



Standard Test Method for In Situ Determination of Direct Shear Strength of Rock Discontinuities¹

This standard is issued under the fixed designation D4554; 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 measurement of peak and residual direct shear strength in a drained condition of in situ rock discontinuities as a function of stress normal to the sheared plane. This sheared plane is usually a significant discontinuity that may or may not be filled with gouge or soil-like material.

1.2 The measured shear properties are affected by scale factors. The severity of the effect of these factors must be assessed and applied to the specific problems on an individual basis.

1.3 The values stated in SI units are to be regarded as the standard. No other units of measurements are included in this standard.

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

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:²

D422 Test Method for Particle-Size Analysis of Soils

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

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

Used in Engineering Design and Construction

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

D6026 Practice for Using Significant Digits in Geotechnical Data

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

3. Terminology

3.1 Definitions:

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

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *discontinuities*—any surface across which some property of the rock mass is not continuous. Discontinuities include joints, schistosity, faults, bedding planes, cleavage, and zones of weakness, along with any filling material.

3.2.2 *peak shear strength*—the maximum shear stress in the complete curve of stress versus displacement obtained for a specified constant normal stress.

3.2.3 *residual shear strength*—the shear stress at which nominally no further rise or fall in shear strength is observed with increasing shear displacement and constant normal stress as shown in Fig. 1. A true residual strength may only be reached after considerably greater shear displacement than can be achieved in testing. The test value should be regarded as approximate and should be assessed in relation to the complete shear stress – displacement curve.

3.2.4 *shear strength parameter, c* —apparent cohesion; the projected intercept on the shear stress axis of the plot of shear stress versus normal stress as shown in Fig. 2.

3.2.5 *shear strength parameter, ϕ* —friction angle; the angle of the tangent to the failure curve at a normal stress that is relevant to design as shown in Fig. 2.

3.2.5.1 *Discussion*—Different values of c and ϕ relate to different stages of a test, for example, c' , c_r' , ϕ_a , and ϕ_b , of Fig. 2.

4. Summary of Test Method

4.1 This test method is performed on rectangular-shaped blocks of rock that are isolated on all surfaces, except for the shear plane surface.

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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.