

Soil Profile Characterization of Pithampur (M.P.)

Ashish Pawar*, Vaibhav Singh**

* (PG Scholar, Department of Civil Engineering, SVVV Indore)

** (Assistant Professor, Department of Civil Engineering, SVVV Indore)

ABSTRACT

Geotechnical site characterization is a fundamental process in geotechnical engineering that involves the investigation and evaluation of the subsurface conditions at a specific location. It plays a crucial role in the design, construction, and maintenance of various infrastructure projects, including buildings, bridges, dams, tunnels, and highways. By understanding the geotechnical properties of the site, engineers can make informed decisions and develop appropriate designs to ensure the safety and stability of structures. In this paper, research work has been conducted for the development of geotechnical site characterization of the Pithampur Industrial Area. Pithampur Industrial Area has been selected because it is the largest developing industrial area of Madhya Pradesh as well as there are a lot of inherent variations in soil strata. Geotechnical site characterization is significant in the development of Pithampur industrial area in Madhya Pradesh. It ensures the proper foundation design, safe infrastructure development, identification of geotechnical hazards, site-specific design considerations, environmental compliance, and overall successful implementation of industrial projects in the area.

Keywords - Borehole, Geotechnical Characterization, In-situ Test, Strata, Soil Properties

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I. INTRODUCTION

Geotechnical site characterization typically involves a combination of field investigations, laboratory testing, and data analysis [1]. Soil profile identification through geotechnical site characterization is of paramount importance in construction projects. It involves the detailed examination and understanding of the soil layers present at a site, including their composition, properties, and arrangement. This information is essential for engineers and designers to make informed decisions and develop appropriate construction strategies [2]. Drilling and sampling are crucial components of geotechnical site characterization. They involve the excavation of boreholes or test pits to obtain representative soil and rock samples for laboratory testing and analysis. Drilling and sampling methods provide valuable information about the subsurface conditions, including soil classification, strength, stiffness, permeability, and other geotechnical properties. This study investigates the properties of the soil to give base data, which can be used for future construction design. Pithampur Industrial Area has been selected because it is the largest developing industrial area of Madhya Pradesh as well as there are a lot of inherent variations in soil strata. Pithampur Industrial Area is divided into 3 parts according to its sectors, i.e. Sector-I, Sector-II, and Sector-III, respectively.

This study was carried out to describe, characterize and classify soil strata of the Pithampur Industrial Area. Pithampur is a town in the Dhar district of Madhya Pradesh, India. Pithampur is an Industrial hub and is a part of the Indore Metropolitan Region. Pithampur houses major industries and companies of Madhya Pradesh. Pithampur is approximately located at a latitude of 22°37'11" N and 75°41'36" E.

II. STUDY AREA

10 major locations have been selected in the Pithampur as shown in figure 1. The coordinates of the locations are shown in figure 2.

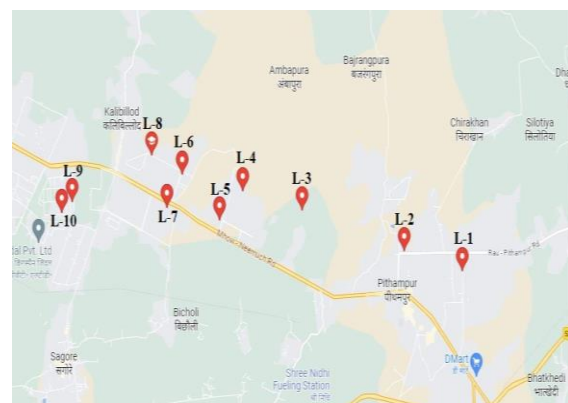


Fig. 1 Study Locations

III. EXPERIMENTAL ANALYSIS

Based on the strata encountered at the site, the following relevant field and laboratory tests are conducted on the samples collected from the boreholes to fulfill the objective of the studies.

Location	Co-ordinates
L-1	22.618610608113308, 75.6915709361569
L-2	22.620353636143992, 75.67869633372649
L-3	22.626374835698023, 75.65517872662026
L-4	22.62954378216985, 75.64144581736117
L-5	22.62510723665368, 75.63715428321771
L-6	22.629839124886242, 75.62845804837411
L-7	22.627185657732685, 75.62466562270983
L-8	22.634296818117356, 75.6216149783433
L-9	22.62679033440437, 75.6043786043023
L-10	22.625781969537837, 75.60085849974463

Fig. 2 Coordinates of Locations

Table 1 Soil Tests

Test / Parameter	Indian Standard (IS) Codes
Specific Gravity	IS 2720 (Part-3) : 1980
Grain Size Analysis	IS 2720 (Part 4) : 1985
Atterberg's Limit	IS 2720 (Part 5) : 1985
Shrinkage Limit	IS 2720 (Part 6) : 1972
Free Swell Index	IS 2720 (Part 40) : 1977
Natural Moisture Content	IS 2720 (Part 2) : 1973
Triaxial Test	IS 2720 (Part 11) : 1993
Direct Shear Test	IS 2720 (Part 13) : 1986
IS Soil Classification	IS 1498
Standard Penetration Test	IS 2131: 1963

Table 2 Rock Tests

Test / Parameter	Indian Standard (IS) Codes
Core Recovery (CR)	IS 11315 (Part-11) : 1985
Rock Quality Designation (RQD)	IS 11315 (Part-11) : 1985
Density of Rock	IS 13030: 1991
Water Absorption of Rock	IS 1124: 1974
Point Load Strength Test Index of Rock	IS 8764: 1998
Unconfined Compressive	IS 9143: 1979

Strength of Rock	
Triaxial Test	IS 2720 (Part 11) : 1993
Direct Shear Test	IS 2720 (Part 13) : 1986
IS Soil Classification	IS 1498
Standard Penetration Test	IS 2131: 1963



Fig. 3 Boring Operations



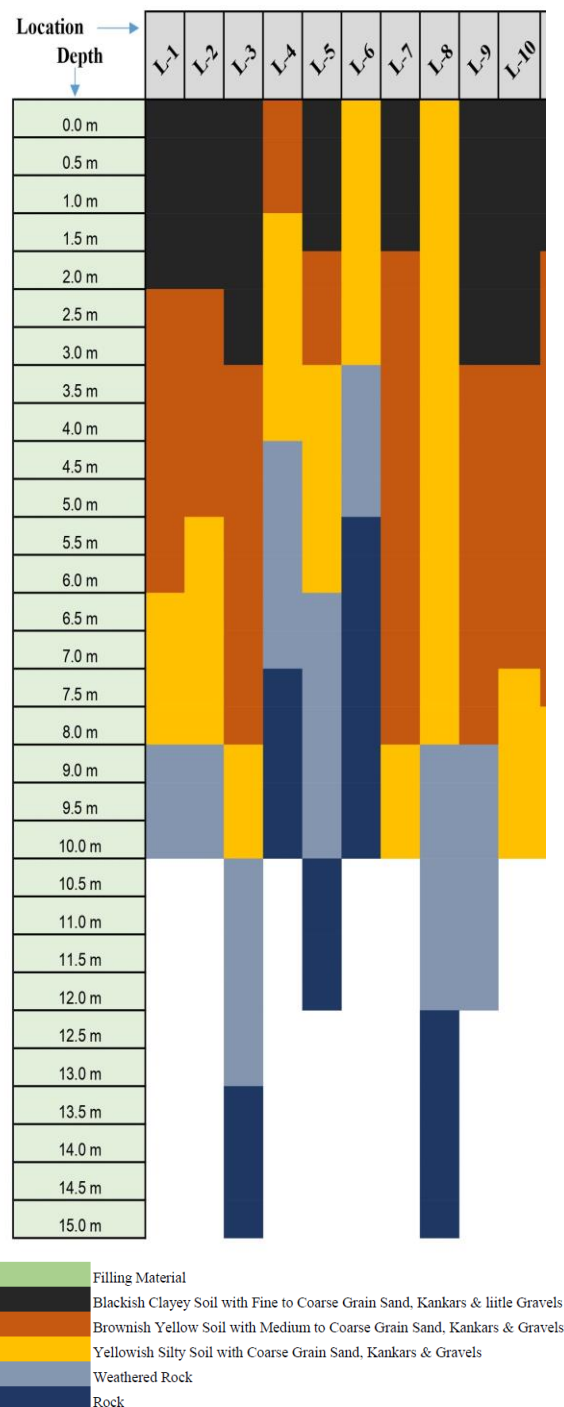
Fig. 4 Soil Sampling



Fig. 5 Soil Testing

IV. RESULTS AND DISCUSSIONS

Soil profile map has been generated using nearly 25 boreholes at mentioned locations. The depth of boreholes is 10 m and few boreholes are taken up to a depth of 15 m. two-dimensional soil profile map is shown in fig 6.



Different types of strata that encountered in the mentioned location is filling material, blackish clayey soil, brownish yellow soil, yellowish silty soil, weathered rock and rock.

In the shallow depths i.e., up to 3 m blackish clayey soil is found which have a poor net safe bearing capacity (SBC) of 7 t/sq. m. From 3m to 8 m depth, brownish soil is found which has an SBC of 19 t/sq. m. At greater depth i.e., below 9 m, weathered rock has been found which has an SBC of 32 t/sq. m. As per the SBC value at different depths the foundation specifications can be decided for the future developments in the study area.

V. CONCLUSION

In this study, a thorough site characterization based on geotechnical data has been completed. Geological and geotechnical information has been used to study the geotechnical characterization of the Pithampur region. A two-dimensional soil profile is created utilizing the borehole data that is available. Contractors, researchers, and governmental organizations can use the findings to design new infrastructure.

1. Blackish Clayey Soil with Fine to Coarse Grain Sand, Kankars, and Little Gravels have been detected in the majority of the research area sites up to a depth of 3 m, indicating that the foundation in this area should be placed below 3 m depth.
2. A good rigid base for the raft and isolated footings will be provided by the brownish yellow soil with medium to coarse grain sand, kankars, and gravels and yellowish silty soil with coarse grain sand, kankars, and gravels, which are found from 3 m to 8 m.
3. As weathered rock is found below this level and will make an ideal base for large loads, foundations for massive constructions should be set below 8 meters.
4. In order to determine the dimensions of foundations in a specific location at various depths, Net Safe Bearing capability gives information on the load carrying capability of soil profiles at each location for various depths.

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