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Falls

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Falls are the leading cause of fatalities in the construction industry. An average of 362 fatal falls occurred each year from 1995 to 1999, with the trend on the increase.

It is important that safety and health programs contain provisions to protect workers from falls on the job. The following hazards cause the most fall-related injuries:


Unprotected Sides, Wall Openings, and Floor Holes


Improper Scaffold Construction


Unguarded Protruding Steel Rebars


Misuse of Portable Ladders

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Falls: Unprotected Sides, Wall Openings, and Floor Holes

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Am I In Danger?

Almost all sites have unprotected sides and edges, wall openings, or floor holes at some point during construction. If these sides and openings are not protected at your site, injuries from falls or falling objects may result, ranging from sprains and concussions to death.

This worker is not protected by any of the protective systems that are required by OSHA.

How Do I Avoid Hazards?

- Use at least one of the following whenever employees are exposed to a fall of 6 feet or more above a lower level:
  - Guardrail Systems
  - Safety Net Systems
  - Fall Arrest Systems
- Cover or guard floor holes as soon as they are created during new construction.
- For existing structures, survey the site before working and continually audit as work continues. Guard or cover any openings or holes immediately.
- Construct all floor hole covers so they will effectively support two times the weight of employees, equipment, and materials that may be imposed on the cover at any one time.
- In general, it is better to use fall *prevention* systems, such as guardrails, than fall *protection* systems, such as safety nets or fall arrest devices, because they provide more positive safety means.

Construction Worker Dies

Additional Information:

- OSHA Standard: 1926.501(b)(1)
- Worker Deaths by Falls: A Summary of Surveillance Findings and Investigative Case Reports. NIOSH Publication 2000-116 (2000, November). See listing on NIOSH website.

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Guardrail Systems

Where workers on a construction site are exposed to vertical drops of 6 feet or more, OSHA requires that employers provide fall protection in one of three ways *before* work begins:

- Placing guardrails around the hazard area.
- Deploying safety nets.
- Providing personal fall arrest systems for each employee.

This guardrail appears to be properly constructed except for the missing toeboard that is required to prevent object from falling to the floor below and possibly striking another worker.

Many times the nature and location of the work will dictate the form that fall protection takes. If the employer chooses to use a guardrail system, he must comply with the following provisions:

- Top edge height of top rails, or equivalent guardrail system members, must be between 39 and 45 inches above the walking/working level, except when conditions warrant otherwise and all other criteria are met (e.g., when employees are using stilts, the top edge height of the top rail must be increased by an amount equal the height of the stilts).
- Midrails, screens, mesh, intermediate vertical members, or equivalent intermediate structures, must be installed between the top edge and the walking/working surface when there is no wall or other structure at least 21 inches high.
  - Midrails must be midway between the top edge of the guardrail system and the walking/working level.
  - Screens and mesh must extend from the top rail to the walking/working level, and along the entire opening between rail supports.
  - Intermediate members (such as balasters) between posts must be no more than 19 inches apart.
  - Other structural members (such as additional midrails or architectural panels) must be installed so as to leave no openings wider than 19 inches.
- Guardrail systems must be capable of withstanding at least 200 pounds of force applied within 2 inches of the top edge, in any direction and at any point along the edge, and without causing the top edge of the guardrail to deflect downward to a height less than 39 inches above the walking/working level.
- Midrails, screens, mesh, and other intermediate members must be capable of withstanding at least 150 pounds of force applied in any direction at any point along the midrail or other member.
- Guardrail systems must not have rough or jagged surfaces that would cause punctures, lacerations, or snagged clothing.
- Top rails and midrails must not cause a projection hazard by overhanging the terminal posts.

Additional Information:

- OSHA Standard: 1926.501(b)(1)
- Worker Deaths by Falls: A Summary of Surveillance Findings and Investigative Case Reports. NIOSH Publication 2000-116 (2000, November). See listing on NIOSH website.

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Safety Net Systems

Where workers on a construction site are exposed to vertical drops of 6 feet or more, OSHA requires that employers provide fall protection in one of three ways *before* work begins:

- Placing guardrails around the hazard area,
- Install safety nets, or
- Providing personal fall arrest systems for each employee.

