PART O

CONCRETE, CONCRETE FORMS, SHORING, AND MASONRY CONSTRUCTION

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**WAC 296-155-675 Scope, application, and definitions applicable to this part.**

1. **Scope and application.** This part sets forth requirements to protect all construction employees from the hazards associated with concrete and masonry construction operations performed in workplaces covered under chapter 296-155 WAC.

2. **Definitions applicable to this part.**

   - **Bull float** is a tool used to spread out and smooth the concrete.
   - **Competent person** is 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 action to eliminate them.
   - **Controlling Contractor** is a prime contractor, general contractor, construction manager, or any other legal entity that has the overall responsibility for the construction of the project, including planning, quality, and completion.
   - **Dead Load** is a constant load, without load factors, due to the mass (weight) of members, the supported structure and permanent attachments or accessories.
   - **Falsework** is formwork to support concrete and placing operations for supported slabs of concrete structures, including all supporting members, hardware, and bracing.
   - **Formwork** is 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.
   - **Guy** is a line that steadies a high piece or structure by pulling against an off-center load.
   - **Jacking operation** is 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 (parked) location, or from a temporary location to another 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.
   - **Lift slab** is 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** is an area alongside a masonry wall, which is under construction, and which is clearly demarcated to limit access by employees.
   - **Post-tensioning Operations** is a method of stressing reinforced concrete in which tendons running through the concrete are tensioned after the concrete has hardened.
   - **Precast concrete** is concrete members (such as walls, panels, slabs, columns, and beams) which have been formed, cast, and cured prior to final placement in a structure.
   - **Qualified** is one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated their ability to solve or resolve problems relating to the subject matter, the work, or the project.
   - **Reinforced Concrete** is composite material in which the concrete provides the material's compressive strength, while the reinforcing in the form of additional embedded material provides the tensile strength and/or ductility.
Reinforcing Ironworker is a worker primarily engaged in the hoisting, rigging, field fabrication, moving, and installation of reinforcing steel assemblies, members, post-tensioning cables, and related equipment. Reinforcing steel activities include, but are not limited to: off-loading and material handling of reinforcing components; fabrication, pre-assembly, and placement of reinforcing steel columns, beams, joists, mats, welded wire mesh, and curtain-walls; and the placement of post-tensioning cables.

Reinforcing Steel Assemblies is vertical and horizontal columns, caissons, walls, drilled piers, mats, and other similar structures. For purposes of this standard, reinforcing steel includes rods, bars, or mesh made from composite and/or other materials.

Reshoring is 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.

Shore is a supporting member that resists a compressive force imposed by a load.

Slip Form is a form that is moved as concrete is placed and slides without being detached to form walls or other concrete structures.

Stressing Jacks are portable hydraulic devices that pull the tendons associated with post-tensioning concrete to create a permanent tension load.

Tendon is a metal element, usually of steel such as wire, stranded components (such as wires), bars or rods used in pre-stressing or post-tensioning concrete.

Vertical slip forms are forms which are jacked vertically during the placement of concrete.
**WAC 296-155-680 General provisions.**

1. **General.** All equipment, material and construction techniques used in concrete construction and masonry work must meet the applicable requirements for design, construction, inspection, testing, maintenance and operations as prescribed in ANSI A10.9-1997, Concrete and Masonry Work Safety Requirements.

2. **Construction loads.** You must not place any construction loads on a concrete structure or portion of a concrete structure unless the employer 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.

3. **Vertical loads.** Vertical loads consist of a dead load plus an allowance for live load. The weight of formwork together with the weight of freshly placed concrete is dead load. The live load consists of the weight of workers, equipment, runways and impact, and must be computed in pounds per square foot (psf) of horizontal projection.

4. **Lateral loads.** Braces and shores must be designed to resist all foreseeable lateral loads such as wind, cable tensions, inclined supports, impact of placement, and starting and stopping of equipment. The assumed value of load due to wind, impact of concrete, and equipment acting in any direction at each floor line must not be less than 100 pounds per lineal foot of floor edge or two percent of total dead load of the floor, whichever is greater. Wall forms must be designed for a minimum wind load of 10 psf, and bracing for wall forms should be designed for a lateral load of at least 100 pounds per lineal foot of wall, applied at the top. Walls of unusual height require special consideration.

5. **Special loads.** Formwork must be designed for all special conditions of construction likely to occur, such as unsymmetrical placement of concrete, impact of machine-delivered concrete, uplift, and concentrated loads.

6. **You must check form supports and wedges during concrete placement to prevent distortion or failure.**

7. **Site Access and Layout.** The controlling contractor must ensure that the following is provided and maintained:
   - Adequate access roads into and through the site for the safe delivery and movement of derricks, cranes, trucks, other necessary equipment, the material to be erected, and the means and methods for pedestrian and vehicular control.
     
     **EXCEPTION:** This requirement does not apply to roads outside of the construction site.
   - A firm, properly graded, and drained area, that is readily accessible to the work with adequate space for the safe assembly, rigging, and storage of reinforcing and post-tensioning materials, and the safe operation of the reinforcing contractor's equipment.
   - Adequate exterior platform for landing materials on the floors of multi-tiered buildings.
     
     **EXCEPTION:** Where, the design, structure, or space constraint precludes the installation of exterior platforms.
     
     **EXCEPTION:** Where the design of the structure allows for the safe landing of materials without the exterior platform.
(d) Adequate protective system designed and constructed in accordance Chapter 155 Part N Excavation, Trenching, and Shoring prior to the commencement of reinforcing operations in excavations and/or trenches.

(8) Written Notifications Prior to Commencement of and Immediately Following Reinforcing Steel Installation and Concrete Placement.

The controlling contractor must ensure that the reinforcing steel contractor on the project is provided with the following written notifications at the times indicated:

(a) Prior to commencement of reinforcing steel installation, that formwork and falsework has been inspected by a competent person and determined to meet the design requirements of the installing formwork/falsework contractor as indicated in subsections (8)(b) and (8)(c) below and immediately after the installation of reinforcing steel and placement of the concrete.

(b) Prior to commencement of reinforcing steel installation, that the vertical formwork, elevated decks, and other working/walking surfaces are structurally stable and remain adequately braced, guyed, or supported to allow safe access of reinforcing workers, materials, and equipment.

(c) Prior to commencement of reinforcing steel installation, that the protective system for excavations and/or trenches has been inspected by a competent person.

(9) Stability Requirements for Vertical and Horizontal Columns, Walls, and other Reinforcing Assemblies.

(a) Reinforcing steel for walls, piers, columns, prefabricated reinforcing steel assemblies, and similar vertical structures must be guyed, braced, or supported to prevent collapse.

(b) Guys, braces, or supports.

(i) Systems for guying, bracing, or supports must be designed by a qualified person.

(ii) Guys, braces, and supports must be installed and removed as directed by a competent person.

(c) Reinforcing steel must not be used as a guy or brace.

(d) The controlling contractor must prohibit other construction processes below or near the erection of reinforcement assemblies until they are adequately supported and/or secured to prevent structural collapse.

(e) The reinforcing steel contractor must flag specific areas of the erection level for their work activity. The guying and/or bracing must be in place before the release of the reinforcing assembly from the hoist rigging.
(10) Impalement protection and custody.

(a) You must guard all protruding reinforcing steel, onto and into which employees could fall, to eliminate the hazard of impalement.

(b) Wire mesh rolls: You must secure wire mesh rolls at each end to prevent dangerous recoiling action.

