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Q1.What causes earthquakes? If the Richter magnitude reaches at 8 or above what will be the consequences? Differentiate primary and secondary waves?

Ans. Cause of earthquakes:

Earthquakes are caused by a sudden release of stress along faults in the earth's crust. The continuous motion of tectonic plates causes a steady build-up of pressure in the rock strata on both sides of a fault until the stress is sufficiently great that it is released in a sudden, jerky movement. The resulting waves of seismic energy propagate through the ground and over its surface, causing the shaking we perceive as earthquakes.

Consequences:

Magnitude	Earthquake Effects	Estimated Nu Each Year
2.5 or less	Usually not felt, but can be recorded by seismograph.	900,000
2.5 to 5.4	Often felt, but only causes minor damage.	30,000
5.5 to 6.0	Slight damage to buildings and other structures.	500
6.1 to 6.9	May cause a lot of damage in very populated areas.	100
7.0 to 7.9	Major earthquake. Serious damage.	20
8.0 or greater	Great earthquake. Can totally destroy communities near the epicenter.	One every 5 to

from the above table we can get that how much and earth quake of 8 or higher is dangerous it can totally destroy hole communities.
Most of the buildings are destroyed and can cause huge destruction.
Sometimes the earth release various gases and can cause fire.
Earth quake of magnitude 8 or higher comes once in 5 to 10 years and there are several destructive events up to now in the worlds history.

Primary waves:

Primary waves travel faster, move in a push-pull pattern, travel through solids, liquids and gases, and cause less damage due to their smaller size.

Secondary waves:

Secondary waves travel slower, move in an up-and-down pattern, travel only through solids, and cause more damage due to their greater size.

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

Ans. Role of geology in selection of sites for dams and reservoirs:

The role of geology in site selection of dams and reservoirs is very important because we construct dams and reservoir on the earth and geology is the study of earth so with out geology there is no dam,reservior or any kind of construction is possible. Geology allow us to know earth condition of site and what kind of dam will be more suitable for our need and the earth can bear.well in doing so it includes some steps which are given below.

Selection of sites:

Selection of sites is based on following basis:

Topographically: most suitable place must be chosen for construction.

Ideally it must be a narrow gorge or a small valley with enough catchment area available behind so that calculated amount of water can be easily stored in the reservoir created upstream.

Location of spillway: All dam should have an adequate spillway for passing flood flows. If a river gorge is narrow, then there may not be sufficient spillway width available and a suitable location on the periphery of the reservoir has to be found to locate a spillway.

•**Possibility of river diversion during construction :** The way, river can be diverted at a particular site for making way for construction of the dam

may affect the design of the dam and also the construction schedule.

•**Sedimentation possibilities :**The average quantity of sediment carried by the river has to be known, as precisely as possible, which would give an idea of the rate at which a proposed reservoir way get filled up.

Technically:

The site must be sound as possible: strong, impermeable and stable. Strong rocks make the job of designer easy. Impermeable sites ensure better storage inventories. Site must be stable with respect to seismic shocks slope failures around dam.

Constructional:

The site should be far from the materials which will be used for the construction. Their non-availability will make the cost of project high.

Human welfare:

site selection should be done in such a way that it must cause minimum damage to public in the destruction or failure.

Q3.What are the different types of mass wasting? Also explain the protective measures of landslides?

Ans. **Types of mass wasting:**

Types of mass wasting is divided in two categories according to their movement.

1.fast movement

2.slow movement

1.fast movement:

.slumps:

Slump is a type of slide (movement as a mass) that takes place within thick unconsolidated deposits (typically thicker than 10 m). Slumps involve movement along one or more curved failure surfaces, with downward motion near the top and outward motion toward the bottom. They are typically caused by an excess of water within these materials on a steep slope.

.Rock & debris fall:

Falls are landslides that involve the collapse of material from a cliff or steep slope. **Falls** usually involve a mixture of free **fall** through the air, bouncing or rolling. A **fall** type landslide results in the collection of **rock** or **debris** near the base of a slope.

.Rock and debris slide:

mass of predominantly unconsolidated and incoherent soil
and **rock** fragments that has slid or rolled rapidly down a steep slope when comparatively dry to form an irregular hummocky deposit.

.flow:

Flows occur when the material, soil, and/or rock, behave more like a liquid or fluid. **Flows** include mudflows, debris **flows** or lahars (superheated water that moves down an erupting volcano). **Flows** occur due to a large amount of water or ice present in the soil or material.

2.slow movements:

.creep:

Creep is a very slow **mass movement** that goes on for years or even centuries. You can't see **creep** happening but leaning fences and poles and broken retaining walls show where it has taken place. Some hills are covered with long narrow steps called terracettes. Terracettes are built by soil **creep**.

.solifluction:

Mass movement of soil and regolith affected by alternate freezing and thawing. Characteristic of saturated soils in high latitudes, both within and beyond the permafrost zone. A number of features of the Cairngorm environment contribute to active **solifluction**: frequent freeze-thaw cycles.

