Designation: D 1632 – 06

Standard Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory[1]

This standard is issued under the fixed designation D 1632; 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 reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the procedure for making and curing compression and flexure test specimens of soil-cement in the laboratory under accurate control of quantities of materials and test conditions.

1.2 *This practice offers a set of instructions for performing one or more specific operations. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this practice may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

1.3 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

C 127 Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate

D 558 Test Methods for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures

D 559 Test Methods for Wetting and Drying Compacted Soil-Cement Mixtures

D 560 Test Methods for Freezing and Thawing Compacted Soil-Cement Mixtures

D 1633 Test Method for Compressive Strength of Molded Soil-Cement Cylinders

D 1634 Test Method for Compressive Strength of Soil-Cement Using Portions of Beams Broken in Flexure (Modified Cube Method)

D 1635 Test Method for Flexural Strength of Soil-Cement Using Simple Beam with Third-Point Loading

D 4753 Guide for Evaluating, Selecting, and Specifying Balances and Standard Masses for Use in Soil, Rock, and Construction Materials Testing

E 11 Specification for Wire Cloth and Sieves for Testing Purposes

3. Significance and Use

3.1 This practice is used to prepare soil-cement specimens for compressive and flexural strength testing in accordance with Method B of Test Method D 1633, Test Method D 1634, and Test Method D 1635.

3.2 This practice does not apply to soil-cement specimens prepared in commonly available molds, which are 4.0 in. (101.6 mm) in diameter and 4.584 in. (116.4 mm) in height. For these size specimens, Methods D 559 or Methods D 560 should be used for sample preparation. Compressive strength testing should be in accordance with Method A of Test Method D 1633.

4. Apparatus

4.1 *Compression Test Specimen Molds*—Molds (Fig. 1) having an inside diameter of 2.8 ± 0.01 in. (71 ± 0.25 mm) and a height of 9 in. (229 mm) for molding test specimens 2.8 in. (71 mm) in diameter and 5.6 in. (142 mm) high; machined steel top and bottom pistons having a diameter 0.005 in. (0.13 mm) less than the mold; a 6-in. (152-mm) long mold extension; and a spacer clip. At least two aluminum separating disks 1/16 in. (1.54 mm) thick by 2.78 in. (70.6 mm) in diameter shall be provided.

NOTE 1—Satisfactory molds may be made from cold-drawn, seamless steel tubing having a Rockwell hardness of approximately 85 HRB or from steel pipe machined on the inside. The 2.8 by 5.6-in. (71 by 142-mm)

[1] This practice is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.15 on Stabilization With Admixtures.

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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.

