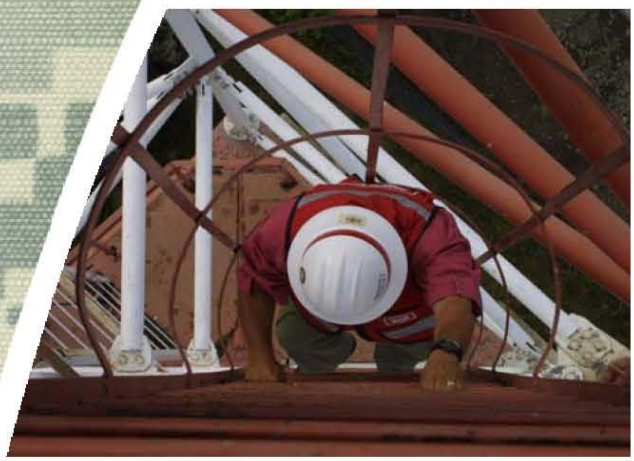
US Army Corps of Engineers.

FALL PROTECTION
Program Guide



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BUILDING STRONG®

USACE Fall Protection Guide

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Chapter 1

Introduction

1. Purpose. This Guide establishes criteria and requirements for developing and managing Fall Protection (FP) programs to protect all personnel at USACE-Owned/Operated Facilities.

2. Background. Falls are a leading cause of work-related injuries and fatalities, with thousands of workers suffering injuries due to falls with lost time from work, and half of all fall fatalities occurred in the construction industry. The intent of this guide is to establish criteria, requirements and best practices for fall protection programs in order to heighten awareness and protect all personnel exposed to fall hazards in the workplace. Falls are preventable and careful planning and preparation lays the necessary groundwork for an accident-free workplace.

3. Application. This guide applies to all USACE-Owned/Operated Facilities where there is a need for a Fall Protection program to ensure the safety of all personnel. It provides information on standards, regulations, and criteria and requirements for the protection of personnel and workers working at heights and exposed to fall hazards.

4. USACE Fall Protection Policy. Per the USACE Safety and Health Requirements Manual, EM 385-1-1, every facility having personnel working at heights, exposed to fall hazards and using fall protection equipment is responsible for establishing, implementing and managing a Fall Protection Program, which includes identification and elimination or control of fall hazards. These facilities are responsible for: assigning responsibilities; surveying and assessing fall hazards; providing prevention and control measures; training of personnel; inspecting fall protection equipment; auditing and evaluating effectiveness of the program; and ensuring proper installation and use of fall protection systems and providing rescue equipment with accompanying rescue procedures. Fall protection must be provided to personnel exposed to fall hazards on any elevated walking/working surface with unprotected side, edge, or floor openings, from which there is a possibility of falling four feet or more to lower level or where there is a possibility of a fall from any height onto dangerous equipment, into a hazardous environment, or onto an impalement hazard.

5. Facility Fall Protection Policy. Each facility may prescribe supplemental requirements for special conditions above and beyond the USACE policy stated in paragraph 4 above. Developing a facility-specific policy will provide guidance and requirements and delineate responsibilities at the facility. A facility-specific policy should emphasize management's commitment to provide a safe work environment for personnel working at heights and the fact that safety of personnel during performance of their work is of the utmost importance.

6. Basic Requirements for Fall Protection. The threshold limit for providing fall protection is mandated by EM 385-1-1 and OSHA.

a. The standard fall protection threshold for federal employees in our facilities is 4 feet as per EM 385-1-1 and OSHA's General Industry Standards, 29 CFR 1910, Subpart D.

b. At construction sites, workers shall adhere to the threshold height no greater than 6 feet, as per EM 385-1-1 and OSHA's Construction Industry Standards, 29 CFR 1926.500, Subpart M. When USACE employees visit construction sites to inspect contractor work, they shall comply with the 6 ft threshold.

c. If there is a potential to fall onto dangerous equipment, into a hazardous environment, or onto an impalement hazard from any height, the employee must be protected.

For information only, the following is a table indicating the threshold for various industries:

Industry	Feet	Regulations Source
Contractor or Construction	6	EM 385-1-1 29 CFR 1926.500
General Industry	4	EM 385—1-1 29 CFR 1910.23
Shipyard	5	29 CFR 1915.159
Marine Terminals	4	29 CFR 1917.112
Long-Shoring	8	29 CFR 1918

7. Compliance. 29 CFR 1960, Section 19 of the Occupational Safety and Health Act (OSHA) of 1970 and Executive Order 12196 prescribes requirements for federal occupational safety and health programs and contains provisions to assure safe and healthful working conditions for federal employees. Under Section 19 of the OSHA Act and 29 CFR 1960.16 (for Federal Agencies), Occupational Safety and Health programs shall be consistent and in compliance with the standards promulgated under Section 6 of the Act. Section 6 directs, by rule, the Secretary of Labor to promulgate the OSHA Standard 29 CFR 1910.

a. USACE personnel shall comply with the EM 385-1-1 and 29 CFR 1910 requirement of 4 feet as stated under Subpart D, Walking-Working Surfaces, unless there are other alternate promulgated standards that are more specific to an Activity, Command, or industry, such as the 6 foot requirement for USACE contractors performing construction and demolition work.

b. Therefore, at USACE-owned/operated facilities fall protection must be provided to each employee on any elevated walking/working surface ABOVE 4 FEET including working from fixed ladders and where there is a possibility of a fall to a lower level, onto dangerous equipment, into a hazardous environment, or onto an impalement hazard.

Exceptions: (1) When climbing ladders, or (2) when erecting or dismantling supported scaffolds, when it is determined by a competent person after conducting an evaluation, that providing fall protection is not feasible or creates a greater hazard (i.e., when it is necessary to erect scaffolding before the structure and requiring the scaffold structure to be erected or put in place).

8. Comparison between OSHA and EM 385-1-1 Fall Protection Requirements. Appendix A provides a comparison between various OSHA and USACE EM 385-1-1 fall protection standards. All the fall protection standards, regulations and requirements are similar in the application and use of fall protection equipment. A primary difference is the threshold limit at which fall protection is required (4, 5, or 6 feet heights). These heights impact the level at which temporary guardrails and work platforms are installed or used. Fall arrest equipment **cannot** be used at these elevations as the minimum clearance required for using fall arrest systems safely is approximately 11 feet [depending on the length of the lanyard, type of lanyard (e.g., self-retracting lanyard), and the height of anchorage point]. Other fall arrest systems require more clearance. Fall restraint, travel restraint and warning line systems **may be** used at any elevation and are not impacted by the prescribed threshold limits of 4, 5 and 6 feet, because if using these systems, the user will not be exposed to a fall hazard.

9. Regulations and Standards.

a. EM 385-1-1. It shall be included and enforced on all DoD contracts involving construction, dismantling, or demolition or removal work. In addition, EM 385-1-1 shall be required for service, supply, and research and development contracting actions unless technical representatives (in conjunction with safety and health professionals) advise that special precautions are not appropriate. Contractors performing such work shall comply with all pertinent provisions of the latest version of the manual (FAR 52.236-13).

b. 29 CFR, PART 1926.500, Subpart M, Fall Protection Requirements in the Construction Industry.

c. 29 CFR, PART 1910, Occupational Safety and Health Standards for General Industry.

d. 29 CFR PART 1915, Occupational Safety and Health Standards for Shipyard Employment.

e. 29 CFR 1917, Marine Terminals.

f. 29 CFR PART 1918, Safety and Health Regulations for Long shoring.

g. 29 CFR PART 1960, Basic Program Elements for Federal Employee Occupational Safety and Health Programs.

h. DoD Directive 6055.1, Occupational Safety and Health Program.

i. American National Standards Institute (ANSI), Z359 Fall Protection Code, (24 November 2007).

j. Unified Facilities Guide Specification (UFGS) 01 35 26 Governmental Safety Requirements.

k. NLI A14.3 (R2008) Safety Requirements for Fixed Ladders.

l. Unified Facilities Criteria (UFC) (2007) Roofing Maintenance and Repair.

Chapter 2

Fall Protection Program

1. General. Each USACE-Owned/Operated facility that has personnel exposed to fall hazards is required to establish and implement a Fall Protection program per EM 385-1-1. The managed Fall Protection Program shall be in writing, reviewed and approved by the local Safety office.

- ***As an alternative to this requirement, a USACE-Owned Facility, in lieu of a separate written program with the safety office review and approval, may state in writing that it is using this guide as their Fall Protection program. Site specific requirements would be included, to include Appendix B.***

2. Components of the Fall Protection Program.

a. Facility policy.

b. Duties and responsibilities.

c. Workplace surveys and assessment of fall hazards.

d. Training Requirements.

e. Fall hazard prevention and control, including the preparation of Fall Protection and Prevention Plans.

f. Inspection, storage, care, and maintenance of equipment.

g. Rescue procedures.

h. Mishap reporting.

i. Audits and evaluation.

3. Fall Protection Program Format. A written Fall Protection Program sample/template can be found in Appendix B.

Chapter 3

Duties and Responsibilities

1. General. USACE facilities shall delineate duties and assign responsibilities to qualified and trained personnel involved in the development and management of the Fall Protection Program. Each facility shall ensure that assigned personnel have the necessary skills, knowledge, training and expertise to mange, administer, and implement the Fall Protection Program.

2. Fall Protection Program Manager/Administrator. The duties and responsibilities of the Fall Protection Program manager/administrator include, but are not limited to, the following:

- Developing and managing the Fall Protection Program at the activity;
- Ensuring all personnel exposed to fall hazards and using fall protection equipment are adequately trained before using the equipment;
- Ensuring other personnel involved in the Fall Protection Program are adequately trained;
- Developing overall fall protection training programs;
- Developing and approving fall protection equipment purchases; and
- Evaluating the Fall Protection Program effectiveness.

3. Qualified Person (Qualified Person) for Fall Protection (reference Appendix Q of EM 385-1-1). The Qualified Person for Fall Protection shall also meet the qualifications of a Competent Person for Fall Protection. The duties and responsibilities of the Qualified Person for Fall Protection include, but not limited to, the following:

- Supporting the Fall Protection Program;
- Preparing, reviewing, approving and modifying:
  - Fall Protection and prevention plans;
  - Rescue plans and procedures;
- Designing, selecting, certifying, evaluating, and analyzing fall protection systems and equipment;
- Designing or supervising the design, selection, installation and inspection of certified anchorages and horizontal lifelines;
- Reviewing, preparing, and approving project fall protection specifications;

- Preparing contract documents for fall protection systems; and

- Having knowledge of all fall protection standards and regulations.

4. Competent Person For Fall Protection (reference Appendix Q of EM 385-1-1). The duties and responsibilities of the Competent Person for Fall Protection include, but are not limited to, the following:

- Immediate supervision (in conjunction with the Fall Protection Program Manager), implementation and monitoring of the Fall Protection Program;

- Preparation and implementation of:

  - Fall Protection and prevention plans;

  - Rescue plans and procedures;

- Identification of hazardous and dangerous conditions in the workplace and take prompt corrective measures to correct them;

- Conducting fall hazard surveys and prepare survey reports;

- Inspection and installation of approved fall protection systems;

- Ensuring end users working at heights and using fall protection equipment are adequately trained;

- Supervising the selection, installation and inspection on non-certified anchorages;

- Understanding and knowledge of fall protection systems and equipment;

- Conducting inspections and accident investigations;

- Having full responsibility and authority to implement the Fall Protection and Prevention Plan and Rescue Plan procedures;

- Knowledge of fall protection regulations and standards;

- Monitoring employee compliance with the Fall Protection and Prevention Plan and Rescue Plan requirements.

Chapter 4

Workplace Survey and Assessment of Fall Hazards

1. Fall Hazard Survey. A fall hazard survey will identify potential fall hazards in the workplace. The gathered information will provide documentation to assist in the development of viable solutions to protect personnel exposed to fall hazards. Understanding work procedures and how a person conducts the required task is very important in the selection and development of the most appropriate fall protection method. A fall hazard survey will help identify options for fall hazard elimination and/or selecting other control measures. The fall hazard survey shall be conducted annually and the survey information, required for identifying fall hazards at existing buildings or facilities should include, at a minimum:

a. Interview of end user(s) and their supervisors;

b. Work-paths and movement of the end users;

c. Range of mobility in each fall-hazard zone;

d. Location and distances to obstructions;

e. Potential anchorage location, if a fall hazard cannot be eliminated or prevented;

f. Available clearance and total fall distance;

g. Number of personnel exposed to fall hazards;

h. Frequency and duration of exposure;

i. Lock-Out/Tag-Out hazards;

j. Potential severity of falls;

k. Access or egress to fall-hazard area;

l. Condition of floors and other surfaces, to include load-bearing capacity;

m. Reviews of any fall mishap reports at the facility;

n. Identification of the presence of:

- Hot objects, sparks, flames, and heat-producing objects;
- Electrical and chemical hazards;
- Sharp objects;

- Abrasive surfaces;
- Moving equipment and materials;
- Weather factors; and
- Any other maintenance, work environment issues or conditions

2. Structural Integrity of walking/working surfaces. Facilities shall determine if the walking or working surfaces on which employees are to walk or work have the strength and structural integrity to safely support the workers. Employees shall not be permitted to work on those surfaces until it has been determined that the surfaces have the requisite strength and structural integrity to support the workers and equipment related to their tasks. Once it has been determined that the surface is safe for employees to work on, then it should be determined if a fall hazard exists at the work location.

3. Visiting Employees/Contractors. If visitors or contractors are visiting or performing work at the facility where the worksite is located and fall hazards or potential fall hazards are encountered, they will work under the project Fall Protection Plan or develop their own if the fall hazards are not addressed under the project Fall Protection Plan.

4. Fall Hazard Assessment. After conducting the fall hazard survey at a workplace, a hazard analysis can be performed to assess the risk, hazard severity, and fall mishap probability. This will help in prioritizing the hazard ranking and selection of the most viable fall protection solutions. The primary consideration is to eliminate/remove potential fall hazards from the work place.

5. Fall Hazard Survey Report. The following are guidelines for preparing a report:

- A survey shall be conducted for each fall hazard to which a person may be exposed;
- The report shall identify one or more methods to eliminate or control fall hazards;
- A person who is familiar with building operations and work procedures should accompany the individual conducting the survey;
- The survey should include pertinent information as to the type of fall hazard showing basic configuration (drawings/photos);
- The report shall identify environmental factors that may affect the building/facility;
- The report shall establish risk factors to assist in hazard ranking;
- The report shall be revised whenever there is a change in work procedure/task equipment or requirements that will render the previous report obsolete;

- Interview personnel that will be working at heights and exposed to fall hazards.

  - ***Note: The survey should be conducted by the Competent Person for Fall Protection. The Competent Person can train and delegate another person to assist with the survey.***

A Sample Fall Hazard Survey Report can be found in Appendix C.

Chapter 5

Training

1. Training Requirements. All USACE personnel working at heights, exposed to fall hazards and using fall protection equipment or other personnel involved in the Fall Protection Program shall be trained to recognize the hazards of falling in the workplace and how to minimize such hazards.

a. Before using fall protection equipment, the employee must be trained in the safe use of equipment. It is recommended that all employees exposed to fall hazards receive a minimum of 4-8 hours of fall protection training including hands-on training, or as appropriate.

b. Annual refresher training shall be provided as necessary for employees to maintain an understanding of these subjects.

c. Written certification of training is required and shall be maintained at the job site for the duration of the work. For those visitors working under the project Fall Protection Program, they shall provide a certificate of training. The certificate shall identify the name of the employee trained, date of training, and the signature of the trainer. Additionally, a determination shall be made as to whether the training has resulted in personnel acquiring the required skills and knowledge.

d. A daily "Tool Box" meeting shall be conducted before work is begun to discuss fall hazards for that day and to remind workers to comply with the established Fall Protection procedures.

e. For USACE personnel who may be in a situation that requires climbing involving the use of fall arrest systems, the end user training shall also include practical climbing in a controlled situation in the presence of a Competent Person for Fall Protection. Additionally, end users shall be trained in rescue and self-rescue equipment and procedures. A Competent Person who has the knowledge, expertise, and education to deliver the training shall train end users. The Competent Person should also be qualified as a Fall Protection trainer for end users.

f. Hands-on training is also required for investigation and inspection work.

g. Architects, engineers, and designers involved in planning and designing buildings, facilities, and structures shall be knowledgeable in fall protection and prevention control measures and incorporate fall protection measures into their design work to help contractors during the construction phase and to provide protection to USACE personnel performing their work during normal operations and maintenances. Training requirements for other USACE personnel involved in the Fall Protection Program and not listed in paragraph 4.2 shall be determined by the Fall Protection Program Manager.

2. Fall Protection Training Matrix. All training shall be based on the requirements of ANSI/ASME Z359 (2007). The following training matrix requirements and methods identify the degree of training for various USACE personnel:

Fall Protection Training Requirements and Methods

Trainee Group	**Desired Training Objectives**	**Training Mechanism, Type and Length**
End User/Authorized Persons	- Selection and safe use of equipment - Application limits - Proper anchoring and tie-off techniques - Estimation of fall distances - Determination of deceleration distance - Total fall distance - Methods of inspection - Storage, care, and maintenance of equipment - Applicable regulations Limitations of equipment - Specific lifelines - Rescue and self rescue techniques - Recognize fall-hazard deficiencies - Recognize fall risks at worksite	Formal/hands-on training using local equipment or on-site training as applicable to the activity (2-8 hours or as appropriate, deemed by a Competent Person for Fall Protection) Refresher training – 1 hour annually.
Safety Professionals Construction Managers/Quality Assurance Personnel	- Recognize fall hazard deficiencies - Recognize fall risks at worksite - Basic fall protection systems and equipment - Methods of use - Proper anchoring and tie-off techniques - Methods of inspection and record keeping - Storage of the equipment - Applicable regulations- Rescue equipment and procedures	Interactive CD-ROM or Formal Classroom

Trainee Group	**Desired Training Objectives**	**Training Mechanism, Type and Length**
Competent Person for Fall Protection (As Designated by the Facility or Designated in Writing as the Competent Person)	- In addition to the authorized person training, training shall also include: -Various fall protection systems - Donning of the equipment - Proper inspection and record keeping - Recognize and identify fall hazards at work-site - Equipment installation techniques - Proper anchoring and tie off techniques - Risk assessment and hazard ranking - Preparation, update, review and approval of Fall Protection and Prevention plans, and Rescue and Evacuation plans - Applicable fall protection regulations - Plan and specification review and approval	Formal Training (Minimum 32 hours, including a minimum of 16 hours classroom and 8 hours of hands-on)
Qualified Person for Fall Protection	- Design, select, analyze, and certify fall protection systems and equipment - Preparation, update, review, and approval of fall protection and prevention plans, and rescue and evacuation plans - Fall protection regulations and standards - Plan and specification review and approval	Formal Classroom (40 hours or as appropriate)
Architects and Engineers (Designers) involved in planning and design of buildings, facilities and structures	- Understand various fall protection and prevention planning and design considerations during construction and maintenance phases - Recognize fall hazard deficiencies - Recognize fall risks assessment and control measures at worksites - Basic systems identification and proper use	Formal Classroom (Awareness Training)
Fall Protection Program Managers/ Administrators	- Recognize and identify fall hazards at workplaces - Risk assessment and hazard ranking - Selection, safe use, and limitation of fall protection systems and equipment - Storage, care, and maintenance of the equipment - Applicable fall protection regulations	Qualified or Competent Person formal training.
Supervisors of End Users	- Fall protection awareness training - Familiarization with SOPs - Local program requirements - Proper inspection and record keeping - Proper anchoring and tie-off techniques	Local Training plan/briefing, and/or instruction, SOP or Web Based Training (Awareness Training)

3. Refresher/Update Training. Personnel exposed to fall hazards shall receive refresher/update training on the safe use of fall protection equipment and rescue in the following:

a. End users, Program Manager/administrator, and the authorized rescuer (in-house person who conducts rescue): Fall Protection - minimum of one hour refresher training annually to stay current with fall protection and rescue requirements.

b. Fall Protection Competent and Qualified Person for Fall Protection: Refresher /update training every two years.

4. Fall Protection Training Roster.

a. All employees newly assigned to a job must review and understand the Fall Protection and Prevention Plan if working under the plan. Whenever the fall hazards, fall protection equipment, or methods change during the course of the job, the Fall Protection and Prevention Plan must be reviewed again by all employees working at the job site. Employees shall be trained in job hazard recognition and shall be trained in the proper use of fall protection equipment. Procedures may be developed at the local level to ensure compliance.

b. All contractor and subcontractor workers exposed to fall hazards shall be trained accordingly.

c. If additional requirements arise or change at the job site as work progresses, the Fall Protection and Prevention Plan and Rescue Plan shall be reviewed and updated by a Qualified or Competent Person and signed by all workers exposed to fall hazards.

d. For those employees or contractors visiting to perform work at heights and exposed to fall hazards at the USACE activity being visited and before starting work at that site, they shall be trained on the proper use of fall frotection and rescue equipment.

5. Training roster. A Fall Protection training roster can be found in Appendix D.

Chapter 6

Fall Hazard Prevention and Controls

1. Hierarchy of controls. USACE-Owned Facilities shall select fall protection control measures compatible with the type of work being performed. If fall hazards cannot be eliminated, fall protection can be provided through the use of fall protection systems and equipment and in accordance with Chapter 6 of this guide. The preferred order of control measures for fall hazards are:

a. Elimination - Removing the hazard from a workplace. This is the most effective control measure e.g., lower various devices or instruments, such as meters or valves to the height level of the individual, instead of servicing such devices or instruments at heights;

b. Prevention (traditional) - Isolating or separating the hazard from the general work areas e.g., same level barriers such as guardrails, walls, covers or parapets;

c. Work Platforms (movable or stationary) – Use scaffolds, scissor lifts or aerial lift equipment to facilitate access to work location and to protect personnel from falling when performing work at high locations;

d. Personal Protective Systems and Equipment - These shall be used after other control measures (such as eliminating or isolating fall hazards) are determined not to be practical, or when a secondary system is needed e.g., when it is necessary to increase protection by employing a backup system;

e. Administrative Controls - This includes introducing new work practices that reduce the risk of a person falling e.g., erecting warning lines or restricting access a work area.

- ***NOTE: Control measures are not mutually exclusive. There may be situations when more than one control measure should be used to reduce the risk of a fall.***

2. Fall Protection and Prevention Plans. The Fall Protection & Prevention Plan, as required by USACE EM 385-1-1, Paragraph 21.C.01 is a document prepared by each USACE-Owned Facility for the purpose of planning, designing, installing, monitoring, and rescuing workers exposed to fall hazards and to prevent fall accidents from occurring in the workplace. It is a living document that will require modification due to changes during different phases of work, procedures, or methods of construction or maintenance work.

a. A Qualified Person for Fall Protection or Competent Person for Fall Protection shall be responsible for preparing the Fall Protection & Prevention Plan, as well as making any required changes, designs, updates, or approvals relating to various methods and requirements pertaining to Fall Protection systems.

b. It is of utmost importance that a Fall Protection & Prevention Plan be prepared and approved prior to start of work. The plans shall be kept at the work site at all times, with any changes noted.

- ***Note: The American National Standards Institute, ANSI Z359 Standard, titled "Minimum Requirements for a Comprehensive Managed Fall Protection Program" identifies the Fall Protection and Prevention Plan as "Written Fall Protection Procedures". According to EM 385-1-1, Paragraph 21.C.01, preparation of the Fall Protection and Prevention Plan is a requirement as part of the fall protection program***

3. Fall Protection & Prevention Plan requirements. The Fall Protection & Prevention Plan is different from a Fall Protection Program required per 29 CFR 1926.502(k). A Fall Protection Plan as required by OSHA is available only to employees who can demonstrate that it is infeasible or it creates greater hazard to use conventional Fall Protection systems: (i.e., guardrail, safety nets, or personal fall arrest system). The Fall Protection & Prevention Plan is a document that includes written procedures for performing a specific work, task, or project, indicating the proper way of using safe fall protection systems and equipment and any other relevant information. However, it is a requirement to develop Fall Protection & Prevention Plan for routine and non-routine tasks. The Fall Protection & Prevention Plan shall include the following:

a. Description of fall hazards that will be encountered at the workplace by users during performance of their work;

b. Type of fall protection/fall prevention methods or systems used for every phase of work;

c. Training requirements for every employee exposed to fall hazards;

d. Type of fall protection equipment and systems provided to the employees that might be exposed to fall hazards;

e. The names of Qualified and Competent Persons for Fall Protection;

f. Indicate fall protection equipment and instructions for assembly, disassembly, storage maintenance, and care;

g. Fall Protection & Prevention Plan is prepared either by a Competent or Qualified Person for Fall Protection. They will also ensure implementation of the plan. All employees working at heights at a job site shall understand and agree to use the Fall Protection & Prevention Plan;

h. Rescue plan and procedures.

4. Preparing the plan. The plan shall:

a. Be prepared specifically for the work place and specific task;

b. Provide for 100% continuous fall protection;

c. Include training requirements and qualifications of the end user permitted to use the system;

d. Include the following:

- Identification of acceptable anchorages;
- Anchorages selected or designed by Qualified Person for Fall Protection or Competent Person for Fall Protection (Certified or Non-Certified anchorages);
- Complete setup procedure for access;
- Clearance requirements/free fall distance/total fall distance;
- Detailed instructions for assembling, use and dismantling of the system including description of all the components;
- Number of personnel using the system;
- Any limitations of the system;
- Applicable manufacturer standards/drawings;
- Detailed instructions for inspecting each component of the system and intervals of inspection;
- Any other related info.

5. Sample Fall Protection & Prevention Plan. A sample Fall Protection and Prevention Plan is included in Appendix E.

Chapter 7

Fall Protection Systems, Criteria and Design Requirements

1. System Selection. It is very important that a Qualified Person or a Competent Person for Fall Protection plan, evaluate, design, and select the most appropriate, safe, and efficient fall protection system. There are many fall protection systems that are available or can be used and it is of the utmost importance to select the right system for a specific work application. A complete understanding of work procedures will enable the Qualified Person or Competent Person for Fall Protection to select the most appropriate fall protection system.

2. Redundant Systems. In every fall-hazard situation, it is always advisable to have two protective systems: primary and secondary system as back-up. If the primary system fails, the secondary system will be activated to protect the employee from falling. For example, when approaching an unprotected side or edge of a roof, the employee's primary protective system is the employee standing on a safe work surface. A secondary protective system is required as a backup, such as a fall arrest/restraint system or guardrails. When climbing a fixed ladder or a pole, the employee's primary fall protective system are his hands and feet. A ladder-climbing device or a self-retracting lanyard would function as a secondary backup system. Always attempt to plan for two fall protection systems.

3. Fall Protection Systems. Every employee exposed to fall hazard shall be protected from falling to a lower level by the use of fall protection systems. The common fall protection systems are:

a. Guardrail Systems;

b. Covers;

c. Work Stands/Stationary Work Platforms and Catwalks;

d. Safety Nets;

e. Fall Arrest System.

f. Other Fall Protection Systems include:

- Horizontal Lifelines;
- Vertical Lifelines;
- Ladder Climbing Devices;
- Positioning Systems;
- Restraint Systems;

- Rope Access;
- Aerial Lifting Equipment, Movable Working Platforms, and Scaffolds ;
- Warning Systems.

Note: A Safety Monitoring System used by itself as a fall protection method is prohibited, however it may be used in conjunction with other fall protection systems. Reference EM 385-1-1, section 21.L.

Note: Controlled Access Zones are not allowed as a fall protection method. Reference EM 385-1-1, section 21.D

4. Prevention Systems (Passive Fall Protection Systems) Criteria & Requirements.

a. Guardrail System. A Guardrail System is a conventional method for the prevention of falls from heights which is installed at all open sided floors, openings and platforms where a person may walk or work.

