controls. Quality assurance and control measures must require strict enforcement of all requirements.

(3) If interim or final acceptance testing is anticipated to occur two or more months after the initial pipe or system installation preparatory meeting, conduct a supplemental preparatory meeting prior to the testing to review the test procedures and AHA.

20-9. Figures and Tables.
Not Applicable.

20-10. Checklists and Forms.
Not Applicable.

Chapter 21
Fall Protection

21-1. References.

a. ANSI/ASSP A10.11, Safety Requirements for Personnel Nets (https://www.assp.org) (21-1.a)

b. ANSI/ASSP A10.32, Personal Fall Protection Used in Construction and Demolitions (https://www.assp.org) (21-1.b)

c. ANSI/ASSP Z359.0, Definitions and Nomenclature Used for Fall Protection and Fall Arrest (https://www.assp.org) (21-1.c)

d. ANSI/ASSP Z359.1, The Fall Protection Code (https://www.assp.org) (21-1.d)

e. ANSI/ASSP Z359.2, Minimum Requirements for a Comprehensive Managed Fall Protection Program (https://www.assp.org) (21-1.e)

f. ANSI/ASSP Z359.3, Safety Requirements for Lanyards and Positioning Lanyards (https://www.assp.org) (21-1.f)

g. ANSI/ASSP Z359.4, Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components (https://www.assp.org) (21-1.g)

h. ANSI/ASSP Z359.6, Specifications and Design Requirements for Active Fall Protection Systems (https://www.assp.org) (21-1.h)

i. ANSI/ASSP Z359.7, Qualification and Verification Testing of Fall Protection Products (https://www.assp.org) (21-1.i)

j. ANSI/ASSP Z359.9-2021, Personal Equipment for Protection Against Falls – Descent Controllers (https://www.assp.org) (21-1.j)

k. ANSI/ASSP Z359.11, Safety Requirements for Full Body Harnesses (https://www.assp.org) (21-1.k)

l. ANSI/ASSP Z359.12, Connecting Components for Personal Fall Arrest Systems (https://www.assp.org) (21-1.l)

m. ANSI/ASSP Z359.13, Personal Energy Absorbers and Energy Absorbing Lanyards (https://www.assp.org) (21-1.m)

n. ANSI/ASSP Z359.14, Safety Requirements for Self-Retracting Devices for Personal Fall Arrest and Rescue Systems (https://www.assp.org) (21-1.n)

o. ANSI/ASSP Z359.15, Safety Requirements for Single Anchor Lifelines and Fall Arresters for Personal Fall Arrest Systems (https://www.assp.org) (21-1.o)

p. ANSI/ASSP Z359.16, Safety Requirements for Climbing Ladder Fall Arrest Systems (https://www.assp.org) (21-1.p)

q. ANSI/ASSP Z359.18, Safety Requirements for Anchorage Connectors for Active Fall Protection Systems (https://www.assp.org) (21-1.q)

r. ANSI/ASSP Z490.1, Criteria for Accepted Practices in Safety, Health and Environmental Training (https://webstore.ansi.org/) (21-1.r)

s. ANSI/Scaffold and Access Industry Association (SAIA) A92.2, Vehicle-Mounted Elevating and Rotating Aerial Devices (https://webstore.ansi.org/) (21-1.s)

t. ANSI/SAIA A92.3, Manually Propelled Elevating Aerial Platforms (https://webstore.ansi.org/) (21-1.t)

u. ANSI/SAIA A92.5, Boom-Supported Elevating Work Platforms (https://webstore.ansi.org/) (21-1.u)

v. ANSI/SAIA A92.6, Self-Propelled Elevating Work Platforms (https://webstore.ansi.org/) (21-1.v)

w. 29 CFR 1910 Subpart D, Walking-Working Surfaces (https://www.govinfo.gov/content/pkg/CFR-2022-title29-vol5/pdf/CFR-2022-title29-vol5-part1910-subpartD.pdf) (21-1.w)

x. 29 CFR 1910 Subpart I, Personal Protective Equipment (https://www.govinfo.gov/content/pkg/CFR-2020-title29-vol5/pdf/CFR-2020-title29-vol5-part1910-subpartI.pdf) (21-1.x)

y. 29 CFR 1926.106, Working Over or Near Water (https://www.govinfo.gov/content/pkg/CFR-2020-title29-vol8/pdf/CFR-2020-title29-vol8-sec1926-106.pdf) (21-1.y)

z. 29 CFR 1926.453. Aerial Lifts (https://www.govinfo.gov/content/pkg/CFR-2022-title29-vol8/pdf/CFR-2022-title29-vol8-sec1926-453.pdf) (21-1.z)

aa. 29 CFR 1926.1431, Hoisting Personnel (https://www.govinfo.gov/content/pkg/CFR-2020-title29-vol8/pdf/CFR-2020-title29-vol8-sec1926-1431.pdf) (21-1.aa)

bb. 29 CFR 1926 Subpart M, Fall Protection (https://www.govinfo.gov/content/pkg/CFR-2020-title29-vol8/pdf/CFR-2020-title29-vol8-part1926-subpartM.pdf) (21-1.bb)

21-2. Definitions.

a. Active Fall Protection System. A personal fall protection system that requires Authorized Persons (that is, End-Users) to wear or use personal fall protection equipment and that requires fall protection training. Active fall protection systems can include any travel restraint or personal fall arrest systems (PFAS). (21-2.a)

b. Anchorage. A secure connecting point or terminating component of a personal fall protection system that can safely withstand the forces exerted by the activation of fall protection and rescue equipment. The anchorage is a secured structure (for example, beam, girder, column, floor). Anchorage is either engineered or improvised. (21-2.b)

c. Anchorage Connector. A component or subsystem by which fall protection or rescue equipment is secured or attached to the anchorage. This includes any device designed to suspend human loads and capable of withstanding forces generated by a fall (for example, steel cable sling, tie-off adapter (that is, anchor strap), load-rated hoist ring designed for construction applications, tripod, davit arm). (21-2.c)

d. Authorized Person (End-User). A person who has been trained in the use of assigned personal fall protection equipment, including hands-on training and practical demonstrations in a typical fall-hazard situation. They use personal fall arrest, restraint, or positioning equipment while performing work assignments at heights. (21-2.d)

e. Authorized Rescuer. A person who is trained on rescue procedures and assigned by the employer to rescue Authorized Persons who may require rescue. (21-2.e)

f. Carrier. The specified track of a climbing ladder PFAS consisting of a flexible or rigid member upon which the carrier sleeve travels. The carrier is secured to the

climbing ladder or structure by carrier mounting brackets. The carrier may be continuous or may contain joints or splices. (21-2.f)

g. Certified Anchorage. An anchorage for personal fall arrest, positioning, restraint, or rescue systems that a QP for Fall Protection certifies to be capable of supporting the potential fall forces that could be encountered during a fall or that meet the criteria for a certified anchorage. (21-2.g)

h. Clearance Requirement. The distance below the Authorized Person that must remain clear of obstructions to ensure that the Authorized Person does not encounter any object or obstruction during a fall. (21-2.h)

i. Competent Person for Fall Protection (CP for Fall Protection). A person designated in writing by the employer to be responsible for the immediate supervision, implementation, and monitoring of the Fall Protection Program. The CP for Fall Protection, who through training, knowledge, and experience in fall protection and rescue systems and equipment, is capable of identifying, evaluating, and addressing existing and potential fall hazards. The CP for Fall Protection has the authority to take prompt corrective measures with regard to such hazards. The term “Competent Person (CP)”, as used in this chapter, refers to “Competent Person for Fall Protection.” (21-2.i)

j. Competent Person (CP) or Qualified Person (QP) Trainer. An individual who by training, knowledge, and experience can conduct CP or QP-level fall protection training (respectively). (21-2.j)

k. Competent Rescuer. An individual, who by training, knowledge, and experience in the safe use of specialized rescue equipment (for example, harness, lanyards, horizontal lifelines (HLL)), is capable of the implementation, supervision, and monitoring of the employer’s rescue plan. The individual in this role must be designated by the employer. (21-2.k)

l. Competent Rescuer Trainer. An individual who by training, knowledge, and experience specific to fall protection rescue, can conduct rescue training. (21-2.l)

m. Fall Protection Program Administrator (also known as, Program Manager). A person designated by the employer to be responsible for the development, implementation, monitoring, and evaluation of the employer’s Fall Protection Program. The Program Administrator must have training and a working knowledge of current fall protection regulations, standards, equipment, and systems. (21-2.m)

n. Free-Fall Distance. The vertical distance traveled during a fall, measured from the onset of a fall from a walking-working surface to the point at which the fall protection system begins to arrest the fall. It excludes deceleration distance and the elongation of a lifeline or lanyard. It includes any distance that a deceleration device slides before engaging or the distance that a self-retracting lifeline or lanyard extends before fall

arrest forces are applied. The distance is measured using a common reference point, typically the fall arrest attachment point (that is, anchor point). (21-2.n)

o. Horizontal Lifeline (HLL) System. An active fall protection system made of flexible wire, rope, or synthetic cable that is spanned horizontally between two end anchorages or anchorage connectors. It may include in-line energy absorber, lifeline tensioner, or turnbuckles and may also include intermediate anchorages. The system is used for attaching a fall arrest or in restraint system applications. (21-2.o)

p. Infrequent. A task or job is performed only on occasion, when needed (for example, equipment breakdown), on an occasional basis, or at sporadic or irregular intervals. Infrequent tasks include work activities such as annual maintenance or servicing of equipment, monthly or quarterly replacement of batteries or HVAC filters, and responding to equipment outage or breakdown. In these instances, the frequency of exposure to fall hazards is very limited. By contrast, tasks performed or repeated on a daily, routine, or regular basis are not infrequent activities. Infrequent tasks also do not include those that workers perform as a primary or routine part of their job or repeatedly at various locations during a work-shift. A task may be considered infrequent when it is performed once a month, once a year, or when needed. (21-2.p)

q. Lower Levels. Areas below the level where the employee is located and to which an employee can fall. Such areas include but are not limited to, ground levels, floors, roofs, ramps, runways, excavations, pits, tanks, materials, water, and equipment. (21-2.q)

r. Non-Certified Anchorage. Unquestionably strong anchorage that a CP can judge to be capable of supporting the predetermined anchorage strength as prescribed by 29 CFR 1926, Subpart M and ANSI/ASSP Z359.1 requirements. Non-certified anchorages are used for fall-arrest, work positioning, travel restraint, or rescue. (21-2.r)

s. Passive Fall Protection System. A system that does not require a worker to use or wear personal fall protection equipment. Examples include guardrails, safety nets, covers, and compliant parapet walls. (21-2.s)

t. Qualified Person for Fall Protection (QP for Fall Protection). A person with a recognized degree or professional certificate with extensive knowledge, training, and experience in the fall protection and rescue field. The QP for Fall Protection must be capable of designing, analyzing, evaluating, and specifying fall protection and rescue systems. The term “Qualified Person (QP),” as used in this chapter, refers to “Qualified Person for Fall Protection.” (21-2.t)

u. Single Anchor lifeline. A flexible line along which a fall arrestor travels that is supported by a single anchorage. A lifeline may be used in vertical, horizontal, or sloped applications. (21-2.u)

v. Temporary. Means that the duration of the task the worker performs is brief or short. Temporary, brief, or short tasks generally include those that a worker is able to perform in less time than it takes to install or set up conventional fall protection. Examples of temporary tasks include changing a filter in a roof-top HVAC system, replacing a part on a satellite dish, caulking or resealing the flashing around a skylight, or sweeping a chimney. (21-2.v)

21-3. Personnel Required Qualification/Training. Train all personnel (for example, Program Administrator, QPs, CPs, Authorized Persons, Authorized and Competent Rescuers, trainers) according to ANSI/ASSP Z359.2 and ANSI/ASSP Z490.1.

a. Fall Protection Program Administrator/Manager. (21-3.a)

(1) Training must be conducted by a CP trainer or QP trainer.

(2) USACE Program Administrators must complete annual refresher training consisting of at least one hour of fall protection and rescue-related informational meetings or training.

b. Qualified Person for Fall Protection (QP for Fall Protection). (21-3.b)

(1) Training must be conducted according to ANSI Z359.2 and be conducted by a QP trainer.

(2) Training must include instruction in proper identification, design, assembly, inspection, certification, recertification, and use of all fall protection equipment and systems that they encounter in their work as a QP.

(3) Training must be conducted according to ANSI Z359.2.

(4) USACE QPs must complete annual refresher training consisting of at least one hour of fall protection and rescue-related informational meetings or trainings.

c. Competent Person for Fall Protection (CP for Fall Protection). (21-3.c)

(1) Training must be conducted by a CP trainer or QP trainer.

(2) Initial training must include a minimum of 24 hours of course work, with a combination of formal classroom training and performance assessment of trainees based upon observation of physical demonstrations of skill or theoretical exercises. The CP trainer must document the training and issue a single certificate to the CP that shows that they have completed CP fall protection training.

(3) USACE CPs must complete annual refresher training consisting of at least two hours of fall protection and rescue-related informational meetings or trainings.

(4) CPs must have the authority to stop work if it is determined to be unsafe.

d. Authorized Person (End-User). (21-3.d)

(1) Training must be conducted, at minimum, by a CP that is qualified to train on the safe use and hazards of fall protection systems and equipment. Authorized Persons must be trained before they use the personal fall protection equipment. The CP must be qualified to train workers to safely use fall protection systems and equipment and to recognize fall hazards related to their use.

(2) The training must include:

(a) The nature of fall hazards in the work area.

(b) The correct procedures for erecting, using, dismantling, inspecting, maintaining, and storing fall protection equipment.

(c) The application limits, free-fall distance, total fall distance, and clearance requirements of fall protection systems and equipment.

(d) Rescue equipment and procedures.

(e) Hands-on training and practical demonstrations.

(f) Proper anchoring and tie off techniques.

(g) All applicable requirements from this chapter.

(3) Retrain Authorized Persons as necessary when any of the following situations present):

(a) There are changes in the Fall Protection Program that make earlier training obsolete.

(b) There are changes in fall protection or rescue equipment that make earlier training obsolete.

(c) Inadequacies in an employee's performance are identified that indicate a lack of knowledge or skill.

(d) There are changes in workplace conditions that could affect the safe use of the personal fall protection equipment.

(4) In addition to any of the above retraining situations, Authorized Persons must complete annual refresher training consisting of at least one hour of training that includes a refresher and any changes to the fall protection and rescue requirements.

e. Competent Rescuer. (21-3.e)

(1) Training must be conducted, at minimum, by a Competent Rescue trainer.

(2) Competent Rescuers must have a working knowledge, through experience and training, of current fall protection and planned rescue standards, equipment, and systems.

(3) The training must include:

(a) Safe use of all types of equipment and systems used for rescue including inspection of the systems prior to use, installation, component compatibility, descent control, backup systems, dismantling, storage, and the common hazards associated with each system.

(b) Instruction and practical demonstrations (that is, performance assessment) on how to properly select, inspect, anchor, assemble and use the fall protection and rescue equipment used.

(4) Competent Rescuers must complete refresher training every two years, with rescue drills conducted annually, to stay current with fall protection and rescue requirements.

f. Authorized Rescuer. (21-3.f)

(1) Training must be conducted, at minimum, by a Competent Rescuer. Authorized Rescuers must be trained before they are exposed to fall hazards or a potential rescue event.

(2) Training must include:

(a) Instruction in the method(s) of rescue and equipment being used including self-rescue and assisted rescue.

(b) Practical demonstrations on the fall protection and rescue equipment the individual may use. The demonstration must include how to properly select, inspect, anchor, assemble, disassemble, store, and use the equipment u.

(c) A demonstration (that is, performance assessment) by the trainee on before-use inspection of rescue equipment and systems.

(3) Authorized Rescuers must complete refresher training every two years, with rescue drills conducted annually, to stay current with fall protection and rescue requirements.

21-4. Roles and Responsibilities.

a. Fall Protection Program Administrator. The Program Administrator is responsible for the overall development, implementation, monitoring and evaluation of the employer's Fall Protection Program. This person can also function as a QP, CP, CP trainer, QP trainer or competent rescue trainer if so trained (see para 21-3). The Program Administrator will: (21-4.a)

(1) Advise and provide guidance for managers, employees, and others on all matters pertaining to their Fall Protection Program.

(2) Establish all duties and responsibilities required by the Fall Protection Program and assign them to individuals who are trained and qualified to perform them.

(3) Verify personnel are provided with resources to accomplish their responsibilities.

(4) Establish and implement a procedure to identify and eliminate or control new and existing fall hazards.

(5) Ensure the proper development and implementation of the Fall Protection and Prevention Plan and Rescue Plan (see para 21-7).

(6) Ensure that an appropriate level of training is provided to all personnel involved in the Fall Protection Program, to include Authorized Persons, CPs, QPs, and others as required.

(7) Ensure that a rescue plan is prepared and implemented for every location where a PFAS is used to control fall hazards.

(8) Participate in investigations, either personally ro by designating persons qualified to perform the investigation, of all accidents and near misses related to falls from heights.

(9) Measure and evaluate the effectiveness of the Fall Protection Program by conducting periodic program evaluations. Make necessary improvements.

b. Qualified Person for Fall Protection (QP for Fall Protection). The QP is responsible for technical support of the Fall Protection Program. The QP will: (21-4.b)

(1) Design, analyze, evaluate, and specify fall protection and rescue systems.

(2) Supervise the design, selection, installation, and inspection of certified anchorages and HLL.

(3) Participate in investigation of all accidents and near misses related to falls from heights.

c. CP for Fall protection. The CP is responsible for the onsite supervision, implementation, and monitoring of the Fall Protection Program. The CP will: (21-4.c)

(1) Conduct a fall hazard survey to identify all fall hazards before End-Users are exposed to those hazards.

