



## **CONSTRUCTION ENVIRONMENTAL HEALTH & SAFETY EXHIBIT**

### **FALL PREVENTION AND PROTECTION**

#### **I. Definitions**

- A. **Controlled Access Zone (CAZ):** An area in which fall hazards are present, where access to the area is limited to only those personnel required to perform the task at hand, and where personal fall arrest systems or personal fall prevention systems are used in place of guardrails or covers.
- B. **Cover:** A protective device positively secured over a hole or opening on a horizontal surface, which once installed, prevents employees from falling through the hole or opening to a lower level, or prevents materials from being dropped through the hole or opening to a lower level.
- C. **Feasible:** As it applies to fall prevention and protection, feasible shall mean possible.
- D. **Floor Opening (Hole):** Any gap, void, or opening in a floor, roof, or other horizontal surface equal to or greater than two (2) inches in its least dimension.
- E. **Guardrail:** A barrier erected in front of unprotected edges or around openings that prevents employees from falling to lower levels. The term 'guardrail' includes top and mid-rails.
- F. **Horizontal Lifeline:** A lifeline designed and installed in a horizontal manner, used as the connection point for a personal fall arrest system.
- G. **Leading Edge:** The edge of a floor, roof, or formwork for a floor or other walking/working surface which changes location as additional floor/roof/decking/formwork is placed or constructed.
- H. **Personal Fall Arrest System (PFAS):** A system used to arrest an employee in a fall from a working level.
- I. **Personal Fall Prevention System (PFPS):** A system, used by an individual inside a controlled access zone that does not allow the user to reach the unprotected edge. These are restraint devices where the user is positively tethered to an anchorage point.
- J. **Safety Monitoring System:** A system in which a Competent Person is responsible for recognizing and warning employee of fall hazards.
- K. **Toeboard:** A low protective barrier that will prevent the fall of materials and equipment to lower levels and provide protection from falls for personnel.
- L. **Vertical Lifeline:** A lifeline designed and installed in a vertical manner, used as the connection point for a personal fall arrest system.
- M. **Wall Opening:** Any gap or void twenty-two (22) inches or higher and twelve (12) inches or wider, in a wall or partition, through which employees can fall to a lower level. NOTE: These numbers are more stringent than 29CFR Part 1926.500.
- N. **Warning Line:** A barrier erected on a roof to warn employees that they are approaching an unprotected side or edge, and which designates an area in which roofing work may take place without the use of typical fall protection systems.

#### **II. General Requirements**

- A. All work and practices shall comply with OSHA29CFR Part 1926.500 through 1926.503, ANSI 359.1, and the manufacturer's requirements and recommendations for any fall protection systems and equipment used.
- B. Each Contractor requiring employees to work in areas where fall and falling object hazards are present is required to have a fall prevention and protection program, specific to that Contractor's operations, which meets or exceeds the guidelines listed in this Standard. This program shall be part of the Contractor's HASP.



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- C. Any person observed utilizing fall protection in an unsafe manner shall be cause for the Foreman or supervisor to immediately halt the operation, and conduct re-training, at a minimum. Training or re-training is the responsibility of the employer.
- D. The employer's Competent Person shall ensure that all Employees potentially exposed to fall or falling object hazards possess the knowledge and skill required to perform the duties for which they are assigned. In addition, a hazard analysis shall be completed prior to any operation, any fall or falling object hazards shall be clearly identified, and hazard controls defined. The hazard analysis shall be reviewed with the work crews prior to the start of work, and where conditions change. Where a PFAS is used by employees, the Competent Person shall calculate the total fall distance to ensure that employee will not contact levels or objects below the elevated surface.
- E. Fall prevention or protection systems are required for all project Employees and trades that are potentially exposed to falls equal to or greater than six (6) feet. NOTE: It is presumed by the University that fall prevention and protection systems can be safely implemented, installed, and used with proper planning and training.
- F. Where a ladder or stairs are the only means for access into a controlled access zone (e.g. steel erection decking area), danger signs informing project personnel of the fall hazard and the requirement for PFAS use shall be posted at the ladder/stair access point.
- G. The use of warning lines is only allowed for operations on low-sloped roofs. The warning line shall be set no less than fifteen feet (15') from the roof edge. Ladder or other access points from the roof edge to the working area shall consist of guardrails (on both sides of the access walkway) from the edge of the roof to the warning line. All other requirements shall comply with 29CFR1926.502. All employees working between the warning line and the roof edge shall be protected from falling by means of a personal fall arrest or fall restraint system. Danger signs indicating that fall protection is required shall be placed along the entire length of the control line at intervals no less than ten (10) feet. The use of safety monitoring systems is not allowed for fall protection purposes on roofs or in any other location.

### **III. Elevators and Hoistways**

- A. Riding on top of the elevator or personnel hoist car is not permitted except during the erection, dismantling, and inspection operations. The employee(s) on the top of the cab shall be protected from falling by means of a guardrail. The employee on the top of the cab may utilize a PFAS provided that the anchor point meets the requirements of 29CFR Part 1926.502 (d).
- B. For permanent elevator construction, the false car or temporary platform will be enclosed on all sides by guardrails and toeboards, in compliance with 29CFR Part 1926.502. A removable front rail shall be provided on the car to provide access onto and off the car.
- C. For permanent elevator construction, a falling object protection system, consisting of a minimum of 3/4" plywood and 2" framing, shall be installed above the car, and shall extend at least to the perimeter of the car floor.
- D. Prior to commencement of permanent elevator construction, elevator shaft openings and entryways shall be fully protected and enclosed from the floor to the top of the opening/entryway using fire-retardant plywood doors and framing, or a combination of removable guardrails and fire-retardant safety netting (full height). This protection shall be installed after consultation with the contracted elevator constructor and shall be



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installed so as not to interfere with the permanent elevator door installation. This protection may be removed upon completion of the permanent elevator doors and jambs.

- E. All access doors and gates into elevator shafts shall swing open away from the shaft and shall be operable from both the inside and the outside of the shaft but may be constructed so that the elevator constructor can block the door (on the inside of the shaft) from being opened.

#### **IV. Excavations**

Excavations six (6) feet or greater in depth require fall protection, in the form of guardrails, around all openings. Guardrails shall be installed as the excavation progresses. Where Employees must enter the area between the guardrails and the edge of the excavation, they shall be protected by a personal fall arrest or prevention system. This requirement will not apply to excavations that are sloped at least 1 1/2: 1 (H: V).

#### **V. Falling Object Protection**

- A. Where materials, debris tools, and/or equipment are stored or piled higher than the height of the top edge of the toeboard, paneling or screening shall be installed from the top edge of the toeboard to the top edge of the guardrail system. No material storage is allowed above the height of the top rail of the guardrail system. NOTE: Equipment including scaffolding, aerial lifts, material hoists, etc. must be designed or engineered to accept the weight and wind loads associated with screening or paneling. This is the responsibility of the Contractor.
- B. Where work is taking place in areas where no falling object protection is provided (e.g. steel erection, bolting up, scaffold erection, guardrail installation, etc.), or where work is taking place at or over the edge of the elevated work area, the area(s) below the work operation shall be cordoned off with DANGER tape. Danger signs informing project personnel of the overhead hazard shall be posted at the area perimeter. No personnel are allowed within the cordoned off area(s). NOTE: The area to be cordoned off shall extend at least fifteen (15) feet from the vertical plane of the elevated work area. Where fifteen (15) feet is not feasible, the size of the cordoned off area and the need for additional controls (e.g. work practice controls, traffic/pedestrian controls, details, etc.) shall be assessed by the Contractor, the contractor Safety Representative, and the Project Safety Manager to ensure that adequate protection is provided for all personnel and property below.
- C. Where work must be performed above building entrances and exits, whether on the construction site or part of a public area, canopies shall be installed and enclosed to fully protect pedestrians from falling objects. This shall be done in conjunction with sub-section A above (screening/paneling). These canopies shall be capable of withstanding the maximum forces that could be applied from potential falling objects, considering the maximum fall distance from the elevated work area to the canopy. This is the responsibility of the Contractor.
- D. In areas adjacent to public walkways or travel ways, canopies shall be installed and enclosed to fully protect pedestrians and vehicles from falling objects. This shall be done in conjunction with sub-section A above (screening/paneling). These canopies shall be capable of withstanding the maximum forces that could be applied from potential falling



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objects, considering the maximum fall distance from the elevated work area to the canopy. This is the responsibility of the Contractor.

