

Systems of Safety
Applied to Focus-Four Hazard Categories
Four-Hour Workbook
First Edition



*University of Medicine & Dentistry of New Jersey (UMDNJ),
School of Public Health (SPH)
Office of Public Health Practice (OPHP)*

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Federal Disclaimer

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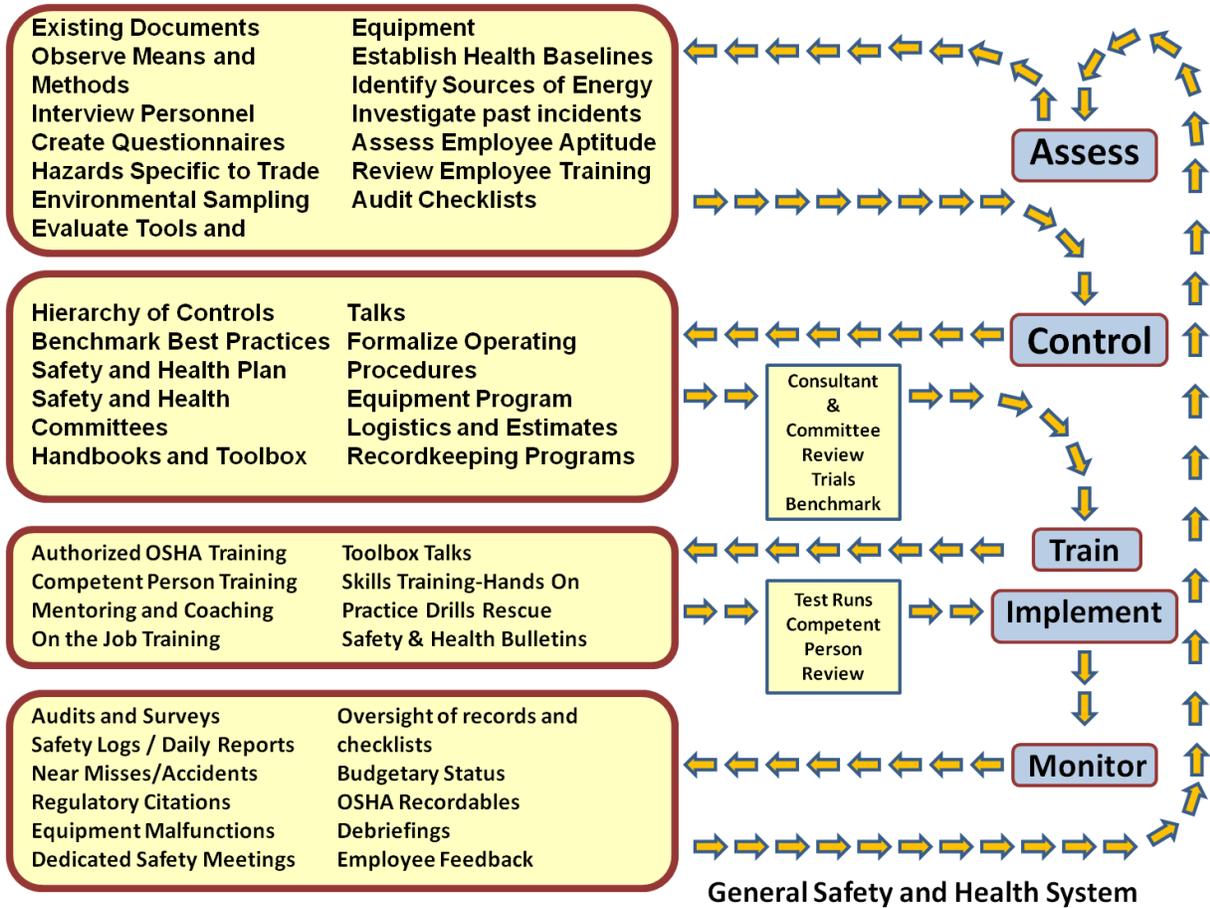
Module One: Systems

Section One: Introduction: Systems of Safety

This systems approach to safety and health is a holistic way of looking at the construction processes we perform and determining how to apply means, methods and strategies to help make them flow more consistently. We start this discussion by examining what is meant by a system, and demonstrate how construction processes are systematic, consisting of many participants, materials and equipment. It is our goal to help all stakeholders realize that they must actively participate in the process in order for the system to work successfully. Knowing the respective roles within safety systems helps us work together to prevent and avoid incidents which are actually system malfunctions added to by the loss of life and great hardship. If participants, inside a given system, support each other, the system will stand successful and safely accomplish its collective goal, purpose or mission. When we work together on jobsites and know our role inside of our own system, we help perpetuate the greater system and ourselves.

The Occupational Safety and Health Administration requires that employers working in the United States assess the work environment, plan how to protect workers, train workers, and monitor their activities assuring the effectiveness of such safety and health measures. In many respects, this protective responsibility often extends to other entities such as the controlling contractor. Each employee engaged in construction activities should be able to recognize and avoid unsafe conditions and work with other participants to support the greater whole. This is best achieved, by implementing a system that clearly defines roles and responsibilities and encourages the active participation of all stakeholders.

How does a System of safety work?



Module One: Systems

Section Two: Rights and Responsibilities

What are some of your rights and responsibilities under OSHA?

Employers must:

The employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees.

Employers must:

Assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment (PPE). If such hazards are present, or likely to be present, the employer shall:

- *Select, and have each affected employee use, the types of PPE that will protect the affected employee from the hazards identified in the hazard assessment;*
- *Communicate selection decisions to each affected employee; and*
- *Select PPE that properly fits each affected employee.*

Employers must:

Inform employees of the existence, location and availability of your medical and exposure records when you first begin employment and at least annually thereafter. Employers also must provide these records to you or your designated representatives within 15 working days of your request.

Employees can:

File a complaint with OSHA if you believe that there are either violations of OSHA standards or serious workplace hazards.

Employees can:

Request information from their employers on safety and health hazards in the workplace, chemicals used in your workplace, tests the employer has done to measure chemical, noise and radiation levels, precautions they should take and procedures to be followed if you or other employees are involved in an incident or are exposed to hazardous chemicals or other toxic substances.

Employees can:

Request copies of appropriate standards, rules, regulations and requirements that your employer should have available at the workplace.

Employees can:

Review the Log and Summary of Occupational Injuries and Illnesses (OSHA 300) at a reasonable time and in a reasonable manner or have an authorized representative do so for you.

Employees can:

Access relevant exposure and medical records.

Employees can:

File a complaint with OSHA if you believe that there are either violations of OSHA standards

or serious workplace hazards and request OSHA to conduct an inspection.

Employees Should:

Get involved in any meetings or hearings to discuss any objections your employer has to OSHA' s citations or to changes in abatement deadlines.

Employees Can:

File a discrimination complaint within 30 days if you are punished or discriminated against for exercising your safety and health rights or for refusing to work (not guaranteed by the OSH Act) when faced with an imminent danger of death or serious injury and there is insufficient time for OSHA to inspect.

Module One: Systems

Section Three: Applying Controls

Once an employer has observed, assessed, and identified hazardous vulnerabilities within a company or organization, they must seek to control unsafe conditions or practices by deliberate and methodical controls. In a successful system of safety, you should be familiar with these controls and

A. Hierarchy of Controls

Performing a Job Hazard/Safety Analysis JHA/JSA is fundamental to controlling events that could cause harm to employees or property. Since it is always best to work through some delineated structure to avoid haphazard and arbitrary guesswork, safety and health professionals have long used the Job Hazard

Analysis (JHA), also commonly referred to as Job Safety Analysis (JSA) along with an applied hierarchy of controls. Just as a checklist may guide us through a walk-through audit on a worksite, so does the structure of a JHA/JSA and a hierarchy of controls guide us when applying controls to our workplaces. Keep in mind that you always want to start to select controls first from the most protective choices and work your way downward, only discounting more protective controls because of infeasibility. Nearly every job can be broken down into smaller job tasks or steps. When beginning a job hazard analysis, watch the employee perform the job and list each step as the worker takes it. Be sure to record enough information to describe each job action without getting overly detailed. Avoid making the breakdown of steps so detailed that it becomes unnecessarily long or so broad that it does not include basic steps. You may find it valuable to get input from other workers who have performed the same job. Later, review the job steps with the employee to make sure you have not omitted something. Point out that you are evaluating the job itself, not the employee's job performance. Always keep in mind that employee involvement is critical to ultimate success of our venture, so include the employee in all phases of the analysis—from reviewing the job steps and procedures to discussing uncontrolled hazards and recommended solutions.

Job Hazard/Safety Analysis Matrix

Task	Hazard	Control	Means of Implementation
Break tasks down to smaller sub-tasks.	List all possible associated hazards preferably in an order of severity	Use the Hierarchy of Controls 1. Elimination 2. Engineering 3. Mitigation	Should set out procedures that are easy to understand and accomplish in the field. Include the use equipment and requisite training and administrative

A job hazard analysis is a technique that focuses on job tasks as a way to identify hazards before they occur. It focuses on the relationship between the worker, the task, the tools, the work environment and the necessary steps to control a hazard.

B. Written Health and Safety Plan (HASP)

Committing a plan to writing formalizes and makes the plan easier to follow with less misunderstandings and interpretations. Imagine how distorted and convoluted the study of history or science might be if we learned everything solely by word of mouth; orally passed down from generation to generation. A written HASP helps us formalize: the hazards we assess at our worksites, the controls we choose, and a clear means of implementation.

Module One: Systems

Section Four: Competent Persons

Competent Person

The single most important person on any construction field crew is the Competent Person. OSHA defines a Competent Person as one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. Various sections of the regulations have slightly more specific meanings for a Competent Person. Ideally, Competent Persons, whom interact constantly with employees under their supervision, have the unique ability to mentor and coach in real time. Given the important role of the Competent Person in any construction system, one can easily see why it is vital to have especially well trained and experienced Competent Persons. In many respects, they are the eyes and ears of the employer and represent the employer in the field.

