XVII. FALL PREVENTION / PROTECTION

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PROCEDURE FOR FALL PREVENTION

1. Fall Hazards

Definition. A fall hazard is created when a construction activity exposes an employee to an unprotected fall which may result in injury or death.

Fall hazards create the greatest exposure to injury on construction sites. These hazards include: 1) falls from elevation, 2) falls on the same level, and 3) being struck by falling objects. The most common hazard, falls from elevation, generally includes falls from ladders, from elevated workplaces, through floor openings, and from leading edges. Falls on the same level are usually caused by slipping and tripping hazards. Accidents involving falling objects are sourced by objects that are improperly stored, disposed of, or mishandled at elevation.

A. Fall Hazard Locations. To prevent fall hazards, it is necessary to recognize <u>where</u> falls are most likely to occur. Construction activities from the following locations require increased fall hazard awareness:

- Ladders
- Scaffolds
- Work Platforms
- Formwork
- Bridges
- Structural Steel
- Openings
- Reinforcing Steel
- Stay-in-Place Decking
- Cluttered/Congested Areas
- Excavations

Falls from any of these locations may occur while accessing, climbing, travelling, or working at elevation. Once the fall hazard locations have been recognized, the next step in the fall prevention process involves identifying the type of fall hazards that may occur at these locations.

B. Identifying Fall Hazards. Effectively preventing falls requires identifying, evaluating and controlling the fall hazards most likely to cause accident and injury. This effort can only be accomplished by organizing a team of participants (committee) representing each department of the construction company. This committee should be comprised of personnel representing production, engineering, estimating, and safety. These members should participate in a collaborative effort to identify, evaluate and control all fall hazards. Fall hazards can be identified by using the following methods:

- Interviews
- Job Site Inspections.

Interviews. The best way to identify fall hazards is to talk to the construction workers. Attempt to identify the construction activities performed at elevation, and how those activities are carried out. By asking the right questions, one can gain a better understanding of the work and its inherent hazards. The best employees to interview are those who have the most experience working at elevation (carpenters, laborers). Their insights can be invaluable not only in recognizing fall hazards, but in identifying practical means of control. The interview process may be conducted on an individual basis or in groups at safety meetings.

Jobsite Inspections. Another means of identifying fall hazards is to conduct a jobsite inspection of construction activities. Select both workers and their supervisors to identify elevated work locations, construction activities performed at those locations, and what is required to get the job done. Videotaping fall hazards is an excellent means of identifying and evaluating work at elevation. Taking still photos is another useful means of evaluating fall hazards. Jobsite inspections can also be performed by insurance carrier representatives.

C. Evaluating/Prioritizing Fall Hazards. Once a list of fall hazards has been identified, each hazard must be evaluated and prioritized in order of the most dangerous to determine which should be controlled first. To determine which fall hazards create the greatest exposure and potential for injury, consider the following factors:

- the frequency of exposure;
- the number of employees exposed;
- the likelihood of an accident occurring; and
- the potential severity of injury.

2. Fall Prevention

A. Definition. Fall prevention is any means used to reasonably prevent employee exposure to a fall hazards, either by eliminating work at elevation, using aerial lifts, scaffolds, work platforms with guardrails, or similar protection.

The key to fall prevention is to develop a plan, prior to construction, designed to eliminate exposure to fall hazards. Fall prevention planning involves an in-depth analysis of each construction activity that exposes employees to potential fall hazards. Based on this analysis, the contractor must select the most appropriate method of protection (elimination, prevention, or control). The primary objective during the planning phase of any construction activity should be disposing of the need for fall arrest equipment in favor of fall prevention measures that eliminate fall hazards.

B. Fall Prevention Measures. To be effective, fall prevention measures must be initiated in the planning and scheduling phase. The most desirable measures are those which provide an alternative approach to the work by implementing engineering controls and eliminating any fall hazard potential.

When elimination is not possible, prevention measures become necessary. Selecting the appropriate fall prevention measure(s) can only be determined after assessing the location of work and the type of construction activity performed.

Preventing falls involves providing proper access to the work location, protecting unguarded openings and leading edges, practicing good housekeeping, and engineering out hazardous exposures. The following is a list of fall prevention measures that should be implemented to avoid fall hazards:

a) Engineering Controls

- Implement engineering controls into the design process by interacting with designers, fabricators, and material suppliers to build safety measures into the structure, material, or equipment utilized during the construction process.

- Maximize the pre-assembly of structural components on the ground.

- Use mechanical pin extractors to disconnect rigging from the ground.

- Design holes and/or attachments for stanchions, lifelines, and retractable devices on structural components to permit assembly on the ground and provide protection at elevation.

b) Determining Alternative Approaches to the Work

- Question whether the construction activity can be performed alternatively without employee exposure to a fall hazard.

- Use radios to signal cranes and to communicate between employees and crews performing tasks such as wire pulling, testing, etc.

c) Providing Proper Access

- Includes correct installation and proper use of ladders, scaffolds, stair-towers, and stairways.

- Attach fall arrest systems (lifelines) to bridge steel and formwork before erection to accommodate safe access.

d) Providing Guardrail Protection

Designate the following work locations as requiring guardrail protection:

- elevated work platforms (such as on formwork);
- scaffolds;
- openings/holes in bridge decks, floors or other unprotected surfaces; and
- unprotected sides of ramps/stairways/platforms.

