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The When, Where and How to look for Fall Exposure

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Introduction

CFR 1926.500 Subpart M, "Fall Protection" sets the criteria for fall protection in the construction industry.

Exhibit 1: Duty to Have Fall Protection – Setting the Example

It first states that there are only two times when some form of fall protection is not needed; one prior to the work commencing and two after the work has been completed. To completely comprehend the need for fall protection, it is necessary to understand the limits of the law in Subpart M. This includes what is required of the contractor and what the standard does not address. You must have an understanding of all fall protection requirements, including those in other standards in CFR 1926 that also regulate what the worker may and may not do or be exposed to.

Other Subparts with Fall Protection Requirements
Subpart C – Access and Egress

In Subpart C - Access and Egress is addressed. You as the safety manager must recognize fall protection begins at the walking working surface. The employee must have a clear obstacle free access egress. A lack of lay down area for material would not be justification for a worker who receives a broken leg from walking over rebar. In constructing Raven Stadium the three lost time injuries, which I dealt with, were associated with access through areas of mud. These areas of mud were greater than 12'' deep and several feet wide. The individuals hurt attempting to move through the mud had injuries resulting in pulled tendons, twisted ankles, and strained knees. In concrete construction the use of form oil on formwork creates slippery surfaces. The use of insulating blankets after the concrete is placed creates slippery work area conditions. When weather conditions change and it rains, snows, or ice accumulates on the plastic insulating blankets a prime condition for twisted ankles, broken legs and strained backs is created. Although the foot level fall does not always turn the red panic light on in ones mind, I guarantee a significant amount of injuries could be avoided by addressing your attention to the problem at hand.

Exhibit 2: Access and Egress

Subpart L – Scaffolds, Aerial Lifts, and Boatswain Chair

In Subpart L - Scaffolds, Aerial lifts, and Boatswain chair are addressed. The use of guardrails at 10' on scaffolds is part of the fall protection requirement, where as on swing stage

independent lifelines and rope grabs are used. Scissor lifts and articulating boom lifts also contained in this standard, are always an area of concern on a construction site. There is the 100% tie off requirement in the boom lift with its ability to tilt and rotate the basket, whereas the scissor lift only moves up and down in the vertical plane and may require fall protection by the manufacturer.

Exhibit 3: Foreman "Among the Missing"

Subpart N – Cranes, Derricks, Hoists, Elevators and Conveyors

Subpart N - Cranes, Derricks, Hoists, Elevators and Conveyors require the use of a variety of fall protection including: harness, lanyard, rope, rope grab and guardrails. The assembly of Hammer Head Cranes where guardrails may or may not be provided requires particular attention. If the guardrail is not provided, your attention to its assembly to ensure that the workers use harnesses and a

lanyard is paramount. Where you might not feel comfortable climbing a tower crane to oversee the erection, a pair of 10x50 power field glasses and a megaphone will allow you to effectively ascertain what you need to see and convey a message to heights of several hundred feet.

With the installation of elevators and material hoists there is exposure to a number of employees. There is exposure not only to the worker in the elevator shaft, but to individuals along exterior edges of the structure with material or personnel hoist installation, and also to those people working adjacent to these areas. Removable guardrail is the protection of choice, because this provides protection to those working in and around the shaft, but also allows subsequent trades who will need to access the shaft area easy access. I have found Elevator tradesmen to be excellent in fall protection compliance, nevertheless you still need to monitor compliance and express your concerns on the fall hazards associated with their work. In developing trusting relationships with your workers in the field, a key component to a successful and safe work environment is demonstrating your concerns for the workers' welfare.

Subpart O – Motor Vehicles, Mechanized Equipment, and Marine Operations

Subpart O - Motor Vehicles, Mechanized Equipment, and Marine Operations, Rock Crushers, the use of Hoppers in batch plant operations, Pile Driving, and the use of Pile Leads, all require some form of fall protection. Rock crushers have guardrail to protect the worker who monitors the operation on an elevated workstation. In pile driving a worker is occasionally required to climb leads as high as a 100' cable or rope, attached at the bottom and top of the leads is a rope grab. The worker climbs the leads while attached to the rope grab, this provides fall protection. Concrete batch plants access ladders may incorporate rest platforms, lifelines, rope grabs, and guardrails. Workers who may need to access material hoppers need fall protection such as a harness and a lanyard to prevent possible engulfment by the material should voids be present.

