

An ACI Standard

Specifications for Concrete Construction (ACI 301-20)

Reported by ACI Committee 301

ACI 301-20



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An ACI Standard

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This is a Reference Specification that the Architect/Engineer can apply to projects involving concrete construction by citing it in the Project Specification. A mandatory requirements checklist and an optional requirements checklist are provided to assist the Architect/Engineer in supplementing the provisions of this Specification as required or needed by designating or specifying individual project requirements.

The first five sections of this Specification cover general requirements for concrete construction. 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 for interior slabs, industrial floor slabs, tilt-up construction, precast structural concrete, and precast architectural concrete.

The materials, processes, quality control measures, and inspections described in this document should be tested, monitored, or performed as applicable only by individuals holding the appropriate ACI Certification or equivalent.

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

ACI 301M-20 supersedes ACI 301M-16, was adopted August 31, 2020, and published August 2021.

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SECTION 1—GENERAL REQUIREMENTS

1.1—Scope

1.1.1 This Specification covers construction of cast-in-place concrete, architectural concrete, lightweight concrete, mass concrete, post-tensioned concrete, shrinkage-compensating concrete for interior slabs, industrial floor slabs cast on ground, tilt-up construction, precast structural concrete, and precast architectural concrete.

1.1.2 Unless otherwise specified, Sections 1 through 5 apply to Work where this Specification is referenced. Work covered by Sections 6 through 14 apply only if that Work is designated in Contract Documents.

1.1.3 This Specification is incorporated by Contract Documents and provides requirements for Contractor.

1.1.4 This Specification governs for construction within its scope. If there are differences between requirements of this Specification and project-specific Contract Documents, project-specific Contract Documents govern.

1.1.5 Use shotcrete as designated in Contract Documents.

1.1.6 *Work not specified*—The following Work is not in the scope of this Specification:

- (a) Manufactured concrete products specified by ASTM standards
- (b) Environmental concrete structures
- (c) Heavyweight shielding concrete
- (d) Paving concrete
- (e) Terrazzo
- (f) Insulating concrete
- (g) Refractory concrete
- (h) Nuclear containment structures
- (i) Concrete piles; drilled piers; and caissons assigned to Seismic Design Categories A, B, and C
- (j) Fire safety
- (k) Slipformed concrete walls
- (l) Residential post-tensioned slabs-on-ground

1.1.7 This Specification governs if there is a conflict with referenced materials and testing standards.

1.1.8 Contractor is permitted to submit written alternatives to any provision in this Specification for consideration.

1.1.9 Ignore provisions of this Specification that are not applicable to Work.

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

1.1.11 Unless otherwise stated, the SI system of units is applicable to ASTM combined standards referenced in this Specification.

1.1.12 The Notes to Specifier are not part of this Specification.

1.2—Interpretation

1.2.1 Unless otherwise explicitly stated, this Specification shall be interpreted using the following principles:

1.2.1.1 Interpret this Specification consistent with the plain meaning of the words and terms used.

1.2.1.2 Definitions provided in this Specification govern over the definitions of the same or similar words or terms found elsewhere.

1.2.1.3 Headings are part of this Specification and are intended to identify the scope of the provisions or sections that follow. If there is a difference in meaning or implication between the text of a provision and a heading, the meaning of the text governs.

1.2.1.4 Notes to a table are part of this Specification. The meaning of the provision text governs in the event of a difference in meaning or implication between the provision text and a note to a table.

1.2.1.5 If a provision of this Specification involves two or more items, conditions, requirements, or events connected by the conjunctions “and” or “or,” interpret the conjunction as follows:

- (a) “and” indicates that all the connected items, conditions, requirements, or events apply.
- (b) “or” indicates that the connected items, conditions, requirements, or events apply singularly.

1.2.1.6 The use of the verbs “may” or “will” indicates that the specification provision is for information to Contractor.

1.2.1.7 The phrases “as indicated in Contract Documents” and “as designated in Contract Documents” mean the specifier included provision requirements in Contract Documents.

1.2.1.8 The phrase “unless otherwise specified” means the specifier may have included an alternative to the default requirement in Contract Documents.

1.2.1.9 The phrase “if specified” means the specifier may have included a requirement in Contract Documents for which there is no default requirement in this Specification.

1.3—Definitions

acceptable or accepted—determined to be satisfactory by Architect/Engineer based on requirements of Contract Documents.

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

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.

