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Solution 3; Data given

Total settlement = 15 cm

Settlement after 2 months = 3 cm

Time required for attending 6cm = ?

Drinage type = single

$t_1 = 2 \text{ months} = 60 \text{ day}$

$\frac{U_1}{U_2} = \frac{S_1}{S_2}$ U_1 = Consolidation after 2 months

U_2 = 100% consolidation

Put the value

$U_1 = U_2 \times \frac{S_1}{S_2} \Rightarrow 100 \times \frac{3}{15} = 20\%$

Let us assume the degree of consolidation $U < 60\%$.

$\frac{S_1}{S_3} = \frac{U_1}{U_3}$ and $\frac{U_1}{U_3} = \left(\frac{T_{V_1}}{T_{V_3}}\right)^{1/2}$ T_V = Time factor

$\because \frac{S_1}{S_3} = \sqrt{\frac{T_{V_1}}{T_{V_3}}} \Rightarrow \frac{3}{6} = \sqrt{\frac{60}{t_3}}$

\# $t_3 = 240$ day or 8 months 6cm Settlement

Check the relation ship used in Que.

$\frac{U_1}{U_3} = \frac{S_1}{S_3}$

$\frac{20}{U_3} = \frac{3}{6} \Rightarrow U_3 = \frac{20 \times 6}{3} = 40\%$.

Since $U = 40\% < 60\%$.

Hence OK

Settlement in 1 months = ?

Settlement in 2 months = 3 cm.

S_5 = settlement in one months

S_1 = settlement in two months.

$$\frac{S_1}{S_5} = \sqrt{\frac{t_1}{t_5}}$$

$$\frac{3}{S_5} = \sqrt{\frac{2}{1}}$$

$$S_5 = \sqrt{\frac{9}{2}} = \underline{2.12 \text{ cm}}$$

Settlement in 4 months = ?

S_6 = Settlement in 4 months

$$\frac{S_1}{S_6} = \sqrt{\frac{t_1}{t_6}} \Rightarrow \frac{3}{S_6} = \sqrt{\frac{2}{4}}$$

$$\frac{9}{S_6^2} = \frac{1}{2} \Rightarrow S_6 = \sqrt{18} = \underline{4.24 \text{ cm}}$$

Settlement in 6 months = ?

S_7 = Settlement in 6 months.

$$\frac{S_1}{S_7} = \sqrt{\frac{t_1}{t_7}} \Rightarrow \frac{3}{S_7} = \sqrt{\frac{2}{6}}$$

$$\frac{9}{S_7^2} = \frac{1}{3} \Rightarrow S_7 = \sqrt{27} = \underline{5.20 \text{ cm}}$$

Settlement in 10 months

$$\frac{S_1}{S_8} = \sqrt{\frac{t_1}{t_8}} \Rightarrow S_8 = 3\sqrt{\frac{10}{2}} = \underline{6.71 \text{ cm}}$$

Check for degree of consolidation

$U_2 = 100$, $S_2 = 15$ cm

$$\frac{U_1}{U_2} = \frac{S_1}{S_2}$$

$$U_1 = U_2 \times \frac{S_1}{S_2} = 100 \times \frac{6.71}{15} = 44.73\% < 60\%$$

Hence ok

(3)

~~Solution~~

Sol 3; Time req for Settlement 6cm ⟶ 240 day

Settlement S_1 → 2.12 cm

S_4 → 4.24 cm

S_6 → 5.20 cm

S_{10} → 6.71 cm

Q2)

Soln. Site investigation are generally done to obtain the information that is useful for one or following purpose.

1) To select the type of depth of foundation for a given structure

2) To determine the bearing capacity of the soil

3) To estimate the probable maximum & differential settlement

4) To establish the ground water level and to determine the properties of water

5) To predict the lateral earth pressure against retaining wall and abutement

6) To select Suitable construction techinques

7) To predict & to solve potential foundation problems.

8) To ascertain the suitability of the soil as a construction material.

9) To investigate the safety of the existing structure and to suggest the remedial measures.

Q1(i) **Plate load test;**

Plate load test is a field test to determine the ultimate bearing capacity of soil and the Probable settlement under a given loading. Test essentially consists in loading a rigid plate at the foundation level, and determining the settlements corresponding to each increment. The Ultimate bearing capacity is taken as the load at which the plate starts sinking at a rapid rate.

1. Bearing Plate; square or circular made of Steel of not less than 25mm size 300 to 750 mm

2. Test pit; The test pit, usually at the foundation level, equal to 5 time of test Plate

3. Loading arrangement; The loading to the test plate may be applied with the help of a hydraulic Jack.

i) Gravity loading Platforms

ii) Reaction truss method

$$\text{Settlement } P_p = P_F \left[\frac{B_p(B+0.3)}{B(B_p+0.3)}\right]^2$$

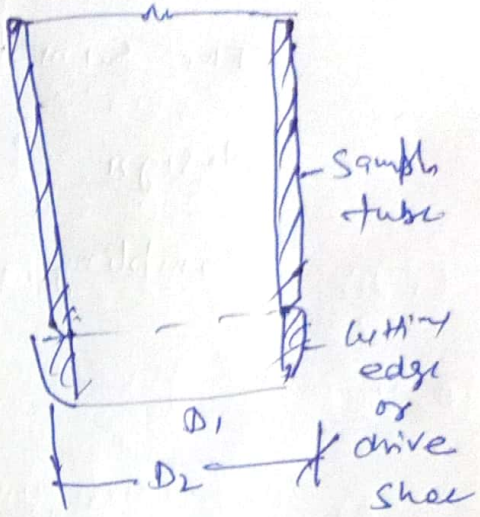
P_p = Settlement of Plate, P_F = Settlement of Actual footing

