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Q 1: What causes earthquakes? If the Richter magnitude at 8 or above what will be the consequences? Differentiate primary & secondary waves.

Earthquake:

An earthquake is an intense shaking of Earth's surface. The shaking is caused by movements in Earth's outermost layers.

Causes of earthquakes:-

An earthquake is caused by a sudden slip on a fault. The tectonic plates are always slowing 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 & cause the shaking that we feel.

Tectonic Earthquakes:

Earthquakes causes by plate tectonics are called tectonic quakes. They account for most earthquakes wordwide and usually occur at the boundries of tectonic plates.

Induced Earthquakes:

Induced quakes are caused by human activity, like tunnel construction, filling reservoirs & implementing geothermal or fracking projects.

Volcanic Earthquakes:

Volcanic quakes are associated with active volcanisim. They are generally not as powerful as tentonicquakes & often occur relatively near the surface. Consequntly, they are usually only felt in the vicinity of the hypocentre.

Collapse Earthquakes:

Collapse quakes can be triggered by such phenomena as cave-ins, mostly in karst areas or close to mining facilities, as a result of subsidence.

Consequences:

If the Richter magnitude reaches at 8 or above total destrution of building bridges and roads occurs.

Difference between P-wave & S-wave

Primary Wave	Secondary Wave.
1) The first kind of body wave is the P wave or primary wave.	1) The second type of body wave is the S wave or secondary wave, which is the second wave we feel in an earthquake.
2) They travel through the earth's interior & can passs through both solid & molten rock. They shake the ground back & forth. Primary wave travel faster.	2) Secondary waves travel slower, move in an up-&-down pattern, travel only through solids, & causes more damage due to their grater size.
3) Typically speed are 330m/s in air, 1450m/s in water & about 5000m/s in granite.	3) S-waves lag behind P-waves as they travel 1.7 time slower. However they do more damge because they're bigger & shake the ground vertically & horizontally.

Q 3. What are the different types of mass wasting? Also explain the protective measures of lanslides?

Mass Wasting:

It is defined as the large movement of rock, soil and debris downward due to the

force of gravity. In the other words, the earth's outer crust is being 'wasted' away on a 'massive' scale and falling to lower elevations.
Sometimes it is also called mass movement or slope movement.

Types of mass wasting:

Fast movements:

1) Slumps
2) Rock & Debris fall
3) Rock & Debris Slides
4) Flow

Slow movements:

1) Creep
2) Solifluction
3) Permafrost

Slump:

It is a form of mass wasting that occurs when coherent mass of loosely consolitated materials or a rock layer moves a short distance down a slope. Movement is characterized by sliding along a concave-upward or planar surface.

Rock & Debris fall:

This heppens when a piece of rock falls down the slope. Debri fall are similar, exept they involve a mixture of soil, regolith & rocks. At the base there is an accumulation of fallen material termed talus.

Rock & Debris slides:

It occurs when loose dirt or sediment falls down a slope, a rockslide occurs only when solids rocks are transported down slope.

Fast - flowing rock slides or debris slides behave similarly to snow avalnches, and are often reffered to as rock avalanches or debris avalanches.

Flow:

Flows are landslides that involve the movement of material down a slope in the form of a fluid. When material on a slope becomes saturated with water, making it much heavier, it may develop into a debris flow or mud flow.

Creep:

It is the imperceptibly slow, steady, downwards movement of slope-forming soil or rock. Movement is caused by shear stress sufficient to produce permanent deformation, but too small to produce shear failure.

Solifluction:

Literally it means "soil flow" is a category of shallow mass movement, which affects saturated unconsolidated deposits & results from reduction of internal friction and cohesion due to excess water.

Permafrost:

Permafrost is any ground that remains completely frozen - 32°F (0°C) or colder - for a least two years straight. These permanently from grounds are most common in regions with high mountains & in Earth's latitudes - near North & South Poles.

Protective measures of Landslides:

1) Maintain as much as possible on the slope to help retain the soil.
2) Do not put yard waste on the slope.

3) Do not add additional water from downspouts to slopes from storm water runoff being directed to a hillside.

4) Do not have an irrigation system on a hillside.

5) Use georigids materials they are materials used for erosion control that ensuve the soil cappacity to grow plants, reducing the damage caused by heavy rains and wind in slopes & embankments.

6) Rock bolts can be used to stabilize coherent masses.

7) There are also various direct methods for preventing landslides; these include modifying slope geometry using chemical agents to reinforce slope material, installing structures such as piles & travelling walls, grouting rock joints & fissures, diverting debris pathways, & rerouting surface & underwater drainage.