(c) When protective covers are provided by the reinforcing steel contractor, the protective covers must remain in place after reinforcing steel activities have been completed to protect workers from other trades only if the controlling contractor or its authorized representative:

(i) Has directed the reinforcing steel contractor to leave the protective covers in place; and

(ii) Has inspected and accepted control and responsibility for the protective covers; or

(iii) Has placed control and responsibility for the protective covers on another contractor other than the reinforcing steel contractor.

NOTE: The responsibilities of the controlling contractor related to accepting the control and custody of protective covers does not relieve the individual employer or subcontractor from protecting their employees from impalement hazards in accordance with the provisions of this sub-section.

(11) Post-tensioning operations. The controlling contractor must:

(a) Provide written documentation to the employer performing the stressing operation that the minimum specified initial concrete compressive strength has been achieved prior to commencement of stressing operations.

(b) Ensure no employees (except those essential to the post-tensioning operations) are permitted to be behind the jack or the fixed end anchorage during tensioning operations. No employees are permitted above or alongside the full length of the tendons during tensioning operations.

(c) Ensure signs and barricades are erected to limit access into the stressing area only to personnel engaged in stressing or de-tensioning operations.

(d) Prohibit other construction trades from working in the barricaded area during stressing operations.

(e) Ensure there is an adequate safe work platform of a minimum of three feet measured from the end of the floor slab to the platform toeboard, such as an extension of the formwork, for stressing tendons, cutting tendon tails, and grouting where tensioning operations are above grade.

EXCEPTION: Where the adjoining structure or other structural space constraint precludes the installation of exterior platforms.
(i) The work platform required in subdivision (e) must include guardrails and
toeboards meeting the requirements of 296-880-50005 WAC, and must be kept
clear of any debris or materials not related to the stressing or de-tensioning
operation.

(f) Ensure stressing equipment is secured to prevent accidental displacement during
operation.

(g) Ensure stressing equipment calibrations specifications are available on
site. Prior to stressing, a competent person must verify the adequacy of the stressing
equipment calibrations.

(h) Ensure a competent person inspects the stressing equipment for damage or defects
before stressing operations begin, and periodically during the stressing operations. The
use of stressing equipment must conform to the manufacturer's instructions and
recommendations.

(i) Ensure methods are employed to insure that supporting forms, falsework or shoring
does not fall due to cambering of the concrete during the stressing operations. Dead
loads and construction loads (including those due to stressing) must be considered in
the design of the forms, falsework, and shoring.

(8)—Reinforcing steel.

(a) You must guard all protruding reinforcing steel, onto and into which employees could
fall, to eliminate the hazard of impalement.

(b) Wire mesh rolls: You must secure wire mesh rolls at each end to prevent dangerous-
recoiling action.

(c) Guying: You must guy or support reinforcing steel for walls, piers, columns,
and similar vertical structures to prevent overturning and to prevent collapse.

(9)—Post-tensioning operations.

(a) You must not permit any employee (except those essential to the post-tensioning
operations) to be behind the jack during tensioning operations.

(b) You must erect signs and barriers to limit employee access to the post-tensioning area
during tensioning operations.

(12) Hoisting of stressed members

(a) You must handle stressed members at pick points specifically designated by the
manufacturer.

(b) You must lift stressed members with lifting devices recommended by the
manufacturer or the engineer in charge.

(c) No one must be allowed under stressed members during lifting and erecting.
(13) Working under loads.

(a) Concrete buckets:

(i) You must not permit any employee to work under concrete buckets while buckets are being elevated or lowered into position.

(ii) To the extent practical, you must route elevated concrete buckets so that no employee, or the fewest number of employees, are exposed to the hazards associated with falling concrete buckets.

(b) Reinforcing assemblies:

(i) Routes for suspended loads must be pre-planned to ensure that no employee is required to work directly below a suspended load except for:

(A) Employees engaged in the placing or initial connection of the reinforcement assemblies; and

(B) Employees necessary for the hooking or unhooking of the load.

(ii) When working under suspended loads, the following criteria must be met:

(A) Materials being hoisted must be rigged to prevent unintentional displacement;

(B) Hooks with self-closing safety latches or their equivalent must be used to prevent components from slipping out of the hook.

(C) The controlling contractor must prohibit all activities under or in the hazard area of hoisting operations, including unloading and staging areas for reinforcing assemblies.

(14) Personal protective equipment.

(a) You must not permit any employee to apply a cement, sand, and water mixture through a pneumatic hose unless the employee is wearing protective head and face equipment.

(b) Fall protection must be provided at four feet or more in accordance with 296-880-20005(6) WAC.

(c) You must not permit any employee to place or tie reinforcing steel more than four feet above any adjacent working surface unless the employee is protected by personal fall arrest systems, safety net systems, or positioning device systems meeting the criteria of chapter 296-155 WAC, Part C-1.

(d) You must protect each employee on the face of formwork or reinforcing steel from falling four feet or more to lower levels by personal fall arrest systems, safety net systems, or positioning device systems meeting the criteria of chapter 296-155 WAC, Part C-1.
(15) Training Requirements.

Employers must ensure that each employee who performs reinforcing steel and/or posttensioning activities has been provided training by a qualified person in the following areas for the activities in which they are engaged:

(a) The hazards associated with reinforcing steel and post-tensioning activities;

and,

(b) The proper procedures and equipment to perform reinforcing steel and post-tensioning activities.
WAC 296-155-681 Safe walking surfaces on concrete structural members.

You must not use structural members with studs, dowels, or shear connectors installed on the top side as a walkway and/or means of access unless such studs, dowels, or shear connectors are covered with suitable material and in such a manner as to provide a walking surface at least as stable and free of hazards as the top surface of the member would provide without attachments installed.

Note: For the purpose of this section, “stud” means all protruding metal attachments to structural members.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 16-09-085 (Order 15-08), § 296-155-681, filed 04/19/16, effective, 05/20/16. Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-155-681, filed 5/15/89, effective 6/30/89.]
WAC 296-155-682 Requirements for equipment and tools.

(1) **Bulk cement storage.** Bulk storage bins, containers, and silos must be equipped with the following:

   (a) Conical or tapered bottoms; and
   
   (b) Mechanical or pneumatic means of starting the flow of material.

(2) You must not permit any employee to enter storage facilities unless the ejection system has been shut down and locked out in accordance with WAC 296-155-429.

(3) You must use harnesses, lanyards, lifelines or droplines, independently attached or attended, as prescribed in chapter 296-155 WAC, Part C-1, Fall protection requirements for construction.

(4) **Concrete mixers.** Concrete mixers with one cubic yard (.8 m3) or larger loading skips must be equipped with the following:

   (a) A mechanical device to clear the skip of materials; and
   
   (b) Guardrails installed on each side of the skip.

(5) **Power concrete trowels.** Powered and rotating type concrete troweling machines that are manually guided must be equipped with a control switch that will automatically shut off the power whenever the hands of the operator are removed from the equipment handles.

(6) **Concrete buggies.** Concrete buggy handles must not extend beyond the wheels on either side of the buggy.

   **Note:** Installation of knuckle guards on buggy handles is recommended.

(7) **Runways.**

   (a) Runways must be constructed to carry the maximum contemplated load with a safety factor of 4, have a smooth running surface, and be of sufficient width for two buggies to pass. Single runs to have a minimum width of 42 inches with turnouts. Runways to have standard railings. Where motor driven concrete buggies are used, a minimum 4-inches by 4-inches wheel guard must be securely fastened to outside edge of runways.

   (b) All concrete buggy runways which are 12 inches or more above a work surface or floor, or ramps with more than 4 percent incline are considered “elevated” runways.

   **Exception:** Small jobs utilizing only one concrete buggy, or larger jobs utilizing a “one-way traffic pattern” may be exempt from the requirements for “turnouts” or for “sufficient width for two buggies to pass.”
EXEMPTION

Runways less than 12 inches above the floor or ground which are utilized by hard-powered buggies only, may be exempt from the requirements for guardrails and wheelguards.

