



Designation: C858 – 18

Standard Specification for Underground Precast Concrete Utility Structures¹

This standard is issued under the fixed designation C858; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

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.

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

- A184/A184M Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
- A615/A615M Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- A706/A706M Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
- A996/A996M Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
- A1064/A1064M Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
- 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 Circular 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 Definitions of Terms 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.

Current edition approved Jan. 1, 2018. Published January 2018. Originally approved in 1978. Last previous edition approved in 2010 as C858 – 10^{ε1}. DOI: 10.1520/C0858-18.

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 Pozzolan Admixture*—Fly ash or other pozzolan admixtures shall conform to Specification **C618**.

5.3.3 *Air-Entraining Admixtures*—Air-entraining admixtures shall conform to Specification **C260**.

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 and Wire Fabric Reinforcement*—Wire and wire fabric reinforcement shall conform to Specification **A1064/A1064M**.

5.5.2 *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.

6.3.2 *Air Entrainment*—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**.

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.