

Course Overview

Concrete and Masonry

- This module covers requirements to protect construction workers from premature removal of formwork, failure to brace masonry walls, failure to support precast panels, inadvertent operation of equipment, and failure to guard reinforcing steel. Also, health hazard and control information including skin, eye, and inhalation hazards and associated protective measures.
- Estimated length: 30 minutes.
- Audience: Construction workers, supervisors and managers.

Course Overview

Course Objective

- Given current OSHA and industry information regarding construction worksite illnesses, injuries and fatalities, the student will be able to recognize Concrete & Masonry related hazards in construction.
 - Specifically, the student will be able to:
 - 1: Identify major hazards associated with concrete & masonry work in construction
 - 2: Describe types of concrete & masonry hazards
 - 3: Protect themselves from concrete & masonry hazards
 - 4: Recognize employer requirements to protect workers from exposure to concrete & masonry hazards, including abatement methods.

Course Overview

References

OSHA's Subpart Q, Concrete and Masonry Construction:

- Title 29 of the Code of Federal Regulations (CFR), Part 1926.700 through 706.
- Center for Disease Control.
- National Institute for Occupational Safety and Health. (NIOSH).
- North Carolina Department of Labor

Course Overview

Agenda

- General requirements
- Equipment and tools
- Cast-in-place concrete
- Precast concrete
- Lift-slab construction
- Masonry construction
- Health hazards

General Requirements

Find the Hazard



The ladder is too short to allow proper access to the work area. They are more than 6 feet above the ground and we can't tell if they are wearing fall protection but it doesn't look like it.

General Requirements

Definitions

- **Bull float**
 - A tool used to spread out and smooth concrete.
- **Formwork**
 - The total system of support for freshly placed or partially cured concrete.
- **Lift slab**
 - A method of concrete construction in which floor and roof slabs are cast on or at ground level and, using jacks, lifted into position.
- **Limited access zone**
 - An area alongside a masonry wall, which is under construction, and is clearly demarcated to limit access by employees.
- **Precast concrete**
 - Concrete members which have been formed, cast, and cured prior to final placement in a structure.

General Requirements

Definitions

- **Reshoring**
 - The construction operation in which shoring equipment is placed, as original forms and shores are removed, to support partially cured concrete and construction loads.
- **Shore**
 - A supporting member that resists a compressive force imposed by a load.
- **Vertical slipforms**
 - These forms are jacked vertically during placement of concrete.
- **Jacking operation**
 - The task of lifting a slab during the construction of a building where the lift-slab process is being used.

General Requirements

- Construction Loads
- Jobsite personnel must not place construction loads on a concrete structure or portion of a concrete structure unless it has been determined by the employer, based on information received from a person who is qualified in structural design, that the structure or portion of the structure is capable of supporting the intended loads.

General Requirements

- Reinforcing Steel
- All protruding reinforcing steel (i.e. rebar) onto and into which employees could fall, must be guarded to eliminate the hazard of impalement.
- In California, approved covers bearing a Cal OSHA approval number C-1710-AG must be used to protect workers from impalement.

General Requirements

- Post-Tensioning Operations
- Site employees (except those essential to the post-tensioning operations) must not be permitted to be behind the jack during tensioning operations.
Signs and barriers must be erected to limit employee access to the post- tensioning area during tensioning operations.
- Signs and barriers must be erected to limit employee access to the post- tensioning area during tensioning operations. No non-essential employees are allowed access to the work zone.

General Requirements

- Concrete Buckets
- Employees must not be permitted to ride concrete buckets.

General Requirements

- Working Under Loads
- Employees must not be permitted to work under concrete buckets while the buckets are being elevated or lowered into position.

General Requirements

- Personal Protective Equipment
- Employees must wear protective head and face equipment when applying cement, sand, and water mixture through pneumatic hoses.
- Employees must be protected with fall protection to place or tie reinforcing steel more than 6 feet above any adjacent working surfaces.

Equipment and Tools

- General Requirements for Equipment and Tools Includes Those For:
- Bulk cement storage, Concrete mixers, Power concrete trowels, Concrete buggies, Concrete pumping systems, Concrete buckets, Tremies, Bull floats, Masonry saws, and Lockout/tagout procedures.

Equipment and Tools

- Bulk cement storage
- Bulk storage bins, containers, and silos shall be equipped with:
 - Conical or tapered bottoms; and
 - Mechanical or pneumatic means of starting the flow of material.

Equipment and Tools

Bulk Cement Storage

- No employee shall be permitted to enter storage facilities unless the ejection system has been shut down, locked out, and tagged to indicate that the ejection system is not to be operated.

Equipment and Tools

Concrete Mixers

- Concrete mixers with one cubic yard or larger loading skips shall be equipped with:
 - A mechanical device to clear the skip of materials; and
 - Guardrails installed on each side of the skip.

Equipment and Tools

Power Concrete Trowels

- Powered and rotating type concrete troweling machines that are manually guided shall be equipped with a control switch that will automatically shut off power whenever hands of operator are removed from equipment handles.

Equipment and Tools

Concrete Pumping Systems

- Concrete pumping systems using discharge pipes shall be provided with pipe supports designed for 100 percent overload.
- Compressed air hoses used on concrete pumping system shall be provided with positive fail-safe joint connectors to prevent separation of sections when pressurized.

Equipment and Tools

Concrete Buggies

- Concrete buggy handles shall not extend beyond the wheels on either side of the buggy.
- See any problems in the photo? Use you mouse to identify.

Equipment and Tools

Concrete Buckets

- Concrete buckets equipped with hydraulic or pneumatic gates shall have positive safety latches or similar safety devices installed to prevent premature or accidental dumping.
- Concrete buckets shall be designed to prevent concrete from hanging up on top and the sides.

Equipment and Tools

Tremies

- Sections of tremies and similar concrete conveyances shall be secured with wire rope (or equivalent materials) in addition to the regular couplings or connections.

Equipment and Tools

Bull floats

- Bull float handles used where they might contact energized electrical conductors, shall be constructed of nonconductive material or insulated with a nonconductive sheath whose electrical and mechanical characteristics provide the equivalent protection of a handle constructed of nonconductive material.

Equipment and Tools

Masonry Saws

- A Masonry saw shall be guarded with a semicircular enclosure over the blade.
- A method for retaining blade fragments shall be incorporated in the design of the semicircular enclosure.

Equipment and Tools

Lockout/Tagout Procedures

- No employee shall be permitted to perform maintenance or repair activity on equipment (compressors, mixers, screens or pumps) where inadvertent operation of equipment could cause injury, unless all potentially hazardous energy sources have been locked out and tagged.

Equipment and Tools

Lockout/Tagout Procedures

- Tags shall read Do Not Start or similar to indicate that the equipment is not to be operated.
- The mixer in the photo is an example of machinery that should be tagged if it is defective and not to be operated.

Cast-In-Place Concrete

Formwork:

- Formwork must be designed, fabricated, erected, supported, braced, and maintained so that it will be capable of supporting without failure all vertical and lateral loads that might be applied to the formwork
- Conformance with ANSI's Construction and Demolition Operations - Concrete and Masonry Work (ANSI A10.9-1983) meets this requirement.

Cast-In-Place Concrete

Drawings or Plans

- Drawings and plans, including all revisions for the jack layout, formwork (including shoring equipment), working decks and scaffolds, must be available at the jobsite.

Cast-In-Place Concrete

Shoring and Reshoring

- All shoring equipment must be inspected prior to erection (meets formwork drawings).
- Damaged shoring equipment must not be used for shoring.
- Erected shoring equipment must be inspected immediately prior to, during, and immediately after concrete placement.
- Shoring equipment found damaged or weakened must be immediately reinforced.

Cast-In-Place Concrete

Shoring and Reshoring

- If single-post shores are used one on top of another (tiered), additional shoring requirements must be met:
 - Designed by a qualified designer and inspected by an engineer qualified in structural design,
 - Vertically aligned,
 - Spliced to prevent misalignment, and
 - Adequately braced in two mutually perpendicular directions at the splice level. Each tier also must be diagonally braced in the same two directions.