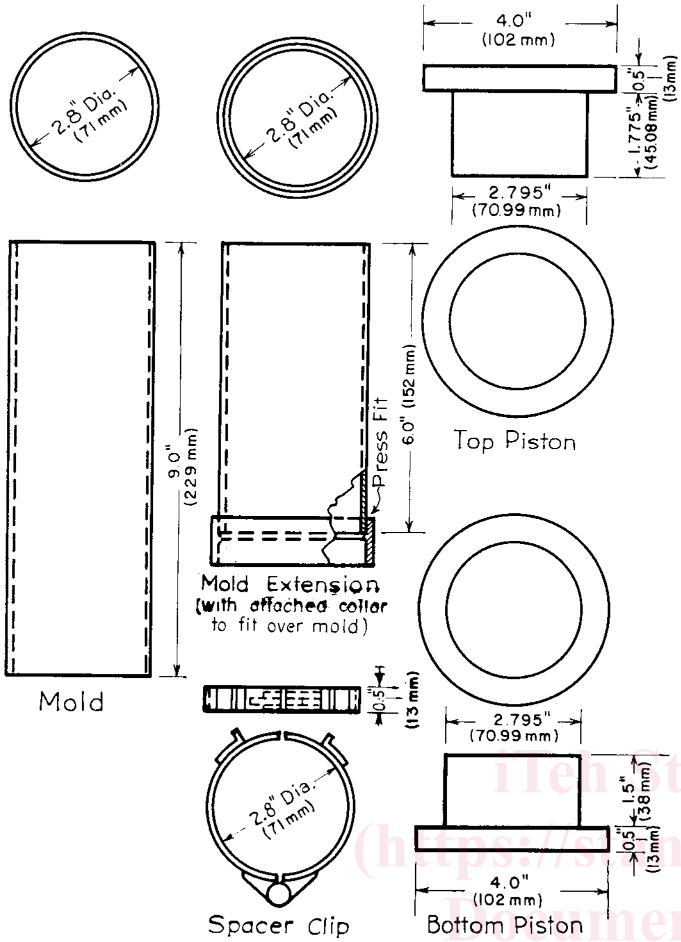

FIG. 1 Soil-Cement Cylinder Mold

specimens fit many triaxial compression machines in service, and thus may be used for triaxial as well as unconfined compression tests.

4.2 *Flexure Test Specimen Molds*—Molds having inside dimensions of 3 by 3 by 11¼ in. (76.2 by 76.2 by 285.8 mm) (see Fig. 2 and Fig. 3) for molding specimens of the same size. The molds shall be so designed that the specimen will be molded with its longitudinal axis in a horizontal position. The parts of the molds shall be tight-fitting and positively held together. The sides of the molds shall be sufficiently rigid to prevent spreading or warping, and shall be made of metal having a hardness not less than 85 HRB. The interior faces of the molds shall be plane surfaces with a permissible variation, in any 3-in. (76.2-mm) line on a surface, of 0.002 in. (0.051 mm) for new molds and 0.003 in. (0.076 mm) for molds in use. The distance between opposite sides shall be 3 ± 0.01 in. (76.20 ± 0.25 mm) for new molds, and 3 ± 0.015 in. (76.20 ± 0.38 mm) for molds in use. The height of the molds shall be 3 in. (76.20 mm) with permissible variations of – 0.01 in. (–0.25 mm) and + 0.005 in. (+ 0.13 mm) for both new molds and for molds in use. Four ⅜-in. (9.52-mm) spacer bars and top and bottom machined steel plates shall be provided. The plates shall fit the mold with a 0.005-in. (0.13-mm) clearance on all sides.

4.3 *Sieves*—2-in. (50-mm), ¾-in. (19.0-mm), No. 4 (4.75-mm) and No. 16 (1.18-mm) sieves conforming to the requirements of Specification E 11.

4.4 *Balances*—A balance or scale of 25-lb (12-kg) capacity, sensitive to 0.01 lb (0.0045 kg) and a balance of 1000-g capacity, sensitive to 0.1 g, both meeting the requirements of Specification D 4753.

4.5 *Drying Oven*—A thermostatically controlled drying oven capable of maintaining a temperature of 230 ± 9°F (110± 5°C) for drying moisture samples.

4.6 *Compression Testing Machine or Compression Frame*, having a capacity of approximately 60 000 lbf (267 kN) for compacting flexural test specimens and for optional use in compacting compression test specimens.

4.7 *Dropping-Weight Compacting Machine*—A controlled dropping-weight device of 15 lb (6.8 kg) for striking the top piston, for optional use in compacting compression test specimens (see Fig. 4 and Fig. 5). When this equipment is used, the top piston listed in 4.1 is made the foot of the compacting device.

4.8 *Compression Specimen Extruder*, consisting of a piston, jack, and frame for extruding specimens from the mold.

4.9 *Miscellaneous Equipment*—Tools such as trowel, spatula, pan, and the like, or a suitable mechanical device for thoroughly mixing the sample of soil-cement with water; graduate for measuring water, moisture sample cans, and the like.

4.10 *Tamping Rod*—A square-end cut, ½-in. (12.7-mm) diameter, smooth steel rod approximately 20 in. (510 mm) in length.

4.11 *Moist Room or Cabinet*—A moist room or cabinet capable of maintaining a temperature of 73.4 ± 3°F (23.0± 1.7°C) and a relative humidity of not less than 96 % for moist curing specimens.

5. Preparation of Materials

5.1 Bring materials to room temperature (preferably 65 to 75°F (18 to 24°C)) before beginning the tests.

5.2 Store cement in a dry place, in moisture-proof containers, preferably made of metal. Thoroughly mix the cement in order that the sample may be uniform throughout the tests. Pass it through a No. 16 (1.18-mm) sieve and reject all lumps.