(2) Identify, evaluate, and impose limits on the workplace activities to control fall hazard exposures and swing falls and communicate all limitations to all employees authorized to utilize the fall protection system.

(3) Immediately stop the work if it is determined to be unsafe and take prompt corrective measures to mitigate fall hazards.

(4) Prepare, update, review, and approve Fall Protection and Prevention Plans as directed by the Program Administrator. Specify in the Fall Protection and Prevention Plan, the fall protection systems, anchorage locations, connecting means, body harness, and other equipment that Authorized Persons must use when exposed to a fall hazard. (See para 21-7)

(5) Review procedures as workplace activities change to determine if additional practices, procedures, or training need to be implemented before workplace activities continue.

(6) Ensure that a Rescue Plan has been developed and is in place for all PFAS (see para 21-7).

(7) Supervise the selection, installation, use, and inspection of non-certified anchorages in consultation with the Fall Protection Program Manager and QP.

(8) Verify that personal fall protection systems are properly installed and inspected.

(9) Prior to working at heights, verify Authorized Persons are trained and authorized to do so.

(10) Prior to working at heights, verify that available and required clearances are adequate before Authorized Persons start work (see table 21-1).

(11) Review at least annually and as needed, the Fall Protection and Prevention Plan and the Rescue Plan to ensure the Authorized Persons are up to date with and practicing the latest procedures for each workplace.

(12) Ensure prompt rescue of Authorized Persons can be accomplished via the procedures identified in the Rescue Plan.

(13) Participate in investigations of all accidents and near misses related to falls from heights.

(14) Immediately remove from service all personal fall protection systems and equipment that is damaged, malfunctioning, or was subjected to a fall.

(15) Inspect and document all fall protection equipment at frequency required by manufacturer, applicable regulations, and this chapter (see para 21-5).

d. Authorized Person. The Authorized Person must understand workplace activities and fall protection, rescue systems, and equipment used. They must follow the policy, procedures, and the instructions of the CP. The Authorized Person will: (21-4.d)

(1) Bring to the attention of the CP all unsafe or hazardous conditions, actions, or unsafe work practices that may cause injury either to themselves or others, before proceeding with the workplace activities.

(2) Properly use, inspect, maintain, store, and care for their fall protection equipment and systems.

(3) Inspect all fall protection equipment for damage or defects prior to each use and notify the CP of any concerns prior to using (see para 21-5).

e. Competent Rescuer. The Competent Rescuer is responsible for anticipating the potential for rescue and implementing, supervising, and monitoring the Rescue Plan before Authorized Persons start any work at heights (see para 21-7). In addition, the Competent Rescuer will: (21-4.e)

(1) Verify all Authorized Rescuers have been trained and are proficient at performing rescue procedures.

(2) Identify and confirm the availability of the resources necessary to conduct a safe, effective, and prompt rescue from heights

(3) Know the hazards associated with rescue from heights and how to mitigate these hazards within the rescue area.

(4) Verify the rescue equipment is protected against damage by workplace conditions.

(5) Verify Rescue Plans, procedures, and methods are effective by conducting rescue drills at least annually. Ensure that any deficiencies are corrected. (See para 21-7.b)

f. Authorized Rescuer. The Authorized Rescuers is responsible for performing or assisting in workplace rescues for personnel suspended in or attached to fall protection systems. The Authorized Rescuer will: (21-4.f)

(1) Verify that a Rescue Plan and procedures have been developed for any workplace where a PFAS is used. Review the plan and procedures before fall hazards are encountered in the workplace.

(2) Inspect the rescue equipment intended for use in a recue according to procedures developed by the Competent Rescuer. Ensure that it is protected, in proper working condition, and securely stored until it is needed.

(3) Recognize fall hazards that may endanger the rescuer during rescue operations. Including the necessary procedures in the Rescue Plan to ensure the rescuer safety.

g. Employer. The employer will ensure adequate resources (for example, equipment, training, personnel) are provided to ensure prompt rescue to all fallen workers. (21-4.g)

21-5. Inspection Requirements.

a. Fall Protection Equipment. Inspect fall protection and rescue systems and equipment according to the manufacturer's instructions and any other applicable requirements, or as prescribed by the CP, to include the following: (21-5.a)

(1) Remove from service any equipment that is damaged, malfunctioning, or was subjected to a fall.

(2) Before Use. The Authorized Person and Authorized Rescuer must inspect personal fall protection and rescue equipment prior to each use to determine that it is in a safe working condition.

(3) Semi-Annual. A CP must inspect fall protection and rescue systems and equipment at least semi-annually and whenever equipment is subjected to a fall. Such inspections must be documented by the CP.

(4) Inspect, at minimum, the following:

(a) Harnesses, Lanyards, Straps, and Ropes. Check all components for cuts, wear, tears, damaged threads, broken fibers, undo stretching, pulled or torn stitches, frayed edges, mold, alterations, damage due to deteriorations, discoloration, abrasions,

burn or chemical damage (for example, contact with fire, acids, corrosives), UV deterioration, missing markings or labels, and any internal deterioration.

(b) Hardware (for example, snaphooks, carabiners, connectors, D-rings). Check all components for signs of excessive wear, cracks, corrosion, and deformation. Look for distorted hooks or faulty springs, tongues unfitted to the shoulder buckles, lose or damaged mountings, and non-functional parts.

b. Safety Nets. CPs must inspect safety nets according to the manufacturer's instructions and ANSI/ASSP A10.11 and 29 CFR 1926.502 (29 CFR 1926 Subpart M). Remove from service and replace any damaged or defective nets. Such inspections must be documented by the CP. (21-5.b)

21-6. Activity Hazard Analysis (AHA) Requirements.
Develop AHAs according to paragraphs 1-6 or 2-6, as applicable, to include the following:

a. Prior to erecting or dismantling scaffolds, a CP must conduct an evaluation to determine the feasibility and safety of providing fall protection. If fall protection is not feasible, detail the rationale for infeasibility and what fall hazard controls will be used in the AHA. (21-6.a)

b. It is understood that the provision of fall protection for the first person who establishes anchorages may be difficult because this first person is the source of the initial anchorage. In this situation, fall protection may not be required. This decision will be made by the CP and documented in the AHA for the task. After anchorages are installed, fall protection is required. (21-6.b)

21-7. Minimum Plan Requirements.

a. Fall Protection and Prevention Plan. A Fall Protection and Prevention Plan is required when employees are working at heights or exposed to fall hazards. The plan must be developed by a CP or QP and updated as conditions change, but at least annually. The plan must include the following: (21-7.a)

(1) Detailed description of the activity being performed.

(2) Description of the anticipated hazards or concerns and the control measures that will be implemented to mitigate the hazards to an acceptable level. Describe the fall protection and prevention systems, to include the design of anchorages and fall arrest and HLL systems and the equipment and methods employed for the phase of work.

(3) Assignment of personnel and their roles and responsibilities. Include necessary information/documentation to support qualification/training of such persons according to para 21-3). If fall protection components or systems are used that require

instructions, supervision, design calculations, or drawings, then include the name, qualifications, and responsibilities of the QP.

(4) Inspection and oversight methods to ensure adherence to the plan.

(5) Describe maintenance and storage of fall protection equipment.

b. Rescue Plan. A Rescue Plan (that is, written rescue procedures) is required when PFAS are used. The plan must be developed by a Competent Rescuer to include the following: (21-7.b)

(1) Method(s) for self-rescue and assisted rescue of any worker who falls including rescue equipment. The rescue function may be performed by self-rescue, assisted rescue, local emergency services, in-house professionals, CPs, QPs or contractor services.

Note. If other methods of rescue are planned (that is, jurisdictional public or government emergency rescue agencies), indicate in the plan how to contact and summon the agency to the site.

(2) If required, identify, select, and document anchorages for self-rescue and assisted rescue. Anchorages selected for rescue must be capable of withstanding static loads of 3,000 pounds (13.3 kN) or five times the applied loads as designed by a QP.

(3) Rescue equipment used for self-rescue or assisted rescue (that is, self-retracting lanyard (SRL) with rescue capability) must meet ANSI/ASSP Z359.4 and Z359.14.

(4) Identify assigned safety spotters (also known as, the “buddy system”) who will be within visual and verbal range to initiate rescue of the fallen worker, if required.

c. Fall Protection Program (USACE Only). A written Fall Protection Program must be developed when USACE employees perform work at heights. The program must include the following: (21-7.c)

(1) Requirements for each facility to develop a Site-Specific Fall Protection and Prevention Plan and Rescue Plan (see paras 21-7.a and 21-7.b).

(2) Procedures for conducting fall hazard surveys and preparation of a survey report for all facilities.

21-8. General Requirements.

a. Fall Protection Threshold Height Requirements. Floating plant and vessels are excluded from these requirements, except where specifically cited in chapter 19. See chapter 25 for fall protection requirements in excavations. (21-8.a)

(1) Unless specified differently below, the fall protection threshold height requirement is 6 feet (1.8 m) for all work covered by this manual. This requirement applies to both government and contractor workers and includes steel erection activities, systems-engineered activities (for example, prefabricated), metal buildings, residential wood construction, scaffolding work, installing or removing sheet piles, cofferdams, h-piles, or other interlocking materials.