(8) Concrete pumps and placing booms.

(a) Definitions.

Concrete delivery hose. A flexible concrete delivery hose which has two end couplings.

Concrete pump. A construction machine that pumps concrete.

Controls. The devices used to operate a machine.

Delivery systems. The pipe, hoses and components, through which the concrete is pumped.

Grooved end. A pipe clamp pipe connection where a groove is machined or rolled directly into the outside of the pipe wall (for example: Victualic).

Material pressure. The pressure exerted on the concrete inside the delivery system.

Placing boom and placing unit. A manual or power driven, slewable working device which:

- Consists of one or more extendable or folding parts for supporting the concrete delivery system, and directs the discharge into the desired location; and
- May be mounted on trucks, trailers, or special vehicles.

Qualified person. Someone who:

- Possesses a recognized degree or certificate of professional standing; or
- Has extensive knowledge, training, and experience; or
- Successfully demonstrated the ability to resolve problems relating to the work.

Restraining devices. A sling, cable, or equivalent device used to minimize excess movement of a delivery system in case of separation.

Whip hoses. A suspended hose that has only one coupling and is used to direct the delivery of concrete.

(b) Equipment requirements.

(i) Equipment identification tag.

You must ensure the following identification is furnished if originally identified by the manufacturer and on all pumps manufactured after January 1, 1998:

- The manufacturer’s name;
- The year of manufacture;
- The model and serial number;
• The maximum material pressure;
• The maximum allowable pressure in the hydraulic system; and
• The maximum weight per foot of delivery system including concrete.

(ii) Manufacturer’s manual.
You must have the manufacturer’s operation/safety manual or equivalent available for each concrete pump or placing boom.

(iii) Unsafe condition of equipment.
If during an equipment inspection a condition is revealed that might endanger workers, the equipment must not be returned to service until the condition is corrected.

(iv) Controls.
Controls must have their function clearly marked.

(v) Hydraulic systems.
(A) Concrete pumps and placing booms hydraulic systems must have pressure relief valves to prevent cylinder and boom damage.
(B) Hydraulic systems must have hydraulic holding valves if hose or coupling failure could result in uncontrolled vertical movement.

(iv) Certification.
In the event of failure of a structural member, overloading, or contact with energized electric power lines and before return to service, the equipment must be certified safe by:
• The manufacturer; or
• An agent of the manufacturer; or
• A professional engineer.

(vii) Marking weight. A permanent, legible notice stating the total weight of the unit must be marked on:
• Trailer or skid mounted concrete pumps;
• Placing booms; and
• All major detachable components over 500 hundred pounds.

(viii) Lifting a pump.
A concrete pump must be lifted using the lift points specified by the manufacturer or a professional engineer.

(ix) Emergency shutoff.
A concrete pump must have a clearly labeled emergency stop switch that stops the pumping action.
(x) Inlet and outlet guarding.
   (A) The waterbox must have a fixed guard to prevent unintentional access to the moving parts.
   (B) The agitator must be guarded with a point of operation guard in accordance with chapter 296-806 WAC, Machine safety, and the guard must be:
       • Hinged or bolted in place;
       • At least 3 inches distance from the agitator;
       • Be capable of supporting a load of 250 pounds.
   (C) A person must not stand on the guard when the pump or agitator is running.

(xi) Outriggers.
   (A) You must use outriggers in accordance with the manufacturer’s specifications.
   (B) Concrete pump trucks manufactured after January 1, 1998, must have outriggers or jacks permanently marked to indicate the maximum loading they transmit to the ground.

(xii) Load on a placing boom.
   (A) The manufacturer’s or a licensed, registered, structural engineer’s specifications for the placing boom must not be exceeded by:
       • The weight of the load;
       • The length and diameter of suspended hose;
       • The diameter and weight of mounted pipe.
   (B) A concrete placing boom must not be used to drag hoses or lift other loads.
   (C) All engineering calculations regarding modifications must be:
       • Documented;
       • Recorded; and
       • Available upon request.

(xiii) Pipe diameter thickness. The pipe wall thickness must be measured in accordance with the manufacturer’s instruction, and:
       • Be sufficient to maintain a burst pressure greater than the maximum pressure the pump can produce;
       • The pipe sections must be replaced when measurements indicate wall thickness has been reduced to the limits specified by the manufacturer.
(xiv) Pipe clamps.

(A) You must not pump concrete through a delivery system with grooved ends, such as those for Victualic-type couplers.

(B) Pipe clamps must have a pressure rating at least equal to the pump pressure rating.

(C) Pipe clamps contact surfaces must be free of concrete and other foreign matter.

(D) If quick connect clamps are used, you must pin or secure them to keep them from opening when used in a vertical application.

(xv) Delivery pipe.

(A) A delivery pipe between the concrete pump and the placing system must be supported and anchored to prevent movement and excessive loading on clamps.

(B) Double ended hoses must not be used as whip hoses.

(C) Attachments must not be placed on whip hoses (i.e., “S” hooks, valves, etc.).

<table>
<thead>
<tr>
<th>Hose Diameter</th>
<th>Hose Length (12’ and less) Max. yards per hour</th>
<th>Hose Length (12’ and longer) Max. yards per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>2”</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>3”</td>
<td>90</td>
<td>50</td>
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<tr>
<td>4”</td>
<td>160</td>
<td>110</td>
</tr>
<tr>
<td>5”</td>
<td>See Manufacturer specs</td>
<td>See manufacturer specs</td>
</tr>
</tbody>
</table>

- The above figures are based on a minimum of a 4” slump and a 5 sack mix.
- Variables in mix design can have an effect on these ratings.
- Aggregate should not exceed 1/3 the diameter on these delivery system.

(xvi) Restraining. A restraining device must:

- Be used on attachments suspended from the boom tips; and
- Have a load rating not less than 1/5 of its ultimate breaking strength.

(xvii) Equipment inspection.

(A) An inspection must be conducted annually for the first 5 years and semiannually thereafter and must include the following:

- Nondestructive testing of all sections of the boom by a method capable of ensuring the structural integrity of the boom;
- Be conducted by a qualified person or by a private agency.
(B) The inspection report must be documented and a copy maintained by the employer and in each unit inspected. It must contain the following:

- The identification, including the serial numbers and manufacturer’s name, of the components and parts inspected and tested;
- A description of the test methods and results;
- The names and qualifications of the people performing the inspection;
- A listing of necessary repairs; and
- The signature of the manufacturer, an agent of the manufacturer, or a qualified person.

Note: See WAC 296-155-628(8)(d) for the inspection worksheet criteria.

(xviii) Equipment repair.

(A) Replacement parts must meet or exceed the original manufacturer’s specifications or be certified by a registered professional structural engineer.

(B) A properly certified welder must perform any welding on the boom, outrigger, or structural component.

(xix) Compressed air cleaning of the piping system. To clean the piping system:

(A) The pipe system must be securely anchored before it is cleaned out.

(B) The flexible discharge hose must be removed.

(C) Workers not essential to the cleaning process must leave the vicinity.

(D) The compressed air system must have a shutoff valve.

(E) Blow out caps must have a bleeder valve to relieve air pressure.

(F) A trap basket or containment device (i.e., concrete truck, concrete bucket) must be available and secured to receive the clean out device.

(G) Delivery pipes must be depressurized before clamps and fittings are released.

(c) Qualifications and training requirements.

(i) Operator trainee-Qualification requirements. To be qualified to become a concrete pump operator, the trainee must meet the following requirements unless it can be shown that failure to meet the requirements will not affect the operation of the concrete pump boom.

