Concrete and masonry construction, more so than most trades, are highly skilled activities that require numerous specialized abilities including, but not limited to, an understanding of chemistry, building techniques, specialized tools, and a unique language. The definitions below are extracted from OSHA standards, however they barely scratch the surface. Words and phrases such as: Adiabatic Curing, Hand Float, and Water-Cement Ratio are peculiar to these trades.

**DEFINITIONS**

Listed below are terms, with accompanying OSHA notes, which must be understood when dealing with concrete and masonry construction:

**Bull float:** a tool used to spread out and smooth concrete.

[Note: Bull float handles that might contact energized electrical conductors must be constructed of nonconductive materials or insulated with a nonconductive sheath.]

**Formwork:** the total system of support for freshly placed or partially cured concrete, including the mold or sheeting (form) that is in contact with the concrete as well as all supporting members including shores, reshores, hardware, braces, and related hardware.

[Note: 1 Formwork must be designed, fabricated, supported, braced and maintained so that it will be capable of supporting without failure all vertical and lateral loads that may reasonably anticipated to be applied to the formwork.]

[Note: 2 Drawings with all revisions for the jack layout, formwork (including shoring equipment), working decks, and scaffolds must be available at the job site.]

**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 which is clearly demarcated to limit access by employees.
Precast concrete: concrete members (such as walls, panels, slabs, columns, and beams) which have been formed, cast, and cured prior to final placement in a structure.

Reshoring: the construction operation in which shoring equipment (also called reshores or reshoring equipment) is placed, as the original forms and shores are removed, in order to support partially cured concrete and construction loads.

[Note: 1 All Shoring equipment must be inspected prior to erection to determine that the equipment meets the requirements specified in the formwork drawings.]

[Note: 2 Shoring equipment found to be damaged such that it is not capable of supporting without failure all vertical and lateral loads that may reasonably anticipated to be applied to them must not be used.]

[Note: 3 Erected shoring equipment shall be inspected immediately prior to, during, and immediately after concrete placement.]

[Note: 4 Shoring equipment that is found to be damaged or weakened after erection, such that its strength is reduced to the point where it is not capable of supporting without failure all vertical and lateral loads that may reasonably anticipated to be applied to them will be immediately reinforced.]

[Note: 5 The sills for shoring must be sound, rigid, and capable of carrying the maximum intended load.]

[Note: 6 All base plates, shore heads, extension devices, and adjustment screws must be in firm contact, and secured when necessary, with the foundation and the form.]

[Note: 7 Eccentric loads on shore heads and similar members shall be prohibited unless these members have been designed for such loading.]

[Note: 8 Whenever single post shores are used one on top of another (tiered), the below will apply:
   a. The design of the shoring shall be prepared by a qualified designer and the erected shoring shall be inspected by an engineer qualified in structural design.
   b. The single post shores shall be vertically aligned.
   c. The single post shores shall be spliced to prevent misalignment.
   d. The single post shores shall be adequately braced in two mutually perpendicular directions at the splice level. Each tier shall also be diagonally braced in the same two directions.]

[Note: 9 Adjustment of single post shores to raise formwork will not be made after the placement of concrete.]

[Note: 10 Reshoring shall be erected, as the original forms and shores are removed, whenever the concrete is required to support loads in excess of its capacity.]
Shore: a supporting member that resists a compressive force imposed by a load.

Tremie: a pipe through which concrete may be deposited under water.

[Note: Sections of tremies and similar concrete conveyances must be secured with wire rope (or equivalent materials) in addition to the regular couplings or connections.]

Vertical slip forms: forms which are jacked vertically during the placement of concrete.

Jacking operation: the task of lifting a slab (or group of slabs) vertically from one location to another (e.g., from the casting location to a temporary location, or to its final location in the structure), during the construction of a building/structure where the lift-slab process is being used.

MAJOR HAZARDS

Both concrete and masonry construction require skilled, trained personnel to produce quality work performed in a safe manner. Serious accidents, including wall collapse, can happen in an instant due to premature removal or actual failure of the formwork. Additionally, failure to brace masonry walls, failure to support precast panels, overloading, etc., can cause serious mishaps.

No construction loads will be placed on a concrete structure unless our competent person determines, 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 loads.

