



INDIAN INSTITUTE OF TECHNOLOGY GANDHINAGAR

Department of Civil Engineering

Soil Mechanics Laboratory

b) WET SIEVING AND HYDROMETER ANALYSIS

IS: 2720 (Part 4) – 1985 (Reaffirmed-2006)

THEORY:

Soil gradation (sieve analysis) is the distribution of particle sizes expressed as a percent of the total dry weight. The percentage of sand, silt and clay in the inorganic fraction of soil is measured in this procedure. The method is based on Stoke's law governing the rate of sedimentation of particles suspended in water.

NEED AND SCOPE:

The results of testing will reflect the condition and characteristics of the aggregate from which the sample is obtained. Therefore, when sampling, it is important to obtain a disturbed representative sample that is representative of the source being tested because the distribution of different grain sizes affects the engineering properties of soil.

APPARATUS REQUIRED:

1. Glass cylinders of 1000-ml capacity
2. Thermometer
3. Hydrometer
4. Electric mixer with dispersing cup
5. Balance sensitive to ± 0.01 g
6. Stop watch & Beaker

RE-AGENTS REQUIRED:

Dispersing solution-4% (Dissolve 5 g of sodium hexa-metaphosphate in de-ionized water of 125 ml)

PROCEDURE:

Soil passing 4.75mm I.S. Sieve and retained on 75micron I.S. Sieve contains no fines. Those soils can be directly dry sieved rather than wet sieving.

Wet Sieving:

If the soil contains a substantial quantity (say more than 5%) of fine particles, a wet sieve analysis is required. All lumps are broken into individual particles.

1. Take 200gm of oven dried soil sample and soaked with water.
2. If de-flocculation is required, 2% calgon solution is used instead of water.
3. The sample is stirred and left for soaking period of at least 1 hour.
4. The slurry is then sieved through 4.75 mm sieve and washed with a jet of water.
5. The material retained on the sieve is the gravel fraction, which should be dried in oven and weighed.
6. The material passing through 4.75 mm sieve is sieved through 75 micron sieve.
7. The material is washed until the water filtered becomes clear.
8. The soil passed through 75 micron sieve is collected and dried in oven.



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Hydrometer Analysis:

9. Take 40 gm of the oven dry soil sample after removing soluble salts and organic matter if any.
10. It is then mixed with 4% solution of dispersing agent in water to get a known amount of suspension by volume and stirred well.
11. This suspension should be made 24 hrs before testing.
12. After 24 hours, the suspension is again mixed using Electric mixer with dispersing cup and
13. Following stirring with mixer, the suspension which is made up to 1000 ml in the measuring cylinder is turned end to end for even distribution of particles before the time 't' begins to be measured.
14. The hydrometer readings are recorded at regular intervals as indicated in the data sheet. From the data obtained the particle size distribution curve is plotted in the semi-logarithmic graph sheet along with the dry sieve analysis results.

CORRECTIONS (INDIVIDUAL):

Meniscus Correction (C_m):

Since the suspension is opaque, the readings will be taken at the top of the meniscus while the actual should be from the bottom of the meniscus. It is constant for a hydrometer (Always positive).

Temperature Correction (C_t):

If the temperature is less than 27°C, the correction is negative and vice-versa. Temperature should be measured from starting till end of the tests at regular intervals and are averaged. Then it is compared with the standard temperature (27°C).

Dispersion Agent Correction (C_d):

Addition of calgon always increases the specific gravity of the specimen. Hence, this correction is always negative.

ALTERNATIVE CORRECTIONS (COMBINED):

Composite Correction for Dispersion Agent and Temperature, ($C_t - C_d$):

Insert the hydrometer in the comparison cylinder containing dispersant solution in distilled water with the same concentration as used for making the soil suspension. The Composite correction ($C_t - C_d$) is negative of the hydrometer reading corresponding to the top meniscus. It has to be taken every 30 minutes throughout the test.



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PRESENTATION OF DATA:

HYDROMETER ANALYSIS

- | | | |
|---|--|--|
| 1. Sample No: | 4. Hydrometer No. = | 8. Cross-sectional area of the jar = |
| 2. Soil's specific gravity oil (G_s) = | 5. Dispersing agent correction (C_d) = | 9. Weight of soil for sieve analysis (W) = |
| 3. Weight of oven dried soil
In suspension (W_s) = | 6. Temperature correction (C_t) = | 10. Weight passing from 0.075 mm sieve (W_f) = |
| | 7. Meniscus correction (C_m) = | |

Actual time in IST	Elapsed time 'T' (in min)	Hydrometer Reading (R_H)	$R'_H = (R_H + C_m)$	$R = R'_H + (C_t - C_d)$	L, Effective Depth [See Chart]	K See Table II	L/T (L in cm & T in min)	$\sqrt{L/T}$	Particle size $D = K\sqrt{L/T}$ (in mm)	Percent Finer $N' \%$	% Finer on the total wt. N
	30 sec										
	1 min										
	2 min										
	5 min										
	10 min										
	15 min										
	30 min										
	1 hr.										
	2 hrs.										
	4 hrs.										
	8 hrs.										
	24 hrs.										

$$N' \% = \frac{G_s \times R}{(G_s - 1) \times W_s} \times 100$$

Where G_s = Specific Gravity of Soil
 W_s = Dry Wt. of Soil sample

$$N \% = \frac{W_f}{W} \times N' \%$$