(A) Vision requirements:

- At least 20/30 Snellen in one eye and 20/50 in the other. Corrective lenses may be used to fulfill this requirement;
- Ability to distinguish colors, regardless of position, if color differentiation is required;
- Normal depth perception and field of vision.
(B) Hearing requirements. Hearing adequate to meet operational demands. Corrective devices may be used to fulfill this requirement.

(ii) Operator trainee-Training requirements. Operator trainee training requirements include, but are not limited to, the following:

(A) Demonstrated their ability to read and comprehend the pump manufacturer’s operation and safety manual.

(B) Be of legal age to perform the duties required.

(C) Received documented classroom training and testing (as applicable) on these recommended subjects:
   - Driving, operating, cleaning and maintaining concrete pumps, placing booms, and related equipment;
   - Jib/boom extensions;
   - Boom length/angle;
   - Manufacturer’s variances;
   - Radii;
   - Range diagram, stability, tipping axis; and
   - Structural/tipping determinations.

(D) Maintain and have available upon request a copy of all training materials and a record of training.

(E) Satisfactorily complete a written examination for the concrete pump boom for which they are becoming qualified. It will cover:
   - Safety;
   - Operational characteristics and limitations; and
   - Controls.

(iii) Operator-Qualifications requirements. Operators will be considered qualified when they have:

(A) Completed the operator trainee requirements listed in (c)(i) and (ii) of this subsection.

(B) Completed a program of training conducted by a qualified person, including practical experience under the direct supervision of a qualified person.

(C) Passed a practical operating examination of their ability to operate a specific model and type of equipment. Possess the knowledge and the ability to implement emergency procedures.

(D) Possess the knowledge regarding the restart procedure after emergency stop has been activated.

(E) Possess the proper class of driver’s license to drive the concrete pump truck.

(F) Demonstrate the ability to comprehend and interpret all labels, safety decals, operator’s manuals, and other information required to safely operate the concrete pump.
(G) Be familiar with the applicable safety requirements.

(H) Understand the responsibility for equipment maintenance.

(d) Concrete pump inspection worksheet criteria. Concrete pump trucks will be inspected using the following criteria: The manufacturer’s required inspection criteria will be followed in all instances.

| Note: DOT requirements for inspections-Ref. 49 C.F.R. 396.11, Driver Vehicle Inspections and 396.13, Driver Pre-Trip Inspections; and WAC 296-155-610. |

(i) Hydraulic systems.
   (A) Oil level;
   (B) Hoses;
   (C) Fittings;
   (D) Holding valves;
   (E) Pressure settings;
   (F) Hydraulic cylinders;
   (G) Ensure that the emergency stop system is functioning properly;
   (H) All controls clearly marked.

(ii) Electrical.
   (A) All systems functioning properly.
   (B) All remote control functions are operating properly. Ensure that the emergency stop system is functioning properly.
   (C) All controls clearly marked.

(iii) Structural.
   (A) Visual inspection for cracks, corrosion, and deformations of the concrete pump with placing boom structure, and all load carrying components such as outriggers, cross frames, torsion box beams, and delivery line support structures that may lead to nondestructive testing.
   (B) Visual examination of all links, pivots, pins, and bolts.
   (C) Vertical and horizontal movement at the turret, turntable, rotation gear lash, bearing tolerances, not to exceed manufacturer’s specifications.

(iv) Piping systems.
   (A) Wall thickness must not exceed original manufacturer’s specifications.
   (B) Mounting hardware for attaching delivery system.
   (C) Correct clamps and safety pins.
(9) **Concrete buckets.**

(a) Concrete buckets equipped with hydraulic or pneumatic gates must have positive safety latches or similar safety devices installed to prevent premature or accidental dumping.

(b) Concrete buckets must be designed to prevent concrete from hanging up on top and the sides.

(c) Riding of concrete buckets for any purpose is prohibited, and you must keep vibrator crews out from under concrete buckets suspended from cranes or cableways.

(d) When discharging on a slope, you must block the wheels of ready-mix trucks and the brakes set to prevent movement.

(10) **Tremies.** You must secure sections of tremies and similar concrete conveyances with wire rope (or equivalent materials in addition to the regular couplings or connections).

(11) **Bull floats.** Bull float handles, used where they might contact energized electrical conductors, must 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.

(12) Masonry saws must be constructed, guarded, and operated in accordance with WAC 296-155-367 (1) through (4).

(13) **Lockout/tagout procedures.** You must not permit any employee to perform maintenance or repair activity on equipment (such as compressors, mixers, screens, or pumps used for concrete and masonry construction activities) where the inadvertent operation of the equipment could occur and cause injury, unless all potentially hazardous energy sources have been locked out and tagged in accordance with chapter 296-155 WAC, Part I.

[WAC 296-155-683  Concrete finishing.](#)

(1) Scaffolds for use of cement finishers must comply with the requirements of chapter 296-874 WAC, Scaffolds.

(2) Where grinders, chippers, and other equipment is used which creates a thrust force while working on scaffolding, you must securely tie such scaffold to a structure or held in with weighted drop lines.

(3) You must provide grinding and dressing operations carried on within closed rooms, stairwells, elevator shafts, etc., with forced air ventilation.
(4) Grinding machine operators must wear respirators whenever machines are in operation or where dust hazard exists.

(5) Eye protection must be worn by workers engaged in grinding, chipping, or sacking concrete as required by WAC 296-155-215.

WAC 296-155-684 Requirements for cast in place concrete.

(1) General requirements for formwork and placing and removal of forms.
   (a) 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 may reasonably be anticipated to be applied to the formwork. Formwork which is designed, fabricated, erected, supported, braced, and maintained in conformance with the Appendix to this section will be deemed to meet the requirements of this subdivision.
   
   (b) Any form, regardless of size, must be planned in every particular and designed and constructed with an adequate factor of safety. In addition to computable loading, additional form pressures may result from impact during concrete placement, sudden lowering of temperatures retarding the set and increasing the liquid head or static pressure, vibrations of the form or concrete, uneven stressing resulting from failure or weakening of form members, or impact from concrete buckets or placing equipment. As a result, an adequate factor of safety is required to offset these unpredictable conditions.
   
   (c) The thoroughness of planning and design must be governed by the size, complexity, and intended use of the form. Formwork which is complex in nature or which will be subjected to unusually high concrete pressures must be designed or approved for use by an engineer or experienced form designer.
   
   (d) When moved or raised by crane, cableway, A-frame, or similar mechanical device, forms must be securely attached to slings having a minimum safety factor of 5. Use of No. 9 tie wire, fiber rope, and similar makeshift lashing is prohibited.
   
   (e) Taglines must be used in moving panels or other large sections of forms by crane or hoist.
   
   (f) All hoisting equipment, including hoisting cable used to raise and move forms must have a minimum safety factor incorporated in the manufacturer's design, and the manufacturer's recommended loading must not be exceeded. Field-fabricated or shop-fabricated hoisting equipment must be designed or approved by a registered professional engineer, incorporating a minimum safety factor of 5 in its design. Panels and built-up form sections must be equipped with metal hoisting brackets for attachment of slings.

(2) Drawings or plans, including all revisions, for the jack layout, formwork (including shoring equipment), working decks, and scaffolds, must be available at the job site.
(3) **Shoring and reshoring.**

(a) General: Shoring installations constructed in accordance with this standard must be designed in accordance with American National Standard Recommended Practice for Concrete Formwork, ANSI (ACI 347-78), Formwork for Concrete ACI 318-83, or with the following publications of the Scaffolding & Shoring Institute: Recommended Standard Safety Code for Vertical Shoring, 1970; Single Post Shore Safety Rules, 1969; and Steel Frame Shoring Safety, Safety Rules, 1969.