Subpart P – Excavations

Subpart P - Excavations states the worker has to be protected from six foot or greater fall to below. Areas where this exposure would be incurred in the excavation standard would be in the use of a trench box in utility installation, auger caisson, slurry wall installation, trench cuts and underpinning pits. Utility vaults, shafts constructed with liner plates, utilized to install underground pipe the fall exposure must be addressed. The use of guardrails systems, body harness, lanyard with anchor points are utilized, if anchor points are not available the use of a dead man is acceptable.

Subpart R – Steel Erection

Subpart R - Steel Erection requirement for fall protection under the new standard allows tie off for connectors and deckers at 30 feet and erectors at 15 feet. The standard addresses training requirements, erection plan and sequence for erection to eliminate fall exposure. The use of man baskets to access elevated work areas is now permitted after training and requirements for the use of man basket have been met. Although Subpart R allows parameters for the tie off greater than Subpart M Owners may require more stringent fall protection requirements than OSHA. In construction of the Memphis Tennessee Convention Center addition, the city in the contract language required 100% tie off at 6 feet, even on ladders. This was accomplished through the use of horizontal lifelines, retractables, pin lines, harness and lanyard. Tie off at six feet also was required at the terminal expansion of the Seattle Tacoma Washington Airport, where the airport authority again went above and beyond with a 100% tie off requirement at six feet. One thing to remember even with the 15 feet and 30 feet tie off ruling once past the second level of a structure or 30 feet all exterior fall exposure or exposure next to shafts or hoist ways would require some form of fall protection. In Bridge construction fall protection must be installed on pier caps prior to setting of Bridge girders, horizontal life lines placed on the beams prior to placement and do not let the use of c clamps for temporary anchorages by connectors.

Exhibit 4: Seattle Tacoma Airport 100% Tie off

Subpart S – Underground Construction

Subpart S - Underground Construction, Caissons, Cofferdams, and Shafts fall protection would be provided to the worker during and after construction of shafts. As sheeting and shoring was placed and digging commenced, and the shaft went down, Wales and bracing would be installed. Access in and out of the shaft would have to be provided. This could be ladders, stairs or personal lift. Guardrails would be used at all areas of fall exposure. In the tunnels the use of mobile scaffold ,aerial lifts, jumbos , shields, and tunnel-boring machines with trailing equipment again may require the use of guardrail if a six foot fall exposure is met, if a fall would occurred it would be onto the tracks or machinery.

Subpart X – Stairs and Ladders

In stairs and ladders the standard does not require fall protection. In many instances to complete our tasks safely fall protection must be incorporated into the operation. The welder standing on a ladder welding a butt joint for several hours, should fatigue set in or he should slip and fall; fall

protection would save the day. The worker above the guardrail on a ladder at the exterior or interior edge of the building would need protection from the fall hazard. While this scenario is not in black and white, conditions as I have mentioned should trigger the workers and safety managers' decision to go with safety and tie off. In stairways the requirement for guardrails to prevent falls are addressed, when, where, and how to place them. Pan stairs with guardrail in place yet the stairs have not been poured with concrete or filler blocks installed would be a serious fall hazard. With the proper installation of stairs and through the use of guardrails, foot level falls on stairs are hopefully eliminated. In the use of straight ladders on batch plants, slurry tanks and water tanks, the use of rest platforms, cages, safety cable or rope life line with rope or cable grab shall be used along with guard rail.

Subpart V – Power Transmission Towers

In Subpart V - Power Transmission Towers fall protection is addressed with the use of body belts and personal protective equipment.

Definitions

In definitions you need to understand general terminology and understand its meaning as it relates to tasks that require fall protection. Your ability to make suggestions to find solutions for workers who need your expertise is vital for a safe job. In controlled access zone work the contractor can perform work at a greater than six foot exposure if he has met the criteria of the standard and falls into the area where this type of fall protection is acceptable. A controlled access zone would be utilized in overhand brick laying, setting precast, and metal and wood decking. In these areas you would want to direct your attention to assure all requirements in the use of the controlled access zone were met, such as the fall protection plan, naming of the deck erectors, monitor areas to be flagged or marked by warning lines, and monitoring method.