Module One: Systems

Section Five: Systems Exercises

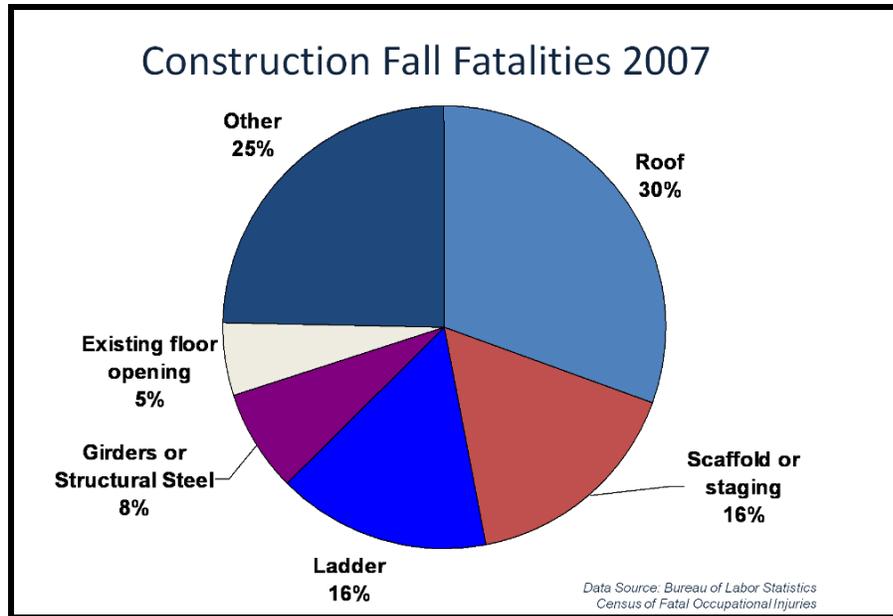
Group Exercise: Discuss with your team:

- 1. The most important rights under OSHA.*
- 2. The difference between preventive controls and protective controls*
- 3. The best qualities of your team's ideal competent person.*

Have you known any great competent persons in you life?

Module Two: Falls

Section One: Systems of Safety Applied to Falls

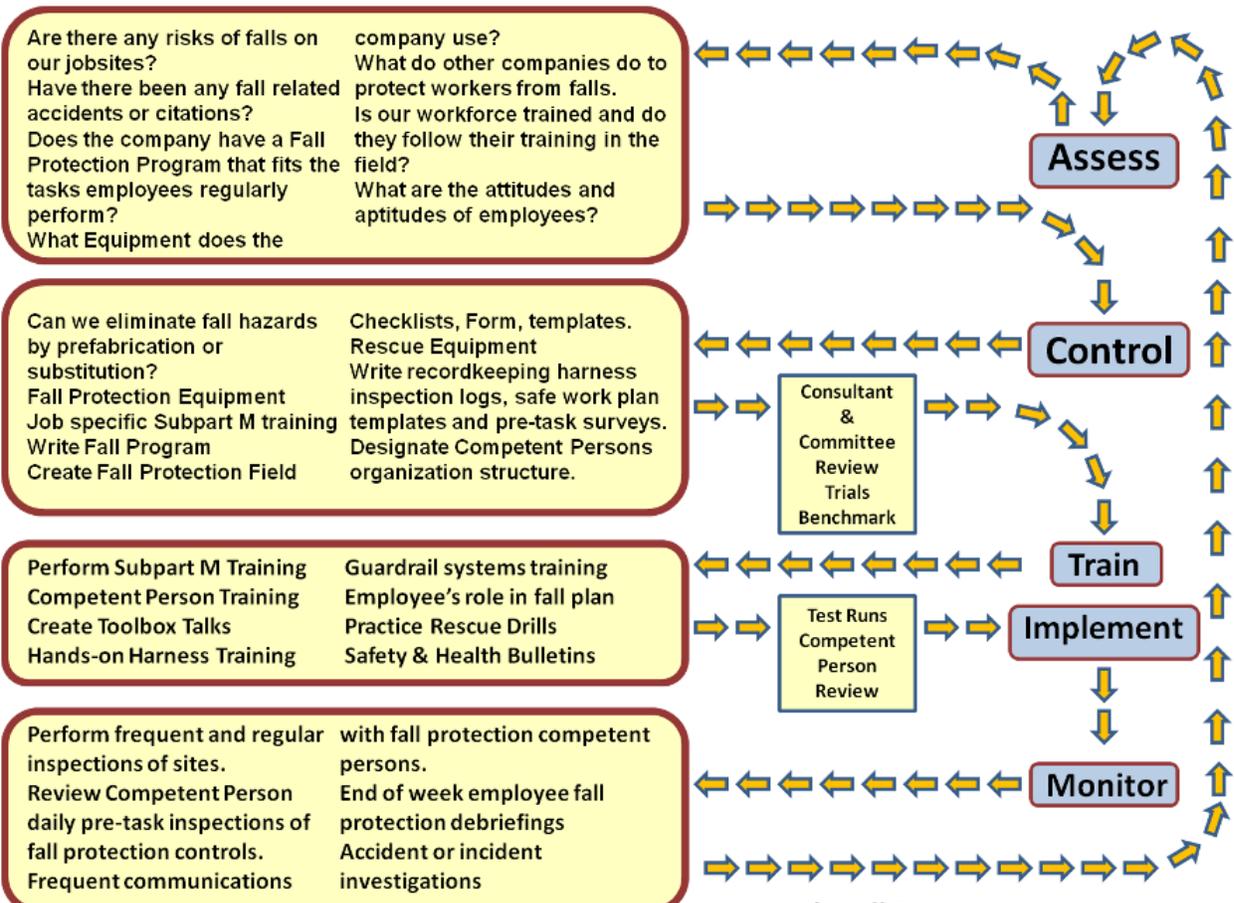


A. Leading Cause of Fatalities

Falls are the leading cause of fatalities in the construction industry. It is important that safety and health programs contain provisions to protect workers from falls on the job. The following hazards cause the most fall-related injuries:

- Unprotected sides, wall openings, roofs, floor holes,*
- Improper scaffold construction,*
- Unguarded or protruding steel rebar,*
- Misuse of portable ladders.*

B. Sample Fall Protection System of Safety



C. Sample Fall Protection Job Hazard Analysis

Fall Protection Assessment of Hazards

Task	Hazard	Control	Means of Implementation
Connecting Steel	Falls to a lower level	<ol style="list-style-type: none"> 1. Personal Fall Arrest System 2. Retractable lifelines 	<ol style="list-style-type: none"> 1. Purchase PFAS equipment 2. Train Workers to use PFAS equipment 3. Subpart M Training
Installing wire rope perimeter protection	Falls to below	<ol style="list-style-type: none"> 1. Prefabrication of perimeter wire rope before steel is hoisted into place 	<ol style="list-style-type: none"> 1. Contract with steel fabricator to deliver steel with wire rope perimeter protection in place or have iron workers install protections at ground level before hoisting into place.

PFAS – Personal Fall Arrest System

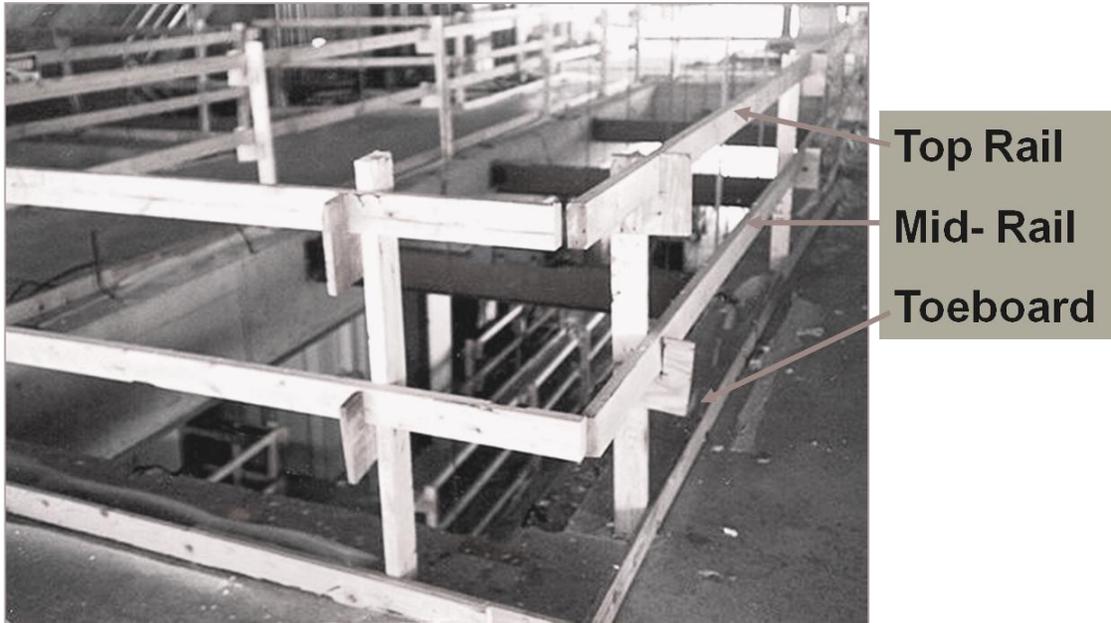
Module Two: Falls

Section Two: Fall Protection Training

A. The Guardrail System

A guardrail system in an engineering control with a top-rail varying from 39 to 45 inches at it's height and have a toeboard, which prevents debris and tools from falling to lower levels and a mid-rail.

Guardrails



- **Top rails between 39 and 45 inches tall**
- **Toeboards at least 3 1/2 inches high**

B. Housekeeping

All places of employment, passageways, storerooms, and service rooms shall be kept clean and orderly and in a sanitary condition. The floor of every workroom shall be maintained in a clean and, so far as possible, a dry condition. Every floor, working place and passageway shall be kept free from protruding nails, splinters, holes, or loose boards. Good housekeeping prevents fires. Bad housekeeping is a breeding place for all types of accidents.

