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Design of Foundation for Various Soil Samples

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Abstract*: This project presents an overview of the analysis of the soil and its characteristics such as bearing capacity of soil and calculation of bearing capacity of soil different field test such as SPT, DCPT and PLT. These are very useful to determine the bearing capacity of soil in cohesionless soil as well as cohesive soil. While excavating soil for performing of PLT it give brief idea about the soil such as type and nature of soil texture of soil, consistency of soil, Make a program using VBA coding to calculate the bearing capacity of the soil at the different water level and results are verified from solved examples. Various inputs that have been taken from user are: - length, breadth, depth of footing, etc.*

Keywords: analysis of the soil

I. INTRODUCTION

General: Basic Definitions Bearing capacity: It is the load carrying capacity of the soil. Ultimate bearing capacity or Gross bearing capacity (qu): It is the least gross pressure which will cause shear failure of the supporting soil immediately below the footing. Net ultimate bearing capacity (qnu): It is the net pressure that can be applied to the footing by external loads that will just initiate failure in the underlying soil. It is equal to ultimate bearing capacity minus the stress due to the weight of the footing and any soil or surcharge directly above it. Assuming the density of the footing (concrete) and soil (γ) are close enough to be considered equal, then qnu = qu –γDf. Where, Df.= depth of the footing Safe bearing capacity: It is the bearing capacity after applying the factor of safety (FOS). These are of two types:-

Safe net bearing capacity: It is the net soil pressure which can be safety applied to the soil considering only shear failure. It is given by

Safe gross bearing capacity (qs): It is the maximum gross pressure which the soil can carry safely without shear failure. It is given by, qs= qns+ γDf. Allowable Bearing Pressure: It is the maximum soil pressure without any shear failure or settlement failure.

II. METHODOLOGY

- IS 2720-17: Laboratory determination of soil permeability.
- IS 2720-18: Determination of field moisture equivalent.
- IS 2720-19: Determination of centrifuge moisture equivalent.
- IS 2720-20: Determination of linear shrinkage.
- IS 2720-12: Determination of shear strength parameters.
- IS 2720-13: Direct shear test. • IS 2720-14: Determination of density index.
- IS 2720-15: Determination of consolidation properties
- IS 2720-16: Laboratory determination of CBR.
- Soil Sampling and Classification • Collect soil samples from multiple sites with varying conditions (e.g., residential, industrial, and coastal areas).
- Classify the soils based on the Unified Soil Classification System (USCS).
- Laboratory Testing Conduct a series of laboratory tests, including:
- Triaxial shear test: Assesses the shear strength of soil under various loading conditions.

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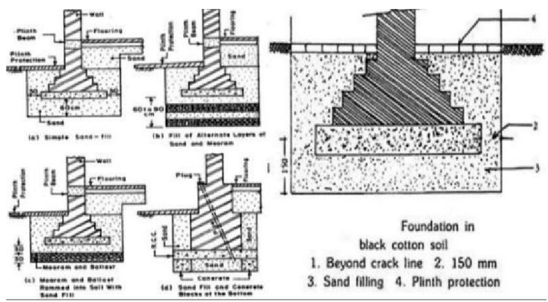
- Foundation Design • For clay soils: Design pile or mat foundations to counteract low bearing capacity. • For sandy soils: Shallow strip foundations with soil densification techniques.
- For silt or loamy soils: Shallow or raft foundations based on load distribution.

Simulation and Validation Use software like PLAXIS, SAP2000, or STAAD.Pro to simulate foundation behavior under different loads and soil conditions. Validate the results with field data where possible.

Methods of analyzing the soil

The various methods of computing the bearing capacity can be listed as follows: 1. Analytical Methods 2. Plate Bearing Test 3. Penetration Test.



HELPFUL HINTS

Testing of soil:-

Terzaghi's Bearing Capacity Theory There are certain assumptions in Terzaghi's Bearing Capacity Theory,
Depth of foundation is less than or equal to its width.
Base of the footing is rough.
Soil above bottom of foundation has no shear strength; is only a surcharge load against the overturning load

Surcharge upto the base of footing is considered.
Load applied is vertical and non-eccentric.
The soil is homogenous and isotropic.
L/B ratio is infinite.

III. RESULT FOR TESTING

Foundation	Total Load (kN)	Dimensions (L × B × H)	Settlement (mm)
A1	67.285	1.5m ×1.5m×0.106m	15.68
A2	125.24	1.5m ×1.5m×0.106m	22.68
A3	67.285	1.5m ×1.5m×0.106m	15.68
B1	126.28	1.5m ×1.5m×0.106m	23.26
B2	239.056	1.5m ×1.5m×0.156m	36.71
B3	126.28	1.5m ×1.5m×0.106m	23.26
C1	177.67	1.5m ×1.5m×0.156m	29.48
C2	332.41	2.0m ×2.0m×0.156m	45.5
C3	177.67	1.5m ×1.5m×0.156m	29.48
D1	222.12	1.5m ×1.5m×0.156m	32.6
D2	408.112	2.0m ×2.0m×0.206m	47
D3	222.12	1.5m ×1.5m×0.156m	32.6

IV. CONCLUSION

This study highlights the importance of a systematic approach to foundation design, emphasizing soil analysis and customization. The findings suggest that understanding the unique properties of soil can significantly enhance structural safety and cost-effectiveness.

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