A safety net is being used under the roof of this building as an acceptable fall protection system.

Many times the nature and location of the work will dictate the form that fall protection takes. If the employer chooses to use a safety net system, he must comply with the following provisions:

- Safety nets must be installed as close as practicable under the surface on which employees are working, but in no case more than 30 feet below.
- When nets are used on bridges, the potential fall area must be unobstructed.
- Safety nets must extend outward from the outermost projection of the work surface as follows:

Vertical distance from working level to horizontal plane of net	Minimum required horizontal distance of outer edge of net from the edge of the working surface
Up to 5 feet	8 feet
5 to 10 feet	10 feet
More than 10 feet	13 feet

- Safety nets must be installed with sufficient clearance to prevent contact with the surface or structures under them when subjected to an impact force equal to the drop test described below.
- Safety nets and their installations must be capable of absorbing an impact force equal to the drop test described below.
- Safety nets and safety net installations must be drop-tested at the jobsite:
  - After initial installation and before being used.
  - Whenever relocated.
  - After major repair.
  - At 6-month intervals if left in one place.
- The drop test consists of a 400 pound bag of sand 28-32 inches in diameter dropped into the net from the highest surface at which employees are exposed to fall hazards, but not

from less than than 42 inches above that level.

- When the employer can demonstrate that it is unreasonable to perform the drop-test described above, the employer or a designated competent person shall certify that the net and net installation have sufficient clearance and impact absorption by preparing a certification record prior to the net being used as a fall protection system. The certification must include:
  - Identification of the net and net installation.
  - Date that it was determined that the net and net installation were in compliance.
  - Signature of the person making the determination and certification.
- The most recent certification record for each net and net installation must be available at the jobsite for inspection.
- Safety nets must be inspected for wear, damage, and other deterioration at least once a week, and after any occurrence which could affect the integrity of the system.
- Defective nets shall not be used, and defective components must be removed from service.
- Objects which have fallen into the safety net, such as scrap pieces, equipment, and tools, must be removed as soon as possible from the net and at least before the next work shift.
- Maximum mesh size must not exceed 6 inches by 6 inches. All mesh crossings must be secured to prevent enlargement of the mesh opening, which must be no longer than 6 inches, measured center-to-center.
- Each safety net, or section thereof, must have a border rope for webbing with a minimum breaking strength of 5,000 pounds.
- Connections between safety net panels must be as strong as integral net components, and must not be spaced more than 6 inches apart.

Additional Information:

- OSHA Standard: 1926.502(c)
- Worker Deaths by Falls: A Summary of Surveillance Findings and Investigative Case Reports. NIOSH Publication 2000-116 (2000, November). See listing on NIOSH website.

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Personal Fall Arrest Systems

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A personal fall arrest system is one option of protection that OSHA requires for workers on construction sites who are exposed to vertical drops of 6 feet or more.

Click on any of the components of the personal fall arrest system illustrated below for descriptions and provisions required by OSHA.

Using Fall Arrest Systems Safely

This worker is protected by a properly constructed fall arrest system.

- Ensure that personal fall arrest systems will, when stopping a fall:
  - Limit maximum arresting force to 1,800 pounds.
  - Be rigged such that an employee can neither free fall more than 6 feet nor contact any lower level.
  - Bring an employee to a complete stop and limit maximum deceleration distance to 3½ feet.
  - Have sufficient strength to withstand twice the potential impact energy of a worker free falling a distance of 6 feet, or the free fall distance permitted by the system, whichever is less
- Remove systems and components from service immediately if they have been subjected to fall impact, until inspected by a competent person and deemed undamaged and suitable for use.
- Promptly rescue employees in the event of a fall, or assure that they are able to rescue themselves.
- Inspect systems before each use for wear, damage, and other deterioration, and remove defective components from service.
- Do not attach fall arrest systems to guardrail systems or hoists.

- Rig fall arrest systems to allow movement of the worker only as far as the edge of the walking/working surface, when used at hoist areas.

