IQRA NATIONAL UNIVERSITY PESHAWER

Paper:
ENGINEERING GEOLOGY

B-tech(civil)

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Question 1:

Why is geology essential when it comes to the domain of civil engineering? Analyze the involvement of Geology in all the aspects of a construction project?

Ans:

Importance of Geology in civil Engineering

Geology is the study of earth, the materials of which it is made, the structure of those materials and the effects of the natural forces acting upon them and is important to civil engineering because all work performed by civil engineers involves earth and its features. Fundamental understanding of geology is so important that it is a requirement in university-level civil engineering programs. For a civil engineering project to be successful, the engineers must understand the land upon which the project rests. Geologists study the land to determine whether it is stable enough to support the proposed project. They also study water patterns to determine if a particular site is prone to flooding. Some civil engineers use geologists to examine rocks for important metals, oil, natural gas and ground water.

Geology aspects in construction project

The construction of large civil engineering projects requires knowledge of the geology of the area concerned. The geology of an area dictates the location and nature of each of the following structures: Dams, Building foundations, roads and railways. Describe the causes of failure of the slope and possible preventive measures. Discuss a geologist's role in a large civil engineering project's feasibility study and site selection stages.

Engineering Geology helps to ensure a stable and cost-effective model for construction projects. Gathering geological information for a project site is important in the planning, design, and construction phase of an engineering project. Carrying out a detailed geological survey of the area before starting the project would reduce the overall cost of the project. Common fundamental problems in reservoirs, bridges and other buildings are usually directly related to the geology of the region in which they were constructed.

Some civil engineering works require some digging of soils and rocks, and they include the charging of the Earth by building on it. In some cases, excavated rocks may be used as building material, and in others, rocks may form a major part of the finished product, such as a highway or a site f or a dam. The feasibility, planning and design, construction and costing of the project and the safety of the project that depend critically on the geological conditions under which the construction will take place. This is particularly the case in the expanded' Greenfield' sites, where the area affected by the project stretches for kilometers over relatively undeveloped land. Sources include the design of the Channel Tunnel and the building of motorways

Question 2:

(a) Give some possible reasons of post-volcanic changes.

Ans:

Causes of volcanoes •

When a part of the earth's upper mantle or lower crust melts, magma forms. A volcano is essentially an opening or a vent through which this magma and the dissolved gases it contains are discharged. Although there are several factors triggering a volcanic eruption, three predominate: the buoyancy of the magma, the pressure from the exsolved gases in the magma and the injection of a new batch of magma into an already filled magma chamber.

The buoyancy of the magma:

As rock inside the earth melts, its volume increases producing a melt that is less dense than the surrounding rock. This lighter magma then rises toward the surface by virtue of its buoyancy. finally, the magma reaches the surface and erupts.

The pressure from the gases in the magma:

Magmas also contain dissolved volatiles such as water, sulfur dioxide and carbon dioxide. Experiments have shown that the amount of a dissolved gas in magma at atmospheric pressure is zero, but rises with increasing pressure.

Injection of new magma into a chamber that is already filled with :

This injection forces some of the magma in the chamber to move up in the conduit and erupt at the surface.

Although volcanologists are well aware of these three processes, they cannot yet predict a volcanic eruption. But they have made significant advances in forecasting volcanic eruptions. Forecasting involves probable character and time of an eruption in a monitored volcano. The character of an eruption is based on the prehistoric and historic record of the volcano in question and its volcanic products. For example, a violently erupting volcano that has produced ash fall, ash flow and volcanic mudflows (or lahars) is likely to do the same in the future.

Effects of volcanoes:

The effects of volcanic eruptions can be divided into primary and secondary effects. The primary effects are immediate and come from the eruption itself whereas The secondary effects result from the primary effects.

Primary effects of a volcanic eruption:

Volcanic gases:

All magma contains dissolved gases That are release during and between eruptions. These gases are mainly steam, carbon dioxide and compounds of sulphur and chlorine.

Lava flows:

Lava flows are streams of molten rock that pour or ooze from an erupting vent. Lava is erupted during either nonexplosive activity or explosive lava fountains. The speed at which lava moves across the ground depends on several factors,

Pyroclastic flows

These are high speed avalanches of hot ash, rock fragments and gas which move down the sides of a volcano. These flows occur when the vent area or ash column collapses.

Tephra

The explosive power of an eruption causes old lava to be blasted into tiny pieces and hurled into the air. The fragments are tephra.

Secondary effects of a volcanic eruption:

Lahars

These are mixtures of water, rock, ash, sand and mud that originate from the slopes of a volcano. Lahars often happen because of heavy rainfall eroding volcanic deposits or heat from a volcanic vent suddenly melting snow and ice.

Landslides

Heat from cooling magma can cause hydrothermal alteraton of the rocks, turning sections of them into clay. This weakens the rocks and increases the risk of slope failures.

Flooding

Explosive eruptions can change the surface areas around a volcano and disrupt drainage patterns, leading to long- term flooding.

(b) Explain how the amount of SiO_2 ultimately effects the composition of igneous rocks?

Ans:

Igneous rocks are commonly classified by their composition and texture. Most are composed of the eight most abundant elements in the Earth's crust. Because of the dominance of oxygen and silicon in the crust, igneous rocks are mostly made up of silicate minerals. These silicates can be generally divided into light and dark silicates. The dark silicates are also called ferromagnesian because of the presence of iron and magnesium in them. They include olivine, pyroxene, amphibole and biotite. The light-colored silicates include quartz, muscovite and feldspar.

Solidification from magma produces great diversity in the mineral compositions which make up the rocks. There are general categories which are keyed to the amounts of light and dark silicates in the rocks. At the light-colored extreme are rocks made up mainly of quartz and the feldspars, with about 70% silica. Such rocks are called granitic rock. Rocks which contain large amounts of the ferromagnesian dark matter and about 50% silica are said to have basaltic composition. Some organization was brought to the continuous variation between these extremes by the Bowen reactions. This model of the process of solidification from magma pictures the processes which causes the composition of the magma and the subsequent rocks to change.

Question 3: Why does weathering occur? Make a comparative analysis of different forms of weathering.

Ans:

Weathering

Weathering is the breakdown of rocks and minerals “in situ,” meaning it occurs without major movement of the rock materials. Weathering happens through processes or sources in the environment, including events like wind and objects like the roots of plants. Weathering is either mechanical, in which rocks are broken down through an external force, or chemical, which means rocks are broken down through a chemical reaction and change.

There are four different types of weathering.

1. Physical weathering
2. Freeze-thaw weathering
3. Chemical weathering
4. Biological weathering

1. PHYSICAL WEATHERING

Physical weathering is caused when there are physical changes. For example the changes in temperature and even the effects of the wind, rain and waves. When a rock gets hot, it will expand and when a rock gets cold it contracts. After this happens the rock begins to crack. This example is called Onion Skin/ Exfoliation weathering. Weathering can also occur when it is exposed to the wind, rain and even waves. Wind can blow tiny parts of sand against a rock causing the rock to break apart slowly. Rain and waves can also wear away rocks if they contain more acid in them, they can wear away rocks fast however if they don't contain much acid it will still wear away rocks however slower.

2. FREEZE-THAW WEATHERING

Another common type of mechanical weathering is freeze-thaw weathering, which happens when weather fluctuates above and below 0 degrees Celsius (32 degrees Fahrenheit). Water flows into the cracks in rocks, but when it freezes, the water crystallizes into a hexagonal form, which takes more space than liquid water, according to the HyperPhysics site maintained at Georgia State University. During the day, the ice will thaw and refreeze again when the temperature drops. This process widens the cracks in rocks and eventually breaks them apart.

3. CHEMICAL WEATHERING

Chemical weathering refers to the process by which rocks break down through chemical reactions; this weathering happens on a molecular level. This type of weathering causes rocks to decompose and occurs most often in warm and humid climates. All rainfall contains carbonic acid, which chemically reacts with the calcium carbonate in rocks like chalk and limestone through a process called carbonation. The rock becomes soluble in water, so the rock gradually dissolves as rain falls on it. Rocks that contain iron minerals oxidize, or rust, which chemically changes the structure of the rock and causes it to break apart.

4. BIOLOGICAL WEATHERING

Biological weathering combines both mechanical and chemical weathering and is caused by plants or animals. As plant roots grow deeper to find sources of water, they push through cracks in rocks, applying force to push them apart. As the roots grow, the cracks become larger and break the rocks into smaller pieces. When plants die, they produce acid as they decompose, causing a chemical reaction in the rock that further dissolves parts of rocks. Essentially plants can make their own soil in this way, allowing the crumbling crack to be more hospitable to the next seed that lodges there. Animals, including humans, can also cause biological weathering through frequent movement over a rock. This friction wears away bits of surface material.