5.3 The mixing water shall be free of acids, alkalies, and oils, and in general suitable for drinking.

5.4 Dry the soil sample, if damp when received from the field, until it becomes friable under a trowel. Drying may be in air or by use of drying apparatus such that the temperature of the sample does not exceed 140°F (60°C). Thoroughly break up the aggregations in such a manner as to avoid reducing the natural size of individual particles.

5.5 Sieve an adequate quantity of representative pulverized soil on the 2-in. (50-mm), ¾-in. (19.0-mm), and No. 4 (4.75-mm) sieves. Discard any aggregate retained on the 2-in. (50-mm) sieve. Remove aggregate passing the 2-in. (50-mm) sieve and retained on the ¾-in. (19.0-mm) sieve, and replace it with an equal mass of aggregate passing the ¾-in. (19.0-mm) sieve and retained on the No. 4 (4.75-mm) sieve. Obtain aggregate for replacement from the original sample.

NOTE 2—This practice for making soil-cement specimens for compression and flexure tests is used primarily with soil materials having not more than 35 % aggregate retained on the No. 4 (4.75-mm) sieve and not more than 85 % retained on the No. 40 (425-µm) sieve.

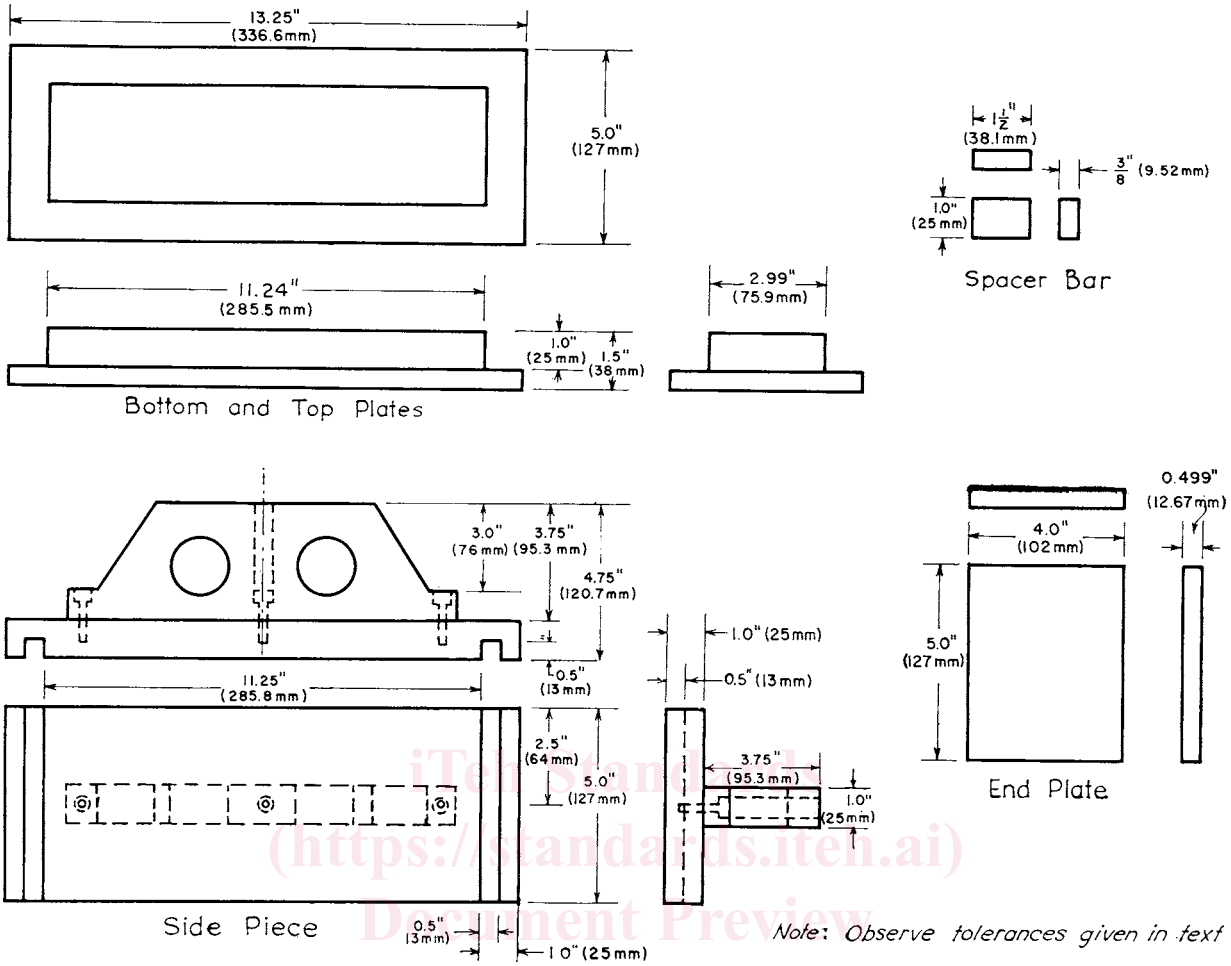

FIG. 2 Mold for Soil-Cement Beam for Flexure Test

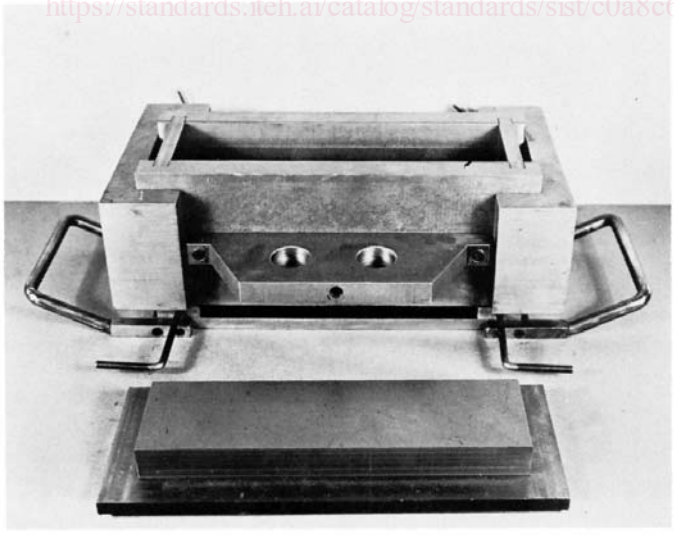

FIG. 3 Heavy Steel Mold and Top Plate for Making 3 by 3 by 11¼-in. (76.2 by 76.2 by 285.8-mm) Flexure Test Beam

5.6 Soak the aggregate passing the ¾-in. sieve and retained on the No. 4 sieve in water for 24 h, remove, and surface dry. Determine the absorption properties in accordance with Test Method C 127.

