

Site Investigation

It is a set of office, laboratory and field studies aimed at exploring and evaluating the proposed sites to establish various engineering establishments to give recommendations on their suitability for the establishment of these projects that enable engineers developing the best designs, expecting potential problems and developing appropriate solutions to reduce human risks and economic losses.

Purposes of site investigation

- 1- Estimating the validity or suitability of the site for the establishment of the proposed project
- 2- Enabling the civil engineer to develop appropriate designs with good economic feasibility.
- 3- It helps to understand and evaluate the engineering difficulties and problems that are likely to occur during or after the construction process and resulting from the geological conditions of the proposed site.
- 4- It helps to verify the safety of the established engineering structures and to study the reasons that led or may lead to the occurrence of Various engineering problems, estimate risks and develop appropriate solutions to reduce human losses and financial damages.

Stages of site investigation

1- Preliminary site survey:

It represents a preliminary study of the site that may be sufficient for some small projects such as small facilities and buildings. A preliminary study for the second phase of site exploration in huge

projects such as dams and tunnels. This stage is less expensive than the following stages and includes the following:

- a) Studying available maps, researches and reports on the proposed site.
- b) Take a site exploration tour.
- c) Preparing preliminary geological maps.
- d) Collecting samples and drilling experimental wells.
- e) Using geophysical methods to understand the subsurface geological nature, especially when there is a need for a second stage in exploration operations.

2- Site Investigation

This stage aims at a detailed and accurate understanding of the geological structures and the nature and characteristics of rocks and soils. This phase includes:

- a) Preparing geotechnical maps, which represent geological maps with engineering expressions. Prepared according to the purpose of establishing the project.
- b) Studying the results of field examinations to provide detailed reports to assess the location.
- c) Drilling exploratory wells with depths, numbers and distances determined by the nature of the project to verify information aggregated and provide additional information that helps to understand the engineering properties of rocks and soils.

3- Foundation Investigation

The main objective of this process is to verify the results of the previous two phases, and some changes may occur to it.

Design based on what is explored at this stage

- a) Ensure the geology of the site during the excavation period for the purpose of establishing foundations.

b) Collecting soil and rock samples during the excavation process to study their characteristics.

Soil exploration methods

1. Excavation works below the surface to measure the change in the properties of the soil or rocks at the site without using any means of extraction visual inspection samples.
2. Exploration wells that enable the extraction of continuous or separate samples from the soil or rocks followed by investigating them in order to determine their properties visually and physically.
3. A combination of exploration wells and subsurface drilling to enable the extraction of soil samples to examine and test them in the laboratory and measure their properties.

Drilling methods

a. Excavated test pits (trial pits): -

Excavations are done manually using hand tools or automatically, so that it allows the soil layers to be seen in their natural and clear position.



b. Drilling with auger or drilling with auger and casing pipe: -

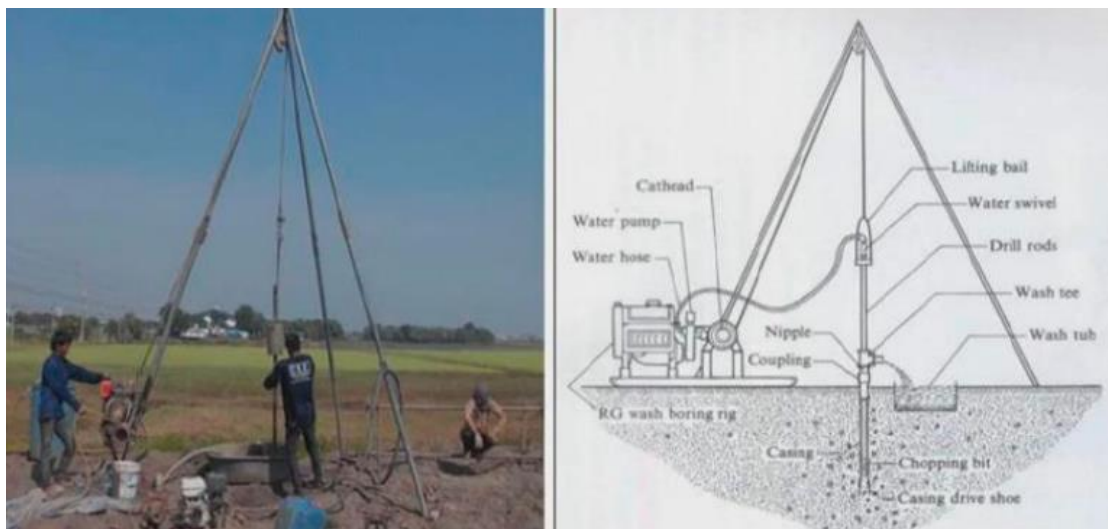
The drill consists of a machine made of steel and has sharp edge capable of digging the soil and the auger works economically to a depth of 5 m in

the stable and not collapsing soil, but if the excavation exceeds 5 m, then the packing pipes are used, and this method is considered suitable for soils with a large proportion of gravel and in rocky soils.