(1) Open sides and edges mean any side or edge (except at entrances to points of access to floors, roofs, working platforms, stairs, catwalks, scaffolds, and ramps or runways) where there is no wall or guardrail system or a gap in such system.

(2) Guardrails consists of top rail, mid-rails, posts (stanchions) and toe-boards.

- ***Note: A continuous screen mesh can replace the mid-rail if it is installed with 200 pounds strength leaving no vertical opening greater than 19 inches.***

(3) Criteria.

- Top rail shall be 42 inches high, plus or minus 3 inches above walking/working level. (39-45 inches high).
- Mid-rail shall be located half way between the top edge of the guardrail system and the walking working surface, but never with more than a 19 inch gap between the mid-rail and the top of the board, or between mid-rail and the walking working surface.
- Posts shall be spaced no more than 8 feet apart on centers.
- Toe-board shall be a minimum of 3½ inches high.

(4) Construction material.

(a) Wood.

- Wood components shall be made of construction grade (stress grade) lumber, minimum 1,500 lb-ft/square inch fiber;

- Top rail and Posts shall be minimum 2x4 inches of lumber;

- Mid rail shall be made a minimum 1x6 inches lumber;

- Toe-board shall be made a minimum 1x4 inches lumber.

(b) Structural Steel. Posts top-rail and mid-rail shall be at least 2-inch x 2-inch x 3/8 inch structural steel angles.

(c) Pipe Railing. Post, top rail and mid rail shall be at least 1-1/2 inches nominal diameter (schedule 40 pipe).

(d) Steel Cable. Top-rail and mid-rail shall be at least ¼ inch steel cable flagged every 6 feet with high visible material. There shall not be more than a 3 inch sag in the steel cable.

(e) Chains. Chains are only allowed for use as rails in marine applications (EM 385-1-1, Section 19.E).

(5) Strength Requirements. The following is the minimum forces the guardrail system members shall withstand without failure when applied within 2 inches from the top edge in any outward or down-word direction:

- Top-rails - 200 pounds

- Mid-rail - 150 pounds

- Toe-board - 50 pounds

- When a 200 pound force is applied at the top edge of the top-rail in a downward direction, it shall not deflect more than 3 inches.

- Any screens, mesh, intermediate vertical members, solid panels, and any equivalent structural members - 150 pounds.

b. Handrails:

(1) Permanent hand rails: 34-38 inches high.

(2) Temporary handrails (during construction): 30-37 inches high.

- ***Note: If a segment or side of the railing system is required to be left open for easy access at an unprotected side, edge, hatch, etc, use self-closing swing gates to protect personnel from falling.***

c. Parapets.

(1) When working around parapets, constructed at unprotected sides or edges of roofs, the height and strength requirement shall comply with guardrail requirements (42" +/- 3" high).

(2) Newly designed parapets shall meet this requirement as well.

(3) For existing parapet walls with heights of less than 42 inches, the parapet wall may be used as a Fall Protection system if the vertical height is a minimum of 30 in (76 cm) and the width a minimum of 18 in (46 cm) at the top of the wall for a total of 48 in (1.2 m) combined. The effective height of a parapet wall is the sum of the height of the wall and the wall width at the top of the wall. If this criteria is not met, it is not acceptable and personnel working around or close to the parapet will require additional protection (i.e. installing temporary railing). See EM 385-1-1 Change 2, paragraph l.

d. Covers.

- Install covers on any hole, 2 inches or more in its least dimension.

- All covers shall be capable of supporting without failure at least twice the weight of the employees, equipment and materials that may be imposed on the cover at all times.

- Covers shall be secured .

e. Work-Stands, Stationary Work Platforms and Catwalks. Work-stands, stationary work platforms and catwalks shall be equipped with guardrails or other Fall Protection system.

f. Safety Nets. Safety nets are installed as close as practical below the leading edge for employee protection or when working over water, on bridges or high-rise buildings or structures.

(1) Minimum breaking strength of border rope or webbing is 5,000 pounds.

(2) Safety net mesh opening should not be larger than 36 square inches or longer than 6 inches on any side opening.

(3) In any case, the net shall not be installed lower than 25 feet from the working surface.

(4) Safety nets must extend out from the working surface as follows:

Distance from working level to the net	Distance the net should extend from working surface
Up to 5 feet	**8 feet**
Over 5 feet up to 10 feet	**10 feet**
Over 10 feet	**13 feet**

(5) Safety nets shall be tested in suspension position in the field and certified by a qualified person immediately after installation and at six months intervals using a drop test of 400 pounds, dropped from the same elevation that a worker might fall.

(6) Inspect safety nets immediately after installation, weekly thereafter and following any alteration or repairs, or after inclement weather. Inspection must be documented.

(7) Shackles and hook used to safety net installations shall be made of forged steel.

(8) Immediately remove any debris that falls in the net.

5. Personal Fall Arrest System (Active System). The system will become activated when a fall is arrested. PFAS is considered a secondary system.

a. A Personal Fall Arrest System (PFAS) consists of the following subsystems and components:

(1) Anchorage System – Consists of anchorage and anchorage connector;

(2) Connecting Means - includes lanyard (may include energy or shock absorber, snap hooks, and carabiners, self retracting lanyards, or fall arrestors;

(3) Body Support (Full body harness with integral dorsal D-ring);

(4) Rescue procedures- self-rescue or assisted rescue.

b. Employees shall work in pairs (buddy system). As a minimum, a buddy will assist in donning fall protection equipment and in addition there must be an assigned safety person (spotter) if there is an employee or employees climbing and performing work at heights and using PFAS.

c. PFAS Weight Criteria. PFAS are generally only certified and labeled within the capacity range of 130 to 310 pounds (59 to 140.6 kg) including the weight of the worker, equipment and tools.

(1) Heavy Workers. Workers shall not be permitted to exceed the 310 pounds limit unless the harness and the lanyard are approved for such and must be in writing by the manufacturer. While PPE may have the strength to stop the worker from contacting a lower level or object during a fall, typically the fall forces imposed on the body of a heavy worker will be higher than those on the average-weight worker. This situation requires the need to review and evaluate the PFAS used. The following are some questions for consideration by the Qualified Person or Competent Person for Fall Protection before selection and use of the equipment by heavy workers:

- Can the structure or the anchorage support the potential fall forces?

- Can the free fall distance be minimized during a fall? The ability to adjust the energy absorbing lanyard's length or raising the anchorage location will minimize the free fall distance.

- Is the lanyard or lifeline rated for higher capacity?

- Is the full body harness rated for higher capacity?

- Is the rescue plan adequate to accommodate heavy-weight workers? The rescue equipment for heavy workers may need to be more robust, or other methods for rescue may need to be planned.

(2) Light-weight Workers. For workers with body weight less than 130 pounds, a specially designed harness and also a specially designed energy absorbing lanyard shall be utilized which will properly deploy if this person was to fall.

d. Specific PFAS Requirements.

(1) The system must limit the maximum arrest force on the workers body to 1800 pounds when wearing a full-body harness. ANSI Z359.1 requires the maximum arresting force for the energy absorbers to be under 900 pounds.

(2) Maximum free-fall distance is 6 feet unless using a special lanyard designed for 12 foot free fall. Note that this term does not refer to the length of the fall but instead refers to the name of equipment used when the worker is anchored to a location that is below the Dorsal-D ring.

(3) Shall stop the fall with a deceleration distance of not more than 42 inches.

(4) Prevent the worker from contacting lower level or object.

- ***Note 1. The Fall Protection Code, ANSI/ASSE Z359.1 (2007) Standard permits the use of a frontal D-ring attachment point located at the sternum to be used for fall arrest as long as the free fall distance shall not exceed 2 feet and the maximum arrest force on the body does not exceed 900 pounds***

- ***Note 2. OSHA Standards and the ANSI Z359 Standards permit the free fall distance to exceed 6 feet, up to 12 feet, if the maximum arrest force on the body does not exceed 1,800 pounds. Only the Qualified Person for Fall Protection can make this determination (increasing the free fall distances more than 6 feet).***

e. Fall Arrest Subsystems and Components. All equipment shall meet the requirements of ANSI Z359.1 (2007). Equipment meeting ANSI A10.14 shall not be used and shall be taken out of service.

(1) Anchorage System for Fall Arrest: Shall withstand a minimum force (breaking strength) of 5,000 pounds, or engineered for twice the maximum arresting force by the Qualified Person for Fall Protection. Equipment shall not be proof tested by the user, capacity is determined by calculations only.

- ***Note: Some manufacturers require 5,400 pounds minimum anchorage strength for their equipment.***

(2) Snaphooks and Carabiners:

(a) Minimum strength of 5,000 pounds.

(b) The gate must withstand a minimum force of 3,600 pounds when applied in all directions and shall meet the requirement of ANSI Z359.1 (2007). Snaphooks and carabiners shall be sized to be compatible with the connectors they are connected to. Compatible connections will prevent unintentional disengagement.

(c) Snaphooks and carabiners shall be self-closing and self-locking capable of being opened by at least two consecutive deliberate actions. The non-locking types are prohibited.

(3) Lanyards:

- Lanyards vary in length from 2-6 feet;
- Strength of 5,000 pounds;
- Synthetic rope lanyard - minimum diameter is 1/2 inch;
- Provide energy absorber (shock absorber) with lanyards (integral in-line is preferred);
- Depending on special or specific applications, dual shock-absorbing lanyards (Y Lanyards or Twin Leg -100% Tie off) may be required. Warning: Do not attach the unused leg of the lanyard to any part of the harness except to attachment points specifically designated by the manufacturer; especially the Y lanyard having a single common energy absorber. The joint between the two legs shall be designed for 5,000 pounds. It is highly recommended to use a Y lanyard having legs that expands and contracts (Retractable). When traversing, do not connect to anchorages that are farther than the lanyard length and do not allow the legs of the lanyard to pass underarms, between the legs and around the neck of the end user. Do not use Y lanyard if the free fall distance is more than 6 feet unless permitted by the manufacturer.
- A lanyard strap shall not be wrapped around a tie-off point and then attached back to it-self unless it is a tieback lanyard where the lanyard straps have been designed accordingly.
- The snap hook shall only be secured to an integral D-ring (incorporated into the body harness by the manufacturer).

- Shall have a permanently attached label indicating manufacturer's name, serial number/lot number, manufacture date, capacity, and that it meets the applicable OSHA and ANSI Z359.1 Standards.

- It shall be recognized that synthetic rope and nylon strap lanyards have more give than Kevlar or wire rope lanyards.

(4) Energy Absorbers:

- Shall not elongate more than 42 inches;

- Maximum arresting force of 1800 pounds, minimum operating force (activation force) to deploy or elongate the energy absorber shall be 450 pounds (According to ANSI Z359.1, the energy absorbers when dynamically tested the maximum arrest force shall not exceed 900 pounds);

- Shall have a permanently attached label indicating the manufacturer's name, serial number/lot number, manufacture date, maximum elongation force, maximum free fall distance, capacity, and that it meets OSHA and ANSI Z359.1 standards;

(5) Self-Retracting Devices (SRD). SRDs are deceleration devices made of synthetic rope, webbing or wire rope. There are four types of SRDs:

(a) Self Retracting Lanyard (SRL);

(i) The maximum arrest distance shall not exceed 2 ft;
(ii) Average arrest force on the body shall not exceed 1,350 pounds.
(iii) Maximum Peak force shall not exceed 1,800 pounds
(iv) **Use only in vertical applications** (used in fall arrest and when the tie off point is located above the dorsal D-ring);
(v) The activation force required to deploy the energy absorber shall be less than 450 pounds.

(b) Self Retracting Lanyard with Leading Edge Capability (SRL-LE);

(i) Maximum arrest distance of 4.5 feet;
(ii) Free fall distance of 5 feet;
(iii) Average arrest force on the body of 900 pounds;
(iv) **Equipped with energy absorber** which is a pouch made of stitched fabric;
(v) **Used in vertical and horizontal applications** (may be used in fall arrest and restraint systems).

(c) Self Retracting Lanyard with Rescue Capability (SRL-R);

(i) Minimum static strength of 3000 pounds
(ii) Minimum mechanical advantage of 3:1

(d) A hybrid combination of any two of the above.

- Full-Body Harness shall have:
  - a maximum arresting force of 1,800 pounds;
  - a Dorsal D-ring or D- strap that is incorporated into the full-body harness;
  - a permanently attached label indicating manufacture's name, serial number/lot number, manufacture date, capacity, annual competent person inspection and that it meets OSHA & ANSI Z359.1 requirements; and

(5) Lineman's equipment (Use electrically rated harnesses). The full body harness used around high voltage equipment or structures shall be an industry designed linemen's Fall Protection harness that will resist arc flashing and shall have either straps or plastic coated D-Rings and positioning Side-Rings in lieu of exposed metal D-Rings and exposed metal positioning Side-Rings. All other exposed metal parts of the linemen's harnesses shall also be plastic coated (i.e. buckles and adjusters).

(6) Criteria for donning of the full body harness:

- It is very important and critical that the harness snugly fits the body;
- Always use the buddy system when donning a harness;
- The user shall be able to reach the dorsal D-ring with his/her thumb;
- Maximum four flat fingers of slack between the legs and the leg- straps;
- Ensure chest strap is across the chest/breast bone.

(7) D-Rings and connectors:

- Shall have a minimum tensile strength of 5,000 pounds;
- Shall be drop forged, pressed or formed steel;
- Connectors and D-rings shall have corrosion resistant finish.

(8) Fall Arrestor (Rope or cable Grab).

- Fall arrestors shall have an ultimate strength of 3,600 pounds;

- It must be installed Right-side up.
- Use only Type 1 Fall Arrestor designed for use on vertical lifelines.

(9) Ropes:

- Synthetic rope lifelines: minimum strength of 5,600 pounds;
- Wire rope lifeline: minimum strength of 6,000 pounds;
- Vertical lifelines: minimum strength of 5,000 pounds.

2. Other Fall Protection Systems.

a. Horizontal Lifeline System. A horizontal lifeline (HLL), also called a catenary line or static line, is a fall arrest system, consists of a flexible rope, wire or synthetic cable that is installed on a horizontal plane between two anchorages and used for attachments of a worker's lanyard or lifeline device which moves horizontally on the horizontal lifeline. A HLL is used to control dangerous pendulum-like swing falls. A Qualified Person for Fall Protection must design the system.