Note. Do not use sheet pile stirrups as a fall protection method.

(2) For all work performed on USACE-owned or operated permanent facilities, the threshold height requirement when working on or near open-sided floors, platforms, or unprotected edges is 4 feet (1.2 m).

(3) Workers exposed to fall hazards must be protected from falling to a lower level by the use of standard guardrails, work platforms, temporary floors, safety nets, engineered fall protection systems, personal fall protection systems, or the equivalent in the following situations:

(a) Where there is a possibility of a fall from any height onto dangerous equipment, into a hazardous environment, or onto an impalement, provide hazard fall protection, regardless of height.

(b) Whenever workers are exposed to falls from unprotected sides or edges, access ways, fixed ladders over 24 feet (7.3 m) in height, unprotected roof edge or floor openings, holes and skylights, unstable surfaces, leading edge work, scaffolds, formwork, work platforms, rebar assembly, steel erection, and engineered metal buildings.

(c) For access ways or work platforms over water, machinery, or dangerous operations.

(d) For steel erection activities, when connectors are working at the same connecting point, they must connect one end of the structural member before going out to connect the other end. The connectors must always be 100% tied off.

b. Fall Protection Control Measures. Use the following hierarchy of controls for fall protection to abate fall hazards. Select and use a fall protection method(s) to protect workers performing work at heights: (21-8.b)

(1) Elimination/Prevention. Remove the hazard from work areas or change the task, process, controls or use other means to eliminate the need to work at heights with its subsequent exposure to fall hazards. Use the most effective control method, such as build roof trusses on ground level and then lift into place or lower the location of a meter or valve at high locations to the worker's level.

(2) Passive Controls (same-level barrier). Isolate and separate fall hazards from work areas by erecting same-level barriers such as guardrails, walls, covers, or parapets.

(3) Active Controls (Personal Protective Systems and Equipment). Use of personal fall protection systems, including and in order of effectiveness: restraint, positioning, or PFAS. All systems require the use of full body harness, connecting means, and safe anchorage system.

(4) Administrative Controls. Introduce new work practices that reduce the risk of falling from heights, or to warn a person to avoid approaching a fall hazard (for example, warning systems, warning lines, audible alarms, signs, training of workers to recognize specific fall hazards).

c. Personal Fall Protection Equipment Systems and Sub Systems (Active Fall Protection Systems). All personal fall protection systems must meet the requirements contained in ANSI/ASSP Z359 standards. All newly purchased equipment will meet the latest ANSI/ASSP standards. Equipment manufactured to ANSI/ASSP Z359.1 prior to 2007 is not permitted on USACE project sites. (21-8.c)

(1) Use personal fall protection equipment and systems whenever a person is working at heights and exposed to a fall hazard.

Note. It is understood that the provision of fall protection for the first person who establishes anchorages may be difficult because this first person is the source of the initial anchorage. In this situation, fall protection may not be required. This decision will be made by the CP and documented in the AHA for the task. After anchorages are installed, fall protection is required.

(2) Base the selection of personal fall protection equipment on the type of work being performed, the work environment, worker characteristics (for example, weight, size, shape), the type and position and the location of anchorage, and the required length and type of the connecting means needed to perform the work activity.

(3) Anchorage System (Anchorage PFAS).

(a) Anchorages used for attaching the PFAS must be independent of any anchorage used to support or suspend platforms. They must be capable of supporting at least 5,000 pounds (22.2 kN) per worker attached for non-certified anchorages or be

designed by a QP for twice the maximum arrest force on the body for certified anchorages.

Note. Do not use electric conduits, utility pipes, ductwork, or unstable points as anchorages for personal fall protection systems.

(b) Anchorage Connectors. Use anchorage connectors to attach the PFAS to the anchorage. When anchorage connectors are used to attach the PFAS to the anchorage, they must be capable of withstanding without breaking a 5,000 pounds (22.2 kN) load per attached worker. Do not attach more than one connecting means (that is, worker) to an anchorage connector, unless designed and designated by a QP or the manufacturer (for example, tripod or davit style anchorage connectors.

(4) Connecting Means.

(a) Connecting means and subsystems may include energy absorbing lanyards with snap hooks or carabiners at each end, self-retracting devices (SRDs), or fall arresters (for example, rope or cable grabs).

(b) Lanyards must be ropes, straps, or webbing made from synthetic materials or steel.

(c) Energy absorbing lanyards, including rip stitch, tearing, and deforming lanyards must be capable of sustaining a minimum tensile load of 5,000 pounds (22.2 kN).

(d) Single or “Y” lanyards used in PFAS must not be longer than 6 feet (1.8 m) in length.

(e) Use a 6 feet (1.8 m) free-fall energy-absorbing lanyard only when the tie-off point is located above the dorsal D-ring, creating a free-fall distance of less than 6 feet (1.8 m). When the energy absorber is deployed during a fall, the average arrest force on the body must not exceed 900 pounds (4 kN) under ambient dry conditions, with a maximum deceleration distance of 4 feet (1.2 m) and the maximum arresting force is 1,800 pounds (8 kN). (See ANSI/ASSP Z359.13)

(f) When an anchor point is located below the dorsal D-ring, a free-fall distance greater than 6 feet (1.8 m) is created. For these situations, use a 12 feet (3.7 m) free-fall energy absorbing lanyard according to the manufacturer’s instructions and recommendations. When the energy absorber is deployed during a fall, the average arrest force on the body must not exceed 1,350 pounds (6 kN), with a maximum deceleration distance of 5 feet (1.5 m) and the maximum arresting force is 1,800 pounds (8 kN). (See ANSI/ASSP Z359.13)

Note. A 12 feet (3.7 m) free-fall energy absorbing lanyard does not refer to the lanyard length. Instead, it refers to a free-fall distance that is greater than 6 feet (1.8 m) and up

to 12 feet (3.7 m) that is created by the anchor point being located below the dorsal D-ring. The maximum length of the lanyard used must not exceed 6 feet (1.8 m).

(g) The 6 feet (1.8 m) and 12 feet (3.7 m) free-fall energy absorbing lanyards must meet the requirements of ANSI/ASSP Z359.13.

(h) Do not loop lanyards over or through an object and then attached back to themselves, unless permitted by the manufacturer.

(i) "Y" Lanyards (that is, double leg). When using a lanyard with two integrally connected legs for 100% tie-off, attach only the snaphook, located at the center of the lanyard near the energy absorber, to the fall arrest attachment element of the harness.

(i-1) The two legs of the lanyard and the joint between the legs must withstand a force of 5,000 pounds (22.2 kN).

(i-2) When one leg of the lanyard is attached to the anchorage, do not attached the unused leg of the lanyard to any part of the harness except to attachment points specifically designated by the manufacturer for this purpose (for example, lanyard parking attachment element).

(i-3) The 6 feet (1.8 m) free-fall "Y" lanyard may only be used when the tie-off point is located above the dorsal D-ring height, creating a free-fall distance of less than 6 feet (1.8 m).

(i-4) When the tie-off point is located below the dorsal D-ring, the free-fall distance is greater than 6 feet (1.8 m), so a 12 feet (3.7 m) free-fall "Y" lanyard must be used.

Note. A 12 feet (3.7 m) free-fall energy absorbing "Y" lanyard does not refer to the lanyard length. Instead, it refers to a free-fall that is greater than 6 feet (1.8 m) up to 12 feet (3.7 m) which is created by the anchor point being located below the dorsal D-ring. The maximum length of each leg of the "Y" lanyard used must not exceed 6 feet (1.8 m)

(i-5) The maximum arrest force on the body must not exceed 1,800 pounds (8 kN).

(i-6) The 6 feet (1.8 m) and 12 feet (3.7 m) free-fall energy absorbing "Y" lanyards must meet ANSI/ASSP Z359.13 requirements.

(j) Equip all single and "Y" energy absorbing lanyards with at least one deployment indicator. Design personal energy absorbing lanyards such that it is obvious if they have been activated, or include a warning, flag or label that indicates activation.

(5) Self-Retracting Devices (SRDs). All SRDs must meet and be used according to the requirements of ANSI/ASSP Z359.14. Select the type and class most appropriate for the fall hazard and work activities performed.

(6) Fall Arresters. Fall arresters (that is, rope grabs) that are designed to be used with a single anchor lifeline or climbing ladder fall arrest systems (that is, ladder climbing devices) must be approved by the manufacturer for such use. Fall arresters must have a minimum ultimate strength of 3,600 pounds (16 kN).

(a) For single anchor lifelines climbing ladder fall arrest systems, use the automatic fall arresters.

(b) The requirements for fall arresters in ANSI/SSP Z359.15 supersede the corresponding requirements prescribed in ANSI/ASSP Z359.1.

(7) Hardware (Snap hooks, Carabiners, D-rings, and Connectors)

(a) Snaphooks and carabiners must be self-closing and self-locking, and capable of being opened only by at least two consecutive deliberate actions.

