Experimental Investigation on Field Test of Soil at a Construction Site

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Abstract: Soil Investigation or geotechnical investigation is a procedure that determines the stratigraphy (study of rocks) and relevant physical properties of the soil underlying the site. This is done to ensure that this substructure, which is eventually going to hold up construction site, is safe and enduring. For any civil engineering project, however big or small, it is of primary importance that a proper field survey and a very precise geotechnical investigation be conducted. Geotechnical investigation is an integral part of the construction process which is done to obtain information about the physical characteristics of soil/rock around a site. It is a below-ground investigation wherein the soil strata is sampled and tested to establish its characteristics, which will influence the construction project.

These investigations form the basis for planning, designing, and constructing the structures. The serviceability and performance of the structure depend on the accuracy and adequacy of these investigations. How accurate the information in the geotechnical report is strongly influences the design, construction, project cost, and safety.

Keywords **– Soil Investigation & Field Test (Vane Shear Test, Plate Load Tests, Standard Penetration Test(SPT), Cone Penetration Test, Pressure Meter Test, Geophysical Methods)**

I. Introduction

Soil investigation must be undertaken to determine the bearing capacity of the soil, its settlement rate and the position of the water table. A civil engineer needs to understand the soil behavior of the construction site and to find. the satisfactory solution to the soil problem. The knowledge of subsoil conditions at a site is a prerequisite for safe and economical design of sub-structural elements. A well planned and properly executed site investigation programme will provide information about the stratigraphy and physical properties. of the soil at the site including ground water table, Soil Investigation for Static facility for Propellants and its fluctuations. The process of investigation are as follows:

Sub-surface Investigation:
Preliminary Exploration which is study of geology of the site and the reconnaissance.Detailed investigation follows the preliminary investigation and from this we come to know about the nature, sequence and thickness of soil layers and lateral variations, sequence and position of ground water table.

Borehole:
As a part of geotechnical investigation,we need to construct boreholes.There are different methods used for boring.e.g. Auger Boring,Wash Boring,Percussion Boring, Rotary Boring etc. The suitability of any particular method of boring depends mainly on the nature of soil,the position of water table,the ease and accuracy with which changes in soil and ground water conditions can be determined.

Soil Sample*:*

Generally it can be classified as

(i) Disturbed Sample: Disturbed Sample are those where natural soil structure gets modified or disturbed during sampling procedure.

(ii) Undisturbed sample: Here original soil structure is preserved and also soil properties have not undergone any alteration or modification.

For all practical purpose, undisturbed soil sample is suitable for all laboratory tests including shear strength and consolidation tests.

Types of soil samples Required for Laboratory Tests

Types Of Test	Types Of Sample Required
Natural water content	Undisturbed
Density	Undisturbed / Representative
Specific Gravity	Undisturbed / Representative
Grain size distribution	Undisturbed
Atterberg's Limit	Undisturbed
Coefficient of permeability	Undisturbed
Consolidation parameters	Undisturbed
Shear strength parameters	Undisturbed

Field Tests:

The field tests commonly used in sub-surface investigation are:

(i) Vane Shear Test:

The shear vane test is a method of measuring the undrained shear strength of a cohesive soil. The test is carried out with equipment consisting of a rod with vanes mounted to it that is inserted into the ground and rotated. A gauge on the top of the rod measures the torque required to cause failure of the soil and provides a conversion to shear strength. The equipment has been in use since at least 1948. The equipment has also been used since at least 1967 to assess the shear strength of packs of snow at risk of forming a slab avalanche.

(ii) Plate Load Tests:

The Plate Bearing Test (or Plate Loading Test) is an insitu load bearing test of soil used for determining the ultimate bearing capacity of the ground and the likely settlement under a given load. ... The test load is gradually increased till the plate starts to settle at a rapid rate

(iii) Standard Penetration Test (SPT):

The standard penetration test (SPT) is an in-situ dynamic penetration test designed to provide information on the geotechnical engineering properties of soil. This test is the most frequently used subsurface exploration drilling test performed worldwide. The test procedure is described in ISO 22476-3, ASTM D1586[1] and Australian Standards AS 1289.6.3.1. The test provides samples for identification purposes and provides a measure of penetration resistance which can be used for geotechnical design purposes. Many local and widely published international correlations which relate blow count, or N-value, to the engineering properties of soils are available for geotechnical engineering purposes

(iv) Cone Penetration Test:

Cone penetration testing (CPT) is an in-situ test that is used to identify the soil type. In this test a cone penetrometer is pushed into the ground at a standard rate and data are recorded at regular intervals during penetration. A cone penetration test rig pushes the steel cone vertically into the ground. The cone penetrometer is instrumented to measure penetration resistance at the tip and friction in the shaft (friction sleeve) during penetration. A CPT probe equipped with a pore-water pressure sensor is called a CPTU. CPT probes with other sensors are also used.

