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PREVENTING SLIP AND FALL ACCIDENTS

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Safety and Environmental considerations are important part of our daily lives, not only for our individual protection, but for the protection of others and the environment as well. In order to maintain a high level of knowledge and responsiveness, each employee and faculty member is issued a copy of this manual. This safety manual is the guiding document of the University Safety Program. Each employee, student and faculty member is responsible for following/obeying to the rules included herein. Student workers are especially subject to accidents and environmental mistakes, and must be trained and guided by knowledgeable faculty and staff. Questions about the content of the manual should be directed to your supervisor or Environmental Health and Safety representatives.

This informational booklet is proposed to provide a general overview of a particular safety related topic. This publication does not itself alter compliance responsibilities, which are set forth in OSHA standards themselves, Department of Environmental Health and Safety at Wichita State University.

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PREVENTING SLIP AND FALL ACCIDENTS

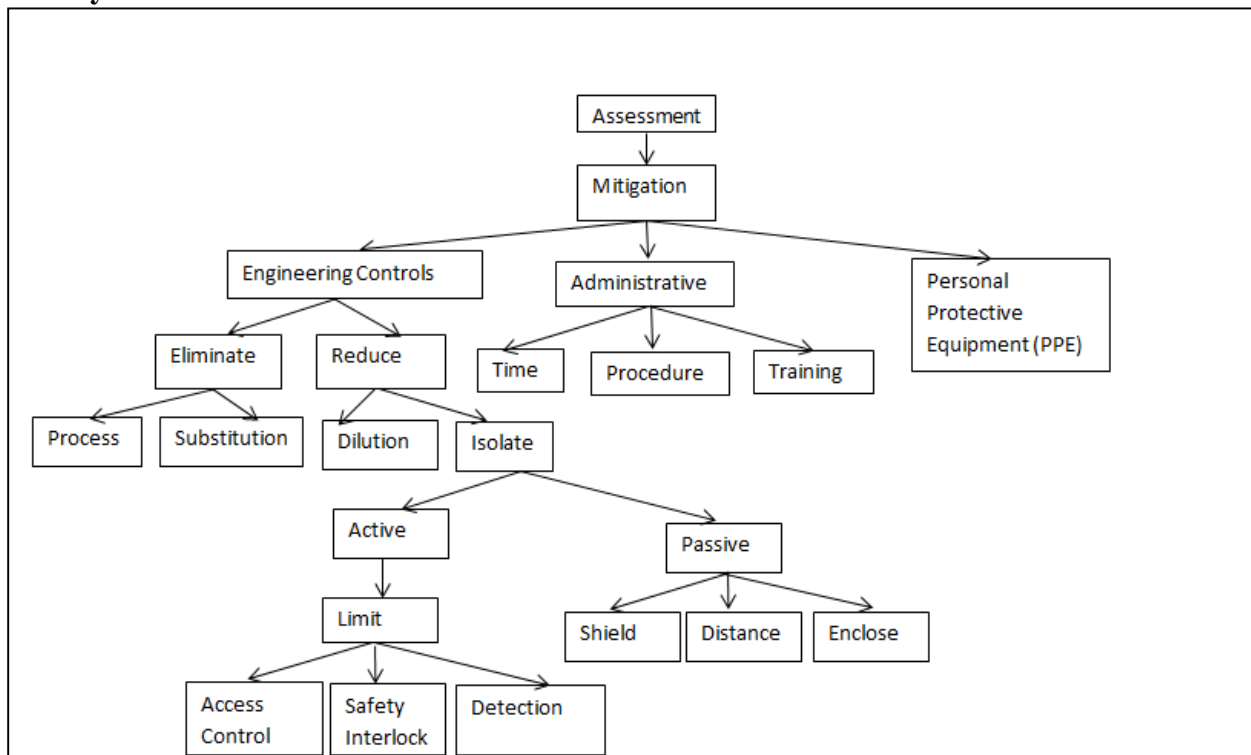
According to Occupational Safety and Health Administration (OSHA), each year, on average, between 150 and 200 workers are killed and more than 100,000 are injured as a result of falls at construction sites.

- Where protection is required, select fall protection systems appropriate for given situations.
- Use proper construction and installation of safety systems.
- Supervise employees properly.
- Use safe work procedures.
- Train workers in the proper selection, use, and maintenance of all protection systems.

This manual will improve;

- The understanding of fall hazards
- The understanding of fall prevention strategies
- Knowledge, skills, and ability to avoid fall hazards and fall-related losses

Layer of Protection



Fall Hazard Elimination/Reduction Strategies

- Eliminating the hazards through engineering design/practice
- Installing fall protection systems

- Providing personal protective equipment
- Training personnel in hazard recognition and avoidance

Engineering Controls

- Follow all applicable laws/regulations (CFR 29, 1926: Safety and Health Regulations for Construction)
- Evaluate alternative equipment, alternative methods
- Conduct Job Safety Analysis(JSA)/design jobs to avoid hazards
- Evaluate maintenance, housekeeping needs, and develop policies, procedures
- Develop written procedures (plans, protocols, checklists) for JSA, inspections, maintenance, communication, etc.
- Develop and implement training for each job/each equipment procedure