(1) HLLs shall be designed, installed, certified, and used under the supervision of a Qualified Person for Fall Protection, as part of a complete fall arrest system, which maintains a safety factor of 2. HLLs can be either permanent or temporary systems.

(2) Design Considerations for HLLs. Certain parameters should be taken into consideration when designing horizontal lifelines, such as:

- Initial and maximum deflection or sag of the line;
- Clear span between supports or anchorages;
- Design of anchor points and anchorage connectors;
- Number of workers attached to the system;
- Free-fall distance and total fall distance;
- Minimum clearance below horizontal lifeline system;
- Unit weight of the cable and the line;
- Total weight of all workers attached to horizontal lifeline.

(3) The components of a typical HLL subsystem may include the following:

- Anchorages, anchorage connectors;

- Lifeline tensioner;
- Cable or rope;
- In line energy absorber.

(4) Presently, there is no U.S. standard that spells out/mandates HLL system verification and testing requirements. Presently, ANSI is developing a new HLL standard. Verification testing requirements may include the following tests:

- Line fittings static test;
- Corrosion Inspection.

Unfortunately, with a safety factor of two, many tests have the potential to activate the lifeline system and careful consideration is required in determining testing requirements.

b. Vertical Lifeline System. A vertical lifeline is a vertical line from a fixed anchorage independent of the walking/working surface to which a lanyard or device is attached.

- When vertical lifelines are used, each employee shall be attached to a separate lifeline. There shall not be more than one worker attached to a vertical lifeline and each worker requires his/her independent vertical lifeline.
- Vertical lifelines shall be protected from sharp edges, against being cut or abraded.
- A rope grab is a fall arrester designed to move up or down a lifeline, to which the harness is attached.

(1) System Requirements.

- Shall have a minimum breaking strength of 5,000 pounds.
- Connected to an overhead anchorage that can withstand a force of 5,000 pounds.

c. Positioning System. The system consists of a body harness and a short lanyard attached to a vertical work surface. System requirements are as follows:

(1) The system consists of anchorage, one or two short lanyards, and body support, usually a full body harness;

(2) The system shall be rigged so that a person cannot free fall more than 2 feet;

(3) Attached to anchorage capable of supporting 3,000 pounds or twice the potential impact load of the worker whichever is greater.

(4) When working above 24 feet, use a fall arrest system.

- ***Note: When using positioning system (only) it is not considered fall protection. If a person is using positioning system and exposed to fall hazard a separate system shall be provided to provide the back-up to protect the person from fall.***

d. Restraint System. Restraint systems can be used on horizontal or mildly slopped surfaces between 0 and 18.4 degrees (4 vertical into 12 horizontal). The system consists of :

(1) Safety harness (full-body harness) attached to securely rigged restraint lines;

(2) Restraint system shall be rigged to allow the movement of employees only as far as the sides and edges of the walking/working surfaces. The person will not be exposed to a fall hazard;

(3) Fall arrestors and self retracting lanyards are prohibited for use as part of a restraint system, or in horizontal applications unless they are permitted for such use by the manufacturer.

- ***Note: The terms: Restraint System, Travel Restraint, Fall Restraint, Work Restraint and Travel Restriction used and referenced in the new ANSI Z359 Fall Protection Code are the same.***

e. Rope Access.

(1) Requires two independent anchorages;

(2) Two lifelines or ropes attached to the anchorages, a working line and a back-up safety line. Each one is to be independently anchored;

(3) Ropes should be of low-stretch Kernmantel and arranged so that any abrasion will be avoided;

(4) Use full-body harness.

f. Ladder Climbing Device System.

(1) Installed on fixed ladders over 20 ft in length;

(2) Anchorage strength requirement is 3,000 pounds;

(3) Free fall distance shall not exceed 2 feet;

(4) The connector from the frontal D–ring to the tie off point on the ladder (rope or cable grab) shall be no more than 9 inches long;

(5) Do not attach or install ladder climbing devices to off-the-shelf ladders. Ensure the ladder can sustain the fall forces. Off-the-shelf ladders having ¾ inch rungs are usually designed

for 500 pounds only. If a fall occurs, the ¾ inch rungs will not sustain the forces imposed on the ladder and specifically when a cable is used as part of the climbing system;

(6) There shall be 100% transition at the top of the ladder.

g. Warning Line System. A warning-line system is a barrier erected on a walking and working surface or a low-pitch roof having a slope less than or equal to 4 in 12 (vertical to horizontal) or less than 18.4 degrees, to warn workers that they are approaching (an) unprotected fall hazard(s). Requirements include:

(1) A warning line system must be erected around all sides of the work area;

(2) When mechanical equipment is not being used, the warning line shall be erected not less than six feet from the edge of the roof. When mechanical equipment is being used, the warning line shall be erected no less than fifteen feet from the roof edge, which is parallel to the direction of mechanical equipment operation;

(3) Warning lines shall have the appropriate OSHA compliant flag attached to them;

(4) The line consists of rope, wires or chains, 34-39 inches high flagged every 6 feet;

(5) Supporting stanchions shall be capable of resisting 16 pounds force applied horizontally 30 inches from the base of the stanchion;

(6) The wire, rope or chain shall have a minimum tensile stress of 500 pounds.

(7) For roofing work:

- Installed six to ten feet away from a leading edge, and flagged every 6 feet; provide signage indicating “warning line.”

- The height of the warning line should be between 34-39 inches.

- Shall consist of a rope, wire or chain and supporting stanchions.

h. Safety Monitoring System. The safety monitoring system **shall not** be used by itself as a fall protection method. Safety monitoring system may be used in conjunction with other fall protection systems. “Unified Facilities Guide Specification UFGS 01 35 26 titled Governmental Safety Requirements” and USACE EM 385-1-1 (2008) prohibits the use of a safety monitor as the only fall protection method employed. The safety monitoring system may be used with a warning line system as a method of guarding against falls during work on low-pitched roofs and leading edge work only.

(1) System Requirements: A person acting in the capacity of a monitor shall be trained in both the safety monitor duties and warning line system, and shall:

- Have control authority over the work as it relates to fall protection;

- Be instantly distinguishable from other members of the work crew by wearing distinguishable markings or a different-colored high-visibility vest;

- Have no other duties while acting as safety monitor;

- Be positioned with a clear unobstructed view, and be able to maintain normal voice communication with all workers under their protection;

- Not supervise more than eight exposed workers at one time.

i. Controlled Access Zone. Controlled access zone **shall not** be used as a fall protection system.

Chapter 8

Fall Protection Guidelines for Specific Work Applications

1. Communication Towers.

a. Maintenance Work.

- The preferred method for accessing existing towers to perform maintenance work is by the use of fixed ladders with attached climbing devices because it provides conventional fall protection during ascent and descent of the structure.

- To secure permanent anchorage on the tower, the first worker up is the one who installs the self retracting lanyard for the next workers up to use. Working on the tower requires a portable anchor, full-body harness, use of a self retracting lanyard, a ladder climbing device or rope grab.

- After a permanent anchorage is secured in place, workers that follow the first person up will require full-body harness, a SRL, vertical lifeline, ladder climbing device and/or rope grab.

- When working on towers, workers are required to wear fall arrest equipment at all times.

- All climbing facilities shall be visually inspected daily at the base by a competent person for rust, corrosion, deterioration, or other hazards on the climbing facilities that could lead to death or injury of an employee in the performance of their duties. Additionally, the climbing facilities shall be visually inspected for these items as the employees ascend to the elevation point where work is being performed. If any such hazard is identified during inspection, employees shall not use the climbing facility until such hazards are abated.

b. Tower Erection and Personnel Lifting. Before an employee may perform any job related to hoisting personnel aloft for work, the employees shall receive training on safe access. The operator of the hoist shall have thorough understanding and comply with the following rules (1) to (7) of hoisting personnel on hoist lines.

(1) An anti-two block device shall be used on all hoist lines, except where ambient radiation frequency (RF) precludes that use. In such case, a site specific rigging plan shall be established and maintained on site to ensure that two blocking cannot occur and that effective communication between the hoist operator and personnel being lifted is maintained at all times.

(2) A trial lift of the maximum intended personnel load shall be made from ground level to the location to which personnel are to be hoisted.

(3) A pre-lift meeting shall be held before the trial lift at each location and each time a new employee is assigned to the operation.

(4) The employer shall ensure that all trial lifts, inspections, and proof tests shall be performed and documented, and the documentation shall remain on site during the entire length of the project.

(5) Employees shall be hoisted to their work stations by using a personnel platform, boatswains chair and/or boatswains seat type and full body harness.

(6) Employees being hoisted shall remain in continuous sight of and/or in direct communication with the operator or signal person.

(7) Employees shall not be hoisted during adverse weather conditions (high winds, electrical storms, snow, ice or sleet) or other impending danger, except in the case of emergency employee rescue.

2. Roof Work.

a. Working within six feet of an unguarded roof edge having a slope less than 4/12: During performance of work on low-pitched roofs with a potential fall hazard greater than 4 feet, ensure that employees engaged in such work shall be protected from falling from all unprotected and edges of the roof as follows:

- Use restraint or fall-arrest systems; OR

- Use a warning-line system for other personnel working more than six feet away from the edge.

- Mechanical equipment shall be used or stored only in areas where employees are protected by a warning-line system, fall restraint, or fall-arrest systems.

- On flat roofs with no parapet or guardrails: When working 6 feet from the edge, use a full-body harness and lanyard for restraint system. Establish a warning line system six to ten feet away from the leading edge or temporary guardrails for roofing work without fall arrest system. Personnel working within the warning line system do not require fall protection. For other trades (i.e. mechanical work) the warning line shall be installed15 feet away from the edge.

➢ *Note: For existing parapet walls with heights of less than 42 in., the parapet wall may be used as a fall protection system if the vertical height is a minimum of 30 in. and the width a minimum of 18 in. at the top of the wall for a total of 48 in. combined. The effective height of a parapet wall is the sum of the height of the wall and the wall width at the top of the wall. New parapet walls shall be designed to a height of 42 in. +/- 3 in. to be considered adequate fall protection systems. See Change 2 to EM 385-1-1, paragraph l.*

b. Steep roof (greater than a 4/12 pitch): A fall arrest or guardrail system shall be used when working on steep roof.

- Warning line and safety monitor system are prohibited on surfaces exceeding 4 to 12 pitch, and on any surface whose dimensions are less than 45 inches in all directions.

- Use a full-body harness, self retracting lanyard, roof brackets/anchors for anchorage points (single or multiple connections designed for 5000 pounds per person). Also use slide guards.

3. Leading Edge Work. Use horizontal lifelines, full-body harness, and lanyard/self retracting lanyard, roof anchors, guardrail system, and a restraining system.

4. Scaffold Work.

- Use guardrails, cross bracing or full-body harness, and lifelines. During erection and dismantling operations it is highly recommended to have a fall protection system. During erection and dismantling of scaffolds an evaluation shall be conducted by the competent person to determine the feasibility and safety of providing fall protection.

- On supported scaffolds over 20 feet high, use stairs instead of ladders to access the scaffold.

5. Suspended Scaffolds Including Single and Two-Point Suspended Scaffolds.

- In addition to railing, use an independent vertical lifeline connected to a full-body harness for every worker in suspended scaffolds.

- Full body harness is to be connected to the fall arrestor (rope grab) on the vertical lifeline with a lanyard no longer than 3 feet.

- The rope of the vertical lifeline shall be of the material and diameter compatible with requirements as marked on the fall arrestor.

- The suspended scaffold shall be maintained in accordance with manufacturer's instructions and specifications.

6. Aerial Lifting Equipment. Aerial Lifting Equipment usually has either a platform surrounded by guardrails (i.e. JLG) or a basket (i.e. cherry picker) used to raise and lower employees.

- Aerial lifting equipment that has a boom (articulating and non-articulating) are subject to sometimes "hanging up" on protruding object while being raised, and jolting the platform or basket when releasing from the caught projection. This upward jolt can propel (eject) an employee from the platform or man basket. Employees in an aerial lift must be connected with a restraint system.

- A restraint system in an aerial lift must protect an employee from being ejected from the platform or man-basket. It is important that the restraint system keep the employee from being

ejected over the guardrail or out of the basket. If an employee were to be ejected over the guardrail, the resulting momentum force could be sufficient to tip over the aerial lift if the boom is raised high enough and resulting momentum forces great enough.

- Always use full body harness in a restraint system. Aerial lifts often have designed anchorages at the platform level, knee level or the waist level. Depending on the level of the anchorage point and the tie off point on the full body harness (at the dorsal D-ring), the lanyard selected must be short enough to prevent ejection from the man-platform or man-basket. For example: If an employee is wearing a full body harness with a six-foot lanyard connected to the dorsal D-ring, the lanyard must be connected at the foot level in order to prevent ejection over the guardrail or out of the basket. Exception: A six-foot lanyard could be used connected to an anchorage higher than foot level if it is a tie-back style where the lanyard can be shortened.

- A lanyard with a shock-absorber can be used in a restraint system since the employee will not see forces high enough to deploy the shock-absorber.

- Guardrails on an aerial lift can be used as an anchorage (tie off point) for a restraint system if they can withstand a force of 3,000 pounds. These anchorages are normally marked and approved by the manufacturer.

- When working in a boom-supported articulating lift and before elevating the work platform, the operator will check to see that all occupants' full-body harnesses are on and properly attached.

7. Confined Space Entry. When entering a confined space, and if there is a hazard of exposure to vertical fall, the person entering such space shall be tied to lifeline or SRL and rescue and retrieval equipment. A co-worker should be able to retrieve the victim utilizing the retrieval mechanism from outside the confined space without any difficulty.

8. Excavated Trenches or Holes More Than Six Feet Deep. Provide temporary guardrail systems on both sides of the trench, or around holes, or establish a warning line system. Any person crossing this line or guardrails is required to have fall protection.

