Northwestern

FACILITIES

FALL PROTECTION

Permanent fall prevention/protection measures must be included as an integral part of the design phase for all construction and renovation/repair projects. All walking/working surfaces where employees are exposed to fall hazards (i.e. roof systems, ladders, skylights and floor openings) shall be permanently guarded or have qualified anchorages for personal fall arrest systems.

The intent is to prevent exposure to fall hazards where possible and to protect University occupants and maintenance personnel that are exposed to fall hazards. Specifically, for safe access to all equipment associated with operations and maintenance, or other equipment. This includes, but is not limited to, HVAC equipment, windows, roofs, lighting, and fire safety equipment. Access must not put personnel at risk. In general, access should not require maintenance personnel provide equipment such as ladders or lifts. Access for exterior window washing is an exception to this rule.

All safe access and fall hazards associated with operations and maintenance should be identified, and design measures should be instituted to mitigate these hazards.

This document contains condensed descriptions of specific design criteria from the Occupational Safety and Health Administration's (OSHA) fall protection standards on guarding floor openings, wall openings, holes, fixed ladders, and fixed industrial stairs. If there are any conflicts between these design standards and applicable building codes, the more stringent requirements govern.

All new construction projects and renovations, alternations or repairs of existing roof systems, or roof mounted equipment must comply with the OSHA regulations and applicable building codes. In addition, any equipment installations or renovations of equipment that would subject personnel to fall hazards must incorporate fall protection solutions into the project design phase.

A qualified person with extensive experience in fall protection is required to plan, evaluate, design, and select the most appropriate fall prevention/protection solution. Building anchorages, tie-downs, and any other affected parts of the building shall be designed and certified by a registered Professional Engineer (PE) currently registered in Illinois with expertise in fall protection systems. A variety of fall protection solutions are available and it is important to select a system based on the specific building type, roof system, or work application. It is imperative that the designers consider the continuity of the fall protection systems selected throughout the campus. All fall protection system shall be designed and installed similarly with compatible components to reduce variability in fall protection systems on campus. Users of these systems must be trained on how to properly use, inspect, and maintain the selected fall protection systems.

During the design phase, the qualified person or designer must consider the following to prevent falls:

1. Safe access to or egress from any potential work area
2. Provisions for permanent guardrail systems or edge protection such as parapets that meet the height criteria established by OSHA (min. 42 inches)
3. Selection of material that can withstand harsh environments

4. Location of and safe access to equipment for maintenance, if possible place roof top equipment at least 15 feet away from unprotected sides and edges. This 15 foot distance is the current OSHA requirement for working and walking surfaces.
5. Identification and location of utilities that service the buildings
6. Use of fall-arrest systems and devices, including the provision of suitably located permanent rooftop anchorages and field identification of all required anchorage point locations.

There are two methods for fall protection compliance: Fall Restraint and Fall Arrest.

1. Fall restraint prevents personnel from entering a fall hazard. Parapets, guardrails are examples of fall restraint systems.
2. Fall arrest assumes that a person might not be safely restrained from a fall and must be arrested or caught during an actual fall event. Fall arrest systems must be designed for "over the side" work such as window washing, where personnel are supported using a swing stage or boatswain's chair.

The primary goal is to eliminate fall hazards where feasible. Architects, consultants, and project managers should consider that fall protection control measures are not intended to be used independently but in many cases a combination of controls should be implemented to prevent or reduce exposure to fall hazards. The hierarchy of controls should be considered where engineering controls are the first line of protection, and personal fall arrest systems are the last resort for protection. Below are some examples to consider:

1. Engineering Controls that are designed to eliminate hazards are the preferred method for protecting employees from or controlling exposure to fall hazards. Examples of engineering controls used to eliminate or reduce exposure are listed below:
    - Changing equipment or processes to control hazard (e.g. using aerial lifts to access work area)
    - Installing screens/gutter guards to reduce frequency of exposure
2. Passive Fall Protection Systems do not require operational involvement from the employee in order to be protected while performing work at elevated heights. Examples of passive systems are listed below:
    - Installation of guardrail systems
    - Construction of parapet walls meeting height criteria for guardrails
3. Active Fall Protection Systems begin with a qualified anchorage point and have components connected to the worker (body harness, lanyard, self-retracting lifeline, rope grab, etc). Active Fall Protection Systems require that employees understand when they are exposed to fall hazards and have a working knowledge of the fall protection system available for their protection. Proper training in the use of active systems is essential for an effective fall protection system.
4. Personal Fall Arrest Systems (PFAS) are considered active systems and shall be incorporated into the building design when elimination of the fall hazard or a passive system is not feasible. Examples of PFAS are listed below:
    - Fixed point anchors certified as an attachment point for workers that work locally
    - Horizontal Lifeline (HLL) systems to serve as an anchorage attachment for continuous fall protection
5. PFAS shall provide secure anchorages to arrest a fall while preventing the users from free falling more than six (6) feet. Anchorages must be easily accessible from the roof access in order to avoid fall hazards during connection to the fall protection system. Systems shall

provide uninterrupted access to the entire length of the structure without having to disconnect from the system to pass through intermediate support points. All PFAS shall be capable of supporting at least two (2) workers at a time. All essential components shall be designed and tested as part of the system in order to provide a complete and fully operational fall arrest system.

Specific Requirements

1. Fall protection must be provided for each employee working on elevated surfaces 4 feet above a lower level or whenever there is a possibility of falling onto dangerous equipment or into a hazardous environment, or where there are impalement hazards present. The listed examples are not all inclusive.
    a. Skylights - Every skylight shall be guarded by a standard skylight screen or a fixed standard railing on all exposed sides. Skylight screens must be capable of withstanding a load of at least 200 lbs applied perpendicularly at any one point on the screen. In addition, screens must be constructed and mounted such that when subjected to ordinary loads they will not deflect downward and break the glass below the screen.
    b. Flat or Low Slope Roof Systems - Employees engaged in work on low slope roofs shall be protected from unprotected edges of the roof by one or more of the following methods:
        - Approved Guardrail System or parapet wall meeting OSHA height criteria (min. 42 inches)
        - Employee use of a fall-restraint or fall-arrest system
    c. Steep Slope Roof Systems - Employees engaged in work on steep slope roof shall be protected from falling from all unprotected edges of the roof by one or more of the following methods:
        - Employee use of a positioning devices, fall-restraint, or personal fall-arrest system (e.g. PFAS or HLL)
    d. These guidelines are for use by Facilities Management Project Managers and Northwestern consultants on projects of all scales.
2. Mechanical equipment shall be placed only in areas where employees are protected by fall restraint or fall arrest systems. If possible place roof access and mechanical equipment on roofs at least 15 feet away from edges to avoid the use of PFAS.
3. The anchorage connectors and all components of fall arrest systems must be made of stainless steel or other corrosion resistant materials and comply with all sections of ANSI Z539.1.
4. A reduced roof plan showing all fall protection system locations, anchor load ratings, number of authorized users that may attach to the system at one time, date of initial certification, and name of registered professional engineer who certified the anchorages shall be provided.
5. A log shall be maintained on site with a thorough description of inspection and certification procedures. The certification test and inspection results shall be maintained and include the date and person performing the inspection and certification.
6. Fall protection design shall consider prompt rescue procedures in the event an employee is subjected to a fall using a fall arrest system.

The certified fall arrest system must be marked on as-built drawings with the PE seal.

1. Personal Fall Arrest Systems shall:
    a. Be rigged such that an employee cannot free fall more than six (6) feet or contact a lower level

b. Limit the maximum arresting force on an employee to 1800 pounds when used with a full body harness
c. Bring an employee to a complete stop and limit the maximum deceleration travel distance to 42 inches.
d. Have sufficient strength to withstand twice the potential impact energy of an employee free falling six(6) feet or the free fall distance permitted by the system, whichever is less.

2. The Life Safety strategies included here are not comprehensive; these guidelines are intended to provide ideas and not exclude any from consideration. The project team is encouraged to develop additional strategies and refer to current documents published by OSHA's fall protection regulations and ANSI Z359.1

For additional information please see Occupational Safety and Health Administration 29 CFR 1910.23-27, 1910.66 and 1910.132 ANSI Z359.1 Fall Protection Code, and Northwestern University Risk Management's Fall Protection Program: https://www.northwestern.edu/risk/environmental-health-and-safety/fall-protection-program.html. Specifically, the NU Risk Management Fall Protection Program has design criteria which, if not in conflict with codes and standards, should be included in a project design.