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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 Concrete](#)³

2.3 *American Welding Society Standard:*

AWS-D1.4 [Structural Welding Code Reinforcing Steel](#)⁴

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>.

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.

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.

6.3.1 *Water-Cementitious Material Ratio*—Concrete that will be exposed to freezing and thawing shall have a water-cementitious ratio of 0.45 or less.

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