EXPERIMENT NO.

DETERMINATION OF SPECIFIC GRAVITY OF SOIL BY USING DENSITY BOTTLE

(IS: 2720 (Part 3/sec. 1) – 1980 – Determination of specific gravity for fine grained soil)

Objective: The objective of the experiment is to determine the specific gravity of soil fraction passing through 4.75 mm IS Sieve through density

The density bottle method is the most accurate method and is suitable for all types of soils. The density bottle method is the standard method used in the laboratory. This method is based on the principle of comparing the given mass of soil sample to equal volume of standard fluid at prescribed test temperature.

Apparatus: **Density Bottle:** Density Bottle of 50 ml or 100 ml capacity with stopper having capillary hole at its centre.

Water Bath: Constant temperature water bath with test temperature set at $27^{o}C \pm 0.2^{o}C$.

Vacuum Desiccator: Vacuum desiccator of 200 mm – 250 mm diameter.

Electronic Balance: Balance with accuracy of measurement up to 0.001 g. **Oven:**

Thermostatically controlled oven capable of maintaining a temperature of 105^{o} to $110^{o}C$.

Wash Bottle: Wash bottle filled with de-aired distilled water.

Followings are optional.

Spatula: Spatula blade of 150 mm long and 3 mm wide.

Glass Rod: 150 mm long and 3 mm wide glass rod.

Riffler: Riffler box for sampling of soil specimen with opening 7 mm wide.

Material: Oven dried sample at a constant temperature of 105^{o} to $110^{o}C$ for 24 hours shall be used for the test. 40 - 50 g of sample should be taken in case of fine grained soils.

Procedure:

1. Clean and dry the density bottle by washing it thoroughly with distilled water. Drain out the excess water.
2. Rinse the bottle with alcohol to remove the water and drain the alcohol. Then rinse the bottle in ether to remove alcohol and drain the ether. Turn the

bottle upside down for a few minutes to permit ether vapours to come out. (optional in our laboratory but specified in IS code)

3. Find out the empty mass of density bottle with the stopper accurate up to 0.001 g, M_1 (g.).
4. Take about 10 g. to 20 g. of oven dried soil sample, cooled it in desiccator and transfer it carefully in the density bottle.
5. Find out the mass of density bottle, soil sample along with the stopper as M_2 (g.).
6. Add around 10 ml to 20 ml of de-aired distilled water in the bottle, so that the soil is completely soaked. In ideal case keep the bottle undisturbed for 2 hours to 10 hours. However in the laboratory this step may not be followed due to shortage of time.
7. Add more water till it occupies half of density bottle. Then remove entrapped air by subjecting the contents to a partial vacuum (air pressure shall be reduced to 20 mm of mercury).
8. Fill the bottle completely, put the stopper on it and place the bottle on the stand fitted with constant temperature water bath. Keep it there for about one hour so that the temperature of soil and water kept in the bottle reaches 27^{o} C. (In laboratory sometime this step may be skipped but record temp.)
9. Take out the bottle and wipe it clean and dry from outside. Fill the capillary of the stopper with drops of distilled water, in case it is not full. Determine the mass of the bottle and its contents and note as M_3 (g.).
10. Make the bottle empty and clean it thoroughly. Fill it with distilled water, put the stopper on it and wipe the bottle dry from outside. Note down this mass as M_4 (g).
11. Repeat the above mentioned steps 4 to 10 twice. The average of the three observations is reported as specific gravity of the soil sample at prescribed test temperature.

Observations:

Serial No.	Parameters	Quantity		
		Test 1	**Test 2**	**Test 3**
1.	Density bottle No.			
2.	Mass of density bottle with stopper (M_1 g.)			
3.	Mass of density bottle + dry soil + stopper (M_2 g.)			
4.	Mass of density bottle + soil + distilled water + stopper (M_3 g.)			
5.	Mass of density bottle + distilled water + stopper (M_4 g.)			
6.	Specific Gravity of Soil sample $G_s = \frac{M_2 - M_1}{(M_2 - M_1) - (M_3 - M_4)}$			

Average value of specific gravity _____ at _____ ^{o}C

Sample calculations:

Fig 1. Specific gravity bottles

Discussions: