

Chapter 12

Subsurface Investigation

ABSTRACT

A good knowledge about a site including its subsurface conditions is very important in its safe and economical development. It is therefore an essential preliminary to the construction of any civil engineering work. This chapter outlines the objectives of site characterization and the general objectives of geotechnical investigation. It discusses the phases of field investigation and the stages of a full exploratory program including methods of sample recovery and field tests and sampling methods. Geophysical techniques can contribute very greatly to the process of ground investigation by allowing an assessment, in qualitative terms, of the lateral variability and vertical profiling of the near-surface materials beneath a site. Some of these geophysical techniques are discussed in the chapter. Laboratory examination/verification and testing should be made of representative portions of the samples to establish appropriate soil parameters. Some soil parameters may be estimated by correlations. The results of the subsurface investigation and related testing, together with interpretations, discussions, and foundation recommendations, are usually presented in the form of a detailed soil report.

12.0 SUBSURFACE INVESTIGATION

A good knowledge about a site is very important in the safe and economical development of the site. A thorough investigation of the site is therefore an essential preliminary to the construction of any civil engineering works. As a matter of fact, in many countries, public building officials usually require soil data together with the recommendations of the geotechnical consultant prior to issuance of a building permit.

12.0.1 Objectives of Site Investigation

1. To assess the general suitability of the site.
2. To know the nature of each stratum and engineering properties of the soil and rock, which may affect the design and mode of construction of proposed structure and foundation.
3. To foresee and provide against difficulties that may arise during construction due to ground and other local conditions.

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4. To find out the sources of construction material and selection of sites for disposal of water or surplus material.
5. To investigate the occurrence or causes of all natural and man-made changes in conditions and the results arising from such changes.
6. To ensure the safety of surrounding existing structures.
7. To design for the failed structures or remedial measures for the structures deemed to be unsafe.
8. To locate the ground water level and possible corrosive effect of soil and water on foundation material

Geotechnical investigations are performed by geotechnical engineers to obtain information as to the distribution, type and physical properties of subsurface and surface materials at project sites. They are required as an aid in the design, construction and maintenance of most civil engineering structures, Adeyeri (2013). The field and laboratory investigations required to obtain the above information are termed soil exploration. They are necessary for the solution to foundation, construction and groundwater problems and are usually required in a virgin territory and /or when additions and alterations to existing facilities are being contemplated.

A soil exploration program can be carried out in a number of ways including the use of test pits, trenching (particularly for locating faults and slide planes), boring, and in situ tests, Fell et al. (1992). Other methods of subsurface exploration include geologic mapping, photogrammetry and geophysical methods. Some of these are discussed later.

12.0.2 General Objectives of Geotechnical Investigation

The general objectives of geotechnical investigation are to:

1. Define lateral and vertical distribution of soil layers.
2. Define groundwater conditions.
3. Define the depth of the proposed foundation and its bearing capacity.
4. Identify potential foundation problems.
5. Identify geologic hazards.
6. Procure samples.
7. Perform In-Situ testing (SPT or CPT) and ex-situ tests.
8. Determine soil and rock properties.
9. Establish method of construction.
10. Determine suitability of the site material for construction.

12.0.3 Planning for Subsurface Exploration

The planning of the site exploration program involves location and depth of borings, test pits or other methods to be used, and methods of sampling and tests to be carried out. The purpose of the exploration program is to determine, within practical limits, the stratification and engineering properties of the soils underlying the site. The principal properties of interest will be the strength, deformation, and hydraulic characteristics. The program should be planned so that the maximum amount of information can be obtained at minimum cost. In the earlier stages of an investigation, the information available is

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