Additional Information:

- OSHA Standard: 1926.502(d)
- What is the Fall Distance. OSHA Region VII (1998, July). This 22-minute video introduces the viewer to fall distance calculations for personal fall arrest systems.
- Worker Deaths by Falls: A Summary of Surveillance Findings and Investigative Case Reports. NIOSH Publication 2000-116 (2000, November). See listing on NIOSH website.
- Interpretations and Clarifications - Subpart M -- Fall Protection (29 CFR 1926.500-503).

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Attachment Location

The attachment of the body harness must be located in the center of the wearer's back, near the shoulder level, or above the head.

- OSHA Standard: 1926.502(d)(17)

Body Harnesses

Body harnesses are designed to minimize stress forces on an employee's body in the event of a fall, while providing sufficient freedom of movement to allow work to be performed.

Do not use body harnesses to hoist materials.

- OSHA Standard: 1926.502(d)(18)

As of January 1, 1998, body belts are not acceptable as part of a personal fall arrest system, because they impose a danger of internal injuries when stopping a fall.

Vertical Lifelines/Lanyards

Vertical lifelines or lanyards must have a minimum breaking strength of 5,000 pounds, and be protected against being cut or abraded. Each employee must be attached to a separate vertical lifeline, except during the construction of elevator shafts, where two employees may be attached to the same lifeline in the hoistway, provided:

- Both employees are working atop a false car that is equipped with guardrails.
- The strength of the lifeline is 10,000 pounds (5,000 pounds per employee).
- All other lifeline criteria have been met.

Self-retracting vertical lifelines and lanyards that automatically limit free fall distance to 2 feet or less must be capable of sustaining a minimum tensile load of 3,000 pounds when in the fully extended position. If they do not automatically limit the free fall to 2 feet or less, ripstitch lanyards, and tearing and deforming lanyards, must be capable of sustaining a minimum tensile load of 5,000 pounds when in the fully extended position.

OSHA Standard: 1926.502(d)(9)

Webbing

Webbing are the ropes and straps used in lifelines, lanyards, and strength components of body harnesses. The webbing must be made from synthetic fibers.

- OSHA Standard: 1926.502(d)(14)

Anchorages

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

- As part of a complete personal fall arrest system which maintains a safety factor of at least two.
- Under the supervision of a qualified person.
- OSHA Standard:1926.502(d)(15)

Horizontal Lifelines

Horizontal lifelines are to be designed, installed, and used under the supervision of a qualified person, and as part of a complete personal fall arrest system which maintains a safety factor of at least two.

On suspended scaffolds or similar working platforms with horizontal lifelines that may become vertical lifelines, the devices used to connect to a horizontal lifeline must be capable of locking in both directions on the lifeline.

- OSHA Standard: 1926.451(g)(3)(ii)
- OSHA Standard: 1926.451(g)(3)(iii)
- OSHA Standard: 1926.502(d)(7)
- OSHA Standard: 1926.502(d)(8)

Connectors

Connectors, including D-rings and snaphooks, must be made from drop-forged, pressed or formed steel, or equivalent materials. They must have a corrosion-resistant finish, with smooth surfaces and edges to prevent damage to connecting parts of the system.

D-Rings must have a minimum tensile strength of 5,000 pounds, and be proof-tested to a minimum tensile load of 3,600 pounds without cracking, breaking, or becoming permanently deformed.

Snaphooks must have a minimum tensile strength of 5,000 pounds, and be proof-tested to a minimum tensile load of 3,600 pounds without cracking, breaking, or becoming permanently deformed. They must also be locking-type, double-locking, designed and used to prevent the disengagement of the snaphook by the contact of the snaphook keeper with the connected member.

