



Standard Test Method for Laboratory Determination of Pulse Velocities and Ultrasonic Elastic Constants of Rock¹

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1. Scope*

1.1 This test method describes equipment and procedures for laboratory measurements of the pulse velocities of compression waves and shear waves in rock (**1**)² and the determination of ultrasonic elastic constants (**Note 1**) of an isotropic rock or one exhibiting slight anisotropy.

NOTE 1—The elastic constants determined by this test method are termed ultrasonic since the pulse frequencies used are above the audible range. The terms sonic and dynamic are sometimes applied to these constants but do not describe them precisely (**2**). It is possible that the ultrasonic elastic constants may differ from those determined by other dynamic methods.

1.2 This test method is valid for wave velocity measurements in both anisotropic and isotropic rocks although the velocities obtained in grossly anisotropic rocks may be influenced by such factors as direction, travel distance, and diameter of transducers.

1.3 The ultrasonic elastic constants are calculated from the measured wave velocities and the bulk density. The limiting degree of anisotropy for which calculations of elastic constants are allowed and procedures for determining the degree of anisotropy are specified.

1.4 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.

1.5 *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.*

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 The boldface numbers in parentheses refer to the list of references at the end of this test method.

2. Referenced Documents

2.1 ASTM Standards:³

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

D6026 Practice for Using Significant Digits in Geotechnical Data

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 For common definitions of terms in this standard, refer to Terminology D653.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *compression wave velocity*—the dilational wave velocity which is the propagation velocity of a longitudinal wave in a medium that is effectively infinite in lateral extent. It is not to be confused with bar or rod velocity.

4. Summary of Test Method

4.1 Details of essential procedures for the determination of the ultrasonic velocity, measured in terms of travel time and distance, of compression and shear waves in rock specimens include requirements of instrumentation, suggested types of transducers, methods of preparation, and effects of specimen geometry and grain size. Elastic constants may be calculated for isotropic or slightly anisotropic rocks, while anisotropy is reported in terms of the variation of wave velocity with direction in the rock.

³ 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.