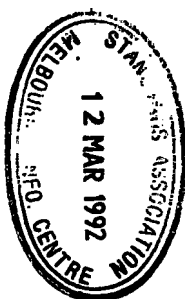


Australian Standard®



Methods of testing soils for engineering purposes

1990 ED.

Method 7.1.1: Soil reactivity tests— Determination of the shrinkage index of a soil—Shrink swell index

1 SCOPE This Standard sets out a method for conducting a swell test and a simplified core shrinkage test on companion samples of undisturbed soil. Soil suction determinations are not essential to the method. The method is applicable to samples with any initial moisture content but is particularly useful for determining the shrinkage index (see AS 2870.2) of soils sampled in an initially dry state.

2 REFERENCED AND RELATED DOCUMENTS

2.1 Referenced documents The following documents are referred to in this Standard:

- AS
1289 Methods of testing soils for engineering purposes
1289.0 Part 0: General requirements and list of methods
1289.F6.1 Method F6.1: Soil strength and consolidation tests—Determination of the one-dimensional consolidation properties of a soil
1289.B1.1 Method B1.1: Soil moisture content tests—Determination of the moisture content of a soil—oven drying method (standard method)

1726 SAA Site Investigation Code

2.2 Related document Attention is drawn to the following related document:

- AS
2870 Residential slabs and footings
2870.2 Part 2: Guide to design by engineering principles

3 APPARATUS The following apparatus is required:

- (a) A drying oven complying with AS 1289.0.
- (b) A balance of 500 g capacity having a limit of performance of ± 0.05 g.
- (c) A spatula or palette knife of convenient size.
- (d) A flat glass plate approximately 10 mm thick and at least 400 mm square.
- (e) Brass drawing pins.
- (f) Vernier callipers accurate to 0.02 mm, capable of measuring lengths 50 mm to 120 mm.
- (g) A load device suitable for applying vertical loads without impact to the swell specimen within a period of 2 s. The device should be capable of maintaining specified loads for long periods with an accuracy of ± 2 percent of the applied load increment.
- (h) A consolidation cell, i.e. a device to hold the specimen in a ring which is fixed to the base of the consolidation cell, with porous plates on each face of the specimen. The consolidation cell shall also provide a means for submerging the specimen, for transmitting the vertical load, and for measuring the change in thickness of the specimen. The consolidation ring shall conform to the following requirements:
 - (i) Preferred minimum specimen diameter—45 mm.
 - (ii) Maximum ratio of specimen diameter to thickness—2.5:1.
 - (iii) The ring shall be made from material that is corrosion resistant in relation to the soil to be tested. The inner surface of the ring shall be smooth and should be smeared with grease (see Note 1) to minimize edge disturbance. A ring with a cutting edge attached provides the most accurate fit in most soils.
- (i) Dial gauge or electronic displacement transducer with a travel of at least 5 mm and readable to 0.01 mm.
- (j) Porous plates as specified in AS 1289.F6.1.

4 SAMPLES Obtain an intact sample of soil for the swell test with a minimum diameter of 45 mm. For the shrinkage test, the sample diameter shall range between a minimum of 38 mm and a maximum of 51 mm, and the minimum length of the sample shall be equal to approximately 3.5 diameters. Record a visual description of the soil. A standard class undisturbed sample as defined in AS 1726 meets the minimum requirement of quality for an intact sample for this test.

5 PROCEDURE The procedure shall be as follows:

5.1 Swell test

- (a) Prepare a swell specimen from the soil sample for the consolidation cell as in AS 1289 F6.1. Collect the trimmings for determination of initial moisture content (w_{01}) and seal the remaining core sample for the core shrinkage specimen.
- (b) Assemble the consolidation cell with ring, specimen and dry porous stone plates.
- (c) Place the consolidation cell in the loading device and apply a seating pressure of about 5 kPa. Adjust the position of the dial gauge zero setting to allow for a small amount of initial settlement of the specimen. Record the initial reading and time.
- (d) Load the specimen to 25 kPa $\pm$ 1 kPa (see Note 2) and record the dial gauge reading and the time. Monitor the initial specimen settlement (if evident) for a maximum period of 30 min. Inundate the specimen with distilled water (see Note 3), monitoring readings frequently in the first hour after inundation until swelling commences. The dial gauge reading taken just prior to the inundation of the specimen is the datum from which swelling strain is determined.
- (e) Take further readings of sample movement and time at a maximum time interval of 12 h. The minimum testing time for a swelling soil shall be 24 h. Testing may be terminated if the movement between the last reading and a reading at least 3 h previously is less than 5 percent of the total specimen swelling movement recorded to that time.
- (f) Determine the final moisture content (w_{f1}) of the specimen in accordance with AS 1289.B1.1.

5.2 Simplified core shrinkage test

- (a) Prepare a cylindrical core shrinkage specimen from the soil sample. The specimen shall have a length within the range of 1.5 to 2 diameters.
- (b) Measure and record the average length of the specimen with the vernier callipers to the nearest 0.1 mm (H_0). Determine the initial mass of the specimen (m_{02}).
- (c) Collect the sample trimmings for determination of initial moisture content (w_{02}).
- (d) Determine the mass of two drawing pins (m_p). Place a drawing pin firmly into the centre of each end of the specimen so that the head of the pin makes contact with the soil specimen. Using the vernier callipers, measure the distance between the rounded heads of the pins (D_0).
- (e) Allow the specimen to rest on a smooth surface. Take readings approximately twice per day of total mass of specimen and pins (m_t), and distance between drawing pins (D_t) (see Note 4). Ensure that the drawing pins are in good contact with the specimen ends by pushing them firmly before taking length measurements. Record crack development through the specimen. Discontinue readings once shrinkage ceases or cracking develops sufficiently either to impede interpretation of measurements or to restrict frequent handling of the specimen.
- (f) Place specimen in the oven to dry at 105°C to 110°C. After a minimum of 24 h, remove the specimen and measure the distance between the drawing pins (D_d) and the mass of the specimen and pins (m_d).
- (g) Break the specimen apart and inspect for uniformity and for rock, gravel or organic inclusions. Estimate the percentage by volume of significant inert inclusions.

6 CALCULATIONS

- (a) *Swell test* Determine the total swell from the initial dial gauge reading just prior to inundation and the final dial gauge reading. The swelling strain (ϵ_{sw}) is then the total swell, less the initial settlement observed prior to wetting of the sample (5.1(d)), expressed as a percentage of the initial height of the swell specimen.