C. Certification of Fall Protection Training

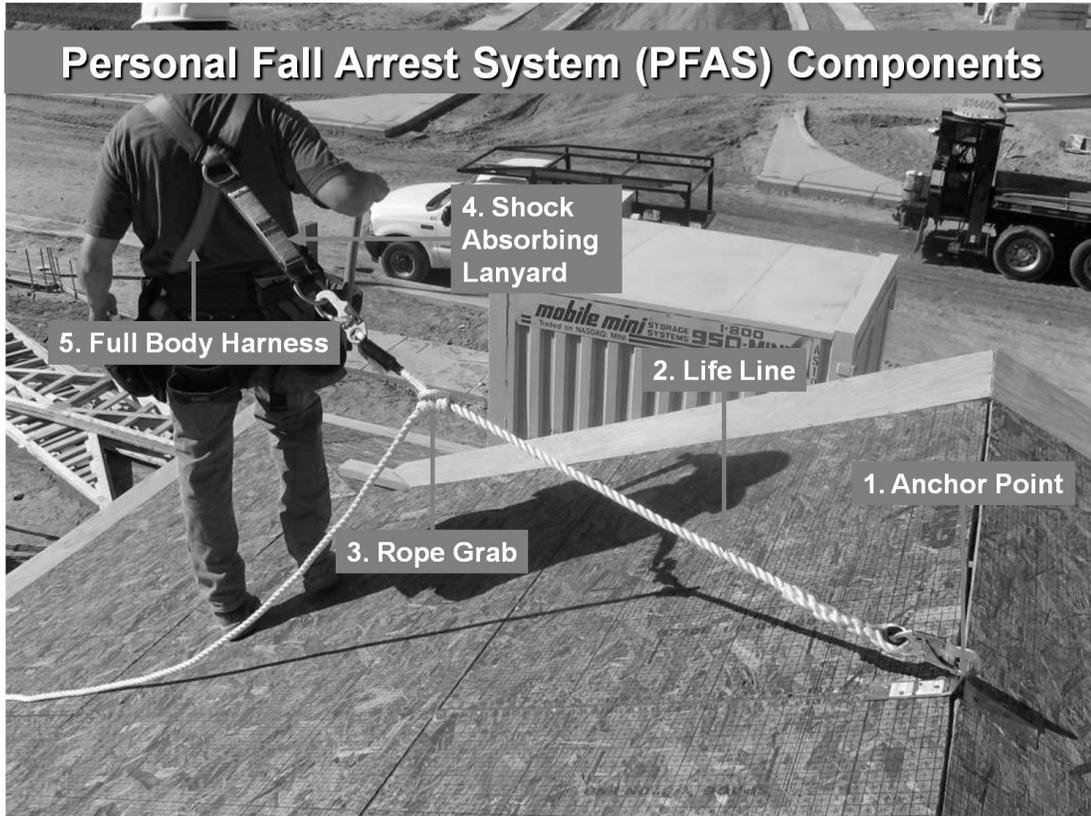
Most contractors do not know that fall protection training is required for almost all workers on construction sites and that employers shall have a written certification record that will contain the:

- Name or other identity of the employee trained,*
- date of the training,*
- signature of the person who conducted the training or the signature of the employer. (If the employer relies on training conducted by another employer the certification record shall indicate the date the employer determined the prior training was adequate rather than the date of actual training.*

D. Retraining of Fall Protection Training

Retraining: When the employer has reason to believe that an employee does not have the proper understanding and skill required by the fall protection training or when there are changes in the workplace, changes in the types of fall protection systems or equipment to be used render previous training obsolete; or inadequacies in employee's knowledge or behavior around protection systems or equipment indicate that the employee has not retained the requisite understanding or skill.

E. Parts of a Personal Fall Arrest System



F. Swing Hazards

□ *Minimize swing falls:*

- *Work directly below the anchor.*
- *Do not extend your work zone more than 30° from the anchor.*
- *Manage the slack in the rope*

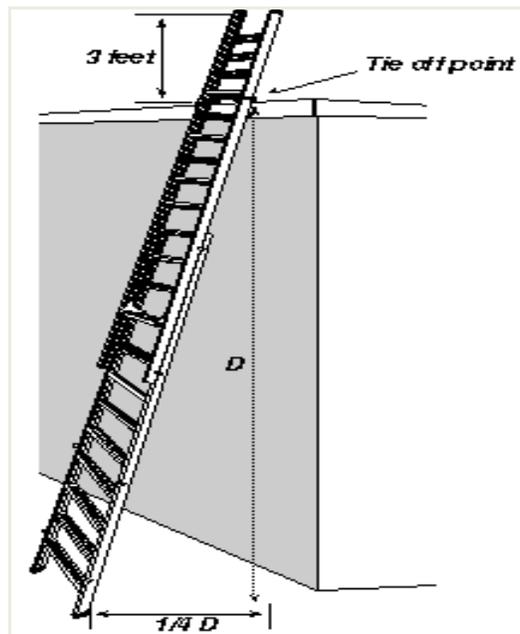
G. Competent Person Responsibility

In your fall protection training, all trainees must be made aware of their respective designated competent persons. The competent person:

- Has the knowledge and experience needed to identify fall hazards.*
- Has authority to eliminate fall hazards.*
- Has authority to stop work if unsafe conditions exist.*
- Can evaluate fall hazards and protections.*
- Assesses workers who use fall protection systems.*
- Conducts safety inspections.*

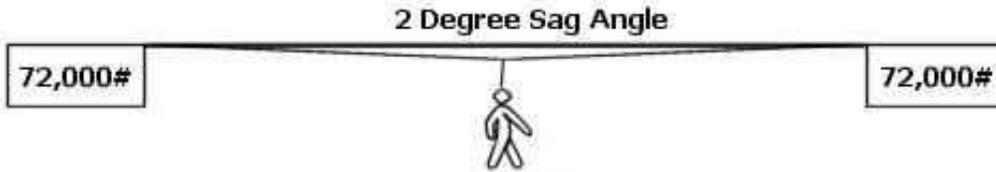
H. Ladders

Extension ladders should be used at a 4 to 1 pitch (1.2 to .3 m). For every 4 ft. (1.2 m) in height, the bottom of the ladder should be 1 ft. (.3 m) away from the structure.



I. Sag Angles

Sag Angle of horizontal life lines are very important because too tight of an angle greatly stress pressure on line.



Anchor Loading Varies with Sag Angle of Horizontal Line



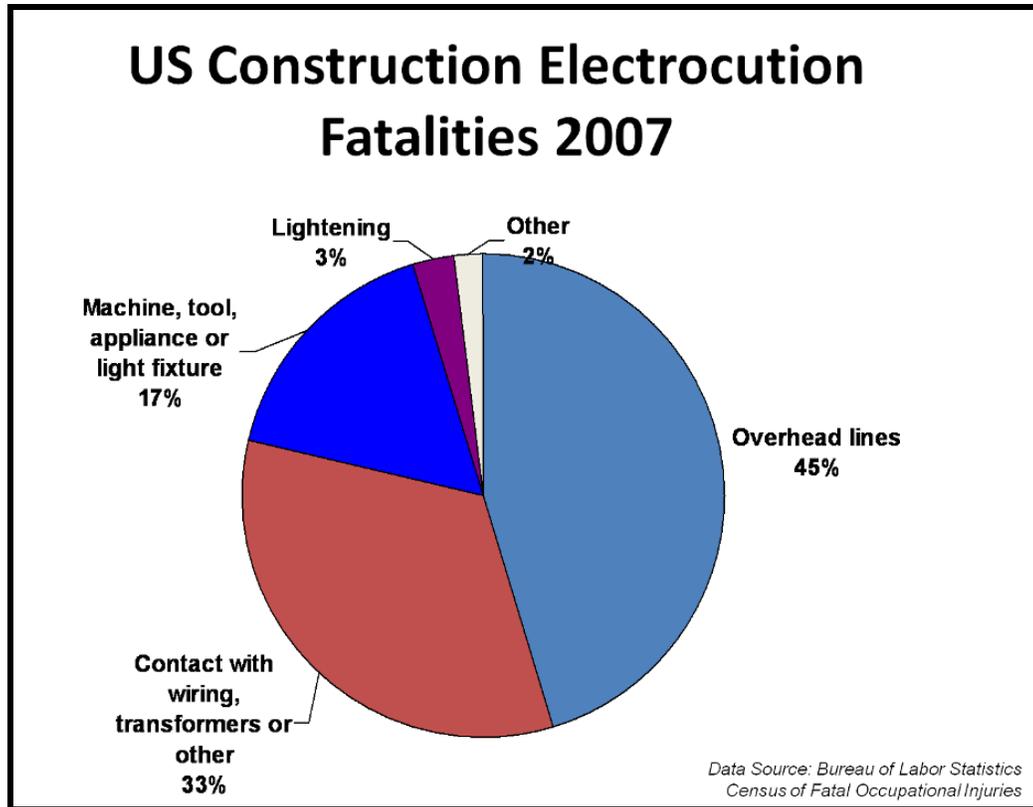
Module Two: Falls

Section Three: Fall Protection Group Exercise

1. Describe in order the best forms of fall protection.
2. What makes us so heavy when we fall and how much do we weigh when we are free falling?
3. Calculate the fall distance of a six foot worker wearing a six foot lanyard and deceleration device.

Module Three: Electrical

Section One: Systems of Safety Applied to Electrical Hazards



A. Electrical Fatalities

- On average, nearly one worker per day is electrocuted.*
- Electricity is dangerous and undetectable without instruments.*

