



Designation: D420 – 18

Standard Guide for Site Characterization for Engineering Design and Construction Purposes¹

This standard is issued under the fixed designation D420; 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.

INTRODUCTION

Site characterization for engineering design and construction purposes involves both simple and complex techniques that may be accomplished by many different procedures and may be variously interpreted. These studies are frequently site specific and are influenced by geological and geographical settings, by the purpose of the site characterization, by design requirements for the project proposed, and by the background, training, and experience of the staff involved.

This document is a guide to the selection of the various ASTM standards that are available for the exploration of soil, rock, and groundwater for projects that involve surface and/or subsurface construction, or both. It is intended to improve consistency of practice and to encourage rational planning of a site characterization program. Since the subsurface conditions at a particular site are usually the result of a combination of natural, geologic, topographic, and climatic factors, and of historical modifications both natural and manmade, an adequate and internally consistent exploration program will allow evaluation of the results of these influences.

1. Scope*

1.1 This guide refers to ASTM methods to perform site characterization for engineering, design, and construction purposes. The objective of the site characterization should be to identify and locate, both horizontally and vertically, significant soil and rock types and groundwater conditions present within a given site area and to establish the characteristics of the subsurface materials by sampling or in situ testing, or both.

1.2 Laboratory testing of soil, rock, and groundwater samples is specified by other ASTM standards not listed herein. Subsurface exploration for environmental purposes is also outside the scope of this guide.

1.3 Prior to commencement of the site characterization the site should be checked for potentially hazardous or otherwise contaminated materials or cultural/archeological conditions. If evidence of unknown potentially hazardous or otherwise contaminated materials or conditions are encountered in the course of the site characterization, work shall be interrupted until the circumstances have been evaluated and revised instructions issued.

¹ This guide is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.01 on Surface and Subsurface Characterization.

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1.3.1 In addition the location and nature of underground and overhead utilities should be identified to ensure that there is no impact to the proposed site characterization. Impacts may include but are not limited to interference with geophysical methods, damaging utilities, creating an unsafe work condition, and limiting accessibility for exploratory equipment.

1.4 The values stated in either SI units or inch-pound units are to be regarded as the 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. Inch-pound units are provided in brackets for convenience.

1.5 *This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the*

*A Summary of Changes section appears at the end of this standard

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

1.8 The procedures used to specify how data are collected/recorded or calculated, in this standard are regarded as the industry standard. In addition, they are representative of the significant digits that generally should be retained. The procedures used do not consider material variation, purpose for obtaining the data, special purpose studies, or any considerations for the user's objectives; and it is common practice to increase or reduce significant digits of reported data to be commensurate with these considerations. It is beyond the scope of this standard to consider significant digits used in analysis methods for engineering design.

1.9 *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.*

2. Referenced Documents

2.1 ASTM Standards:²

- C119** Terminology Relating to Dimension Stone
- C294** Descriptive Nomenclature for Constituents of Concrete Aggregates
- D75/D75M** Practice for Sampling Aggregates
- D653** Terminology Relating to Soil, Rock, and Contained Fluids
- D1195/D1195M** Test Method for Repetitive Static Plate Load Tests of Soils and Flexible Pavement Components, for Use in Evaluation and Design of Airport and Highway Pavements
- D1196/D1196M** Test Method for Nonrepetitive Static Plate Load Tests of Soils and Flexible Pavement Components, for Use in Evaluation and Design of Airport and Highway Pavements
- D1452/D1452M** Practice for Soil Exploration and Sampling by Auger Borings
- D1586** Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils
- D1587/D1587M** Practice for Thin-Walled Tube Sampling of Fine-Grained Soils for Geotechnical Purposes
- D2113** Practice for Rock Core Drilling and Sampling of Rock for Site Exploration
- D2487** Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- D2488** Practice for Description and Identification of Soils (Visual-Manual Procedures)
- D2573/D2573M** Test Method for Field Vane Shear Test in

- Saturated Fine-Grained Soils
- D3213** Practices for Handling, Storing, and Preparing Soft Intact Marine Soil
- D3282** Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
- D3385** Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer
- D3404** Guide for Measuring Matric Potential in Vadose Zone Using Tensiometers
- D3550/D3550M** Practice for Thick Wall, Ring-Lined, Split Barrel, Drive Sampling of Soils
- D4044/D4044M** Test Method for (Field Procedure) for Instantaneous Change in Head (Slug) Tests for Determining Hydraulic Properties of Aquifers
- D4050** Test Method for (Field Procedure) for Withdrawal and Injection Well Testing for Determining Hydraulic Properties of Aquifer Systems
- D4083** Practice for Description of Frozen Soils (Visual-Manual Procedure)
- D4220/D4220M** Practices for Preserving and Transporting Soil Samples
- D4394** Test Method for Determining In Situ Modulus of Deformation of Rock Mass Using Rigid Plate Loading Method
- D4395** Test Method for Determining In Situ Modulus of Deformation of Rock Mass Using Flexible Plate Loading Method
- D4403** Practice for Extensometers Used in Rock
- D4428/D4428M** Test Methods for Crosshole Seismic Testing
- D4429** Test Method for CBR (California Bearing Ratio) of Soils in Place (Withdrawn 2018)³
- D4452** Practice for X-Ray Radiography of Soil Samples
- D4506** Test Method for Determining In Situ Modulus of Deformation of Rock Mass Using Radial Jacking Test
- D4544** Practice for Estimating Peat Deposit Thickness
- D4553** Test Method for Determining In Situ Creep Characteristics of Rock (Withdrawn 2017)³
- D4554** Test Method for In Situ Determination of Direct Shear Strength of Rock Discontinuities
- D4555** Test Method for Determining Deformability and Strength of Weak Rock by an In Situ Uniaxial Compressive Test
- D4623** Test Method for Determination of In Situ Stress in Rock Mass by Overcoring Method—Three Component Borehole Deformation Gauge
- D4630** Test Method for Determining Transmissivity and Storage Coefficient of Low-Permeability Rocks by In Situ Measurements Using the Constant Head Injection Test (Withdrawn 2017)³
- D4631** Test Method for Determining Transmissivity and Storativity of Low Permeability Rocks by In Situ Measurements Using Pressure Pulse Technique (Withdrawn 2017)³
- D4633** Test Method for Energy Measurement for Dynamic Penetrometers