9. Covers.

- Holes mean a gap or void one inch (per 29 CFR 1910.23) or more in its least dimension in a floor, roof, or walking/working surface (29 CFR 1926.500 and EM 385-1-1 section 21.F.01 states a hole 2 inches in its least dimension requires a cover).

- A gap or opening in flooring, stairways, ramps, or roofing two inches or greater through which material or tools can fall through; or, in the case of larger holes, a person can step or fall through. In either case, fall protection in the form of a secured and marked covering, fall protection, or barricading is required. Examples include Manholes, Pits, Tanks, Skylights, Open Shafts, Chutes and Hatches. Consideration should also be given to guarding holes which may be a trip or entrapment hazard.

- If there is a danger of falling through a skylight opening, a standard screen/mesh cover or guardrail system shall be installed on all sides of the skylight.

- Trenches, manhole covers, and other appurtenances—when located in a roadway and vehicular aisles—shall be designed to carry twice the maximum axle load of the largest vehicle expected to cross over.

10. Scissor Lift/Mobile Scaffolds.

- When working from elevated work-platforms four feet or higher, elevating work platforms must be equipped with standard guardrail and toe boards. If the worker's feet leave the floor of the elevating work platform or the worker is required to exit the lift—at height, continuous fall protection must be provided. The worker must connect to an anchorage point outside of the scissor lift/mobile scaffold before opening the wing gate and stepping out of the work-platform. The worker must not be simultaneously connected to the work-platform and to an anchorage point outside of the work-platform, in case the scissor lift/mobile scaffold were to travel.

- A fall restraint system shall be used with scissor lifts. Lanyards used with the restraint system shall be sufficiently short to prohibit workers from climbing out of, or being ejected from the platform.

11. Ladders.

a. Fixed Ladders:

- Unless light work is being performed and three points of contact are maintained at all times (two feet /one hand, or two hands/one foot), work from a fixed ladder shall not be performed unless he/she is wearing fall protection; such as a full body harness attached to a ladder climbing device or self-retracting lanyard which in turn is attached to a properly designed and installed anchorage.

- If the total length of the climb on a fixed ladder equals or exceeds 20 feet, the following requirements must be met: fixed ladders must be equipped with either (a) ladder climbing devices or; (b) self-retracting lifelines. A cage or well may be used in lieu of ladder climbing or self retracting lanyard if the ladder is greater than 20 feet but less than 30 feet in length.

- All ladder climbing safety devices must permit the worker to ascend or descend without continually having to hold, push, or pull any part of the device, leaving both hands free for climbing. These safety devices must be activated within 2 feet after a fall occurs. Ladder climbing devices shall be attached to a frontal centered D-ring or other specifically designed centered frontal attachment point on a full body harness.

- The side rails of the ladder extensions must extend at least 36 inches above the top level or landing platform or working surface served by the ladder, and must afford a "power grip" (hand must be able to encircle or almost encircle the side rail).

  - ***Note: Although allowed by OSHA, Ladder cages are not a safe fall protection method. They cannot stop a fall. The purpose of the ladder cage is to afford the worker the ability to lean back and support him/herself if necessary to rest during climbing.***

b. Portable and Extension Ladders, non self-supporting.

- Ladder shall be so placed as to prevent slipping, or it shall be lashed, or held in position (tied).

- An employee may perform work from a non-self-supporting portable ladder placed at the correct angle and properly secured (e.g. lashing top and bottom), if the employee is facing the ladder and his/her body is between the side rails, and he/she uses one hand to grasp the ladder and both feet are on the ladder rungs.

- Non-self-supporting ladders must be used at an angle where the horizontal distance from the top support to the foot of the ladder is approximately one-quarter of the working length of the ladder.

- An employee must use at least one hand to grasp the ladder when climbing and when ascending or descending the climber must face the ladder.

- An employee shall not stand or work from the top three rungs of a non-self-supporting portable ladder.

- The spacing of rungs or steps of a portable ladder shall be on 12-inch centers and the minimum width between side rails of a straight ladder or any section of an extension ladder shall be 11.5 inches.

- The length of single ladders or individual sections of ladders shall not exceed 30 feet.

- When portable ladders are used for access to an upper landing surface, the side rails must extend at least 3 feet above the upper landing surface. When such an extension is not possible, the ladders must be secured, and a grasping device such as a grab rail must be provided to assist workers in mounting and dismounting the ladder. In no case shall the extension be such that ladder deflection under load would, by itself, cause the ladder to slip off its support.

- The top of a non-self-supporting ladder must be placed with two rails supported equally unless it is equipped with a single support attachment.

- Do not paint wooden ladders – paint hides defects and can create a slippery climbing surface.

- An employee shall not carry any object or load that could cause the employee to lose balance and fall.

c. Portable Ladders, self-supporting (Step Ladders):

- Neither the top of a step ladder nor the step below the top of the ladder (top step) shall be used as a step, nor used to stand on while performing work.

- Do not use a closed stepladder as a straight ladder – it may slip out.

- Step ladders shall not exceed 20 feet in length.

- The steps of a step ladder must be corrugated, knurled, dimpled, coated with skid-resistant material, or treated to minimize slipping.

12. Stairways.

- Stairways having four or more risers, or rising more than 30 inches in height must have at least one handrail. The international Building Code and the International Fire Code require the height of permanent hand rails to be 34-38 inches.

- Mid-rails, screens, mesh, or intermediate horizontal members must be provided between the top rail and stairway steps to the stair-rail system. Intermediate horizontal members when used must not be more than 19 inches apart.

- Unprotected sides and edges of stairway landings must be provided with a top rail at a height of 42-inch (+ or – 3 inches) guardrail systems and a mid-rail or mid-rails spaced in the vertical direction at a height of no more than 19 inches between mid-rail and the top rail of the guard rail system.

13. Working Near Wall Openings. Any time work is performed near a wall or window opening where there is a fall hazard to a lower level present, fall protection must be provided e.g. guardrail or fall arrest system.

14. Working Over Water. On piers, wharves, quay walls, barges, aerial lifts, cranes-supported work platforms:

- Employees working over or near water, where the danger of drowning exists, shall wear U.S. Coast Guard-approved lifejacket or buoyant work vests.

- When continuous fall protection is used without exception to prevent workers from falling into water, the facility has effectively removed the drowning hazard and PFDs are not required.

- When using safety nets as a fall protection, USCG approved PFDs are usually required.

- When working over or near water and the distance from walking/working surface to the water surface is 25 feet or more, workers shall be protected from falling by the use of a fall protection system (PFDs are optional).

- When working over or near water, where the distance from the walking/working to the water's surface is less than 25 feet and the water depth is less than 10 feet, or hazards from currents, intake machinery or barges, etc., are present, fall protection is required (PFDs are optional).

15. Elevated Work Area Near Guardrails. Whenever an employee climbs above the flooring (e.g. climbs a step ladder placed on a platform) of a lift, catwalk, platform, scaffold, elevated work platform or stairway above 4 feet (6 feet construction) or working on stilts, thereby reducing the height of the top rail in relation to the employee to less than 42 inches (plus or minus 3 inches), the height of the guardrail must be raised accordingly to maintain a protective height of 42" (107cm) above the stilt or raised platform/work-stand height. If this is not possible utilize another fall protection system.

Chapter 9

Guidance For Fall Rescue Procedures

1. Introduction.

a. When a person is working at heights and is using fall protection equipment, he/she may require rescue if that person falls and is suspended in a harness. Prompt rescue is very important. Studies indicate that a person suspended in a harness may have blood circulation problems within a few minutes. Accordingly, a site specific Rescue Plan must be prepared in writing and maintained for all instances where personnel work at heights and are exposed to fall hazards. The Rescue Plan contains detailed procedures on the methods of rescue; methods of self rescue; equipment used; training requirements; specialized training for rescuer; procedures for requesting rescue; and available medical assistance. Where the rescue may not be or cannot be solely performed by a jurisdictional public (e.g. local fire department) and/or Government-emergency response team, then the Rescue Plan must contain detailed procedures on the planned rescue methods.

b. The Rescue Plan is a part of the written Fall Protection and Prevention Plan and contains provisions for potential self-rescue or assisted rescue of an end user of fall protection. The Fall Protection & Prevention Plan covers every fall hazard to which authorized persons are exposed to.

c. Another important document is the Pre-Incident Plan. A Pre-Incident Plan is a formal written plan prepared jointly by the USACE-Owned Facility and the emergency responders containing factors that need to be evaluated when assessing the potential situations (e.g. fuel storage tanks, energized power cables, hazardous material, fall hazards) that could affect a facility during emergency conditions. The Pre-Incident Plan is prepared, reviewed, updated, and approved by a competent person. The Fall Protection program manager from the activity reviews and concurs with the portion of Pre-Incident Plan, which addresses rescuing a person who has fallen and is suspended in a harness and incorporates this information into the Rescue Plan.

2. Background.

a. Following a fall from a height the end user of fall protection, who is wearing a body harness that is properly secured to an anchorage, may be suspended in the harness for a length-of-time if self-rescue or rescue by co-workers cannot be performed quickly. Sustained immobility in a body harness may lead to suspension trauma also known as harness induced pathology and suspension trauma resulting from the accumulation of blood in the veins commonly called venous pooling. The symptoms (known as orthostatic intolerance) of suspension trauma include light-headedness, dizziness, weakness and occasionally fainting.

b. Normally when an individual faints and collapses, the pooled blood is now no longer being held down by gravity and returns to the heart, where it is once again distributed to the

body. Assuming no injuries are caused during the collapse, the individual will quickly regain consciousness and recovery is likely to be rapid.

c. When an individual hangs in a harness in a vertical or near-vertical position without moving his legs, the same thing can happen, only this time when he passes out he remains vertical. An accumulation of blood in the legs reduces the amount of blood in circulation. After an initial speeding up of the heart beat, the heart rate then slows down and blood pressure will diminish in the arteries. The reduction in quantity and/or quality (oxygen content) of blood flowing to the brain leads to unconsciousness and harmful effects on other vital organs. If these conditions continue, they potentially may be fatal.

d. The importance of a timely rescue of a worker suspended in a harness or who has become incapacitated due to an injury and/or heart attack mandates the need for a written rescue plan.

3. General Requirements.

Before an end user of fall protection is exposed to a fall hazard and before starting work activities, the Fall Protection program manager and the end user shall ensure there is a pre-incident plan and rescue plan in place that addresses rescuing a person who has fallen and is suspended in a harness. If a pre-incident plan is not available the Fall Protection program manager may work with the facility safety officer to obtain from the jurisdictional public/Government-emergency response agency information including emergency contact phone numbers and rescue capability, and shall include this information in the rescue plan along with alternative/supplemental rescue methods required to perform a timely rescue of an end user suspended in a body harness, or who is incapacitated at heights for other reasons. End users of fall protection shall be trained in the methods for minimizing the effect or delaying suspension trauma if an end user is suspended in a body harness and unable to perform a self-rescue, and needs to wait to be rescued (e.g. keep legs moving and raise knees into the body to help prevent the pooling of blood in the legs).

4. Initiation of Rescue.

An end user using Fall Protection equipment shall have an assigned safety person (spotter), also known as the “buddy system”, who is within visual/verbal range of the end user. The duty of the assigned safety person is to periodically check (at least every 5 minutes) to assure that the end user has not fallen and is suspended in his/her harness. The assigned safety person shall have the ability to make quick contact with the jurisdictional public/Government-emergency response team.

5. Fall Arrest Rescue Plan.

A site-specific rescue plan for an employee suspended in a body harness after a fall shall be prepared in writing by the USACE-Owned Facility and shall include:

a. Pre-incident Planning. As per NFPA standards, written pre-incident plan is prepared by the jurisdictional public (e.g. fire department) and/or Government-emergency response agencies.

As per reference (c): *"Pre-incident planning is ensuring that responding emergency personnel know as much as they can about a facility's construction, occupancy, and fire protection systems before an incident occurs. With this knowledge, the fire department can compare a potential incident at the facility with its available resources and plan the department's response accordingly. Pre-incident planning is not restricted to building components. It includes other factors and conditions that may be relevant to an emergency at a particular site."* The Fall Protection Program Manager, or the end user shall verify that rescue procedures are in place for any workplace where the authorized rescuer will perform a rescue. The types of fall protection systems being used and the work environment shall be reviewed with the jurisdictional public and Government-emergency response agency. The pre-incident plan shall be reviewed and updated by the USACE-Owned Facility's Fall Protection Program Manager annually, or whenever there is a change to the job site that will affect items in the plan.

b. Methods of Rescue.

(1) Jurisdictional Public Emergency Response Agency.

(2) Government Emergency Response Agency.

(3) Assisted Rescue. The written rescue plan shall include instructions for contacting rescue personnel, plus a description and probable location of all equipment to be used by the rescue team (i.e. scissor lift/aerial lift), and complete instructions and procedures for performing rescue safely and promptly.

(4) Self-rescue. An end user who has fallen and is suspended in a fully body harness and is not incapacitated (e.g. an injury, stroke or heart attack), can usually perform a self rescue if:

(a) The end user can reach an adjoining structure and has the strength and mobility to pull himself/herself up and onto the structure.

(b) The end user has a self-deploying/manual deploying coiled webbing rescue ladder attached to lanyard anchorage, which after a fall allows him/her to climb up to the anchorage point (or at least simply stand in the ladder allowing the necessary circulation of blood to the entire body while an assisted rescue is being commenced).

(c) An "automatic or manual controlled descent device" can be used as a self-rescue device if there is one attached to a separate anchorage point (minimum 3,000 pound strength) and if there is a vertical tag-line attached to the controlled descent device's safety snap hook which can be reached by the employee suspended in the full body harness. The tag-line is pulled bringing down the self-retracting line from the controlled descent device, and the descent device safety snap is attached either to the back "D" ring or front rescue "D" ring of the fully body harness, and the deployed shock absorber lanyard detached (this method is only viable if there is a "quick release" device which will allow the disconnecting of the shock absorber lanyard under tension). Once the deployed shock absorber lanyard is disconnected from the fully body harness the controlled descent device will allow the end user to descend at a controlled rate to a lower level. This method requires "hands-on" training.

