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Specifications for Structural Concrete

An ACI Standard

Reported by ACI Committee 301

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Specifications for Structural Concrete

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Specifications for Structural Concrete

An ACI Standard

Reported by ACI Committee 301

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This is a Reference Specification that the Architect/Engineer can apply to any construction project involving structural concrete by citing it in the Project Specifications. Checklists are provided to assist the Architect/Engineer in supplementing the provisions of this Reference Specification as needed by designating or specifying individual project requirements.

The first five sections of this document cover general construction requirements for cast-in-place structural concrete and slabs-on-ground. These sections cover materials and proportioning of concrete; reinforcement and prestressing steel; production, placing, finishing, and curing of concrete; formwork performance criteria and construction; treatment of joints; embedded items; repair of surface defects; and finishing of formed and unformed surfaces. Provisions governing testing, evaluation, and acceptance of concrete as well as acceptance of the structures are included. The remaining sections are devoted to architectural concrete, lightweight concrete, mass concrete, post-tensioned concrete, shrinkage-compensating concrete, industrial floor slabs, tilt-up construction, precast structural concrete, and precast architectural concrete.

Keywords: architectural; cold weather; compressive strength; durability; concrete slab; consolidation; curing; finish; formwork; grouting; hot weather; industrial floors; inspection; joints; lightweight concrete; mass concrete; mixture proportions; placing; precast; post-tensioned; prestressing steel; repair; reshoring; shoring; shrinkage-compensating; slabs-on-ground; steel reinforcement; testing; tilt-up; tolerance; welded wire.

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(mandatory portion follows)

SECTION 1—GENERAL REQUIREMENTS

1.1—Scope

1.1.1 *Work specified*—This Specification governs the construction of cast-in-place and precast structural concrete and industrial floor slabs cast on ground.

Provisions of this Specification shall govern except where other provisions are specified in Contract Documents.

1.1.2 *Work not specified*—The following subjects are not in the scope of this Specification:

- Precast concrete products covered by ASTM specifications;
- Heavyweight shielding concrete;
- Slipformed paving concrete;
- Terrazzo;
- Insulating concrete;
- Refractory concrete;
- Shotcrete; and
- Slipformed concrete walls.

1.1.3 *Units*—Values in this Specification are stated in inch-pound units. A companion specification in SI units is also available.

1.2—Definitions

acceptable or **accepted**—determined to be satisfactory by Architect/Engineer.

acceptance—acknowledgment by Architect/Engineer that submittal or completed Work is acceptable.

ACI Concrete Field Testing Technician Grade I—a person who has demonstrated knowledge and ability to perform and record the results of ASTM standard tests on freshly mixed concrete and to make and cure test specimens. Such knowledge and ability shall be demonstrated by passing prescribed written and performance examinations and having credentials that are current with the American Concrete Institute.

Architect/Engineer or **Engineer/Architect**—Architect, Engineer, architectural firm, engineering firm, or architectural and engineering firm issuing Contract Documents or administering the Work under Contract Documents, or both.

architectural concrete—concrete that is typically exposed to view, is indicated as architectural concrete in Contract Documents, and therefore requires special care in selection of the concrete materials, forming, placing, and finishing to obtain the desired architectural appearance.

backshores—shores placed snugly under a concrete slab or structural member after the original formwork and shores have been removed from a small area at a time, without allowing the slab or member to deflect, or support its own weight or existing construction loads.

cast-in-place concrete—concrete that is deposited and allowed to harden in the place where it is required to be in the completed structure, as opposed to precast concrete.

check test—test performed to verify a previous test result of freshly-mixed concrete.

Contract Documents—a set of documents supplied by Owner to Contractor as the basis for construction; these documents contain contract forms, contract conditions, specifications, drawings, addenda, and contract changes.

Contractor—the person, firm, or entity under contract for construction of the Work.

design reference sample—sample of precast concrete color, finish, and texture that is submitted for initial verification of design intent.

duct—the material creating a conduit in a concrete member to accommodate the prestressing steel of a post-tensioning tendon.

equivalent diameter of bundle—the diameter of a circle having an area equal to the sum of the bar areas in a bundle of reinforcing bars.

expansive cement—a cement that, when mixed with water, produces a paste that, after setting, tends to increase in volume and is used to compensate for volume decrease due to shrinkage or to induce tensile stress in reinforcement.

exposed to view—portion of structure that can be observed by the public during normal use.

high-early-strength concrete—concrete that, through the use of additional cement, high-early-strength cement, or admixtures, has accelerated early-age strength development.

jack clearance—minimum space required to safely install, operate, and remove a hydraulic jack through its full range of movement in stressing of a tendon.

licensed design engineer—an individual representing the Contractor who is licensed to practice engineering as defined by the statutory requirements of the professional licensing laws of the state or jurisdiction in which the project is to be constructed.

lightweight concrete—structural concrete containing lightweight aggregate conforming to ASTM C330 and having an equilibrium density, as determined by ASTM C567, between 90 and 115 lb/ft^3.

mass concrete—any volume of structural concrete in which a combination of dimensions of the member being cast, the boundary conditions, the characteristics of the concrete mixture, and the ambient conditions can lead to undesirable thermal stresses, cracking, deleterious chemical reactions, or reduction in the long-term strength as a result of elevated concrete temperature due to heat from hydration.

normalweight concrete—structural concrete containing aggregate that conforms to ASTM C33 and that typically has a density between 135 and 160 lb/ft^3.

