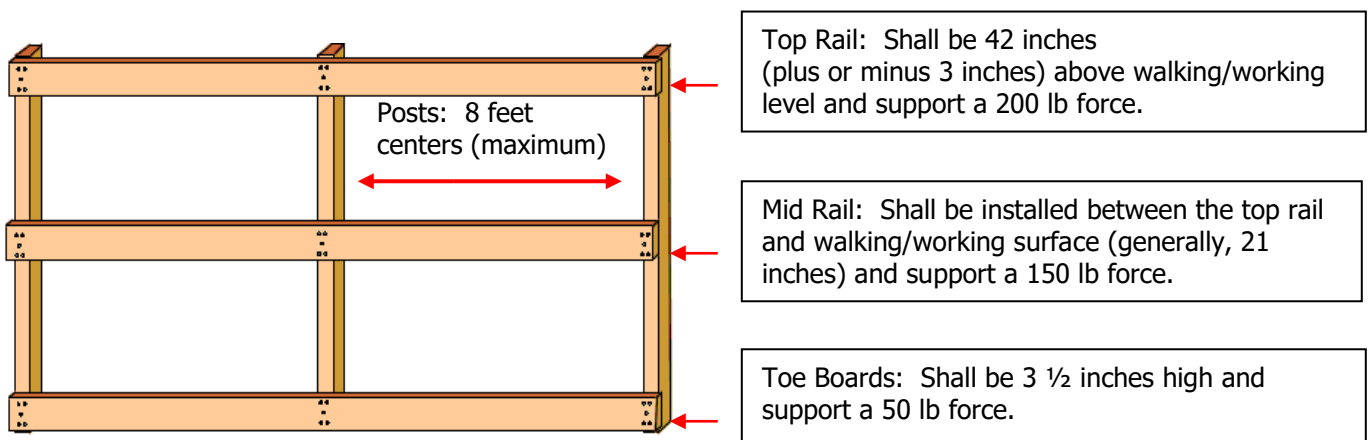
GUARDRAIL SYSTEMS



Guardrail Requirements

If the employer chooses to use guardrail systems to protect workers from falls, the systems must meet the following criteria:

- The top edge height of top rails or guardrails must be 42 inches (plus or minus 3 inches) above the walking/working level. When workers are using stilts, the top edge height of the top rail or guardrail must be increased an amount equal to the height of the stilts.
- Mid rails, screens, mesh, intermediate vertical members, or equivalent intermediate structural members shall be installed between the top edge of the guardrail system and the walking/working surface when there is no wall or parapet wall at least 21 inches high.
 - Mid rails, when used, shall be installed at a height midway between the top edge of the guardrail system and the walking/working level.
 - Screens and mesh, if used in place of mid rails, shall extend from the top rail to the walking/working level and along the entire opening between top rail supports.



Guardrail systems shall be capable of withstanding, without failure, a force of at least 200 pounds applied within 2 inches of the top edge in any outward or downward direction along any point along the top edge. The following are guidelines for designing guardrail systems which will meet the requirements:

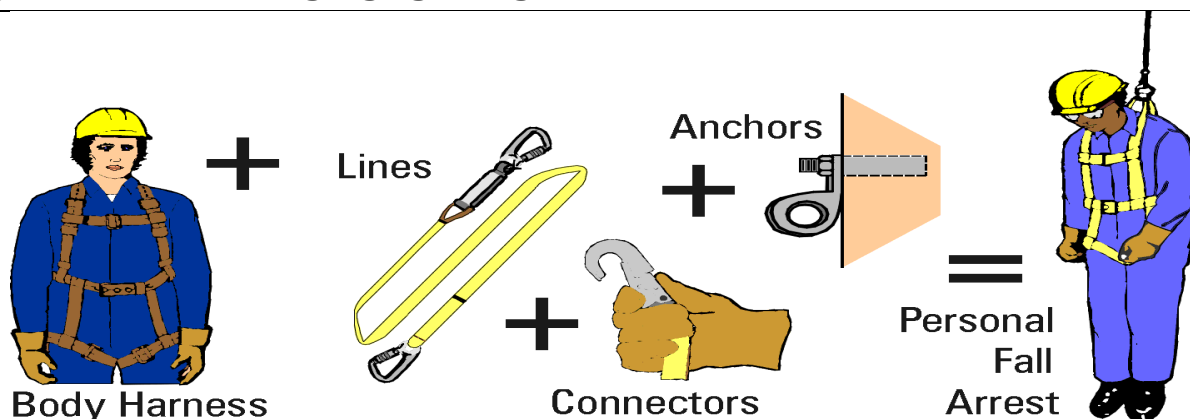
For wood railings: posts shall be at least 2 X 4 inch lumber, spaced not more than 8 feet apart on centers. The top rail shall be at least 2 X 4 inch lumber and the mid rail shall be at least 1 X 6 inch lumber.