Additional fall prevention measures include using elevating equipment, performing work on the ground, practicing good housekeeping, protecting openings/holes, isolating areas below elevated work, and discussing fall prevention measures with employees. **All of these measures are intended to prevent the fall before its occurrence.**

3. Fall Protection

A. Definition. Fall protection involves using personal fall arrest equipment to prevent the completion of a fall and to reduce the possibility of resulting injuries.

Fall protection measures are taken when employee exposure to a fall hazard cannot be eliminated by using fall prevention measures. For example, climbing forms or rebar requires complete and continuous protection. Sometimes the only way to provide this protection includes using a self-retracting device anchored overhead and attached to the employee. This fall arrest system protects an employee while climbing by preventing a complete fall.

B. Fall Arrest Systems. A fall arrest system includes the proper anchorage, body support (harness/belt), and connecting means (lanyards/lifelines) interconnected and rigged to arrest a free fall. **The primary function of a fall arrest system is to minimize the consequences of a fall rather than preventing its occurrence.** The use of fall arrest equipment should be recognized as a means of minimizing injuries sustained from a fall. It does not prevent the fall.

A fall arrest system could be as basic as a safety belt connected to a six foot lanyard which is attached to a safe anchorage point. A more intricate system may include a vertical lifeline attached above the employee to an independent anchorage point and a rope grab connected to the vertical lifeline with a lanyard. The lanyard is then attached to a harness, making a complete fall arrest system. This system is typically used on a two-point suspension scaffold operation such as for finishing concrete walls.

A variety of fall arrest equipment is available to establish an effective fall arrest system. This equipment includes the use of full body harnesses, safety belts, lanyards, lifelines, retractable devices, rope grabs, safety nets, and associated hardware. The various components connected together make up a fall arrest system. Compatibility of these components is the key to their effectiveness.

Fall arrest systems are useful, but must be recognized as the least desirable fall protection method and should only be used as a last resort.

C. Selecting Proper Equipment. Establishing an effective fall arrest system begins with selecting the proper personal fall arrest equipment to protect the employee in the event of a fall.

Selecting the proper equipment should be based on:

- the task being performed;
- requirements for worker mobility;
- the number of employees requiring protection;
- the distance of potential fall;
- the presence of concrete, dirt, moisture, solvents, and other environmental factors.

The proper selection and purchase of safety equipment does not constitute a fall protection program. This is only one step. A complete, effective program ensures that: I) appropriate anchorage points are established; 2) proper inspection and maintenance procedures are enforced; and 3) workers are trained and supervised in the proper use and application of all equipment.

Notes: 1. **Final Rule.** OSHA's final fall protection rules, effective February 6, 1995, were published in the August 9, 1994, Federal Register. They apply to construction operations 6 feet (1.8 meters) above lower levels.
2. Other OSHA Standards apply specifically to use of temporary ladders. This rule assumes proper ladder tie off.

4. Components of a Fall Arrest System

The purpose of a fall arrest system is two fold: I) to stop the fall, and 2) to distribute the impact energy experienced during fall arrest. Fall arrest systems properly installed and used, can prevent or minimize possible injury. The three basic components of a fall arrest system include;

(a) Anchorage - Component and Structure
(b) Body Support - Full Body Harness, Safety Belt
(c) Connecting - Lanyards, Lifelines, Devices

Tip: All three must be compatible.

A fall arrest system requires identifying the proper anchorage. wearing the appropriate body support, and using a connecting means capable of attaching the worker to the anchorage. This system is designed to control a free fall and minimize injury. The key to any fall arrest

system is selecting the proper fall arrest equipment and engineering a system capable of protecting the employees in the event of a fall. A critical factor in the design of any fall arrest system is ensuring that all components (anchorage, body support, and correcting means) are compatible.

A. Anchorage. An anchorage is a secure point of attachment for lanyards, lifelines, or deceleration devices capable of withstanding the anticipated forces applied during a fall. **Anchorage planning is the key to designing fall arrest systems.**

The anchorage point should be positioned on an independent structure and used for securing a lifeline or lanyard. An anchorage point should be located above the worker to avoid unnecessary swing in the event of a fall. The anchorage point should be capable of supporting 5,400 pounds minimum strength for fall protection systems allowing free falls up to six feet. Alternatively, retracting lifelines permitting free falls of two feet or less require anchorage points capable of supporting only 3000 pounds.

Anchorage points must be engineered by a qualified person. This individual must be capable of determining the required strength, location and design of the selected anchorage to meet the requirements of the construction activity. Each anchorage point must be carefully planned into the job to provide continuous and complete protection during the work task.

Selecting anchorage points requires evaluating the following characteristics:

(a) Strength. The strength of an anchorage point is its most important characteristic because failure of any anchorage is likely to result in an unprotected fall.

The required strength for a fall arrest system ultimately depends on the potential forces applied and the integrity of the anchorage component selected.

(b) Independence. Anchorage points for fall arrest systems should be independent of the working platform and its anchorage.

(c) Height. The primary consideration in determining anchorage point height is to minimize free fall to the shortest distance possible. The shorter the free fall, the less impact force experienced during fall arrest.

(d) Clearance. The total fall distance must be determined to ensure the height and location of the anchorage is sufficient to prevent collision injury with the ground or other objects.

