

**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.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 16-09-085, § 296-155-684, filed 4/19/16, effective 5/20/16. Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.440, 49.17.060, and 29 C.F.R. 1926, Subpart CC. WSR 12-01-086, § 296-155-684, filed 12/20/11, effective 2/1/12. Statutory Authority: Chapter 49.17 RCW. WSR 94-15-096 (Order 94-07), § 296-155-684, filed 7/20/94, effective 9/20/94; WSR 89-11-035 (Order 89-03), § 296-155-684, filed 5/15/89, effective 6/30/89.]