Common Types of Fall Environments

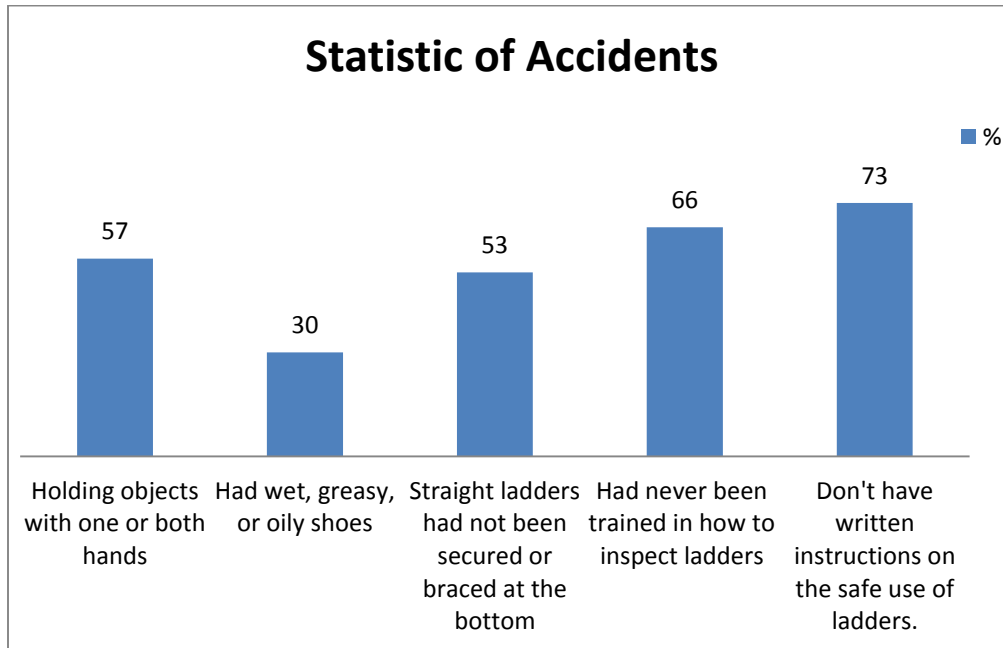
- 1) Falls from ladders
- 2) Falls from scaffolding
- 3) Falls from or out of buildings
- 4) Other falls from one level to another (e.g., falls from stationary vehicles and falls from trees)
- 5) Other and unspecified falls. Examples of common elevated working environments.

1. LADDER SAFETY

Most Common Reasons of Ladder Accidents

- Wrong ladder used
 - Ladder in poor condition
 - Ladder used improperly
- Accident Statistic

According to Bureau of Labor Statistics study of 1,400 ladder accidents back up NIOSH's classification:



1.1 Ladder Selection

- A ladder must be the right height for the job so that you don't have to overreach.
- A ladder must have the capacity to support the weight that will be on it. Remember that the total weight a ladder has to support is your weight plus the weight of any tools and materials you use while working on the ladder.

Weight rating system:

- I-A means the ladder can hold a maximum weight of 300 pounds
- I means a maximum weight of 250 pounds
- II means a maximum weight of 225 pounds
- III means a maximum weight of 200 pounds

No metal ladders around:

- Electricity: Check for metal parts and never use a ladder that is wet around electricity.
- Corrosives: Aluminum, steel, and acids are not compatible, so never use a metal ladder around corrosives.
- Flammables: Do not use metal ladders around flammables—the ladder could potentially cause a spark that could ignite around flammables.

1.2 Ladder Inspection

All ladders should be inspected before each use.

Check to ensure that:

- Steps are in good repair and free of mud, grease, oil or sticky substances
- Side rails have no cracks or splits
- Metal parts are lubricated
- Rope is not worn
- Spreaders or other locking devices are in place and working properly
- Splinters or sharp edges have been filed down
- Safety feet are solid and in place
- Metal ladders are free of dents and bent parts
- You should also inspect ladders following any tip overs or possible damage to a ladder that has been struck by something, hit something, or been dropped

Don't use and try to repair defective ladder!

1.3 Ladder Setup

- 4-to-1 rule: Place the base of the ladder 1 foot from the wall for every 4 feet between the base and the support point. For instance, if it is 8 feet from the base of a ladder to its support point, the base of the ladder should be 2 feet away from the building.
- Support point: Extend extension ladders at least 3 feet above a support point such as the edge of a roof.
- Overlap: Ensure that the upper section of an extension ladder overlaps and rests on the bottom section. The overlap should always be on the climbing side of the ladder. For ladders of 36 feet or more, the overlap should be least 3 feet.
- Secured: Secure ladders at the top and bottom.

1.4 Climbing-Descending

- Never climb a ladder if you are very tired, feeling ill, on medication that affects alertness or balance, or if you are impaired by alcohol or drugs.
- Never slide down a ladder: Descend safely, lowering one foot at a time and holding on to the side rails with both hands.
- Carry tools on a belt or shoulder strap
- Don't climb higher than the fourth rung from the top on a straight or extension ladder, or the second step from the top on a stepladder.
- Face the ladder when you go up or down, holding on to the side rails with both hands as you climb.
- One person at a time: Allow only one person on a ladder at a time.
- Check your shoes: Check your shoes before you climb, and wipe off wet, muddy, or greasy soles.

1.5 Ladder Maintenance

Routine ladder maintenance should include:

1. Check joints
2. Test hardware and fittings
3. Lubricate moveable parts
4. Replace worn rope on extension ladders
5. Make sure safety feet are in good condition
6. Clean rungs and steps

2. SCAFFOLDS SAFETY

Scaffolds: A temporary elevated platform and its supporting structure used for supporting workmen, materials, or both in the construction or repair of buildings and other large structures.

2.1 Responsibilities

Managers

Managers will ensure adequate funds are available and budgeted for the purchase of equipment in their areas. They will also identify the employees affected by this safety policy and procedure. Managers will obtain and coordinate the required training for the affected employees. Managers will also ensure compliance with this safety policy and procedure through their auditing process.

Supervisors

Supervisors will not allow any employee who has not received the required training to perform any of the tasks or activities. Supervisors will communicate appropriate needs to managers and/or supervisors. Supervisors will ensure that employees are provided with PPE as necessary for their job. Supervisors will ensure that a competent person is in charge of scaffold erection according to the manufacturer's specifications.

Competent Person

The competent person will oversee the scaffold selection, erection, use, movement, alteration, dismantling, maintenance, and inspection. The competent person will be knowledgeable about proper selection, care, and use of the fall protection equipment. Additionally, the competent person shall assess hazards.

Employees

Employees shall comply with all applicable guidelines contained in this safety policy and procedure. Employees will report damaged scaffolds, accessories, and missing or lost components. Employees will assist with inspections as requested.

Safety Department

Safety and Loss Control will provide prompt assistance to managers/unit heads, supervisors, or others as necessary on any matter concerning this safety policy and procedure. Safety and Loss Control will assist in developing or securing required training. Safety and Loss Control will also work with Purchasing and Central Equipment Unit to ensure that all newly purchased scaffolds comply with current safety regulations and this safety policy and procedure. Safety Engineers will provide consultative and audit assistance to ensure effective implementation of this safety policy and procedure.