(e) Identification. Anchorage points must be identified by a qualified person. Employees should be educated about what is (and what is not) considered acceptable anchorage. When practical, anchorages should be labeled by painting the approved locations so workers know exactly where to secure for proper anchorage.

Anchoring Devices/Points

Non-Anchorages

- Structural Members
    - Railings
- Anchors/Fasteners
    - Guardrails
- Eyebolts
    - Rungs

- Imbeds
    - Pipe Vents
- Turnbuckles
    - C-Clamps
- Shackles
    - Bolt Holes
- Slings
- Retractables
- Cross Arm Straps

B. Body Support. Body support is the means of fall protection worn by an employee to minimize the consequences of a fall. Body support can take the form of either a body (safety) belt or a full body harness. Body supports are equipped with D-rings for the attachment of a connecting means, such as a lanyard or retractable device. The location of these attachment points is designed to meet the anticipated use of the body support. Specifically, full body harnesses are used to provide fall arrest while body belts provide work positioning and fall restraint protection.

Proper selection of a body support is determined by its anticipated use in conjunction with the construction activity or a fall arrest system. The two types of body supports, the full body harness and the body belt, have different uses and associated hazards.

The full body harness is preferable over the body belt because of its ability to distribute the forces over the body as opposed to the vulnerable mid-section, thereby minimizing injury. Additionally, the harness has a sliding D-ring which helps avoid excessive whipping of the neck during fall arrest. Another advantage of harness use involves permitting prolonged suspension in an upright position. This makes rescue easier and allows an employee to be suspended for prolonged periods of time (more than 30 minutes) without breathing restrictions or extreme discomfort. These advantages make the full body harness the most desirable body support.

C. Connecting Means. Connecting means secure an employee to an anchorage and include the use of lanyards, lifelines, and devices such as retractables and rope grabs. Selecting the appropriate connecting means requires matching the capability of the fall arrest equipment with the requirements of the work task. For example, where an employee is erecting formwork, the work task requires vertical and horizontal mobility while climbing the forms. The appropriate connecting means in this instance might include a retractable device which moves along a horizontal lifeline. However, if the employee is finishing a concrete wall from a two point suspension scaffold, then a rope grab attached to an independent lifeline would provide the necessary connecting means.

The key to selecting connecting means is determining the workers' mobility during the performance of the work task and providing the most practical means of protection. Whether to use a lanyard, lifeline, or device is dictated by the nature of the work. This choice is the key to controlling a fall hazard.

Most fall arrest systems utilize one or more of the following connecting means:

- Lifelines (horizontal, vertical)
- Lanyards
- Retractable Devices
- Rope Grabs
- Hardware (Snap Hooks, D-Rings, Shackles)

(a) Lifelines. Lifelines may be either vertical or horizontal lines.

A vertical lifeline extends from a fixed overhead anchorage point to the ground and is attached to a lanyard usually by a rope grab. The lifeline should be long enough to reach the ground and prevent the rope grab from running off of it. Vertical lifelines are commonly used on suspended scaffolds and/or where the construction activity requires only vertical mobility. On suspension scaffolds, using rope grabs, shock absorbing lanyards and full body harnesses is advisable.

Horizontal lifelines serve as anchoring lines that are rigged between fixed anchor points located at the same elevation. The purpose of a horizontal lifeline is to minimize potential swing falls by providing a constant overhead support as the worker moves horizontally. The lifeline serves as an attachment point for lanyards or retractable devices. Horizontal lifelines are commonly using during bridge steel erection and other construction activities where horizontal mobility is required. These lifelines should be positioned above the waist and designed by a qualified person knowledgeable in fall arrest loads, anchorage needs, and other erection requirements.

Inspection of vertical and horizontal lifelines for chafing, cuts, abrasions, and other defects is critical for longevity and operating efficiency. Synthetic lifelines of 5/8 inch nylon, polyester, or equivalent capability are preferable. Wire rope lifelines should be a minimum 1/2 inch extra improved plow-steel with a minimum breaking strength of 5,400 pounds.

Some common hazards associated with lifeline use include:

- improper installation of the lifeline;
- insufficient anchorage strength;
- overloading the lifeline with employees;
- improper positioning of the lifeline;
- lack of protection over sharp edges; and
- knotting of lines at anchorage points (which can reduce lifeline capacity in rope by 50 percent).

(b) Lanyards. A lanyard connects a harness to an anchorage point or to a device such as a retractable. A lanyard is a short, flexible rope or strap webbing. OSHA requires at least 1/2 inch diameter synthetic rope to be used as a lanyard.

A lanyard is designed to permit limited freedom of movement during work (2-6 feet). Minimum attachment height should be at or above the level of the D-ring to ensure the free fall distance will be less than 6 feet. The worker should be exposed to as little slack as possible to limit free fall distances.

Shock absorbing lanyards can be used to reduce the impact resulting from a fall and should be incorporated into the fall arrest system, especially when safety belts are used.

Lanyards are commonly used during work from aerial lifts, two-point suspension scaffolds, and other fall hazard locations where movement is limited. Lanyards are sometimes used to restrain a worker from approaching an unprotected opening or a leading edge.

Common hazards associated with lanyard use include:

- disregard for manufacturer's instructions;

- incorrect length;
- chokering the lanyard back onto itself;
- tying knots to shorten the lanyard;
- looping the lanyard over sharp edges; and
- weakening due to exposure to concrete, solvents, acids or welding/cutting operations.

(c) Retractable Devices. A retractable device attaches the body support (preferably a harness) to a lifeline or anchorage point. The retractable device functions as a deceleration device and features a locking mechanism designed to instantaneously arrest a free fall. The device contains a self-retracting lifeline (cable, rope, webbing) which extends and automatically retracts as the worker climbs up or down. The retractable device operates on the same principle as an automobile seat belt. The device is activated the moment a fall occurs limiting the workers' free fall to approximately 18 inches and thereby reducing the forces applied at impact.

Retractable devices are used during climbing operations or in conjunction with horizontal lifeline systems. These devices are useful for climbing protection on formwork, reinforcing steel, structural steel, and pile driving leads. Retractables should be installed minimally above shoulder height at the highest point of climb and can be accessed by a tag line. For example, retractable devices can be attached to formwork on the ground. Then when the form is raised into position the employee can use a tagline to access the devices cable and hook-up at ground level for continuous protection while climbing.

Some hazards associated with the use of retractable devices include:

- cable kinking and accumulating dirt/concrete;
- failure to properly maintain and service the device according to the manufacturer's recommendations;
- improperly using or installing the device; and
- not removing the device from service once a fall has been arrested.

(d) Rope Grabs. The rope grab connects the lanyard to the lifeline and allows employees vertical movement. Rope grabs are designed to arrest a fall mechanically, bringing the worker to a complete stop. Rope grabs may be manually operated or travel freely on a lifeline. They should be located at the highest possible elevation on the lifeline to minimize the fall distance. A shock absorbing lanyard (3 feet maximum) can be used with the rope grab to increase lateral movement and minimize the arresting forces on the employee and fall arrest system.

Rope grabs are typically used on two-point suspension scaffold operations such as finishing concrete walls and during pile driving operations which require the use of bosun-chairs.

Common hazards associated with rope grab use include:

- incompatible lifelines, snap hook attachments, or lanyards;
- worn locking arms or other mechanical parts; and
- using the rope grab upside down.

(e) Hardware. Hardware consists of snap hooks, D-rings, carabiners, shackles, and other rigging components used to connect the various components of a fall arrest system.

Snap hooks are a self-closing connecting device with a gatekeeper latch that remains closed until manually released. They are part of a lanyard or device which are commonly attached to a D-ring. Double-locking snap hooks should be used to eliminate the risk of "roll-out." Roll-out occurs when the snap hook disengages at the D-ring by a twisting force.

D-rings are attachment points on the harnesses or the safety belt for a lanyard or device.

A carabiner is an oblong snap hook which is commonly secured to an anchorage to support a device such as a retractable. Shackles and similar rigging hardware are also commonly used as connectors.

All hardware must be compatible and properly used and maintained to ensure maximum efficiency as a fall protection device.

Summary. The primary function of fall arrest equipment is to provide complete and continuous protection while accessing and working at elevation. To provide this protection:

- keep the free fall distance to a minimum, preferably two feet or less;
- use a full body harnesses to minimize fall arrest forces, create comfortable prolonged suspension, and to accommodate rescue;
- eliminate dangerous swing fall hazards;
- plan rescue; and
- ensure that fall protection is preplanned and implemented into the work task.

The key to designing any fall arrest system is to ensure that the anchorage, body support. and connecting means are <u>compatible</u> with one another. This will assure maximum effectiveness and continuous protection.

5. Developing a Program

Developing a fall prevention program is initiated by establishing a committee comprised of managers, field supervision, labor, engineering personnel, and a safety representative. This committee should work in a collaborative effort to:

- develop the essential elements of a program, and
- become familiar with the methods of protection and the available technology for controlling fall hazards.

Once these objectives have been achieved, a fall hazard awareness program should be initiated by providing education and training.

The actual development of a fall prevention program involves the following seven steps:

Step 1 — <u>Write a policy</u> and <u>define the scope</u> of the program.

Step 2 — <u>Identify fall hazards.</u>

Step 3 — <u>Determine appropriate methods of protection</u> (eliminating, preventing, or controlling the fall).

Step 4 — Conduct education and training to ensure effective employee understanding of fall hazards and precautions.

Step 5 — Perform inspection and maintenance of fall arrest equipment and systems.

Step 6 — Administer and audit the program for compliance and continuous improvement.

Step 7 — Develop a site-specific fall prevention work plan for each construction project. This plan should include all the elements (steps) outlined in the company's fall prevention program.

The first six steps are outlined below.

Step 1: Write Policy/Define Scope. An effective program begins with a policy statement that expresses the intent of the company regarding all elevated work.

Policy. An example of a policy statement might be:

Employment at **(Company Name)** jobsites shall be free from all "recognized" fall hazards.

This statement should be signed by me president of the company.

Scope. The scope of the company policy should establish a working height as a minimum guideline for providing complete and continuous protection. The scope of the fall prevention plan should also identify elevated work locations requiring protection.

All employees exposed to a potential free fall greater than _____ feet are required to be protected. This _____ foot requirement applies to all openings, leading edges, work platforms, and surfaces under construction. Emphasis is also placed on providing ground level fall protection and falling object potential.

