Geotechnical Investigation of soil and rocks.

Introduction:

Engineering geology is the application of the science of geology to the technology of ground engineering.

The subject requires a comprehensive knowledge of geology, as well as an understanding of engineering properties and behaviour of the geological materials.

The practice involves site investigation and site characterization specific to the needs of the engineering project.

The geotechnical engineer plays a key role in most civil engineering projects as most structures are built on or in the ground. Geotechnical engineers assess the properties and behaviour of soil and rock formations.

1. Geotechnical engineering:

It is a collective term for the more individual disciplines of:

Soil mechanics ,

Foundation engineering ,

Engineering geology and hydrology ,

Environmental science ,

Rock mechanics ,

Rock engineering ;and Other related disciplines to civil engineering design and construction.

The geotechnical engineer may, for example, assess the materials to be used for the stability of dams, roads, channels, bridges, highways, UG pipelines, tunnels and airport runways.

Investigations:

Site evaluation for geomorphology, geology, structure, strong and weak zones, seismicity.

Materials evaluation for their suitability (for foundation, stability of structure,construction.

In-situ testing to evaluate rock mass

deformation modulus and shear strength is sometimes required for the design of foundations for major structures such as dams and bridges, however, such testing is not performed for structural foundations or slopes associated with typical highway applications.

A laboratory-testing program consists of index tests to obtain general information on material consistency and performance tests to measure specific properties (e.g., shear strength, compressibility, hydraulic conductivity) for design and constructability assessments.

3. TWO different Properties of Rocks:

The properties of rock fall into two broad classes: a) rock material properties relating to the rock itself and b) rock mass properties relating to the in-place rock mass, including its discontinuities.

4. Rock material properties that are essential in assessing hydraulic erodibility of rock include rock type, color, particle size, texture, hardness, and strength.

Seismic velocity, weathering, and secondary cavities are properties related to both the rock material and mass.

5. **Rock mass properties** are comprised of features generally observed, measured, and documented in the field for in-place rock.

The properties of a rock mass are significantly different from the properties of samples of the same rock mass.

The strength and mechanical behavior of the rock mass are commonly dominated more by the nature of its mass properties than by its material properties.

6. ROCK (sample) MATERIAL PROPERTIES:

Rock material properties are measurable or describable lithologic properties of rock material that can be evaluated in hand specimens or tested in the laboratory.

Rock material properties are related to the physical properties of the rock-forming minerals and the type of mineral bonding.

Properties are determined from hand specimens, core sections, drill cuttings, outcroppings, and disturbed samples using qualitative procedures, simple classification tests, or laboratory tests.

7. Punch-Penetration Index Test:

The punch-penetration index test evaluates the penetration resistance of the intact rock cores. Because the punch-penetration test actually penetrates the rock, it provides the capability to reveal some important rock excavatability features that other tests may fail to illustrate.

One important feature which the punch-penetration test has been successful in identifying is rock toughness.

8. Thin Section Petrographic Analysis :

Thin section petrographic analysis is used to evaluate the mineralogy of the intact rock cores. In petrography, the mineral content and the textural relationships within the rock are described in detail.

9. Elasticity:

The elasticity is the property of a substance to deform with external forces and return to its original shape when the stress is removed.

The deformation fully capable of restoration is called elastic deformation.

Within the range of the
elastic deformation,
the ratio of the stress (***0)***to
the strain ***(E)*** is a constant ***(E)*** which is known as elastic modulus, namely, *E*= ***O/ E***.
The elastic modulus is a measure of the ability to resist deformation.

10. Plasticity:

The plasticity describes the deformation of a material undergoing non-reversible changes of shape in response to external forces.

This non-reversible deformation is called plastic deformation.