(b) Snaphooks and carabiners must have a minimum gate strength of 3,600 pounds (16 kN) in all directions (see ANSI/ASSP Z359.12).

(c) Snaphooks and carabiners must have a minimum tensile strength of 5,000 pounds (22.2 kN). D-rings, O-rings, snaphooks and carabiners must be capable of withstanding a tensile load of 5,000 pounds (22.2 kN).

(d) Connectors, adjusters, and any buckles used as adjusters must be capable of withstanding a minimum tensile load of 3,372 pounds (15 kN). They must be made of drop forged, pressed, or formed steel, or made of equivalent materials. They must have a corrosion resistant finish and all surfaces and edges must be smooth to prevent damage to interfacing parts of the system.

(e) All connecting components used in PFAS must be compatible and used properly.

Note. The requirements for hardware and connectors prescribed in ANSI/ASSP Z359.12 supersede the corresponding requirements prescribed in ANSI/ASSP Z359.1.

(8) Body Harnesses.

(a) Full Body Harness. PFAS require the use of a full-body harness. Do not use body belts.

(b) Only full body harnesses meeting the requirements of ANSI/ASSP Z359.1 or Z359.11 are permitted.

(c) All full body harnesses used in PFAS must permanently incorporate a dorsal attachment element (that is, D-ring), may contain any combination of other elements, and must permanently include a load bearing sub-pelvic strap. All full body harnesses must permanently incorporate a waist belt, back strap, or other means of controlling the separation of the shoulder straps on the back of the bull body harness. The dorsal D-ring must be integrally attached and positioned at the wearer's upper back between the shoulder blades. The dorsal D-ring may also be used in travel restraint and rescue.

(d) Only use sternal attachment points when determined acceptable by the CP and where there is no chance to fall in a direction other than feet first and fall distance is no greater than 2 feet (0.6 m).

Note. The sternal attachment may also be used for ladder climbing with guided fall arrester, or ladder climbing with an overhead self-retracting lifeline, during fall arrest, work positioning, travel restraint, rescue, or rope access.

(e) The frontal D-ring is located at the waist for use as a ladder climbing connection for guided type fall arresters where there is no chance of a fall in a direction other than the feet first. The frontal D-ring is also used in suspended rope access system, work positioning, travel restraint and rescue.

(f) Equip all full body harnesses with suspension trauma preventers (for example, stirrups, relief steps) to provide short-term relief from the effects of suspension trauma.

(g) Equip all harnesses with at least one fall-arrest indicator and at least one lanyard parking attachment element having a disengagement load of not more than 120 pounds (0.5 kN). Use the lanyard parking attachment element to attach the unused leg of the "Y" lanyard to the harness.

(h) Lineman's Equipment (electrically rated harnesses). Body harnesses used around high voltage equipment or structures must be an industry designed "linemen's fall protection harness" that will resist arc flash, such body harnesses must meet the requirements of ASTM F887 and ANSI/ASSP Z359.11 and must bear a label or similar stating such. The arc flash harnesses must either have 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 (for example, buckles and adjusters) must also be plastic coated. The harness may have no metal above the waist or, if there is, must be equipped with insulated metal components.

(9) Personal Fall Arrest Systems (PFAS).

(a) PFASs are generally certified for users within the capacity range of 130 to 310 lbs. (59 to 140.6 kg) and include the weight of the worker, equipment, and tools.

(b) Do not exceed the 310 lbs. (140.6 kg) limit unless permitted in writing by the manufacturer.

(c) For workers with body weight less than 130 lbs. (59 kg), use a specially designed harness and a specially designed energy absorbing lanyard that will properly deploy if they were to fall.

(d) When stopping a fall, the PFAS must limit the maximum arresting force on the body of the employee to 1,800 pounds (8.0 kN) when used with a full body harness.

(e) Rig PFAS such that a use can neither free-fall more than 6 feet (1.8 m) nor contact any lower level or other physical hazard in the path of the fall. The free-fall distance of 6 feet (1.8 m) can be exceeded if the proper energy absorbing lanyard is used and there is adequate clearance distance.

Note. Free-fall distances should always be kept to a minimum. PFAS must be rigged so an employee cannot free-fall in excess of 6 feet (1.8 m), provided the employer can demonstrate the manufacturer designed the system to allow a free-fall of more than 6 feet (1.8 m) and tested the system to ensure a maximum arresting force of 1,800 pounds (8 kN) is not exceeded.

(10) Flexible HLL.

(a) Do not use locally manufactured flexible HLLs unless they are custom designed for limited use or site-specific applications by an RPE who is also qualified in designing HLL systems. See paragraphs 1-2 or 2-2, as applicable, for RPE definition.

(b) Commercially manufactured HLLs must be designed, installed, certified, and used under the supervision of a QP, as part of a complete PFAS. The CP may, if deemed appropriate by and under the direction of the QP, supervise the assembly, disassembly, use, and inspection of the HLL systems.

(c) The design must include drawings, required clearance, instructions on proper installation and use procedures, proof testing reports, and inspection requirements.

(d) An RPE must design all HLL anchorages who is also trained and qualified in designing HLL systems (see ANSI/ASSP Z359.6).

(e) The design of all HLLs must be approved by the USACE supervisor or accepted by KO or COR as part of the Fall Protection and Prevention Plan.

(f) Do not use steel cable or wire rope guardrails as a HLL unless it meets the requirements of an HLL.

(11) Single Anchor Lifelines. A single anchor lifeline must have a minimum tensile strength of 5,000 pounds (22.2 kN) and may only be attached to a single overhead

anchorage. Each worker must be attached to a separate lifeline system. Single anchor lifelines can be used in horizontal, vertical, and sloped applications.

Note. The requirements for single anchor lifelines prescribed in ANSI/ASSP Z359.15 supersede the corresponding requirements prescribed in ANSI/ASSP Z359.1.

(12) Climbing Ladder Fall Arrest Systems (CLFAS). CLFAS include the carrier, carrier mounting brackets, and the carrier sleeve. The carrier is a track that is at least 20 feet (6.1 m) in length and consists of a rigid or flexible member that is securely attached to the climbing fixed ladder or to the adjacent structure. The carrier sleeve (cable grab) is connected to the harness and travels along the carrier during climbing.

(a) Anchorage strength must be a minimum of 3,000 pounds (13.3 kN) or 2,700 pounds (12 kN) according to ANSI Z359.16. The applied load transferred to the system because of a fall must be at least 2,700 pounds (12 kN).

(b) The carrier sleeve located between the front D-ring of the harness and the carrier must be 9 inches (23 cm) long.

Note. Effective two years from date of this publication, all carrier sleeves used must be equipped with panic grab.

(c) The free-fall distance when using a CLFAS must not exceed 2 feet (0.6 m).

(d) Ensure that there is 100% transition at the top of the CLFAS for safe access to above work surface or roof.

(e) Do not install CLFAS on ladders that have three-quarter (¾) inch (1.9 cm) rungs (for example, commercial off-the-shelf ladders) unless the ladders are designed to withstand the fall forces.

(13) Restraint System.

(a) Consider using restraint system over fall arrest. Restraint is an active fall protection system that prevents the user from reaching an area where a free-fall could occur.

(b) Anchorages used for restraint systems must be capable of supporting at least 3,000 pounds (13.3 kN) per worker attached for non-certified anchorages or be designed by a QP for twice the maximum foreseeable force for certified anchorages.

(c) Use restraint systems only on flat or low-sloped surfaces (</= 18.4^{o} or 4:12 slope).

(d) Select and rig the connecting means to allow travel of the user only so far that they are not exposed to the fall hazard.

Note. When lanyards are used as the connecting means, the lanyard may be longer than 6 feet (1.8 m) and the length can either be adjustable or fixed.

(14) Positioning System. A positioning system uses some of the same equipment as an active fall protection system (for example, arrest, restraint). However, a positioning system used alone does not constitute fall protection and an additional fall protection system must be used in conjunction (for example, PFAS). The following are system requirements for positioning systems:

(a) They must be rigged such that a worker cannot free-fall more than 2 feet (0.6 m).

(b) Anchorages used for attached positioning systems must be capable of supporting at least 3,000 pounds (13.3 kN) per worker attached for non-certified anchorage or twice the potential impact load of a worker's fall for certified anchorage or, whichever is greater.

(c) Ensure that workers achieve 100% tie-off during use.

(d) Use attachment points for positioning on the full body according to the manufacturer’s instructions (for example, sides or front of the harness).

(e) Positioning lanyard can be adjustable or fixed.

d. Guardrail Systems (Passive Fall Protection System). To be considered an effective fall protection system, guardrail systems must be installed to meet the requirements of paragraph 21-8.d. If deficiencies in the system are identified, the system must be corrected before personnel are exposed to the fall hazard(s), or another fall protection system must be implemented to provide the necessary protection from exposure to the fall hazard(s). A standard guardrail system must meet the following (see chapter 19 for marine and floating plant guardrails): (21-8.d)

(1) Toprails, midrails, and posts, and must have a vertical height of 42 +/- 3 inches (106.7 cm +/- 7.6 cm) from the upper surface of the toprail to the floor, platform, runway, or ramp level.