Cast-In-Place Concrete

Shoring and Reshoring

- Adjustment of single-post shores to raise formwork must not be made after the placement of concrete.
- Reshoring must be erected, as the original forms and shores are removed, whenever the concrete is required to support loads in excess of its capacity.

Cast-In-Place Concrete

Vertical Slip Forms

- The steel rods or pipes on which jacks climb or by which the forms are lifted must be:
 - (1) specifically designed for that purpose and
 - (2) adequately braced where not encased in concrete.

Cast-In-Place Concrete

Vertical Slip Forms

- Jacks and vertical supports must be positioned in such a manner that the loads do not exceed the rated capacity of the jacks.

Cast-In-Place Concrete

Vertical Slip Forms

- Jacks or other lifting devices must be provided with mechanical dogs or other automatic holding devices to support slip forms whenever failure of power supply or lifting mechanisms occurs.
- Form structure must be maintained within all design tolerances specified for plumbness during the jacking operation.

Cast-In-Place Concrete

Vertical Slip Forms

- Safe rate of lift must not be exceeded.
- Vertical slip forms must be provided with scaffolds or work platforms where employees are required to work or pass.

Cast-In-Place Concrete

Reinforcing Steel

- Reinforcing steel for walls, piers, columns, and similar vertical structures must be adequately supported to prevent overturning and collapse.
- Measures to prevent unrolled wire mesh from recoiling must be taken.
 - Securing each end of the roll.
 - Turning over the roll

Cast-In-Place Concrete

Removal of Formwork

- Forms and shores (except those used for slabs on grade and slip forms) must not be removed until it is determined by the employer that the concrete has gained sufficient strength to support its weight and superimposed loads.

Cast-In-Place Concrete

Removal of Formwork

- Determination based on:
 - Conditions per the plans and specifications or;
 - Concrete has been properly tested with an appropriate ASTM test method designed to indicate the concrete compressive strength, and test results indicate that concrete has gained sufficient strength to support its weight and superimposed loads.

Cast-In-Place Concrete

Removal of Formwork

- Reshoring must not be removed until the concrete being supported has attained adequate strength to support its weight and all loads in place upon it.

Precast Concrete

Precast Concrete

- Precast concrete wall units, structural framing, and tilt-up wall panels must be adequately supported to prevent overturning and collapse until permanent connections are completed.

Precast Concrete

Precast Concrete

- Lifting inserts that are embedded or otherwise attached to tilt-up wall panels must be capable of supporting at least two times the maximum intended load applied or transmitted to them.
- Lifting inserts for other precast members must be capable of supporting four times the load.

Precast Concrete

Precast Concrete

- Only essential employees are permitted under precast concrete that is being lifted or tilted into position.

Lift Slab Operations

Plans and Design

- Lift-slab operations must be designed and planned by a registered professional engineer, experienced in lift-slab construction.
- Plans and designs must:
 - Be implemented to include detailed instructions and sketches indicating the prescribed method of erection.
 - Include provisions for ensuring lateral stability of building/structure during construction.

Lift Slab Operations

Jacking Equipment

- Jacking equipment (e.g. threaded rods, lifting attachments, lifting nuts, hook-up collars, T-caps, shearheads, columns, and footings) must be capable of supporting at least two and one-half times the load being lifted during jacking operations and the equipment must not be overloaded.

Lift Slab Operations

Jacking Operation

- No employee, except essential to jacking operation, permitted in building/structure while any jacking operation is taking place unless building/structure reinforced sufficiently (per determination of a project independent registered professional engineer) to ensure its integrity during erection.
- Under no circumstances must any employee who is not essential to the jacking operation be permitted immediately beneath a slab while it is being lifted.

Masonry Construction

Limited Access Zone

- Established prior to masonry wall construction.
- Equal to the height of the wall to be constructed plus 4 feet.
- Run the entire length of the wall.
- On unscaffolded side restricted to entry only by employees actively engaged in constructing the wall.

Masonry Construction

Limited Access Zone

- Kept in place until the wall is adequately supported to prevent overturning and collapse unless the height of wall is more than 8 feet and unsupported; in which case, it must be braced.
- Bracing must remain in place until permanent supporting elements of structure are in place.