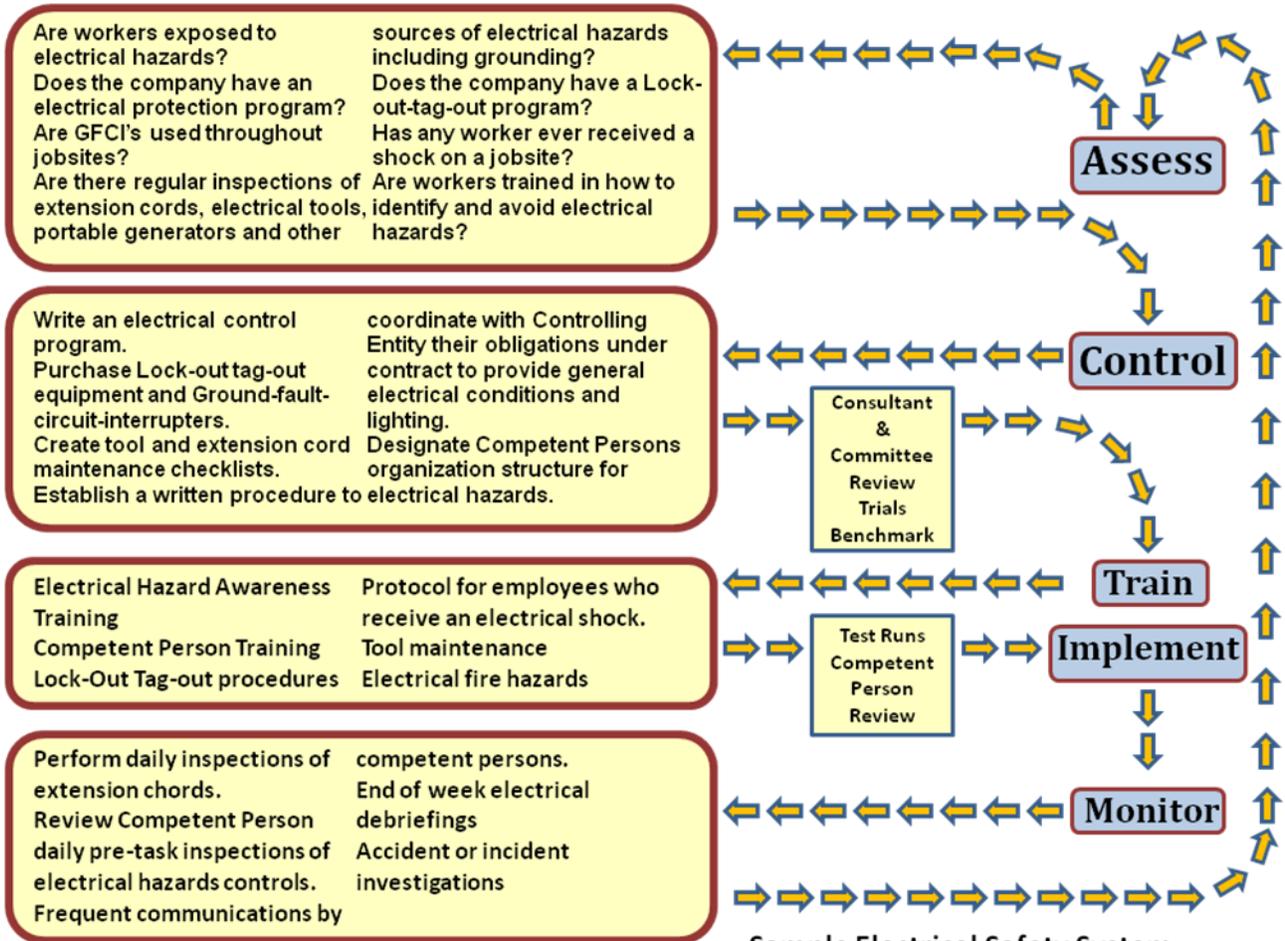
B. Electrical Injuries

Electricity has become essential to modern life. Perhaps because it is such a familiar part of our surroundings, it often is not treated with the respect it deserves. Safety

and health programs must address electrical incidents and the variety of ways electricity becomes a hazard. In general, OSHA requires that employees not work near any part of an electrical power circuit unless protected. The following hazards are the most frequent cause of electrical injuries:

- Contact with power lines.*
- Lack of ground fault protection.*
- Path to ground missing or discontinuous.*
- Electrical equipment not used in a manner prescribed.*
- Inappropriate use of extension and flexible cords.*
- Working in and around water or damp conditions.*

C. Sample System of Safety Applied to Electrical Hazards



D. Sample Electrical Protection Job Hazard Analysis

Electrical : Assessment of Hazards

Task	Hazard	Control	Means of Implementation
Working with an electrical tool	Shock Electrocution Indirect falls Burns	1. Grounding 2. GFCI 3. Inspection of tools 4. Inspection of extension cords	1. Purchase GFCI 2. Have a daily electrical inspection by a competent person. 3. Train workers in the recognition of electrical hazards and how they can harm them.
	Fire	1. Correct sized conductors	1. Follow applicable electric code for wire gauge size to amperage of circuit .
Electrical work	Shock Electrocution Indirect falls Burns	1. Lock-out –Tag Out	1. Create a full Lock-out tag-out program for electrical work 2. Train electricians in how to use a lock-out-tag our program
	Fire	1. Correct sized conductors	1. Follow applicable electric code for wire gauge size to amperage of circuit .

GFCI – Ground Fault Circuit Interrupter

Module Two: Electrical

Section Two: Electrical Safety Training

A. Competent Person Responsibility

Inside of your electrical protection training all trainees must be made aware of their respective designated competent persons and know that the controlling contractor or qualified electrical contractor, who provides for general conditions concerning electricity, also has authority and responsibilities at their sites. The competent person:

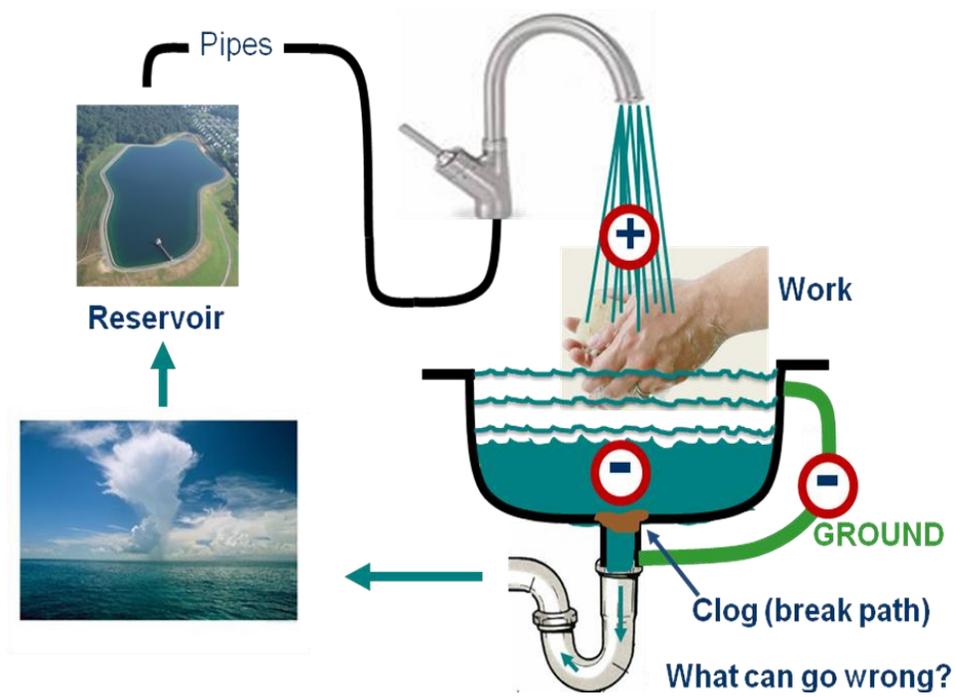
- Performs daily inspections of extension cords.*
- Reviews daily pre-task inspections of electrical controls.*
- Assists with incident investigations.*
- Develops an end of week electrical debriefing.*

B. Electrical Terms

- *Current -- electrical movement (measured in amps)*
- *Circuit -- complete path of the current. Includes electricity source, a conductor, and the output device or load (such as a lamp, tool, or heater)*
- *Resistance -- restriction to electrical flow*
- *Conductors – substances, like metals, with little resistance to electricity that allow electricity to flow*
- *Grounding – a conductive connection to the earth which acts as a protective measure*
- *Insulators -- substances with high resistance to electricity like glass, porcelain, plastic, and dry wood that prevent electricity from getting to unwanted areas.*

C. The Electric Circuit

Simplified Analogy to an Electric Circuit



Note the similarities from an electrical circuit and what cycle.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

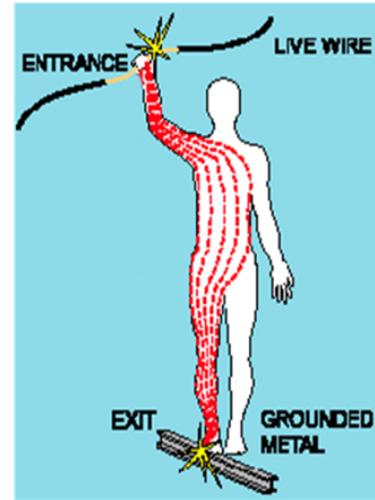
D. Electric Shock

Shock Severity

Severity of the shock depends on:

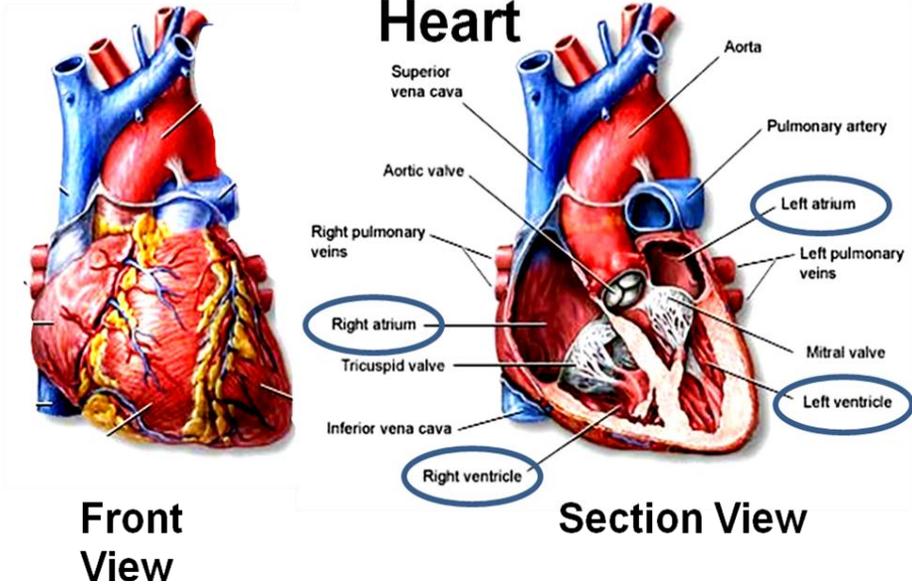
- Path of current through the body
- Amount of current flowing through the body (amps)
- Duration of the shocking current through the body,

**LOW VOLTAGE DOES NOT MEAN
LOW HAZARD**



The National Safety Council estimates that approximately 300 people in the United States die each year as a result of an electric shock from low voltage systems (120 or 277 volt circuits). People become injured and death occurs when voltage pushes electrons through the human body, particularly through the heart.

The Heart



Electric shock can damage the electrical rhythm inside of the heart which can lead to a heart attack, stroke, pulmonary embolism or a blood clot.

E. Ground Fault Circuit Interrupters

*Protect you from shock by detecting difference in current between the black and white wires. If ground fault detected, GFCI shuts off electricity in 1/40th of a second
Use GFCI's on all 120-volt, single-phase, 15- and 20-ampere receptacles, or have an assured equipment grounding conductor program*



F. Excavations pose danger from underground utilities.

Call Before You Dig

Before digging, the competent person should verify if there are any underground utilities such as electric, gas or water.

(Many states have a one-call phone number to provide a mark-out for the locations of utilities buried under and nearby a proposed excavation)



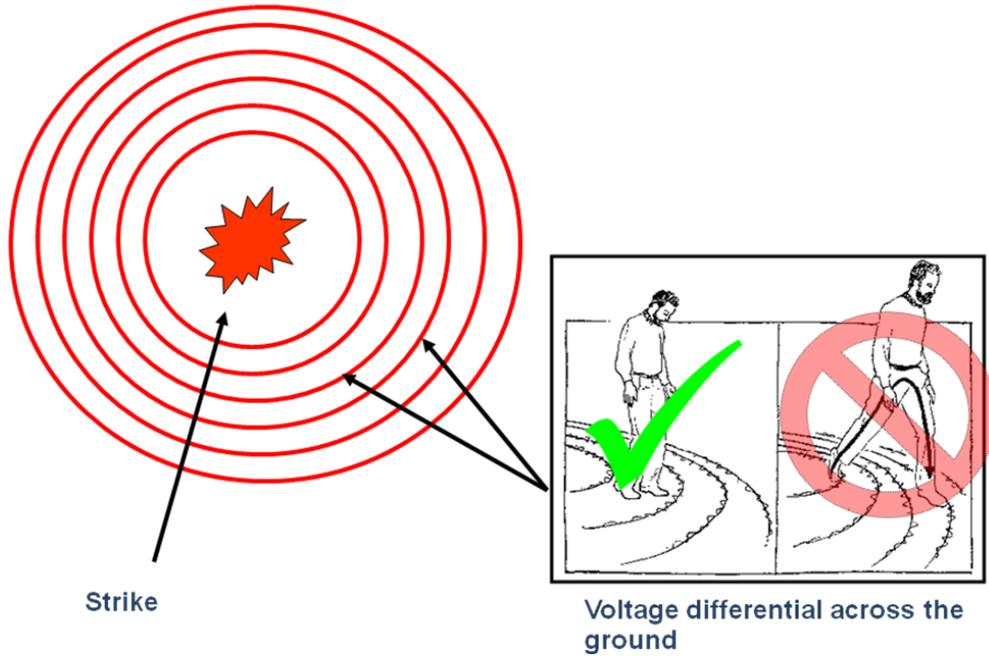
G. Overhead hazards

Overhead and buried power lines at your site are especially hazardous because they carry extremely high voltage. Fatal electrocution is the main risk, but burns and falls from elevations are also hazards. Using tools and equipment that can contact power lines increases the risk.

Examples of Equipment That Can Contact Power Lines

- *Aluminum paint rollers*
- *Backhoes*
- *Concrete pumpers*
- *Cranes*
- *Long-handled cement finishing floats*
- *Metal building materials*
- *Metal ladders*
- *Raised dump truck beds*
- *Scaffolds*

High Voltage Crane/Excavator Contact



If you are ever adjacent to electrically charged equipment, such as a crane or excavator, it is recommended that you place your feet and legs close to together and take short shuffle-steps away from the point of contact and move in a semicircular direction. Larger steps can connect rings of electrical differential.

H. Lightning

Lightning of course is the oldest know electrical hazard and can affect us at home at play as well as on at work. There are good established rules of thumb concerning lightning:

Lightning Decision Tree

1. *"If you can see it, flee it; If you can hear it, clear it."*
2. *Weather Channel; NOAA Weather Radio*
3. *Make decision to suspend activities and notify people.*
4. *The 30/30 Rule says to shut down when lightning is six miles away. Use a "flash to bang" (lightning to thunder) count of five seconds equals one mile (10 = 2 miles; 20 = 4 miles; 30 = 6 miles).*
5. *Notify people via radio, siren or other means.*
6. *Move to safe location A large permanent building or metal vehicle is best.*
 - *Unsafe places are near metal or water; under trees; on hills; near equipment, in open areas, roof tops.*
7. *Reassess the hazard. It's usually safe after no thunder and no lightning have been observed for thirty minutes. Be conservative here.*

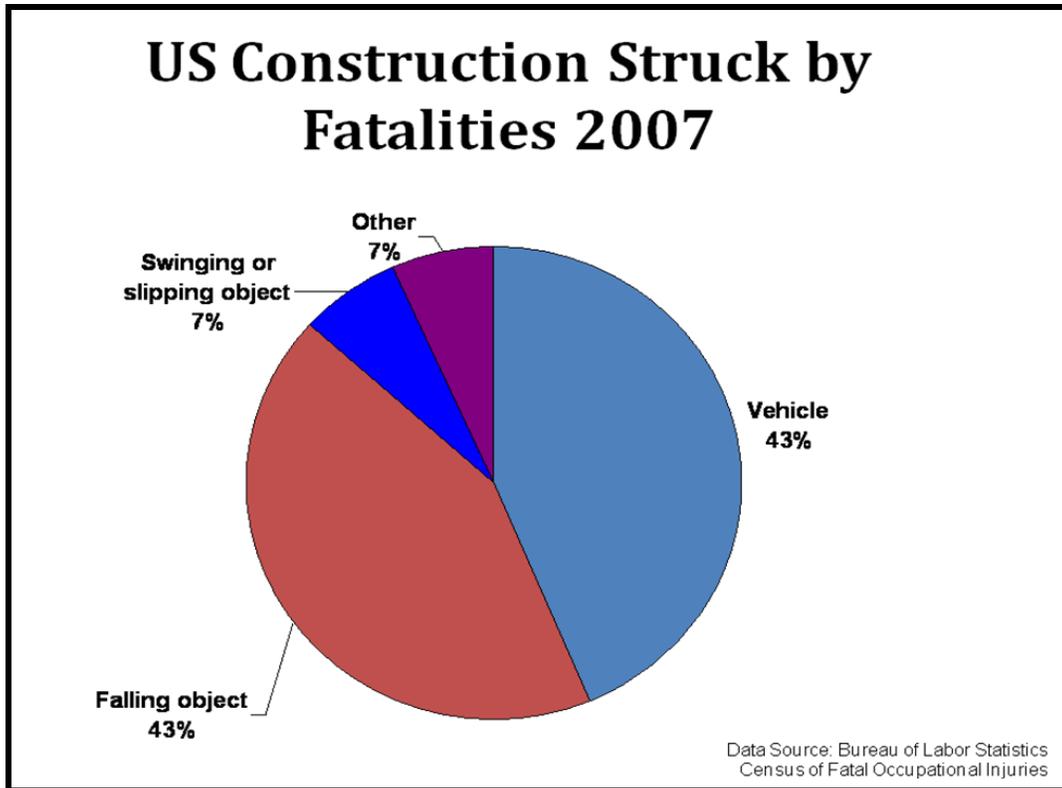
Module Three: Electrical

Section Three: Group Electrical Safety Exercise

Each group should make a list of various electrical controls and affix a label to them such as elimination, engineering, mitigation, then give each control a score accordingly: ten (10) points for types of elimination controls, seven points for an engineering control and (5) points for a mitigation control. Try and make the list as long as possible and be creative.

Module Four: Struck-by

Section One: Systems of Safety Applied to Struck-by Hazards



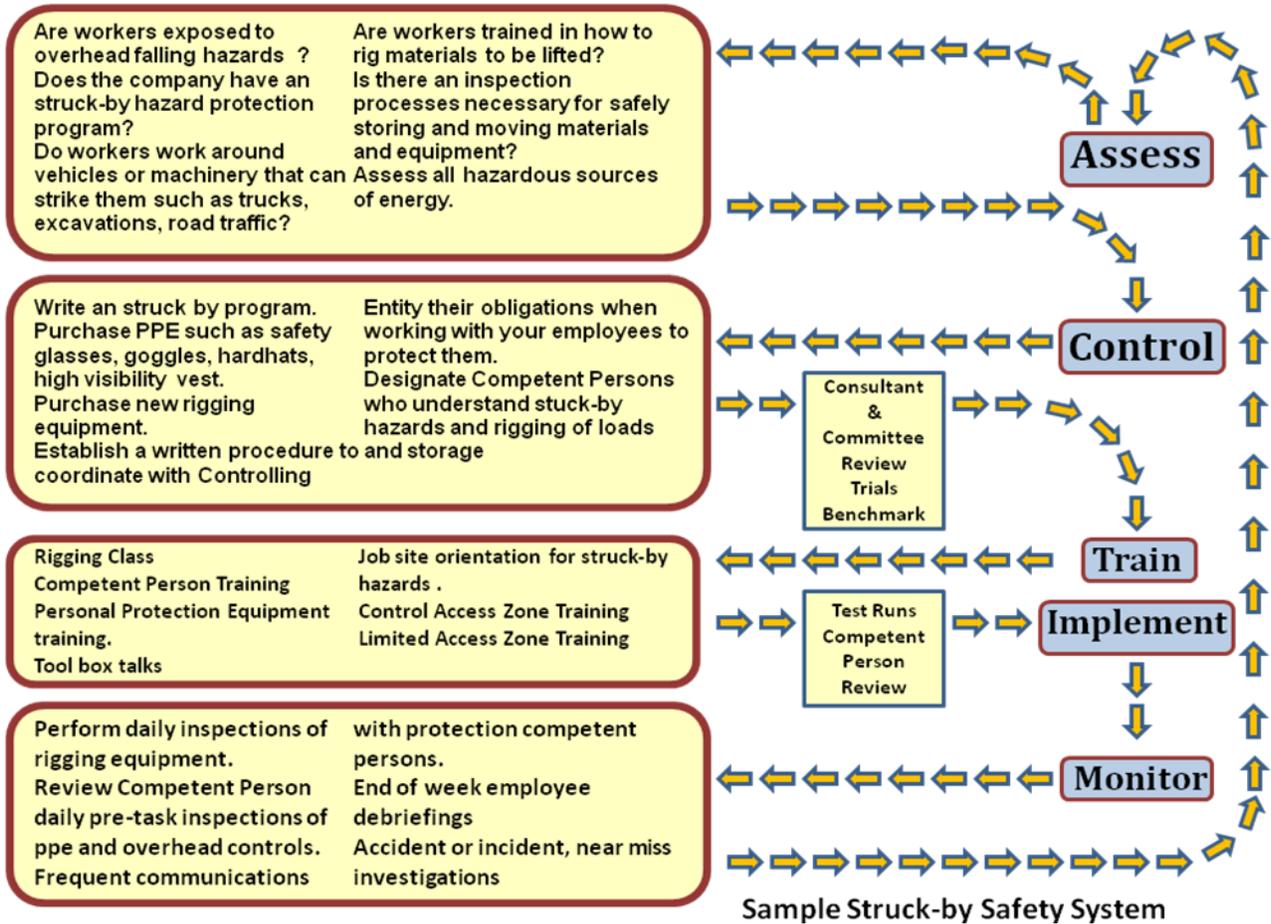
A. Struck-by Injuries and Fatalities

Struck-by objects are a leading cause of construction-related deaths. Approximately 75% of struck-by fatalities involve heavy equipment such as trucks or cranes. The number of workers fatally struck by a vehicle was at a seven-year high in 1998. Safety and health programs must take into account the many ways struck-by accidents can occur. One in every four struck-by vehicle deaths involves construction workers, more than any other occupation. In a very real sense, struck-

by hazards represent sources of potential energy which can be quantified at our worksites when we perform an assessment. The following related hazards commonly cause struck-by injuries and fatalities:

- Falling objects.*
- Rigging failure.*
- Loose or shifting materials.*
- Tip over or malfunction.*
- Lack of overhead protection.*
- Vehicle and equipment strikes.*
- Backing incidents.*
- Workers on foot.*
- Flying objects.*
- Masonry walls tipping over.*

B. A Sample Struck-by System of Safety



C. Sample Struck-by Job Hazard Analysis

Struck-by Assessment of Hazards

Task	Hazard	Control	Means of Implementation
Walking around construction site	1. Struck by falling and flying objects 2. Struck by machinery, vehicles, equipment	1. Safety glasses, goggles, hardhats. 2. High visibility vests. 3. Establish safety work zones for rigging loads, overhead hazards. 4. Establish Limited/ Controlled Access Zones	1. Purchase PPE and train workers when and how to wear and maintain them. 2. Coordinate various safety zones on site with controlling entity. 3. Train workers who rig or store materials on the proper means and methods.