(b) You must inspect all shoring equipment prior to erection to determine that it is as specified in the shoring layout.

(c) A shoring layout must be prepared or approved by a person qualified to analyze the loadings and stresses which are induced during the construction process.

(d) A copy of the shoring layout must be available at the job site.

(e) The shoring layout must include all details of the specification, including unusual conditions such as heavy beams, sloping areas, ramps, and cantilevered slabs, as well as plan and elevation views.

(f) You must not use shoring equipment found to be damaged such that its strength is reduced to less than that required by WAC 296-155-684 (1)(a) for shoring.

(g) You must inspect erected shoring equipment immediately prior to, during, and immediately after concrete placement.

(h) Upon inspection, you must immediately remove and replace shoring equipment that is found to be damaged or weakened.

(i) The sills for shoring must be sound, rigid, and capable of carrying the maximum intended load without settlement or displacement.

(j) 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.

(k) Eccentric loads on shore heads and similar members must be prohibited unless these members have been designed for such loading.

(l) The minimum total design load for any shoring used in slab and beam structures must be not less than 100 pounds per square foot for the combined live and dead load regardless of slab thickness; however, the minimum allowance for live load and formwork must be not less than 20 pounds per square foot in addition to the weight of the concrete. Additional allowance for live load must be added for special conditions other than when placing concrete for standard-type slabs and beams. Shoring must also be designed to resist all foreseeable lateral loads such as wind, cable tensions, inclined supports, impact of placement, and starting and stopping of equipment. The assumed value of load due to wind, impact of concrete, and equipment acting in any direction at each floor line must not be less than 100 pounds per lineal foot of floor edge or two percent of total dead load of the floor, whichever is greater. (See subsection (3)(b) of this section.)

(m) When motorized carts are used, the design load must be increased 25 pounds per square foot.
(4) The design stresses for form lumber and timbers must be within the tolerance of the grade, condition, and species of lumber used.

(5) The design stresses used for form lumber and timber must be shown on all drawings, specifications, and shoring layouts.

(6) All load-carrying timber members of scaffold framing must be a minimum of 1500 f (stress grade) construction grade lumber. All dimensions are nominal sizes except that where rough sizes are noted, only rough or undressed lumber of the size specified must satisfy minimum requirements.

(7) When shoring from soil, an engineer or other qualified person must determine that the soil is adequate to support the loads which are to be placed on it.

(8) You must take precautions so that weather conditions do not change the load-carrying conditions of the soil below the design minimum.

(9) When shoring from fill or when excessive earth disturbance has occurred, an engineer or other qualified person must supervise the compaction and reworking of the disturbed area and determine that it is capable of carrying the loads which are to be imposed upon it.

(10) You must use suitable sills on a pan or grid dome floor or any other floor system involving voids where vertical shoring equipment could concentrate an excessive load on a thin concrete section.

(11) When temporary storage of reinforcing rods, material, or equipment on top of formwork becomes necessary, these areas must be sufficient to meet the loads.

(12) If any deviation in the shoring plan is necessary because of field conditions, you must consult the person who prepared the shoring layout for approval of the actual field setup before concrete is placed.

(13) You must check the shoring setup to ensure that all details of the layout have been met.

(14) The completed shoring setup must be a homogenous unit or units and must have the specified bracing to give it lateral stability.

(15) You must check the shoring setup to make certain that bracing specified in the shoring layout for lateral stability is in place.

(16) All vertical shoring equipment must be plumb. Maximum allowable deviation from the vertical is 1/8 inch in 3 feet. If this tolerance is exceeded, you must not use the shoring equipment until readjusted within this limit.

(17) Upon inspection, you must immediately remove and replace shoring equipment that is found to be damaged or weakened.

(18) You must not release or remove shoring equipment until the approval of a qualified engineer has been received.

(19) You must plan removal of shoring equipment so that the equipment which is still in place is not overloaded.

(20) Slabs or beams which are to be reshored should be allowed to take their actual permanent deflection before final adjustment of reshoring equipment is made.

(21) While the reshoring is underway, you must not permit any construction loads on the partially cured concrete.
(22) You must not exceed the allowable load on the supporting slab when reshoring.

(23) You must thoroughly recheck the reshoring to determine that it is properly placed and that it has the load capacity to support the areas that are being reshored.

WAC 296-155-685 Tubular welded frame shoring.

(1) Metal tubular frames used for shoring must have allowable loads based on tests conducted according to the Recommended Procedure for Compression Testing of Scaffolds and Shores, Scaffolding & Shoring Institute, 1967.

(2) Design of shoring layouts must be based on allowable loads which were obtained using the test procedures of subsection (1) of this section and on at least a two and one-half to one safety factor.

(3) You must inspect all metal frame shoring equipment before erection.

(4) You must not use metal frame shoring equipment and accessories if heavily rusted, bent, dented, rewelded, or having broken weldments or other defects.

(5) All locking devices on frames and braces must be in good working order, coupling pins must align the frame or panel legs, pivoted cross braces must have their center pivot in place, and all components must be in a condition similar to that of original manufacture.

(6) When checking the erected shoring frames with the shoring layout, the spacing between towers and cross-brace spacing must not exceed that shown on the layout, and all locking devices must be in the closed position.

(7) Devices for attaching the external lateral stability bracing must be securely fastened to the legs of the shoring frames.

(8) All baseplates, shore heads, extension devices, or adjustment screws must be in firm contact with the footing sill and the form material, and must be snug against the legs of the frames.

(9) Eccentric loads on shore heads and similar members are prohibited unless the shore heads have been designed for such loading.

(10) When formwork is installed at an angle, or sloping, or when the surface shored from is sloping, the shoring must be designed for such loading.

(11) Adjustment screws must not be adjusted to raise formwork after the concrete is in place.
WAC 296-155-686  Tube and coupler shoring.

(1) Tube and coupler towers used for shoring must have allowable loads based on tests conducted according to the Recommended Procedure for Compression Testing of Scaffolds and Shores, Scaffolding & Shoring Institute, 1967.

(2) Design of shoring layouts must be based on working loads which were obtained using the test procedures of subsection (1) of this section and on at least a two and one-half to one safety factor.

(3) You must inspect all tube and coupler components before being used.

(4) You must not use tubes of shoring structures if heavily rusted, bent, dented, or having other defects.

(5) You must not use couplers (clamps) if deformed, broken, or having defective or missing threads on bolts, or other defects.

(6) The material used for the couplers (clamps) must be of a structural type such as drop-forged steel, malleable iron, or structural grade aluminum. You must not use gray cast iron.

(7) When checking the erected shoring towers with the shoring layout, the spacing between posts must not exceed that shown on the layout, and all interlocking of tubular members and tightness of couplers should be checked.

(8) All baseplates, shore heads, extension devices, or adjustment screws must be in firm contact with the footing sill and the form material, and must be snug against the posts.

(9) Eccentric loads on shore heads and similar members are prohibited unless the shore heads have been designed for such loading.

(10) You must take special precautions when formwork is at angles, or sloping, or when the surface shored from is sloping.

(11) Adjustment screws must not be adjusted to raise formwork after the concrete is in place.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 16-09-085 (Order 15-08), § 296-155-686, filed 04/19/16, effective, 05/20/16.  Statutory Authority:  Chapter 49.17 RCW.  89-11-035 (Order 89-03), § 296-155-686, filed 5/15/89, effective 6/30/89.]

WAC 296-155-687  Single post shores.

(1) When checking erected single post shores with the shoring layout, the spacing between shores in either direction must not exceed that shown on the layout, and all clamps, screws, pins, and all other components must be in the closed or engaged position.

(2) For stability, single post shores must be horizontally braced in both the longitudinal and transverse directions. You must also install diagonal bracing, You must install bracing as the shores are being erected.

(3) You must securely fasten devices which attach to the external lateral stability bracing to the single post shores.

(4) All baseplates or shore heads of single post shores must be in firm contact with the footing sill and the form material.
(5) Whenever single post shores are used in more than one tier, the layout must be designed and inspected by a structural engineer.

(6) Eccentric loads on shore heads are prohibited unless the shore heads have been designed for such loading.

(7) When formwork is at an angle, or sloping, or when the surface shored from is sloping, the shoring must be designed for such loading.

(8) You must make adjustments of single post shores to raise formwork after concrete is in place.

(9) Respecting fabricated single post shores, the following apply:
   (a) The clamp used for adjustable timber single post shores must have working load ratings based on tests conducted according to the standard test procedures for fabricated single post shores in Recommended Procedure for Compression Testing of Scaffolds and Shores, Scaffolding & Shoring Institute, 1967, and on at least a 3 to one safety factor.
   (b) Shoring layouts must be made using working loads which were obtained using the test procedures of (a) of this subsection, and on at least a 3 to one safety factor.
   (c) You must inspect all fabricated single post shores before being used.
   (d) You must not use fabricated single post shores if heavily rusted, bent, dented, rewelded, or having broken weldments or other defects. If they contain timber, they must not be used if timber is split, cut, has sections removed, is rotted, or otherwise structurally damaged.
   (e) All clamps, screws, pins, threads, and all other components must be in a condition similar to that of original manufacture.

(10) Respecting adjustable timber single post shores, the following apply:
   (a) The clamp used for adjustable timber single post shores must have working load ratings based on tests conducted according to the standard test procedures for fabricated single post shores in Recommended Procedure for Compression Testing of Scaffolds and Shores, Scaffolding & Shoring Institute, 1967, and on at least a three to one safety factor.
   (b) Timber used must have the safety factor and allowable working load for each grade and species as recommended in the Tables for wooden columns in the Wood Structural Design Data Book, National Forest Products Association, 1970.
   (c) The shoring layout must be made using the allowable load obtained by using the test procedure for the clamp or Tables for timber referred to in (a) and (b) of this subsection.
   (d) You must inspect all timber and adjusting devices to be used for adjustable timber single post shores before erection.
   (e) You must not use timber if it is split, cut, has sections removed, is rotted, or is otherwise structurally damaged.
   (f) You must not use adjusting devices if heavily rusted, bent, dented, rewelded, or having broken weldments or other defects.
(g) All nails used to secure bracing on adjustable timber single post shores must be driven home and the point of the nail bent over.

(11) Respecting timber single post shores, the following must apply:

(a) Timber used as single post shores must have the safety factor and allowable working load for each grade and species as recommended in the Tables for wooden columns in the Wood Structural Design Data Book, National Forest Products Association, 1970.

(b) You must prepare the shoring layout by using working loads obtained by using the Tables referred to in (a) of this subsection.

(c) You must inspect all timber to be used for single post shoring before erection.

(d) You must not use timber if it is split, cut, has sections removed, is rotted, or is otherwise structurally damaged.

(e) All nails used to secure bracing on timber single post shores must be driven home and the point of the nail bent over.

(12) Tiered single post shores. Whenever single post shores are used one on top of another (tiered), you must comply with the following specific requirements in addition to the general requirements for formwork:

(a) The design of the shoring must be prepared by a qualified designer and the erected shoring must be inspected by an engineer qualified in structural design.

(b) The single post shores must be vertically aligned.

(c) The single post shores must be spliced to prevent misalignment.

(d) The single post shores must be adequately braced in two mutually perpendicular directions at the splice level. Each tier must also be diagonally braced in the same two directions.

(e) Adjustment of single post shores to raise formwork must not be made after the placement of concrete.

(f) 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.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 16-09-085 (Order 15-08), § 296-155-687, filed 04/19/16, effective, 05/20/16. Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-155-687, filed 5/15/89, effective 6/30/89.]

WAC 296-155-688 Vertical slip forms.

(1) Slip forms must be designed and constructed, and the form movement carried out, under the immediate supervision of a person or persons experienced in slip form design and operation. Drawings prepared by a qualified engineer, showing the jack layout, formwork, working decks, and scaffolding, must be available at the job site, and followed.

(2) The steel rods or pipe on which the jacks climb or by which the forms are lifted must be designed for this purpose. Such rods must be adequately braced where not encased in concrete.
(3) Forms must be designed to prevent excessive distortion of the structure during the jacking operation.

(4) Vertical slip forms must be provided with scaffolding or work platforms completely encircling the area of placement.

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

(6) The jacks or other lifting devices must be provided with mechanical dogs or other automatic holding devices to support the slip forms whenever failure of the power supply or lifting mechanism occurs.

(7) The form structure must be maintained within all design tolerances specified for plumbness during the jacking operation.

(8) Lifting must proceed steadily and uniformly and must not exceed the predetermined safe rate of lift. A jacking system, which provides precise, simultaneous movement of the entire form in small preselected increments, is recommended for large structures.

(9) Workers placing reinforcing steel must comply with the requirements of chapter 296-155 WAC, Part C-1 when working above the scaffold level.

(10) The total allowable load on slip form platforms must be determined by the design engineer and enforced by the field supervisor.

(11) Lateral and diagonal bracing of the forms must be provided to prevent excessive distortion of the structure during the sliding operation.

(12) While the slide is in operation, the form structure must be maintained in line and plumb.

(13) A field supervisor experienced in slip form construction must be present on the deck at all times.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060, 16-09-085 (Order 15-08), § 296-155-688, filed 04/19/16, effective 05/20/16. Statutory Authority: Chapter 49.17.010, .040, .050, .060 RCW, 98-05-046 (Order 97-10), § 296-155-688, filed 2/13/98, effective 4/15/98, Chapter 49.17 RCW, 91-03-044 (Order 90-18), § 296-155-688, filed 1/10/91, effective 2/12/91; 89-11-035 (Order 89-03), § 296-155-688, filed 5/15/89, effective 6/30/89.]

WAC 296-155-689 Placing and removal of forms.

(1) When moved or raised by crane, cableway, A-frame, or similar mechanical device, forms must be securely attached to slings having a minimum safety factor of 5. Use of No. 9 tie wire, fiber rope, and similar makeshift lashing is prohibited.

(2) You must use taglines in moving panels or other large sections of forms by crane or hoist.

(3) All hoisting equipment, including hoisting cable used to raise and move forms must have a minimum safety factor incorporated in the manufacturer's design, and the manufacturer's recommended loading must not be exceeded. Field-fabricated or shop-fabricated hoisting equipment must be designed or approved by a registered professional engineer, incorporating a minimum safety factor of 5 in its design. Panels and built-up form sections must be equipped with metal hoisting brackets for attachment of slings.
(4) Forms intended for use where there is a free fall of over 10 feet must be equipped with adequate scaffolding and guardrails, or employees working on the forms must be protected from falls in accordance with chapter 296-155 WAC, Part C-1 during forming and stripping operations.

(5) You must not release vertical forms being raised or removed in sections until adequately braced or secured. You must not release overhead forms until adequately braced or secured.

(6) You must protect workers or others at lower levels from falling materials. You must erect appropriate warning signs along walkways.

(7) You must not remove forms until the concrete is cured. The concrete must be adequately set in order to permit safe removal of the forms, shoring, and bracing. You must adhere to engineer's specifications and local building codes in determining the length of time forms should remain in place following concrete placement. In addition, you must perform tests on field-cured concrete specimens in order to insure that concrete has obtained sufficient strength to safely support the load prior to removal of forms.