Your knowledge of the standard in its entirety is critical to whether you will be effective on the job or not. Every subcontractor on the job will be knowledgeable in his or her field. You will have to be better or at least as knowledgeable. When a new trade comes on to the site, bone up on the requirements of their work task and what exposure you can anticipate. As an example a roof of greater than a 4/12 pitch requires fall protection whereas less than a four twelve pitch is considered a flat roof. How will fall protection requirements be met, what are your options? In roofing work a warning line system is allowed in combination with guardrails and edge monitors on a flat roof. The distance warning line has to be back from the edge, its construction and how it's flagged every six feet. All these details have to be adhered to. The training of the work force and its documentation is also key. The work past the warning line must use an edge monitor. Plan the work and work the plan. Your knowledge of the total scope of the work is important, for example less than a 50 foot roof no warning line is required but other safety means must be used including an edge monitor who is recognized by a colored vest or hat designation and verifying the roofing crew is trained and that this documentation of training is on site these safety methods are permitted under Subpart M. In definitions the terminology must be understood to take fall protection to the next level. You must have that working knowledge of what is allowed and how you will comply with the CFR requirements regarding the task at hand.

1926.501 - Duty to Have Fall Protection

In 1926.501 the duty to have fall protection identifies 15 areas that would mandate the use of fall protection.

1. Unprotected sides and edges, you would find this condition in building construction, bridge and roadway construction. The use of guard rails, nets, and personal fall arrest systems would be utilized to eliminate this hazard.

2. Leading edge work, this work could entail the placing of plywood decks or placing steel decking during erection. This condition would utilize guard rail systems, safety net systems, and personal fall arrest system or if the contractor can demonstrate this is not feasible or creates a greater hazard, he can develop a fall protection plan and use a controlled access zone and use an edge monitor.
3. Hoist areas are areas where a worker may have to lean over the side of a building to facilitate landing of material from cranes. Landing platforms or outriggers, which may reach beyond the buildings edge, may be used. The use of guardrails or personal fall arrest systems would be used for fall protection.
4. Holes, this is an opening of two inches or more. The hole must be covered and marked “hole” or “cover” and support twice the intended load, plus secured to the deck. Typical areas in the deck or floor where holes could be anticipated would be pipe holes, roof top equipment holes, electrical access holes, duct holes or chase, places where access has been missed and now core boring must take place. Forklift, scissor and aerial lift activity would be of concern in areas where they could access the hole covers. Training workers on the equipment, relaying to the workers that they need to get off of the equipment to see if there is a 4`x4` hole opening under the sheet of plywood. You must check the material being used for a cover. I have seen 1/8” luan plywood for skylights and sheet rock for floor openings; do not take for granted it will be done right. When trades uncover openings to continue pipe or ductwork they should not uncover any more than they can work on, to limit the exposure.

Exhibit 5: Sheetrock Floor Hole Cover – Twice the Intended Load?

5. Form work and reinforcing steel, in formwork guardrails and fall arrest systems would be used. Where placing reinforcing steel in vertical walls, rod busters are permitted to use safety belts with positioning hooks and are allowed to climb up to 24 feet high.
6. Ramps, runways and other walkways such as conveyor ramps, access ramps onto decks, guardrail would be the fall protection used but cable lifelines along with a fall arrest system may be used. When scaffold planks are incorporated into a ramp, the ramp needs to be at least 18 inches wide.

