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.

Designation: D7608 – 18

Standard Test Method for Torsional Ring Shear Test to Measure Drained Fully Softened Shear Strength and Stress Dependent Strength Envelope of Fine-Grained Soils[1]

This standard is issued under the fixed designation D7608; 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 a procedure for performing a torsional ring shear test under a drained condition to measure the fully softened shear strength and stress dependent strength envelope of fine-grained soils (using a reconstituted normally consolidated specimen). The fully softened strength and the corresponding stress dependent effective stress strength envelope are used to evaluate the stability of slopes that do not have a pre-existing shear surface but have been subjected to environmental conditions and shear stresses that lead to soil softening, deterioration of the soil fabric, and strength loss. It has been shown (Skempton 1970[2] and 1977[3]) that under these conditions and within the depth zones that have undergone softening, first-time slope failures can occur at effective stress levels that correspond to a fully softened strength envelope. It has also been shown empirically (Skempton 1970[2] and 1977[3]) that fully softened strength of fine grained soils can be approximated by the peak strength of a reconstituted and normally consolidated specimen. In this test method, reconstituted and normally consolidated specimens are sheared at a controlled and constant displacement rate until the peak shear resistance has been obtained. Generally, the drained fully softened failure envelope is determined at three or more effective normal stresses. A separate test specimen must be used for each normal stress to measure the fully softened strength otherwise a post-peak or even drained residual strength will be measured if the same specimen is used at the same or at another effective normal stress because of the existence of a prior shear surface.

1.2 The ring shear apparatus allows a reconstituted specimen to be normally consolidated at the desired normal stress prior to drained shearing. The test results closely simulate the fully softened strength of stiff natural fine-grained soils (Skempton 1970[2] and 1977[3]) and compacted fills of fine-grained soils (Gamez and Stark 2014[4]). This simulates the mobilized shear strength in overconsolidated clays, claystones, mudstones, and shales in natural slopes and compacted fill in manmade slopes, such as, dams, levees, and highway embankments, after the soil has fully softened and attained the fully softened strength condition.

1.3 A shear stress-displacement relationship may be obtained from this test method. However, a shear stress-strain relationship or any associated quantity, such as modulus, cannot be determined from this test method because defining the height of the shear zone is difficult and needed in the shear strain calculations. As a result, the height of this shear zone is unknown, so an accurate or representative shear strain can therefore not be determined.

1.4 The selection of normal stresses and final determination of the shear strength envelope for design analyses and the criteria to interpret and evaluate the test results are the responsibility of the engineer or entity requesting the test.

1.5 *Units*—The values stated in SI units are to be regarded as the standard. The values given in parentheses are mathematical conversions to inch-pound units that are provided for information only and are not considered standard.

1.6 *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.*

1.7 *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.*

[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.

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[2] Skempton, A. (1970). "First-time slides in over-consolidated clays." Géotechnique, 20(3), 320–324.

[3] Skempton, A. (1977). "Slope stability of cutting in brown London clay." Proc. 9th Int. Conf. on Soil Mechanics and Foundation Engineering, Society of Soil Mechanics and Foundation Engineering, Tokyo, 261–270.

[4] Gamez, J. and Stark, T.D. (2014). "Fully Softened Shear Strength at Low Stresses for Levee and Embankment Design" ASCE Journal of Geotechnical and Geoenvironmental Engineering, June, 140(9), 06014010-1-06014010-6.

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