Prior to construction of a masonry wall, a limited access zone will be established as follows:

a. it must be equal to the height of the wall to be constructed plus 4 feet and it must run the entire length of the wall.

b. on the side of the wall that will be unscaffolded, the limited access zone must be:
   1. restricted to entry only by employees actively engaged in constructing the wall, and,
   2. if the wall is 8 feet or less, the limited access zone will be kept in place until the wall is adequately supported to prevent overturning and collapse, or
   3. if the height of the wall is more than 8 feet and unsupported, the wall must be braced. The bracing must remain in place until permanent supporting elements of the structure are in place.
Concrete and masonry work are performed in such a variety of circumstances and conditions -- under ground, over ground, on sides of structures, on top of structures, inside confined spaces, precast and cast in-place concrete, etc. Each circumstance presents specific hazards which must be addressed. The competent person on site will point out unusual, specific hazards and means to deal with them.

SAFETY PROCEDURES

The competent person will ensure that all equipment is inspected as required and defective equipment is removed from service.

The competent person will ensure the drawing or plans, with revisions, for all equipment and procedures to be used in concrete or masonry construction are available at the job site.

For the safety of all employees, the following safety rules are established:

a. Limited or controlled access zones will be restricted to employees who have actual job responsibilities within the established zones.

b. Employees will not work under concrete buckets while they are being elevated or lowered into position.

c. Employees, except those required for the job, are not allowed under precast concrete members while they are being lifted or tilted into position.

d. Personal protective equipment, determined by the competent person on the job site, will be used without fail. It should be noted that when cement is mixed with water, a highly alkaline solution is produced by the dissolution of calcium, sodium, and potassium hydroxides. Gloves should be worn to protect the skin. Hands should be washed after contact. OSHA requires head and face equipment for employees applying a cement, sand, and water mixture through a pneumatic hose.

e. Employees will not be allowed to perform maintenance on any equipment where the unexpected activation of that equipment could cause harm without following the procedures in our Control of Hazardous Energy Program.

f. When fastening other materials to a concrete surface (such as a wooden 2” X 4”), only a fastener of 7/32-inch shank diameter or less will be driven in and it may be no closer than 2 inches from the unsupported edge or corner of the work surface.

g. Fasteners will not be driven directly into brick or concrete closer than 3” from the unsupported edge of corner unless a special guard, fixture, or jig is used.
NOTE: Exception to the above: Low-velocity tools may drive no closer than 2" from an edge in concrete.

h. Concrete mixers with one cubic yard or larger loading skips will be equipped with a:
   a. mechanical device to clear the skip of materials.
   b. guardrail installed on each side of the skip.

Note: Regardless of the size of the skip, point of operation guarding must be utilized.

**REBAR PROTECTION**

All protruding reinforcing steel onto and into which employees could fall will be guarded to eliminate the hazard of impalement. Protection from impalement on protruding rebar is primarily a function of fall protection when employees are working above rebar or other impalement hazards.

When working at the same grade as rebar protruding 4 to 6 feet, there is not, for all practical purposes, an impalement hazard. In these instances, acceptable rebar caps are appropriate to prevent cuts, abrasions or other minor injuries.

At grade, the lower the rebar sticks up, the greater the impalement hazard due to tripping. If there is any chance for impalement, acceptable rebar caps are mandatory.

**CONCRETE CUTTING**

Only trained and authorized personnel will operate concrete tile cutting equipment. The following guidelines will be used during all concrete cutting operations.

   a. follow the manufacturer’s recommendations for the safe use of the equipment.
   b. use the correct blade (size, type, speed) for the job, properly tightened. Inspect the blade and all equipment before use.
   c. ensure all safety guards are functioning properly.
   d. never operated a hand held saw above shoulder height.
   e. wear proper safety equipment including eye, hand and skin protection. Depending on the job, respiratory protection or dust masks may be required.
   f. establish a control zone and keep others out who are not directly involved with the work at hand.
   g. ensure there is adequate coolant/water when appropriate.
   h. never operate an internal combustion saw in a confined space.
One of the major hazards of cutting concrete is exposure to silica dust. See Table below.