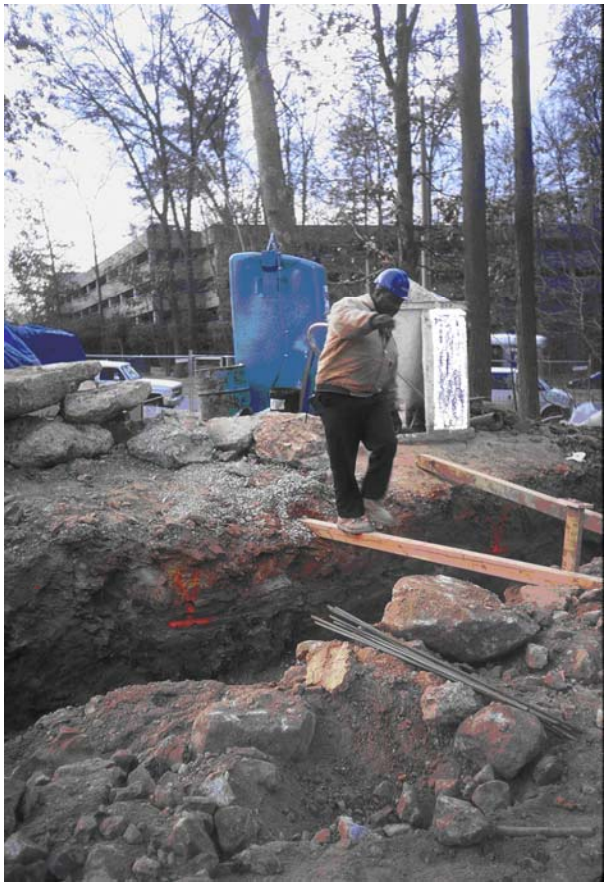

Exhibit 6: Walking the Plank

7. Excavations trenches, underpinning pits, auger caissons, the use of trench boxes, and slurry wall construction, vaults for utilities these are all areas where some form of fall protection must be provided. The use of guardrails, retractables, lifelines, and fall arrest systems all could be used to eliminate exposure.
8. Dangerous equipment, any person six feet or more above dangerous equipment need to be protected. Dangerous equipment includes rock crushers, batch plants, open hoppers, for sand and gravel, conveyor systems only to name a few. Protection may be provided by guardrail, fall arrest systems.
9. Overhand brick laying when performed on scaffold is regulated by Subpart L scaffolds when it is preformed without scaffold, guardrails, personal fall arrest system or a controlled access zone is allowed.
10. and 11. Roofing, flat roofs and steep roofs greater than four twelve pitch have different requirements as previously discussed. Warning lines edge monitors, fall protection plans, fall arrest systems, guardrail, rope grabs, lifelines, scaffold around the outside of the perimeter are all options available to the roofer.
12. Precast concrete erection, exterior erection of precast, the use of double tees and columns in precast parking garages are all well above the six foot fall exposure range. The use of guardrail, independent lifelines with rope grabs, concrete anchors, utilizing existing precast lifting eyes, horizontal cable lifelines and personal fall arrest systems are acceptable fall protection methods. The controlled access zone also can be used if the required criteria are met.
13. Residential construction, the employer can use guardrail systems, personal fall arrest systems or the controlled access zone after completing a fall protection plan. Areas of exposure would be

floor edges, truss installation, roof work, floor joist installation, balconies where guardrail has not been installed and windows less than the 39” to 45” high.

14. Wall openings; a wall opening is an area 18” wide by 30” high. Anything that meets this criteria would have to be protected, guardrail installed or another form of protection provided. Where you could anticipate this exposure is in concrete building construction, staircase landing, buildings where metal stud walls are 24 inches on center instead of 16 inches on center, next to material and personal lifts installed on the exterior of structures any place where the sheet rock or metal stud installers are performing work, or when guardrail next to elevator shafts are removed to install the elevator doorframe. When glazers come onto the job and remove the guardrail and install the mullions to hold the glass, usually the horizontal aluminum does not meet the 21” and 42” requirement for guardrail thus falling into the wall opening category. These are but a few areas that you need to anticipate monitoring during construction.
15. Walking working surface while we previously discussed walking working surface under this category, there is also protection required from falling objects. This is accomplished by the use of toe boards on scaffold and edges of building. The CFR 1926 also states no material shall be stored within 10 feet of the edge of a structure or 6 feet of a hoist way of a shaft. The use of overhead protection to enter or exit a structure, roping off the area where overhead edge work will be performed on the structure with a spotter on the ground making sure no one goes into the strike area should something be dropped from the exterior of the structure.

1926.502 - Fall Protection Systems Criteria and Practice

In this section it goes into fall protection systems that are permitted, read it and keep your copy of the standard handy so you can reference it as needed. My 1926 sits on the dash of my pickup.

1926.503 - Training Requirements

I feel all the fall exposure we have previously discussed cannot be eliminated unless the following conditions exist.

