CRD-C 32-84

STANDARD TEST METHOD FOR FLOW UNDER WATER OF HYDRAULIC-CEMENT CONCRETE

1. Scope

1.1 This method* covers the determination of the flow of concrete intended to be placed under water using a tremie. The test may be conducted in the laboratory or in the field.

1.2 The values stated in inch-pound units are to be regarded as the standard. The metric equivalents of inch-pound units may be approximate.

2. Applicable Documents

2.1 ASTM Standards

C 143 Method for Slump of Portland-Cement Concrete** (CRD-C 5)

C 172 Method of Sampling Freshly Mixed Concrete** (CRD-C 4)

C 360 Method for Ball Penetration in Fresh Portland-Cement Concrete** (CRD-C 46)

C 939 Method for Flow of Grout for Preplaced-Aggregate Concrete** (CRD-C 611)

3. Significance and Use

3.1 This method permits direct observation of the ability of a sample of concrete, representing a mixture intended to be placed under water using a tremie, to flow out of the sort of pipe that is used as a tremie, under water. Very satisfactory performance from the standpoint of flow in use while being placed under water using a tremie has been noted for mixtures showing underwater flow by this method of 12 in. (610 mm) or more.

4. Apparatus

4.1 *Tube*. The tube shall be a 24-in. (600-mm) length of steel pipe having an inside diameter of 4 in. (100 mm). The top and bottom ends shall be open and parallel to each other and at right angles to the axis of the length of the tube. The interior of the pipe shall be smooth. The pipe will be sufficiently smooth if it feels smooth to the fingers. Lifting handles shall be attached on both sides near one end of the tube. A support collar system for holding the tube upright in the center of the metal pail shall be provided and shall be clamped to the metal pail at three equally spaced locations around the circumference of the pail top. Figs. 1 and 2 are representations of a satisfactory apparatus.

4.2 *Pail.* The pail shall be a metal container of nominal 11-1/2-in. (300-mm) diameter and 12-in. (300-mm) to 15-in. (375-mm) height.

4.3 *Support collar.* The collar shall be constructed of 1/4-in. (6-mm) sheet steel and shall have three arms spaced at equal intervals around the circumference. The ends of the arms to be attached to the pail top shall have clamping devices which will firmly anchor the collar in place so as to center the tube in the container. Locking set screws shall be provided in the collar and arm ends contiguous to the tube to keep the tube centered and anchored during concrete filling and rodding operations. There shall be a slight clearance between tube and collar to provide for freedom of movement during the tube-lifting operation.

4.4 *Tamping rod.* The tamping rod shall be a round, straight, steel rod 5/8 in. (16 mm) in diameter and approximately 30 in. (750 mm) in length, having the tamping end rounded to a hemispherical tip the diameter of which is 5/8 in.

5. Sample

5.1 The concrete shall be taken in accordance with Method C 172. Approximately 0.2 ft^3 (0.006 m^3) is required for one test.

5.2 This method is applicable to freshly mixed concrete having coarse aggregate up to 37.5 mm (1-1/2 in.) in nominal maximum size. If the coarse aggregate is larger than 37.5 mm in nominal maximum size, the method is applicable when it is performed on the fraction of concrete passing a 37.5-mm (1-1/2-in.) sieve with the larger aggregate being removed in accordance with Method C 172. This method is not considered applicable to nonplastic and noncohesive concrete.

6. Procedure

6.1 Fasten the collar arms to the pail by use of the adjustable clamps. After wetting the inside of the tube, insert it into the collar, seat it firmly in the bottom of the pail, and secure it with the locking set screws in the collar. Fill the tube to the top with concrete in three equal layers.

6.2 Rod each layer with 25 strokes of the tamping rod, distributing the strokes uniformly

* Based on a method described in "Tremie Concrete for Bridge Piers and Other Massive Underwater Placements, "by Ben C. Gerwick, Jr., Terence C. Holland, and G. Juri Komendant, FHWA/RD-81/153, US DOT, 1981, 194 pp (pages 6-12).

**Annual Book of ASTM Standards.

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Fig. 1. Prototype tremie flow test apparatus.

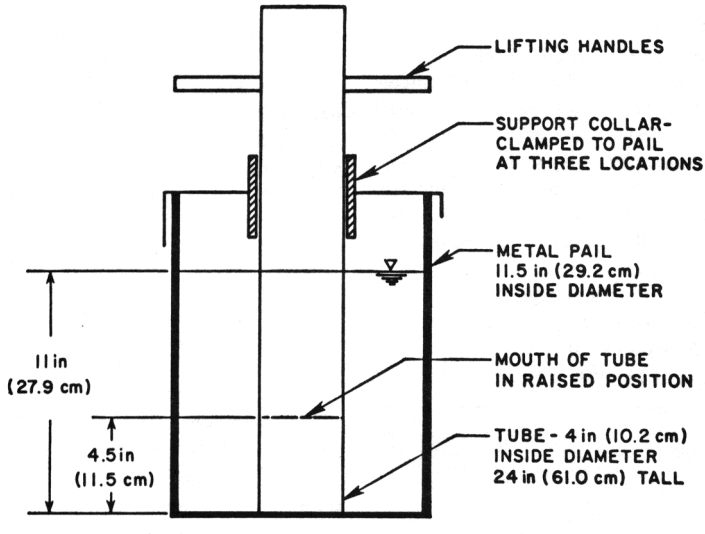

Fig. 2. Schematic of tremie flow test apparatus.

over the cross section of each layer. Rod the bottom layer through its depth. Rod the second and top layers throughout their depths, with the rod just penetrating into the layer below.

6.3 In filling and rodding the top layer, keep an excess of concrete above the tube top at all times. After rodding is completed, strike off the surface of the concrete at the tube top. Remove any excess concrete that has accumulated outside the tube in the pail bottom. Fill the annulus between the pipe and the pail with water to a minimum depth of 11 in. (275 mm). Loosen the collar set screws to completely free the tube and lift the tube until the bottom end is 4-1/2 in. (115 mm) above the bottom of the pail (Fig. 3). Once the concrete ceases to flow out of the tube, measure the distance from the top of the tube to the top of the concrete in the tube.

7. Report

7.1 Record the underwater flow in terms of in. (mm) to the nearest 1/4 in. (5 mm) of subsidence during the test.

Fig. 3. Tube-lifting operation.