NOTES FOR TRAINERS (TRAINER'S MANUAL)

Fall Protection

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TRAINING TOOLS AND STRATEGIES

This Trainer's Manual is a companion document to the case study (trainee manual) designed to help trainers prepare for and lead a productive discussion about the case study and associated questions by providing some additional information. The document also provides online resources and content to extend group discussions about the case study topic.

Prior to conducting the in-class discussions, the trainer should read through both the case study document (trainee manual) and the Trainer's Manual to fully understand the content and prepare for the discussion.

TRAINING DELIVERY

The trainees should be given the trainee manual at the start of the training. Divide the trainees into small groups of approximately four students per group based on their prior construction experience level. For example, ideally, each group will consist of trainees with diverse training experience.

There are four real-world case scenario-based activities in the trainee manual and several discussion questions as part of the overview section. These activities and questions will help trainees master the knowledge needed for providing fall protection on construction sites.

Each case scenario comes with its description, pictures, activity instructions, and supplemental materials where appropriate. For each case scenario, the trainer should initially provide an overview of the topic. Then, allow students time to review the case information provided and engage in a brief discussion as a team to answer the questions and complete the assigned tasks. After each group performs its discussions and/or tasks, each group can share their feedback with the overall group of trainees at large. Briefly discuss the case and facilitate an overall group discussion with the help of answers and additional information contained in this manual.

The manual also contains sample prompt discussion questions for each section to engage the trainees and trigger participation. Depending on the trainer's approach, discussion questions will likely take from 1 to 3 minutes to answer/discuss. Since there is a good chance the trainees will have prior construction experience related to the topic, their engagement will result in an excellent learning environment.

LEARNING OBJECTIVES

The primary learning objective of the fall protection case study is to prepare trainees to anticipate, recognize, evaluate, and develop control strategies for hazardous conditions and work practices in the construction industry related to fall protection. At the completion of the training, trainees should be able to:

- Explain why use of fall protection systems is important
- Analyze different types of fall protection systems for implementation on a project

- Develop and implement guidance for fall hazard controls on projects
- Determine the most appropriate type of fall protection system to use for a particular work operation or site condition
- Revise the specified fall protection if the working conditions change

INTRODUCTION SECTION

Trainers should begin the technical portion of the training by introducing the types of fall hazards commonly present on construction jobsites, the importance of using fall protection systems, and the different types of fall protection systems available and commonly used. Trainers should go over the various definitions by asking the group to define the terms. The questions answered below address some of the critical concepts associated with fall protection, and are included in the case study document for the trainees to review, discuss, and respond to. Trainees may generate additional items and questions during their team discussions.

Note: This case study focuses on falls from elevation. It does not cover falls to the same level due to a worker slipping or tripping.

1. What types of fall hazards are commonly present on construction projects?

Falling to a lower level may occur whenever there is a significant difference in elevation. For example, a fall hazard is present when there is an unprotected roof or floor edge and unprotected roof or floor hole. The leading edge where the work to build a roof, floor, formwork, or scaffolding is progressing is a type of fall hazard. A building element, such as structural steel, rebar cage, retaining wall, and large piece of machinery, may also pose as a fall hazard if it is elevated and workers stand on or access the element as part of their work. Similarly, the edge of a trailer or truck presents a fall hazard as workers load or unload materials and equipment. Temporary structures designed to allow access to work at heights, such as scaffolding, ladders, and scissor lifts, pose as potential fall hazards. The unguarded edge of an excavation or manhole is also a type of fall hazard. Many other examples exist on construction sites. All of these conditions, if not protected, can lead to injuries and fatalities due to falls.

2. How prevalent are falls compared to other types of injury incidents?

According to OSHA, falls are the leading cause of death in construction (https://www.osha.gov/stop-falls). The Bureau of Labor Statistics (BLS) reports that in 2018, 320 of the 1,008 deaths (32%) that occurred in the construction industry were due to falls to a lower level. The high rate of falls is not unique to 2018. BLS statistics show that falls to a lower level is the leading cause of worker injuries and fatalities in construction year after year. As a result, falls is one of OSHA's Focus Four hazards along with caught-in or –between, struck-by, and electrocution.