Unless it is designed for the following connections, snaphooks must not be engaged:

- Directly to webbing, rope, or wire.
- To each other.
- To a D-ring to which another snaphook or other connector is attached.
- To a horizontal lifeline.
- To any object which is incompatibly shaped in relation to the snaphook such that the connected object could depress the snaphook keeper and release itself.
- OSHA Standard: 1926.502(d)(1)

Excerpt from Memo to Region VIII

Where an employer is using a fall arrest system that permits a fall of more than six feet, a citation should be issued under 1926.104(d) unless the employer shows that (1) limiting an arrested fall to six feet is infeasible; (2) the arresting fall distance, though more than 6 feet, is as short as feasible; (3) it has taken reasonable steps to determine that (a) the arresting forces will be limited to 1800 pounds and (b) the system will not fail in an arrested fall.

Example of an employer that takes "reasonable steps": An employer calculates the total arresting fall distance and the loads imposed on the system based on measurements, product data and appropriate calculations. Using product data, the employers determines that the components, as used, will have the necessary strength to sustain the loads and that the arresting forces on the worker would be limited to 1800 pounds.

Example of an employer that fails to take "reasonable steps": An employer sets up a system that allows an arrested fall of more than six feet. It asserts that, in its judgment, the system will work. However, it has made no assessment of how far the arrested fall would be, what the loads of an arrested fall would be, and failed to assess the load capacity of the system.

For more information, see Interpretations and Clarifications - Subpart M -- Fall Protection (29 CFR 1926.500-503).

Deaths Due to Unprotected Sides, Wall Openings and Floor Holes

Case Reports

The following Case Reports of falls investigated by OSHA illustrate how seemingly innocent workplace activities can have deadly consequences.

- An employee taking measurements was killed when he fell backward from an unguarded balcony to the concrete 9½ feet below.
- A roofer, handling a piece of fiberboard, backed up and tripped over a 7½ inch parapet. He fell more than 50 feet to ground level and died of severe head injuries.
- Two connectors were erecting light weight steel I-beams on the third floor of a 12-story building, 54 feet above the ground. One employee removed a choker sling from a beam and then attempted to place the sling onto a lower hook on a series of stringers. While the crawler tower crane was booming away from the steel, the wind moved the stringer into the beam the employee was standing on. The beam moved while the employee was trying to disengage the hook, causing him to lose his balance and fall to his death.

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Falls: Improper Scaffold Construction

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Am I In Danger?

Working with heavy equipment and building materials on the limited space of a scaffold is difficult. Without fall protection or safe access, it becomes hazardous. Falls from such improperly constructed scaffolds can result in injuries ranging from sprains to death.

This scaffold is not in compliance with the regulations because it mixes several different scaffold components in the same scaffold. The guardrails are also improper because they are not complete.

How Do I Avoid Hazards?

- Construct all scaffolds according to the manufacturer's instructions.
- Install guardrail systems along all open sides and ends of platforms.
- Use at least one of the following for scaffolds more than 10 feet above a lower level:
  - Guardrail Systems
  - Fall Arrest Systems
- Provide safe access to scaffold platforms [*For more, see Scaffold Access*].
- Do not use climb cross-bracing as a means of access.

Construction Worker Dies

Additional Information:

- OSHA Standard: 1926.451(g)(1)
- OSHA Construction Scaffolding eTool
- Worker Deaths by Falls: A Summary of Surveillance Findings and Investigative Case Reports. NIOSH Publication 2000-116 (2000, November). See listing on NIOSH website.

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Scaffold Access

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Climbing the structural cross-braces of a scaffold is *unsafe*, and *specifically forbidden* by federal standards. However, OSHA permits direct access from another scaffold, structure, or personnel hoist.

If such access is not possible, portable ladders, hook-on ladders, attachable ladders, stair towers, stairway-type ladders, ramps, walkways, or built-in ladders must be used, under the following regulations:

Portable, Hook-on, and Attachable Ladders

- Must be positioned so as not to tip the scaffold.

Hook-on and Attachable Ladders

- Must be specifically designed for the type of scaffold with which they are used.
- Must have their lowest rung no more than 24 inches above the level on which the scaffold is supported.
- When used on a supported scaffold more than 35 feet high, must have rest platforms at 35-foot maximum intervals.
- Must have a maximum rung length of 11½ inches, and a maximum space between rungs of 16¾ inches.