(v) Pressure Meter Test:

The pressuremeter test is an in-situ testing method used to determine the stress-strain response of the tested soil. ... The interpreted results are used to estimate the soil's stiffness, strength, and the "at-rest horizontal earth pressure".

(vi) Geophysical Methods:

Geophysical methods can be used for cost-effective site characterization and monitoring by observing variations in the electrical, magnetic, and seismic properties of subsurface materials.

Number and Deposition of Trial Pits and Borings

The purpose of soil exploration is to provide the designer with complete information about the subsoil layers at the site. The number and spacing of boreholes or trial pits depend upon extent of site, uniformity of strata, nature of structure and loading diagram. As per IS:1892-1979 recommendations, for a compact building site covering an area of about 0.4 hectare,one bore hole or trial pit in the center and one at each corner will be sufficient.For larger areas,it may be useful to perform sounding test /cone penetration tests at a spacing of 50m to 100 m by dividing the area in a grid pattern.

Borehole Logs:

After the soil investigation has been completed and the results of laboratory tests become available, the ground conditions discovered in each boreholes are summarized in the form of a chart called borehole log. A borehole log contains following data-

(i) The soil profile with elevations of different strata

(ii) Ground water table

(iii) Termination level of borehole

(iv) The depth or range of depth at which samples are taken

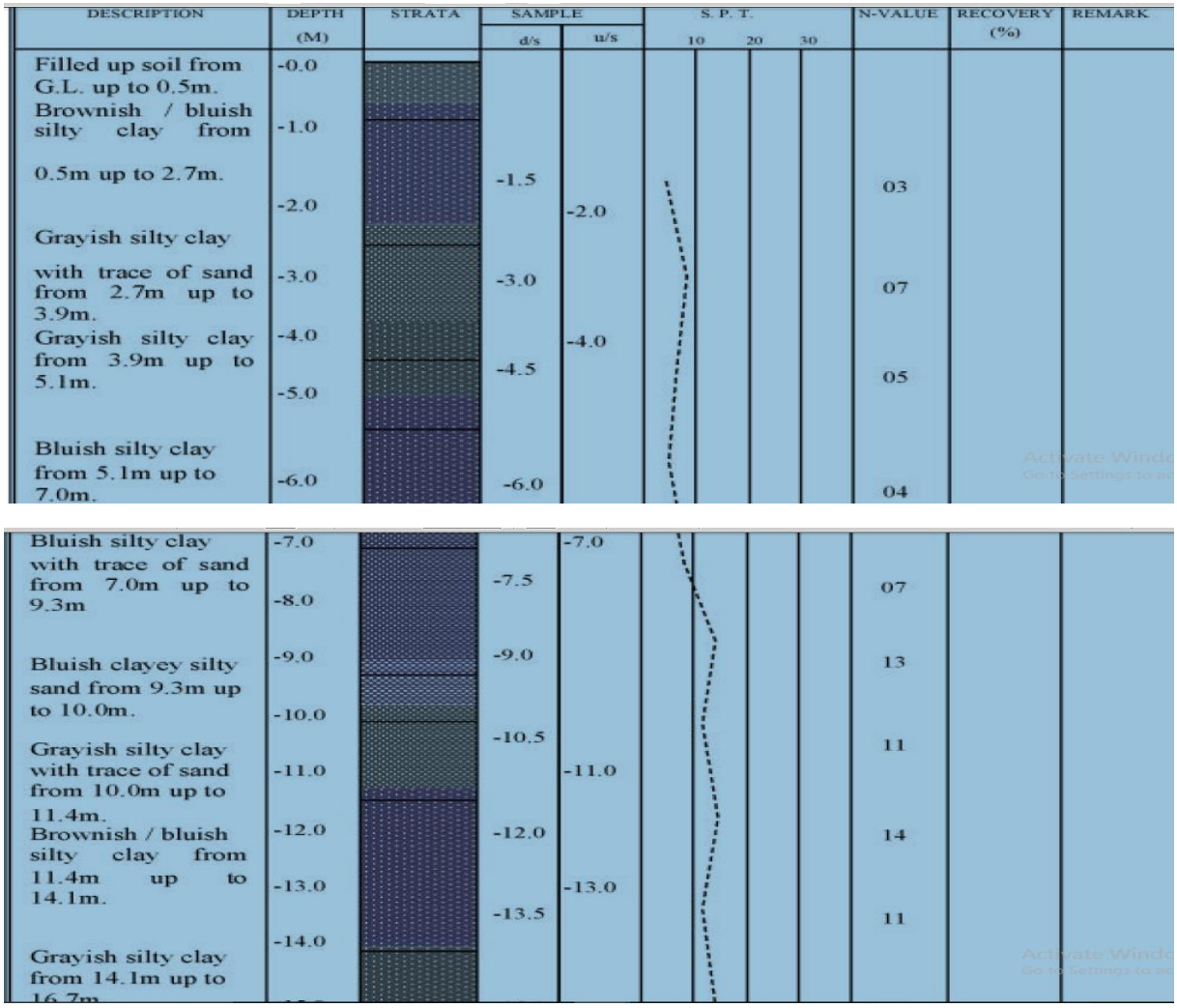
(v) Depths at which in-situ tests were performed