Module Four: Struck-by

Section Two: Struck-by Training

A. Nature of Struck-by Training

Struck-by recognition, avoidance and prevention involves understanding potential energy in its many forms. While potential energy could be a boulder sitting atop a

cliff, it could also be the powder actuated projectile (a bullet). Other struck by incidents could include:

- Falling objects.*
- Rigging failure.*
- Loose or shifting materials.*
- Tip over or malfunction.*
- Lack of overhead protection.*
- Vehicle and equipment strikes.*
- Backing incidents.*
- Workers on foot.*
- Flying objects.*
- Masonry walls tipping over.*

B. Struck-by Rigging Failures

Before starting any hoisting activity the firm, company or property owner, known as the Controlling Entity must provide a clear, firm, drained and graded area and maintains a controlled access into various fall and swing zones. The Controlling Entity provides coordination and pre-pick planning Whenever something is hoisted, you should have someone in charge that has the knowledge, skill and ability to perform the following:

- Know the weight of the load*
- Know the center of gravity of the load.*
- Make load attachment above the center of gravity of the load.*
- Select hitch that will hold and control.*

- Know the rated capacity of slings and hardware.*
- Select sling best suited for load.*
- Inspect all rigging before the lift.*
- Protect sling from sharp surfaces.*
- Proper calculation of increased tension caused by sling angles (on all rigging components!).*
- 10. Allow for proper D/d ratio (the D/d Ratio is the ratio of the diameter around which the sling is bent divided by the body diameter of the sling.)*
- Calculate reductions when using choker hitch.*

C. Vehicles are very dangerous

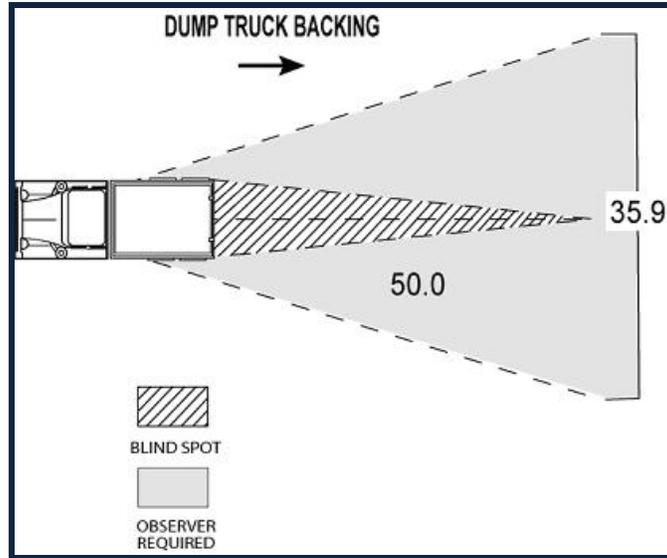
If vehicle safety practices are not observed at your site, you risk being pinned between construction vehicles and walls, struck by swinging backhoes, crushed beneath overturned vehicles, you risk being struck by trucks or cars.

How Do I Avoid Hazards?

- Wear seatbelts*
- Check vehicles before each shift to assure that all parts and accessories are in safe operating condition.*
- Do not drive a vehicle in reverse gear with an obstructed rear view, unless it has an audible reverse alarm, or another worker signals that it is safe.*
- Drive vehicles or equipment only on roadways or grades that are safely constructed and maintained.*

- ❑ *Make sure that you and all other personnel are in the clear before using dumping or lifting devices.*
- ❑ *Lower or block bulldozer and scraper blades, end-loader buckets, dump bodies, etc., when not in use, and leave all controls in neutral position.*
- ❑ *Set parking brakes when vehicles and equipment are parked, and chock the wheels if they are on an incline.*
- ❑ *All vehicles must have adequate braking systems and other safety devices.*
- ❑ *Haulage vehicles that are loaded by cranes, power shovels, loaders etc., must have a cab shield or canopy that protects the driver from falling materials.*
- ❑ *Do not exceed a vehicle's rated load or lift capacity.*
- ❑ *Do not carry personnel unless there is a safe place to ride.*
- ❑ *Use traffic signs, barricades or flaggers when construction takes place near public roadways.*
- ❑ *Workers must be highly visible in all levels of light. Warning clothing, such as red or orange vests, are required; and if worn for night work, must be of reflective material.*

Blind Spots: *If the Driver doesn't see the Spotter, the driver should stop the vehicle or equipment.*



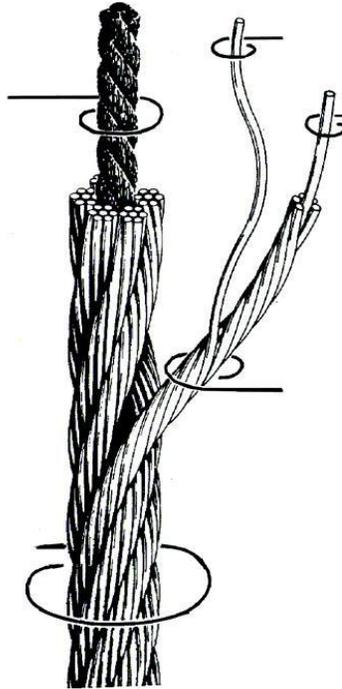
Conspicuity Class	Use Description	
1		<ul style="list-style-type: none"> • Worker can give full and undivided attention to approaching traffic. • Ample separation between worker and vehicular traffic. • Background is not too complex. • Vehicle/equipment speeds do not exceed 25 mph.
2		<ul style="list-style-type: none"> • Greater visibility is desired during inclement weather. • Complex backgrounds are present. • Employees perform tasks that divert attention away from approaching vehicles. • Vehicle/equipment speeds exceed 25 mph, but less than 50 mph. • Work activities take place in or near vehicle traffic space.
3		<ul style="list-style-type: none"> • Vehicle/equipment speeds exceed 50 mph. • Worker and vehicle operator have high task loads. • Wearer must be conspicuous through the full range of body motions at a minimum of a ¼ mile (390 m) and must be identifiable as a person.

High visibility clothing.

D. Wire Ropes

Wire ropes act like a machine in that they have many moving parts that all must work together to perform a function (lifting and hoisting). If one part of a machine is broken the rest of the machine can malfunction or works harder than it must to compensate for the damaged parts of the machine. So if you see damaged wire ropes that are rusted, kinked, broken, crushed or bird-caging (unwinding) you should bring this to the attention of your competent person.

Can you tell the different parts of this wire rope machine?



E. Masonry Walls

Constructing concrete and masonry walls is especially dangerous because of the tremendous loads that need to be supported. There are risks of major accidents, and even death, when jacks or lifting equipment are used to position slabs and walls, or when shoring is required until structures can support themselves.

How Do I Avoid Hazards?

- Do not place construction loads on a concrete structure until a qualified person indicates that it can support the load.
- Adequately shore or brace structures until permanent supporting elements are in place, or concrete has been tested to assure sufficient strength.
- Only allow those who are essential to and actively engaged in construction or lifting operations to enter the work area.
- Take measures to prevent unrolled wire mesh from recoiling, such as securing each end or turning the roll over.
- Do not load lifting devices beyond their capacity.
- Use automatic holding devices to support forms in case a lifting mechanism fails.

F. Struck by Protections

- Use safety glasses, goggles, face shields, etc., where machines or tools may cause flying particles.*
- Inspect tools, such as saws and lathes, to insure that protective guards are in good condition.*
- Make sure you are trained in the proper operation of powder actuated tools.*

- Secure tools and materials to prevent them from falling on people below.*
- Barricade hazard areas and post warning signs.*
- Use toeboards, screens, or guardrails on scaffolds to prevent falling objects,*
- Use debris nets, catch platforms, or canopies to catch or deflect falling objects*
- Reduce compressed air used for cleaning to 30 psi, and only use with appropriate guarding and protective equipment.*
- Never clean clothing with compressed air.*

Module Four: Struck-by

Section Three: Struck-by Exercise

As a group exercise, discuss the “good, better, best” measures that can protect you and other workers on a jobsite.