WAC 296-155-690 Appendix to WAC 296-155-684 cast in place concrete.

General requirements for formwork.

(This Appendix is nonmandatory.)

This Appendix serves as a nonmandatory guideline to assist employers in complying with the formwork requirements in WAC 296-155-684 (1)(a). Formwork which has been designed, fabricated, erected, braced, supported, and maintained in accordance with Sections 6 and 7 of the American National Standard for Construction and Demolition Operations-Concrete and Masonry Work, ANSI A10.9-1983, must be deemed to be in compliance with the provision of WAC 296-155-684 (1)(a).

WAC 296-155-691 Precast concrete and tilt-up operations.

(1) It must be the responsibility of the contractor to use accessories which are designed to be compatible.

(2) You must know the design capacity of all lifting devices and accessories. You must use the devices and accessories with the appropriate capacity.

(3) Prior to pouring the panels of a tilt-up type construction job, a set of plans or job specifications, including lifting procedures.

(a) These plans must be at the job site and made available upon request.
(b) Any changes made in the rigging procedure of a tilt-up panel or slab must provide the same degree of safety as required by the original plans.

(c) The plans or specifications must contain the following information:
   (i) The type, size, and location of all lifting inserts.
   (ii) The type, size, and location of all brace inserts or fittings for guy wires in each panel and floor or support.
   (iii) The size of braces or guys to be used.
   (iv) The compression strength which concrete panels must attain prior to being lifted.

(4) You must include the following conditions in the erection process and incorporate them in the design plan:
   (a) Braces and all associated components of the bracing system must be designed to incorporate a safety factor of one and one-half to resist any normal stresses to which they may be subjected, including normal high wind velocity pressures for the area.
   (b) Precast concrete wall units, structural framing, and tilt-up wall panels must be adequately supported to prevent overturning and to prevent collapse until permanent connections are completed.
   (c) Floor braces used to secure panel sections must be placed at an angle of not less than 45 degrees or more than 60 degrees from horizontal when physically possible to install in this manner.
   (d) The bracing on all panel sections must be installed in such a manner as to prevent the panel from accidentally rotating.
   (e) Each panel section not secured by other means must have a minimum of two braces. The braces must be installed in such a manner as to evenly distribute the load or guy wires, when properly installed, may be used in lieu of stiff leg braces.
   (f) If braces are attached to a panel or slab by bolts tightened into inserts installed in holes drilled in concrete, the type of inserts used and method of installation must be such as to develop the required strength to be maintained for the bracing system.
   (g) Inserts to be installed for lifting sections of tilt-up precast panels must be designed mechanically to maintain a safety factor of 3.
   (h) Lifting inserts which are embedded or otherwise attached to precast concrete members, other than the tilt-up members, must be capable of supporting at least 4 times the maximum intended load applied or transmitted to them.
   (i) The compression strength of the concrete must be such that when the property, size, and amount of inserts are installed a minimum safety factor of two will be maintained.
   (j) Lifting hardware must be capable of supporting at least 5 times the maximum intended load applied or transmitted to the lifting hardware.
   (k) You must discard lifting bolts or other lifting devices which have been bent, worn, or are defective.
(l) The upper and lower sections of telescoping type braces must be secured by high tensile steel pins or bolts which provide adequate shear strength and which will positively secure against accidental removal.

(m) You must not alter manufactured products in a manner which would reduce the safe working load to less than its original value.

(n) You must position inserts so that bolts, or lifting devices, when inserted, will be perpendicular to the face on which they are placed.

(5) Design of the panels and layout of the pour must be made in such a manner so that when picking, the top of the panel will be away from the crane. If this is not possible, the contractor must consult with a representative of the department and the crane company involved to determine the procedure to be followed in lifting and placing in its permanent position safely. You must lift and handle panels in such a manner that they will not strike the hoisting equipment, in case of failure.

(a) Physical stops must be provided which will prevent the bottom edge of a panel being set from slipping off the edge of its supporting structure.

(b) You must not set tilt-up panels when there is a possibility that wind velocity would create a hazardous condition.

(c) You must designate a qualified signalperson and they must with the crane operator on lifting procedures prior to making the pick. The signalperson must be located in such a position during the pick of the panel that they can observe both the crane operator and the employees working in the immediate area.

(d) During the lifting process, workers must keep clear of the underside of the panel.

(e) You must keep people not involved in the lifting process clear of the hazardous area near where panels are being raised, moved or placed.

(f) If braces must be removed temporarily during construction, you must provide other effective means to safely support the panel during the interim period.

(g) You must properly brace or otherwise secure each panel prior to removal of the hoisting equipment.

(h) You must properly shore short panels or sections not otherwise supported by floor, footings, columns or other structure.

WAC 296-155-694 Requirements for lift-slab construction operations.

(1) Lift-slab operations must be designed and planned by a registered professional engineer who has experience in lift-slab construction. You must implement such plans and designs and they must include detailed instructions and sketches indicating the prescribed method of erection. These plans and designs must also include provisions for ensuring lateral stability of the building/structure during construction.
(2) Jacks/lifting units must be marked to indicate their rated capacity as established by the manufacturer.

(3) You must not load jacks/lifting units beyond their rated capacity as established by the manufacturer.

(4) Jacking equipment must be capable of supporting at least two and one-half times the load being lifted during jacking operations and you must not overload the equipment. For the purpose of this provision, jacking equipment includes any load bearing component which is used to carry out the lifting operation(s). Such equipment includes, but is not limited to, the following: Threaded rods, lifting attachments, lifting nuts, hook-up collars, T-caps, shearheads, columns, and footings.

(5) Jacks/lifting units must be designed and installed so that they will neither lift nor continue to lift when they are loaded in excess of their rated capacity.

(6) Jacks/lifting units must have a safety device installed which will cause the jacks/lifting units to support the load in any position in the event any jack/lifting unit malfunctions or loses its lifting ability.

(7) Jacking operations must be synchronized in such a manner to ensure even and uniform lifting of the slab. During lifting, you must keep all points at which the slab is supported within 1/2 inch of that needed to maintain the slab in a level position.

(8) If leveling is automatically controlled, a device must be installed that will stop the operation when the 1/2 inch tolerance set forth in subsection (7) of this section is exceeded or where there is a malfunction in the jacking (lifting) system.

(9) If leveling is maintained by manual controls, such controls must be located in a central location and attended by a competent person while lifting is in progress. In addition to meeting the definition in WAC 296-155-012(4), the competent person must be experienced in the lifting operation and with the lifting equipment being used.

(10) You must limit the maximum number of manually controlled jacks/lifting units on one slab to a number that will permit the operator to maintain the slab level within specified tolerances of subsection (7) of this section, but in no case must that number exceed 14.

(11) You must not permit any employee, except those essential to the jacking operation, in the building/structure while any jacking operation is taking place unless the building/structure has been reinforced sufficiently to ensure its integrity during erection. The phrase “reinforced sufficiently to ensure its integrity” used in this subsection means that a registered professional engineer, independent of the engineer who designed and planned the lifting operation, has determined from the plans that if there is a loss of support at any jack location, that loss will be confined to that location and the structure as a whole will remain stable.

(a) Under no circumstances, must you permit any employee who is not essential to the jacking operation to be immediately beneath a slab while it is being lifted.

(b) For the purpose of subsection (11) of this section, a jacking operation begins when a slab or group of slabs is lifted and ends when such slabs are secured (with either temporary connections or permanent connections).

