

GRAIN SIZE ANALYSIS BY WET AND DRY SIEVE ANALYSIS

1. Objective: Dry and Wet Sieve Analysis is carried out to quantitatively determine the Particle/Grain Size Distribution for soil particles of size 75 micron and bigger. For soil particles of size 4.75 mm and bigger, dry sieve analysis is done and for soil particles of size above 75 micron and below 4.75 mm, wet sieve analysis is done.

2. Apparatus Required:



Fig. 1: Balance

The balance to be used must be sensitive to the extent of 0.1% of total weight of sample taken.



Fig. 2: Sieve

I.S sieves (100 mm, 63 mm, 20 mm, 10 mm, 4.75 mm, 2.00 mm, 1.18 mm, 0.600 mm, 0.425 mm, 0.300 mm, 0.150 mm and 0.075 mm). I.S 460-1962 to be referred. The sieves set should have lid at top and Pan at base.



Fig. 3: Sieve Shaker

Mechanical Sieve Shaker



Thermostatically Controlled Hot Air Oven

Fig. 4: Oven



Fig. 5: Trays



Fig. 6: Wire Brush

3. Reference: IS-2720 (Part 4):1985 (Reaffirmed- May 2015) "Methods of test for soils: Grain size analysis".

4. Procedure:

1. Dry the soil sample in a Thermostatically Controlled Hot Air Oven at 105 to 110 °C.
2. The quantity of the soil sample to be taken for the test should be as per Table 1 given below:

Maximum size of material present in substantial quantities	Weight to be taken for test
75 mm	60 kg
40 mm	25 kg

25 mm	13 kg
19 mm	6.5 kg
12.5 mm	3.5 kg
10 mm	1.5 kg
6.5 mm	0.75 kg
4.75 mm	0.40 kg

Table 1: Quantity of sample taken for Test

3. Take representative sample of soil by using a Riffler or by any suitable method.
4. Take about 1 kg oven dried soil sample and sieve it through 4.75 mm IS sieve. The soil fractions retained on and passing 4.75mm Sieve shall be taken separately for the analysis.
5. Weigh the portion of the soil sample retained on 4.75mm Sieve and record the mass.
6. Sieve the sample retained on 4.75 mm IS sieve through the sieve of size 4.75mm and higher (100 mm, 63 mm, 20 mm, 10 mm and 4.75 mm). Other sieves may be introduced in between the sieves, depending upon the additional information desired to be obtained. The sieves shall be agitated for minimum period of 10 minutes and any particles may be tested to see if they will fall through, but they shall not be pushed through. The soil fraction retained on each sieve shall be weighed to an accuracy of 0.1% of its total weight and record the weight.
7. The portion of soil passing 4.75mm Sieve shall be sieved through set of sieves of 2.00 mm, 1.18 mm, 0.600 mm, 0.425 mm, 0.300 mm, 0.150 mm and 0.075 mm. The sieves shall be agitated for minimum period of 10 minutes. The sample retained on each sieve shall be weighed and recorded.
8. The soil retained on 75 micron IS sieve is soaked in a solution of 1 g Sodium Hydroxide and 1 g of Sodium Carbonate in 1 litre of water to dislodge the silt and clay particles.
9. Dispersion agent may not be required for all the types of soil. Wet analysis may be carried out without dispersing agent.

10. Wash the soaked soil specimen on 75 micron sieve until the water passing is substantially clean. The fraction retained on the sieve should be tipped in a tray, dried in the oven, weighed and recorded. Repeat the same procedure two more times with different samples from the same size for better accuracy.

5. Observation and Recording:

I.S Sieve Number/Size (mm)	Wt. retained in each Sieve (gm)	Percentage retained on each sieve	Cumulative percentage retained on each Sieve	% Finer
100				
63				
20				
10				
4.75				
2.00				
1.18				
0.600				
0.425				
0.300				
0.150				
0.075				
PAN				

Table 2

6. Calculation:

1. The percentage of soil retained on each sieve shall be calculated on the basis of total weight of soil sample taken. Then, cumulative percentage of soil retained (which will give % finer when deducted from 100) on successive sieve is found.
2. Plot a graph on log scale with "Particle size (Diameter)" on X- axis & "Percent finer" on Y- axis. The graph is known as grading curve (Fig. 6). Corresponding to 10%, 30% and 60% finer, obtain diameters from graph, which are designated as D_{10} , D_{30} and D_{60} .
3. Calculate the Coefficient of Uniformity (C_u) and the Coefficient of Curvature (C_c) using the following equations:

- $C_u = D_{60} / D_{10}$
- $C_c = D_{30}^2 / (D_{60} \times D_{10})$

7. General Remarks: In the case of clayey soils, dry sieving shall not be used and wet sieving shall be used.

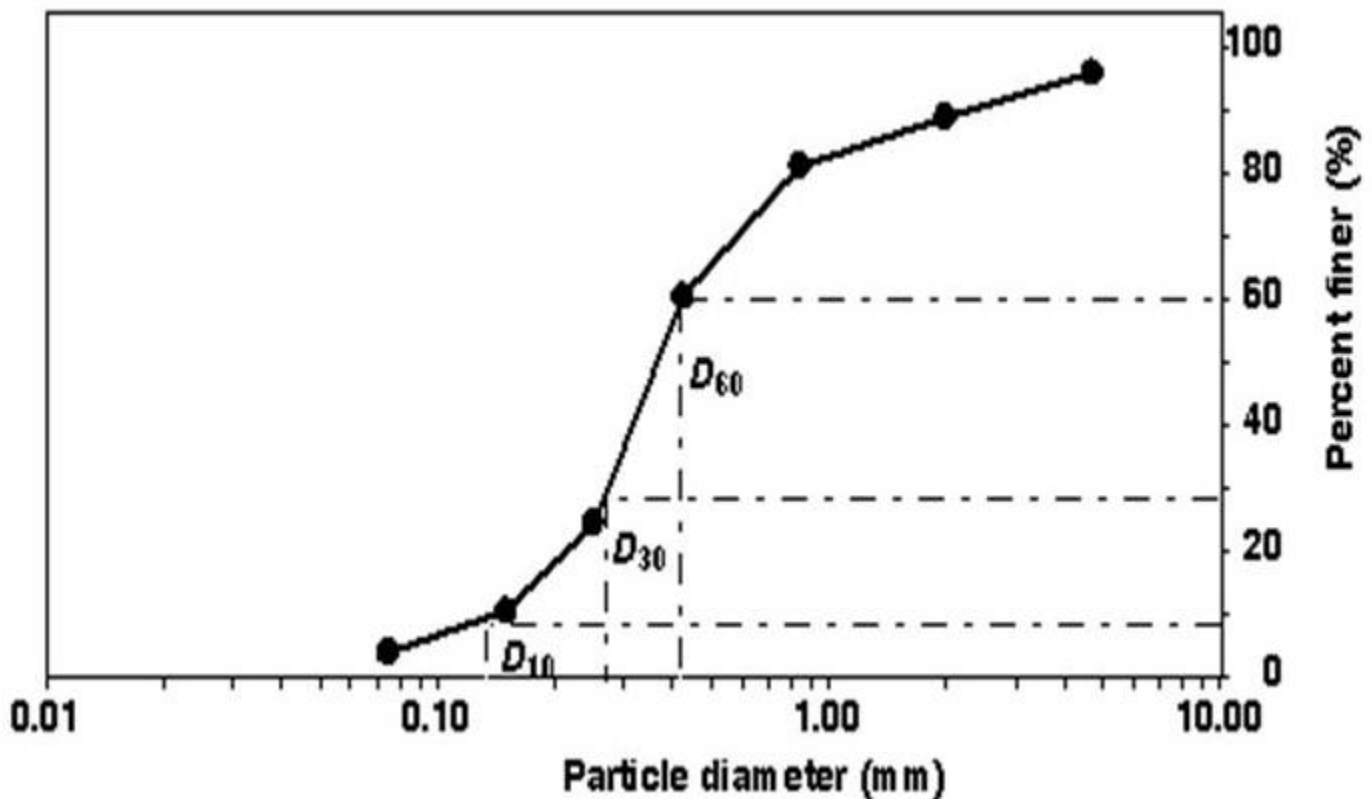


Fig. 8: Plot of Percent Finer vs. Particle Diameter