1. You train the workers on the fall hazards they will incur in doing their task and the fall exposure they will be exposed to in the work area, the conditions in the work area may not be necessarily created by them but they will have to deal with it.

Exhibit 7: Proper Use of a Harness?

2. Train the workers on what type of fall protection is available and its limitations. Train the workers on how to use the equipment properly. Have them try the harness on and adjust it to fit. Too loose or too tight could mean personal injury. Show them how to inspect the equipment and when to remove it from service. Document the training and have the worker sign off. Changes in the workplace or fall exposure could mean retraining or a change in fall protection. Observe the workers as they perform their job; observe their usage of the fall protection equipment. If the employee demonstrates that he does not understand or comply with fall protection by not tying off or wearing equipment improperly, retraining would be required. In CFR 1926 Subpart M Appendix A-E roofing, guardrails, personal fall arrest systems, positioning device systems, fall protection plans are discussed to assist you in writing a fall protection plan or deciding on what fall protection to use.

Exhibit 8: Just When You Thought It Couldn't Get Worse

Discipline Policy

Unlike not wearing your safety glasses, failure to comply with fall protection is unforgiving. The first time could be your last. Fall protection is a first time and you are out offense. I send the offender home for a day the first time he forgets to tie off and the second time he is fired. I treat all offenders equally foreman and worker alike. A leader leads and the worker will follow. If the foreman does not tie off the worker will not either. In construction of Ravens stadium I sent 7 foreman homes for a day during the 12 month project period. The message received by the workforce was tie off or be among the missing. Three workers fell on this project all were wearing harnesses this speaks for itself.

Exhibit 9: Superintendent Gone For a Day

Analysis of a Fatality
Iron Worker Falls from Bridge

Who: An Iron Worker falls from bridge during decking.

Where: One Iron worker installing steel decking on a bridge 100 feet in the air, and working with several other workers. The bridge had five deck beams; there were three horizontal life lines one on each exterior beam and one in the center beam. The deceased was using a retractable attached to the right horizontal life line. The worker was working two bays over from the horizontal life line when he fell between the beams, his life line extended three feet at which point the angle that the decking sets on cut the lanyard and the worker fell to the ground.

What Happened: Analyzing the accident, the worker should have been attached to the closest Horizontal life line. Two, the retractable he was using had a web life line instead of a cable life line which would not cut as easy as a web lanyard. By inspecting their equipment I found that in addition to the equipment worn by this individual other equipment belonging to the company should have also been removed from service. This indicates that no competent person was present during decking.

Exhibit 10: Bridge Fatality

Ironworker Falls Through Roof Opening
Who: An Iron Worker falls through roof opening.

Where: Iron worker setting steel decking works all day walking around floor openings, One time, the worker attempts to step across roof opening, he falls 34 feet.

What Happened: Analyzing this fatality under the new Subpart R, "all holes and opening will be Guarded or will be covered." You as the safety manager must enforce all policies and discipline nonconformance.

Demolition Worker Falls through Floor Hole
Who: Demolition worker falls through floor hole.

Where: The now deceased worker was working in an area next to an elevator shaft that was covered by plywood. The hole that was covered by plywood was marked and totally fenced in by guardrail, mid-rail and top rail cable. The workers who had to access this area were required to have a harness and lanyard on and use them. All observations till this accident occurred the workers were observed using their fall protection. The deceased accessed the restricted area with out tying off, he then lifted a hole cover to move the plywood to the next floor, at this point the worker stepped forward and fell 53 feet to concrete.

What Happened: Analyzing this fatality I found that the area was guarded as required, the Contractor had the required documentation of training on site. I feel that the only thing that would have prevented this accident would have been the foreman overseeing all work within the restricted area.

Conclusion

Know the Standards. Know the progression of work and what hazards are associated with each task. Know what fall protection equipment is available and its limitations. Know the right tool for the right job. Think out of the box, a lot of fall protection equipment can be used in a variety of fall exposure applications. Last the use of discipline; use it as a tool to assist you in compliance. In the use of discipline, treat all workers equally, foreman and workers alike.

ALL WORKERS EXPOSED TO A SIX FEET FALL NEED TO USE FALL PROTECTION
FALL PROTECTION WORKS

Exhibit 11: Even the Safety Man Gets Evaluated