.permafrost:

During the winter, this moisture freezes, causing ground ice to develop. In the summer, the ground ice thaws and saturates the soil. Once saturated, the layer of soil then flows as a **mass** from higher elevations to lower elevations at a very slow rate.

Protective measures of land slides:

1. Covering the land with impermeable membranes in order to **prevent** water infiltration in the **landslide**.
2. Directing surface water sources away from the **landslides**; Draining ground water streams away from the **landslides.**
3. Minimizing irrigation on the surface of the soil.
4. Revegetation with plants that have deep roots.
5. Terracing redistributes mass along the slope and reduces mass angle.
6. Retaining wall can catch debris and stabilize regolith.
7. Rock bolts can be used to stabilize coherent masses.

Q4.Differentiate fault, joint and fold?

(a) What do the normal faults cause to the crust of the Earth?
(b) Folds develop in which type of rock?
(c) What is the effect of faulting on outcrop?

(d) Where should a site for a civil engineering project be located? a) On faulted zone b) on folded strata c) On a joint d) Must be avoided to possible extent to be built on all three.

Ans: Fault:

Fault, in geology, a planar or gently curved fracture in the rocks of Earth's crust, where compressional or tensional forces cause relative displacement of the rocks on the opposite sides of the fracture.

Joint:

A joint is a break of natural origin in the continuity of either a layer or body of rock that lacks any visible or measurable movement parallel to the surface of the fracture.

Fold:

Fold, in geology, undulation or waves in the stratified rocks of Earth's crust. Stratified rocks were originally formed from sediments that were deposited in flat horizontal sheets, but in a number of places the strata are no longer horizontal but have been warped.

(a)cause of fault to earth crust:

faults within the Earth's crust result from the action of plate tectonic forces, with the largest forming the boundaries between the plates, such as subduction zones or transform faults.[1] Energy release associated with rapid movement on active faults is the cause of most earthquakes. Faults may also displace slowly, by aseismic creep.

(b). **Folds** form under varied conditions of stress, hydrostatic pressure, pore pressure, and temperature gradient, as evidenced by their presence in soft sediments, the full spectrum of **metamorphic rocks**, and even as primary flow structures in some **igneous rocks**.

(c). In dip **faults** which occur parallel to the dip of the **outcrop**, the most prominent **effect** observed after **faulting** and erosion of the upthrown block is a horizontal shift between the two parts of the **outcrop**. ... Explanation: Oblique **faults** with downthrow to the left side result in an offset with an overlap.

(d).

Ans.(d) must be avoided to possible extent to be built on all three.

Q5.Describe tunneling on the basis of geology? Also determine geological investigation for tunnels?

Ans. There are two types of tunnelling on the basis of geology

1.hard rock tunnelling

2.soft rock tunnelling

Hard rock tunnelling:

Tunneling through **hard rock** almost always involves blasting. Workers use a scaffold, called a jumbo, to place explosives quickly and safely. The jumbo moves to the face of the **tunnel**, and drills mounted to the jumbo make several holes in the **rock**.

Soft rock tunneling:

tunnels most commonly are used for urban services (subways, sewers, and other utilities) for which the need for quick access by passengers or maintenance staff favours a shallow depth. Workers dig soft-rock tunnels through clay, silt, sand, gravel or mud.

Geological investigation for tunnels:

(a)**Selection of Tunnel Route (Alignment):**

There might be available many alternate alignments that could connect two points through a tunnel. However, the final choice would be greatly dependent on the geological constitution along and around different alternatives: the alignment having least geologically negative factors would be the obvious choice.

(b)**Selection of Excavation Method:**

Tunneling is a complicated process in any situation and involves huge costs which would multiply manifolds if proper planning is not exercised before starting the actual excavation. And the excavation

methods are intimately linked with the type of rocks to be excavated. Choice of the right method will, therefore, be possible only when the nature of the rocks and the ground all along the alignment is fully known. This is one of the most important aim and object of geological investigations.

(c)**Selection of Design for the Tunnel:**

The ultimate dimensions and design parameters of a proposed tunnel are controlled, besides other factors, by geological constitution of the area along the alignment. Whether the tunnel is to be circular, D-Shaped, horse-shoe shaped or rectangular or combination of one or more of these outlines, is more often dictated by the geology of the alignment than by any other single factor. D-shape or horse-shoe shape may be conveniently adopted but these shapes would be practically unsuitable in soft ground or even in weak rocks with unequal lateral pressure. In those cases circular outline may be the first choice.

(d**)Assessment of Cost and Stability**:

These aspects of the tunneling projects are also closely interlinked with the first three considerations. Since geological investigations will determine the line of actual excavation, the method of excavation and the dimensions of excavation as also the supporting system (lining) of the excavation, all estimates about the cost of the project would depend on the geological details.

(e)Assessment of Environmental Hazards:

The process of tunneling, whether through rocks or through soft ground, and for whatsoever purpose, involves disturbing the environment of an area in

more than one way. The tunneling methods might involve vibrations induced through blasting or ground cutting and drilling, producing abnormal quantities of dust and last but not the least, interference with water supply system of the nearby areas.

The end