For pipe railings: posts, top rails, and mid rails shall be at least one and one-half inches nominal diameter with posts spaced not more than 8 feet apart on centers.

For structural steel railings: posts, top rails, and mid rails shall be at least 2 inch X 2 inch X 3/8 inch angles with posts spaced not more than 8 feet apart on centers.

When employees are exposed to falling objects (i.e. tools, materials), toe boards, screens, or guardrail systems to prevent objects from falling from higher levels shall be installed.

PERSONAL FALL ARREST SYSTEMS



Personal Fall Arrest Systems consist of an anchorage, connectors, and a full body harness. They may include a deceleration device, lifeline, or suitable combinations. Employees using Personal Fall Arrest Systems must conform to the following requirements:

- Personal Fall Arrest Systems shall be inspected prior to each use for wear or damage. Defective components shall be removed from service.
- The attachment point of the body harness shall be located in the center of the wearer's back near shoulder level, or above the wearer's head.
- Be rigged so that an employee can neither free fall more than six (6) feet nor contact any lower level.
- Bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet.

Body belts are not acceptable as part of a personal fall arrest system.

Snaphooks shall be sized to be compatible with the member to which they are connected to prevent unintentional disengagement. Only locking type snaphooks shall be used.

Dee-rings and snaphooks shall have a minimum tensile strength of 5,000 pounds.

Horizontal lifelines shall be designed, installed, and used under the supervision of a qualified person. Lifelines shall be protected against being cut or abraded.

Lanyards and vertical lifelines shall have a minimum breaking strength of 5,000 pounds.

Self retracting lifelines and lanyards that limit the free fall distance to 2 feet or less shall be capable of sustaining a minimum tensile load of 3,000 pounds applied to the device with the lifeline or lanyard in the fully extended position.

Self retracting lifelines and lanyards that do not limit the free fall distance to 2 feet or less, shall be capable of sustaining a minimum tensile load of 5,000 pounds applied to the device with the lifeline or lanyard in the fully extended position.

Anchorage used for attachment of personal fall arrest systems shall be independent of any anchorage being used to support or suspend platforms and must be capable of supporting at least 5,000 pounds per person attached, or shall be designed, installed, and used as follows:

- (a) As part of a complete personal fall arrest system which maintains a safety factor of at least two (i.e. capable of supporting at least twice the weight expected to be imposed upon it).
- (b) Under the supervision of a qualified person.

POSITIONING DEVICE SYSTEMS



A Positioning Device System is the use of a body belt or full body harness system rigged to allow an employee to be supported on an elevated vertical surface, such as a wall, and work with both hands free while leaning. Positioning Device Systems and their use shall conform to the following provisions:

- Positioning Device Systems are to be set up so that a worker can not free fall more than two (2) feet.
- They shall be secured to an anchorage capable of supporting at least twice the potential impact load of an employee's fall or 3,000 pounds, whichever is less.
- Requirements for snaphooks, dee-rings, and other connectors used with positioning device systems must meet the same criteria as those for personal fall arrest system.

COVERS

Covers for holes in floors, roofs, and other walking/working surfaces shall meet the following requirements:

- Covers located in roadways and vehicular aisles shall be capable of supporting, without failure, at least twice the maximum axle load of the largest vehicle expected to cross over the cover.
- All other covers shall be capable of supporting, without failure, at least twice the weight of employees, equipment, and materials that may be imposed on the cover at any one time.
- All covers shall be secured when installed to prevent accidental displacement by the wind, equipment, or employees.
- All covers shall be color coded or they shall be marked with the word "HOLE" or "COVER" to provide warning of the hazard.



ALTERNATIVE MEASURES TO PERSONAL FALL PROTECTION

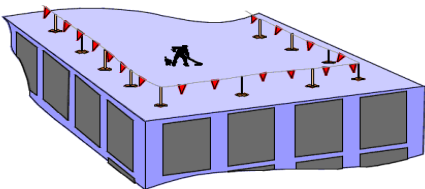
The fall protection standard allows three alternative fall protection measures for pre-cast concrete, leading edge work, overhand bricklaying, roofing, and residential construction. The three alternatives are Warning Line Systems, Controlled Access Zones, and Safety Monitoring Systems. **However, the employer must prove conventional fall protection is infeasible or would cause a greater hazard and then develop a written fall protection plan (except for roofing, overhand bricklaying, and residential construction).**