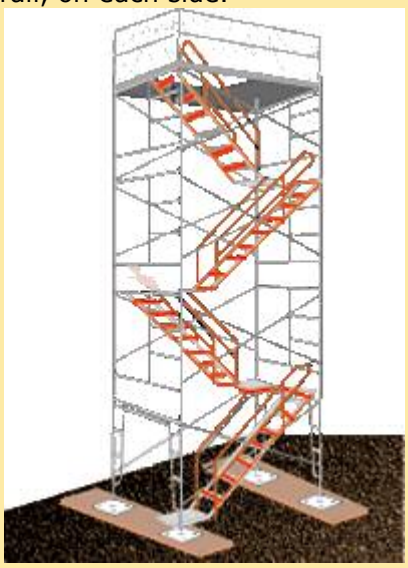
Stairway-type Ladders

- Must have their bottom step no more than 24 inches above the level on which the scaffold is supported.
- Must have rest platforms at 12-foot maximum intervals.
- Must have a minimum step width of 16 inches, except that mobile stairway-type ladders shall have a minimum step width of 11½ inches.
- Must have slip-resistant treads on all steps and landings.

Stair Towers

- Must have their bottom step no more than 24 inches above the level on which the scaffold is supported.

- Must have a stair-rail, consisting of a top-rail and a mid-rail, on each side.
  - The top-rail of each stair-rail must also be capable of serving as a handrail, unless a separate handrail is provided.
  - Stair-rails and handrails must be designed and constructed to prevent punctures, lacerations, snagged clothing, and projection.
  - Handrails, and top-rails used as handrails, must be at least 3 inches from other objects.
  - Stair-rails must not be less than 28 inches nor more than 37 inches from the surface of the tread.



- Must be at least 18 inches wide between stair-rails, and have a landing platform at least 18 inches wide by at least 18 inches long at each level.
- Must have slip-resistant surfaces on all treads and landings.
- Must be installed between 40 degrees and 60 degrees from the horizontal.
- Must have uniform riser height, within ¼ inch, for each flight of stairs, except for the top and bottom steps of the *entire system.*
- Must have uniform tread depth, within ¼ inch, for each flight of stairs.

Built-in Scaffold Ladders

- Must be specifically designed and constructed for use as ladder rungs.
- Must have a rung length of at least 8 inches.
- Must not be used as work platforms when rungs are less than 11½ inches, unless each employee uses fall protection or a positioning device [1926.502(e)].
- Must be uniformly spaced within each frame section.
- Must have rest platforms at 35-foot maximum intervals on all supported scaffolds more than 35 feet high.
- Must have a maximum space between rungs of 16¾ inches.

Steps and rungs of ladders and stairways must line up vertically with each other between rest platforms.

Ramps and Walkways

- Must have guardrails which comply with [1926.502(b)] 1926 Subpart M if more than 6 feet above lower levels.
- Must have a slope of no more than 1 vertical to 3 horizontal degrees (20 degrees above the horizontal).
- Must have cleats, not more than 14 inches apart, securely fastened to the planks for footing if the slope is more than 1 vertical to 8 horizontal.

Direct Access

- Direct access to or from another surface shall only be used when the scaffold is not more than 14 inches horizontally and 24 inches vertically from the other surface.

Additional Information:

- OSHA Standard: 1926.451(e)
- Worker Deaths by Falls: A Summary of Surveillance Findings and Investigative Case Reports. NIOSH Publication 2000-116 (2000, November). See listing on NIOSH website.

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Deaths Due to Improper Guardrails on Tubular Welded-frame Scaffolds

Case Reports

The following Case Reports of falls investigated by OSHA illustrate how seemingly innocent workplace activities can have deadly consequences.

- An employee preparing masonry fascia for removal from a building fell from the third level of a tubular welded-frame scaffold. No guarding system was provided for the scaffold. Further, the platform was coated with ice, creating a slippery condition.
- A contract employee was taking measurements from an unguarded scaffold inside a reactor vessel when he either lost his balance or stepped backwards and fell 14½ feet, sustaining fatal injuries.
- An employee was installing overhead boards from a scaffold platform consisting of two 2" x 10" boards with no guardrails. He lost his balance, fell 7½ feet to the floor, and was fatally injured.
- A laborer was working on the third level of a tubular welded-frame scaffold which was covered with ice and snow. Planking on the scaffold was inadequate, there was no guardrail, and no access ladder for the various scaffold levels. The worker slipped and fell head first approximately 20 feet to the pavement below.

