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Standard Specification for Underground Precast Concrete Utility Structures¹

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1. Scope

1.1 This specification covers the recommended design criteria and manufacturing practices for monolithic or sectional precast concrete utility structures. Concrete pipe and box culverts are not covered under this specification. Also, precast concrete manholes covered in Specification C478 are excluded from this specification.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

2. Referenced Documents

2.1 ASTM Standards:²

- A82/A82M Specification for Steel Wire, Plain, for Concrete Reinforcement
- A184/A184M Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
- A185/A185M Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
- A496/A496M Specification for Steel Wire, Deformed, for Concrete Reinforcement
- A497/A497M Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete
- A615/A615M Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- A706/A706M Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
- A996/A996M Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
- C31/C31M Practice for Making and Curing Concrete Test Specimens in the Field

- C33 Specification for Concrete Aggregates
 - C39/C39M Test Method for Compressive Strength of Cylindrical Concrete Specimens
 - C42/C42M Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
 - C94/C94M Specification for Ready-Mixed Concrete
 - C150 Specification for Portland Cement
 - C192/C192M Practice for Making and Curing Concrete Test Specimens in the Laboratory
 - C231 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
 - C260 Specification for Air-Entraining Admixtures for Concrete
 - C330 Specification for Lightweight Aggregates for Structural Concrete
 - C478 Specification for Precast Reinforced Concrete Manhole Sections
 - C494/C494M Specification for Chemical Admixtures for Concrete
 - C595 Specification for Blended Hydraulic Cements
 - C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
 - C857 Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
 - C989 Specification for Slag Cement for Use in Concrete and Mortars
- 2.2 *American Concrete Institute Standard:*
- ACI 318 Building Code Requirements for Reinforced Concrete³
- 2.3 *American Welding Society Standard:*
- AWS-D1.4 Structural Welding Code Reinforcing Steel⁴

3. Terminology

3.1 Definition of Term Specific to this Standard:

- 3.1.1 *utility structure*—a structure that is used by electric, gas, communication, or similar industries.

¹ This specification is under the jurisdiction of ASTM Committee C27 on Precast Concrete Products and is the direct responsibility of Subcommittee C27.10 on Utility Structures.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from American Concrete Institute (ACI), P.O. Box 9094, Farmington Hills, MI 48333-9094, <http://www.aci-int.org>.

⁴ Available from American Welding Society (AWS), 550 NW LeJeune Rd., Miami, FL 33126, <http://www.aws.org>.

4. Ordering Information

4.1 Unless otherwise stipulated by the purchaser in his order, a structure produced in accordance with this specification and constructed in accordance with the design drawings approved by the purchaser shall be acceptable.

5. Materials

5.1 Cementitious Materials:

5.1.1 *Cement*—Cement shall conform to the requirements for Portland cement of Specification C150 or shall be Portland blast-furnace slag cement or Portland-pozzolan cement conforming to the requirements of Specification C595, except that the pozzolan constituent in the Type IP Portland-pozzolan cement shall be fly ash.

5.1.2 *Fly Ash*—Fly ash shall conform to the requirements of Specification C618, Class F or Class C.

5.1.3 *Ground Granulated Blast-Furnace Slag (GGBFS)*—GGBFS shall conform to the requirements of Grade 100 or 120 of Specification C989.

5.1.4 *Allowable Combinations of Cementitious Material*—The combination of cementitious materials used in concrete shall be one of the following:

5.1.4.1 Portland cement only;

5.1.4.2 Portland blast furnace slag cement only;

5.1.4.3 Slag-modified Portland cement only;

5.1.4.4 Portland-pozzolan cement only;

5.1.4.5 A combination of Portland cement and fly ash;

5.1.4.6 A combination of Portland cement and ground granulated blast-furnace slag;

5.1.4.7 A combination of Portland cement, ground granulated blast-furnace slag (not to exceed 25 % of the total cementitious weight), and fly ash (not to exceed 25 % of the total cementitious weight).

5.2 *Aggregates*—Aggregate shall conform to Specification C33 and light-weight aggregate shall conform to Specification C330, except that the requirements for grading shall not apply.

5.3 *Admixtures*—Admixtures may be used provided such admixtures are not injurious to other products used in the concrete.

5.3.1 *Chemical Admixtures*—Chemical admixtures shall conform to Specification C494/C494M.

5.3.2 *Fly Ash and Pozzolanic Admixture*—Fly ash or other pozzolanic admixtures shall conform to Specification C618.

5.3.3 *Air-Entraining Admixtures*—Air-entraining admixtures conforming to Specification C260 shall be used when there is a risk that the concrete may be exposed to a freeze-thaw cycle. The concrete mixture shall contain 5.5 ± 1.5 % air by volume as determined by Specification C231.

5.4 *Water*—Water used for curing, washing aggregate, or mixing concrete shall be clean and free of injurious amounts of oil, acids, alkalis, salts, organic materials, or other substances that may be incompatible with concrete or steel.

5.5 Steel Reinforcement:

5.5.1 *Wire Reinforcement*—Wire reinforcement shall conform to Specifications A82/A82M or A496/A496M.

5.5.2 *Wire Fabric Reinforcement*—Wire fabric reinforcement shall conform to Specifications A185/A185M or A497/A497M.

5.5.3 *Bar Reinforcement*—Bar reinforcement shall conform to Specifications A184/A184M, A615/A615M, A706/A706M, or A996/A996M.

6. Manufacture

6.1 *Forms*—Forms shall be accurately constructed and strong enough to maintain the structure's dimensions within the tolerances given in Section 8. Forms should be constructed in such a manner as to minimize the seepage of water. All casting surfaces shall be smooth nonporous material.

6.1.1 *Cleaning and Oiling*—Forms shall be cleaned before each use. New forms shall be free of paint or other protective coatings that might cling to the surface of the structure. Releasing agents applied to the form to aid in breaking the bond between the form and the concrete shall not be injurious to the concrete.

6.2 *Reinforcement*—Steel reinforcement shall conform to the requirements of this specification and shall be securely positioned in the form to maintain design concrete cover given in Section 7 during concrete placement. All chairs, bolsters, braces, and spacers in contact with form and reinforcing rod shall be of material that will not deteriorate.

6.3 *Mixture*—The aggregates shall be sized, graded, proportioned, and thoroughly mixed in a batch mixer with proportions of cement and water as will produce a homogeneous concrete having the required specified compressive strength. If Ready-Mix concrete is used, it shall be in accordance with Specification C94/C94M.

6.4 *Concrete Placement*—Concrete shall be deposited as nearly as practicable in its final position. Concrete shall be placed in the form at a rate such that the concrete is plastic at all times and flows readily into all parts of the form and around all reinforcement steel and embedded fixtures without segregation of materials. Concrete that has partially hardened or has been contaminated by foreign material shall not be deposited in the form.

6.5 *Curing*—Structures shall be cured by an accepted industry method that will develop the required 28-day compressive strength without affecting the long-term durability of the concrete.

7. Design Requirements

7.1 The elastic method of structural design or the strength design method of reinforced concrete design as outlined in ACI 318, shall be used to design the concrete sections, including the reinforcement required, when the structure is subjected to the loading conditions covered in Practice C857.

7.2 *Access Openings*—The structural design shall take into consideration the number, placement, and size of access openings.

7.3 *Floors*—The minimum floor thickness resulting from slope shall be considered as the nominal floor thickness in the design of the structure.

7.4 *Terminators, Knockouts, and Sumps*—Duct terminators, knockouts, and sumps shall be designed to carry the loads imposed upon them. The basic structure shall be designed to carry all imposed loads with knockouts removed.