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Standard Test Method for Expansion Index of Soils[1]

This standard is issued under the fixed designation D 4829; 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 provides an index to the expansion potential of compacted soils when inundated with distilled water.[2]

1.2 This test method controls variables that influence the expansive characteristics of soils and still retains a relatively simple test for practical engineering applications.

1.3 The values stated in SI units are to be regarded as the standard. The values stated in inch-pound units are approximate.

~~1.4~~

1.4 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D 6026.

1.4.1 The method used to specify how data are collected, calculated, or recorded in this standard is not directly related to the accuracy to which the data can be applied in design or other uses, or both. How one applies the results obtained using this standard is beyond its scope.

1.5 *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:*

D 653 Terminology Relating to Soil, Rock, and Contained Fluids[3]

D 698 Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft lbf/ft^3(600 kN-m/m^3))[3]

D 854 Test Method for Specific Gravity of Soils[3]

D 2216 Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock[3]

D 2435 Test Method for One-Dimensional Consolidation Properties of Soils[3]

D 3740 Practice for Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction[3]

D 3877 Test Methods for One-Dimensional Expansion, Shrinkage, and Uplift Pressure of Soil-Lime Mixtures[3]

D 4318 Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils[3]

D 4753 Specification for Evaluating, Selecting, and Specifying Balances and Scales for Use in Testing Soil, Rock and Related Construction Materials Testing[3]

D 6026 Practice for Using Significant Digits in Calculating and Reporting Geotechnical Test Data[4]

E 11 Specification for Wire-Cloth Sieves for Testing Purposes[5]

3. Terminology

3.1 Refer to Terminology D 653 for standard definitions of terms. Additional terms are as follows:

~~3.2~~

3.2 *Definitions:*

3.2.1 *expansion index, EI*—1000 times the difference between final and initial height of the specimen divided by the initial height.

~~[1] This test method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.05 on Structural Properties of Soils.~~

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[2] Refer to Anderson, J. N., and Lade, P. V., "The Expansion Index Test,'' *Geotechnical Testing Journal*, Vol 4, No. 2, ASTM, 1981, pp. 58–67.

[3] *Annual Book of ASTM Standards*, Vol 04.08.

[4] *Annual Book of ASTM Standards*~~, Vol 14.02.~~, Vol 04.09.

[5] *Annual Book of ASTM Standards*, Vol 14.02.

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

3.2.2 *scarification*—scratching the surface of a compacted layer to facilitate bonding with the next layer and avoid potential lamination between compacted layers.

4. Summary of Test Method

4.1 The specimen is compacted into a metal ring so that the degree of saturation is between 40 and 60 % and the specimen and the ring are placed in a consolidometer. A vertical confining pressure of 6.9 kPa (1 lbf/in.^{2}) is applied to the specimen and then the specimen is inundated with distilled water. The deformation of the specimen is recorded for 24 h or until the rate of deformation becomes less than ~~0.0005~~0.005 mm/h (0.0002 in./h), whichever occurs first. A minimum recording time of 3 h is required.

5. Significance and Use

5.1 The expansion index, *EI*, is used to measure a basic index property of soil and therefore, the *EI* is comparable to other indices such as the liquid limit, plastic limit, and plasticity index of soils, as in Test Method D 4318.

5.2 The *EI* is not used to duplicate any particular field conditions such as soil density, water content, loading, in-place soil structure or soil water chemistry. However, the test procedure keeps all conditions constant allowing direct correlation of data between organizations. All organizations can benefit from these collective experiences.

5.3 The classification of a potentially expansive soil is based on the following table:

Expansion Index, EI	Potential Expansion
0–20	Very Low
21–50	Low
51–90	Medium
91–130	High
>130	Very High

NOTE 1—Notwithstanding the statements on precision and bias contained in this test method: the precision of this test method is dependent on the competence of the personnel performing it and the suitability of the equipment and facilities used. Agencies which meet the criteria of Practice D 3740 are generally considered capable of competent testing. Users of this test method are cautioned that compliance with Practice D 3740 does not ensure reliable testing. Reliable testing depends on several factors; Practice D 3740 provides a means of evaluating some of those factors.

6. Apparatus

6.1 *Mold*—The mold shall be cylindrical in shape, made of metal, and have the capacity and dimensions indicated in Fig. 1. It shall have a detachable collar inscribed with a mark ~~5.085~~0.8 mm (2.00 in.) above the base. The lower section of the mold is designed to retain a removable stainless steel ring ~~2.54~~25.4 mm (1 in.) in height, ~~10.19~~101.9 mm (4.01 in.) in internal diameter, and not less than ~~0.31~~3.10 mm (0.120 in.) in wall thickness.

6.2 *Rammer*—A metal rammer having a ~~5.085~~0.8 mm (2.00 in.) diameter circular face and weighing 2.5 kg (5.5 lbf) shall be equipped with a suitable arrangement to control height of drop to a free fall of ~~30.5~~ 304.8 ± 1.3 mm (12 ± 0.05 in.) above the top of the soil. See Test Methods D 698 for specification of a suitable rammer.

6.3 *Balance*—A balance of at least 1000 g capacity meeting the requirments of Specification D 4753, Class GP2.

NOTE ~~1—For~~ 2—For further information refer to Specification D 4753.

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

6.5 *Straight Edge*—Steel straight edge ~~30.5~~ at least 150 mm ~~(12~~(6 in.) in length and having one bevelled edge.

6.6 *Sieves*—A 4.75-mm (No. 4) sieve conforming to the requirements of Specification E 11.

6.7 *Mixing Tools*—Miscellaneous tools such as mixing pans, spoons, trowels, spatula, and so forth, or a suitable mechanical device for thoroughly mixing the sample of soil with increments of water.

6.8 *Loading Device*—A consolidometer or equivalent loading device as described in Test Method D 2435 for supporting and submerging the specimen, for applying a vertical load, and for measuring the change in height of the specimen. The consolidometer ring must be as specified in 6.1.

6.9 *Porous Disks*—The disks shall be smooth ground and fine enough to minimize intrusion of soil into the disks and shall reduce false displacements caused by seating of the specimen against the surface of porous disks (Note ~~2~~3). Such displacements ~~may be~~are significant, especially if displacements and applied vertical pressures are small.

NOTE ~~2—A~~ 3—A suitable pore size is 10 µm.

6.9.1 Porous disks shall be air dry.

~~6.9.2Porous disks shall fit close to the consolidometer ring to avoid extrusion or punching. Suitable disk tolerances are described in 6.3 of Test Method D2435~~

6.9.2 Porous disks shall fit close to the consolidometer ring to avoid extrusion or punching. Suitable disk tolerances are 12.7 mm (0.50 in.) high and 101.5 ± 0.13 mm (3.995 ± 0.005 in.) in diameter or as described in 6.3 of Test Method D 2435.

7. Sample Preparation

7.1 *Preparation for Sieving*—If the soil sample is damp when received from the field, dry it until it becomes friable under a trowel. Drying may be in air or by the use of drying apparatus, such that the temperature of the sample does not exceed 60°C