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

Contract Documents—a set of documents that form the basis of an agreement between Owner and Contractor; these documents can contain contract forms, contract conditions, specifications, drawings, addenda, and contract changes.

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

defective work—construction or material that does not comply with Contract Documents.

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

drawings—graphic presentation that details requirements for Work.

duct—a conduit in a concrete member to accommodate the prestressing steel of a post-tensioning tendon and provide an annular space for protective coating.

encapsulated tendon—a tendon that is enclosed completely in a watertight covering from end to end, including anchorages, sheathing with coating, and caps over the strand tails.

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, increases 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, admixtures, or other acceptable methods, 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 retained by 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.

movement joint—an interface between adjacent portions of Work that allows movement in one or more direction.

nonencapsulated tendon—a tendon that has bare metallic anchorages and sheathing that is continuous between anchorages but not connected to the anchorages.

normalweight concrete—concrete containing aggregate that conforms to **ASTM C33/C33M** and that typically has a density between 2160 and 2560 kg/m³.

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

placing drawing—drawing that gives size, location, and spacing of reinforcement, and other information required for site-cast concrete construction.

point of delivery—location where concrete is discharged from the vehicle used to transport concrete to the project site.

point of placement—location where concrete is placed in structure.

prestressing steel—high-strength steel element; for example, strand, bars, or wire, used to impart prestress forces to concrete.

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 in 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 in 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.

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

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 support the weight of the formwork, concrete, and construction loads above.

strength test—standard test conducted for evaluation and acceptance of concrete determined as the average of the compressive strengths of at least two 150 x 300 mm cylinders or at least three 100 x 200 mm cylinders made from the same sample of concrete, taken in accordance with **ASTM C172/C172M** at the point of delivery, handled 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—plain or reinforced concrete in a member required to transfer gravity loads, lateral loads, or both, to the ground.

submit—provide to Architect/Engineer for review.

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

surface defects—imperfections in concrete surfaces defined in Contract Documents requiring repair.

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.

testing agency—person, firm, or entity under contract for providing testing services that will be used to determine conformance to Contract Documents.

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

water-cementitious materials ratio (w/cm)—ratio of mass of water, excluding that absorbed by aggregate, to the mass of cementitious materials in a mixture, stated as a decimal.

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

1.4—Referenced standards

1.4.1 Standards cited in this Specification are listed with serial designation including year of adoption or revision.

1.4.1.1 *American Concrete Institute standards*

ACI 117M-10(15)—Specification for Tolerances for Concrete Construction and Materials and Commentary

ACI 216.1M-14(19)—Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies

ACI 423.7-14—Specification for Unbonded Single-Strand Tendon Materials

ACI ITG-7M-09—Specification for Tolerances for Precast Concrete

1.4.1.2 *ASTM International standards*

ASTM A36/A36M-19—Standard Specification for Carbon Structural Steel

ASTM A47/A47M-99(2018)—Standard Specification for Ferritic Malleable Iron Castings

ASTM A108-18—Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

ASTM A123/A123M-17—Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M-16a—Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A184/A184M-17—Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement

ASTM A193/A193M-19—Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications

ASTM A276/A276M-17—Standard Specification for Stainless Steel Bars and Shapes

ASTM A307-14—Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength

ASTM A325-14—Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

ASTM A416/A416M-18—Standard Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete

ASTM A421/A421M-15—Standard Specification for Stress-Relieved Steel Wire for Prestressed Concrete

ASTM A490-14a—Standard Specification for Structural Bolts, Steel, Heat Treated, 150 ksi Minimum Tensile Strength

ASTM A500/A500M-18—Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A563-15—Standard Specification for Carbon and Alloy Steel Nuts

ASTM A572/A572M-18—Standard Specification for High Strength Low-Alloy Columbium-Vanadium Structural Steel

ASTM A615/A615M-18e1—Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

ASTM A666-15—Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

ASTM A675/A675M-14(2019)—Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties

ASTM A706/A706M-16—Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement

ASTM A722/A722M-16—Standard Specification for High-Strength Steel Bars for Prestressing Concrete

ASTM A767/A767M-16—Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement

ASTM A775/A775M-17—Standard Specification for Epoxy-Coated Steel Reinforcing Bars

ASTM A779/A779M-16—Standard Specification for Steel Strand, Seven-Wire, Uncoated, Compacted, for Prestressed Concrete

ASTM A780/A780M-09(2015)—Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

ASTM A820/A820M-16—Standard Specification for Steel Fibers for Fiber-Reinforced Concrete