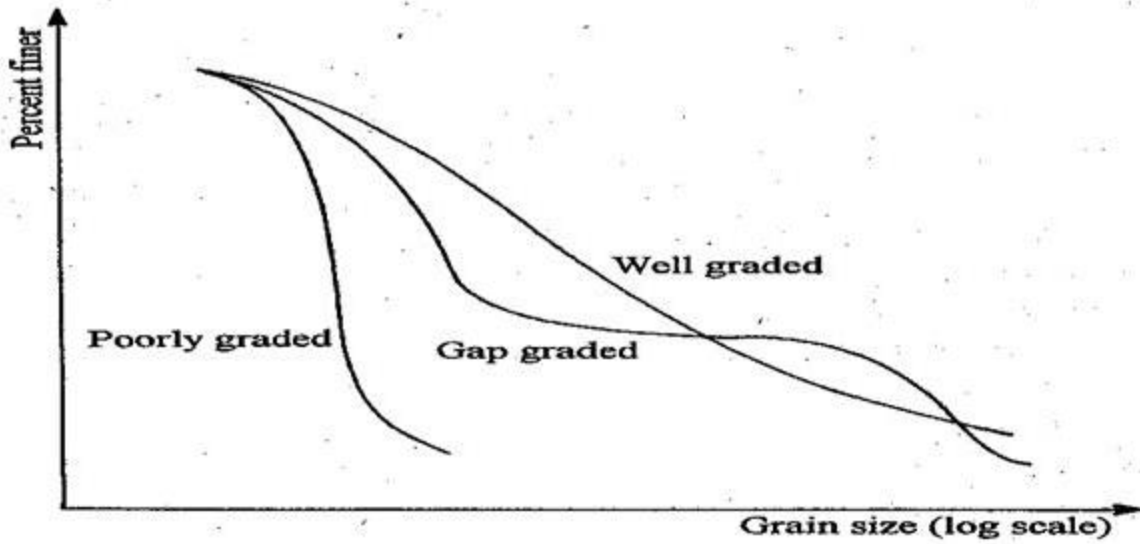


Fig. 9: General nature of grain-size distribution of well graded, poorly graded and gap graded soil

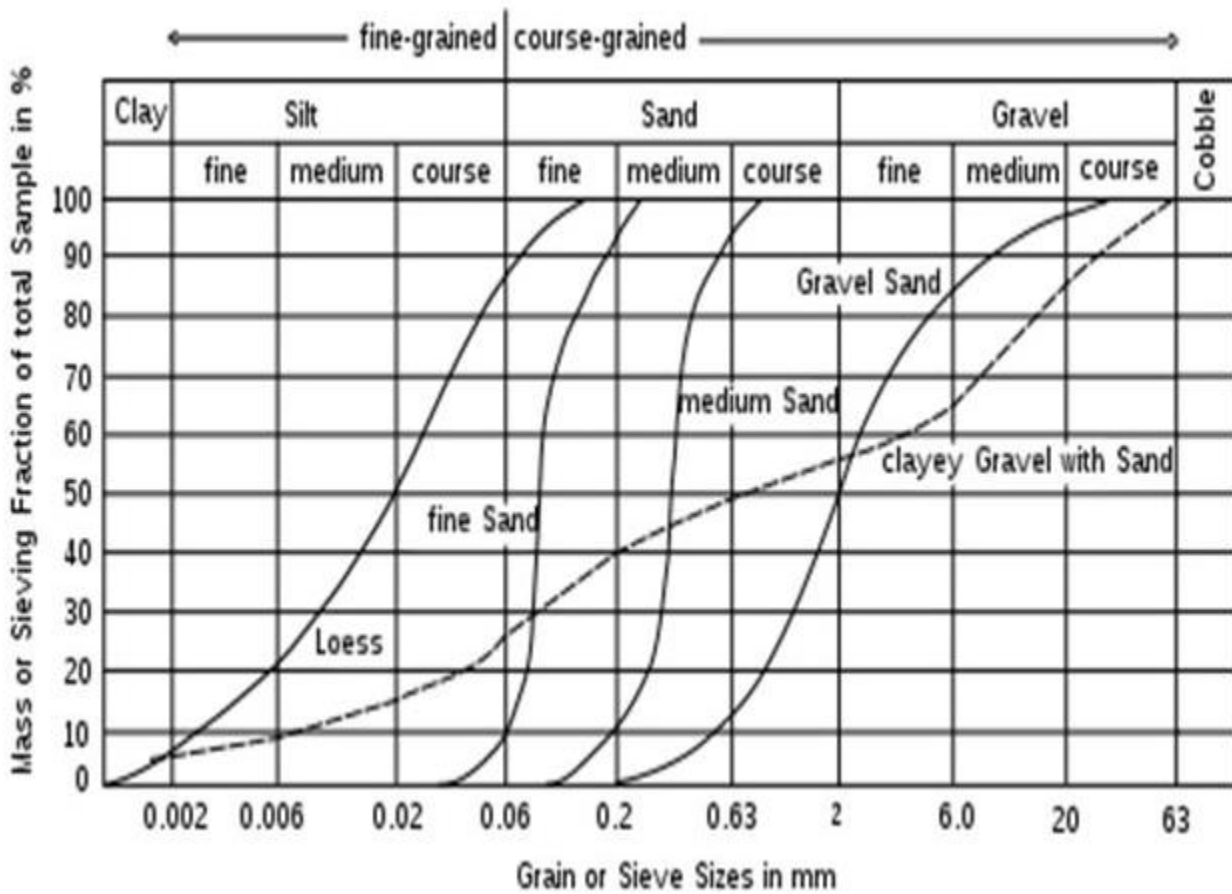


Fig. 10: Soil Classification based on percent finer vs. grain size