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**SECTION (A)**

**DEPARTMENT BE(C)**

**PAPER GEOLOGY**

**Q1.What causes earthquakes?**

Ans. **An earthquake is caused** by a sudden slip on a fault. The tectonic plates are always slowly moving, but they get stuck at their edges due to friction. When the stress on the edge overcomes the friction, there is an earthquake that releases energy in waves that travel through the earth's crust and cause the shaking that we feel.

**SECOND CAUSE**

**Earthquakes are usually caused** when rock underground suddenly breaks along a fault. This sudden release of energy causes the seismic waves that make the ground shake. When two blocks of rock or two plates are rubbing against each other, they stick a little. They don't just slide smoothly; the rocks catch on each other. The rocks are still pushing against each other, but not moving. After a while, the rocks break because of all the pressure that's built up. When the rocks break, the earthquake occurs.

**Q2. Differentiate between primary and secondary waves?**

**Ans.** **Primary waves**

* It is the first wave which we fell in earth quake
* Primary waves travel through the earth surface
* Primary waves travel faster as compare to secondary
* It moves in a push pull pattern
* They shake the ground back and fourth
* Typically speeds are 330m/s in air
* 1450m/s in water
* 5000m/s in granite

It can pass through both solid and molten rock

**Secondary waves**

* it is the second wave which we fell in earthquake
* secondary waves travel 1.7 times slower
* they cause less damage because they are bigger

Secondary waves shake the ground horizontally

**Q. If the Richter magnitude reaches at 8 or above what will be the consequences?**

 **Ans** when the Richter magnitude reaches at 8 or above then it will change to destruction of houses buildings roads and bridges.

**Q2 Describe the role of geology in selection of sites for dams and reservoirs?**

# Ans. Topographical studies

# Reservoir location

# Petrology studies

# Mineralogy studies

# Geological factors

# General examination of rocks

# Preliminary drill hole study

# The role of geology in selection of sites for dams and reservoirs

# Dams are engineering structures constructed for different purposes. They are of different sizes, shapes and types. In all cases, many essential studies should be carried out before deciding the location, type and size of the dam. Among those studies is the geological investigations which should be carried out to deduce the geological conditions in the most relevant site, depth of the foundations and their types, cut-off depth, type of the available construction materials, and type of the expected geological hazards. Without proper geological investigations, the siting of a dam will cause serious hazards during construction and during commissioning of the dam. In this study, Mosul Dam case is considered as the consequences of inadequate geological investigations which were carried out by the contractor and supervised by Swiss Consultant. The location of the dam site and its foundations are built over a highly karstified area, where gypsum and limestone beds are exposed and exist deep under the ground surface, and even deeper than the foundations. Accordingly, grouting treatment was carried out and still on going, but all the attempts to have a safe and relevant dam were in vain. In this study we have provided the essential studies which should be included during the geological investigation to have a safe and sound dam.

**The geological investigations should include four main topics; these are**

 1.

The geology of the dam site including the foundation for the dam itself and the sites for other structures such as spillway, diversion tunnel and outlet works. To check whether the dam foundation has sufficient strength and durability to support the type of dam proposed, whether the foundation is watertight, especially, when karstified rocks occur in the site and in deeper horizons bellow the foundations.

2.

The geology of the area to be occupied by the reservoir once the dam is completed. Whether the storage area is watertight or are there areas of cavernous limestone and/or gypsum which might lead to the dam not retaining water.

3.

Stability of the slopes in the dam site and reservoir area whether landslides into the reservoir are possible which might cause a wave of water to be pushed over the top of the dam.

4.

Finding sources of the construction materials which will be needed to build the dam in nearby areas of the dam site including all required types like: aggregates of different types and sizes, filling materials in the core and both surfaces (if the dam is of earth-fill type).

**Q3.What are the different types of mass wasting ? Also explain the protective measure of land slide ?**

**ANS Types of mass wasting**

**FAST MOVEMENTS**

* ROCK AND DEBRIS FALL
* FLOW
* SLUMPS
* ROCK AND DEBRIS SLIDES

**SLOW MOVEMENTS**

* CREEP
* SOLIFLUCTION
* PERMAFROST

**EXPLANATION**

|  |  |
| --- | --- |
| **Flows** | occur when soil or rock acts like a liquid |

**Slumps**

|  |  |
| --- | --- |
|  | a slice of material that moves as one piece along a curved surfaceA slump is a form of [mass wasting](https://en.wikipedia.org/wiki/Mass_wasting) that occurs when a coherent mass of loosely consolidated materials or a rock layer moves a short distance down a [slope](https://en.wikipedia.org/wiki/Grade_%28slope%29).[[1]](https://en.wikipedia.org/wiki/Slump_%28geology%29#cite_note-1) Movement is characterized by sliding along a concave-upward or planar surface. Causes of slumping include [earthquake](https://en.wikipedia.org/wiki/Earthquake) shocks, thorough wetting, freezing and thawing, undercutting, and loading of a slope. |

|  |  |
| --- | --- |
| **Landslides** | made up of unconsolidated rock; includes rockslides and avalanches |
|

|  |  |
| --- | --- |
| **Creeps** |  material that moves slowly down gently sloping areas |

 |  |

**Rock and Debris slides**

Rock and debris slides happens when a rock or debris slide down a preexisting surface

