EXPERIMENT 8  BULK DENSITY OF SOIL

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8.0  OBJECTIVE

After completing this practical exercise, you should be able to determine soil bulk density (apparent specific gravity).

8.1  INTRODUCTION

The soil moisture is generally measured on dry weight basis. To determine soil moisture on volume basis bulk density plays an important role. The soil moisture on dry weight basis is multiplied by bulk density to determine soil moisture on volume basis.

Dry Bulk Density (BD) of soil is the ratio of dry soil to the total volume of soil (including particles and pores).

\[
BD = \frac{W_s}{V_t} = \frac{W_s}{V_s + V_a + V_w}
\]  (8.1)

Where,
- \(BD\) = bulk density, gm/cc
- \(W_s\) = dry weight of soil, gm
- \(V_t\) = total volume of soil, cc
- \(V_s\) = volume of soil solids, cc
- \(V_a\) = volume of air, cc
- \(V_w\) = volume of water, cc

Its value ranges between 1 gm/cc for clays and 1.8 gm/cc for sand and the average value of medium soil is generally of order of 1.5 gm/cc.

8.2  EXPERIMENT

8.2.1  Requirements
- Core soil sampler
8.2.2  Procedure

Bulk density is determined by taking un-compacted soil sample of known volume by using following procedure:

- Measure the weight of core cylinder, kg
- Measure the diameter of core cylinder \((d)\), cm
- Measure the depth of core cylinder \((h)\), cm
- Calculate the area \((A)\) of cross-section of the core cylinder, \(cm^2\)

\[
A = \frac{\pi d^2}{4}
\]

- Calculate the volume \((V)\) of the core cylinder (same as volume of soil) by multiplying area of cross-section with core depth, \(cm^3\)

\[
V = A \times h
\]

- Drive cutting edge of cylinder of core sampler into the soil and obtain un-compacted soil core within the tube.
- Trim sample carefully at both ends of the core cylinders.
- Place the soil sample in the oven for drying for about 24 hours.
- Weigh the soil sample after drying.
- Divide weight of soil sample by volume of soil by using relationship given in eq. 8.1.

8.3  OBSERVATIONS AND CALCULATIONS

Example

Weight of core cylinder = 1.72 kg
Diameter of core cylinder \((d)\) = 7.5 cm
Depth of core cylinder \((h)\) = 15 cm
Area of cross-section of core cylinder \((A)\) = 44.2 \(cm^2\)
Volume of core cylinder \((V)\) = 662.3 cc
Weight of dry soil sample with core cylinder = 2.7 kg
Weight of dry soil sample = 2.7 kg−1.72 kg
Bulk density ($BD$) = $0.98$ kg = $980$ gm

Bulk density ($BD$) = $980$ gm / $662.3$ cc

= $1.47$ gm/cc

**Exercise**

Weight of core cylinder

Diameter of core cylinder ($d$)

Depth of core cylinder ($h$)

Area of cross-section of core cylinder ($A$)

Volume of core cylinder ($V$)

Weight of dry soil sample with core cylinder

Weight of dry soil sample

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**8.4 RESULTS**

Bulk density of soil = $gm/cc$