2.2 Types of Scaffolds

2.2.1 Self-supporting scaffolds are one or more working platforms supported from below by outriggers, brackets, poles, legs, uprights, posts, frames, or similar supports. The types of self-supporting scaffolds include: Fabricated Frame, Tube and Coupler, Mobile, Pole

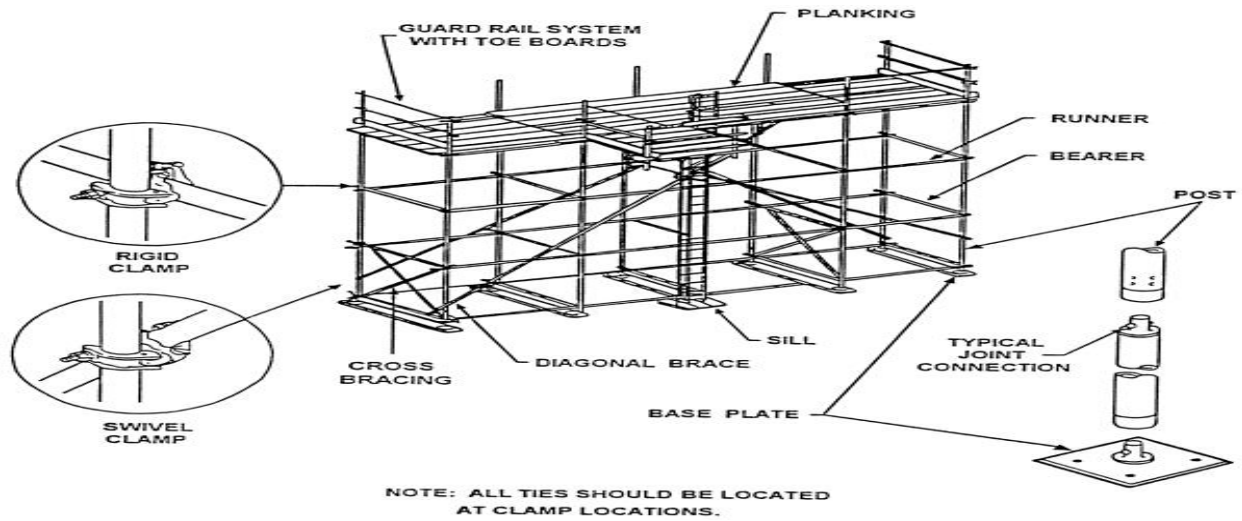


Figure 2.1: Self-supporting scaffold

2.2.2 Suspension scaffolds are one or more working platforms suspended by ropes or other means from overhead structures(s). The types of suspension scaffolds include: Single-Point Adjustable (Boatswain's Chairs), Two-Point Adjustable (Swing Stage), Multiple-Point Adjustable, Multi-Lend, Category, Float (Ship), Interior Hung, Needle Beam.

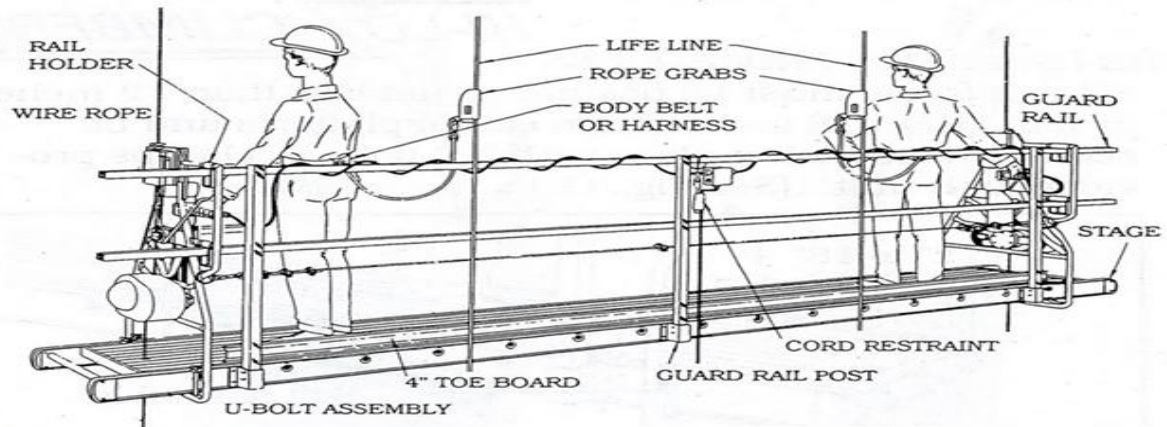


Figure 2.2: Suspension scaffold

2.2.3 Special use scaffolds and assemblies are capable of supporting their own weight and at least 4 times the maximum intended load. The types of special use scaffolds include: Form and Carpenter Bracket, Roof Bracket, Outrigger, Pump Jack, Ladder Jack, Window Jack, Horse, Crawling Boards, Step, Platforms, and Trestle Ladder

CARPENTER'S BRACKET SCAFFOLD

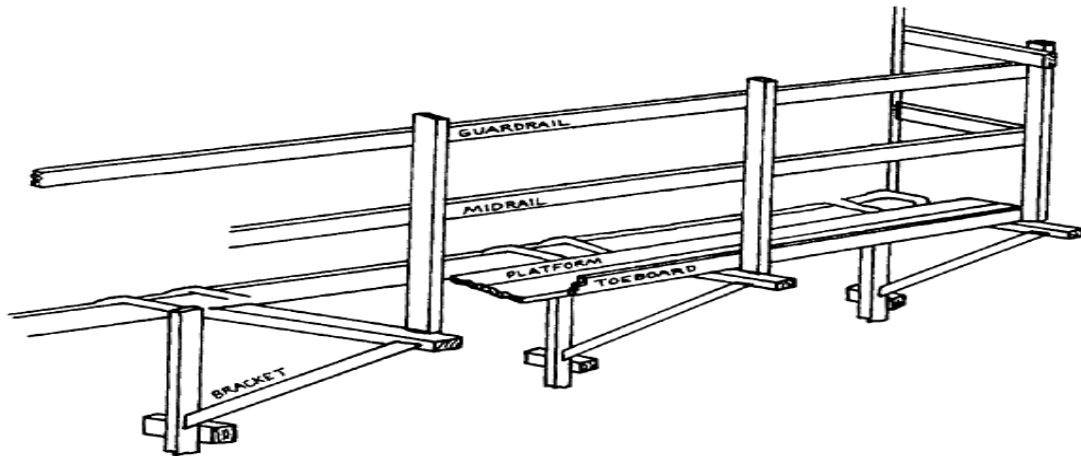




Figure 2.3: Carpenters bracket scaffold

2.3 Why Is Scaffold Safety Important?

Bureau of Labor Statistics studies showed that 25 percent of workers injured in scaffold accidents had received no scaffold safety training, and 77 percent 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.

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

2.4 Scaffolds Fall Protection

- Scaffolding 10' or higher must have some means of fall protection:
 - guardrails or
 - personal fall arrest system (PFAS)
- Toprails installed between 38" and 45" High.
- Midrails installed halfway between toprail and platform.
 - Cross bracing ok as guardrails if the center point is between 20" to 30" for Midrail and 38" to 45" for Toprail.
- Toprails to 200 lbs. of force/Midrails to 150 lbs. of force in any direction.

Erecting and Dismantling:

- Fall protection should be used when feasible and when it does not create a greater hazard
- Competent person determines the feasibility and safety of providing fall protection.
- Anyone working on or around a scaffold must wear a hard hat.
- Workers on or below scaffolds must be protected from falling objects by:

- Toeboards
- Mesh
- Screens
- Equivalent measures

2.5 Scaffold Capacity

- Scaffolds must be capable of supporting its own weight and at least 4x the expected load.
- Expected load includes:
 - Workers
 - Equipment
 - Tools
 - Materials

$$\begin{aligned}
 &\underline{\text{Scaffold Capacity} = \text{Expected Load} \times 4} \\
 &\quad 400 \text{ lbs of Workers} \\
 &\quad 100 \text{ lbs of Tools} \\
 &\quad + \underline{100 \text{ lbs of Materials}} \\
 &600 \text{ lbs} \times 4 = 2,400 \text{ lbs}
 \end{aligned}$$

2.6 Safety Requirements for Scaffolds

Safe Scaffold Erection and Use Safe scaffold erection and use is important in minimizing and controlling the hazards associated with their use. Scaffold work practices and rules should be based on:

- Sound design
- Selecting the right scaffold for the job
- Assigning personnel
- Training
- Fall protection
- Guidelines for proper erection
- Guidelines for use
- Guidelines for alteration and dismantling
- Inspections
- Maintenance and storage

2.6.1 Sound Design

The scaffold should be capable of supporting its own weight and at least four times the maximum intended load to be applied or transmitted to the scaffold and components. Suspension ropes should be capable of supporting six times the maximum intended load. Guardrails should be able to withstand at least 200 pounds of force on the top rail and 100 pounds on the midrail.

2.6.2 Selecting the Right Scaffold for the Job

You cannot contract away the responsibility for selecting the right scaffold for your job. But if you do contract for scaffolding:

- Choose a scaffold supplier, rental agency and/or erector who is thoroughly knowledgeable about the equipment needed and its safe use.
- Obtain the owner's manual prepared by the scaffolding manufacturer, which states equipment limitations, special warnings, intended use and maintenance requirements.

If you have to select your own scaffold, begin by reviewing the written requirements (blueprints, work orders, etc.) to determine where scaffolds should be used and the type of scaffolding needed. Make sure that the scaffolds meet all government and voluntary requirements. Consider that scaffolds are generally rated light, medium and heavy duty. **Light duty scaffolds** can support a limited number of employees and hand tools. **Medium duty scaffolds** must be capable of safely holding workers, hand tools and the weight of construction materials being installed. **Heavy duty scaffolds** are needed when the scaffold must sustain workers, tools and the weight of stored materials.

2.6.3 Assigning Personnel

Assign a competent person to oversee the scaffold selection, erection, use, movement, alteration, dismantling, maintenance and inspection. Only assign trained and experienced personnel to work on scaffolding. Be certain they are knowledgeable about the type of scaffolding to be used and about the proper selection, care and use of fall protection equipment.

2.6.4 Training

Employees should receive instruction on the particular types of scaffolds that they are to use. Training should focus on proper erection, handling, use, inspection, removal and care of the scaffolds. Training must also include the installation of fall protection, particularly guardrails, and the proper selection, use and care of fall arrest equipment.

The competent person(s) should receive additional training regarding the selection of scaffolds, recognition of site conditions, scaffold hazard recognition, protection of exposed personnel and the public, repair and replacement options, and requirements of standards. Site management personnel should also be familiar with correct scaffolding procedures so they can better determine needs and identify deficiencies.

2.6.5 Safety Requirements for Scaffolds (Fall Protection, Proper Erection & Use)

Accidents and injuries can be reduced when the guidelines in this section are followed.

- The footing or anchorage for scaffolds shall be sound, rigid, and capable of carrying the maximum intended load without settling or displacement. Unstable objects such as barrels, boxes, loose brick, or concrete blocks shall not be used to support scaffolds or planks.
- No scaffold shall be erected, moved, dismantled, or altered except under the supervision of competent persons.
- Guardrails and toeboards shall be installed on all open sides and ends of platforms more than 10 feet above the ground or floor, except needle beam scaffolds and floats. Scaffolds 4 feet to 10 feet in height having a minimum horizontal dimension in either direction of less than 45 inches shall have standard guardrails installed on all open sides and ends of the platform.
- Guardrails must be 2 X 4 inches, or the equivalent, not less than 36 inches or more than approximately 42 inches high, with a midrail, when required, of 1 X 4 inch lumber, or the equivalent. Supports must be at intervals not to exceed 8 feet. Toeboard and the guardrail shall extend along the entire opening.
- Scaffolds and their components must be capable of supporting without failure at least 4 times the maximum intended load.
- Any scaffold, including accessories such as braces, brackets, trusses, screw legs, ladders, couplers, etc., damaged or weakened from any cause must be repaired or replaced immediately, and shall not be used until repairs have been completed.

