18. SOIL EXPLORATION

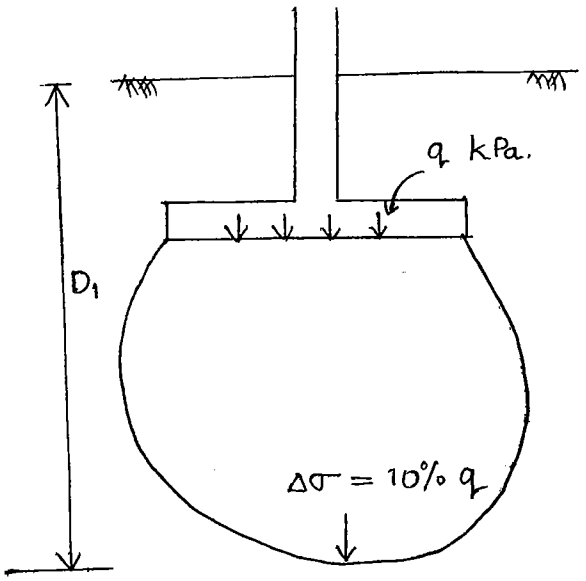
→ Soil Investigation

* For small sites → 1 hole at centre.

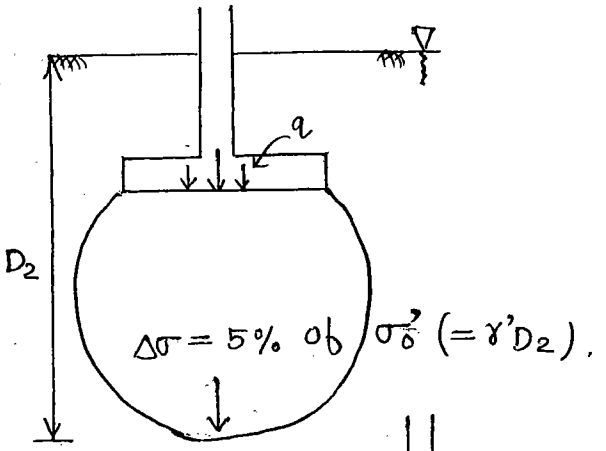
For areas upto 0.4 ha with important buildings } 5 holes → 1 @ centre, 4 @ corners

* The min. depth of exploration is equal to 'significant depth'.

Significant depth is the depth at which increase in stress is equal to 10% of intensity of load applied. (= D_1).

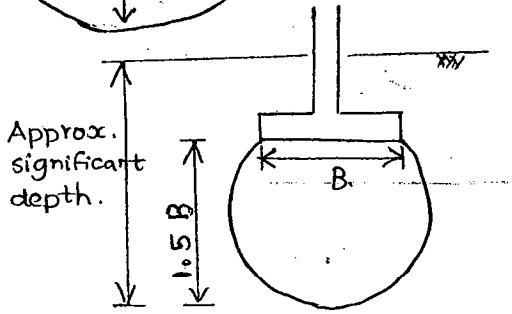


It can also be explained as the depth (D_2) at which increase in stress is equal to 5% of overburden pressure at that point.



Significant depth = Higher of D_1 & D_2

* Approximately significant depth = 1.5 B to 2 B, below the footing. As per IS code, its ≈ 1.5 B.



* Methods of Exploration:

(i) Open trial pits → upto 3m depth

(ii) Auger boring – suitable for clays & shallow depths (6m) for highways, railways etc.

(iii) Wash boring – for deep holes, not suitable for hard stratum, can be used even below WT

(iv) Rotary drilling – for any soil, including rock.

(v) Percussion boring – for hard stratums & rocks

(vi) Core drilling – to obtain rock samples.

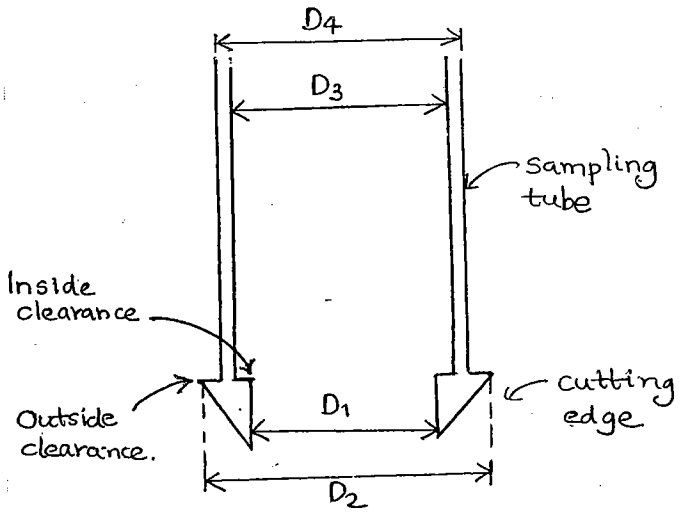
* Sampler :-

An equipment to collect soil sample.

-Types of Samplers:

(i) Thin walled Sampler – used to collect undisturbed samples. (engineering properties)

(ii) Thick walled Sampler – used to collect disturbed samples (index properties)



* Area ratio, $A_r = \frac{D_2^2 - D_1^2}{D_1^2} \times 100$

⊙ To obtain undisturbed sample, $A_r \leq 10\%$

* Inside clearance, $= \frac{D_3 - D_1}{D_1} \times 100$

⊙ To obtain undisturbed sample, it should be 0.5 to 3%

* Outside clearance $= \frac{D_2 - D_4}{D_4} \times 100$

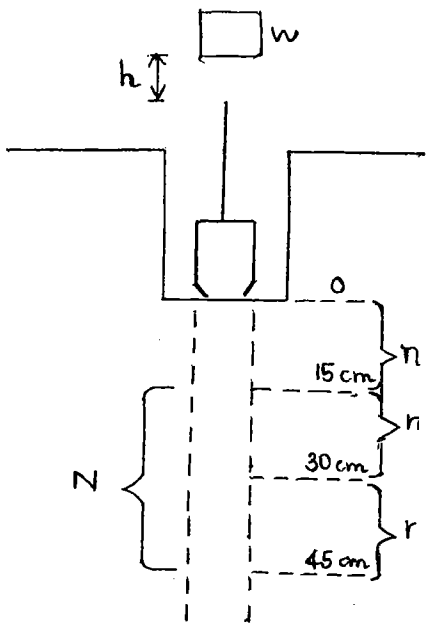
⊙ It shall be 0 to 2%

→ Standard Penetration Test (SPT)

- an insitu test.
- best suited to cohesionless soils.
- conducted by using split spoon sampler.

* SPT value or N-value of soil:

- It is the no: of blows to cause a penetration of 30 cm.



- N value (at field) $= n_2 + n_3$
- The more the N-value, the more the strength of soil.
- Weight of hammer, w = 65 kg
- Height of fall, h = 75 cm

* Corrections for N-value.

(i) Overburden Pressure Correction

- to report N-value to a std. overburden pressure. (96 kN/m² ≈ 100 kN/m²)
- If N_F is N-value measured at field, the corrected value N' for overburden pressure.

Peck, Hansen & Thornburn (by IS code also) :-

⊙ $N' = N_F * 0.77 \log_{10}\left(\frac{1905}{\sigma_0'}\right)$ for $\sigma_0' \geq 24\ kN/m^2$

where σ_0' → effective overburden pressure at the depth. (in kN/m^2).

Correction factor, $\frac{N'}{N_F}$ shall be blw 0.45 & 2.

⊙ $N' = N_F * \left(\frac{350}{\sigma_0' + 70}\right)$; by Gibbs & Holtz

(ii) Dilatancy Correction.

– It is required only if the soil is fine sand or silt and if present below the WT.

– If $N' > 15$;

Corrected value, $N'' = 15 + \left(\frac{N' - 15}{2}\right)$

– If $N' \leq 15$;

Corrected value, $N'' = N'$ (no correction required)

→ Cone Penetration Test (CPT)

– insitu test for cohesionless soil.

– types :

(i) Static

(ii) Dynamic

→ Pressuremeter Test

– to measure in-situ stress-strain curve of soil.

→ Geophysical Methods

(i) Seismic Refraction method. – for civil engg. investigation

(ii) Seismic Reflection method. – for petroleum investigation

→ Soil Stabilisation Methods:

(i) Mechanical Stabilisation.

(ii) Cement Stabilisation.

(iii) Lime stabilisation.

(iv) Chemical stabilisation.

→ Ground Improvement Techniques:

(i) Electro osmosis.

(ii) Vibro floatation method

(iii) Terraprobe method.

(iv) Lime piles.

(v) Stone columns

(vi) Geotextiles.