3. How can falls be prevented?

The best way to prevent falls is to eliminate the hazard. Eliminating the need to work at elevation or eliminating the elevated condition itself are preferable. However, site conditions and work requirements may not make these solutions possible. Reducing the height may be another potential solution. When the hazard cannot be eliminated or reduced to an acceptable level, fall protection is required. Examples of fall protection include: guardrail systems, safety net systems, personal fall arrest systems, and parapets. Fall protection training and education can also help to prevent fall incidents. In some cases, choosing a different work method or tools can prevent falls. For example, use of a ladder, which has been recognized as a significant factor in falls, could be discouraged in favor of another means of access such as a scissors lift.

4. When is fall protection for workers required?

OSHA requires that fall protection be provided at elevations of six feet or higher in the construction industry. In addition, OSHA requires that fall protection be provided when working over dangerous equipment and machinery, regardless of the fall distance. In states like Washington, the height at which fall protection is required is more stringent. For example, the State of Washington specifies that fall protection is required when the walking/working surface is four feet or more above the lower level. Chapter 880 of Section 296 of the Washington Administrative Code (WAC) provides the specific conditions when fall protection is required.

Fall Hazards and Protection Systems - Case Scenario #1

Case Objective: Identify the fall hazards, and proper and improper ways of using fall prevention methods**.**

Discussion: An understanding of what constitutes a fall hazard and being able to recognize fall hazards on projects is essential to preventing injuries/fatalities due to falls. Next, trainees should have a level of knowledge sufficient to select appropriate ways of mitigating the fall hazards. Trainers can benefit the learning process by engaging trainees in discussions of case studies that involve fall hazards. Trainees will benefit when trainers provide guidance on the positives and negatives of different types of fall protection for given situations. Give the trainees 2 – 3 minutes to review each case, and then lead a quick discussion about the case.

Activity # 1: Typical trenching operation.

Case Study: The case study activity is from a storm sewer project to upgrade existing storm sewer lines. The activity shown in the picture involves the installation of storm sewer pipes. You will see an open trench, double stacked trench boxes, ladder with three rungs above the trench boxes, crew members, and traffic delineation in the photo. The public and traffic are kept out of the work area by traffic control devices. Employees in the work area are actively involved in the operation and exempt from fall protection.

Response: The open trench creates a fall hazard. Protection from falling into the trench is provided at the location of the trench boxes, however no protection is provided along the trench outside of the trench boxes. The trench is deep enough that fall protection may be required. WAC 296-880-30005(1)(d) addresses the requirement for fall protection at excavations and includes a specific exemption from the use of fall protection when employees are directly involved in the excavation process. Also, OSHA 1926.501 indicates that fall protection is only required at excavations if the excavation cannot be readily seen. There is a chance that workers could fall into the trench when standing along the trench outside the trench boxes.

Activity # 2: Typical trenching operation.

Case Study # 2: The case study activity is from a freshwater reservoir intake project to mitigate fish getting caught in the intake. The activity shown in the picture involves constructing the freshwater intake and fish ladder to divert fish back into the river.

Response: Access into the trench is needed to conduct the work. Similar to the previous activity, the unprotected edge along the trench creates a fall hazard. Protection must be provided to prevent workers from falling into the trench. Another potential fall hazard exists on top of the intake pipe. Work tools and materials are present on the top of the intake pipe, indicating that it is a working surface. However, no fall protection is provided to prevent workers from falling off of the intake pipe while working. Additionally, no tie-off points for fall protection are present. The workers installed a pedestrian bridge in this operation, and stairs were provided with an access gate for the employees. The access gate offers protection when the stairs are not in use. The pedestrian bridge and stairs remove the need for ladders and allow for tools and supplies to be lowered by rope and bucket.

Fall Protection Measures and Controls

The core message here should be that there are multiple controls to protect workers from falls.

1. Seek volunteers to share examples of various hazardous jobs/tasks from their current or previous places of employment as they pertain to falls. The intent of the activity is for the trainees to hear about multiple unique fall exposures and controls from co-trainees.

2. Select a particular job or task that the trainees shared, and make a list of hazards and controls.

3. Ask the trainees to list some ways to control a fall associated with a job or task in a specific site condition.

Fall Protection Methods – Case Scenario # 2

Discuss the various fall prevention methods commonly used in the construction industry and move to case scenario #2.

Case Scenario #2

Activity Goal: This activity is designed to improve your ability to analyze the jobsite scenario and suggest the proper type and method of fall protection. Two project scenarios are provided that include work at elevation and the potential for falling. Different types of fall protection can be used to protect the workers. Discuss the opportunities for fall protection, and the pros and cons of the different types and methods. Recommend a type of fall protection to use.

Activity # 1: Installing False Deck and Perimeter Walkways on a Bridge under Construction

Case Study # 1: The case involves constructing an elevated structure (bridge) as part of a major interstate highway on the west coast. The bridge is elevated above the ground, and adjacent to a lake. There are multiple girders (structural members) set in place with a false deck located approximately 6 feet below the top flange of the structural members. The false deck will be used for supporting concrete formwork for the bridge slab. When performing the construction operations at elevation, fall protection and protection from falling objects are critical issues, especially when erecting the formwork.

Response: Multiple fall hazards exist at this point in the construction of the bridge. Workers standing on the top flange of a bridge girder are at risk of falling. In this case, the working surface is greater than 4 feet above the next lower level (false deck) and, as a result, fall protection is required in the State of Washington. Additionally, the edge/outside girders expose workers to a fall greater than 10 feet. The bridge spans over the ground and possibly over water based on the level of the lake below.

Fall protection is required at a 10 feet trigger height when working from structural members such as bridge girders. To mitigate the fall hazard during the installation of the false deck between each structural member, a horizontal static line system can be installed along the length of each girder for the workers to tie-off to. Along the edge girder, a perimeter walkway can be installed using a combination of horizontal static line for tying off and aerial lifts to provide access. Horizontal static lines may be removed after the false deck and perimeter walkway are fully installed and provide protection for workers.

Activity # 2: Accessing Column Caps

Case Study # 2: The case comes from bridge construction to connect a state highway and an interstate freeway. Improvements include building a new on-ramp, a new off-ramp, and a new flyover ramp. Construction also includes adding traffic cameras, electronic signs for traveler notification, highway advisory radio transmitters, and traffic data collectors to provide real-time traffic information for the web and 5-1-1. The project includes a 43-foot-wide, 1,061-foot-long precast concrete segmental bridge. The activity shown in the picture represents columns supporting column caps that require worker access to build forms and ultimately pour concrete and set girders.

Response: Each column cap presents a fall hazard for workers due to their height. Workers on top of the column cap must be kept safe from falls. Providing tie-off points and equipping workers with a harness and fall arrest system is one option. A guardrail around the full perimeter of the column caps can be installed. A perimeter walkway with guardrail around the column cap is another fall protection option. A stair tower (shown in the photo), can be installed to provide access to the working platform at the column cap.

After the column caps are constructed, bridge girders are installed. To prevent falls, walkways between girders are constructed. Even though the bridge girders are considered structural members and therefore the trigger height for fall protection defaults to 10 feet, the walkways between girders (structural members) require guardrails since the trigger height for fall protection when standing on a ramp or walkway is 4 feet. To safely access the work area on the column caps, workers can use aerial lifts to construct a working platform with guardrails.

Fall Protection Strategies - Case Scenario #3

At this point in the training, the trainees have a good grasp of the concepts of fall hazard identification and control systems. Review the hierarchy of controls as a way to assign controls to the hazards. Then turn the focus on Case Scenario #3 as a way for the trainees to apply their knowledge.

