RESEARCH ARTICLE OPEN ACCESS

Geology aspects in Civil Structure Constructions

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Abstract:

Aspects of Geology are of immense importance in Civil Structure Constructions. The detailed investigation of Geology plays an important role in structural design of various civil engineering structure foundations. As well as it is important to develop and explore quarries for various construction materials. Construction of dam, tunnel, reservoir and other civil engineering projects under the consideration of safety precaution, and using material are more stable, durable and economical due to the knowledge of geology. Rocks are the most common material which is used in the construction of foundation. The local geology of an area is important when planning a major construction .The full knowledge of geology increase the strength, stability, and durability of civil engineering projects.

Keywords — **Aspects, Geology, structure, quarries, Rocks etc.**

1.1 INTRODUCTION

Engineering geology is the application of the geology to engineering study for the purpose of assuring that the geological factors regarding the location, design, construction, operation and maintenance of engineering works are recognized and accounted for.

Engineering geologists provide geological and geotechnical recommendations, analysis, and design associated with human development and various types of structures. The realm of the engineering geologist is essentially in the area of earth-structure interactions, or investigation of how the earth or earth processes impact human made structures and human activities.

Engineering geology studies may be performed during the planning, environmental impact analysis, civil or structural engineering design, value engineering and construction phases of public and private works projects, and during post-construction and forensic phases of projects. Works completed by engineering geologists include; geological hazard assessments, geotechnical, material properties, landslide and slope stability, erosion, flooding, dewatering, and seismic investigations, etc.

Engineering geology studies are performed by a geologist or engineering geologist that is educated, trained and has obtained experience related to the recognition and interpretation of natural processes, the understanding of how these processes impact human made structures (and vice versa), and knowledge of methods by which to mitigate against hazards resulting from adverse natural or human made conditions. The principal objective of the engineering geologist is the protection of life and property against damage caused by various geological conditions.

The practice of engineering geology is also very closely related to the practice of geological engineering and geotechnical engineering. If there is a difference in the content of the disciplines, it mainly lies in the training or experience of the practitioner.

1.2 TYPES OF ROCKS AND LOAD CARRYING CAPACITY

Table 1.2.1 Rock load carrying capacity

Uniaxial Compressive Strength		Ranges for some Common Rock Material
Term	Kg/cm^2	
VERY WEAK – VW	**< 70**	**1. Schist, siltstone- VW-W**
WEAK - W	**70-200**	**2. Sandstone , limestone VW-M**
MEDIUM STRONG - MS	**200-700**	**3. Granite,Basalt,Gniess, Quartzite, Marble – MS-VS**
SRTONG – S	**700-1400**	
VERY STRONG -VS	**>1400**	

I. Schist -

Schist (pronounced /ʃɪst/ SHIST) is a medium-grade metamorphic rock. Schist has medium to large, flat, sheet-like grains in a preferred orientation (nearby grains are roughly parallel). It is defined by having more than 50% platy and elongated minerals (such as micas or talc), often finely interleaved with quartz and feldspar. These lamellar (flat, planar) minerals include micas, chlorite, talc, hornblende, graphite, and others. Quartz often occurs in drawn-out grains to such an extent that a particular form called quartz schist is produced. Schist is often garnetiferous. Schist forms at a higher temperature and has larger grains than phyllite. Geological foliation (metamorphic arrangement in layers) with medium to large grained flakes in a preferred sheetlike orientation is called schistosity.

The names of various schists are derived from their mineral constituents. For example, schists primarily composed of biotite and muscovite are called mica schists. Most schists are mica schists, but graphite and chlorite schists are also common. Schists are also named for their prominent or perhaps unusual mineral constituents, as in the case of garnet schist, tourmaline schist, and glaucophane schist.

II. Siltstone –

Siltstone is a clastic sedimentary rock. As its name implies, it is primarily composed (greater than 2/3) of silt sized particles, defined as grains 2–62 µm or 4 to 8 on the Krumbein phi (φ) scale. Siltstones differ significantly from sandstones due to their smaller pores and higher propensity for containing a significant clay fraction. Although often mistaken as a shale, siltstone lacks the fissility and laminations which are typical of shale.

Siltstones may contain concretions. Unless the siltstone is fairly shaly, stratification is likely to be obscure and it tends to weather at oblique angles unrelated to bedding. Mudstone or shale are rocks that contain mud, which is material that has a range of silt and clay. Siltstone is differentiated by having majority silt, not clay.

III. Sandstone –

Sandstone is a clastic sedimentary rock composed mainly of sand-sized (0.0625 to 2 mm) mineral particles or rock fragments.

Most sandstone is composed of quartz or feldspar (both silicates) because they are the most resistant minerals to weathering processes at the Earth's surface, as seen in Bowen's reaction series. Like uncemented sand, sandstone may be any color due to impurities within the minerals, but the most common colors are tan, brown, yellow, red, grey, pink, white, and black. Since sandstone beds often form highly visible cliffs and other topographic features, certain colors of sandstone have been strongly identified with certain regions.

IV. Limestone –

Limestone is a sedimentary rock, composed mainly of skeletal fragments of marine organisms such as coral, forams and molluscs. Its major materials are the minerals calcite and aragonite, which are different crystal forms of calcium carbonate ($CaCO_3$).

About 10% of sedimentary rocks are limestones. The solubility of limestone in water and weak acid solutions leads to karst landscapes, in which water erodes the limestone over thousands to millions of years. Most cave systems are through limestone bedrock.

