ACI 350.5-12

Specifications for Environmental Concrete Structures

An ACI Standard

Reported by ACI Committee 350

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Advancing concrete knowledge

Specifications for Environmental Concrete Structures

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This specification is a Reference Specification that the Architect/Engineer can make applicable to a construction project by citing it in the Project Specifications. The Architect/Engineer supplements the provisions of this Reference Specification as needed by designating or specifying individual project requirements.

The document covers materials and proportioning of concrete; reinforcement and prestressing reinforcement; production, placing, finishing, and curing of concrete; formwork design and construction; and shotcrete. Methods of treatment of joints and embedded items, repair of surface defects, and finishing of formed and unformed surfaces are specified. Separate sections are devoted to architectural concrete, mass concrete, and internal and external post-tensioned prestressed concrete. Provisions governing testing, evaluation, and acceptance of concrete as well as acceptance of the structure are included.

Keywords: admixtures; aggregates; air entrainment; architectural concrete; compressive strength; consolidation; curing; density; durability; evaluation; environmental concrete; finishes; floors; formwork (construction); grouting; inspection; joints; mass concrete; mixture proportioning; post-tensioned prestressed concrete; prestressing reinforcement; reinforcing steels; reshoring; shoring; subgrades; tolerances.

CONTENTS

ACI 350.5-12 became effective September 24, 2012, and was published April 2013.

(Mandatory portion follows)

SECTION 1—GENERAL REQUIREMENTS

1.1—Scope

1.1.1 *Work specified*—This specification covers cast-in-place environmental concrete and shotcrete. 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:

a) Precast concrete products
b) Heavyweight shielding concrete
c) Slipformed paving concrete
d) Lightweight concrete
e) Shrinkage-compensating concrete
f) Terrazzo
g) Insulating concrete
h) Refractory concrete
i) Self-consolidating concrete
j) Slipformed concrete walls
k) Tilt-up concrete construction

1.2—Definitions

accepted—determined to be satisfactory by Architect/Engineer.

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 ACI.

ACI Reference Specification—a standardized mandatory-language document prescribing materials, dimensions, and workmanship incorporated by reference in contract documents with information in the Mandatory Requirements Checklist required to be provided in the Project Specification.

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

architectural concrete—concrete designated by Architect/Engineer as requiring a specified 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.

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

core wall—portion of the externally prestressed circular concrete tank wall placed in circumferential compression by prestressing.

cover coat—the layer or layers of shotcrete applied over the wire coat of an externally prestressed circular concrete tank wall.

diaphragm—thin metal sheet formed with vertical ribs embedded within the core wall of circular externally prestressed concrete tanks.

duct—a conduit (plain or corrugated) to accommodate prestressing steel for post-tensioned installation.

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

finish coat—final layer of shotcrete placed on the cover coat of an externally prestressed circular concrete tank wall.

high-early-strength concrete—concrete that, through the use of ASTM C150 Type III cement or admixtures, is capable of attaining specified strength at an earlier age than normal concrete.

environmental engineering concrete structures—concrete structures intended for conveying, storing, or treating water, wastewater, or other nonhazardous liquids, and for secondary containment of hazardous materials.

Licensed Design Engineer—an individual engaged by the Contractor who is licensed to practice engineering as defined by the statutory requirements of the licensing laws of the state or jurisdiction in which the project is to be constructed.

mass concrete—a volume of concrete with dimensions large enough to require that measures be taken to prevent damage from the generation of heat and temperature gradients from hydration of the cementitious materials and attendant volume change.

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

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

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

plain mass concrete—mass concrete containing no reinforcement or less reinforcement than necessary to be considered reinforced mass concrete.

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.

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.

prestressed concrete—structural concrete in which internal stresses have been introduced to reduce potential tensile stresses in concrete resulting from loads.

Project Drawings—graphic presentation of project requirements.

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

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

reinforced mass concrete—mass concrete containing adequate reinforcement, prestressed or nonprestressed, designed to act together with the concrete in resisting forces including those induced by temperature and shrinkage.

required—mandatory as prescribed in project 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 installation of the reshores.

shore—a temporary support designed to carry the weight of formwork, fresh concrete, and construction loads from above for recently built structures that have not developed full design strength.

strength test—the average of the compressive strengths of two cylinders made from the same sample of concrete and tested at 28 days or at test age designated for determination of specified compressive strength f_c'.

submittal—document or material provided to Architect/Engineer for review and acceptance.

wire coat—layer of shotcrete in direct contact with the prestressed reinforcement of an externally prestressed circular concrete tank wall.

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.

wrapped prestressing system—prestressing system that applies a high tensile strand or wire, wound under tension by machines, around a circular concrete tank wall.

1.3—Reference standards

American Concrete Institute

117-90—Standard Specifications for Tolerances for Concrete Construction and Materials

350-06—Code Requirements for Environmental Engineering Concrete Structures

423.6-01—Specification for Unbonded Single-Strand Tendons and Commentary (withdrawn)

506.2-95—Specifications for Shotcrete

American Petroleum Institute

RP 13B-1-09—Recommended Practice for Field Testing Water-Based Drilling Fluids

American Welding Society

AWS D1.4-98—Structural Welding Code—Reinforcing Steel

ASTM International

A82/A82M-97a—Standard Specification for Steel Wire, Plain, for Concrete Reinforcement

A184/A184M-01—Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement

A185/A185M-97—Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete Reinforcement

A416/A416M-02—Standard Specification for Steel Strand, Uncoated Seven Wire for Prestressed Concrete

A421/A421M-02—Standard Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete

A475-98—Standard Specification for Zinc-Coated Steel Wire Strand

A496/A496M-97a—Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement

A497-99—Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete Reinforcement

A615/A615M-03—Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

A641/A641M-98—Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire

A648-95—Standard Specification for Steel Wire, Hard Drawn for Prestressing Concrete Pipe