Concrete and Masonry Health Hazards

Health Hazards

- Need to be recognized, evaluated and controlled.
- Examples:
 - Portland cement, widely used in construction.
 - Mixtures of mortar and grout .

Concrete and Masonry Health Hazards

Health Hazards

- Cement and concrete so common many workers don't give second thought.
- Cement and concrete dust can be a breathing, eye and skin hazard.
- Degree of hazard depends upon concentration of dust, duration of exposure and individual sensitivity.

Concrete and Masonry Health Hazards

Cement Hazards

- Different cements have different ingredients.
- Many cements contain substances that can be hazardous, like silica, lime, gypsum, nickel, cobalt, and chromium compounds.

Concrete and Masonry Health Hazards

Breathing Cement Dust Can Cause

- Chronic bronchitis.
- Silicosis from crystalline silica or quartz.
- Some scientists believe cement dust with the hazardous substance chromium may lead to cancer.

Concrete and Masonry Health Hazards

Cement and Skin

- Cement dust, especially when wet, can be hazardous to the skin.
- Wet cement dust can cause burns, rashes, and other kinds of skin irritation.
- Lime, found in most cements, is often the cause.

Concrete and Masonry Health Hazards

Cement and Skin

- When wet concrete or mortar is trapped against the skin (falling inside boot, in gloves, soaking through work clothing) result may be first, second, or third degree burns or skin ulcers.
- These injuries can take several months to heal and may involve hospitalization and skin grafts.

Concrete and Masonry Health Hazards

Cement Allergy

- Some workers may slowly become allergic to cement if they have skin contact with it over a long period of time.
- Cement dust and wet cement can irritate the eyes causing them to burn, and water.
- Keep photo and fade to photo from #54

Concrete and Masonry Health Hazards

Labels and MSDSs

- Get the bag in which the cement products arrived on site and check the label.
- Look for the ingredients, a hazard warning statement and manufacturers name and address.
- Read the Material Safety Data Sheet (MSDS) for the product.
- MSDS lists specific ingredients, health and safety hazards, first aid procedures, PPE and other safety and health information

Concrete and Masonry Health Hazards

Solid / Dry Concrete

- Solid concrete should not be cut dry.
- Dry concrete can be potentially hazardous when cut, drilled, or broken up.
- Dust has all the same hazards as the dust from new cement.
- If not a new product, there will be no label or MSDS to check.
- Best approach is to play it safe and work with the solid / dry concrete as though it was cement dust.

Concrete and Masonry Health Hazards

Protect Yourself

Cement and Concrete Dust:

How to protect yourself from breathing cement and concrete dust?

- Stay out of dusty areas if you can.
- Wet down the work to keep dust out of the air.
- Wear approved respirator with HEPA cartridge.

Safety Tip: Use power tools with high efficiency particulate (HEPA) filters when cutting, drilling or grinding concrete if at all possible. These filters are designed to trap more than 99% of those breathable particles in the air. Use special HEPA vacuums to clean up dust when possible, not dry sweeping

Concrete and Masonry Health Hazards

Flammable Chemicals

Caution!

When dispensing flammable chemicals such as curing agents, bond breakers, and retardants, use proper grounding and bonding procedures.

Concrete and Masonry Health Hazards

Other Hazardous Substances

- Some epoxy sealants, form oils, curing agents, bond breakers, retardants, bonding agents and other hazardous substances on site can be toxic and hazardous.
- As with cement, it is important to keep them off of your skin.
- Check their labels and the MSDSs for additional safety and health precautions.

Concrete and Masonry Health Hazards

Protect your Skin and Eyes

- To protect your skin and eyes from cement avoid getting wet or dry cement on your skin or in your eyes.
- If you do, immediately wash it off with lots of water.
- Check the MSDS for additional information.

Concrete and Masonry Health Hazards

- For your eyes, wear goggles or safety glasses with side shields to protect yourself from splashes.
- Wear gloves to protect your hands or longer length gloves to protect your hands and forearms. Use a type which are impermeable where the cement can't get through them. Check the MSDS for the type of glove recommended by the manufacturer. Leather or cloth work gloves won't protect you if the cement is wet.
- For your feet, wear rubber or other impermeable boots resistant to cement or alkali.
- Respirators with HEPA cartridges may be required and worn when dust levels are high or above the OSHA Permissible Exposure Limits. It is important to select the proper type, and to properly store and maintain them.
- For arms and legs wear coveralls with long sleeves and full length trousers. Pull the sleeves down over the gloves. For concrete placements where the mix could overtop the boots, workers can use duct tape to make a seal for the boot to keep the wet concrete out.

