



Standard Test Method for Determining In Situ Creep Characteristics of Rock¹

This standard is issued under the fixed designation D4553; 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 preparation, equipment, test procedure, and data documentation for determining in situ creep characteristics of a rock mass using a rigid plate subjected to controlled loading.

1.2 This test method is designed to be conducted in an underground opening; however, with suitable modifications, this test could be conducted at the surface.

1.3 The test is usually conducted parallel or perpendicular to the anticipated axis of thrust, as dictated by the design load or other orientations, based upon the application.

1.4 Flexible plate apparatus can be used if the anticipated creep displacement is within the tolerance of the travel of the flat jacks.

1.5 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI 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 and health practices and determine the applicability of regulatory limitations prior to use.* For specific precaution statements, see Section 8.

2. Referenced Documents

2.1 *ASTM Standards:*²

D653 Terminology Relating to Soil, Rock, and Contained Fluids

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

D4394 Test Method for Determining In Situ Modulus of

Deformation of Rock Mass Using Rigid Plate Loading Method

D4403 Practice for Extensometers Used in Rock

3. Terminology

3.1 *Definitions*—See Terminology D653 for general definitions.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *creep*—a time-dependent displacement of a plate pushed into the surface of the rock by a constant normal load. It is not directly related with laboratory creep data because of the nonuniformity of stress within the rock mass underneath the plate.

3.2.2 *displacement*—movement of the rigid plate, grout pad, or rock in response to and in the same direction as the applied load.

3.2.3 *load*—total force acting on the rock face.

3.2.4 *rigid plate*—plate with a deflection of less than 0.0005 in. (0.0125 mm) from the center to the edge of the plate when maximum load is applied.

4. Summary of Test Method

4.1 Areas on two opposing faces of a test opening are flattened, smoothed, and made parallel.

4.2 A grout pad and rigid metal plate are installed against each face and a hydraulic loading system is placed between the rigid plates.

4.3 The two faces are rapidly loaded to the desired creep load, without shock, the load maintained, and the displacement of the plate measured as a function of time.

5. Significance and Use

5.1 Results of this test method are used to predict time-dependent deformation characteristics of a rock mass resulting from loading. It is a test that may be required depending on rock type or anticipated loads, or both.

5.2 This test method may be useful in structural design analysis where loading is applied over an extensive period.

5.3 This test method is normally performed at ambient temperature, but equipment can be modified or substituted for operations at other temperatures.

¹ This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.12 on Rock Mechanics.

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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.