Designation: D3080/D3080M – 23

Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions[1]

This standard is issued under the fixed designation D3080/D3080M; 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 consolidated drained shear strength of one specimen of a soil material under direct shear boundary conditions. The specimen is deformed at a controlled rate on or near a single shear plane determined by the configuration of the apparatus.

1.2 Shear stresses and displacements are nonuniformly distributed within the specimen. An appropriate height of the failure zone cannot be defined for calculation of shear strains. Therefore, stress-strain relationships or any associated quantity such as the shear modulus, cannot be determined from this test.

1.3 The results of the test are affected by the presence of coarse-grained soil or rock particles, or both, which may make the testing data invalid in some cases. Check requirements of maximum soil particle size in 6.2.1 and 6.2.2.

1.4 Test conditions, including normal stress, access to water during consolidation and shearing, and specimens conditions should be selected to represent the field conditions being investigated and are left to the engineer or office requesting the test. The rate of shearing must be slow enough to ensure drained conditions.

1.5 Generally, three or more tests are performed on specimens from one soil sample, each under a different normal load, to determine the effects upon shear resistance and displacement. The development of criteria to interpret and evaluate test results is left to the engineer or office requesting the test. Interpretation of multiple tests requires engineering judgment and is beyond the scope of this test method. This test method pertains to the requirements for a single test.

1.6 This test method limits the maximum particle size of the test specimen based on the size of the shear box. Likewise, the gap size during shear is specified. It is acceptable for the testing requester to require a certain gap size between the upper and lower shear box halves to accommodate certain sand size particles. Presently there is insufficient information available for specifying the gap dimension based on particle size distribution.

1.7 *Units*—The values stated in either inch-pound units or SI units [given in brackets] 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 nonconformance with the standard.

1.7.1 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 a slug. The slug unit is not given, unless dynamic (F = ma) calculations are involved.

1.7.2 It is common practice in the engineering/construction profession to concurrently use pounds to represent both a unit of mass (lbm) and of 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 of mass. However, the use of balances and scales recording pounds of mass (lbm) or recording density in lbm/ft^3 shall not be regarded as nonconformance with this standard.

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

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

1.8.2 The procedures used to specify how data are collected/recorded and calculated in the 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 increase or reduce significant digits of reported data to be commensurate with these considerations. It is beyond the scope

[1] This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.05 on Strength and Compressibility of Soils.

Current edition approved Nov. 1, 2023. Published December 2023. Originally approved in 1972. Last previous edition approved in 2011 as D3080/D3080M–11. DOI: 10.1520/D3080_D3080M-23.

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

of these test methods to consider significant digits used in analysis methods for engineering design.

1.9 *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.*

1.10 *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

D698 Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

D1557 Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))

D1587/D1587M Practice for Thin-Walled Tube Sampling of Fine-Grained Soils for Geotechnical Purposes

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

D2435/D2435M Test Methods for One-Dimensional Consolidation Properties of Soils Using Incremental Loading

D2487 Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

D2488 Practice for Description and Identification of Soils (Visual-Manual Procedures)

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

D4220/D4220M Practices for Preserving and Transporting Soil Samples (Withdrawn 2023)[3]

D4318 Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

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

D6026 Practice for Using Significant Digits and Data Records in Geotechnical Data

D6027/D6027M Practice for Calibrating Linear Displacement Transducers for Geotechnical Purposes

D6913/D6913M Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

3. Terminology

3.1 *Definitions:*

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

3.2 *Description of Terms Specific to This Standard:*

3.2.1 *fabricated slurry specimen*—laboratory reconstituted specimen formed by consolidating a slurry to a specified water content.

3.2.2 *failure criterion*—(Generically defined in Terminology D653.) For this standard, *failure criterion* is often taken as the maximum shear stress attained, or in the absence of a peak condition, the shear stress at 10 percent relative lateral displacement. Depending on soil behavior and field application, other suitable criteria may be defined at the direction of the requesting agency.

3.2.3 *nominal normal stress—in the direct shear test*, the applied normal (vertical) force divided by the area of the shear box.

3.2.3.1 *Discussion*—The contact area of the specimen on the imposed shear plane decreases during shear and hence the true normal stress is unknown.

3.2.4 *nominal shear stress—in the direct shear test*, the applied shear force divided by the area of the shear box.

3.2.4.1 *Discussion*—The contact area of the specimen on the imposed shear plane decreases during shear and hence the true shear stress is unknown.

3.2.5 *percent relative lateral displacement*—The ratio, in percent, of the relative lateral displacement to the diameter or lateral dimension of the specimen in the direction of shear.

3.2.6 *pre-shear—in strength testing*, the stage of a test after the specimen has stabilized under the consolidation loading condition and just prior to starting the shearing phase.

3.2.7 *relative lateral displacement*—the displacement between the top and bottom shear box halves.

4. Summary of Test Method

4.1 This test method consists of placing the test specimen in the direct shear device, applying a predetermined normal stress, providing for wetting or draining of the test specimen, or both, consolidating the specimen under the normal stress, unlocking the shear box halves that hold the test specimen, and shearing the specimen by displacing one shear box half laterally with respect to the other at a constant rate of shearing deformation while measuring the shearing force, relative lateral displacement, and normal displacement (Fig. 1). The shearing rate must be slow enough to allow nearly complete dissipation of excess pore pressure.

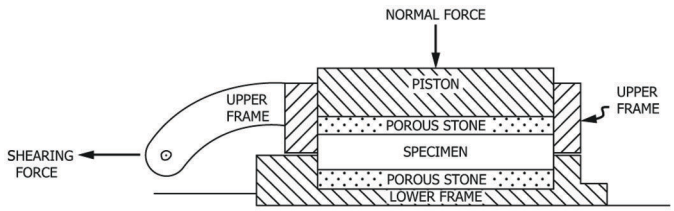

FIG. 1 Test Specimen in Single Shear Apparatus

[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.

[3] The last approved version of this historical standard is referenced on www.astm.org.