



Standard Test Methods for Crosshole Seismic Testing¹

This standard is issued under the fixed designation D4428/D4428M; 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 These test methods are limited to the determination of the velocity of two types of horizontally travelling seismic waves in soil materials; primary compression (*P-wave*) and secondary shear (*S-wave*) waves. The standard assumes that the method used to analyze the data obtained is based on first arrival times or interval arrival times over a measured distance.

1.2 Acceptable interpretation procedures and equipment, such as seismic sources, receivers, and recording systems are discussed. Other items addressed include borehole spacing, drilling, casing, grouting, deviation surveys, and actual test procedures.

1.3 These test methods are primarily concerned with the actual test procedure, data interpretation, and specifications for equipment which will yield uniform test results.

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

1.4.1 The procedures used to specify how data are collected/recorded and calculated in these test methods are regarded as the industry standard. The procedures used do not consider material variation, purpose for obtaining the data, special purpose studies, or any considerations for the user's objectives. Measurements made to more significant digits or better sensitivity than specified in these test methods shall not be regarded as nonconformance with this standard.

1.5 *Units*—The values stated in either SI units or inch-pound units [presented 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 non-conformance with the standard. Reporting of

test results in units other than SI shall not be regarded as nonconformance with this test method.

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.*

2. Referenced Documents

2.1 ASTM Standards:

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

D6026 Practice for Using Significant Digits in Geotechnical Data

3. Terminology

3.1 Definitions:

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

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *seismic wave train*—the recorded motion of a seismic disturbance with time.

4. Summary of Test Method

4.1 The Crosshole Seismic Test makes direct measurements of P-wave velocities, or S-wave velocities, in boreholes advanced primarily through soil. At selected depths down the borehole, a borehole seismic source is used to generate a seismic wave train. Downhole receivers are used to detect the arrival of the seismic wave train in offset borings at a recommended spacing of 3 to 6 m [10 to 20 ft]. The distance between boreholes at the test depths is measured using a borehole deviation survey. The borehole seismic source is connected to and triggers a data recording system that records the response of the downhole receivers, thus measuring the travel time of the wave train between the source and receivers.

¹ These test methods are under the jurisdiction of ASTM Committee D18 on Soil and Rock and are the direct responsibility of Subcommittee D18.09 on Cyclic and Dynamic Properties of Soils.

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