



Transport
Roads & Maritime
Services

Test method T127

Apparent density of fine soil particles

OCTOBER 2012



Revision Summary

Ed/Rev Number	Clause Number	Description of Revision	Authorisation	Date
		Reformatted and Revision Summary Added	D.Dash	May 1999
		Date on Test Method Revised to Agree with Date on Revision	D.Dash	Feb 2001
Ed2/ Rev 0	All	Reformatted RMS template	J Friedrich	October 2012

Note that Roads and Maritime Services is hereafter referred to as 'RMS'.

The most recent revision to Test method T127 (other than minor editorial changes) are indicated by a vertical line in the margin as shown here.

Test method T127

Apparent density of fine soil particles

1. Scope

This test method sets out the procedure for the determination of the Density at 25°C of soil particles finer than 4.75 mm using a density bottle. The test is based on the method set out in Australian Standard 1289.

2. Definition

Term	Definition
Apparent Density	The apparent density is the density of the impermeable portion of a permeable material (i.e. the solid matter plus pores and voids impermeable to water) at a stated temperature

3. Apparatus

- (a) A density bottle of approximately 1 litre capacity
- (b) A desiccator
- (c) A thermostatically controlled drying oven with good air circulation, capable of maintaining a temperature within the range of 105°C to 110°C
- (d) A balance of at least 2 kg capacity accurate and readable to 0.1 g within the operating range
- (e) A thermometer to cover the range 0-100°C readable and accurate to 1°C
- (f) A 4.75 mm AS sieve and pan
- (g) A source of vacuum, e.g. a filter pump or vacuum pump
- (h) A wash bottle containing distilled water
- (i) A wash bottle contained acetone or alcohol
- (j) A constant temperature water bath, a large bath of water to dampen temperature variations, or a constant temperature room

4. Test Portion

- (a) Allow the sample to dry sufficiently to enable it to be crumbled. If there is any reason to believe that this will change the apparent density of the soil particles due to water of hydration, the soil must not be oven dried prior to test (See *Technique, (a)*).
- (b) Determine the mass of the sample and sieve on the 4.75 mm sieve. Use the fraction passing the sieve for this test and keep the fraction retained on the 4.75 mm sieve for use in Test Method T128, Apparent Density of Soils Containing Coarse Particles. Determine the mass of material passing the 4.75 mm sieve and record as a percentage of the total mass.

5. Procedure

- (a) Wash the complete density bottle with distilled water, rinse several times with acetone and dry by blowing air into the bottle. Determine the mass of the bottle plus stopper to 0.1 g (M_1).
- (b) Obtain, by riffing or quartering the material passing the 4.75 mm sieve, a sub-sample which will occupy about one-third of the volume of the density bottle. Oven-dry the sub-sample at 105-110°C. Transfer the soil particles to the density bottle from the desiccator in which they have cooled. Determine the mass of the bottle and contents plus stopper to 0.1 g (M_2). (See *Technique (a)*).

- (c) Add distilled water to fill the bottle approximately two-thirds full and allow the soil particles to soak for about 24 hours.
- (d) Boil the contents of the bottle gently for at least 10 minutes, occasionally rolling the bottle to assist in the removal of entrapped air. While cooling, gradually apply a partial vacuum to the bottle (air pressure not exceeding 100 mm of mercury). Take care during this operation to ensure that any air trapped in the soil does not bubble too violently lest small drops of the suspension be lost through the mouth of the bottle.
- (e) Fill the bottle with distilled water and allow the bottle and contents to reach a constant temperature of approximately $25 \pm 2^\circ\text{C}$ in the water bath or constant temperature room. During this period add distilled water as necessary to maintain the water level. Insert the stopper. Dry the outside of the bottle and determine the mass of the bottle and contents to the nearest 0.1 g (M_3). Measure the temperature of the contents to the nearest 1°C .
- (f) Empty the bottle and clean. Fill the bottle with distilled water and allow the bottle and contents to reach the constant temperature of $25 \pm 2^\circ\text{C}$. During this period add distilled water as necessary to maintain the water level. Insert the stopper. Dry the outside of the bottle and determine the mass of the bottle and water to the nearest 0.1 g (M_4).
- (g) Repeat the procedure using a separate sub-sample.

6. Calculations

- (a) Calculate the apparent density (D_a) of the soil particles passing the 4.75 mm sieve as follows:

$$D_a = \frac{D_1 \times (M_2 - M_1)}{(M_4 - M_1) - (M_3 - M_2)} \text{ g/mL}$$

Where

D_a = apparent density of the soil particle passing the 4.75 mm sieve.

D_1 = density of liquid used at 25°C .

M_1 = mass of density bottle.

M_2 = mass of bottle and dry soil particles.

M_3 = mass of bottle, soil particles and liquid.

M_4 = mass of bottle when full of liquid only.

If the two results differ by more than 0.03 g/mL repeat the tests.

7. Reporting

- (a) Report the apparent density of the soil particles passing the 4.75 mm sieve to the nearest 0.01 g/mL obtained by averaging the results obtained above.
- (b) Report the temperature at which the test was carried out and the liquid used (if other than distilled water).

8. Technique

- (a) If there is any reason to believe that oven drying of the sample would change the apparent density of the soil due to loss of water of hydration, test the soil in its natural condition and determine the mass of soil used by oven-drying at the end of the test. To obtain the correct apparent density of the soil particles amend the mass of oven-dried soil to allow for any chemically-held water that has been removed by oven-drying.
- (b) With certain soils, e.g. those containing water soluble salts, a different liquid, such as kerosene, should be used.