The key to an effective fall prevention work plan is establishing a minimum height for protection, determining the appropriate method of protection, and selecting the proper fall arrest equipment.

Step 2: Identify Fall Hazards. Identification of jobsite fall hazards begins by analyzing construction operations requiring elevated work (e.g. building concrete walls, or placing structural steel). The next step involves defining each elevated work task required to perform that construction operation. The final step involves identifying the specific fall hazards which can occur during each work task as well as while accessing to and egressing from the work location.

The key to identifying fall hazards is breaking the construction operation down into the required work tasks and listing the associated fall hazards that occur during each task.

It is also important to identify the hazards associated with accessing/egressing work locations and the required work task mobility.

The primary objective is to minimize potential fall hazards by controlling the most frequent work task with the greatest probability for injury.

Step 3: Determine Appropriate Methods of Protection. The three primary methods of protecting workers from a fall include:

- Elimination — eliminating the fall hazard;
- Prevention — preventing employee exposure; and
- Control — controlling the fall.

The most critical and perhaps difficult decision in designing a fall arrest system is selecting the appropriate method of protection. The selection process for controlling fall hazards must be carried out with the guidance of qualified personnel who are experienced in a wide range of methods and equipment. Preplanning is the key to selecting and implementing the most appropriate method of protection. **The fundamental principle underlying the selection process is that it is more reliable to depend on engineering controls, which provide automatic protection, than to depend on human behavior to control hazards.**

(a) Elimination. The elimination of fall hazards is the first and primary means of preventing falls from elevation. This method of protection requires careful assessment of the work to be done and how to accomplish that work safely. By evaluating the location of work and the type of construction activity, one can determine the inherent fall hazards associated with the work and its location. Once the fall hazards have been identified, practical means of eliminating the hazard must be preplanned into the construction process. This may include developing a different way of performing the work while maintaining or even enhancing productivity. The idea is to design safety into the construction process rather than address it as an afterthought.

Examples of eliminating fall hazards include:

- performing as much work on the ground as possible to eliminate the hazard of climbing/working at elevation; and
- assembling guardrail systems and fall arrest systems on formwork and/or structural steel at ground level rather than at elevation.

(b) Prevention. Preventing employee exposure to fall hazards should be given second consideration when a hazard cannot be entirely eliminated. This method also requires assessment of the construction activities and the hazardous work locations. Consideration must be given to planning effective, permanent means of fall prevention and to making changes to the elevated work locations. Taking these measures precludes the need to rely on the employees behavior and the use of fall arrest equipment.

Examples of fall prevention methods include:

- guardrail systems;
- aerial lifts; and
- stairs, ramps, runways.

(c) Control. Controlling a fall is the least desirable method of protection because it minimizes the consequences of a fall rather than prevent its occurrence. It should only be considered after determining that the fall hazard cannot be eliminated or the possibility of falling prevented. This method of protection requires the use of personal fall protection equipment to prevent a complete fall and to reduce the risk of injury. Preplanning considerations should include the selection of fall arrest equipment and the proper way to install and use it correctly.

Step 4: Conduct Education and Training. Education and training are the key to making employees aware of the need for and use of fall prevention and protection methods.

Education provides employees with the knowledge to understand the appropriate methods of protection (elimination/prevention/control) and the capabilities and limitations of fall arrest equipment/systems. Training provides employees with a skill, namely applying fall protection principles, techniques, and equipment operation.

Step 5: Perform Inspection and Maintenance. Fall protection systems and equipment must be inspected and maintained regularly. Inspection and maintenance procedures apply to guardrail protection, aerial lifts, covers and barricades for openings, and the use of personal fall arrest equipment and devices including safety nets. Because these systems and equipment are designed to prevent serious or fatal injury, visual inspections before each use and regular inspection and maintenance are vital. This should be performed in accordance with the manufacturers guidelines and written company procedures.

Each worker must be instructed how to use, inspect and maintain equipment properly. This instruction should address the following measures for using fall arrest equipment and devices:

- understand how the equipment/device works;
- inspect it frequently;
- use it properly;
- keep it clean; and
- store it properly and securely.

Step 6: Administer/Audit Program. Administration of the program should be assigned to jobsite supervisors with designated responsibilities (e.g. who selects/distributes fall arrest equipment, who provides training, who designates anchorage points, etc.). To enhance program effectiveness, the jobsite superintendent should be given the authority to implement the company program, to delegate responsibility, and to ensure compliance.

Auditing a program involves evaluating the effectiveness of the fall prevention program. It is an opportunity to determine if previously established policy and objectives have been met and to decide what changes (if any) are required. Audits are required to continually improve any program, and are based on feedback from supervisors and employees.

Appendix
Model Fall Protection Program

Fall Protection Policy

(Company Name) is committed to continuous Fall Hazard Control wherever the potential exists for personnel falls from heights of at least 6 feet. **Accordingly, (Company Name)** will take all practical measures to eliminate, prevent, and control fall hazards. Work sites and activities shall be surveyed to identify all hazards of personnel falling from elevations. First consideration shall be given to the elimination of those hazards and, if a fall hazard cannot be practically eliminated, second consideration shall be given to implementing effective permanent means of fall prevention.

If a fall hazard cannot be eliminated or fall prevention assured, effective fall protection means shall be planned, implemented, and carefully monitored to control the risks of personnel injury due to falling. Fall protection systems shall be continuous by design and supervision shall control against their intermittent or improper use.