Q1(ii) 7(6)

Soil Sampling;

Different types of soil samplers

i) standard split spoon
ii) open drive and piston
iii) Piston type samplers



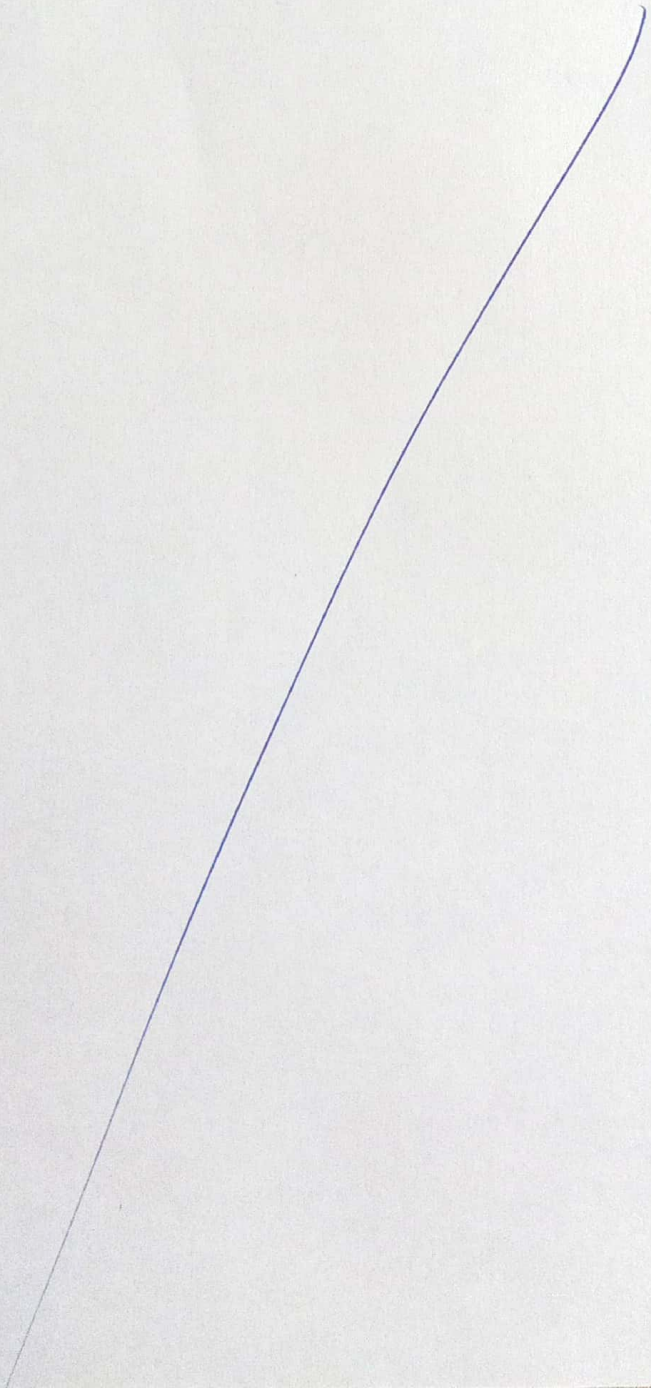
i) standard split spoon;

(1) The most commonly use samplers for obtaining the disturbed sample of the soil
(2) It consist mainly of three part (I) Driving shoe made of Tools steel made of about 70 mm long (II) steel tube about 450 mm long split longitudinal in two Halfs (iii) couple at the top of the tube about 150 mm long inside dia of the split tube is 38 mm and outside dia 50 mm.
The sample is collected by jacking or forcing.

(ii) open drive and piston Samplers;
undisturbed Sample are made obtaining from bore hole by open drive samplers or piston samplers. open drive samplers consist of thin well tube which are pushed or driven in the soil.

3) Piston type Samplers:

good quality undisturbed sample are obtained from piston samplers which used thin used sample tube with a piston inside. while the tube is laying lower to the bottom of the drive hole.



Solution →

1> (4) Dynamic properties of soil: →

C_u, C_T, C_ψ and C_ϕ are the dynamic property of soil

a) Co-efficient of elastic uniform compression (C_u): →

It is the ratio of external uniform pressure to the elastic part of the settlement.

b) Co-efficient of elastic uniform shear (C_T): →

It is the ratio of average shear stress at the foundation contact area to the elastic part of the displacement is sliding.

c) Co-efficient of elastic non-uniform shear (C_ψ): →

It is the ratio of the external moment applied to the vertical axis to the product of polar moment of inertia of contact area of the base of foundation on the angle of a rotation of the foundation.

(cont.)

(d) Co-efficient of elastic non-uniform compression (C_ϕ):→

It is the ratio of external moment about a horizontal axis to the product of moment of inertia of cont act area of base of foundation about the same axis.

Part 1(v)→ Differential Settlement:→

A structure is said to undergo differential settlement, if one of its part settles more than the other. The difference in the total settlement between any two points is the magnitude of differential settlement.

Differential Settlement cause:→

- Soil of different lithological characteristics in the horizontal direction (different compressibility and soil compressibility beneath different parts of the foundation structure.
- Drying of soil surface layers.
- The proximity of trees with large roots
- Piping leaks, sewer drainage & service line eli
- Excavations near the structures.
- Different dimensions and depth of structure foundati
- Vibration