(2) Erect midrails halfway between the toprails and the floor, platform, runway, or ramp.

(3) The ends of the toprails and midrails must not overhang the terminal posts except where such overhang does not create a projection hazard.

(4) Provide toe-boards on all open sides and ends at locations where persons are required or permitted to pass or work under the elevated platform, or where needed to prevent persons and material from falling from the elevated platform.

(a) Toe-boards must be, at minimum, 3.5 inches (9 cm) in vertical height. Construct them from 1 inch x 4 inches (2.5 cm x 10.2 cm) lumber or the equivalent.

(b) Securely fasten toe-boards in place so there is no more than one-quarter (¼) inch (0.6 cm) clearance above floor level.

(c) Construct toe-boards of any substantial material, either solid or with openings between adjacent pieces not greater than 1 inch (2.5 cm).

(d) Where material is piled to such a height that a standard toe-board does not provide protection, provide paneling or screening from floor to toprail or midrail.

(e) Toe-boards must support a force of at least 50 pounds (0.22 kN) applied in any outward or downward direction at any point along the toe-board.

(5) Posts. Space posts no more than 8 feet (2.4 m) apart. Install supporting posts at whatever distance is necessary to meet the top rail strength requirement of 200 pounds (0.89 kN) without failure. (See 29 CFR 1910, Subpart D)

(6) Guardrail systems must be smooth surfaced to prevent injury to a worker from punctures or lacerations and to prevent snagging of clothing.

(7) Do not use synthetic or natural fiber ropes as toprails or midrails.

(8) Commercial, off-the-shelf (COTS), engineered guardrail systems may be used instead of constructing a system. If a COTS system is installed, design and manufacture the portable guardrail system (for example, webbing, straps) to meet the same requirements in paragraph 21-8.d. The employer is still responsible for ensuring the system used is approved, completed, installed, and used as designed.

(9) Strength Requirements. Design toprails and midrails to meet the following strength requirements:

(a) Toprail must be capable of withstanding, without failure, a force of at least 200 pounds (0.9 kN) applied within 2 inches (5.1 cm) of the top edge, in any outward or downward direction, at any point along the top edge.

(b) When the previously stated force (that is, 200 pounds within 2 inches (0.9 kN within 5.1 cm)) is applied to the toprail in a downward direction, the top edge of the top rail must not deflect more than 3 inches (7.6 cm) nor to a height less than 39 inches (99 cm) above the walking or working level.

(c) Midrails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members must withstand, without failure, a force of at least 150 pounds (0.67 kN) applied in any downward or outward direction at any point along the midrail or other member.

(d) Provide guardrails receiving heavy stresses from workers trucking or handling materials with additional strength by using heavier stock, closer spacing of posts, bracing, or by other means.

(10) Minimum Construction Materials for Standard Guardrail Components. The following guidelines may be used as a starting point for designing a guardrail system, however, the employer is still responsible for designing and assembling these components in such a way that the completed system meets the requirements of this paragraph 21-8.d.

(a) Wood railings. Wood railing components must be minimum 1,500 lb-ft/in^2 (10,342 kPa) fiber (that is, stress grade) construction grade lumber.

(a-1) Toprails. Constructed using at least 2 inches x 4 inches (5.1 cm x 10.2 cm) lumber.

(a-2) Midrails. Constructed using at least 1 inch x 6 inches (2.5 cm x 15.2 cm) lumber.

(a-3) Posts. Constructed using at least 2 inches x 4 inches (5.1 cm x 10.2 cm).

(b) Structural steel railings.

(b-1) Toprails and midrails. At least 2 inches x 2 inches x 3/8 inch (5.1 cm x 5.1 cm x 0.9 cm) angles.

(b-2) Posts. At least 2 inches x 2 inches x 3/8 inch (5.1 cm x 5.1 cm x 0.9 cm) angles spaced not more than 8 feet (2.4 m) on centers.

(c) Steel Cable (Wire Rope) railings.

(c-1) Toprails and midrails must be at minimum, one-quarter (¼) inch (0.6 cm) steel cable and flagged every 6 feet (1.8 m) with high visibility material. Tension the cables so there is not more than 3 inches (7.6 cm) deflection, in any direction from the center line, under a 200 pounds (0.89 kN) load.

(c-2) Locate support posts to ensure proper tension is maintained.

(c-3) Perimeter safety cables must meet the criteria and requirements for guardrail systems. If the perimeter safety cables are used by the workers as a method

of attaching a lanyard to the cables, then they must meet the requirements of HLL System. (See para 21-8.c)

(11) Hoist Areas. When guardrails are used at hoisting areas, erect a minimum 6 feet (1.8 m) of guardrail on each side of the access point through which materials are hoisted.

(a) A gate or removable guardrail section may be used as long as it meets the standard guardrail height 42 +/- 3 inches (106.7 +/- 7.6 cm) and is secured across the opening between the guardrail sections when hoisting operations are not taking place.

(b) During hoisting operations, if a segment or side of the railing system is required to be left open for easy access at an unprotected side, edge, or hatch, use self-closing swing gates, chain, removable guardrail section or PFAS and restraint system to protect personnel from falling.

e. Existing Parapet Walls (Passive Fall Protection Systems). To be considered an effective fall protection method, parapet walls must be 42 +/- 3 inches (106.7 +/– 7.6 cm) in height. If the height of an existing parapet does not meet the appropriate height requirements, consider installing a guardrail system to provide the necessary protection, or use another method of fall protection. (21-8.e)

f. Covers (Passive Fall Protection Systems). Install covers on all holes. (21-8.f)

(1) Covers must support at least twice the weight of the worker, equipment, and material combined.

Note. Consider all equipment and material (for example, aerial lifts, rolling scaffolds) in the workplace when designing covers.

(2) Secure covers in place and clearly marked with the word “HOLE,” “COVER,” or “Danger, Roof Opening-Do Not Remove,” color-code them, or use an equivalent method (for example, red or orange “X”). Inform all workers of the meaning of the color coding and equivalent methods.

g. Safety Net Systems (Passive Fall Protection Systems). Design, install, use, and maintain safety net systems for fall protection according to ANSI/ASSP A10.11 and 29 CFR 1926.502 (29 CFR 1926 Subpart M). (21-8.g)

Note. See chapter 14 for debris nets.

(1) Install safety nets as close under the work surfaces as practical, but in no case more than 30 feet (9.1 m) below the work surface. Hang nets with sufficient clearance to prevent contact with the surfaces or structures below. Determine the clearance by impact load testing.

(2) When nets are used on bridges, multi-story buildings or structures, ensure that the potential fall area from the walking or working surface to the net is unobstructed.

(3) The maximum size of the mesh openings must not exceed 36 in^2 (232.3 cm^2), nor be longer than 6 inches (15.2 cm) on any side.

(4) The border rope or webbing must have a minimum breaking strength of 5,000 pounds (22.2 kN).

(5) Do not perform work requiring safety net protection until the nets are in place and have either been tested without failure according to the following procedures, or a QP states otherwise.

(a) Test safety nets and safety net installations while in the suspended position immediately after installation. Perform the tests under the supervision of QP and in the presence of the USACE supervisor/KO or COR. Test whenever nets are relocated, after any major repair, and at least every six months if left in place for extended periods.

(b) Perform a drop test. Use a 400 lb. (181.4 kg) bag of sand that is not more than 30 inches +/- 2 inches (76.2 cm +/- 5.1 cm) in diameter. Drop the bag from at least 42 inches (106.7 cm) above the highest working or walking surface at which workers are exposed to fall hazards. Ensure the weight can be safely retrieved after the test is conducted.

(c) The drop test is not necessary if a QP certifies in writing that it is unreasonable to perform the drop test. The certification must state that the net and its installation, to include anchorages, are in compliance with manufacture's recommendations, this manual, applicable federal, state, and local requirements. The QP must sign the certification and include an identification of the net and net installation, and the certification date. Maintain a copy of the certification at the jobsite.

(6) Use only shackles and hooks made of forged steel.

(7) When debris nets are used with safety nets, secure them on top of the safety net. Ensure that they do not compromise the design, construction, or performance of the safety nets.

(8) Remove any materials, scrap pieces, equipment, and tools that have fallen into the safety net as soon as possible and at least before the next work shift. Protect safety nets from sparks and hot slag resulting from welding and cutting operations.

(9) If any welding or cutting operations occur above the nets, provide noncombustible barriers. Increase the frequency of inspections in proportion to the potential for damage to the nets. (See para 21-5.b)

h. Other Engineered Fall Protection Systems. Commercially available engineered and integrated systems are recognized as effective fall protection and may be used provided the requirements of paragraph 21-8.h are met. (21-8.h)

(1) A QP must design, install, certify, and supervise the use of all commercially available engineered and integrated systems. They must be used according to the manufacturer's instructions and recommendations. The CP may, if deemed appropriate by and under the direction of a QP, supervise the assembly, disassembly, use, and inspection of the engineered system.

(2) The design must include drawings, required clearances, and instructions on proper installation, use, and inspection requirements. The USACE supervisor must approve or the KO or COR must accept these systems as part of the Fall Protection and Prevention Plan.

i. Warning Line System (WLS) (Administrative Control). (21-8.i)

(1) Construction Roofing Activities on Low-Sloped Roofs. Employees engaged in construction roofing activities on low-sloped roofs (that is, <18.4°, 4:12 slope) with unprotected sides and edges 6 feet (1.8 m) or more above lower levels can utilize a WLS. At minimum, the WLS must be used in combination with a safety monitor system (see 29 CFR 1926.501(b)(10) and 1926.502(h) (29 CFR 1926 Subpart M)). WLS must comply with the following:

(a) The warning line must be erected around all sides of the roof work area.

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

(c) When mechanical equipment (as defined by 29 CFR 1926.500(b) (29 CFR 1926 Subpart M)) is being used, the warning line must be erected not less than 6 feet (1.8 m) from the roof edge which is parallel to the direction of mechanical equipment operation, and not less than 10 feet (3 m) from the roof edge which is perpendicular to the direction of mechanical equipment operation.

(d) Points of access, materials handling areas, storage areas, and hoisting areas must be connected to the work area by an access path formed by two warning lines.

(e) When the path to a point of access is not in use, a rope, wire, chain, or other barricade, equivalent in strength and height to the warning line, must be placed across the path at the point where the path intersects the warning line erected around the work area, or the path must be offset such that a person cannot walk directly into the work area.

(f) Warning lines must consist of ropes, wires, or chains, and supporting stanchions erected as follows:

(f-1) The rope, wire, or chain must be flagged at not more than 6 feet (1.8 m) intervals with high-visibility material.

(f-2) The rope, wire, or chain must be rigged and supported in such a way that its lowest point (including sag) is no less than 34 inches (86.4 m) from the walking/working surface and its highest point is no more than 39 inches (99.1 cm) from the walking/working surface.

(f-3) After being erected, with the rope, wire, or chain attached, stanchions must be capable of resisting, without tipping over, a force of at least 16 pounds (0.07 kN) applied horizontally against the stanchion, 30 inches (76.2 cm) above the walking/working surface, perpendicular to the warning line, and in the direction of the floor, roof, or platform edge.

(f-4) The rope, wire, or chain must have a minimum tensile strength of 500 pounds (2.22 kN), and after being attached to the stanchions, must be capable of supporting, without breaking, the loads applied to the stanchions as prescribed above.

(f-5) The line must be attached at each stanchion in such a way that pulling on one section of the line between stanchions will not result in slack being taken up in adjacent sections before the stanchion tips over.

(g) An additional fall protection system is required when working outside the WLS.

(h) Mechanical equipment on roofs must be used or stored only in areas where employees are protected by a WLS, guardrail system, or PFAS.

(2) Construction Activities on Low-Sloped Roofs Regardless of Trade. Applies to Contractors only. USACE employees are not permitted to use WLS in this manner.

(a) Contractor employees engaged in construction, non-roofing activities on low-sloped roofs (that is, <18.4°, 4:12 slope) with unprotected sides or edges 6 feet (1.8 m) or more above lower levels can utilize a WLS. The WLS must comply with the following:

(a-1) The warning line is erected at least 15 feet from the edge or nearest edge of a hole.

(a-2) The warning line meets or exceeds the requirements of paragraph 21-8.i and 29 CFR 1926.502(f)(2) (29 CFR 1926 Subpart M).

(a-3) No work or work-related activity is performed in the area between the warning line and the hole or edge.

(a-4) The employer effectively implements a work rule prohibiting employees from going past the warning line.

Note. Paragraph 21-8.i(2) is not in compliance with current OSHA standards, however, OSHA has issued response that a warning line erected at least 15 feet from an edge or hole combined with effective work rules can be expected to prevent employees from going past the line and approaching the fall hazard. In addition, at a distance of 15 feet, the absence of a barrier to restrain employees from unintentionally crossing the line would not place the employee in immediate risk of the fall hazard. Therefore, OSHA will apply a de minimis policy for non-conforming guardrails for WLS used in this manner.

(b) Contractors must determine if paragraph 21-8.i(2)(a) is acceptable to complete their work activities. Procedures and work practices must be documented in their Fall Protection and Prevention Plan (see para 21-7).

j. Designated Areas (Administrative Control). A designated area is a distinct portion of a walking-working surface delineated by rope, wire, tape, or chain in which employees may perform work without additional fall protection during general industry type work (for example, inspecting or maintaining HVAC equipment). Working within a designated area does not require additional fall protection, however, if working outside the designated area, another form of fall protection must be provided when personnel are exposed to fall hazards (see figure 21-2). When the employer uses a designated area, the employer must ensure the following: (21-8.j)

(1) Employees remain within the designated area while work operations are underway.

(2) The perimeter of the designated area is delineated with rope, wire, tape, or chain that has a minimum breaking strength of 200 pounds (0.89 kN) and is installed so its lowest point, including sag, is not less than 34 inches (86.4 cm) and not more than 39 inches (99.1 cm) above the walking-working surface.

(3) Is supported in such a manner that pulling on one section of the line will not result in slack being taken up in adjacent sections causing the line to fall below the limits specified above.

(4) Is clearly visible from a distance of 25 feet (7.6 m) away, and anywhere within the designated area.

(5) Is erected as close to the work area as the task permits.

(6) Is erected not less than 6 feet (1.8 m) from the roof edge for work that is both temporary and infrequent, or not less than 15 feet (4.6 m) for other work.

(7) When mobile mechanical equipment is used to perform work that is both temporary and infrequent in a designated area, the employer must ensure the rope,

wire, tape, or chain is erected not less than 6 feet (1.8 m) from the unprotected side or edge that is parallel to the direction in which the mechanical equipment is operated, and not less than 10 feet (3 m) from the unprotected side or edge that is perpendicular to the direction in which the mechanical equipment is operated. See 29 CFR 1910.29(d) (29 CFR 1910 Subpart D).

k. Safety Monitoring System (SMS) (Administrative Control). An SMS can only be used in combination with a passive, active, or additional administrative control (for example, warning line system (see para 21-8.i)). The use of an SMS as fall protection method, when used independently, is prohibited. See chapter 37 and figure 39-1 for exemption. (21-8.k)

l. Controlled Access Zones. USACE does not recognize Controlled Access Zones as acceptable for controlling exposure to fall hazards, and therefore, cannot be used independently as a fall protection method. (21-8.l)

m. Scaffolds. (21-8.m)

(1) Supported Scaffolds.

(a) When possible, equip scaffolds with a standard guardrail system according to paragraph 21-8.d. If a guardrail system is not possible, use another fall protection system or method (for example, personal fall protection).

(b) For workers erecting and dismantling scaffolds, a CP must conduct an evaluation to determine the feasibility and safety of providing fall protection. If fall protection is not feasible, submit an AHA detailing rationale for infeasibility of use of fall protection for approval by the USACE supervisor or acceptance by the KO or COR. (See para 21-6.a)

(2) Suspended scaffolds.

(a) For single point or two point suspended scaffold, in addition to railings, workers must also tie off to an independent vertical lifeline using a full body harness.

(b) For other suspended scaffolds (for example, catenary, float, needle-beam, boatswain chairs), workers must use a PFAS tied off to an independent vertical lifeline using a full body harness.

(c) Perform a risk assessment when persons are supported on a multi-point adjustable suspended scaffold to evaluate the effectiveness and feasibility of the use of PFASs. Document the risk in the AHA for the activity being performed.

n. Self-Propelled Elevating Work Platforms (Scissor Lifts). The term “scissor lifts” is used to mean all type of self-propelled elevating work platforms having a platform that cannot be positioned completely beyond the base (see ANSI/SAIA A92.6). (21-8.n)

(1) All scissor lifts must be equipped with standard guardrails.

(2) All scissor lifts must be equipped with anchorages according to ANSI/ASSP Z359.1.

Note. Do not use scissor lifts unless they are equipped with anchorages.

(3) Use restraint systems on all scissor lifts. The lanyards, to include adjustable energy absorbing lanyards, used in the restraint system, must be sufficiently short to provide fall restraint and prohibit workers from climbing out of or being ejected from the platform.

(4) Do not use an SRD unless permitted by both the scissors lift and SRD manufacturers and used according to the manufacturers' instructions.

(5) Do not climb on or over the guardrails.

o. Aerial Work Platforms (AWPs) (non-Scissor Lifts). These are boom supported elevating work platforms (see ANSI/SAIA A92.5) and vehicle mounted rotating and elevating aerial devices (see ANSI A92.2). (21-8.o)

(1) Use restraint systems or PFAS on all AWPs. Workers must anchor themselves to the basket or bucket according to the manufacturer's specifications and instructions. Do not anchor to the boom unless allowed by the manufacturer and approved by the CP.