**Solifluction**

Solifluction is a collective name for gradual processes in which a mass moves down a slope related to freeze-thaw activity

Solifluction is flow of saturated soil down slope at rate of a few millimeters or a few centimeters per day or per year

 **Permafrost**

Permafrost is ground that continuously remains frozen for two or more years

 Slow landslide due to slowly melting of permanently frozen ground

**Protective measure of land slides**

* Installation of drainage pipes for **rainwater**
* slope drainage
* Planting of slopes that are vulnerable to landslides with deep-rooted trees and shrubs.
* Reinforcement of floor slabs and external walls in existing buildings
* Revigitation with green plants that have deep roots
* **Terracing**  redistributes mass along a slope and reduces the slope angel
* **Retaining wall can catch debris**
* **Rock bolts can be used to stabilized coherent masses .**
* Do not put yard waste on the slope
* Do not have an irrigation system on a hillside.
* Do not add additional water from downspouts to slopes from storm water runoff being directed to a hillside.

**Q4.Diffrentiate fault joint and fold?**

**Ans Fault**

Fracturing and displacement of rock strata

**Faults**

are defined as the displacement of rock that were once connected along a **fault** line.

**Joint**

Fracture along which no displacement has occurred

**Folds**

In response to compression force the strata mat bend and buckle these are called fold are bends in rocks that are due to compressional forces. Folds are most visible in rocks that layered (also known as sedimentary rocks). Folds are formed when heat and pressure is applied to the rock.

 **(a) What do the normal faults cause to the crust of the earth?**

a) Faults are cracks in the earth crust along which there is movement these can be massive or very small if tension builds up along fault and then suddenly released the result is an earth quake

**(b) Folds develop in which type of rock?**

b) The folds may develop in any type of rock and may be of any shape and flexures

**c) What is the effect of faulting on outcrops?**

Ans Faulting is essentially a process of rupturing and displacement along the plane of rupture

**Effects**

* Changes in the elevation of the ground
* Omission of some strata

Where they are normally expected repetition of some strata in a given direction and displacement and shifts in the continuity of the same rocks in certain region .

**(4) THE ANSWER IS D**

**MUST BE AVOIDED TO POSSIBLE EXTENT TO BE BUILD ON ALL THREE**

**Q(5) Describe tunneling on the basis of geology? Also determine geological investigation for tunnels?**

**ANS Definition**

 Tunnels may be defined as underground routes or passages driven through the ground without disturbing the overlaying soil or rock over

**Types**

* **Traffic tunnels**
* **Hydropower tunnels**
* **Public utility tunnels**

Tunnels can be regarded as real masterpieces in the underground. One requires extensive geological data and forecasts on the rock mass and groundwater conditions for a successful underground construction. A construction site’s rock mass is designated as loose or solid rock, according to various SIA standards and recommendations, in the domain of an underground construction project. This includes all of its ingredients e.g., groundwater, gas and contamination.

A tunnel is an underground passageway, dug through the surrounding soil/earth/rock and enclosed except for entrance and exit, commonly at each end. A pipeline is not a tunnel, though some recent tunnels have used immersed tube construction techniques rather than traditional tunnel boring methods.

A tunnel may be for foot or vehicular road traffic for rail traffic, or for a canal. The central portions of a rapid transit network are usually in the tunnel. Some tunnels are aqueducts to supply water for consumption or for hydroelectric stations or are sewers Utility tunnels are used for routing steam, chilled water, electrical power or telecommunication cables, as well as connecting buildings for convenient passage of people and equipment. Secret tunnels are built for military purposes, or by civilians for smuggling of weapons contraband or people Special tunnels, such as wildlife crossings are built to allow wildlife to cross human-made barriers safely. Tunnels can be connected together in tunnel networks.

Investigations for planning and design of tunnels. It provides an overall approach or perspective rather than cookbook solutions. Inflexible rules or cookbook solutions often work for some situations in design of civil works but not in geological investigations which is intended for owners, as well as the planners, engineers and contractors, concentrates primarily on the aspects of geotechnical issues and investigative methods, which are important to tunneling. Much is based on tunneling practice but the concepts and procedures are applicable worldwide with appropriate modifications for local conditions and methods. For the tunnel designer and builder, the rock or soil surrounding a tunnel is effectively a construction material. Think of it this way; when the excavation is made, the strength of the surrounding ground keeps the hole open until the tunnel supports are installed. Moreover, even after the supports are in place, the ground, through arching, continues to provide a substantial percentage of the total load-carrying capacity. The geology along a tunnel alignment plays a dominant role in many of the major decisions that must be made in planning, designing, and constructing a tunnel. Geology dominates the feasibility, behavior, and cost of any tunnel. Although difficult to appreciate, the engineering properties of the geologic medium and the variations of these properties are as important as the properties of the concrete or steel used to construct the tunnel structure. In a tunnel, the ground acts not only as the loading mechanism, but also as the primary supporting medium. Thus, it is vital that the most appropriate geological investigation is conducted early in the planning process for any tunnel. It has been shown many times that those tunnels that have been investigated more thoroughly have fewer cost overruns and fewer disputes during construction. The unanticipated problems are those that can create costly delays and disputes during tunnel construction. Explorations help evaluate the feasibility, safety, design, and economics of a tunnel project.