<table>
<thead>
<tr>
<th>Substance</th>
<th>(a) mppcf</th>
</tr>
</thead>
<tbody>
<tr>
<td>SILICA</td>
<td>(b) (250 \div (%\text{SiO}_2+5))</td>
</tr>
<tr>
<td>Crystalline Quartz</td>
<td>20</td>
</tr>
<tr>
<td>Threshold Limited calculated from the formula Cristobalite.</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Amorphous, including natural diatomaceous earth</td>
<td>20</td>
</tr>
<tr>
<td>SILICATES (Less than 1% crystalline silica)</td>
<td>20</td>
</tr>
<tr>
<td>Mica</td>
<td>20</td>
</tr>
<tr>
<td>Portland Cement</td>
<td>20</td>
</tr>
<tr>
<td>Soapstone</td>
<td>20</td>
</tr>
<tr>
<td>Talc (non-abestiform)</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Talc (fibrous), use asbestos limit</td>
<td>20</td>
</tr>
<tr>
<td>GRAPHITE (Natural)</td>
<td>15</td>
</tr>
<tr>
<td>INERT OR NUISANCE PARTICULATES</td>
<td>50 (or 15 mg/m³ whichever is the smaller) of total dust &lt;1% SiO</td>
</tr>
<tr>
<td>Note 1 Covers all organic and inorganic particulates not otherwise regulated. Same as Particulates Not Otherwise Regulated.</td>
<td></td>
</tr>
<tr>
<td>Note 2 Inert or Nuisance Dusts includes all mineral, inorganic, and organic dusts as indicated by examples in TLV’s Appendix D.</td>
<td></td>
</tr>
</tbody>
</table>

a. Millions of particles per cubic foot or air, based on impinger samples counted by lightfield techniques.

b. The percentage of crystalline silica in the formula is the amount determined from airborne samples, except in those instances in which other methods have been shown to be applicable.

An effective engineering control to control the silica dust hazard is the use of a wet saw which can cut silica dust by 94%. If feasible, we will always use wet cutting methods. If not feasible, appropriate respiratory protection will be employed.

**CONCRETE PUMPS AND PLACING BOOMS**

OSHA has little to say about concrete pumping systems. Essentially, OSHA says that pumping systems using discharge pipes will be provided with pipe supports designed for 100% overload and compressed air hoses used on concrete pumping systems will be provided with positive fail-safe joint connectors to prevent separation of sections when pressurized.

Concrete pumping systems have the potential for serious mishaps due to the machinery, the weight, the set-up, and the operation. Coordination is required between all persons involved in concrete pumping operations.

Only qualified, authorized, employees may operate concrete pumps and placing booms. The equipment owner/operator manual must be on site and readily available.
Prior to use, the equipment will be inspected per the manufacturer’s instructions and defective equipment will be taken out of service.

Appropriate PPE must be worn including hard hats, face protection, and steel toed work boots.

Extreme care must be exercised in keeping the boom clear of electrical power lines. Safety distances from various electrical currents are found in *Heavy Equipment and Electrical Power Lines*, below.

### HEAVY EQUIPMENT AND ELECTRICAL POWER LINES

**Cranes and derricks. - 1926.550**

Except where electrical distribution and transmissions lines have been deenergized and visibly grounded at point of work or where insulating barriers (not attached to the vehicle) have been erected to prevent physical contact with the lines, the following clearance -- between any part of the vehicle and the line -- will be observed:

<table>
<thead>
<tr>
<th>Line Rating</th>
<th>Minimum Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 kV. or below</td>
<td>10 feet</td>
</tr>
<tr>
<td>Over 50 kV.</td>
<td>10 feet plus .04 inch for each 1 kV. over 50 kV, or twice the length of the line insulator, but never less than 10 feet.</td>
</tr>
</tbody>
</table>

In transit, equipment clearance must be a minimum of:

<table>
<thead>
<tr>
<th>Line Rating</th>
<th>Minimum Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 kV. or below</td>
<td>4 feet</td>
</tr>
<tr>
<td>Over 50 kV. to 345 kV.</td>
<td>10 feet</td>
</tr>
<tr>
<td>Over 345 kV. to 750 kV.</td>
<td>16 feet</td>
</tr>
</tbody>
</table>