- All load-carrying timber members of scaffold framing shall be a minimum of 1,500 fiber (Stress Grade) construction grade lumber.
- All planking must be Scaffold Grades, or equivalent, as recognized by approved grading rules for the species of wood used. The maximum permissible span for 2 X 9 inch or wider planks is shown in the following:
 - The maximum permissible span for 1-1/4 X 9 inch or wider plank of full thickness shall be 4 feet with medium duty loading of 50 p.s.i.
- All planking or platforms must be overlapped (minimum 12 inches) or secured from movement.
- An access ladder or equivalent safe access must be provided.
- Scaffold plank must extend over their end supports not less than 6 inches or more than 18 inches.
- The poles, legs, or uprights of scaffolds must be plumb and securely and rigidly braced to prevent swaying and displacement.
- Overhead protection must be provided for men on a scaffold exposed to overhead hazards.
- Slippery conditions on scaffolds shall be eliminated immediately after they occur.
- No welding, burning, riveting, or open flame work shall be performed on any staging suspended by means or fiber of synthetic rope. Only treated or protected fiber or synthetic ropes shall be used for or near any work involving the use of corrosive substances or chemicals.
- Wire, synthetic, or fiber rope used for scaffold suspension shall be capable of supporting at least 6 times the intended load.
- Scaffolds shall be provided with a screen between the toeboard and guardrail, extending along the entire opening, consisting of No. 18 gauge U.S. Standard wire one-half inch mesh or the equivalent, when personnel are required to work or pass underneath the scaffolds.
- A safe distance from energized power lines shall be maintained (i.e., minimum distance of 3' for insulated lines less than 300 volts; 10' for insulated lines 300 volts or more).
- Tag lines shall be used to hoist materials to prevent contact.
- Suspension ropes shall be protected from contact with heat sources (welding, cutting, etc.) and from acids or other corrosive substances.
- Scaffolds shall not be used during high wind and storms.
- Ladders and other devices shall not be used to increase working heights on scaffold platforms.
- Scaffolds shall not be moved while employees are on them.
- Loose materials, debris, and/or tools shall not be accumulated to cause a hazard.
- Employees working on suspended scaffolds shall employ a fall-arrest system. Be sure that fall protection equipment is available before beginning erection and use it as needed. Have scaffolding material delivered as close to the erection site as possible to minimize the need for manual handling. Arrange components in the order of erection.
- Scaffold components shall not be mixed or forced to fit which may reduce design strength.
- Scaffolds and components shall be inspected at the erection location. Scaffolds shall be inspected before each work shift, after changing weather conditions, or after prolonged work interruptions.
- Casters and wheel stems shall be pinned or otherwise secured in scaffold legs. Casters and wheels must be positively locked if in a stationary position.
- Tube and coupler scaffolds shall be tied to and securely braced against the building at intervals not to exceed 30 feet horizontally and 26 feet vertically.

- Ensure the availability of material hoisting and rigging equipment to lift components to the erection point and eliminate the need to climb with components. Examine all scaffold components prior to erection.
- Return and tag “Do Not Use” or destroy defective components.
- Prohibit or restrict the intermixing of manufactured scaffold components, unless:
 - (1) The components fit together properly,
 - (2) The use of dissimilar metals will not reduce strength, and
 - (3) The design load capacities are maintained.
- Cross braces and scaffold frames shall not be used for access scaffold platforms unless they are equipped with a built-in ladder specifically designed for such purpose.

2.6.6 Guidelines for Alteration and Dismantling

- Require that scaffolds be altered, moved and dismantled under the supervision of a competent person.
- Alteration and dismantling activities should be planned and performed with the same care as with erection.
- Tag any incomplete scaffold or damaged component out of service.

2.6.7 Inspections

Inspect all scaffolds and components upon receipt at the erection location. Return, tag “Do Not Use” or destroy defective components. Inspect scaffolds before use and attach a tag stating the time and date of inspection.

Inspect scaffolds before each work shift and especially after changing weather conditions and prolonged interruptions of work. Check for such items as solid foundations, stable conditions, complete working and rest platforms, suitable anchorage points, required guardrails, loose connections, tie-off points, damaged components, proper access, and the use of fall protection equipment.

2.6.8 Maintenance and Storage

Maintain scaffolds in good repair. Only replacement components from the original manufacturer should be used. Intermixing scaffold components from different manufacturers should be avoided. Fabricated scaffolds should be repaired according to the manufacturer’s specifications and guidance. Job-built scaffolds should not be repaired without the supervision of a competent person. Store all scaffolding parts in an organized manner in a dry and protected environment. Examine all parts and clean, repair or dispose of them as necessary.

3. FALL PROTECTION SYSTEMS CRITERIA AND PRACTICES

Common Fall Protection Ways;

- Guardrail Systems
- Safety net
- Personal fall arrest
- Warning line system
- Controlled access zone

3.1 Guardrail Systems

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

Toprails and midrails of guardrail systems must be at least one-quarter inch (0.6 centimeters) nominal diameter or thickness to prevent cuts and lacerations. If wire rope is used for toprails, it must be flagged at not more than 6 feet intervals (1.8 meters) with high-visibility material.

Steel and plastic banding cannot be used as toprails or midrails. Manila, plastic, or synthetic rope used for toprails or midrails must be inspected as frequently as necessary to ensure strength and stability.

The top edge height of toprails, or guardrails must be 42 inches (1.1 meters) plus or minus 3 inches (8 centimeters), above the walking/working level. When workers are using stilts, the top edge height of the top rail, or equivalent member must be increased an amount equal to the height of the stilts.

Screens, midrails, mesh, intermediate vertical members, or equivalent intermediate structural members must be installed between the top edge of the guardrail system and the walking/working surface when there are no walls or parapet walls at least 21 inches (53 centimeters) high.

When midrails are used, they must be installed at a height midway between the top edge of the guardrail system and the walking/working level. When screens and mesh are used, they must extend from the top rail to the walking/working level and along the entire opening between top rail supports. Intermediate members, such as balusters, when used between posts, shall not be more than 19 inches (48 centimeters) apart.

Other structural members, such as additional midrails and architectural panels, shall be installed so that there are no openings in the guardrail system more than 19 inches (48 centimeters).

The guardrail system must be capable of withstanding a force of at least 200 pounds (890 newtons) applied within 2 inches of the top edge in any outward or downward direction. When the 200 pound (890 newtons) test is applied in a downward direction, the top edge of the guardrail must not deflect to a height less than 39 inches (1 meter) above the walking/working level.

Midrails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural

members shall be capable of withstanding a force of at least 150 pounds (667 newtons) applied in any downward or outward direction at any point along the midrail or other member.

Guardrail systems shall be surfaced to protect workers from punctures or lacerations and to prevent clothing from snagging.