ASTM A882/A882M-04a(2010)—Standard Specification for Filled Epoxy-Coated Seven-Wire Prestressing Steel Strand

ASTM A884/A884M-14—Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement

ASTM A886/A886M-17—Standard Specification for Steel Strand, Indented, Seven-Wire, Stress-Relieved for Prestressed Concrete

ASTM A910/A910M-18—Standard Specification for Uncoated, Weldless, 2-Wire and 3-Wire Steel Strand for Prestressed Concrete

ASTM A934/A934M-16—Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars

ASTM A955/A955M-18b—Standard Specification for Deformed and Plain Stainless-Steel Bars for Concrete Reinforcement

ASTM A970/A970M-18—Standard Specification for Headed Steel Bars for Concrete Reinforcement

ASTM A992/A992M-11(2015)—Standard Specification for Structural Steel Shapes

ASTM A996/A996M-16—Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement

ASTM A1022/A1022M-16b—Standard Specification for Deformed and Plain Stainless Steel Wire and Welded Wire for Concrete Reinforcement

ASTM A1035/A1035M-16b—Standard Specification for Deformed and Plain, Low-Carbon, Chromium, Steel Bars for Concrete Reinforcement

ASTM A1044/A1044M-16a—Standard Specification for Steel Stud Assemblies for Shear Reinforcement of Concrete

ASTM A1055/A1055M-16—Standard Specification for Zinc and Epoxy Dual-Coated Steel Reinforcing Bars

ASTM A1060/A1060M-16b—Standard Specification for Zinc-Coated (Galvanized) Steel Welded Wire Reinforcement, Plain and Deformed, for Concrete

ASTM A1064/A1064M-18a—Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

ASTM C31/C31M-19—Standard Practice for Making and Curing Concrete Test Specimens in the Field

ASTM C33/C33M-18—Standard Specification for Concrete Aggregates

ASTM C39/C39M-18—Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

ASTM C42/C42M-18a—Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

ASTM C67-14—Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile

ASTM C94/C94M-18—Standard Specification for Ready-Mixed Concrete

ASTM C109/C109M-16—Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)

ASTM C114-15—Standard Test Methods for Chemical Analysis of Hydraulic Cement

ASTM C126-15—Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units

ASTM C138/C138M-17a—Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete

ASTM C143/C143M-15—Standard Test Method for Slump of Hydraulic-Cement Concrete

ASTM C144-11—Standard Specification for Aggregate for Masonry Mortar

ASTM C150/C150M-19a—Standard Specification for Portland Cement

ASTM C157/C157M-08(2014)e1—Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete

ASTM C171-07—Standard Specification for Sheet Materials for Curing Concrete

ASTM C172/C172M-17—Standard Practice for Sampling Freshly Mixed Concrete

ASTM C173/C173M-16—Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

ASTM C192/C192M-15—Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory

ASTM C216-15—Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)

ASTM C231/C231M-17a—Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C260/C260M-10a(2016)—Standard Specification for Air-Entraining Admixtures for Concrete

ASTM C309-11—Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

ASTM C330/C330M-17a—Standard Specification for Lightweight Aggregates for Structural Concrete

ASTM C373-14a—Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products, Ceramic Tiles, and Glass Tiles

ASTM C387/C387M-15—Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar

ASTM C404-11—Standard Specification for Aggregates for Masonry Grout

ASTM C469/C469M-14—Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression

ASTM C494/C494M-17—Standard Specification for Chemical Admixtures for Concrete

ASTM C567/C567M-14—Standard Test Method for Determining Density of Structural Lightweight Concrete

ASTM C578-15—Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation

ASTM C591-15—Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

ASTM C595/C595M-18—Standard Specification for Blended Hydraulic Cements

ASTM C597-09—Standard Test Method for Pulse Velocity through Concrete

ASTM C618-19—Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

ASTM C642-13—Standard Test Method for Density, Absorption, and Voids in Hardened Concrete

ASTM C650-04(2014)—Standard Test Method for Resistance of Ceramic Tile to Chemical Substances

ASTM C666/C666M-15—Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing

ASTM C685/C685M-17—Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing

ASTM C803/C803M-18—Standard Test Method for Penetration Resistance of Hardened Concrete

ASTM C805/C805M-13a—Standard Test Method for Rebound Number of Hardened Concrete

ASTM C834-14—Standard Specification for Latex Sealants