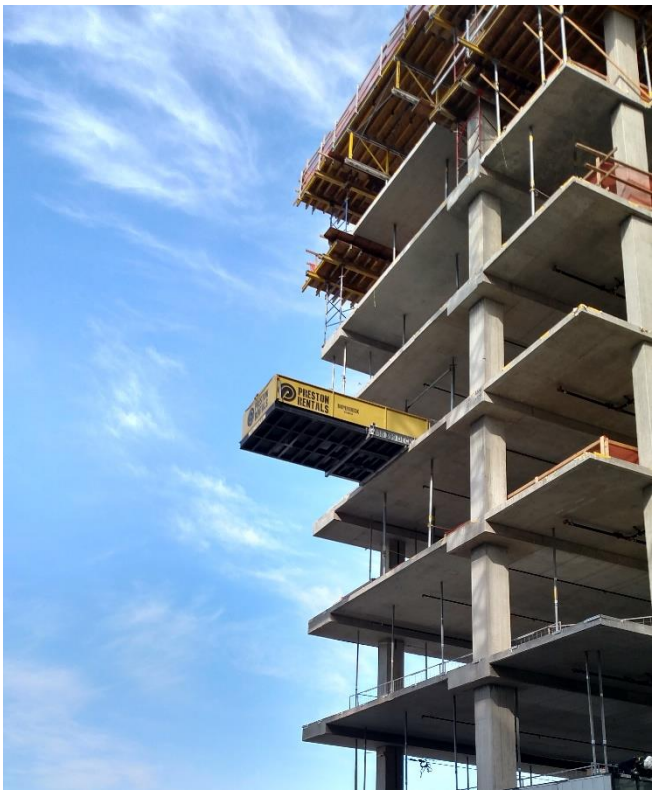
Case Objective: Identify possible engineering controls (i.e., tie-off points, etc.) for fall protection.

Activity Goal: Review the given construction activities and site conditions in the case scenario below, and identify at least three examples of engineering controls that can be used to protect the workers from falling. Describe the resources needed, and the advantages and disadvantages of each type of engineering control. Prepare a table that presents your controls. An example table is provided below.

Control No.	Control Description	Resources Needed	WAC Reference	Advantages	Disadvantages
1					
2					
3					

Activity: Vertical Concrete Operations

Case Study: A multi-story building project, located in downtown Seattle, WA, consists of two 12-story towers over a 4.5-story subterranean parking garage. The towers are Class A, mixed-use office buildings with a combined total floor area of approximately 600,000 square feet. The structural system for the building is a cast-in-place reinforced concrete frame. The exterior enclosure for both towers is a typical glass and panel façade. Construction of a multi-story concrete structure, i.e., vertical concrete construction, consists of building and erecting formwork to construct the slabs, beams/girders, and columns on each floor level. When performing the construction operations at elevation, fall protection and protection from falling objects are critical issues, especially when erecting the formwork. What will the employees forming the deck use for fall protection? What will they tie off to?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Response: Protecting workers from fall hazards during the construction of a cast-in-place concrete building poses a challenge and the project team had to plan control methods in advance. Both leading edge and floor slab hole hazards are present. The fall protection must precede the floor slab construction and be above the floor slab elevation. Similar to any project, the concrete columns preceded the forming of the horizontal decking operations. The concrete crew, while forming the columns, can install a pour-in-place horizontal lifeline concrete sleeve that provides the workers with an overhead tie-off point. In addition, workers can also install and use column straps for a horizontal lifeline system as needed. The workers connect their fall arrest system to the horizontal lifeline when working in the area.

A guardrail system can then be constructed around the perimeter of the slab once it is cast and cured. A 2×4 wood guardrail system nailed to the deck can be used. As the carpentry crew completes more decking, they can move out the guardrail system progressively. Beyond the guardrail system, a controlled access zone can be installed with clearly marked signs warning workers to use fall protection 100% of the time when working in the area.

Culminating Experience - Case Scenario #4

So far, given a case scenario, the group has collectively worked on identifying fall hazards and controls. As a culminating experience during this task, the trainees will use the sample form to complete a full fall protection plan using Case Scenario #3.

Case Objective: Develop a brief fall protection plan

Activity Goal: The goal of this activity is to build on the previous case scenario involving the construction of a multi-story concrete building. This activity is designed to improve your ability to think beyond just a single application of fall protection to analyze a larger project scenario and develop a fall protection plan for a project. For the scenario provided in Case Scenario #3, using the sample template, develop a plan that can be used on the construction site to protect workers from falling. The plan can include a variety of fall protection measures. It should also include the necessary administrative, training, and oversight activities needed to fully implement and monitor the plan, improve the plan during construction if needed, and assess its success.

Activity: Vertical Concrete Operations

Response: An overall fall protection plan for a project should include measures that address safety in every foreseeable work operation and site condition. When a personal fall arrest system is selected, the plan should require all employees to wear a full body harness and double shock-absorbing lanyard system anytime a worker is required to disconnect and reconnect to travel around an obstacle. A worker should never be totally "unhooked." Fall protection should be provided on all fixed elevated surfaces above 4 feet for all trades. The 4-foot fall protection rule does not pertain to ladders and scaffolding as long as they are used in a way that meets WAC standards. Workers who work from temporary elevated surface heights of 4 feet or more should be required to provide a written fall protection plan. The fall protection plan should be submitted and approved prior to starting any work.

Fall Protection Work Plan

WAC 296-880-10020: You must develop and implement a written fall protection work plan covering each area of the work place where the employees are assigned and where fall hazards of 10 feet or more exist. The plan must be available on the jobsite for inspection by the department.

Company Name	Date
Site Address	

(If additional space is needed, use the back of the sheet)

Identify all fall hazards that are 10 feet or more above the ground level or lower level. Check all that apply.

- ☐ Open-sided floors
- ☐ Decks/Balconies
- ☐ Floor holes
- ☐ Skylight holes
- ☐ Wall openings
- ☐ Window openings
- ☐ Door openings
- ☐ Roof holes
- ☐ Leading edge work
- ☐ Mobile lift work

Methods of fall protection to be used: (LSO = Low Slopes Only. Low Slopes = 4 x 12 or less)

- ☐ Guardrail system (LSO)
- ☐ Warning line System (LSO)
- ☐ Catch platform
- ☐ Safety net
- ☐ Covers
- ☐ Personal fall arrest system
- ☐ Personal fall restraint system
- ☐ Positioning device system
- ☐ Horizontal life lines
- ☐ Vertical life lines & rope grab
- ☐ Safety watch system (LSO)
- ☐ Warning line w/ safety monitor (LSO)

Name of safety watch or monitor (if used): _____

Overhead Hazard Protection Methods

- ☐ Hard Hats
- ☐ Overhead Hazard Signs
- ☐ Debris Nets
- ☐ Other: _____
- ☐ Toe boards on Guardrails
- ☐ Screens on Guardrails
- ☐ Barricade to control Access to Area
- ☐ Other: _____

Describe procedures for assembly, maintenance, inspection, disassembly of fall protection system to be used.

_____

_____

Describe procedures for handling, storage, and securing tools, equipment, and materials.

_____

_____

Describe methods of overhead protection for workers who may be in, or pass through work area.

_____

_____

Describe methods to be implemented for prompt, safe removal of injured worker(s).

_____

_____

Employees who received fall protection training on the above site-specific fall protection work plan.

Name(s):	Date:

The competent person's signature verifies that the fall protection work plan has been done, the employees informed of the plan and that employees have received training in the fall protection systems in use:

Name	Title	Date

Training Self-Reflection Activity

Discuss three major takeaways from this training that the trainees will apply at their jobsites.

RESOURCES

"4 Different types of Active Fall Protection for the Construction Industry," Simplified Safety, August 8, 2019, https://simplifiedsafety.com/blog/what-are-the-different-types-of-fall-protection-for-the-construction-industry/.

"Construction Focus four: Fall Hazards," Instructor Guide. OSHA Training Institute, OSHA Directorate of Training and Education, April 2011.

"Fall Protection," Occupational Safety and Health Administration (OSHA), US Department of Labor, https://www.osha.gov/fall-protection.

"Safety Tips for Construction Fall Protection & Prevention," Vector Solutions, September 1, 2015, https://www.vectorsolutions.com/resources/blogs/tips-for-construction-safety-fall-prevention/.

"Unified Fall Protection Basics for Construction Activities," Division of Occupational Safety and Health, Washington State Department of Labor & Industries, https://www.Lni.wa.gov/Safety.

"Washington State Construction Fall Protection Basics," developed by the Associated General Contractors (AGC) of Washington (https://www.agcwa.com/).