

Module 1: Introduction to Site Characterization:

Topics:

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- The Importance of Site Investigation
- Purposes of a Site Investigation
- Objectives
- Need for Site Characterization
- Advantages of Site Investigation

Keywords: *Soil investigation, site characterization, objectives, advantages, applications*

1.1 Introduction:

- Adequate knowledge of ground conditions is very important for analyses, design and construction of projects. Project delays, failures and cost over-run are the result of inadequate and inappropriate soil investigations.
- Hence, soil investigation must be part of the design process.
- Site characterization is the process of collection of information, appraisal of data, assessment and representation through maps without which the hazards in the ground beneath the site cannot be known.
- Modern site investigation differs from its forbears principally because of the need to quantify soil behaviour.
- Site investigation is considered to be an integral part of construction.
- For most construction projects, the variability of the ground and groundwater conditions is a major risk, which if not properly addressed can endanger the physical stability of the construction, either during construction or during the use of the building.
- In principle, all sites must be investigated if construction is to be safe and economical. In practice, the way in which they are investigated can vary widely and the costs and time necessary will be significantly different.
- During site characterization, information about the site necessary to develop a site conceptual model capable of supporting selection and implementation of remedial actions is gathered.
- Typical site characterization activities include evaluations of the historical uses of property, site reconnaissance and collection and analysis of environmental samples. Site investigation will often be carried out by specialists in the field of soil mechanics.
- A geotechnical investigation will include surface exploration and subsurface exploration of a site. Sometimes, geophysical methods are used to obtain data about the sites. Subsurface exploration usually involves soil sampling and laboratory tests of the soil samples retrieved.
- Geo-technical site characterization is usually done through in-situ tests (standard penetration and cone penetration tests), laboratory tests (plasticity, particle size analysis etc.).

- Surface exploration can include geologic mapping, geophysical methods and photogrammetry, or it can be as simple as a geotechnical professional walking around on the site to observe physical conditions.
- To obtain information about the soil conditions below the surface, some form of subsurface exploration is required.

1.2 The Importance of Site Investigation:

- 1) To study the general suitability of the site for an engineering project.
- 2) To enable a safe, practical and economic design to be prepared.
- 3) To determine the possible difficulties that may be encountered by a specific construction method for any particular civil project.
- 4) To study the suitability of construction material (soil or rock).
- 5) To prevent the delay of any construction project due to problematic ground conditions.

1.3 Purposes of a Site Investigation:

- A site investigation program is necessary to provide information for design and construction and for environmental assessment. The purposes of a soil investigation are:
 1. To evaluate the general suitability of the site for the proposed project.
 2. To enable an adequate and economical design to be made.
 3. To obtain physical and mechanical properties of soils for design and construction.
 4. To obtain groundwater conditions.
 5. To disclose and make provision for difficulties that may arise during construction due to ground and other local conditions.
 6. To determine suitability of materials for construction.

1.4 Objectives of Site Characterization:

- Site characterization is done with the following objectives:
 - Determination of the soil properties.
 - Development of map for the region.

1.5 Site characterization should provide the following information:

- The objectives of site investigation have been defined by the various Codes of Practice (BS CP 2001:1950, 1957; BS 5930:1981). They can be summarized as providing data for the following.

1.5.1 Site selection:

- The construction of certain major projects such as earth dams is dependent on the availability of a suitable site. Clearly, if the plan is to build them on the cheapest, most readily available land, geotechnical problems due to the high permeability of the sub-soil or slope instability may make the final cost of the construction prohibitive. Since the safety of lives has to be taken care of, it is important to consider the geotechnical merits or demerits of various sites before the site is chosen for a project of such magnitude.

1.5.2 Foundation and earthworks design:

- Generally, factors such as the availability of land at the right price, in a good location from the point of view of the eventual user, and with the planning consent for its proposed use are of over-riding importance. For medium-sized engineering works, such as motorways and multi-storey structures, the geotechnical problems must be solved once the site is available, in order to allow a safe and economical design to be prepared.

1.5.3 Temporary works design:

- The actual process of construction may often impose greater stress on the ground than the final structure. While excavating for foundations, steep side slopes may be used and the in-flow of groundwater may cause severe problems and even collapse. These temporary difficulties, which may in extreme circumstances prevent the completion of a construction project, will not usually affect the design of the finished works. They must however be the object of serious investigation.

1.5.4 The effects of the proposed project on its environment:

- The construction of an excavation may cause structural distress to neighbouring structures for a variety of reasons such as loss of ground and lowering of the groundwater table. This will result in prompt legal action. On a wider scale, the extraction of water from the ground for drinking may cause pollution of the aquifer in coastal regions due to saline intrusion, and the construction of a major earth dam and lake may not only destroy agricultural land and game, but may introduce new diseases into large populations. These effects must be the subject of investigation.

1.5.5 Investigation of existing construction:

- The observation and recording of the conditions leading to failure of soils or structures are of primary importance to the advance of soil mechanics, but the investigation of existing works can also be particularly valuable for obtaining data for use in proposed works on similar soil conditions. The rate of settlement, the necessity for special types of structural solution, and the bulk strength of the sub-soil may all be obtained with more certainty from back-analysis of the records of existing works than from small scale laboratory tests.

1.5.6 The design of remedial works:

- If structures are seen to have failed or to be about to fail, then remedial measures must be designed. Site investigation methods must be used to obtain parameters for design.

1.5.7 Safety checks:

- Major civil engineering works such as earth dams, have been constructed over a sufficiently long period for the precise construction method and the present stability

of early examples to be in doubt. Site investigations are used to provide data to allow their continued use.

1.6 Need for site characterization:

- 1) As the soil and rock deposition is irregular, they are notoriously variable and often have the properties which are undesirable for the proposed structure which jeopardize the structure if not understood and mitigated.
- 2) Site characterization helps in determining the nature of the site and its behaviour which influences the project.
- 3) The main purpose of site characterization is to reduce the economy.
- 4) It plays a very important role in the assessment and determination of the environmental effects.
- 5) Site characterization provides information regarding the geology, hydrology, hydrogeology, climatic conditions, radioactivity, etc., of the site.

1.7 Advantages of Site Characterizations:

- 1) Determines the nature of the site and its influence on the project.
- 2) It reduces the economy.
- 3) It enables an adequate and economical design to be made.
- 4) It provides information regarding the geology, hydrology, hydrogeology, climatic conditions, radioactivity, etc., of the site.
- 5) It determines the ground water conditions.