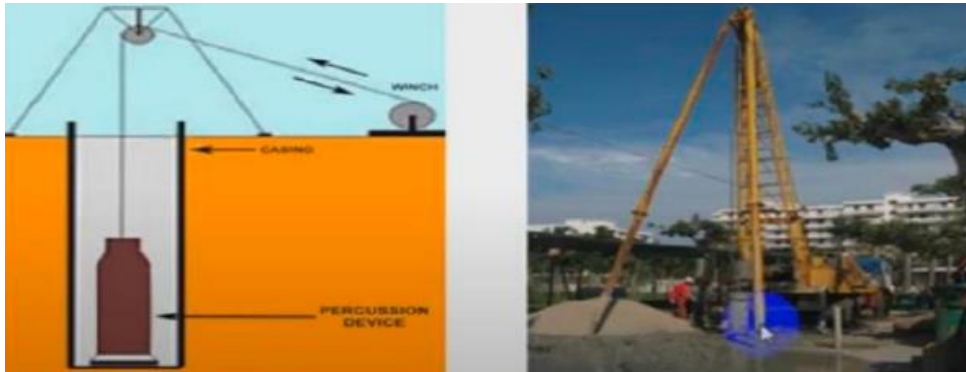


c. Excavation by shoveling method (washing): -

The soil is excavated by hammering on it with a chisel or a sharp tool, and water is pushed under the pressure in an internal tube that can rotate, go up or down, and the soil is extracted using pressurized water excavated from between the inner tube and the outer casing, where the excavation output indicates the current soil quality. When a change occurs in the quality of the excavation output, excavation is stopped, as it is considered an indication of a change in the quality of the layer soil being excavated.



d. Excavation by drilling:-This method is used especially in areas with hard soil and rocks ,the soil and rocks are fragmented By continuously hammering the bottom of the hole with a drill bit, and water is passed over the loosened soil. This method can be beneficial in soils containing layers by changing the rate of drilling speed



d. Rotary drilling: - The drilling rig is used to rotate the drilling head at high speed and pressure that leads to fragmentation soil and penetration of the head or drill bit. This method is accompanied by pumping water with mud through the drilling pipes to reduce friction and increase drilling speed.



Backfilled potholes

Upon completion of excavation and sampling, the excavation must be re-sealed with dry soil and compacted well, or concrete must be poured ordinary or cement mortar, so that these excavations do not cause soil compaction or be a passage for groundwater or any other dangers.

Types of soil samples

- 1- **Undisturbed Samples:** These are the samples that are extracted without disturbance for its natural composition, samples are extracted by drilling machines from wells, using special tubes, as well as samples can be taken from the experimental pits in the form of pieces or lumps of soil. The extracted samples are packaged by wax or paraffin, in order to ensure the stability of nature's characteristics, the most important of which is moisture. The purpose of this sampling is the study of the mechanical properties of the soil through shear, compaction, permeability and other tests.
- 2- **Disturbed Samples:-** These are samples obtained through degradation methods manual and simple tools or boreholes without focusing on the natural installation mode of the auger or hammer drill or washing. The purpose of these samples is to take a quick initial idea of the soil, its formation and classification in addition to the chemical and physical properties such as moisture content, specific weight, sulfate and chloride content, etc.

Soil Tests

- 1- Soil physical properties: These are the properties related to the nature of the soil, soil moisture content, fluidity limits, plasticity, specific gravity, density, voids ratio, and degree of saturation and others.
- 2- The mechanical or engineering properties of the soil (Mechanical Properties): It means properties and behavior soil under the influence of loads, such as soil resistance to shear, compressive strength, and others.
- 3- The chemical properties of the soil: it means the chemical substances present in the soil, which negatively affect concrete foundations, such as sulfate content, chloride content, and soluble salts and others.