Owner—the corporation, association, partnership, individual, public body, or authority for whom the Work is constructed.

permitted—accepted by or acceptable to Architect/Engineer; usually pertains to a request by Contractor, or when specified in Contract Documents.

post-tensioning—a method of prestressing reinforced concrete in which tendons are tensioned after the concrete has attained a specified minimum in-place strength or a specified minimum age.

precast concrete—concrete cast elsewhere than its final position.

prestressed concrete—structural concrete in which internal stresses have been introduced to reduce potential tensile stresses in concrete resulting from loads (see **post-tensioning** and **pretensioning**).

prestressing sheathing—a material encasing prestressing steel to prevent bonding of the prestressing steel with the surrounding concrete, to provide corrosion protection, and to contain the corrosion-inhibiting coating.

prestressing steel—high-strength steel element, such as strand, bars, or wire, used to impart prestress forces to concrete.

pretensioning—method of prestressing in which prestressing steel is tensioned before the concrete is placed.

Project Drawings—graphic presentation of project requirements.

Project Specifications—the written document that details requirements for Work in accordance with service parameters and other specific criteria.

pull-on method—method of seating fixed-end anchorage by tensioning prestressing steel.

quality assurance—actions taken by Owner or Owner's Representative to provide confidence that Work done and materials provided are in accordance with Contract Documents.

quality control—actions taken by Contractor to ensure that Work meets the requirements of Contract Documents.

reference specification—a standardized mandatory-language document prescribing materials, dimensions, and workmanship, incorporated by reference in Contract Documents.

referenced standards—standardized mandatory-language documents of a technical society, organization, or association, including codes of local or federal authorities, which are incorporated by reference in Contract Documents.

required—required in this Specification or Contract Documents.

reshores—shores placed snugly under a stripped concrete slab or other structural member after the original forms and shores have been removed from a large area, thus requiring the new slab or structural member to deflect and support its own weight and existing construction loads applied before the installation of the reshores.

shop drawings—drawings that provide details for a particular portion of Work that are prepared by Contractor in accordance with Contract Documents and are reviewed by Architect/Engineer.

shore—vertical or inclined support members designed to carry the weight of the formwork, concrete, and construction loads above.

shrinkage-compensating concrete—a concrete that increases in volume after setting, designed to induce compressive stresses in concrete restrained by reinforcement or other means, to offset tensile stresses resulting from shrinkage.

strength test—standard test conducted for evaluation and acceptance of concrete determined as the average of the compressive strengths of at least two 6 by 12 in. cylinders or at least three 4 by 8 in. cylinders made from the same sample of concrete, transported, and standard cured in accordance with ASTM C31/C31M and tested in accordance with ASTM C39/C39M at 28 days or at test age designated for f'_c.

structural concrete—concrete used in a member to resist loads and having a specified compressive strength of at least 2500 psi.

submit—provide to Architect/Engineer for review.

submittal—documents or materials provided to Architect/Engineer for review and acceptance.

surface defects—imperfection in concrete surfaces defined in Contract Documents that must be repaired.

tendon—in pretensioned applications, the tendon is the prestressing steel; in post-tensioned applications, the tendon is a complete assembly consisting of anchorages, prestressing steel, and sheathing with coating for unbonded applications or ducts with grout for bonded applications.

tilt-up—a construction technique for casting concrete members in a horizontal position at the project site and then erecting them to their final upright position in a structure.

waste slab—temporary slab to provide a casting surface for tilt-up panels.

wood formwork sheathing—the materials forming the contact face of forms; also called lagging or sheeting.

Work—the entire construction or separately identifiable parts thereof required to be furnished under Contract Documents.

1.3—Referenced standards and cited publications

1.3.1 *Referenced standards*—Standards referred to in this Specification are listed with serial designation including year of adoption or revision.

1.3.1.1 *ACI standards*

117-10	Specifications for Tolerances for Concrete Construction and Materials
423.7-07	Specification for Unbonded Single-Strand Tendon Materials and Commentary
423.9M-10	Test Method for Bleed Stability of Cementitious Post-Tensioning Tendon Grout
ITG-7-09	Specification for Tolerances for Precast Concrete

1.3.1.2 *ASTM standards*

A82/A82M-07	Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
A184/A184M-06	Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
A185/A185M-07	Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
A416/A416M-06	Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
A421/A421M-05	Standard Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete
A496/496M-07	Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
A497/A497M-07	Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete
A615/A615M-07	Standard Specification for Deformed and Carbon-Steel Bars for Concrete Reinforcement
A666-03	Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar