1. INTRODUCTION

The subsoil investigations reported herein were taken up to find out the nature of subsoil at the site of the proposed construction, vide W.O. No.- BSEIDC/Tech/1960/2018-3102 Dated – 10.06.2020 [Sl. No. 8] and to recommend the capacity and type of its foundation. After certain tests on the soil, as detailed below, the desired recommendations have been made on **page 3** of this Report.

2. FIELD WORK

The fieldwork consisted of sinking a bore hole, conducting the necessary field tests in it and collecting soil samples from it for conducting laboratory tests on them.

2.1. Boring

Taking guidance from IS: 1892, one bore hole of 150 mm diameter was sunk at the location shown in the bore hole location map.

2.2 Sampling

2.2.1 Undisturbed Soil Samples

Open drive samplers of 100-mm diameter and about 450-mm length were used for obtaining undisturbed samples of cohesive soils. The collection, sealing, labeling and transportation of the samples to the laboratory were done as per the IS guide-lines.

2.2.2 Disturbed Soil Samples

Disturbed soil samples were collected from the bore hole at suitable intervals of depth (not more than 2.5 m) and at all depths of change in the nature of the subsoil. These samples were sealed in polythene bags with proper identification labels.

2.3 Field Tests

2.3.1 Standard Penetration Tests (SPT)

These tests were conducted as per IS: 2131 – 1963. The depth interval between two consecutive tests was 1 to 1.5 m. The tests were located in between the levels at which undisturbed soil samples were collected.

3. LABORATORY TESTS

Some or all of the following laboratory tests, as necessary, were done on the collected soil samples. Representative soil samples were selected for this from the different soil strata encountered during boring. The tests were performed as per the relevant Indian Standard Codes of Practice.

(a) Natural moisture content

(b) Bulk density

(c) Grain size analysis (using sieves and / or hydrometer)

(d) Specific gravity of soil solids

(e) Atterberg's limit tests (liquid, plastic and shrinkage limits)

(f) Shear Tests :

- [I] Triaxial compression test (unconsolidated – undrained), generally for fine- grained soils
- [II] Unconfined compression tests, only on cohesive soils
- [III] Direct shear tests, generally for coarse-grained soils

(g) Chemical tests on soil/ground water

(h) Other tests as and when required.

4. PRESENTATION OF TEST RESULTS

The field and laboratory test results are given in the **Appendix - B**.

5. SOIL STRATIFICATION

The results of field tests in three bore holes sunk at the site [vide Location Sketch in App. A] and the results of laboratory tests conducted on the collected soil samples indicate that the soil stratification at the site is as describe below.

The subsoil in all BH's is sandy clayey silt [type ML] up to the depth of about [3.0 m in BH 1 and 2] and [from about 4.5 m to 10.5 m depth bgl in BH 3] followed by silty clay [type CI] up to the depth of about 4.5 m bgl and clayey silty sand [type SM-SC / SC-SM / SM] up to the investigated depth of 10.5 m bgl.

Ground water table was struck at about 3.80 m to 3.90 m depth below GL in July, 2020. It is subject to seasonal variations.

6. FOUNDATION ANALYSIS

The safe capacity of foundation of any type and size may be determined on the basis of the soil data given in this Report by using the standard methods of foundation design and following the relevant Indian Standard Codes.

7. RECOMMENDATIONS

The design of the foundation for the proposed structure depends on the nature of both [a] the subsoil and [b] the structure.

The subsoil in all BH's is sandy clayey silt [type ML] up to the depth of about [3.0 m in BH 1 and 2] and [from about 4.5 m to 10.5 m depth bgl in BH 3] followed by silty clay [type CI] up to the depth of about 4.5 m bgl and clayey silty sand [type SM-SC / SC-SM / SM] up to the investigated depth of 10.5 m bgl.

Ground water table was struck at about 3.80 m to 3.90 m depth below GL in July, 2020. It is subject to seasonal variations.

1. The proposed structure may be provided with shallow foundation at a depth of 2.0 m or more. As the formation up to 2 m is loose and soft.

2. The major part of the subsoil is silt and sand. Hence placement of bored cast in situ plane or u/r pile may not be desirable as this formation may collapse during such pile placement. Driven piles may be uneconomical.

The values of net allowable bearing pressures of foundations of certain sizes have been calculated [vide sample of Calculation in Appendix - F] and are tabulated below.

Table 1: Allowable Net Bearing Pressures [q_{na}] and Settlements Expected [s]

Depth (m) below GL	Width (m)	Net allowable bearing pressure (t/m^2)			Maximum expected settlement (mm)
		Strip footing	Square footing	Raft foundation	
2.0	2.0	5.9	6.5	....	50
	3.0	5.3	5.3	....	50
	10.0	....	....	7.7	75
2.5	2.0	7.0	7.8	....	50
	3.0	6.8	6.8	....	50
	10.0	....	....	8.7	75
3.0	2.0	8.2	9.2	....	50
	3.0	8.1	8.5	....	50
	10.0	....	....	9.1	75
3.5	2.0	9.4	10.4	....	50
	3.0	9.2	9.5	....	50
	10.0	....	....	9.4	75
4.0	2.0	10.8	11.6	....	50
	3.0	10.3	10.6	....	50
	10.0	....	....	9.7	75

Note:

If a soil condition much different from those reported herein is met with during foundation trenching, suitable steps should be taken.

For Bihar Foundation Consultants,

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Chief Consultant.