



## Standard Test Methods for One-Dimensional Swell or Settlement Potential of Cohesive Soils<sup>1</sup>

This standard is issued under the fixed designation D 4546; 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 cover three alternative laboratory methods for determining the magnitude of swell or settlement of relatively undisturbed or compacted cohesive soil.

Note 1—Refer to Section 9 to determine the best method for a particular application.

1.2 The test methods can be used to determine (a) the magnitude of swell or settlement under known vertical (axial) pressure, or (b) the magnitude of vertical pressure needed to maintain no volume change of laterally constrained, axially loaded specimens.

1.3 The values stated in SI units are to be regarded as the standard. The values stated in inch-pound units are approximate.

1.4 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:

- D 422 Test Method for Particle-Size Analysis of Soils<sup>2</sup>
- D 423 Terminology Relating to Soil, Rock, and Contained Fluids<sup>2</sup>
- D 6038 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 N·m/600 kN·m/m<sup>3</sup>)<sup>2</sup>
- D 854 Test Method for Specific Gravity of Soils<sup>2</sup>
- D 1557 Test Method for Laboratory Compaction Characteristics of Soils Using Modified Effort (36,000 N·m/600 kN·m/m<sup>3</sup>)<sup>2</sup>
- D 1587 Practice for Thin-Walled Tube Sampling of Soils<sup>2</sup>
- D 2216 Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock<sup>2</sup>
- D 2435 Test Method for One-Dimensional Consolidation Properties of Soils<sup>2</sup>

<sup>1</sup> These test methods are under the jurisdiction of ASTM Committee D18 on Soil and Rock and are the direct responsibility of Subcommittee D18.01 on Structural Properties of Soils.

Current edition approved May 10, 1996. Published December 1996. Originally published as D 4546 – 85. Last previous edition D 4546 – 93.

<sup>2</sup> Annual Book of ASTM Standards, Vol. 04.08.

- D 3550 Practice for Ring-Lined Barrel Sampling of Soils<sup>2</sup>
- D 3740 Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction<sup>2</sup>
- D 3877 Test Methods for One-Dimensional Expansion, Shrinkage, and Uptake Pressure of Soil-Lime Mixtures<sup>2</sup>
- D 4220 Practices for Preserving and Transporting Soil Samples<sup>2</sup>
- D 4318 Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils<sup>2</sup>

### 3. Terminology

3.1 *Definitions*—Refer to Terminology D 653 for standard definitions of terms.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *heave,  $\Delta h$* —increase in vertical height,  $\Delta h$ , of a column of in situ soil of height  $h$  following sorption of water.

3.2.2 *percent heave or settlement, %*—increase or decrease in the ratio of the change in vertical height,  $\Delta h$ , to the original height of a column of in situ soil;  $h > 100$  or  $\Delta h/h < 100$ .

3.2.3 *settlement,  $\delta$* —decrease in vertical height,  $\Delta h$ , of a column of in situ soil of height  $h$ .

3.2.4 *swell,  $L$* —increase in elevation or dilation of soil column following sorption of water.

3.2.5 *free swell,  $L_f$* —percent heave,  $\Delta h/h > 100$ , following sorption of water at the seating pressure  $\sigma_{se}$ .

3.2.6 *primary swell,  $L_p$* —an arbitrary short-term swell usually characterized as being completed at the intersection of the tangent of reverse curvature to the curve of a dimensional change-logarithm of time plot with the tangent to the straight line portion representing long-term or secondary swell (Fig. 1).

3.2.7 *secondary swell,  $L_s$* —an arbitrary long-term swell usually characterized as the linear portion of a dimensional change-logarithm of time plot following completion of short-term or primary swell (Fig. 1).

3.2.8 *swell index*—slope of the rebound pressure - void ratio curve on a semi-log plot.

3.2.9 *swell pressure,  $P_f$* <sup>3</sup>—(f) a pressure which prevents the specimen from swelling as obtained in Method C, or (c) the pressure which is required to return the specimen back to its original state (void ratio, height) after swelling in Method A or B.

Note 2—Swell pressures by Method C corrected for specimen disturbance may be similar to or slightly greater than those by Method A.

## Astm D 4546

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### **Annual**

**Book of ASTM Standards** ASTM International,American Society for Testing and Materials,2003

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**Dredge Material Evaluation and Utilization Plan for New Jersey**, 2003      **Unsaturated Soil Engineering Practice** Sandra L. Houston, Delwyn G. Fredlund, 1997 GSP 68 contains 11 papers presented at a technical session of the First National Conference of the ASCE Geo Institute held in Logan Utah July 16 19 1997      Standard Specifications for Transportation Materials and Methods of Sampling and Testing: Tests American Association of State Highway and Transportation Officials, 1995

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## **Table of Contents Astm D 4546**

1. Understanding the eBook Astm D 4546
  - The Rise of Digital Reading Astm D 4546
  - Advantages of eBooks Over Traditional Books
2. Identifying Astm D 4546
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Astm D 4546
  - User-Friendly Interface
4. Exploring eBook Recommendations from Astm D 4546
  - Personalized Recommendations
  - Astm D 4546 User Reviews and Ratings
  - Astm D 4546 and Bestseller Lists
5. Accessing Astm D 4546 Free and Paid eBooks
  - Astm D 4546 Public Domain eBooks
  - Astm D 4546 eBook Subscription Services
  - Astm D 4546 Budget-Friendly Options
6. Navigating Astm D 4546 eBook Formats

- ePUB, PDF, MOBI, and More
- Astm D 4546 Compatibility with Devices
- Astm D 4546 Enhanced eBook Features

7. Enhancing Your Reading Experience

- Adjustable Fonts and Text Sizes of Astm D 4546
- Highlighting and Note-Taking Astm D 4546
- Interactive Elements Astm D 4546

8. Staying Engaged with Astm D 4546

- Joining Online Reading Communities
- Participating in Virtual Book Clubs
- Following Authors and Publishers Astm D 4546

9. Balancing eBooks and Physical Books Astm D 4546

- Benefits of a Digital Library
- Creating a Diverse Reading Collection Astm D 4546

10. Overcoming Reading Challenges

- Dealing with Digital Eye Strain
- Minimizing Distractions
- Managing Screen Time

11. Cultivating a Reading Routine Astm D 4546

- Setting Reading Goals Astm D 4546
- Carving Out Dedicated Reading Time

12. Sourcing Reliable Information of Astm D 4546

- Fact-Checking eBook Content of Astm D 4546
- Distinguishing Credible Sources

13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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