All personnel (and their supervisors) working where fall hazards cannot be eliminated or the onset of falls prevented, shall be uniformly equipped, trained, and given refresher training at specified intervals to minimize adverse effects of accidental falls. Fall protection equipment and training standards shall be established and compliance with the same shall be mandatory for all organizations. Furthermore, compliance by outside cont.-actors shall be required when working on (Company Name) projects. No Exceptions!

Hierarchy of Preference of Controls

By the term "Safety at Heights," we embrace three topics; the elimination, prevention, and control of falls. Here is what this means to **(Company Name).**

> **Elimination of Fall Hazards.** Elimination of fall hazards is the first and best line of defense against falls from heights. This task requires careful assessment of the workplace and the work itself. The "who, what, when, where, why, how, and how much" of each exposure is considered. Often, pre-consideration of the work and site not only leads to elimination of the hazard, but also identifies alternative approaches to the work that can measurably enhance productivity. The idea is to design safety directly into the work process and not simply try to add safety as an afterthought to an inherently unsafe work procedure. Examples include but are not limited to: servicing a pile hammer when laid down; back filling abutments, walls, etc., before employees access structures; using radios for signaling instead of employees hanging over the edge giving signals; and other mechanical devices that can be controlled from the ground.
>
> **Prevention of Falls.** Preventing falls is the second line of defense when fall hazards cannot be entirely eliminated. This also requires assessment of the workplace and work process. It involves making changes to the workplace so as to preclude the need to rely on the worker's behavior and personal protective equipment to prevent falls. Examples include but are not limited to: use of stairs, guardrails, barriers, and travel restriction systems to prevent the worker from direct and unprotected exposure to the fall hazard. These techniques deal with preventing the fall before the onset.
>
> **Control of Falls.** Controlling falls is the last line of defense. It should be considered only after determining that the fall hazard cannot be eliminated or the possibility of falling prevented. This is the domain of fall protection, and calls for equipment such as: safety nets or harnesses, lanyards, shock absorbers, fall arresters, lifelines, and anchorage connectors. It deals with reducing the risk of injury in falling after onset of the fall. This fall

protection also necessitates workplace and work process assessment and planning in order to select the proper equipment, installation, and proper use of gear.

Fall Hazard Control Function and Staffing

Execution of the **(Company Name)** Fall Protection Policy requires participation by all company employees, subcontractors, and other onsite personnel. This necessary participation may be achieved through one of several different means. The most common is a Weekly Safety Meeting discussion and job specific training for applications requiring fall protection as work progresses.

Identification of Fall Hazards

It is the primary responsibility of the **(Company Name)** jobsite supervisor to assure that all fall hazards are: (1) identified, (2) evaluated, and (3) controlled. There are at least four basic ways to identify fall hazards.

> **Accident/Incident Record Review.** Accident/incident records that give a description of how an accident or incident occurred can be helpful. You may find the work and condition that led to a previous fall is still being performed in the same way at that same location. Or, you may realize that this work is being performed at other locations in the same hazardous way.
>
> **Canvas Surveys.** Canvas surveys have the advantage of being able to obtain information from a large number of workers relatively easily. Although surveys sometimes give incomplete information, they may also reveal a lack of awareness in the work force which is useful to know in planning future training, instruction, and warning steps.
>
> **Interviews.** The best way to identify fall hazards is to talk to the workers themselves. Sometimes the worker will not actually recognize the hazard and may not appreciate the risk of injury or the likelihood of the fall taking place; but they will know the work that they do at heights and how they do it. Consequently, we can access their knowledge by asking the right questions.
>
> **Fall Hazard Inspection Surveys.** Another effective way to identify hazards is to invite experienced workers to assist with a walk-through tour of operations. Workers and their supervisors can point out the various places they have to work and can explain what they do to get the job done.

Evaluation of Fall Hazards

Once a list of fall hazards has been collected, each hazard must be evaluated and prioritized in order of the most dangerous to determine which should be controlled first. As hazards are identified, it will be found that some can be controlled immediately. Therefore, address these as rapidly as possible since there is no objective scientific method to make the distinction between those hazards most likely to produce harm with those least likely to produce harm. However, there are three factors related to fall hazards which would likely effect the severity of the injury and the possibility of the fall occurring.

> **Likely Consequence Rating.** The first consideration in **the** process of evaluating the list of fall hazards is to analyze and determine the likely consequence of a fall for each hazard. Segregate the hazards most likely to result in death or serious physical harm from those less likely to result in death or serious injury.

Probability of Occurrence. The next consideration is the probability or likelihood of an accident occurring. After selecting hazards which will likely result in death or serious physical harm, segregate those most likely to occur from those least likely to occur. Some of the factors affecting probability are:

Proximity to Edge. Workers who must traverse or perform their work at the edge or within 3 feet of the edge of the fall hazard.

Type of Walking/Working Surface. Workers traversing or working on ice, snow, oily surfaces, surfaces with trip hazards near the edge, and surfaces not recently inspected for capacity verification.

Type of Work Performed. Workers who must push or pull tools or material are more likely to lose their balance and fall. Also, workers who cannot maintain three point contact (two feet and one hand or two hands and one foot).