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Falls: Unguarded Protruding Steel Rebars

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Am I In Danger?

Unguarded protruding steel reinforcing bars are hazardous. Even if you just stumble onto an unguarded rebar you can impale yourself, resulting in serious internal injuries or death. *View Rebar Accident*

These rebar should be bent over or protected with caps so that a worker would not be injured by falling on them.

How Do I Avoid Hazards?

- Guard all protruding ends of steel rebar with rebar caps or wooden troughs, *or*
- Bend rebar so exposed ends are no longer upright.
- When employees are working at any height above exposed rebar, fall protection/ prevention is the first line of defense against impalement.

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Rebar Caps

The OSHA Standard requires that rebar "be guarded to eliminate the hazard of impalement." Not all guards provide that level of protection. In some circumstances, the force of a fall can cause rebar to push clear through a plastic cap and still impale a worker, or the worker can be impaled by the rebar and the cap together.

Only rebar caps designed to provide impalement protection, such as those containing steel reinforcement, should be used.

This type of cap positions a 2 x 4 over the exposed rebar,

and has been approved by California OSHA.

Additional Information:

- OSHA Standard: 1926.701(b)
- Mushroom Style Plastic Rebar Covers Used For Impalement Protection. OSHA Standards Interpretation and Compliance Letter (1997, May 29).
- Worker Deaths by Falls: A Summary of Surveillance Findings and Investigative Case Reports. NIOSH Publication 2000-116 (2000, November). See listing on NIOSH website.

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Rebar Accident!

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The following images are from video shot during an investigation of an actual rebar accident*.

- While standing on a rebar column he is in the process of plumbing, a worker in full body harness attempts to hook his positioning lanyards onto a location over his head.

- The positioning device hooks slip, and the worker falls approximately 8 feet to the footings below, where he is impaled through the groin on a protruding rebar.

- Though the rebar is capped, the force of the worker's fall pushes the cap clear to the ground, and bends the rebar nearly 45 degrees.

- This is an example of the rebar caps used at this site. Because it was not steel reinforced, it was insufficient to provide protection in a fall from elevation.

- An employee passing by the accident site gives perspective to the height involved. The victim was only standing approximately at the top of this image, yet the force of his fall bent the rebar like a coat hanger. Luckily, he was taken by helicopter to a nearby hospital and survived his injuries.

* *Courtesy of Utah Occupational Safety and Health Division*

Excerpt from Mushroom Style Plastic Rebar Covers Used For Impalement Protection - OSHA Standards Interpretation and Compliance Letter 05/29/1997

"Tests designed by California OSHA were conducted that entailed dropping sand-filled canvas bags onto rebar protected by standard mushroom caps. Weights of the bags ranged from 140 to 160 pounds, and the bags were dropped from three, five and seven feet. The mushroom caps provided absolutely NO protection.

"Manufacturers of the mushroom caps agree that those caps were designed to provide SCRATCH PROTECTION ONLY and were never intended to prevent impalement, even at grade.

"Considering the serious nature of the hazard, the standard mushroom-style plastic rebar caps should not be used for protection against impalement. Protective devices capable of withstanding at least 250 pounds dropped from a height of ten feet should be used. Although there are no 'approved' mushroom caps on the market, steel reinforced covers and wooden troughs are available, and have been approved by California OSHA and recognized by the California AGC to meet the design criteria."

Bear in mind that, where possible, fall protection is still the best solution. A fall from 10 feet or more on to a wooden trough or steel reinforced cap, even if it doesn't result in impalement, is still likely to produce serious injury.

Deaths Due to Not Guarding Protruding Steel Rebars

Case Reports

The following Case Reports of falls investigated by OSHA illustrate how seemingly innocent workplace activities can have deadly consequences.

- An employee pulling a concrete hose along a form fell two stories and hit his head on steel rebars which punctured his brain.
- A laborer fell through a roof opening about 8 feet to a patio foundation that had about 20 half-inch rebars protruding straight up. The laborer was impaled by one of the bars and died.

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Falls: Misuse of Portable Ladders

Am I In Danger?

You risk falling if portable ladders are not safely positioned each time they are used. While you are on a ladder, it may move and slip from its supports. You can also lose your balance while getting on or off an unsteady ladder. Falls from ladders can cause injuries ranging from sprains to death.

This ladder is being used at the proper angle, and appears to be stable and secure.

How Do I Avoid Hazards?

- Position portable ladders so the side rails extend at least 3 feet above the landing.
- Secure side rails at the top to a rigid support and use a grab device when 3 foot extension is not possible.
- Make sure that the weight on the ladder will not cause it to slip off its support.
- Before each use inspect ladders for cracked or broken parts such as rungs, steps, side rails, feet and locking components.
- Do not apply more weight on the ladder than it is designed to support [*For more, see Ladder Safety*].
- Use only ladders that comply with OSHA design standards [1926.1053(a)(1)].

SAFETY BULLETIN

Construction Worker Dies

Additional Information:

- OSHA Standard: 1926.1053(b)(1)
- Worker Deaths by Falls: A Summary of Surveillance Findings and Investigative Case Reports. NIOSH Publication 2000-116 (2000, November). See listing on NIOSH website.

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Ladder Safety

The OSHA Standard for portable ladders contains specific requirements designed to ensure worker safety:

Loads

- Self-supporting (foldout) and non-self-supporting (leaning) portable ladders must be able to support at least four times the maximum intended load, except extra-heavy-duty metal or plastic ladders, which must be able to sustain 3.3 times the maximum intended load. *(See Figure 1.)*

Figure 1

Angle

- Non-self-supporting ladders, which must lean against a wall or other support, are to be positioned at such an angle that the horizontal distance from the top support to the foot of the ladder is about 1/4 the working length of the ladder. *(See Figure 2.)*

Figure 2

- In the case of job-made wooden ladders, that angle should equal about 1/8 the working length. This minimizes the strain of the load on ladder joints that may not be as strong as on commercially manufactured ladders.

Rungs

- Ladder rungs, cleats, or steps must be parallel, level, and uniformly spaced when the ladder is in position for use. Rungs must be spaced between 10 and 14 inches apart.
- For extension trestle ladders, the spacing must be 8-18 inches for the base, and 6-12 inches on the extension section.
- Rungs must be so shaped that an employee's foot cannot slide off, and must be skid-resistant. *(See Figure 3.)*

Slipping

- Ladders are to be kept free of oil, grease, wet paint, and other

slipping hazards.

- Wood ladders must not be coated with any opaque covering, except identification or warning labels on one face only of a side rail.

Figure 3

Other Requirements

- Foldout or stepladders must have a metal spreader or locking device to hold the front and back sections in an open position when in use. *(See Figure 4.)*
- When two or more ladders are used to reach a work area, they must be offset with a landing or platform between the ladders.
- The area around the top and bottom of ladder must be kept clear.
- Ladders must not be tied or fastened together to provide longer sections, unless they are specifically designed for such use. *(See Figure 5.)*
- Never use a ladder for any purpose other than the one for which it was designed.

Figure 4

Figure 5

Additional Information:

- OSHA Standard: 1926.1053(a)
- Additional Examples

Additional Examples

This is improperly using the top rung of this step ladder to work from.

Death Due to Misuse of Portable Ladders

Case Reports

The following Case Reports of falls investigated by OSHA illustrate how seemingly innocent workplace activities can have deadly consequences.

- An employee was climbing a 10 foot ladder to access a landing which was 9 feet above the adjacent floor. The ladder slid down, and the employee fell to the floor, sustaining fatal injuries. Although the ladder had slip-resistant feet, it was not secured, and the railings did not extend 3 feet above the landing.