5.7 Take a 100-g sample of the soil passing the No. 4 sieve and dry it in the drying oven to constant mass, and determine the water content of the sample to permit calculation of the quantity of water that shall be added to the soil-cement mixture to bring it to the proper water content for molding specimens.

5.8 Take a representative sample of sufficient size to make one flexure test specimen or three compression test specimens of the soil passing the No. 4 (4.75-mm) sieve and also of the fractions passing the ¾-in. (19.0-mm) sieve and retained on the No. 4 (4.75 mm) sieve, prepared as described in 5.4, 5.5, and 5.6.

6. Determining the Mass of Materials

6.1 Determine the mass to the nearest 0.01 lb (5 g) the designed quantities of soil passing the No. 4 (4.75-mm) sieve and aggregate passing the ¾-in. (19.0-mm) sieve and retained on the No. 4 sieve. Determine the mass to the nearest 1 g of the designed quantity of cement and measure the designed quantity of water to the nearest 1 mL.

NOTE 3—The designed quantities of soil, cement, and water are usually based on results obtained from ASTM tests. The "optimum" water content of the mixture and the "maximum" unit weight to which the specimens are compacted are determined by Test Methods D 558. The quantity of cement is usually sufficient to produce soil-cement of a quality suitable for road and runway base construction. This cement quantity is indicated by