The ends of top rails and midrails must not overhang terminal posts, except where such overhang does not constitute a projection hazard.

When guardrail systems are used at hoisting areas, a chain, gate, or removable guardrail section must be placed across the access opening between guardrail sections when hoisting operations are not taking place.

At holes, guardrail systems must be set up on all unprotected sides or edges. When holes are used for the passage of materials, the hole shall have not more than two sides with removable guardrail sections. When the hole is not in use, it must be covered or provided with guardrails along all unprotected sides or edges.

If guardrail systems are used around holes that are used as access points (such as ladderways), gates must be used or the point of access must be offset to prevent accidental walking into the hole.

If guardrails are used at unprotected sides or edges of ramps and runways, they must be erected on each unprotected side or edge.

3.2 Personal Fall Arrest Systems

This system will usually consist of an anchorage, connectors, and a body belt or body harness and may include a deceleration device, lifeline, or suitable combinations. If a personal fall arrest system is used for fall protection, it must do the following:

- Limit maximum arresting force on an employee to 900 pounds (4 kilonewtons) when used with a body belt;
- Limit maximum arresting force on an employee to 1,800 pounds (8 kilonewtons) when used with a body harness;
- Be rigged so that an employee can neither free fall more than 6 feet (1.8 meters) nor contact any lower level;
- Bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet (1.07 meters) and
- Have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of 6 feet (1.8 meters) or the free fall distance permitted by the system, whichever is less.

As of January 1, 1998, the use of a body belt for fall arrest is prohibited.

Personal fall arrest systems must be inspected prior to each use for wear damage, and other deterioration. Defective components must be removed from service. Dee-rings and snaphooks must have a minimum tensile strength of 5,000 pounds (22.2 kilonewtons). Dee-rings and snaphooks shall be proof-tested to a minimum tensile load of 3,600 pounds (16 kilonewtons)

without cracking, breaking, or suffering permanent deformation.

Snaphooks shall be sized to be compatible with the member to which they will be connected, or shall be of a locking configuration.

Unless the snaphook is a locking type and designed for the following connections, they shall not be engaged (a) directly to webbing, rope or wire rope; (b) to each other; (c) to a dee-ring to which another snaphook or other connector is attached; (d) to a horizontal lifeline; or (e) to any object incompatible in shape or dimension relative to the snaphook, thereby causing the connected object to depress the snaphook keeper and release unintentionally.

OSHA considers a hook to be compatible when the diameter of the dee-ring to which the snaphook is attached is greater than the inside length of the snaphook when measured from the bottom (hinged end) of the snaphook keeper to the inside curve of the top of the snaphook. Thus, no matter how the dee-ring is positioned or moved (rolls) with the snaphook attached, the dee-ring cannot touch the outside of the keeper, thus depressing it open. As of January 1, 1998, the use of nonlocking snaphooks is prohibited.

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

Horizontal lifelines shall be designed, installed, and used under the supervision of a qualified person, as part of a complete personal fall arrest system that maintains a safety factor of at least two. Lifelines shall be protected against being cut or abraded.

Self-retracting lifelines and lanyards that automatically limit free fall distance to 2 feet (0.61 meters) or less shall be capable of sustaining a minimum tensile load of 3,000 pounds (13.3 kilonewtons) applied to the device with the lifeline or lanyard in the fully extended position.

Self-retracting lifelines and lanyards that do not limit free fall distance to 2 feet (0.61 meters) or less, ripstitch lanyards, and tearing and deforming lanyards shall be capable of sustaining a minimum tensile load of 5,000 pounds (22.2 kilonewtons) applied to the device with the lifeline or lanyard in the fully extended position.

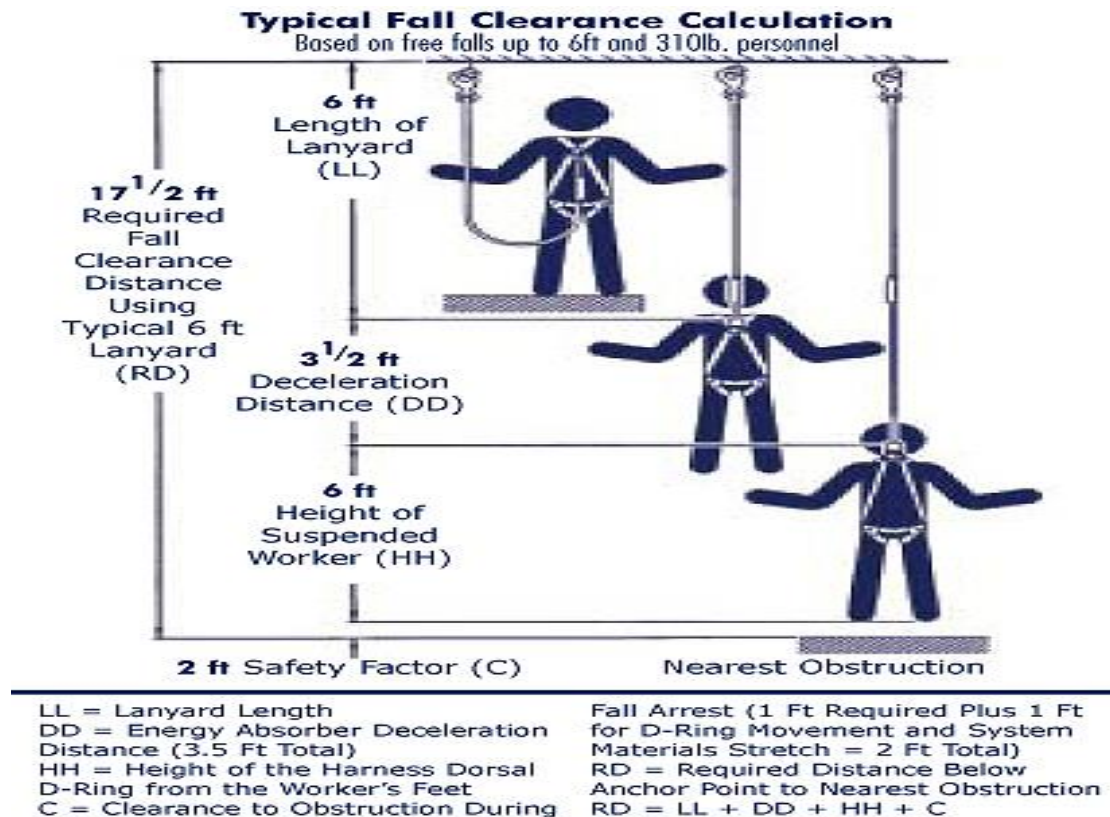
Ropes and straps (webbing) used in lanyards, lifelines, and strength components of body belts and body harnesses shall be made of synthetic fibers.