6. Rescue Equipment Inspection.

Inspection of equipment used by the jurisdictional public and Government-emergency response agencies is the responsibility of these agencies. Prior to use the end user of fall protection shall inspect the self-rescue and assisted-rescue equipment to ensure it is in safe working condition and has been protected against damage from the weather (e.g. UV, water) and from workplace conditions (e.g. chemical, physical). Annually, a Competent Person for Fall Protection shall verify that the rescue equipment markings and instructions are consistent with ANSI and OSHA Standards, and the rescue equipment has been maintained in accordance with manufacturer's instructions.

7. Training Requirements for Rescue.

a. Self Rescue. Training is required for self-rescue techniques. All personnel who will work from a height utilizing Fall Protection shall be trained in self rescue techniques. They shall be trained in these techniques before utilizing Fall Protection and annually thereafter.

b. Rescuer Specialized Training. For assisted-rescue the authorized rescuers shall be properly trained and shall be proficient at performing a rescue of a person suspended in a harness or who has become incapacitated at heights. The authorized rescuer shall be knowledgeable in the selection, use, storage and care of all equipment necessary to perform rescue on end users from all types of fall protection equipment. The authorized rescuer should carefully evaluate the hazards associated with rescue and determine whether or not it is safe to perform rescue and in addition conduct a site visit to the work location prior to writing a rescue plan. The authorized rescuer shall assign and delineate various responsibilities in the rescue and evacuation of an employee who has become incapacitated at heights and/or who is suspended in a body harness after a fall. Authorized rescuer training shall be conducted once every two years and evaluated at least annually by a competent person rescuer and shall include the following:

(1) Fall hazard recognition, elimination and control methods;

(2) Applicable Fall Protection and rescue regulations and standards;

(3) Understanding and using the Fall Protection and Prevention Plan, and the Rescue Plan;

(4) Inspection and maintenance of the equipment including manufacturers' instructions;

(5) Proper uses of various rescue equipment;

(6) Practical applications and drilling scenarios for rescue (hands-on training).

8. Procedures for Requesting Rescue and Medical Assistance.

The phone number for a jurisdictional public and Government-emergency response agencies is usually 911 or a project Control Room depending upon the USACE-Owned Facility. If the

emergency response number is different in must be posted and publicized throughout the USACE-Owned Facility.

9. Transportation Routes to a Medical Facility.

A sketch indicating the route to the nearest medical facility/hospital (a good practice is to highlight the route with a yellow marker) should be included in the post fall-arrest rescue plan) and should be posted at the job site.

10. Anchorages Used for Rescue.

a. Anchorages selected for rescue systems including control descent devices shall be capable of sustaining static loads applied in the direction permitted by the rescue system of at least 3,000 pounds when designed as a rescue system only If the anchorage for fall arrest system is selected as a rescue anchorage, it shall be capable of sustaining 5 times the foreseeable loads, applied in the directions permitted by the personnel fall arrest system per attached person.

b. Anchorage connectors used for rescue shall not be attached to anchorages where such attachment would reduce the allowable capacity of the anchorage itself.

c. Anchorage connections shall be stabilized to prevent unwanted movement or disengagement of the rescue systems from the anchorage. Rescue systems shall be load tested before a live load is placed on the systems.

d. Anchorage should be located at a point above the rescuer to prevent swing fall.

11. Selective Rescue Equipment and Systems.

The following are some of the selective equipment that activities can use to rescue a person incapacitated at heights or has fallen and is suspended in a harness, or can be used to permit a person suspended in a harness to stand and allow the necessary circulation of blood while an assisted rescue is being commenced:

- Automatic Controlled Descent Device;
- Evacuation Harness;
- Manual Controlled Descent Device;
- Rescue Cradle;
- Rescue Lanyard;
- Safety Rescue Ladder;
- Safety Strap/Relief Step Strap;

- Seat Sling;
- Self-Retracting Lanyard with Integral Rescue Capability, and
- Synthetic Rope Tackle Block.

12. References Related to Rescue.

(a) OSHA Safety and Health Information Bulletin, SHIB 03-24-2004

(b) NFPA Fire Protection Handbook, 19 Edition 2003, Section 7

(c) ANSI Z359 Standards (2007): Fall Protection Code

13. Fall Arrest Rescue Plan. The Fall Arrest Rescue Plan should include the following information as part of the Fall Protection and Prevention Plan:

a. Detailed location of the work site with any information that will help find the location, building number, floor number; etc. Post written directions that can be read over the telephone to an ambulance driver/police/fire department or their dispatchers on how to get to the site from the main gate of a facility. Give complete, accurate information to the rescue responder. Post a map at the job site and highlight with yellow marker the route one should take from the site to the nearest hospital that someone can use to drive an employee with minor injuries;

b. Indicate location of the lift or other equipment that will be used in case of emergency and the location of the key;

c. Detailed location of the closest first aid kit. To assure that no time lost looking for first aid kits during an emergency, post a site map marking the location of the first aid kits;

d. Listing of emergency telephone numbers. If an emergency rescue is required, call the telephone numbers in the order that they are listed 1st, 2nd, and 3rd. Post written directions that can be read over the telephone to an ambulance driver/police/fire department or their dispatchers on how to get to the site from the main gate of a facility. Give complete, accurate information to the rescue responder;

e. Send an escort to meet the fire department upon arrival at the scene and help them or the rescuer find the location of the accident;

f. Indicate who is the person (the escort designated to meet the fire department upon arrival at the scene) and their back-up person (in case the designated person is injured), who is responsible to make the phone call in case of emergency;

g. Indicate names of personnel that may require rescue during the course of performing their jobs;

h. If self-rescue is used, indicate the type of self-rescue equipment that is available at the job site or will be utilized during rescue operations;

i. Indicate the training the rescuer should receive in order to become a qualified rescuer;

j. Initiate a buddy system when personnel are working at heights and may require rescue.

Chapter 10

Inspection, Maintenance, Storage and Care Procedures for Fall Protection Equipment

1. Introduction.

Personal arrest systems must be regularly inspected per 29 CFR 1910.66 Appendix C, Section I, paragraph (f). Any component of the system with significant defects such as cuts, tears, abrasions, mold, undue stretching, alterations or additions, which will affect its efficiency, and damage due to deterioration, contact with fire, acids, or corrosives, distorted hooks or faulty springs, tongues unfitted to the shoulder buckles, loose or damaged mountings, nonfunctional parts and any wearing or internal deterioration of the ropes must be taken out of service immediately and should be tagged or marked as unusable or destroyed. All fall protection equipment shall be inspected before each use by the user and by a Competent Person for Fall Protection at intervals of no more than one year or as prescribed by the manufacturer of the equipment. Most manufacturers recommend inspection of the equipment to be conducted twice annually by the Competent Person for Fall Protection. This inspection shall be documented and the tag on the equipment shall be checked and dated by the Competent Person for Fall Protection on the date of inspection. All components and sub-components of the selected fall arrest, positioning, and restraint systems shall be compatible.

- ***As a general rule, always consult equipment manufacturers' instructions and recommendations for use, inspection, care and maintenance procedures.***

2. Equipment Inspection.

a. Anchorage Systems (anchorages and anchorage connectors).

(1) Inspect all components of the anchorage systems.

(2) Observe any abrasions, wear points, damaged threads, or swags in the sling material before use.

(3) For synthetic slings and anchor straps inspect all sewing and loops for wear, chemical damage, burn damage, and/or ultraviolet deterioration.

(4) Refer to the anchorage-attached tags to determine when the sling should be retired.

(5) Inspect cable slings for excessive damage to the steel fibers.

(6) Certify the anchorage system exposed to weather or corrosive conditions.

(7) Inspect anchorage connectors for integrity and attachment to solid surfaces.

b. Snaphooks and Carabiners.

(1) Inspect on regular basis and before each use.

(2) Inspect snaphooks and carabiners for any hook, locks and eye distortion.

(3) Verify there are no cracks, pitted surfaces, and eye distortions.

(4) The keeper latch should not be bent, distorted, or obstructed.

(5) Verify that the keeper latch seats into the nose without binding.

(6) Verify that the keeper spring securely closes the keeper latch.

(7) Test the locking mechanism to verify that the keeper latch locks properly.

(8) Verify that the points where the lanyard attaches to the snaphooks are free of defects

(9) Retire snap hooks, carabiners, and all integral components if any discoloration, deformation, cracks, or abrasions are detected.

(10) Retire immediately if it has sustained any fall, or if the spring brake and gate are bent, or if the gatekeeper no longer engages the slot cleanly.

(11) Damaged snap hook and carabiners shall be tagged and removed from service and the inventory list.

(12) Dirty snap hooks and carabiners shall be cleaned with kerosene, WD-40, or similar solvents and immersed in boiling water for 30 seconds to remove cleaning agent; dry with a soft cloth to ensure that the gate and gatekeeper operate properly.

(13) Ensure that only double-locking-type gates are used.

c. Lanyards and Energy Absorbers

(1) Inspect lanyards, put under a slight tension on a regular basis.

(2) Check all components for abrasion, cuts, discoloration, cracks, burns, knots, torn stitching and excessive wear.

(3) Visually inspect the energy absorber for any signs of damage, paying close attention to where the energy absorber attaches to the lanyard.

(4) Wash lanyards and energy absorbers on a regular basis to remove dirt and grit, which can abrade the fibers.

(5) Lanyards and energy absorbers shall have a permanently attached label indicating the manufacture’s name, serial number/lot number, manufacturer date, maximum elongation,

maximum arresting force, maximum free fall, and capacity. The lanyards and energy absorbers must also have permanently attached labels that indicate they meet OSHA & ANSI Z359.1 requirements. **Lanyards bearing the markings of ANSI A10.14 (only) are not acceptable and they shall be taken out of service**.

(6) Use and review manufacturer's logbook provided with the equipment to determine the age of the lanyard and energy absorber.

(7) Lanyards and energy absorbers shall be inspected by the user prior to each use and by a competent person other than the user at least once a year.

(8) Check for missing marking and labels.

(9) Maximum usage of a lanyard shall not be more than 5 years, unless the competent person for fall protection carefully inspects it, review its history of use and storage, and recommends its continued use, once put in service assuming the new unused lanyard is stored in a climate-controlled location, i.e., in a plastic bag not exposed to fumes, and in a cool location out of direct sunlight. Retire the lanyard:

- After a hard fall
- When the shock absorber even if slightly impacted or deployed
- If the lanyard has been used for any other purpose other than fall protection
- If the equipment shows excessive wear, chemical damage, burn damage, and/or ultraviolet deterioration

d. Fall Arrestor (Rope Grab)

(1) Inspect regularly.

(2) Check for signs of wear, corrosion, rust, and other anomalies.

(3) If any sign of wear or malfunction, remove device from service immediately.

e. Self Retracting Lanyard (SRL)

(1) Inspect before each use for any physical damage.

(2) Inspect by a competent person once every six months and by the manufacturer annually.

(3) Self retracting lanyards shall be returned to the manufacturer for servicing and re-certification once a year. Some manufacturers do not require annual certification. Consult manufacturer's instructions.

(4) SRLs shall have permanently attached labels that indicate they meet ANSI Z359.1 and OSHA Standards and requirements.

(5) Make sure all back nuts or rivets are tight.

(6) Make sure the entire length of the nylon strap is free of any cuts, burns, abrasions, kinks, knots, broken stitches, and excessive wear and retracts freely.

(7) Test the unit by pulling sharply on the lanyard to verify that the locking mechanism is operating correctly.

- ***SRLs should be briefly inspected prior to each use, and more thoroughly inspected by Competent Person for Fall Protection regularly. With specialized training it is possible that a Competent Person for Fall Protection can become certified to conduct re-certification and general services. Usually SRLs are returned to the manufacturer for service and recertification. Any equipment with many movable mechanical components or parts does require specialized inspection. Usually the Competent Person does not have the tools, equipment and/or qualification to conduct such inspection.***

- ***In order to determine if the SRL is in good and safe working condition, specialized testing and inspection has to be conducted on the SRL. This included opening the casing, inspecting the inner components of the SRL, and the drum containing excess spooled line, the locking mechanism, spring, connecting means, and fall indicator and corrosion inspection in special environment. This is the why only the manufacturer can inspect and certify the SRL.***

f. Body Support (Full Body Harness)

(1) Inspect on a daily basis or before each use.

(2) Inspect thoroughly and verify there are no torn, frayed, broken fibers, pulled stitches, frayed edges anywhere on the harness.

(3) Closely examine all of the nylon webbing to ensure there are no burn marks from welding or heat sources, which could weaken the material.

(4) Examine D-ring for excessive wear, deterioration, or cracks.

(5) Verify that buckles are not deformed, cracked, and will operate correctly.

(6) Check to see that all grommets are secure and not deformed from abuse or a fall.

(7) Check tongue/straps for excessive wear from repeated buckling.

(8) All rivets should be tight, not deformed.

(9) Inspect for missing markings and labels.

(10) Ensure harnesses are not painted or marked.

(11) Examine the harness for discoloration, abrasions and ultraviolet deterioration.

(12) Store harnesses in a cool, dry, and safe environment; ideally in a locked storage area.

(13) A Competent Person other than the user shall inspect the harness periodically, or at least once a year.

(14) Wash the harness in a mild soap and rinse multiple times to remove any soap residue and hang to dry out of direct sunlight in a cool, dry environment.

(15) Maintain a logbook indicating the date of entry into service, the nature of the work performed, washing the harness, or other relevant details.

(16) Retire harnesses from service after five years from the date put in service, assuming the new unused harness is stored in a climate-controlled environment, i.e. in a plastic bag not exposed to fumes and in a cool location out of direct sunlight, unless the competent person for fall protection carefully inspects it, reviews its history of use and storage, and recommends its continued use.

(17) The body support harness shall have a permanently attached label indicating manufacturer's name, serial number/ lot number, manufacture date, capacity, and that it meets OSHA & ANSI Z359.1 requirements.

g. Ropes (Synthetic Fibers)

(1) Inspect rope periodically for broken fibers, severely worn areas, or change in the consistency of the core; inspect under slight tension and check for soft areas, bulges, or excessive stiffness.

