Standard Method of Test for

Determining Expansive Soils

AASHTO Designation: T 258-81 (2018)

Technical Subcommittee: 1a, Soil and Unbound Recycled Materials

Release: Group 3 (July)

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1. SCOPE

1.1. This standard covers a method to determine if a soil is expansive and methods to predict the amount of swell.

Note 1—Methods that are being used by various agencies to control the amount of swell are given in the appendix.

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards:*

- T 89, Determining the Liquid Limit of Soils
- T 90, Determining the Plastic Limit and Plasticity Index of Soils
- T 99, Moisture–Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop
- T 100, Specific Gravity of Soils
- T 216, One-Dimensional Consolidation Properties of Soils
- T 273, Soil Suction

3. DETECTING EXPANSIVE SOILS

3.1. The potential expansiveness of a soil may be determined by using the Atterberg Limits of the soil and the natural soil suction.

3.2. From Table 1, determine how potentially expansive the soil is using AASHTO Test Methods for the Liquid Limit (LL) (see T 89), the Plasticity Index (PI) (see T 90), and the soil suction at natural water content (τ_{nat}) (see T 273).

Table 1—Determining Degree of Expansion in Soil

Degree of Expansion	LL	PI	τ_{nat}, kPa
High	>60	>35	>383 kPa
Marginal	50–60	25–35	144 to 383 kPa
Low	<50	<25	<144 kPa

4. DETERMINING THE AMOUNT OF SWELL

4.1. The amount of swell to be expected in a stratum is determined by one of the following described methods. Where more exacting determination of the amount of swell is needed, the Overburden Swell Test Procedure should be used. Due to the length of time and costs required to perform the Overburden Swell Test, an empirical procedure called the Potential Vertical Rise Method may be used to estimate the swell where conditions do not require the more exact determination.

4.2. *Overburden Swell Test and Prediction Procedure*:

4.2.1. *Method 1*—Prepare an undisturbed sample for consolidation testing according to the procedure in T 216. Extreme care should be taken to prevent moisture loss during the preparation stage. From the sample trimmings, determine the field moisture content and the specific gravity of the soil. The field moisture is determined as a percentage of the mass of oven-dried soil and shall be calculated as follows:

$$\text{percentage of moisture} = \frac{\text{mass of water}}{\text{mass of oven-dried soil}} \times 100 \qquad (1)$$

The specific gravity of the soil is determined as outlined in T 100. After the sample has been placed in the consolidometer, a load equal to the existing overburden pressure is applied on the sample. This load shall be maintained until the dial gage of the extensometer indicates that all adjustment to the applied load has ceased. During the application of this load and adjustment period, extreme care must be exercised to prevent desiccation. It is extremely important not to lose any moisture from this sample. This may be accomplished by covering the consolidometer with moist cotton. This loading procedure returns the sample, as closely as possible, to the actual field void ratio and field condition since extrusion allows undisturbed samples to immediately rebound elastically. Actual field conditions are defined as Point One (1) in Figure 1. The sample is then inundated and allowed to reach an equilibrium as indicated by the dial gage of the extensometer. This condition then is defined as Point Two (2) in Figure 1. The sample then is unloaded to the desired pressure, in decrements of load that a laboratory normally uses, thus producing a swell curve from Point Two (2) to Point Three (3) in Figure 1. From this point (Point 3, Figure 1), a normal consolidation-rebound test is conducted as outlined in T 216. The swell-curves form approximately straight lines on a semilog plot; therefore, the No-Volume Change pressure is determined by extrapolating the swell curves between Points 2 and 3 until it intersects the Field Void Ratio as Point Four (4). The Field Void Ratio (e_f) is determined as follows:

$$e_f = \frac{\text{percent field moisture} \times \text{specific gravity}}{\text{percent saturation}} \qquad (2)$$

4.2.2. *Method II*—This method is presented because there may be a need to expedite the work and the existing overburden load may be so small that obtaining swell curves directly may be meaningless. This method may be used only after running several tests by Method I and finding that the slope of the rebound curve, Points Five (5) and Six (6), is substantially the same as the slope of the swell curve, Points Two (2) and Three (3). Method II is the same as Method I to the point where the sample is inundated and the total swell is recorded. At this point, a normal consolidation-rebound load sequence is followed to produce the desired curves. Since the slope of the rebound and swell curves is substantially the same, the swell curve can be produced by passing a curve through Point Two (2), Figure 1 that is parallel to the rebound curve. The intersection of this curve with the Field Void Ratio gives the point of No-Volume Change or maximum swell pressure potential.