WARNING LINE SYSTEMS

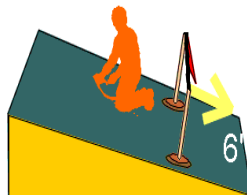
A Warning Line System is a barrier erected on a roof to warn employees that they are approaching an unprotected roof side or edge, and which designates an area in which roofing work may take place without the use of guardrail systems, personal fall arrest systems, or safety net systems to protect employees in the area. Warning line systems are only permitted to be used with roofing work on low sloped roofs (i.e. roof having a slope less than or equal to 4 X 12 pitch). Warning lines shall be erected around all sides of roof work areas and must be erected not less than six (6) feet from the roof edge. When mechanical equipment is being used, the warning line perpendicular to the direction of mechanical equipment operation shall not be less than ten (10) feet from the roof edge.

Warning lines systems must completely enclose an area and may consist of ropes, wires, or chains and supporting stanchions erected as follows:

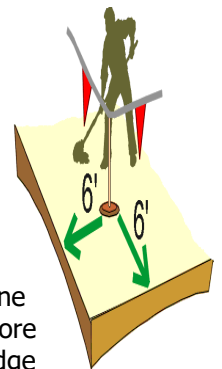
- Flagged at not more than six (6) feet intervals with high visibility material.
- Rugged and supported so that the lowest point including sag is no less than 34 inches from the walking/working surface and its highest point is no more than 39 inches from the walking/working surface.
- After erecting the warning line, stanchions shall be capable of resisting, without tipping over, a force of at least 16 pounds applied horizontally against the stanchion.
- The warning line shall have a minimum tensile strength of 500 pounds after being attached to the stanchions, and shall be capable of supporting, without breaking, the loads applied to the stanchions as stated above.
- Warning lines shall be erected to each stanchion in such a way that pulling on one section of the line between stanchions will not result in slack being taken up in the adjacent section before the stanchion tips over.



Warning Line System



Used only on Low-Sloped roofs

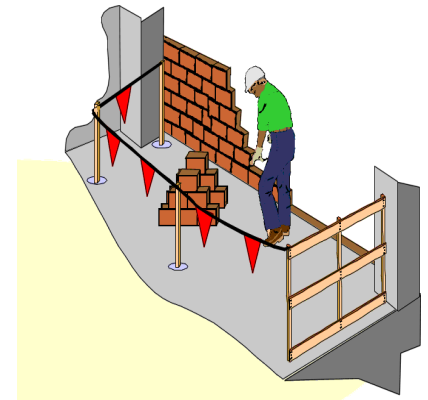


Place line 6' or more from edge

CONTROLLED ACCESS ZONES

A controlled access zone is an area in which certain work may take place without the use of guardrail systems, personal fall arrest systems, or safety net systems and access to the zone is controlled. Controlled access zones (for overhand bricklaying work) are used to keep out workers other than those authorized to enter work areas from which guardrails have been removed. The controlled access zone shall be defined by a control line or by any other means that restricts access. When control lines are used, their use shall conform to the following provisions:

- Erected not less than six (6) feet nor more than twenty-five (25) feet from the unprotected or leading edge (except when erecting pre-cast concrete members).
- Control lines shall consist of ropes, wires, tapes, or equivalent materials, and supporting stanchions.
- Each line shall be flagged or otherwise clearly marked at not more than six (6) feet intervals with high visibility material.
- Rigged and supported in such a way that the lowest point (including sag) is not less than 39 inches from the walking/working surface and the highest point is not more than 45 inches from the walking/working surface.
- Strong enough to sustain stress of not less than 200 pounds.
- The control line shall extend along the entire length of the unprotected or leading edge and shall be connected on each side to a guardrail system or wall.



Controlled Access Zone

SAFETY MONITORING SYSTEMS

A Safety Monitoring System is a safety system in which a competent person is responsible for recognizing and warning employees of fall hazards. In order to use a safety monitoring system, the employer must first prove that fall protection is infeasible or will cause a greater hazard. A safety monitoring system is permitted for pre-cast concrete erection, leading edge work, roofing, and residential construction. To implement a safety monitoring system, the employer must appoint a competent person to monitor the safety of workers and the employer shall ensure that the safety monitor:

- Is competent in the recognition of fall hazards,
- Is capable of warning workers of fall hazard dangers and in detecting unsafe work practices,
- Is operating on the same walking/working surfaces of the workers and can see them,
- Is close enough to work operations to communicate orally with workers, and
- Has no other duties to distract from the monitoring function.