(2) Avoid exposing rope to hazardous chemicals, moisture, acids, or oils.

(3) Do not use the rope after it is impacted or damaged.

(4) Wash the rope on regular basis to remove dirt or grit with lukewarm water and mild detergent; rinse several times to remove soap residue and hang in a dry, cool, dark area.

(5) Store rope in a strong weatherproof bag. Rope should always be dry before placing in storage.

(6) Rope shall have a permanently attached label indicating manufacture's name, serial number/ lot number, manufacture date, capacity, and that it meets OSHA & ANSI Z359.1 requirements.

(7) Retire rope after five years of service unless the competent person for fall protection carefully inspects it, review s its history of use and storage, and recommends its continued use. If it is damaged, impacted, or exposed to chemicals, remove from service immediately.

h. Ladder Climbing Systems

(1) Inspect on a regular basis and as per equipment manufacturer's requirements.

(2) The sleeve should run freely without hand operations or guidance.

(3) Check cable and rails for abrasions, wear, looseness, and cracks.

(4) Before climbing, check integrity of cable, systems, and ground level.

j. Raising/Lowering Rescue Devices

(1) Inspect before each use.

(2) Check for wear and corrosion.

k. Horizontal Lifeline. Inspect the system including anchorages, anchorage connectors, cable and other hardware for defects or loose or components similar to inspection of other fall arrest system components.

3. Additional instructions for assembly, disassembly, storage, inspection, care and maintenance.

a. Protect against cuts and abrasions. All safety lines and lanyards shall be protected against cuts or abrasions and padding must be used wherever sharp edges exist.

b. Store in an approved location. All fall protection/restraint equipment shall be stored in a weatherproof container or locker when not in use. Equipment should not be allowed to lie in water or direct sunlight, since this will affect equipment strength. Never store personal fall arrest equipment in the bottom of a tool box, on ground, or outside exposed to the elements i.e. sun, rain, snow, etc.

c. The fall-arrest system components shall be compatible. Contact the Qualified Person for Fall Protection or manufacturer's representative for assistance. When using fall-arrest systems, all components shall be designed for use with each other, or approval must be obtained from the manufacturer or qualified person to use the configuration that uses different components. All system components shall be compatible.

d. Follow manufacturers and the Qualified Person's instructions for installation, assembly/disassembly, and use. All systems must be installed, assembled, disassembled per the manufacturer's direction. Failure to follow these instructions could lead to the possible failure of a system.

e. In the event of a fall, secure all equipment involved and contact the Safety Office for disposition. Do not reuse safety equipment that has experienced a fall. In the event of a fall, the first response is to ensure the safety of the employees. After rescue and, if required medical aid is provided, all equipment involved must be removed from service..

f. Care and Maintenance of the Equipment.

(1) Hardware: clean on regular basis with WD 40 or other solvents and immerse in boiling water for 30 seconds to remove cleaning agent; dry with a soft cloth to ensure that the gate and gatekeeper operate properly.

(2) Harnesses, Lanyards and Ropes: Wash on regular basis with mild soap and rinse multiple times to remove the soap residue, store in a cool dry and safe environment to dry. Ensure harnesses and lanyards are not painted of marked. Only mark on labels.

Chapter 11

Tie-Off Considerations and Selection of Safe Anchorages

1. Suitable Anchorages.

a. One of the most important aspects of personal fall arrest is fully planning the system before it is put in use. Probably the most overlooked component of the fall-arrest system is planning for suitable anchorages. Such planning should ideally be done during the design stage and before a structure or a building is constructed so that anchorages can be incorporated and identified during construction for maximum use later for maintenance work. If properly planned and designed, these anchorages used during construction work may also be used afterward during maintenance.

b. The strength of a personal fall arrest system depends on its subsystems and components, as well as the anchorages and how strongly such a system is attached to the anchorage. Such attachment shall not significantly reduce the strength of the system, including the structural members e.g., the beams or columns to which it is attached. If a method of attachment is used that will reduce the strength of the system, such component, i.e., beam, column, shall be replaced with a stronger one in order to maintain the appropriate maximum characteristics.

c. There are two classifications of anchorages, Certified and Non-Certified.

(1) Certified: A fall protection or rescue anchorage that a qualified person certifies to be capable of supporting the potential forces that could be encountered in the process of arresting a fall.

(2) Non-Certified: An unquestionably strong anchorage that a competent person judges to be capable of supporting the predetermined anchorage strength as prescribed by OSHA Standards ad ANSI/ASSE Fall Protection Code. Non-certified anchorages are used either for fall arrest, work positioning, travel restraint or rescue.

2. Connecting lanyards. Lanyards shall not be connected to themselves or to another lanyard unless permitted by the manufacturer.

3. Knots in Fall Protection equipment. Knots shall not be tied in lanyards, lifelines, or anchorage connectors (i.e., anchor straps). Tie-off using a knot in a lanyard, lifelines, or anchorage connectors can reduce the strength by 50% or more.

4. Lanyards/lifelines subjected to sharp edges. Tying a rope lanyard or lifeline around rough or sharp edges such as beams, columns or other surfaces may reduce the strength of the line due to cutting action of the sharp edge. If the line is cut or damaged it will drastically affect the design reaction of the system during a fall. Such tie-off should be avoided or alternate rigging method should be used. As an alternate, use beam clamp, wire rope, effective padding, or abrasion-resistance strap (chaffing protection) around or over the sharp or rough surfaces.

5. Anchorage height. The anchorage location should be as high as possible to minimize the free fall distance and prevent any contact with an obstruction or the ground below if a worker falls. Free-fall distance shall not exceed six feet unless a specially designed lanyard is used that will allow the 12 foot free fall provided the maximum arresting force does not exceed 1,800 pounds. The anchorage point height shall reflect this restriction.

6. Worker "Swing". Tie-off point(s) shall be located in such a way to minimize the swinging of the worker (pendulum-like motion) that can occur during a fall. The farther away in a horizontal direction a worker moves from a fixed anchorage (tie-off point), the greater the swinging angle if a fall occurs. If any obstruction exists in the path of the swing fall, the force generated can be significant. The maximum angle of swing away from the tie-off point should not be more than 15 degrees in either direction.

7. Eyebolt Strength. The strength of an eyebolt is rated along the axis of the bolt and its strength is greatly reduced if the force is applied at an angle to this axis (out-of- the-plane of the eye). Also, the diameter of the eyebolt should be compatible to snap hook or carabiner attachment. Non-rotating rings should be avoided, since falls rarely occur directly along the axis of the eyebolt. Where possible, rotating rings (swivel rings) with full motion in the three axes should be used. The ring will then be able to automatically align along the direction of force. Swivel rings used as anchorages in a fall arrest system shall be properly sized. The eyebolt used in the fall protection system shall be forged steel. Effort shall be made to minimize the angle between the axis of the eyebolt and the direction of the pull.

8. Attaching two snaphooks to the same anchorage. If two employees are planning to use the same anchorage simultaneously by using two snap hooks, the anchorage must be certified and rated for use by two people. Connecting both snaphooks to the anchorage will require the use of additional connectors.

9. Horizontal lifelines. Horizontal lifelines, depending on their geometry and angle of sag, may be subjected to greater loads than the impact load imposed by an attached component. When the angle of sag for the horizontal lifeline is less than 30 degrees, the impact force generated is greatly amplified. For example, with a sag angle of 15 degrees, the force amplification is about 2:1 and at 5 degrees sag, it is about 6:1. Depending on the angle of sag, and the line's elasticity, the strength of the horizontal lifeline and the anchorages to which it is attached should be increased a number of times over that of the lanyard. Extreme care should be taken in considering a horizontal lifeline for multiple tie-off. The reason for this is that in a multiple tie-off to a horizontal lifeline, if one employee falls, the movement of the falling worker may cause other employees to also fall. Horizontal lifeline and anchorage strength should be calculated for each additional employee to be tied-off. For these and other reasons, horizontal lifelines shall only be designed, selected, and certified by Qualified Persons for Fall Protection. Inspection of installed horizontal lifelines and anchors before use is mandatory.

- The following are some considerations when evaluating horizontal lifeline systems:
    - Review the design calculations of the system;

- Review manufacturers test data of similar systems.

10. Compatibility. The anchorage and anchorage connector shall be compatible.

11. Tying to a Beam or Column.

- When tying off to a beam or column, do not attach the anchorage connection to a hole in the beam unless evaluated by a Qualified Person for Fall Protection, because the forces generated by a fall will weaken the beam structure.

- Do not drill a hole for tying off as this attachment may weaken the beam.

- The most favorable way to tie off is to use an anchorage connection to wrap around the beam or column, such as an anchor strap, or use a designed beam clamp. The most favorable location is in the center of the span as this action will distribute the forces evenly at the supports. The closer the tie off point is to the beam support the force of a fall on the structure will increase accordingly.

- Take into consideration the impact of shear forces and the bending moment at the supports and also the distribution of forces beyond the supports onto other structural members.

- When selecting the point of anchor in a column, take into consideration the impact of fall forces due to axial loading and bending stresses.

12. Installing anchorages.

- Refrain from welding the anchorage connection to the anchorage unless the welding is performed and certificated annually by a certified welder.

- When using nails to install roof anchors, the number of nails used to attach the component to a wood roof shall be in accordance with the building code requirements. Make sure roof anchors are attached to the rafters.

- Always specify the number of authorized users that are allowed to attach to a specific point of anchor.

- When planning and selecting a point of anchor location, take into consideration the accessibility and ease of securing to it.

- When attaching the fall arrest system to concrete slab, make sure the concrete is strong enough to sustain the static and dynamic loads of the fall forces. The bottom of a concrete slab is usually under tension and very weak.

Chapter 12

Responsibility for Design, Inspection, Certification, and Re-Certification of Anchorages

1. General. Anchorages are either be engineered or improvised systems which are a combination of anchorage point(s) and anchorage connector(s). Improvised fall-arrest anchorages and anchorage connectors shall withstand a force of 5,000 pounds for every person attached to the system. Positioning and restraint anchorage shall withstand a force of 3,000 pounds. Anchorage connectors are usually designed and prefabricated by a manufacturer under the supervision of a qualified person and meet OSHA and ANSI standards. The certification and re-certification of anchorage connectors can be done by either the manufacturer or Qualified Person for Fall Protection.

2. Responsibility of Anchorage Identification, Design and Certification.

a. Anchorages should be designed and installed before use by a Registered Professional Engineer (RPE) with experience in designing Fall Protection systems; or another Qualified Person with appropriate education and experience should design the anchor point to be installed. If there is a need to devise an anchor point from existing structures such as beams, or eyebolts, a Qualified Person for Fall Protection shall be used to evaluate these anchorages.

b. Fall-arrest system anchorages shall be capable of supporting 5,000 pounds per employee attached; or the anchorages shall be designed, installed, and used under the supervision of a Qualified Person for Fall Protection for twice the maximum arrest force as part of a complete fall-arrest system.

(1) A Qualified Person for Fall Protection should be able to calculate the forces generated by arresting a fall; total loading; impact on the structural members the line is attached to; and determine the optimal and safe location where and how to tie-off. The Qualified Person should have the knowledge and be capable of designing, certifying, supervising, approving, and rating the anchor points and tie-off points. Due to the variability in the structural strength of different materials before using an anchorage point, a Qualified Person for Fall Protection must be contacted to ensure that the anchorage point meets/exceeds regulatory requirements.

c. For recertification of active fall protection system, the Qualified Person for Fall Protection or the engineer of record shall specify the frequency of re-certification but not to exceed five years.

3. Inspection, Certification and Re-Certification of Anchorages.

a. Inspection: Fall arrest, positioning, and restraint equipment shall be inspected by the user before each use and by a Competent Person for Fall Protection annually, and in accordance with the manufacturer's instructions. Workers are not qualified to inspect anchor points; however, they could be trained to pay special attention to any cracks developing around the anchor points or if the anchor points are unstable or loose. End users shall not tie-off to unsafe anchorages and

they should bring it to the attention of the Competent Person for Fall Protection if such a situation exists. The manufacturers of the Fall Protection equipment/systems shall indicate in the supplied manufacturer's instructions the methods of inspection and durations. Any components of the system not addressed by the manufacturer's inspection requirements, i.e. anchorages, shall be visually inspected in a manner and frequency specified by the design engineer.

b. Certification and Re-Certification of Anchorages: Anchorages should be field-verified by a Qualified Person for Fall Protection. ANSI Z359.1 addresses certification of anchorage connections but it does not address certification of anchor points. A RPE or a Qualified Person for Fall Protection can certify the structural integrity of the anchor points. Depending on the design, type, location, and the size of the structural member the anchorage is connected to, the environment and weather conditions dictate how often such anchorages shall be inspected and re-certified by a Qualified Person for Fall Protection.

c. Recertification of Fall Protection System: The design of Fall Protection system shall be thoroughly reviewed by an engineer who is qualified in designing Fall Protection systems. The original design of the system should have indicated the frequency of the recertification criteria. The period of recertification shall not exceed five years. Recertification process shall include:

(1) Review of the original design;

(2) Any changes in the hazards or tasks performed;

(3) Changes in regulations or standards;

(4) Any other factors affecting the system.

d. Third Party Certification: USACE-Owned Facilities shall only use fall arrest equipment where manufacturers can substantiate through third party certification that the equipment meet the requirements addressed in ANSI Z359.1, .3 and .4.

Chapter 13

Fall Prevention Considerations During Planning and Design Phase

1. Introduction. When planning and designing new buildings or facilities, planners and designers, including owners/managers of such facilities, are responsible for providing safe design for the protection of all workers and users exposed to the hazards of fall from heights during performance of their work. Architects and engineers or any other entity, planning or designing a building, structure, or facility, including integral assemblies such as weight-handling equipment (cranes, hoists, etc), have the general duty and responsibility to have a safe design for preventing falls throughout the facility. This duty extends to any person who may be involved in the construction, demolition, modification, renovation, maintenance, or normal work operation of the building, structure, or facility.

a. Architects and engineers need to be aware that any part of a building, facility, structure, equipment, and integral assemblies such as weight-handling equipment (cranes, hoists, etc), will require maintenance work. If such work is required, prevention and control measures should be incorporated into the design to eliminate and prevent the need to work at height with its subsequent exposure to fall hazards.

b. Architects, engineers, designers, construction managers, superintendents, contractors/subcontractors, and owners of buildings and facilities have a major role and are responsible for creating a safe work environment and being aware of fall hazards. They shall have the proper knowledge and awareness of fall hazards that will be encountered at the workplaces they are designing, constructing, occupying, and operating.

c. Fall prevention philosophy for designing new buildings and facilities:

(1) Fall hazards should be designed out for new buildings, facilities or structures. When fall hazards cannot be eliminated or prevented, designers should provide alternative remedies such as identification installation of anchorages (hard points).

(2) Any location or part of a building, structure, facility or equipment will one day require, either, maintenance, remodeling, modification or replacement work. Engineers and architects should design new buildings and facilities with this idea in mind.

d. Fall Prevention during design for engineers and architects. Engineers, architects, designers and planners are responsible for designing safe buildings, facilities, structures and equipment. They should strive to eliminate, minimize or prevent the hazards of falling at work places. During construction, potential hazards should be identified and preventive measures should be incorporated in the design to assist contractors building the project in a safe manner. Post construction, the facility should protect personnel during normal work operations and help maintenance personnel conduct their work safely and without exposing them to fall hazards.

e. Applicability of fall protection requirements to Architects and Engineers. The ANSI Z359.2 Standard requires architects and engineers to include Fall Protection systems in the design of new facilities.

f. Architects and engineers are required to be trained in fall prevention and in accordance with this guide.

2. Planning and Design Considerations. It is very important at the design and planning phase to give consideration to the prevention of falls, not only during construction, but subsequent use, or maintenance of the building, structure, or facility. Consideration during various phases includes the following:

a. Construction Phase.

(1) Reducing the risk when working at heights (e.g., installation of guardrails to the perimeter structural members prior to erection).

(2) Reducing the need to work at heights as much as possible by prefabricating modules on the ground before lifting them into position.

(3) The placement and condition of the access road leading to the building or facility during construction, for example, which would enable a crane to place building material in the most appropriate and accessible location.

(4) Preparation and/or clearing debris on the ground or floor below the work area. The ground should be compacted and leveled in order to prevent tilting, unstable equipment, e.g. cranes or scissors lifts.

(5) Provision of temporary safety mesh as much as possible to prevent objects from falling down to lower levels

b. Maintenance and Occupancy Phase.

(1) Safe access to or egress from any work area.

(2) Provision of permanent guardrails or edge protection such as parapets.

(3) Selection of material that can withstand a harsh environment (e.g., special wood planks such as particle boards can weaken due to moisture absorption, thereby not supporting the weight of a worker during a future roofing inspection or maintenance work).

(4) Use of temporary work platforms whenever possible, such as scaffold, and elevating work platforms.

(5) Identification and location of services, e.g. location of power lines, water.

(6) Location and operations of type of equipment selected and devices used, e.g., using adjustable light fixtures that can be lowered to the ground for replacement.

(7) Use of fall-arrest systems and devices, including the provision of suitably located temporary or permanent anchor points and field identification of all required anchorage points.

(8) Provision of safety nets, when required.

(9) Location of and access to equipment.

(10) Location of amenities, such as plants.

(11) First aid facilities and trained personnel.

3. Fall-Hazard Identification. Planners, designers and system safety engineers should identify any fall hazards that will be encountered by an employee working at heights or using means of access to or egress from a building or facility. In order to assist in identifying fall hazards, special considerations should be given to:

a. Consultation, communication, and coordination with safety and health professionals;

b. Knowledge of injuries arising from falls that have occurred at a workplace or at similar workplaces;

c. Communication with various A/Es and contractors to find out if "at risk" workers are having or are likely to have problems while performing their jobs;

d. Accidents or near-miss incidents related to falls at the workplace or similar workplaces; review safety web pages for various accidents that occurred at similar workplaces;

e. Review of relevant fall protection standards, regulations, and guidance documents;

f. Communications with employees of similar facilities to determine what type of risks an employee would face during the performance of their duties;

g. Conducting a walk through inspection of the facility or similar facilities to become familiar with various risk situations;

h. Compiling statistical records indicating potentially unsafe work practices.

4. Risk Assessment. It is the responsibility of the planner or the designer to assess risk of injury to employees while the employees are at the workplace during performance of their work resulting from each hazard that involves falling.

a. Risk in relation to any injury or harm means the probability of that injury or harm occurring is increased. If a hazard is identified, the risks associated with such hazard can be assessed. Assessment of risks will help planners, designers, and system safety engineers

determine the potential injury and thus help identify methods to reduce risks. The necessary steps in a risk assessment process may include the following:

(1) Identify the specific hazardous/situation that might occur in a workplace;

(2) Identify the nature of the decisions to be made about hazards and who is responsible for making these decisions;

(3) Define and decide how such information needs to be presented to the decision makers.

b. The required information may include the determination and assessment of the following:

(1) Size, height, and layout of a workplace;

(2) Material handling methods or accessing all material or equipment at different locations of the facility;

(3) Location and condition of all equipment and/or material used in a workplace;

(4) The number, type of work, and movement of all employees in a workplace, planned facility, or building.

5. Risk Control. Planners and designers should consider the means by which risk may be eliminated or reduced. Once risks have been assessed, measures should be taken to control the hazards of falling. There is a hierarchy or a preferred order of control measures. These range from eliminating the worst hazards to the other methods that reduce risks. Specific control measures may include the following:

a. Plans or designs of new or modifications to existing buildings, structures, or facilities should take fall prevention into consideration;

b. Evaluate methods or the way jobs can be performed safely to eliminate or reduce the likelihood of a fall;

c. Organize and schedule work so that employees do not interfere in safety measures taken or increase the risk of a fall for themselves or others;

d. Identify the information and knowledge required by contractors to enable them to work safely at heights;

e. Collect, assemble, and present the information required to eliminate or reduce hazards;

f. Identify the training or knowledge requirement to work safely if there is a risk of falling.

6. Hierarchy of Control Measures. Elimination of fall hazards is the most preferred control measure.

7. Preventive Considerations and Guidelines for Selective Design Issues and Examples.

- If possible, design buildings or facilities with minimum slope rather than steep slope roofs. Try to minimize the slope of the roof as much as possible, although it is desirable at high snow regions to have steep sloped roofs to shed the weight associated with accumulation.

- Incorporate edge protection, i.e. standard guardrails or 48 inch high parapets, around all open sided floors or openings.

- If the design includes installation of fall arrest system or horizontal lifeline, always have the understanding and knowledge of other equipment operating in the same area i.e. interference between the use of fall arrest system or horizontal lifeline with the crane operation.

- When designing flat roofs incorporate guardrails or 39-inch high parapets around perimeter of the roof.

- Specify strong roofing material like plywood. Do not specify particleboard on roofs as wood planks as such material can hold moisture and collapses under weight.

- Locate equipment, i.e. HVAC systems, away from the edge of the roof or provide standard guardrails around it.

- Use lighting fixtures that can be replaced or maintained without exposing the personnel to the hazard of fall. As an example in a gym use lighting fixtures that can be lowered to the ground for changing light bulbs; or provide catwalk or platform to access such fixtures.

- When providing operable windows, consider inward operating sash's so that window washing can be facilitated from the inside of the facility.

- Locate water valves, meters and other equipment and instrumentation at a location the employee can service without being exposed to a fall hazard.

- If the design of buildings and facilities does not allow for using conventional methods of fall prevention such as the use of guardrails or other methods, identify anchor points that can withstand a force of 5,000 pounds per person wherever there is a location within a building that exposes a person to a fall from height.

- Refrain from designing and installing ladders that are over 20 feet high for accessing a location at a building or structure, instead design staircases for safer access.

- Always provide safe access to service equipment, instrumentation and other amenities within the building or facility.

- Design guardrails or specify covers for utility holes, even if these holes are only a few feet deep. Falling in a shallow utility hole such as steam or electrical lines might expose the person to other hazards like burning or electrocution.

- Always think how any equipment, fixture or part of a building or facility can be maintained in the future. Can such fixtures and equipment be safely accessed without exposing the user to the hazard of falling from heights?

- Understanding the work of the maintenance workers will help eliminate or minimize the hazard of falling.

- It is of the utmost importance for design engineers to understand and know how a contractor will build or construct a building or facility. Knowledge of construction operations will help the engineer or architect design safer buildings and specify the proper material and equipment. This will help contractors during construction operations.

- Always have knowledge and understanding of building and facility operations.

- Provide safe access and egress to every location inside or outside of buildings or facilities.

- Understand work practices for the building or facility being designed.

- Understand the governing safety regulations and standards.

- In addition to the design knowledge, the design engineer should be familiar with construction operations of how to build such facility, have the knowledge of the logistical operations during occupancy, and any maintenance work required afterwards.

- Minimize the width of parapets or short walls, or provide steeply sloped cap flashing. Some occupants of buildings have the tendency of sitting on such wide parapets and exposing themselves to fall hazard.

- When selecting fixtures, equipment or other amenities to be installed on roofs, such as projectors, flagpoles, surveillance cameras, always have in mind how to maintain such equipment or fixtures. As an example install cameras or light fixtures on tracks that can be pulled away from the edge of the roof for maintenance or service.

- Be knowledgeable, understand and identify the delivery of material or equipment procedures during construction operations. ,This will help in siting the building and access roads for the vehicles or equipment to deliver such material in a safe manner.

- Try to eliminate any blind spots in the design.

- All hatches and openings shall be protected either with a cover or railing and the access ladder shall extend above the hatch.

- Provide adequate lighting for locations within a building that will require maintenance work, which is near or within close proximity of a fall hazard.

- If there is a chance of falling in water like working from a pier, consider incorporating fall protection method in the design.

- When designing skylights either incorporate guardrail around the perimeter of the skylight or build the skylight at least 42 inches above the roof level.

Chapter 14

Other Protective Measures

1. Barricaded Area. When working overhead, barricade the area below to prevent entry by unauthorized employees. A distance of six feet shall be barricaded around the worker.

2. Warning Tapes/Signs. Construction warning tape and signs shall be posted so they are clearly visible from all possible access points. When a sign is used, it should clearly indicate the entry requirements, potential hazards, and personal protective equipment requirement.

3. Hard Hat Requirements. Hard hats must comply with ISEA Z89.1, 1997 Type I, Class E/G and will be required when workers are exposed to falling/flying objects.

4. Clothing and Safety Shoes.

a. Suitable clothing shall be worn. Sufficient and proper clothing shall be worn to assist in preventing scratches, abrasions, slivers, sunburn, or similar hazards. Loose or ragged clothing or ties shall not be worn while working around moving machinery. At a minimum, employee must wear a short-sleeved shirt and long pants.

b. Employees shall wear substantial safety-toed footwear made of leather or other equally firm material whenever there is a danger of injury to the feet from: falling or moving objects, or from burning, cutting, penetration, or similar hazards. The soles and heels of such footwear shall be of a material that will not create a slipping hazard. Footwear that has deteriorated to the point where it does not provide the required protection shall not be used.

5. Evacuate Area Below. All non-essential personnel below a construction area must be cleared or protection provided.

6. Secure Stored Materials. All construction materials and equipment stored on a roof or other exposed areas must be secured against inclement weather conditions. Before the end of the workday, all loose materials must be secured to prevent injury or property damage from falling objects. Caution must also be taken not to overload the roof. Materials shall not be stored within six feet of the edge of the roof unless guardrails are erected on the roof edge.

7. Traffic Control. When working over or adjacent to a roadway, traffic control measures must be implemented. Employees working adjacent to roadways must wear vests that are highly visible and have reflective markings. When working adjacent to transportation lanes, traffic control measures should be reviewed to ensure the safety of the personnel on the job site.

8. Control of Falling Objects. When employees are working over other employees, all tools and equipment will be secured so that they will not fall. Tethers should be used to tie off tools and equipment. Employees must wear hard hats whenever there is a potential for falling objects.

Toe boards and solid floor surfaces without any openings shall be provided to prevent objects from falling through the openings.

9. Debris Control. Measures shall be taken to control debris in the construction area. Debris shall not be allowed to accumulate on walking/working surfaces.

10. Lock Out/Tag Out. When working near energy sources, lock-tag/tag-out must be used to eliminate any potential hazards.

Chapter 15

New American National Standards Institute (ANSI) Z359 Fall Protection Standards

ANSI coordinates the development and use of voluntary consensus standards in the United States and the Z359 standards are mandatory for use on USACE projects. The ANSI Z359.1 Standard is based on fall protection systems and the ANSI/ASSE Accredited Standards Committee is working on developing thirteen new fall protection component standards to replace ANSI Z359.1 Standard (2007) as part of the Fall Protection Code. These thirteen new standards when finalized, approved, and published will become part of this Fall Protection Guide. These new ANSI Z359 standards under development are:

- Z359.5: Safety Requirements for Personal Fall Arrest Systems;
- Z359.6: Specifications & Design Requirements for Active Fall Protection Systems;
- Z359.7: Requirements for Third-Party & Self-Certification for Personal Fall Arrest Systems;
- Z359.8: Rope Access Systems;
- Z359.9: Descender Devices;
- Z359.11: Safety Requirements for Full Body Harness for Personal Fall Arrest Systems;
- Z359.12: Safety Requirements for Connecting Components for Personal Fall Arrest Systems (Connectors);
- Z359.13: Safety Requirements for Lanyards & Energy Absorbers for Personal Fall Arrest Systems;
- Z359.14: Safety Requirements for Self-Retracting Devices for Personal Fall Arrest Systems;
- Z359.15: Safety Requirements for Vertical Lifelines for Personal Fall Arrest Systems;
- Z359.16: Safety Requirements for Fall Arresters for Personal Fall Arrest Systems;
- Z359.17: Safety Requirements for Horizontal Lifelines for Personal Fall Arrest Systems;
- Z359.18: Safety Requirements for Anchorage Connectors for Personal Fall Arrest Systems.