#### **VI. Guardrail Construction**

- A. Guardrail construction shall comply with the requirements listed in 29CFR Part 1926.502(b), including Appendix B to Subpart M, at a minimum.
- B. Guardrails shall be installed immediately following (or prior to, if possible) construction of the walking or working surface. No trades or Employees, other than those directly involved in the construction of the walking or working surface shall be allowed to access the walking/working surface until the guardrail systems have been installed.
- C. Where guardrails are installed at an elevation lower than the future finished floor elevation (i.e. prior to placement of concrete slab over metal decking), the guardrail (top and mid-rail) height shall be set so as to accommodate the finished floor elevation, so long as the top-rail height will be maintained between thirty-nine (39) and forty-five (45) inches at both the unfinished and finished floor elevations. Where this is not feasible, a second set of guardrails, set at a height between 39 and 45 inches above the finished floor elevation, shall be installed prior to placement of the finished floor system. The original set of guardrails shall not be removed until after the finished floor system has been placed.
- D. Where wire rope and steel stanchions are used for guardrail construction, the wire rope shall be at least one-half (1/2) inch in diameter, or three-eighths (3/8) inch diameter for 'aircraft cable' (no core). Turnbuckles shall be installed at all turns in the direction of the guardrail. At least three (3) forged steel wire rope clips shall be installed on all eyelets. The use of lap joints is prohibited.
- E. Employees shall not be allowed to use guardrails as an anchor point for personal fall arrest or prevention systems, unless the guardrail system has been designed and engineered as such.

#### **VII. Hoist Areas**

- A. Areas where equipment and materials are hoisted or loaded onto an elevated level from another level, including below-grade hoisting operations, shall be designated as such by the General Contractor. These hoist area requirements also apply to debris chutes.
- B. Removable guardrails or lockable gates/doors shall be installed at each loading area. These guardrails or gates/doors shall remain in place and secured when the loading area is not in use.
- C. A CAZ shall be established far enough from the loading area (i.e. edge of building) so that all materials/equipment hoisted in can be temporarily stored within the CAZ, until the guardrail or gate/door is re-secured at the loading area.
- D. Employees inside the CAZ shall always be protected from falling by personal fall arrest or prevention systems when the guardrail or gate/door is removed.
- E. The area(s) below the hoisting area shall be protected from falling object hazards in accordance with Section V of this Exhibit.

#### **VIII. Horizontal Openings (Holes)**

- A. Employees shall be protected from falling, tripping, and stepping into holes by means of guardrails or covers.



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- B. Where guardrails or covers must be removed, a CAZ shall be established around the hole prior removing the guardrail or cover.
- C. Employees inside the CAZ shall always be protected from falling by personal fall arrest or prevention systems when the guardrail or gate/door is removed.
- D. The area(s) below the hole shall be protected from falling object hazards in accordance with Section V of this Exhibit.
- E. Covers shall be capable of supporting, without failure, at least twice the weight of employees, equipment, and materials that may be imposed on the cover at any one time. No materials or equipment shall be stored or placed on any cover or hole.
- F. Covers shall be positively secured to prevent accidental displacement by wind, equipment, or employees. Cleats secured to the cover do not constitute 'positively secured'.
- G. Covers shall be marked with the word 'HOLE' or 'COVER' and shall be re-marked as necessary to ensure that the markings are clear and understood.
- H. In areas that are accessible to the public depressions or vertical projections in the walking/working surface that cause an elevation change greater than one-quarter (1/4) inch shall be covered to produce the same elevation as the surrounding areas or shall be ramped or beveled at a pitch that does not interfere with pedestrian or equipment travel. Where these depressions or vertical projections cannot be covered/ramped/beveled, they shall be barricaded to protect pedestrians and employees from the hazard.

### **IX. Incidents Involving Falls**

- A. If an employee falls, from any elevated height or at the same level, whether the fall is arrested by a PFAS, a Post Incident Review Meeting, as outlined in the HUEHS Incident Management and Prevention Exhibit, shall be held by the General Contractor.
- B. Following any incident involving a fall, whether injury or property damage is involved, the HUPM shall be notified.

### **X. Ladder Use**

- A. Employees will be permitted to perform work from portable ladders without the use of fall protection when all the following criteria are met:
  - 1. The working height of the employee (the step or rung height on which the employee is standing) is less than ten (10) feet;
  - 2. The work can be performed without the employee having to reach (i.e. the Employee's hips remain within the plane of the vertical side rails);
  - 3. The ladder is properly tied off or in the case of a stepladder, the spreaders are fully extended and locked;
  - 4. The ladder is erected no closer than fifteen (15) feet from an open edge, window, hole, or shaft, regardless of the presence or non-presence of guardrails, and;
  - 5. The Employee can safely maintain three (3) points of contact continuously while ascending or descending the ladder.

### **XI. Ladder Openings**

- A. Guardrail openings at points of ladder access must be equipped with a gate or an offset opening so that employees cannot walk directly into the openings.



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- B. All ladder openings shall be equipped with a rope, secured at the top of the ladder or ladder opening, to be used to manually hoist tools and materials up the ladder. The rope shall be capable of supporting at least twice that maximum anticipated load that could be hoisted.
- C. Ladders constructed and placed for use by more than one contactor (i.e. general-use access ladders) shall be the type that allows the user to walk-through the rails at the top of the ladder.

#### **XII. Lifeline Use**

- A. All lifeline training, installation, and use shall be in strict compliance with the manufacturer's recommendations and requirements. The owner's manual shall be kept on site at any time the equipment is being used and shall be produced upon request.
- B. Vertical lifelines shall be connected to their anchor points with a locking, self-closing snap hook, as defined in 29CFR Part 1926.500. Knots shall not be used to secure lifelines to anchor points.
- C. Horizontal Lifelines shall be either part of a manufactured system, used in the manner for which it was designed, or shall be designed by a Massachusetts-Registered Professional Engineer. Documentation of this design shall be kept on site at any time the equipment is being used and shall be produced upon request.
- D. All horizontal lifelines are to be installed and used under the supervision of a qualified person.

#### **XIII. Rescue Provisions and Plan**

- A. Each operation that involves the use of personal fall arrest systems shall be assessed for rescue needs, should the user of the PFAS fall. Rescue provisions shall be documented on the hazard analysis and shall be reviewed with the entire crew as part of the hazard analysis meeting.
- B. Where self-rescue is utilized as an option, a secondary rescue plan shall be provided, if the Employee is unable to self-rescue (i.e. unconscious or incapacitated).

#### **XIV. Roofing Activities**

- A. Where work is performed on or from a roof, roof area, terrace, or similar with unprotected sides and edges six (6) feet or more above lower levels, employees shall be protected by a guardrail system or personal fall arrest or prevention system. The use of safety monitoring systems is not allowed for fall protection purposes on roofs.
- B. Where roofing activities are conducted on roofs without parapets, or where work is conducted within six (6) of a roof edge, the area(s) below the roof shall be protected in accordance with Section V of this Exhibit.

#### **XV. Scaffolding**

- A. Fall protection requirements for scaffolds shall comply with the requirements outlined in 29CFR Part 1926.450 through 1926.452, and the manufacturer's recommendations and requirements, except as noted below.
- B. Where work is performed on or from any type of temporary elevated platform, supported or suspended, including its supporting structure with unprotected side and edges six (6)



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feet or more above lower levels, employees shall be protected by a guardrail system or personal fall arrest or prevention system. This requirement also pertains to scaffold erection and dismantling.

