Example:

Determine the depth of boreholes required for the rectangular footings of a building of dimensions (2x3m) to be placed at a depth of 1.25 m. below ground surface if total and dry unit weights of soil are 19 and 14 kN/m, respectively. The maximum expected column load is 800 KN. and the W.T. location is at foundation level.

Solution:

Q-1

for structural foundation :-

1- for single separate strip footing:-

Depth = 3 X width of footing > 6m

= 3 X 2 = 6 m

∴ depth of B.h = 1.25 + 6 = 7.25 m

or

2- The depth of the boreholes should extend to the point where the net increas in the stress due to the action of building is less than 10% of the total surface load.

$$\frac{800}{(3+d)(4+d)} = 0.1 \times \frac{800}{3\times 4}$$

$$0.1\,(3+d)(4+d) = 12$$

$$(3+d)(4+d) = 120$$

d	dif	
7	+10	
8	-12	
7.5	-0.75	o.k

$\therefore d = 7.5\ m$

$\therefore$ depth of B.H $= 1.25 + 7.5 = 8.75\ m$

or

3- the depth of borehole should extend to the point where the net increase in stress due to building ($\Delta \sigma_z$) is less than 5 % of the overburden stress in soil.

$$\sigma_o = 1.25 \times 14 + d \times 9 = 17.5 + 9d$$

$$\frac{800}{(3+d)(4+d)} = 0.05\ (17.5 + 9d)$$

$$(3+d)(4+d)(17.5+9d) = 16000$$

d	dif
9	-634
10	+3565
9.2	152

0.1

$\therefore d = 9.2\ m$

$\therefore$ depth of B.H $= 1.25 + 9.2 = 10.45\ m$

The depth of boreholes $= 10.45$

$\simeq 10.5\ m$

Q1- a- Site investigation is to be carried out on an inner city gap site which is being redeveloped for a six store building with a raft footing of 20x30m and at a depth of 2.0m below N.G.L. The net applied pressure at the footing base is 100kN/m^2. Geological map show that the soil is of loose deposit with dry and submerged unit weight of 16.0 and 9.0 kN/m^3 respectively Ground water table at a depth of 2.0m below N.G.L. Outline a suitable site investigation project for this site, giving details of the boreholes (number, depth, and locations), insitue and laboratory test required.

b- For the soil profile shown in fig(1) , calculate corrected S.P.T –N value at a depth of 20.0m below N.G.L.

(20 Marks)

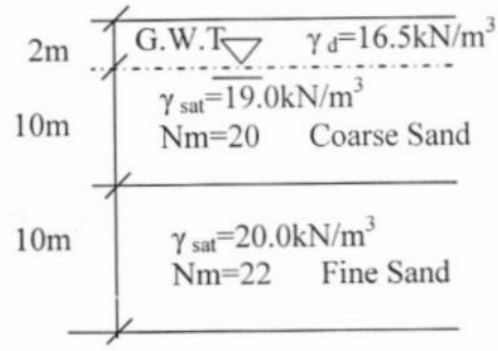

Fig (1)

Q1 a- - No. of Boreholes

Since Building area = $30 \times 20 = 600 m^2$ 7 $300 m^2$

So, Use 5 Boreholes

- layout : Use 4 B.H at the Corner and one B.H at the Center

- Depth of B.H. (Z)

1- $Z = 2 * B = 2 * 20 = 40$ m.

2- 10% of $\Delta\sigma$.

$$0.1\,\Delta\sigma = \frac{\circ\sigma\ B.L}{(B+Z)(L+Z)}$$

$$0.1 \times 100 = \frac{100 * 20 \times 30}{(20+Z)(30+Z)}$$

$$Z = 52.6 \text{ m}$$

3- 5% of P_o'

$$0.05\,P_o' = \frac{100 \times 20 \times 30}{(20+Z)(30+Z)}$$

$$P_o' = 16 \times 2 + 9Z = 32 + 9Z$$

$$0.05 \times (32 + 9Z) = \frac{100 \times 20 \times 30}{(20+Z)(30+Z)}$$

$$Z = 92.3 \text{ m}$$

(1)

The optimum depth of Boreholes is:

$40 + 2 = 42$ m. ⟶ Use 45 m depth.

- Insitue Tests
  - Standard Penetration Test (S.P.T)
  - Plat load Test
- laboratory tests:

Gs, W_c, Atterberg limits, Sieve and Hydrometer Analysis, oedometer test, Unconfined Unconsolidation test, U.U test Chemical test (TSS, P.H, SO_3, Cl_3).

B -

$$N_{cr} = 15 + 0.5(N_m - 15)$$

$$= 15 + 0.5(22 - 15) = 18.5$$

$$N_c = C_N \times N$$

$$C_N = 0.77 \log \frac{2000}{P_o'}$$

$$P_o' = 16 \times 7.5 + 10(19-10) + 7.5(20-10) = 205 kPa$$

$$C_N = 0.77 \log \frac{2000}{205} = 0.761$$

$$N_c = 0.761 \times 18.5 = 14$$