Module Five: Caught-in-between

Section One: Systems of Safety Applied to Caught-in-between

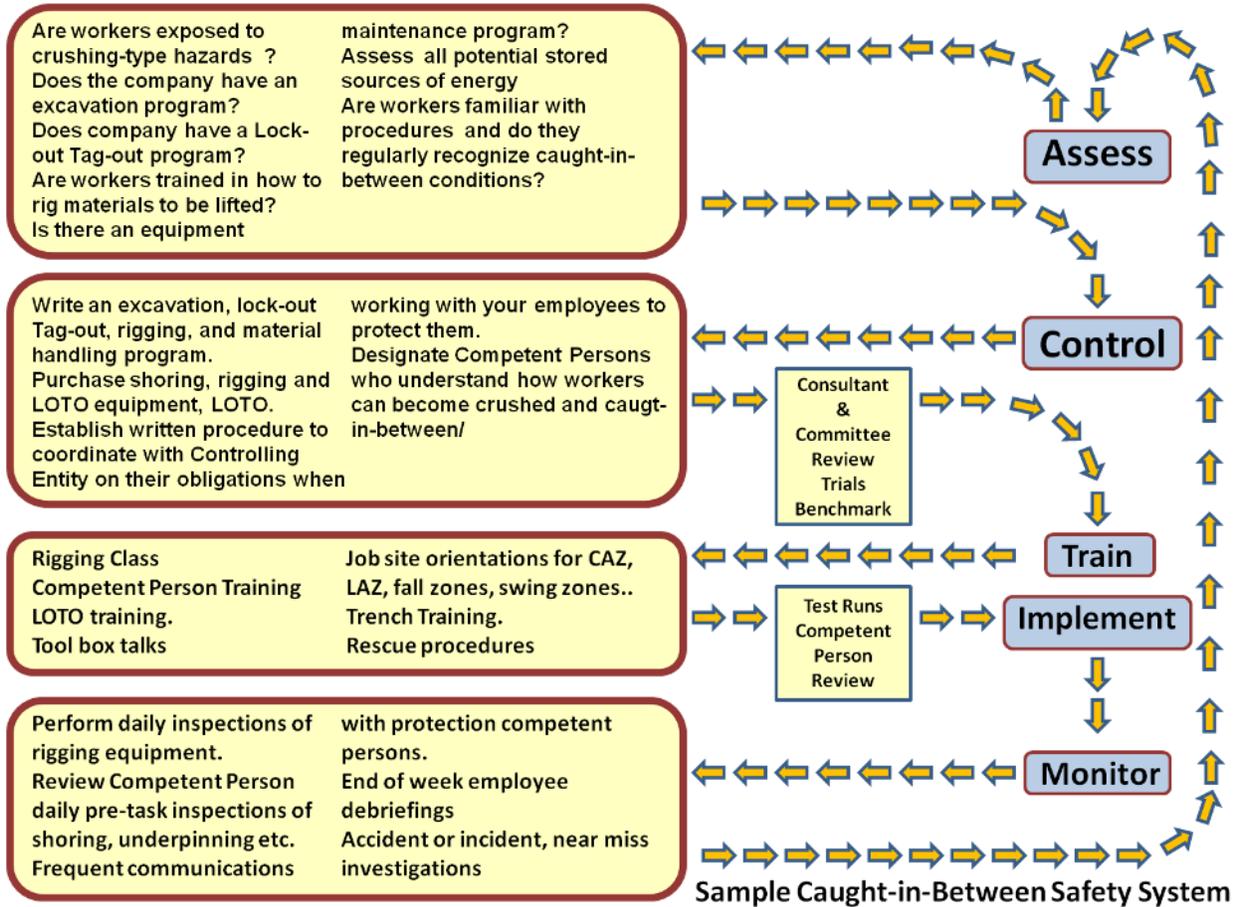
A. Caught-in-between Injuries and Fatalities

Caught-in-between hazards constitute the final focus hazard category of this program. Proportionately, excavations pose the most hazardous caught-in-between conditions and cave-ins are perhaps the most feared trenching hazard. But other potentially fatal hazards exist, including asphyxiation due to lack of oxygen in a confined space, inhalation of toxic fumes, drowning, etc. Electrocution or explosions can occur when workers contact underground utilities. OSHA requires that workers in trenches and excavations be protected, and that safety and health programs address the variety of hazards they face. Heavy equipment with moving swinging and crushing parts are also hazardous and part of this category.

The most common caught-in-between cause of injuries and fatalities are:

- Trench/excavation collapse.*
- Rotating equipment.*
- Unguarded parts.*
- Equipment rollovers.*
- Equipment maintenance.*
- Rigging accidents.*

B. Sample Caught-in-between System of Safety



C. Sample Caught-in-between Job Hazard Analysis

Caught-in-Between Assessment of Hazards

Task	Hazard	Control	Means of Implementation
Working in a trench	1. Trench collapse	1. Shoring, benching, sloping	1. Purchase PPE and train workers when and how to wear and maintain them.
Working with a jammed piece of equipment	1. Crushing	1. Lock-out Tag-out Procedures	1. Training for designated Authorized persons and workers affected by operations.
Working around a mobile crane	1. Crushing	1. Barricade swing radius. 2. Training for workers to recognize caught-in-between hazards	1. Training through toolbox talk to warn workers of danger of swing radius of mobile crane and fall zones. 2. Controlling Entity performs jobsite notification of Controlled Access Zones.

Module Five: Caught-in-between

Section Two: Caught-in-between Hazard Recognition and Avoidance

Very often caught-in-between hazards are conditional, based on environmental factors, so emphasis is the training how the environment can impact the occupational situation, emphasizing that improvising, though often ingenious can have tragic consequences.

A. Common Types of Caught-in-between scenarios

- Trench/Excavation Collapse*
- Rotating Equipment*
- Unguarded Parts*
- Equipment Rollovers*
- Equipment Maintenance*
- Rigging accidents*

B. Some Rules concerning excavations

- All trenching operations will be performed under the supervision of a competent person.*
- Establish locations of underground utilities before digging.*
- Provide a means of egress/access when a trench reaches a depth of 4 feet that is not be more than 25 feet lateral distance from a worker's reach.*
- Ladder top rails must extend at least 3 feet above grade and be secured from displacement.*
- All trenches where workers will enter 5 feet or more deep must be protected from collapse according to OSHA regulations.*
- Documented soil classification must be performed by the competent person to determine type of soil and necessary protection. (Type A, Type B, Type C soil classification).*
- Trenches must be inspected daily by a competent person and after the occurrence of rain or other changing conditions.*
- Trenches greater than 20 feet must be designed by a professional engineer.*

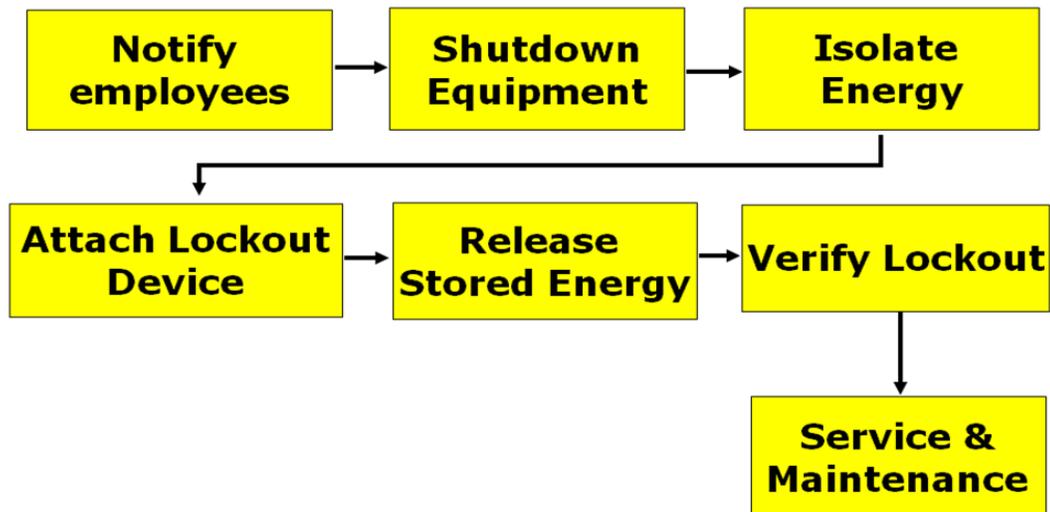
- *Workers cannot be under loads nor allowed to stand alongside the loading of a vehicles to avoid being struck by spillage. The driver of a vehicle is allowed to be in the cab if the cab is designed to withstand impact of loads.*

C. Lock-out Tag-out

Lock-out/Tag-out is important in confined spaces since it is easy to get trapped and hard to escape. Pipelines leading into tanks must be blanked off before entering the space. All electrical and mechanical hazardous energy must be addressed and locked out or tagged as needed.

Sequence of Locking-out:

Lockout Steps



Sequence of Start-up Procedures:

- All warned to stay clear*
- Remove all tools, locks and tags*
- Remove, reverse, open or reactivate isolating devices*
- Visual check that all is clear*
- Start up machine, process or line flow*

Module Five: Caught-in-between

Section Three: Caught-in-between Exercise

What went wrong? As a group, examine how this tragedy could have been avoided.

Case Study

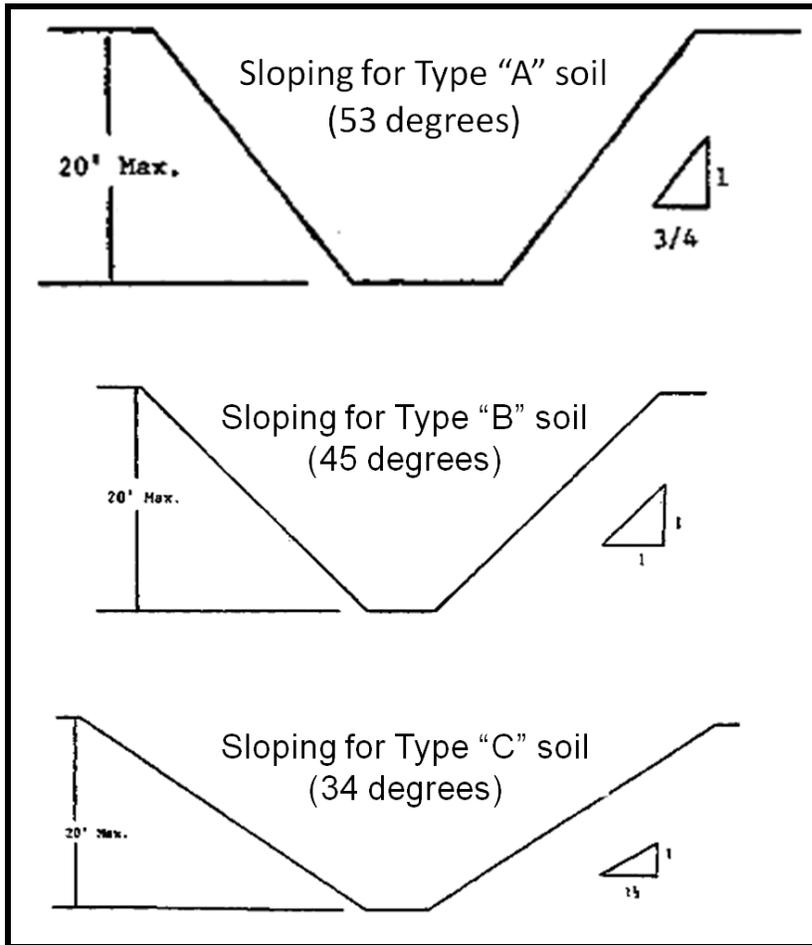
This accident occurred when a 48-year old victim, a mechanic, was attempting to disconnect a wind row elevator from an asphalt lay down machine. The mechanic accessed the hitch pins from inside the hopper of the lay down machine, upon removal of the second of two pins, the front of the wind row elevator collapsed, pinning the victim between the hopper bed and the wind row elevator. Victim was not found until approximately 45 minutes later. He was pronounced dead at the scene.

Appendix A

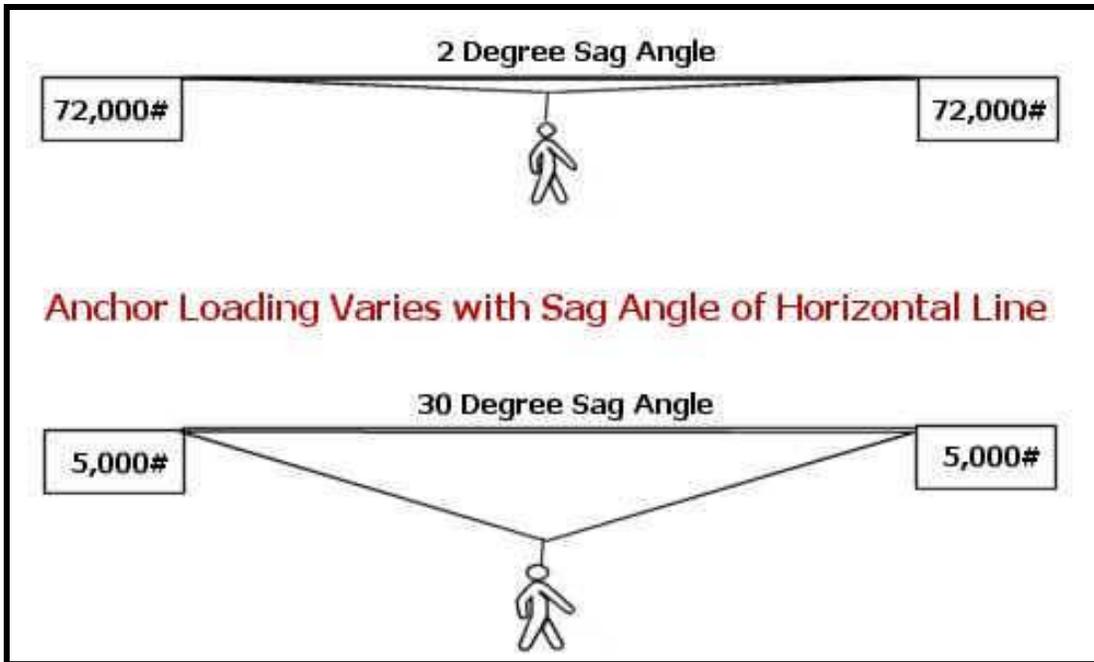
Paying Attention to Angles

Question: *What do excavations, fall protection, rigging and cranes and derricks all have in common?*

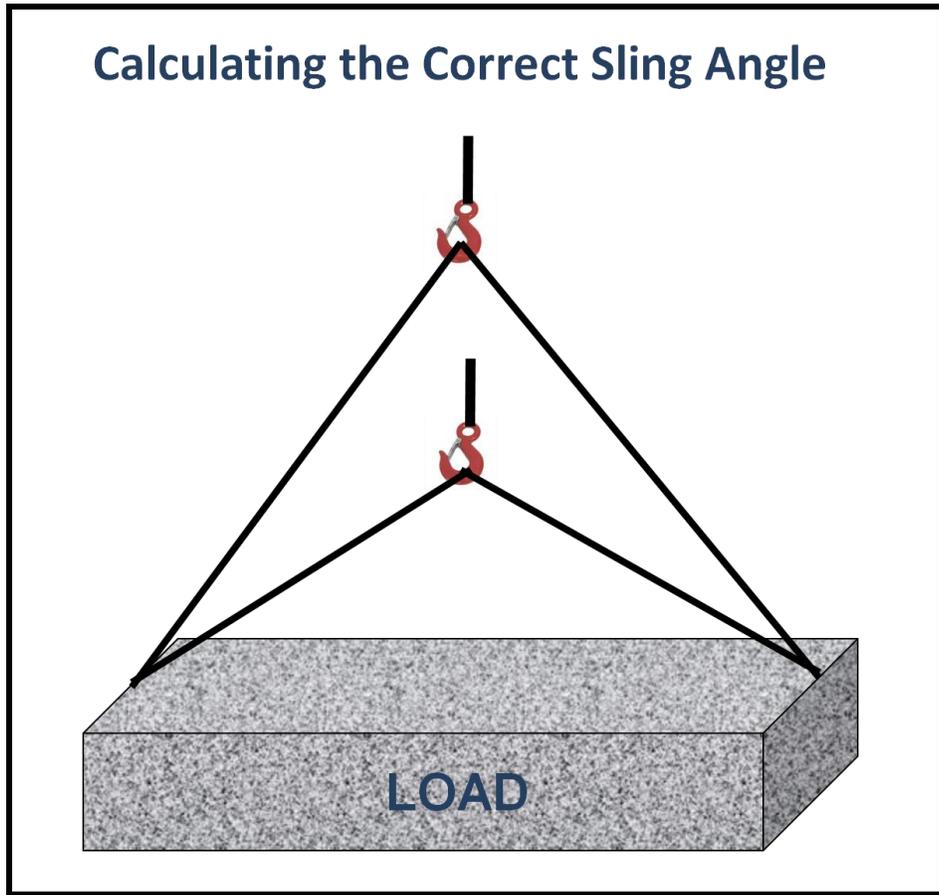
Angles in Excavations:



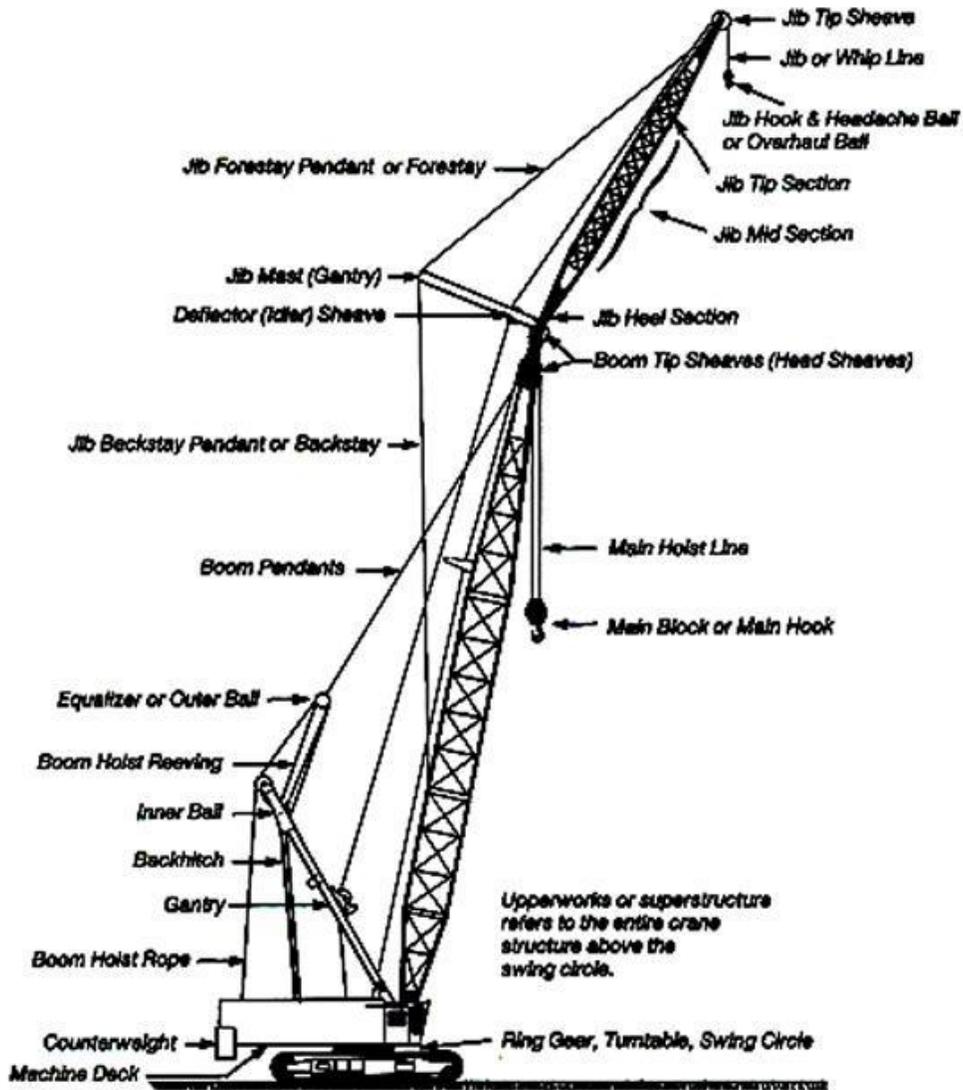
Angles in Fall Protection



Angles in Rigging:



Angles in Cranes and Derricks:



Appendix B: Questionnaire Example

Please take a few minutes to complete this survey. Your specific answers will be completely anonymous, but your views, in combination with those of others, are extremely important.

1. Overall, how satisfied are you with working here? (Please circle one number)

<i>Very</i>					<i>Very</i>
<u><i>Dissatisfied</i></u>					<u><i>Satisfied</i></u>
1	2	3	4		5

2. Prevention (Please circle one number for each statement)

	<i>Disagree</i>	<i>Agree</i>		
	<i>Strongly</i>	<i>Strongly</i>		
<i>I have received the proper safety training for my job</i>	1	2	3	4
<i>I understand all the safety rules and regulations related to my job</i>	1	2	3	4
<i>Employee safety is a top concern of company management</i>	1	2	3	4
<i>Unsafe conditions are fixed in a timely manner</i>	1	2	3	4

3. Reporting and Monitoring (Please circle one number for each statement)

<i>I feel confident any safety concerns I raise will be addressed</i>	1	2	3	4
<i>If I refused to work when I felt I would put myself in danger, I would not get into trouble</i>	1	2	3	4

**Appendix C:
Abbreviations**

<i>ANSI</i>	<i>American National Standards Institute</i>
<i>CIH</i>	<i>Certified Industrial Hygienist (See http://www.abih.org for more information)</i>
<i>CSP</i>	<i>Certified Safety Professional (See http://www.bcsp.org for more information)</i>
<i>HASP</i>	<i>Health & Safety Plan</i>
<i>JHA</i>	<i>Job Hazard Analysis</i>
<i>JSA</i>	<i>Job Safety Analysis</i>
<i>MOC</i>	<i>Management of Change</i>
<i>OPHP</i>	<i>Office of Public Health Practice</i>
<i>OSHA</i>	<i>Occupational Safety & Health Act or Administration</i>
<i>PFAS</i>	<i>Personal Fall Arrest System</i>
<i>PPE</i>	<i>Personal Protective Equipment</i>
<i>ROPS</i>	<i>Roll-Over Protective Structures</i>
<i>SPH</i>	<i>School of Public Health</i>
<i>UMDNJ</i>	<i>University of Medicine & Dentistry of New Jersey</i>
<i>VPP</i>	<i>Voluntary Protection Program</i>
