

Department of Sustainable Natural Resources

SOIL SURVEY STANDARD TEST METHOD

BULK DENSITY OF A SOIL CORE

ABBREVIATED NAME	BD
TEST NUMBER	P14
TEST METHOD TYPE	A
VERSION NUMBER	2

SCOPE

This method covers the determination of the ratio of the mass to the bulk or macroscopic volume of soil particles plus pore spaces in a sample. A known volume of soil is sampled, air-dried and weighed.

SPECIAL APPARATUS

- A cylindrical steel core cutter approximately 75 mm long and 75 mm internal diameter with wall thickness approximately 3 mm, bevelled at one end to 15 mm. The cutter should be adequately lubricated to decrease friction and adhesion with grease or oil. (See Note.) If the lubricant is present in trace amounts only, it will not affect the physical measurement.
- A steel dolly of diameter to suit the core cutter plus a 10 kg steel drop hammer, mallet or sledge hammer.
- Balance.
- Drying oven at 105 °C.

PROCEDURE

1. Expose approximately 300 mm square of the soil layer to be tested. Place the steel dolly on top of the cutter and hammer the latter into the soil layer until the top edge of the cutter is a few millimetres below the soil surface. Take care not to rock the core cutter. Repeat with other cores in close proximity so as to obtain sufficient replicates. Dig out the core samples, taking care not to damage them. Trim the ends of the core level with the ends of the cutter by means of a spatula and steel straight edge. Reject those that are not completely filled with soil. If the cores are satisfactory, pack them in loose soil in plastic bags or other containers. Two or three cores may be placed in one plastic bag but, in this case, wrap each core in aluminium foil. Transfer back to the laboratory in an insulated box packed with foam or vermiculite.

For subsurface samples, dig a pit of the necessary size and depth, and sample as above. If desired, samples may be taken from the wall of the pit.

2. Weigh the cutter containing the wet core to the nearest gram.
3. If the soil moves freely in the cutter, extrude the core into an aluminium tray and dry to constant weight at 105 °C. Several days may be required. Removal of the core may be assisted by partial drying as a preliminary treatment. In cases where the core will not release from the cutter, the soil is dried in place for an extended period.
4. Weigh the dry soil with the cutter and then the cutter separately.
5. Calculate the internal volume of the core cutter, in cubic centimetres from its dimensions measured to the nearest 0.5 mm.

CALCULATIONS

Bulk Density

$$BD (Mg / m^3) = \frac{\text{Mass of dry soil (g)}}{\text{Volume of core (cm}^3\text{)}}$$

Report Bulk Density in Mg/m³ (equivalent to g/cm³) on an oven-dry basis to the nearest 0.01 Mg/m³.

Gravimetric Water Content

$$WCg (g/g) = \frac{\text{Mass of wet soil} - \text{Mass of dry soil (g)}}{\text{Mass of dry soil (g)}}$$

Report Gravimetric Water Content on oven-dry basis to the nearest 0.5 g/g.

REFERENCES

McIntyre, DS & Loveday, J 1974, Bulk density, in Loveday, J (ed) *Methods of Analysis for Irrigated Soils*. Commonwealth Agricultural Bureaux Technical Communication No 54, Farnham Royal, England.

Standards Association of Australia. AS 1289E 3.3-1977. *Determination of the field dry density of a soil: Core cutter method for fine-grained soils*.

NOTE

Lubricate the sample tube inside and out by wiping it with a cloth containing a lubricant. A thin film only is required. Suitable lubricants are Shellmold 02 and P5, paraffin oil, vegetable oils and silicone oils.