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.

³ The last approved version of this historical standard is referenced on www.astm.org.

D4645 Test Method for Determination of In-Situ Stress in Rock Using Hydraulic Fracturing Method (Withdrawn 2017)³

D4700 Guide for Soil Sampling from the Vadose Zone

D4719 Test Methods for Prebored Pressuremeter Testing in Soils (Withdrawn 2016)³

D4729 Test Method for In Situ Stress and Modulus of Deformation Using Flatjack Method (Withdrawn 2017)³

D4840 Guide for Sample Chain-of-Custody Procedures

D4879 Guide for Geotechnical Mapping of Large Underground Openings in Rock (Withdrawn 2017)³

D4971 Test Method for Determining In Situ Modulus of Deformation of Rock Using Diametrically Loaded 76-mm (3-in.) Borehole Jack

D5079 Practices for Preserving and Transporting Rock Core Samples (Withdrawn 2017)³

D5088 Practice for Decontamination of Field Equipment Used at Waste Sites

D5092/D5092M Practice for Design and Installation of Groundwater Monitoring Wells

D5093 Test Method for Field Measurement of Infiltration Rate Using Double-Ring Infiltrometer with Sealed-Inner Ring

D5126 Guide for Comparison of Field Methods for Determining Hydraulic Conductivity in Vadose Zone

D5195 Test Method for Density of Soil and Rock In-Place at Depths Below Surface by Nuclear Methods

D5731 Test Method for Determination of the Point Load Strength Index of Rock and Application to Rock Strength Classifications

D5753 Guide for Planning and Conducting Geotechnical Borehole Geophysical Logging

D5776 Test Method for Bromine Index of Aromatic Hydrocarbons by Electrometric Titration

D5777 Guide for Using the Seismic Refraction Method for Subsurface Investigation

D5778 Test Method for Electronic Friction Cone and Piezocone Penetration Testing of Soils

D5878 Guides for Using Rock-Mass Classification Systems for Engineering Purposes

D6026 Practice for Using Significant Digits in Geotechnical Data

D6032/D6032M Test Method for Determining Rock Quality Designation (RQD) of Rock Core

D6151/D6151M Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling

D6169/D6169M Guide for Selection of Soil and Rock Sampling Devices Used With Drill Rigs for Environmental Investigations

D6282/D6282M Guide for Direct Push Soil Sampling for Environmental Site Characterizations

D6286 Guide for Selection of Drilling Methods for Environmental Site Characterization

D6391 Test Method for Field Measurement of Hydraulic Conductivity Using Borehole Infiltration

D6429 Guide for Selecting Surface Geophysical Methods

D6430 Guide for Using the Gravity Method for Subsurface Site Characterization

D6431 Guide for Using the Direct Current Resistivity Method for Subsurface Investigation

D6432 Guide for Using the Surface Ground Penetrating Radar Method for Subsurface Investigation

D6635 Test Method for Performing the Flat Plate Dilatometer

D6914/D6914M Practice for Sonic Drilling for Site Characterization and the Installation of Subsurface Monitoring Devices

D7015 Practices for Obtaining Intact Block (Cubical and Cylindrical) Samples of Soils

D7046 Guide for Use of the Metal Detection Method for Subsurface Exploration

D7128 Guide for Using the Seismic-Reflection Method for Shallow Subsurface Investigation

D7400 Test Methods for Downhole Seismic Testing

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

G51 Test Method for Measuring pH of Soil for Use in Corrosion Testing

G57 Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method

IEEE/ASTM SI-10 American National Standard for Metric Practice

3. Terminology

3.1 Definitions:

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

4. Significance and Use

4.1 An adequate site characterization will provide pertinent information for decision making on one or more of the following subjects:

4.1.1 Location of the structure, both vertically and horizontally, within the area of the proposed construction and selection of construction methods and equipment.

4.1.2 Location and preliminary evaluation of suitable borrow and other local sources of construction aggregates.

4.1.3 Need for special excavating and dewatering techniques with the corresponding need for information, even if only approximate, on the distribution of soil water content or pore pressure, or both, and on the piezometric heads and apparent permeability (hydraulic conductivity) of the various subsurface strata.

4.1.4 Evaluation of slope stability in natural slopes, cuts, and embankments.

4.1.5 Conceptual selection of embankment types and hydraulic barrier requirements.

4.1.6 Conceptual selection of alternate foundation types and elevations of the corresponding suitable bearing strata.

4.1.7 Development of additional detailed site characterizations for specific structures or facilities.

4.2 The site characterization may require the collection of sufficiently large soil and rock samples of such quality as to allow adequate testing to determine the soil or rock classification or mineralogic type, or both, and the engineering properties pertinent to the proposed design.