Concrete and Masonry Health Hazards

Other Work Practices

- Work in ways that minimize the amount of cement and concrete dust released.
- Wet cut rather than dry cut .
- Mix dry cement in well ventilated areas.
- Work upwind from the dust sources.

Concrete and Masonry Health Hazards

Other Work Practices

- Where possible, use ready-mixed concrete instead of mixing on site.
- When kneeling on fresh concrete, use a dry board or waterproof kneepads to protect knees from cement that can soak through fabric.
- Remove jewelry.

Concrete and Masonry Health Hazards

Musculoskeletal Disorders (MSDs)

- Effects:
 - Sprains and strains to back, arms and shoulders.
 - Activities include lifting and carrying heavy bags, and shoveling and finishing bulk concrete products during placement and finishing.
 - Cumulative effects such as chronic back injury.

Concrete and Masonry Health Hazards

Musculoskeletal Disorders (MSDs)

- Plan work to reduce exposure:
 - Eliminate unnecessary handling.
 - Use mechanical equipment.
 - Minimize obstacles and distances traveled.
 - Use lower weight bags.
 - Evaluate individual capabilities.

Concrete and Masonry Health Hazards

- Personal Hygiene
 - Workers should:
 - Not eat, or smoke with soiled hands.
 - Wash exposed areas at end of shift, before eating or drinking.
 - Use fresh change of clothes daily.

Summary

Employer Responsibilities

- OSHA mandated responsibilities specific to concrete and masonry.
 - Requirements found in Subpart Q, Concrete and Masonry Construction, Title 29 of the Code of Federal Regulations (CFR), Part 1926.700 through 706.
 - Construction employers must and are responsible for compliance to protect construction workers from accidents and injuries resulting from the premature removal of formwork, the failure to brace masonry walls, the failure to support precast panels, the inadvertent operation of equipment, and the failure to guard reinforcing steel.

Summary and Conclusion

Employer Responsibilities

- Summary of most important:
 - Provide a workplace free from serious recognized hazards and comply with standards, rules and regulations issued under the OSHA Act.
 - Examine workplace conditions to make sure they conform to applicable OSHA standards.
 - Make sure employees have and use safe tools and equipment and properly maintain this equipment.
 - Use color codes, posters, labels or signs to warn employees of potential hazards.
 - Establish or update operating procedures and communicate them so that employees follow safety and health requirements.

Summary and Conclusion

Employer Responsibilities

- Summary of most important:
 - Provide medical examinations and training when required by OSHA standards.
 - Post, at a prominent location within the workplace, the OSHA poster informing employees of their rights and responsibilities.
 - Report to the nearest OSHA office within 8 hours any fatal accident or one that results in the hospitalization of three or more employees.
 - Keep records of work-related injuries and illnesses.
 - Provide employees, former employees and their representatives access to the Log of Work-Related Injuries and Illnesses (OSHA Form 300).

TIP: Employers with 10 or fewer employees and employers in certain low-hazard industries are exempt from this OSHA Log requirement.)

Summary and Conclusion

Employer Responsibilities

- Summary of most important:
 - Provide access to employee medical records and exposure records to employees or their authorized representatives.
 - Not discriminate against employees who exercise their rights.
 - Provide to the OSHA compliance officer the names of authorized employee representatives who may be asked to accompany the compliance officer during an inspection.
 - Post OSHA citations at or near the work area involved. Each citation must remain posted until the violation has been corrected, or for three working days, whichever is longer. Post abatement verification documents or tags.
 - Correct cited violations by the deadline set in the OSHA citation and submit required abatement verification documentation.

SUMMARY

Requirements for Concrete and Masonry Construction”

- General Requirements
- Equipment and Tools
- Cast-In Place Concrete
- Formwork
- Lift Slab
- Masonry Construction