(2) Lanyards, to include adjustable energy absorbing lanyards, used in the restraint system must be sufficiently short to provide fall restraint and prohibit workers from climbing out of or being ejected from the platform.

(3) Lanyards with built-in shock absorbers are acceptable.

(4) Do not use an SRD unless permitted by both the aerial work platform and SRD manufacturers and used according to the manufacturers' instructions.

(5) Do not tie off to an adjacent pole or structure unless a safe device for 100% tie-off is used for the transfer.

p. Manually Propelled Elevating Work Platforms (see ANSI/SAIA A92.3). (21-8.p)

(1) All manually propelled elevating work platforms must be equipped with standard guardrails.

(2) If the platform is equipped with anchorages meeting the ANSI Z359, use a restraint system in addition to the guardrails.

(3) The lanyards, to include adjustable energy absorbing lanyards, used in the restraint system, must be sufficiently short to provide fall restraint and prohibit workers from climbing out of or being ejected from the platform.

(4) Adjustable energy absorbing lanyards with built-in shock absorbers are acceptable.

(5) Do not use an SRD unless permitted by both the work platform and SRD manufacturers and used according to the manufacturers' instructions.

(6) Do not occupy a platform when being moved.

(7) Do not climb on or over the guardrails.

q. Fall Protection Requirements when Conducting Inspection, Investigation, or Assessment Work. (21-8.q)

(1) During construction or general industry work activities, fall protection is required for employees exposed to fall hazards while conducting inspection, investigation, or assessment work.

(2) Ensure that the conventional fall protection system (that is, guardrail, safety net or personal fall protection system) is in place when conducting inspections, investigations, or assessments within 6 feet (1.8 m) from an unprotected edge of a roof or other walking or working surface (that is, within the control zone). A warning line system or designated area is not permitted. The CP must develop an AHA for this activity and submit it to the USACE supervisor for approval or to the KO or COR for acceptance.

Note. For general industry work only, when fall protection systems or equipment have been installed and are available for workers to use for pre-work and post-work inspections, investigations or assessments, the above exemption does not apply.

(3) Prior to start of construction or after construction work is complete, fall protection may not be required when conducting inspection, investigation, or assessment work more than 6 feet (1.8 m) away from an unprotected edge of a roof (that is, within the safe zone). The CP must develop an AHA for this activity and submit it to the USACE supervisor for approval or to the KO or COR for acceptance.

(4) During maintenance evolutions (for example, inspecting or maintaining HVAC or other equipment on roofs), fall protection is required when conducting inspection and investigation work.

r. Fall Protection Requirements for Work Performed on Low Sloped Roofs (Only applicable to general industry work). For construction work, see paragraph 21-8.i (WLS). (21-8.r)

(1) When work is performed less than 6 feet (1.8 m) away from the unprotected roof edge, ensure each employee is protected from falling to lower level using a conventional fall protection system (that is, guardrail system, safety net system, personal fall protection system). WLS or designated areas are not permitted.

(2) When work is performed at least 6 feet (1.8 m) but less than 15 feet (4.5 m) away from the unprotected roof edge, ensure each employee is protected from falling by using a conventional fall protection system (that is, guardrail system, safety net system, or personal fall protection system). The use of designated area is acceptable when performing work that is both infrequent and temporary (see para 21-8.j). For lengthy or routine jobs involving exposure to fall hazards, use conventional fall protection systems.

(3) When work is performed 15 feet (4.6 m) or more from the unprotected roof edge:

(a) A fall protection system is not required, provided the work performed is both infrequent and temporary. For lengthy or routine work, use conventional fall protection systems (that is, guardrail system, safety net system, or personal fall protection system) or designated area.

(b) Implement and enforce a work rule prohibiting employees from going within 15 feet (4.6 m) of the unprotected roof edge without using fall protection system.

s. Steep Roofs. When inspection and investigation work is performed on steep roofs (more than 4:12 slope), use conventional fall protection system (that is, guardrail system, safety net system, or personal fall protection system). (21-8.s)

t. Working at Height Over or Near Water. The employer must ensure a QP or CP identifies and determines: (21-8.t)

(1) Task specific SOH requirements for working at height over or near water activities and document it in the Fall Protection Plan and/or AHA prior to work. Abide by all applicable OSHA standards.

(2) Where there are additional hazards (for example, currents, intakes, dangerous machinery, or equipment) present, a fall protection system will be required regardless of the fall distance and PFDs may not be required.

(3) The drowning hazard is removed if continuous fall protection is used (for example, guardrails, personal fall protection) to prevent workers from falling into the water. PFDs may not be required.

(4) The need for fall protection and or PFDs in situations where employees are occupying a boom-attached or suspended personnel platforms over water for construction or marine activities. For example, if an error occurred that resulted in the employees being in the water, would being tied-off increase the drowning hazard?

Personal fall protection equipment may not be needed if PFDs provide better protection. See 29 CFR 1926.106, 29 CFR 1926.453(b)(2)(v), 29 CFR 1926.1431(k)(10)(i), and OSHA's letters of interpretation on these references.

(5) The use of safety nets as fall protection during marine construction activities usually will not eliminate the drowning hazard, so PFDs are usually required. In many cases (such as in bridge construction) there is a risk that materials heavy enough to damage the nets may fall. If required, use safety nets and adequate fall protection.

Note. PFDs must not interfere with proper use of personal fall protection equipment. Follow all manufacturer requirements and chapter 5 of this manual.

21-9. Figures and Tables.

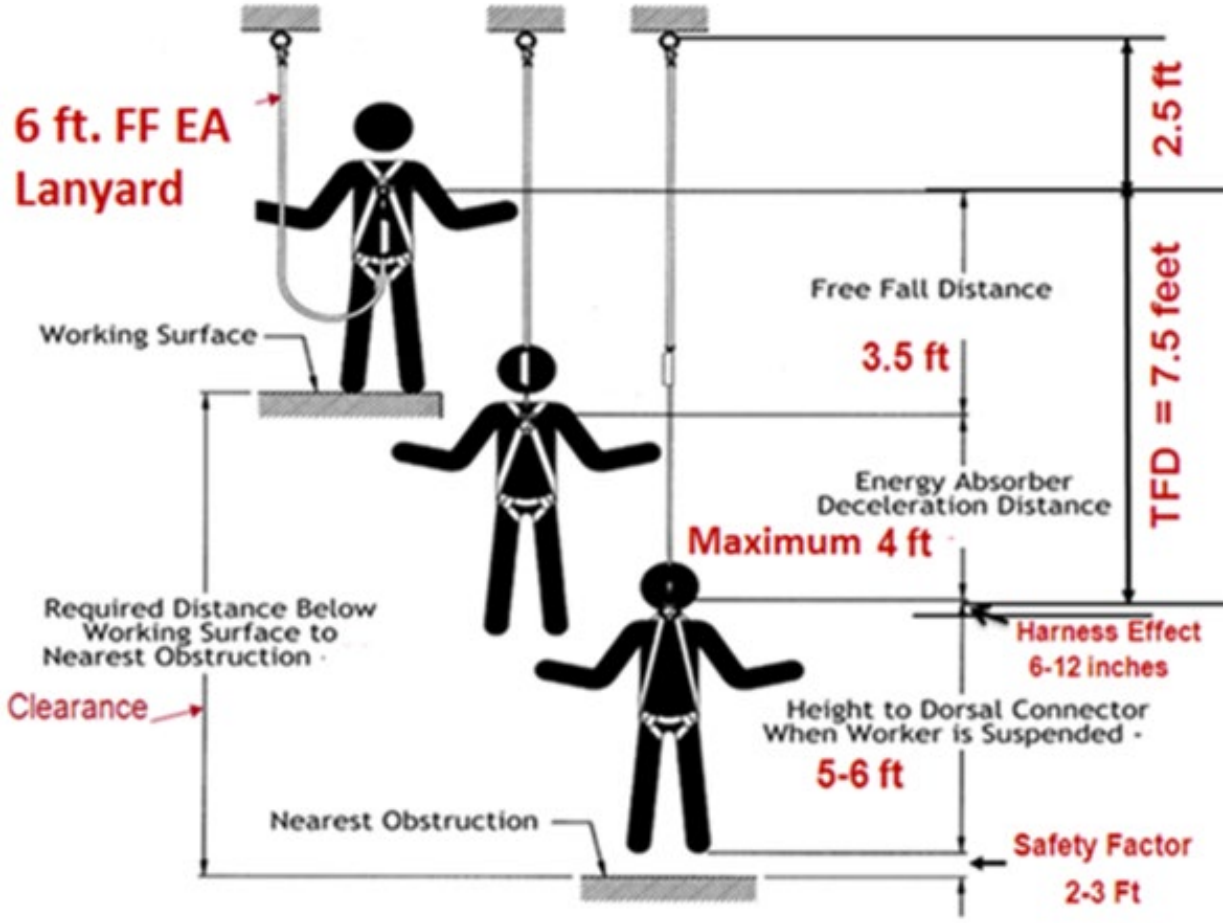


Figure 21-1. Calculating Distance