Designation: D1635/D1635M – 19

Standard Test Method for Flexural Strength of Soil-Cement Using Simple Beam with Third-Point Loading [1]

This standard is issued under the fixed designation D1635/D1635M; 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 test method covers the determination of the flexural strength of soil-cement by the use of a simple beam with third-point loading.

NOTE 1—For methods of molding soil-cement specimens, see Practice D1632.

1.2 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined. The SI units are presented in brackets.

1.2.1 The gravitational system of inch-pound units is used when dealing with inchpound units. In this system, the pound (lbf) represents a unit of force (weight), while the unit for mass is slugs. The rationalized slug unit is not given, unless dynamic (F = ma) calculations are involved.

1.3 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D6026.

1.3.1 The procedures used to specify how data are collected/recorded or calculated in the standard are regarded as industry standard. In addition, they are representative of the significant digits that generally should be retained. The procedures used do not consider material variation, purpose for obtaining the data, special purpose studies, or any considerations for the user's objectives; and it is common practice to increase or reduce significant digits of reported data to be commensurate with these considerations. It is beyond the scope of this standard to consider significant digits used in analysis methods for engineering design.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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]

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D1632 Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory

D2216 Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

D3740 Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

D6026 Practice for Using Significant Digits in Geotechnical Data

E4 Practices for Force Verification of Testing Machines

3. Terminology

3.1 For definitions of common technical terms used in this standard, refer to Terminology D653.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *flexural strength, n*—maximum resistance of a specimen subjected to bending.

3.2.2 *modulus of rupture, n*—calculated stress, assuming linear-elastic behavior, in the tensile face of a beam specimen at the maximum bending moment during a standard test method.

[1] This test method 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.

*A Summary of Changes section appears at the end of this standard

4. Summary of Test Method

4.1 A beam, typically 3 by 3 by 11¼ in. [76 by 76 by 290 mm], is placed in a third-point loading apparatus and loaded until failure.

4.2 The maximum applied load, specimen dimensions, and span length are used to calculate the modulus of rupture.

4.3 Practice D1632 provides methods of molding soil-cement test specimens.

5. Significance and Use

5.1 This test method is used to determine the flexural strength of soil-cement. Flexural strength is significant in pavement design and can be used to determine the thickness of pavement layers.

NOTE 2—The quality of the result produced by this standard is dependent on the competence of the personnel performing it, and the suitability of the equipment and facilities used. Agencies that meet the criteria of Practice D3740 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with Practice D3740 does not in itself assure reliable results. Reliable results depend on many factors; Practice D3740 provides a means of evaluating some of those factors.

6. Apparatus

6.1 *Compression Testing Machine*—The testing machine may be of any type having sufficient capacity and control to provide the rate of displacement or loading prescribed in 8.2. The testing machine shall be equipped with a spherically seated head block having a bearing surface of at least 75 % of the width of the beam but not greatly in excess of the width of the beam. The movable portion of this block shall be held closely in the spherical seat, but the design shall be such that the bearing face may be rotated freely and tilted through small angles in any direction. The compression machine shall be verified in accordance with Practice E4 at least annually to determine if indicated loads are accurate to ±1.0 % in the applicable range of loading

6.2 *Flexural Testing Apparatus*—A four-point loading apparatus shall employ bearing blocks that will ensure that forces applied to the beam will be vertical only and applied without eccentricity. A diagrammatic drawing of an apparatus that accomplishes this purpose is shown in Fig. 1. This type of loading apparatus is commonly referred to as third-point loading since the bearing blocks are located at third points of the span.

6.2.1 The apparatus shall be designed to incorporate the following principles:

6.2.1.1 The distance between supports and points of load application shall remain constant for a given apparatus.

6.2.1.2 The direction of the reactions shall be parallel to the direction of the applied load at all times during the test.

6.2.1.3 The directions of loads and reactions may be maintained parallel by judicious use of linkages, rocker bearings, and flexure plates. Eccentricity of loading can be avoided by use of spherical bearings.

6.2.1.4 The steel plate and bed of testing machine shall be of sufficient hardness and size to support the testing apparatus.

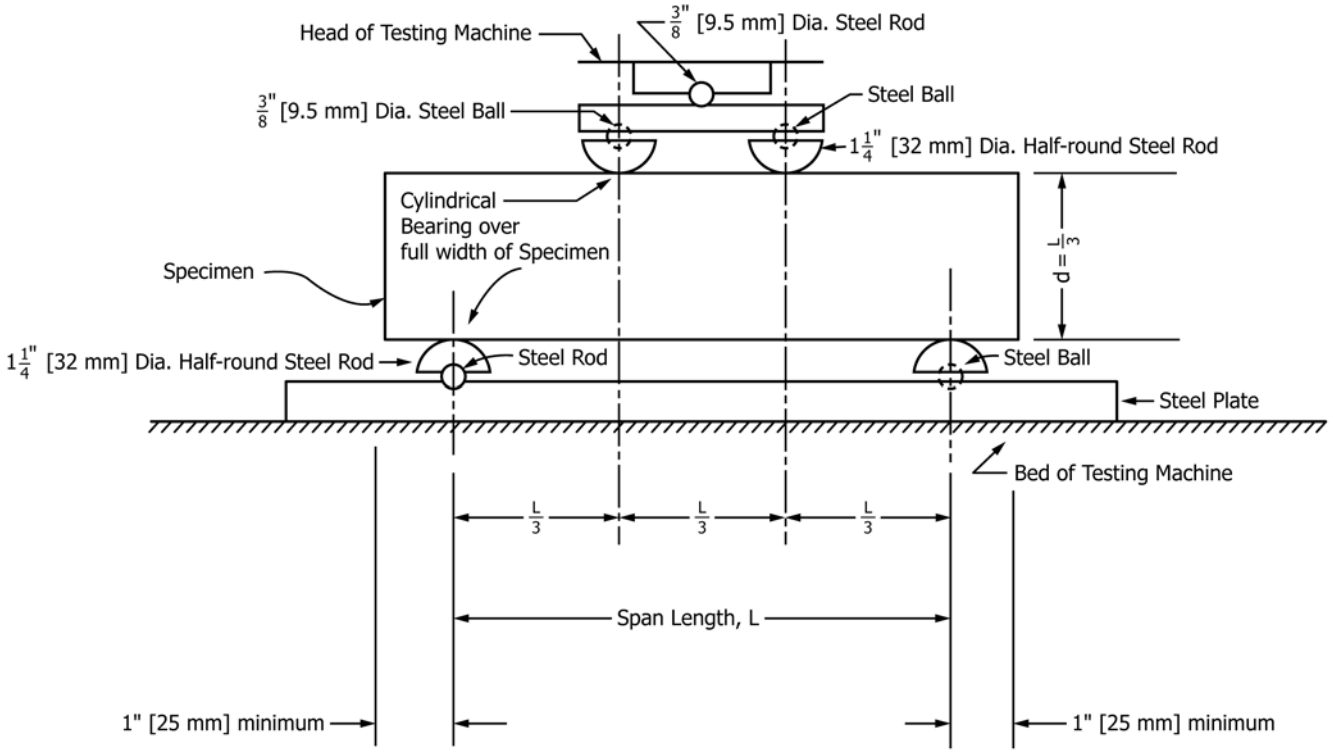

FIG. 1 Diagrammatic View of Suitable Apparatus for Flexure Test of Soil-Cement by Third-Point Loading Method