



Designation: D8281/D8281M – 21

## Standard Test Method for Determining the Presence of Expanding Clays in Rock for Erosion Control Using Ethylene Glycol<sup>1</sup>

This standard is issued under the fixed designation D8281/D8281M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This test method covers the testing for and quantitative determination of the presence of swelling clays of the smectite group in rock for erosion control. The test particles are intended to be representative of erosion control rock and its durability. The test is appropriate for breakwater stone, armor stone, riprap and gabion sized rock materials.

1.2 Ethylene glycol is one of the materials that react with swelling clays to form an organoclay complex having a larger basal spacing than that of the clay mineral itself. Rock containing swelling clay of the smectite group will be expected to undergo expansive breakdown upon soaking in ethylene glycol. If the amount, distribution, state of expansion, and ability to take up glycol is such as to cause such breakdown to occur, it may be expected that similar breakdown may occur of similar rock samples exposed, for longer times, to wetting and drying or freezing and thawing in a water-soaked condition in service.

1.3 The prepared size of the rock specimens may eliminate some of the internal features present in the gross structure. The test specimens may not be representative of the quality of the larger rock samples used in construction. Careful examination of the rock source and proper sampling are essential in minimizing this limitation.

1.3.1 The test is time intensive and requires over two weeks to complete the sample preparation, testing and analysis portions of the procedure.

1.4 The use of reclaimed concrete and materials other than natural rock is beyond the scope of this test method.

1.5 *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 may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-

conformance with the standard. Reporting of test results in units other than SI shall not be regarded as nonconformance with this standard.

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

1.5.2 The SI units presented for apparatus are substitutions of the inch-pound units, other similar SI units should be acceptable providing they meet the technical requirements established by the inch-pound apparatus.

1.5.3 It is common practice in the engineering/construction profession to concurrently use pounds to represent both a unit of mass (lbm) and force (lbf). This practice implicitly combines two separate systems of units: the absolute and the gravitational systems. It is scientifically undesirable to combine the use of two separate sets of inch-pound units within a single standard. As stated, this standard includes the gravitational system of inch-pound units and does not use/present the slug unit for mass. However, the use of balances or scales recording pounds of mass (lbm) or recording density in lbm/ft<sup>3</sup> shall not be regarded as nonconformance with this standard.

1.5.4 Calculations are done using only one set of units; either SI or gravitational inch pound. Other units are permissible provided appropriate conversion factors are used to maintain consistency of units throughout the calculations, and similar significant digits or resolution, or both are maintained.

1.6 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D6026, unless superseded by this standard.

1.6.1 For purposes of comparing measured or calculated value(s) with specified limits, the measured or calculated value(s) shall be rounded to the nearest decimal or significant digits in the specified limits.

1.6.2 The procedures used to specify how data are collected/recorded or calculated, in this standard are regarded as the 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

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.17 on Rock for Erosion Control.

Current edition approved May 1, 2021. Published May 2021. DOI: 10.1520/D8281\_D8281M-21.



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 analytical methods for engineering design.

1.7 *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.*

1.8 *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:<sup>2</sup>

**D653 Terminology Relating to Soil, Rock, and Contained Fluids**

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

**D2693 Specification for Ethylene Glycol (Withdrawn 2021)<sup>3</sup>**

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

**D4753 Guide for Evaluating, Selecting, and Specifying Balances and Standard Masses for Use in Soil, Rock, and Construction Materials Testing**

**D4992 Practice for Evaluation of Rock to be Used for Erosion Control**

**D6026 Practice for Using Significant Digits in Geotechnical Data**

**E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves**

### 2.2 USACE Standards:

**CRD-C 148-69 Method of Testing Stone for Expansive Breakdown on Soaking in Ethylene Glycol<sup>4</sup>**

## 3. Terminology

### 3.1 Definitions:

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

## 4. Summary of Test Method

4.1 Erosion control rock samples are prepared by sieving, crushing, or breaking pieces to pass a minus 75.0 mm [3 in.] size sieve. The specimens are then washed and built to a specific grading. The test specimens are exposed to ethylene glycol for a period of 15 days. At the completion of the test, the

percent loss by mass for each grading is determined. A visual examination of the specimen particles is performed throughout and at the end of testing. The type of deterioration is recorded.

## 5. Significance and Use

5.1 Rock for erosion control consists of individual pieces of natural quarried stone or large boulders and cobbles. The ability of these individual pieces of stone to resist deterioration due to weathering action affects the stability of the integral placement of rock for erosion control and hence, the stability of construction projects, structures, shorelines, and stream banks.

5.2 Deterioration of stone in this test is one indicator that similar samples exposed to wet/dry and freeze/thaw cycles may break down in a water-soaked environment condition in service.

5.3 This test method was developed to be used in conjunction with additional test methods listed in Practice **D4992**. This test method provides a quantitative value indicating potential resistance to weathering; however, the results of this test method are not to be used as the sole basis for the determination of rock durability.

NOTE 1—The quality of the result produced by this standard is dependent upon 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 evaluation some of those factors.

## 6. Apparatus

6.1 *Immersion Containers*—Containers with tight-fitting lids, of sufficient size to hold the specimens fully immersed to a depth of not less than 12.5 mm [ $\frac{1}{2}$  in.] in ethylene glycol. It is advised that these containers be non-reactive, resistant to breakage and resistant to deformation and degradation when exposed to ethylene glycol.

6.2 *Drying Containers* shall conform with ASTM **D2216**, subsection 6.3.

6.3 *Drying Oven*—A thermostatically controlled oven, capable of maintaining a uniform temperature of  $110 \pm 5^\circ\text{C}$  [ $230 \pm 9^\circ\text{F}$ ] throughout the drying chamber. These requirements typically require the use of a forced-draft type oven. The oven shall be vented outside the building.

6.4 *Balance*—A balance capable of determining the mass of the specimen to the nearest 0.1 % of the total mass meeting the requirements of Specification **D4753**.

6.5 *Sieves*, 75 mm [3 in.], 63 mm, [2  $\frac{1}{2}$  in.], 50 mm [2 in.], 37.5 mm [1  $\frac{1}{2}$  in.], 25.0 mm [1 in.] and 19.0 mm [ $\frac{3}{4}$  in.] conforming to the requirements of Specification **E11**.

6.6 *Camera*—A video or still camera capable of producing good quality, color images for “before testing” and “after testing” photographs.

## 7. Reagents and Materials

7.1 *Ethylene Glycol*—The reagent used in this method shall be ethylene glycol meeting requirements of Specification **D2693**.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

<sup>4</sup> For referenced USACE Standards, visit the USACE website, <http://www.wbdg.org/ffc/army-coe/standards>