Particularly Dangerous Work. Workers who must maintain good balance while walking I-beams; workers who must jump across floor openings or across edges; workers exposed to high winds; workers in poorly lit areas or who work over water.

Exposure Time. The longer a worker is exposed to a hazard, the greater the likelihood of an accident occurring. Thus, exposure time is a function of the frequency of exposure, the duration of the exposure, and the number of workers exposed.

Exposure Time = (Frequency of Exposure) ×
(Duration of Exposure) × (Number of Workers Exposed)

Feasibility of Implementation of Effective Controls. Some hazards can be simply and inexpensively eliminated or controlled. Other hazards require relatively large expenditures and greater difficulty from an engineering and design point of view.

In any event, the goal is to provide the greatest amount of protection in the shortest amount of time. We can do this by first isolating the hazards most likely to result in death or serious injury, as well as those easiest to eliminate or prevent in order to provide the greatest protection in the shortest amount of time. However, always keep in mind that hazards of less than 6 feet can, and have, resulted in death, paralysis, brain damage, etc. Also, hazards which may appear to be less likely to result in accidents can produce more than their share of injury. Unfortunately, there is no simple way to predict with certainty where and how an accident will occur. Therefore, we must establish plans to eliminate, prevent or control to the extent feasible <u>all</u> fall hazards which have been identified.

The Bottom Line

Five construction workers are killed each day in America due to falls from elevated surfaces. Falls are the number one cause of serious injuries in construction. Therefore, OSHA has prioritized fall protection enforcement and **(Company Name)** will implement 100 percent fall protection to protect our employees and eliminate needless losses from falls. This will be enhanced through training, supervisor monitoring, and most importantly, from employees who support Zero Lost Time Safety Excellence. And as always, the safety department will be available for technical support and advisement.

Appendix
Terms/Definitions

1. **Anchorage —** a secure point of attachment for lifelines, lanyards, or deceleration devices capable of withstanding the anticipated forces applied during a fall.

2. **Body Belt —** a work positioning (safety) belt, designed to **fit around** a **workers' waist** and used in conjunction with a lanyard, lifeline or rebar assembly. Body belts (single or double D-ring) are designed to restrain a person in a hazardous work position and to reduce the possibility of falls. They should "NOT" be used when a fall potential exists, but for positioning only.

3. **Body Support —** a belt or harness consisting of single or multiple straps that are arranged and assembled for the purpose of providing body support both during and after a fall arrest. The body support is designed to distribute arresting forces over the body (e.g. full body harness).

4. **Competent Person — an** individual knowledgeable about fall protection equipment and systems, including the manufacturer's recommendations and instructions for the proper erection, use, inspection, and maintenance. This person is capable of identifying existing and potential fall hazards and has the authority to take prompt corrective action to eliminate those hazards.

5. **Connecting Means —** a device, lanyard, or lifeline used to connect the body support to the anchorage in such a way as to provide protected movement during an elevated work task.

6. **Fall Arrest System —** includes the proper anchorage, body support (belt/harness) and connecting means (lanyards and lifelines) interconnected and rigged to arrest a free fall.

7. **Fall Hazard —** occurs during any construction activity that exposes an employee to an unprotected fall which may result in injury.

8. **Fall Prevention —** any means used to reasonably prevent exposure to an elevated fall hazard, either by eliminating work at elevation or by using aerial lifts, scaffolds, floors, guardrails or isolating an area.

9. **Fall Protection —** involves using fall arrest equipment and systems to minimize the effects of a fall once it has occurred.

10. **Fall Protection Work Plan —** a written plan in which the employer identifies all areas on the jobsite where a fall hazard exists. The plan describes the method(s) of fall protection necessary to protect employees, and includes safe work practices required during the installation, use, inspection, and removal of the fall protection method selected.

11. **Fall-Restraint System —** an approved device and any necessary components that function together to restrain an employee in such a manner as to prevent that employee from the exposure of falling to a lower level. When standard guardrails are selected, compliance with applicable regulations governing their construction and use shall be followed.

12. **Full Body Harness —** a body support configured of connected straps to distribute a fall arresting force over at least the thighs, shoulders and pelvis. The harness provides a D-ring for attaching a lanyard, lifeline, or deceleration devices.

13. **Horizontal Lifeline —** provides an attachment for the worker's lanyard or other fall arrest device to protect him while moving horizontally and to control dangerous swing falls. It may be a cable or wire rope that is installed horizontally, and that serves as an anchoring line rigged between two or more fixed anchorages on the same level. Horizontal lifelines must be positioned above waist high on a worker and all horizontal lifelines and their installation should be approved and supervised by a qualified person.

14. **Lanyard —** the connecting means (rope, webbing) used to attach a body belt or harness to a lifeline or an anchorage point. Lanyards are usually 2, 4, or 6 feet long and come with or without a shock-absorber.

15. **Leading Edge** — the advancing edge of a floor, decking or formwork which changes location as additional sections are placed. Leading edges not actively under construction are considered to be "unprotected sides and edges," and appropriate methods of fall prevention shall be required to protect exposed workers.

16. **Qualified Person —** a person who by reason of education, experience or training is familiar with the operation to be performed and the hazards involved. The design of fall arrest systems must be engineered by a qualified person.

17. **Rope Grab —** a fall arresting device that provides employees protection while moving in the vertical direction (such as climbing). Rope grabs are designed to move up or down a vertical lifeline which is suspended from a fixed overhead anchorage point. The vertical lifeline is independent of the work platform and is attached to a harness by a rope grab and lanyard. In the event of a fall, the rope grab locks onto the lifeline to arrest the fall. The use of a rope grab device is ideal for fall protection during work from two-point suspension scaffolds.

18. **Safety Monitor System —** a system used in conjunction with a warning line system. A competent person is assigned, as his sole duty, to monitor the proximity of workers to fall hazards when working between the warning line system and the unprotected sides and edges of a work surface.

19. **Safety Nets** — used to provide passive fall protection under and around an elevated work area.

20. **Self-Retracting (Retractable) Lifeline —** a deceleration device which contains a drum--wound line which may be slowly extracted from, or retracted onto, the drum under slight tension during normal employee movement, and which after onset of a fall, automatically locks the drum and arrests the fall. This device limits the fall to approximately 18 inches, and is used during climbing operations or with horizontal lifeline systems.

21. **Shock Absorbing Lanyard —** a flexible line of webbing, cable, or rope used to secure a body belt or harness to a lifeline or anchorage point that has an integral shock absorber. The shock absorbing affect minimizes the forces distributed to the employee and anchorage points.

22. **Unprotected Sides and Edges —** any side or edge of a form, deck, floor, or structure where there is no protection from a falling hazard.

23. **Warning Line System —** a barrier erected on the working surface to warn employees they are approaching an unprotected fall hazard.

Appendix
Equipment Suppliers

1. **DBI/SALA, D B Industries, Inc.,** (800) 233-4019 (MN), P.O. Box 46, Red Wing, MN 55066, (800) 328-6146

2. **Gemtor, Inc.,** 1 Johnson Avenue, Matawan, NJ 07747, (908) 583-6200

3. **Klein Tools,** 7200 McCormick Blvd., Chicago, IL 60659, (708) 677-9500

4. **Miller Equipment,** 1355 15th St., Franklin, PA 16323, (800) 873-5242

5. **Research & Trading Corporation, (RTC),** 3101 North Market Street, Wilmington, DE 19802, (800) 441-7593

6. **Rose Manufacturing Company,** 2250 South Tejon Street, Englewood, CO 80110, (800) 722-1231

7. **Swing Stage Supply Inc.,** 315 Cloverleaf Drive, Unit #E, Baldwin Park, CA 91706, (818) 937-6727

8. **The Sinco Group, Inc.,** P.O. Box 361, One Sinco Place, East Hampton, CT 06424, (800) 243-6753

9. **United Form Services Inc.,** 417 Main, P.O. Box 28, Neodesha, KS 66757, (316) 325-3101.

Appendix
References

Product Literature

1. Fall Protection Tips, J. Nigel Ellis, (1992) Research and Trading Corporation, Wilmington, DE, (302) 762-4300.

2. The Fall Protection Handbook. The Sinco Group Inc., East Hampton, CT, (800) 2436753.

Standards

1. OSHA's Construction Standards, Title 29 Part 1926 (Latest Revision), Superintendent of Documents, Washington, D.C., (202) 783-3238.

2. American National Standards Institute (ANSI) ANSI Z;359.1-1992, "Safety Requirements for Personal Fall Arrest Systems," New York, NY, (212) 642-4900.

3. American National Standards Institute (ANSI) ANSI A10.14 — 1991, "Belts and Lanyards," New York, NY (212) 642-4900.

Training

1. "Principles and Applications of Elevated Fall Hazard Control" (3-Day Seminar); Dynamic Scientific Controls, 3101 N. Market Street, Wilmington, DE 19802, (302) 762-4304.

2. "Safety At Heights and in Confined Spaces" (2 1/2 — Day Seminar); Rose Manufacturing, 2250 South Tejon Street, Englewood, CO 80110, (303) 922-6246.

Consultants

1. Dynamic Scientific Controls — Consultants in Occupational Fall Protection Safety Planning & Commercial Egress Systems; Wilmington, DE, (302) 762-4304.

Articles

1. "Fall Protection Equipment, Selection and Program Development," Best's Safety Directory, V.I. A.M. Best Company, Oldwick, NJ, (908) 439-2200.

2. "Fall Protection," (July 1990) Construction Safety, Construction Safety Association of Ontario, Toronto, Canada, (416) 366-1501.

3. "Fall Arrest Equipment: Uses and Requirements," Center for Excellence in Construction Safety Newsletter, West Virginia University, October 1988, Morgantown, WV, (304) 293--6142.

Books

1. Introduction to Fall Protection (2nd Edition-1994), J. Nigel Ellis, American Society of Safety Engineers, Des Plaines, IL, (708) 692-4121, Ext 18.

2. Fundamentals of Fall Protection (1991), Andrew Sulowski, Ontario Hydro, Ontario, Canada, (416) 231-9679.

Associations

1. International Society for Fall Protection, 800 Kipling Avenue, KB214, Toronto, Ontario, Canada M8Z554, (416) 231-4111 Ext. 6298.

2. National Safety Council, 1121 Spring Lake Drive, Itasca, IL 60143, (708) 285-1121.

3. American Society for Safety Engineers, 1800 E. Oakton Street, Des Plaines, IL 60018, (708) 692-4121.