Anchorage shall be designed, installed, and used under the supervision of a qualified person, as part of a complete personal fall arrest system that maintains a safety factor of at least two, i.e., capable of supporting at least twice the weight expected to be imposed upon it. Anchorages used to attach 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 (22.2 kilonewtons) per person attached.

Lanyards and vertical lifelines must have a minimum breaking strength of 5,000 pounds (22.2 kilonewtons).

3.2.1 Calculating Fall Clearance

How to calculate total fall distance: Lanyard length (6 feet) + deceleration distance (3.5 feet) + worker's height (6 feet) + safety margin (3 feet) = 18.5 vertical feet from anchorage to lower level.



3.3 Positioning Device Systems

These body belt or body harness systems are to be set up so that a worker can free fall no farther than 2 feet (0.6 meters). 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 (13.3 kilonewtons), whichever is greater. Requirements for snaphooks, dee-rings, and other connectors used with positioning device systems must meet the same criteria as those for personal fall arrest systems.

3.4 Safety Monitoring Systems

When no other alternative fall protection has been implemented, the employer shall implement a safety monitoring system. Employers must appoint a competent person to monitor the safety of workers and the employer shall ensure that the safety monitors:

- 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.

Mechanical equipment shall not be used or stored in areas where safety monitoring systems are being used to monitor employees engaged in roofing operations on low-sloped roofs.

No worker, other than one engaged in roofing work (on low-sloped roofs) or one covered by a fall protection plan, shall be allowed in an area where an employee is being protected by a safety monitoring system.

All workers in a controlled access zone shall be instructed to promptly comply with fall hazard warnings issued by safety monitors.

3.5 Safety Net Systems

Safety nets must be installed as close as practicable under the walking/working surface on which employees are working and never more than 30 feet (9.1 meters) below such levels. Defective nets shall not be used. Safety nets shall be inspected at least once a week for wear, damage, and other deterioration. The maximum size of each safety net mesh opening shall not exceed 36 square inches (230 square centimeters) nor be longer than 6 inches (15 centimeters) on any side, and the openings, measured center-to-center, of mesh ropes or webbing, shall not exceed 6 inches (15 centimeters). All mesh crossings shall be secured to prevent enlargement of the mesh opening. Each safety net or section shall have a border rope for webbing with a minimum breaking strength of 5,000 pounds (22.2 kilonewtons). Connections between safety net panels shall be as strong as integral net components and be spaced no more than 6 inches (15 centimeters) apart.

Safety nets shall be installed with sufficient clearance underneath to prevent contact with the surface or structure below. When nets are used on bridges, the potential fall area from the walking/working surface to the net shall 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 (1.5 meters)	8 feet (2.4 meters)
More than 5 feet (1.5 meters) up to 10 feet (3 meters)	10 feet (3 meters)
More than 10 feet (3 meters)	13 feet (3.9 meters)

Safety nets shall be capable of absorbing an impact force of a drop test consisting of a 400-pound (180 kilogram) bag of sand 30 inches (76 centimeters) in diameter dropped from the highest walking/working surface at which workers are exposed, but not from less than 42 inches (1.1 meters) above that level.

Items that have fallen into safety nets including—but not restricted to, materials, scrap, equipment, and tools—must be removed as soon as possible and at least before the next work shift.

3.6 Warning Line Systems

Warning line systems consist of ropes, wires, or chains, and supporting stanchions and are set up as follows:

- Flagged at not more than 6-foot (1.8 meters) intervals with high-visibility material;
- Rigged and supported so that the lowest point (including sag) is no less than 34 inches (0.9 meters) from the walking/working surface and its highest point is no more than 39 inches (1 meter) from the walking/working surface.
- Stanchions, after being rigged with warning lines, shall be capable of resisting, without tipping over, a force of at least 16 pounds (71 newtons) applied horizontally against the stanchion, 30 inches (0.8 meters) above the walking/working surface, perpendicular to the warning line and in the direction of the floor, roof, or platform edge;
- The rope, wire, or chain shall have a minimum tensile strength of 500 pounds (2.22 kilonewtons) and after being attached to the stanchions, must support without breaking, the load applied to the stanchions as prescribed above.
- Shall be attached 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 lines shall be erected around all sides of roof work areas. When mechanical equipment is being used, the warning line shall be erected not less than 6 feet (1.8 meters) from the roof edge parallel to the direction of mechanical equipment operation, and not less than 10 feet (3 meters) from the roof edge perpendicular to the direction of mechanical equipment operation.

When mechanical equipment is not being used, the warning line must be erected not less than 6 feet (1.8 meters) from the roof edge.

3.7 Covers

Covers located in roadways and vehicular aisles must be able to support at least twice the maximum axle load of the largest vehicle to which the cover might be subjected. All other covers must be able to support at least twice the weight of employees, equipment, and materials that may be imposed on the cover at any one time. To prevent accidental displacement resulting from wind, equipment, or workers' activities, all covers must be secured. All covers shall be color coded or bear the markings "HOLE" or "COVER."

3.8 Protection From Falling Objects

When guardrail systems are used to prevent materials from falling from one level to another, any openings must be small enough to prevent passage of potential falling objects. No materials or equipment except masonry and mortar shall be stored within 4 feet (1.2 meters) of working edges. Excess mortar, broken or scattered masonry units, and all other materials and debris shall be kept clear of the working area by removal at regular intervals.

During roofing work, materials and equipment shall not be stored within 6 feet (1.8 meters) of a roof edge unless guardrails are erected at the edge, and materials piled, grouped, or stacked near

a roof edge must be stable and self-supporting.

3.8.1 Canopies

When used as protection from falling objects canopies must be strong enough to prevent collapse and to prevent penetration by any objects that may fall onto them.

3.8.2 Toeboards

When toeboards are used as protection from falling objects, they must be erected along the edges of the overhead walking/working surface for a distance sufficient to protect persons working below. Toeboards shall be capable of withstanding a force of at least 50 pounds (222 newtons) applied in any downward or outward direction at any point along the toeboard. Toeboards shall be a minimum of 3.5 inches (9 centimeters) tall from their top edge to the level of the walking/working surface, have no more than 0.25 inches (0.6 centimeters) clearance above the walking/working surface, and be solid or have openings no larger than 1 inch (2.5 centimeters) in size.

Where tools, equipment, or materials are piled higher than the top edge of a toeboard, panelling or screening must be erected from the walking/working surface or toeboard to the top of a guardrail system's top rail or midrail, for a distance sufficient to protect employees below.

3.9 Training

Employers must provide a training program that teaches employees who might be exposed to fall hazards how to recognize such hazards and how to minimize them. Employees must be trained in the following areas: (a) the nature of fall hazards in the work area; (b) the correct procedures for erecting, maintaining, disassembling, and inspecting fall protection systems; (c) the use and operation of controlled access zones and guardrail, personal fall arrest, safety net, warning line, and safety monitoring systems; (d) the role of each employee in the safety monitoring system when the system is in use; (e) the limitations on the use of mechanical equipment during the performance of roofing work on low-sloped roofs; (f) the correct procedures for equipment and materials handling and storage and the erection of overhead protection; and, (g) employees' role in fall protection plans.

Employers must prepare a written certification that identifies the employee trained and the date of the training. The employer or trainer must sign the certification record. Retraining also must be provided when necessary.

GLOSSARY

Anchorage: A secure point of attachment for lifelines, lanyards or deceleration devices.

Body belt: A strap with means both for securing it about the waist and for attaching it to a lanyard, lifeline, or deceleration device.

Body harness: Straps that may be secured about the person in a manner that distributes the fall-arrest forces over at least the thighs, pelvis, waist, chest, and shoulders with a means for attaching the harness to other components of a personal fall arrest system.

Brace: A tie that holds one scaffold member in a fixed position with respect to another member. Brace also means a rigid type of connection holding a scaffold to a building or structure.

Connector: A device that is used to couple (connect) parts of a personal fall arrest system or positioning device system together.

Controlled access zone: A work area designated and clearly marked in which certain types of work (such as overhand bricklaying) may take place without the use of conventional fall protection systems—guardrail, personal arrest or safety net—to protect the employees working in the zone.

Coupler: A device for locking together the component tubes of a tube and coupler scaffold.

Deceleration device: Any mechanism—such as rope, grab, ripstitch lanyard, specially-woven lanyard, tearing or deforming lanyards, automatic self-retracting lifelines/lanyards—which serves to dissipate a substantial amount of energy during a fall arrest, or otherwise limits the energy imposed on an employee during fall arrest.

Deceleration distance: The additional vertical distance a falling person travels, excluding lifeline elongation and free fall distance, before stopping, from the point at which a deceleration device begins to operate.

Guardrail system: A barrier erected to prevent employees from falling to lower levels.

Harness: A design of straps which is secured about the employee in a manner to distribute the arresting forces over at least the thighs, shoulders, and pelvis, with provisions for attaching a lanyard, lifeline, or deceleration device.

Hoist: A mechanical device to raise or lower a suspended scaffold. It can be mechanically powered or manually operated.

Hole: A void or gap 2 inches (5.1 centimeters) or more in the least dimension in a floor, roof, or other walking/working surface.

Lanyard: A flexible line of rope, wire rope, or strap that generally has a connector at each end for connecting the body belt or body harness to a deceleration device, lifeline, or anchorage.

Leading edge: The edge of a floor, roof, or formwork for a floor or other walking/working surface (such as the deck) which changes location as additional floor, roof, decking, or formwork sections are placed, formed or constructed.

Lifeline: A component consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline), or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline) and that serves as a means for connecting other components of a personal fall arrest system to the anchorage.

Low-slope roof: A roof having a slope less than or equal to 4 in 12 (vertical to horizontal).

Maximum Intended Load: The total load of all employee, equipment, tool, materials, transmitted, wind, and other loads reasonably anticipated to be applied to a scaffold or scaffold component at any one time.

Mechanically Powered Hoist: A hoist which is powered by other than human energy.

Opening: A gap or void 30 inches (76 centimeters) or more high and 18 inches (46 centimeters) or more wide, in a wall or partition, through which employees can fall to a lower level.

Outriggers: The structural member of a supported scaffold used to increase the base width of a scaffold in order to provide greater stability for the scaffold.

Personal fall arrest system: A system including but not limited to an anchorage, connectors, and a body belt or body harness used to arrest an employee in a fall from a working level. As of January 1, 1998, the use of a body belt for fall arrest is prohibited.

Platform: The horizontal working surface of a scaffold.

Positioning device system: A body belt or 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 backwards.

Rope grab: A deceleration device that travels on a lifeline and automatically, by friction, engages the lifeline and locks to arrest a fall.

Safety Belt: A strap with means for securing about the waist or body and for attaching to a lanyard, lifeline, or deceleration device

Safety-monitoring system: A safety system in which a competent person is responsible for recognizing and warning employees of fall hazards.

Self-retracting lifeline/lanyard: A deceleration device containing a drum-wound line which can be slowly extracted from, or retracted onto, the drum under minimal tension during normal employee movement and which, after onset of a fall, automatically locks the drum and arrests the fall.

Snaphook: A connector consisting of a hook-shaped member with a normally closed keeper, or similar arrangement, which may be opened to permit the hook to receive an object and, when released automatically closes to retain the object.

Steep roof: A roof having a slope greater than 4 in 12 (vertical to horizontal).

Toeboard: A low protective barrier that prevents material and equipment from falling to lower levels and which protects personnel from falling.

Unprotected sides and edges: Any side or edge (except at entrances to points of access) of a walking/working surface (e.g. floor, roof, ramp, or runway) where there is no wall or guardrail system at least 39 inches (1 meter) high.

Walking/working surface: Any surface, whether horizontal or vertical, on which an employee walks or works, including but not limited to floors, roofs, ramps, bridges, runways, formwork, and concrete reinforcing steel. Does not include ladders, vehicles, or trailers on which employees must be located to perform their work duties.

Warning line system: 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, body belt, or safety net systems to protect employees in the area.

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