Q : Differentiate fault, joint and fold?

bent & buckle are called folds

Fold: In response to compression force the strata may Permanent wavelike deformation in layered rock or sediment. The effects of fold on rock are shatteing and joining along the axial planes and stressing of limds In the syclinal region dams placed on the upstream limbs have the rick of leakage from beneat the dam.

Fault:

The struture in bedrock along which rocks on one side have moved relative to the other side. Dams found on the fault zones are most liable to the shocks during an earthquake Generally the small scale fault zones can be treated effectly by grouting.

Joint: Frature along which no displacement has occured. A fracture on a rock without noticeable movement.

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

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

Due to the incline nature of the fault plane & downward displacement of a part of the stara, normal faults cause an extension in the crust wherever they occure.

b) Folds develope in which type of rock?

In structural geology, a fold occurs when one or a stack of originally flat & planar surfaces such as "sedimentary stara"

c) What is the effect of faulting on outcrop?

In dip faults which occur parallel to the dip of the outcrop, the most prominent effect observed after faulting & erosion of upthrown block is a horizontal shift between the two parts of the outcrop.

d) Where should a site for a civil engineering projecte be located i) on a fault zone ii) on a folded strata iii) on a joint iv) must

be avoided to possible extent to be built on all three.

We cannot locate a site for a civil engineering project on all these sites because of the following reason.

While the general information about construction site is usually available the planing stage of a project, it is important for a design professional & construction manager, as well as the contractor to visit the site. A poor layout can cause construction problem such as inadequate space for staging, limited access for material. Thus design & construction input are important in the layout of a facility.

Q 2. Describe the role of Geology in slection of siteg for dams & resevoirs.

Role of Geology in selection of sites for dams & reservois:-

1) Topography, a place which is most suitable for the purpose is selected ideally it should be narrow for small valley with enough catchment areas available behind so that the dame is place there will be easily store a calculated volume of water in reservious, created upstream.

2) Technically, suicide should be a sound is possible, strong & stability with reference to seismic failure.

3) Constructionally, the side should not be far from deposits of material which will be required for constructions.

4) Economically, the benefits arising out of a dam is proposed to be place at a particular side could be realistic & justified in terms of land irrigated & power generated & water

stored life and floods stored.

5) Geology of site type of frogs of the area where team will be built property of Rock, chemical, composition, texture & hardness of rocks properity & permeability of rocks.

6) Provides ground water condition provide information on spring wells etc which provide information of water leakage.

7) Structure should provide information on surface features like valley, hills and assessment of dept of bedrock.

8) Structure should probide information on stuuctural detail of folds, faulHs & joints.

9) It provides information of short & long term effects of the proposed reservoir & the construction operation on the region.

10) It provides information about

about noise & dust hazards in construction.

11) It provides information about the effect of the dam on the regional micro-climate.

12) It provides information about aesthetic, plant & animal, ecology, fish preservation and public amenity of the reservoir & downstream reaches.

Q: Describe tunneling on the basis of geology? Also determine geological investigation for tunnels?

Definition:

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

Tunneling and underground excavation, horizontal underground passageway produced by excavation or occasionally by nature's action in dissolving a soluble rock, such as limestone. A vertical opening is usually called a shaft.

Geological investigation for tunnels.

a) Selection of Tunnel Route (Alignment)

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

b) Selection of Excavation Method:

Tunneling is a complicated process in any situation & involves huge costs which would multiply manifolds if proper planning is not excercised before starting the actual excavation. And the excavtion methods are intimately linked with the type of rocks to be excavated. And the excavation methods are intimately linked with the type of rocks to be excavated. Choise of 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 & object of geological investigation.

c Selection of Design for the Tunnel:

The unltimate dimensions & design parameters of a proposed tunnel are controlled, besides other factors, by geological constitution of the area along the allignment. Whether the tunnel is to be cercular, D shaped, horse-shoes shaped or rectangular or combination of one or more of these oullines, is more often dectated by the geology of the allignment then by any other ~~sigbe~~ singal factor. D-shaped or horse-shoe shap may be conveniently adopted but these shapes would be practically unsuitable in soft ground or even in weak rock with unequal lateral pressure. In those cases circular out line may be the first choise.

d) Assessment of cost & stability:

These aspects of the tunneling projects are also closely interlinked with the first three consideration. Since geological invertigations will determine the line of actual encavation, the method of encavation 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.

Assessment of Enviromental Hazards:

The process of tunneling, whether through rocks or through soft ground, and for whatsoever purpose, involves disturbing the enviroment of an area in more than one way. The tunneling method might involve vibrations induced through blasting or ground cutting & drilling, producing abnormal quantities of dust & last but not the least, interference with water supply system of the near by areas.