Limestone has numerous uses: as a building material, an essential component of concrete (Portland cement), as aggregate for the base of roads, as white pigment or filler in products such as toothpaste or paints, as a chemical feedstock for the production of lime, as a soil conditioner, or as a popular decorative addition to rock gardens.

V. Granite –

Granite (/ˈɡrænɪt/) is a common type of felsic intrusive igneous rock that is granular and phaneritic in texture. Granites can be predominantly white, pink, or gray in color, depending on their mineralogy. The word "granite" comes from the Latin granum, a grain, in reference to the coarse-grained structure of such a holocrystalline rock. Strictly speaking, granite is an igneous rock with between 20% and 60% quartz by volume, and at least 35% of the total feldspar consisting of alkali feldspar, although commonly the term "granite" is used to refer to a wider range of coarse-grained igneous rocks containing quartz and feldspar.

The term "granitic" means granite-like and is applied to granite and a group of intrusive igneous rocks with similar textures and slight variations in composition and origin. These rocks mainly consist of feldspar, quartz, mica, and amphibole minerals, which form an interlocking, somewhat equigranular matrix of feldspar and quartz with scattered darker biotite mica and amphibole (often hornblende) peppering the lighter color minerals.

VI. Basalt –

Basalt is a mafic extrusive igneous rock formed from the rapid cooling of magnesium-rich and iron-rich lava exposed at or very near the surface of a terrestrial planet or a moon. More than 90% of all volcanic rock on Earth is basalt. Basalt lava has a low viscosity, due to its low silica content, resulting in rapid lava flows that can spread over great areas before cooling and solidification. Flood basalt describes the formation in a series of lava basalt flows.

Genetic group	mm (sieve no.)	Detrital sedimentary		Chemical organic	Metamorphic		Pyroclastic	Igeneous			
Usual structure		Bedded		Bedded	Foliated	Massive	Bedded	Massive			
Composition		Grains of rock, quartz, feldspar, and clay minerals	At least 50% of grains are of carbonate	Salts, carbonates, silica, carbonaceous	Quartz, feldspars, micas, dark minerals	Quartz, feldspars, micas, dark minerals, carbonates	At least 50% of grains are of igneous rock	Quartz, feldspars, micas, dark minerals		Feldspar; dark minerals	Dark minerals
								Acid	Intermediate	Basic	Ultrabasic
Very coarse-grained		Grains are of rock fragments Rounded grains: CONGOMERATE (11)	(undifferentiated) CALCIRUDITE	CLINKER (31) SALINE ROCKS Gypsum (34) Halite (32) Anhydrite (33)	TECTONIC BRECCIA (41) MIGMATITE (42)	METACON-GLOMERATE (51)	Rounded grains: AGGLOMERATE (61)	PEGMATITE (71) GRANITE	DIORITE (81)	GABBRO	PYROX-
Coarse-grained	75 (3")	Angular grains: BRECCIA (12)	(23)		GNEISS (43)	MARBLE (52) GRANULITE (53)	Angular grains: VOLCANIC BRECCIA (62)	(72)	GRANODIORITE (82)	(91)	ENITE (01)
Medium-grained	4.75 (4)	Grains are mainly mineral fragments SANDSTONE (13) ARKOSE (14) GRAYWACKE (Argillaceous ss) (15)	CALCARENITE (27)	CALCAREOUS ROCKS	SCHIST (44)	QUARTZITE (54)	TUFF (63)	SYENITE (73)	ANORTHOSITE (83)	DIABASE (92)	PERIDO-TITE
Fine-	0.074				Amphibolite (45)			APLITE	MONZONITE		(02)
Very fine-grained	0.005	MUDSTONE (16) SHALE: fissile mudstone (17) SILTSTONE>50 % fine-grained particles (18) CLAYSTONE>50 % very fine grained particles (19)	CALCISILTITE (25) CHALK (26) CALCILUTITE (27)	LIMESTONE (35) DOLOMITE (36)	PHYLLITE (46) Mylonite (47) SLATE (48)	HORNFELS (55)	Fine-grained TUFF (64) Very fine-grained TUFF (65)	RHYOLITE or FELSITE (75)	Dacite (85) ANDESITE (86)	BASALT (93)	DUNITE (03) NEPHELINE-BASALT (04)
Glassy amor-phous				SILICEOUS ROCKS Chert (37) Flint (38) CARBONACEOUS ROCKS LIGNITE/COAL (39)	Ultramylonite (49)		Welded TUFF (66) PUMICE (67)	VOLCANIC GLASSES OBSIDIAN (76)	PITCHSTONE (87)	TACHYLYTE (87)	

ROCK TYPE CLASSIFICATION

1.3. CONCLUSIONS

1.3.1. Refinement of the engineering-geologic conditions of the foundation and properties of clay foundation soil of earth dams being constructed under complex engineering-geologic conditions should be carried out during investigations at the design stage of test embankments and also on fragments of the real structure in the initial period of its construction. These investigations promote an increase of reliability and economy of earth dams.

1.3.2. Comprehensive engineering-geologic investigations during surveys and designing of earth dams do not always permit obtaining sufficiently complete and objective data on the geological structure of the foundation and design characteristics of soil with consideration of their change with time

1.3.3 Timely consideration of the specific characteristics of the foundation of each planned earth dam and refinement of the properties of the foundation soil in an undisturbed mass are the main condition of reliability of the forecasts of consolidation and stability of the dam slopes.