(vi) Type of soil sample

(vii) Results of important laboratory tests

(viii) N-values at the measured elevations

A sample of borehole log is shown below



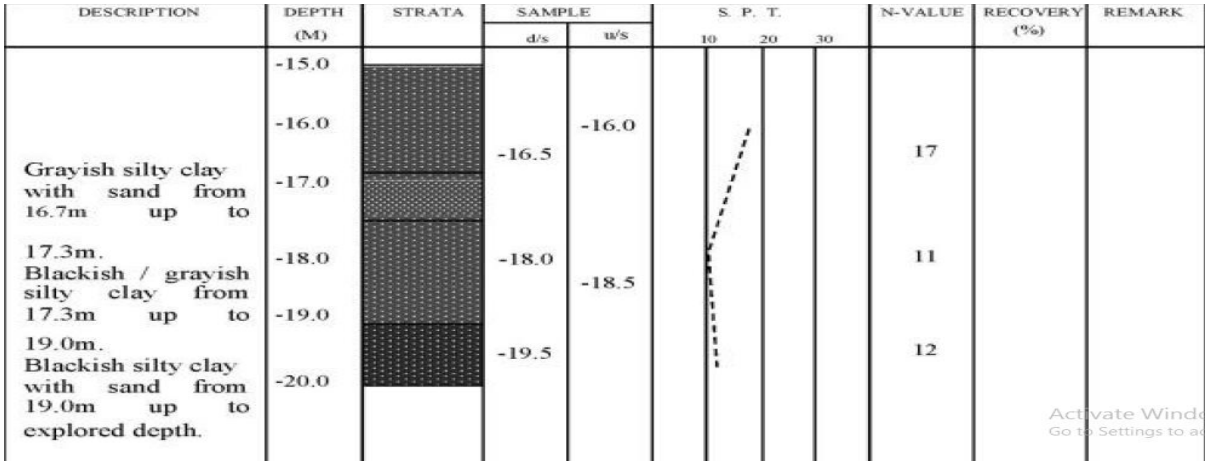


Fig 1 : BORE HOLE CHART

Conclusion:

- General interpretation both surface and sub- surface investigation.
- Importance Of alluvial plain sequence stratigraphy and it's geotechnical relationships.
- Importance of regional hazard maps.
- For any construction the soil that it's built on is of great importance.
- If the foundation is not set on soil ground it can have disastrous impact on the building, tunnel, bridge etc.
- Necessary for the design and construction of the new facilities for evaluating the causes of distress and developing remedies for the existing facilities.

Reference:

This list covers the most commonly used, and cited, guidelines and references. It is presented for information, and useful background, and is by no means an exhaustive list.

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