- C. Cross braces on scaffolds shall not be considered a top or mid-rail, regardless of the intersection height.
- D. The Competent Person shall clearly identify acceptable anchor points and train employees required to don personal fall arrest or prevention systems on a scaffold.
- E. No employees shall be permitted to enter the area at the base of the scaffold, or beneath any other overhead operation on scaffolding, particularly where outriggers are used. The area beneath the scaffold shall be protected in accordance with Section V of this Exhibit.
- F. Ladders or stairs shall be provided to access all levels of scaffolds where the change in elevation is equal to or greater than nineteen (19) inches.

#### **XVI. Stairways**

- A. Stairway construction and use shall comply with the requirements outlined in 29CFR Part 1926.1050 through 1926.1052.
- B. Stairways under construction shall not be used, except by those employees directly engaged in the construction of the stairway. Employees engaged in stairway construction who are exposed to falls equal to or greater than six (6) feet shall be protected from falling by guardrails, safety nets, or personal fall arrest or prevention systems.
- C. Stairways used during construction shall be kept free and clear of materials, equipment, and debris.
- D. Where work is performed in or from an active stairway, the stairway may remain open so long as a minimum travel width of thirty (30) inches is maintained, and no other hazards requiring special protection are present (i.e. welding/cutting, fall hazards, overhead work, etc.). The work area on the stair shall be cordoned off using caution tape, at a minimum. Where a thirty (30) inch travel width cannot be maintained, the stair shall be closed and cordoned off, so long as an alternate means of egress is provided.
- E. Work within active stairs must be coordinated so that alternate means of egress is continuously maintained, or the work shall be accomplished during off-hours, and with the permission of the HUPM. Pre-planning and coordination of work within active stairs is the responsibility of the General Contractor.

#### **XVII. Steel Erection and Precast Concrete Erection**

- A. Fall protection practices related to steel and precast concrete erection operations shall comply with the requirements listed in this Exhibit.
- B. Employees engaged in all activities related to steel and precast concrete erection, including rigging, connecting, decking, bolting-up, welding, etc. who are exposed to falls equal to or greater than six (6) feet shall be protected from falling by guardrails, safety nets, or personal fall arrest or prevention systems. The employer's **Competent Person** is responsible to ensure that adequate fall clearance is maintained during all phases of steel erection.
- C. Where a PFAS or PFPS is used during welding and cutting operations, the operator shall use fall protection equipment that is fire-resistant.
- D. The establishment of Controlled Decking Zones shall comply with Appendix D to Subpart R – Illustration of the Use of Control Lines to Demarcate CDZ's, except that the control



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line shall be set no closer than fifteen (15) feet from the leading edge. All employees working between the control line and the roof edge shall be protected from falling by means of a personal fall arrest or fall restraint system. Danger signs indicating that fall protection is required shall be placed along the entire length of the control line at intervals no less than ten (10) feet.

- E. All tools and equipment used during steel erection shall be secured against accidental displacement or falling. Canvas bolt bags shall be used for storing and carrying bolts, drift pins, etc. The handles of canvas bolt bags shall be reinforced with nine wire.
- F. Falling object protection, as outlined in Section V of this Exhibit, is required during steel and precast erection operations.
- G. Custody of Fall Protection.
  - 1. The General Contractor shall declare, at the time of bid, the entity or Contractor that will be responsible for the installation of guardrails during steel and precast erection operations.
  - 2. Prior to allowing any trades or Employees onto a working floor or an area of a working floor, all guardrails and floor covers must be installed. The General Contractor and Project Safety Manager must inspect the floor or area prior to turnover, and formally accept the conditions from the erector or other person responsible for installation of guardrails and covers. NOTE: Tradesmen or Employees, other than the erector, may be allowed onto a working floor prior to its official turnover, so long as the work required is directly related to the erection process (e.g. temporary lighting installation, inspection by the General Contractor, etc.) and the Employees on the floor are appropriately protected from falls and falling object hazards.

#### **XVIII. Wall Openings**

- A. Employees exposed to falls equal to or greater than six (6) feet through wall openings, as defined in Section I of this Exhibit, shall be protected by guardrails or personal fall arrest or prevention systems.

#### **XIX. References**

1926 Subpart M, Fall Protection