(c) Employers who comply with Appendix A to WAC 296-155-694 are considered to be in compliance with the provisions of subsections (11) through (11)(c) of this section.
(12) When making temporary connections to support slabs, you must secure wedges by tack welding, or an equivalent method of securing the wedges to prevent them from falling out of position. Lifting rods may not be released until the wedges at that column have been secured.

(13) All welding on temporary and permanent connections must be performed by a certified welder, familiar with the welding requirements specified in the plans and specifications for the lift-slab operation.

(14) You must not execute load transfer from jack/lifting units to building columns until the welds on the column shear plates (weld blocks) are cooled to air temperature.

(15) You must positively secure jack/lifting units to building columns so that they do not become dislodged or dislocated.

(16) Equipment must be designed and installed so that the lifting rods cannot slip out of position; you must institute other measures, such as the use of locking or blocking devices, which will provide positive connection between the lifting rods and attachments and will prevent components from disengaging during lifting operations.

**Appendix to WAC 296-155-694-Lift-slab operations**

(This appendix is nonmandatory.)

In WAC 296-155-694(11), WISHA requires employees to be removed from the building/structure during jacking operations unless an independent registered professional engineer, other than the engineer who designed and planned the lifting operation, has determined that the building/structure has been sufficiently reinforced to insure the integrity of the building/structure. One method to comply with this provision is for the employer to ensure that continuous bottom steel is provided in every slab and in both directions through every wall or column head area. *(Column head area means the distance between lines that are one and one half times the thickness of the slab or drop panel. These lines are located outside opposite faces of the outer edges of the shearhead sections—See Figure 1.)* The amount of bottom steel must be established by assuming loss of support at a given lifting jack and then determining the steel necessary to carry, by catenary action over the span between surrounding supports, the slab service dead load plus any service dead and live loads likely to be acting on the slab during jacking. In addition, the surrounding supports must be capable of resisting any additional load transferred to them as a result of the loss of support at the lifting jack considered.
WAC 296-155-695 Miscellaneous concrete construction.

(1) General provisions.

(a) Deadheads used in post tensioning of tendons must be the type that will increase the grip on the cable as the tension is increased.

(b) Proper means and equipment must be used to prevent the over-tensioning of the tendons.

(c) Only qualified workers must perform this type work.

(2) Pre-stressed and post-stressed concrete operations.

(a) Anchor fitting. In utilizing anchor fittings for tensioned strands, the recommendations and instructions of the supplier concerning installation, maintenance, and replacement must be followed.

(b) You must keep tools and strand vices clean and in good repair.

(c) Safety factor.

   (i) Expendable strand deflection devices used to pretension concrete members must have a minimum safety factor of two.

   (ii) Reusable strand deflection devices must have a minimum safety factor of 3.
(d) Jacking operations.
   (i) During jacking operations of any tensioning element or group of tensioning elements, you must keep the anchors turned up close to the anchorplate.
   (ii) You must not permit anyone to stand in line or directly over the jacking equipment during tensioning operations.
   (iii) Employees must not stand behind the jack during tensioning operations.

(e) Jacking and pulling equipment. You must frequently inspect headers, bolts, and hydraulic rams for indication of fatigue, and the threads on bolts and nuts inspected for diminishing cross section.

(f) Storage. You must store stressed members on a level base and adequately supported during storage and transportation to prevent tipping.

(g) Rigging.
   (i) You must handle stressed members at pick points specifically designated on the manufacturer’s drawings.
   (ii) You must lift stressed members with lifting devices recommended by the manufacturer or the engineer in charge.
   (iii) You must not allow anyone under stressed members during lifting and erection.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 16-09-085 (Order 15-08), § 296-155-695, filed 04/19/16, effective, 05/20/16. Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-155-695, filed 5/15/89, effective 6/30/89. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-074 (Order 86-14), § 296-155-695, filed 1/21/86; Order 74-26, § 296-155-695, filed 5/7/74, effective 6/6/74.]

WAC 296-155-697 Requirements for masonry construction.

(1) You must establish a limited access zone whenever a masonry wall is being constructed. The limited access zone must conform to the following:

(2) You must establish the limited access zone prior to the start of construction of the wall.

(3) The limited access zone must be equal to the height of the wall to be constructed plus 4 feet, and must run the entire length of the wall.

(4) You must establish the limited access zone on the side of the wall which will be unscaffolded.

(5) You must restrict entry into the limited access zone to only employees actively engaged in constructing the wall. You must not permit any other employees to enter the zone.

(6) The limited access zone must remain in place until the wall is adequately supported to prevent overturning and to prevent collapse unless the height of wall is over 8 feet, in which case, the limited access zone must remain in place until the requirements of subsection (7) of this section have been met.

(7) All masonry walls over 8 feet in height must be adequately braced to prevent overturning and to prevent collapse unless the wall is adequately supported so that it will not overturn or collapse. The bracing must remain in place until permanent supporting elements of the structure are in place.
(8) Employees engaged in cutting or chipping must wear suitable eye protection in accordance with WAC 296-155-215.

(9) You must construct, guard, and operate masonry saws in accordance with WAC 296-155-367 (1) through (4).

(10) Persons charged with operation of derricks used for stone setting must be qualified in that type of work.

(11) Stone must be set directly on the wall by the derrick.

(12) Breast derricks when used in setting stone must be secured against a slip or kick back and guyed with wire cables. Provide hold down line to prevent derrick from falling back.

(13) Stone cutters must wear goggles while trimming stone or cutting holes.

(14) You must test pins for security before stone is hoisted.

(15) You must protect hoisting cables from chafing and wearing over corners.

(16) Mason’s mortar mixers must have a bar-type grill installed over the mixer opening. The guard must be installed with an automatic disconnect switch to stop the mixer tub rotation and prevent the mixer from starting whenever the guard is not in place.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 16-09-085 (Order 15-08), §296-155-697, filed 04/19/16, effective 05/20/16. Statutory Authority: Chapter 49.17 RCW. 90-17-051 (Order 90-10), §296-155-697, filed 8/13/90, effective 9/24/90; 90-03-029 (Order 89-20), §296-155-697, filed 1/11/90, effective 2/26/90; 89-11-035 (Order 89-03), §296-155-697, filed 5/15/89, effective 6/30/89.]

**WAC 296-155-699 Appendix A to Part O - References to Part O of chapter 296-155 WAC.**

(This Appendix is nonmandatory.)

The following nonmandatory references provide information which can be helpful in understanding and complying with the requirements contained in Part O.

- Building Code Requirements for Reinforced Concrete (ACI 318-83).
- Fornwork for Concrete (ACI SP-4).
- Recommended Practice for Concrete Formwork (ACI 347-78).
- Safety Requirements for Concrete and Masonry Work (ANSI A10.9-1983).
- Standard Test Method for Compressive Strength of Concrete Cylinders Cast In-Place in Cylindrical Molds (ASTM C873-85).
- Standard Method for Developing Early Age Compressive Test Values and Projecting Later Age Strengths (ASTM C918-80).
• Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as Used in Construction (ASTM E329-77).
• Method of Making and Curing Concrete Test Specimens in the Laboratory (ASTM C192-88).
• Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete (ASTM C42-87).
• Methods of Securing, Preparing and Testing Specimens from Hardened Lightweight Insulating Concrete for Compressive Strength (ASTM C513-86).
• Test Method for Comprehensive Strength of Lightweight Insulating Concrete (ASTM C495-86).
• Method of Making, Accelerating Curing, and Testing of Concrete Compression Test Specimens (ASTM C684-81).
• Test Method for Compressive Strength of Concrete Using Portions of Beams Broken in Flexure (ASTM C116-68 (1980)).

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-155-699, filed 7/20/94, effective 9/20/94; 89-11-035 (Order 89-03), § 296-155-699, filed 5/15/89, effective 6/30/89.]