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SEC: B

PAPER: ENGINEERING GEOLOGY

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QUESTION NO.1

Cause of Earthquake:

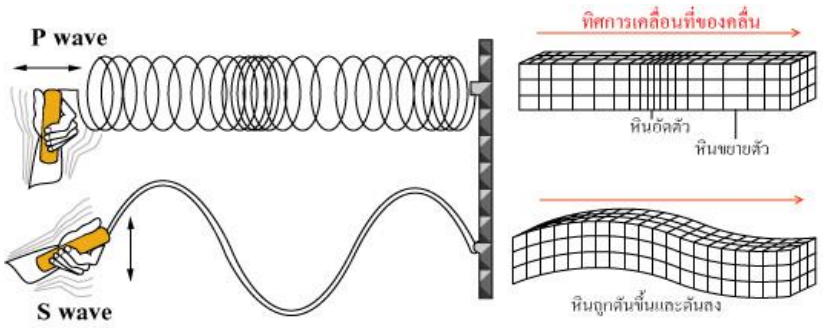
An earthquake is caused by a sudden slip on a fault. The Tectonic Plates are always moving slowly, but they get stuck at their edges due to friction, there is an earthquake that releases energy in waves that travel through the earth's crust and cause the shaking that we feel.

Part B of the question:

If the Richtar Scale magnitude reaches 8.0 or higher, there will be total destruction of buildings, bridges and roads.

Difference between Primary and Secondary waves:

- Both the waves are the types of the Body Waves and both the waves travel through the interior of the earth.
- Primary waves are called P-waves and Secondary waves are called S-waves.
- P-waves can pass through both solid and molten rock and they shake the ground back & forth while Secondary waves shake the ground vertically & horizontally.
- Typical speed of P-waves is 330m/s in air, 1450m/s in water and about 5000m/s in granite. While S-wave is 1.7 times slower than P-waves
- Even though S-waves are slower than P-waves, still S-waves can cause more damage since they travel in curve path.



QUESTION NO.2

Geologists study the land to determine whether it is stable enough to support the proposed project. The full knowledge of geology increase the strength, stability, and durability of civil engineering projects. Similarly Geology plays an important role in the selection of site for dams and reservoirs, in the following form:

The geological investigations to choose the site for dam 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.

Furthermore; if we want to do the detailed geological investigation for the selection of site for dams, that will be:

- ✓ Study of Geological Toposheet
- ✓ Geomorphological study.
- ✓ Detailed Engg. Geological Properties of the area.
- ✓ Study of the area with reference to Geology.
- ✓ Study of rock types.
- ✓ Study of stream channels with different order.
- ✓ Study of Structural Geology of the area.
- ✓ History of the area with reference to rail fall data.
- ✓ Study of seismic data of the date.

QUESTION NO.3

TYPES OF MASS WASTING/MASS MOVEMENT/LAND SLIDING:

The types of Mass Wasting are classified into two categories:

1. Fast Movements
2. Slow Movements

1. **Fast Movements:** Fast Movements are further classified into four types

i) Slumps: Basic meaning ⟶ Slide/downturn/fall/drop

The downward intermittent movement of rock debris is called slump. It is a type of slide wherein downward rotation of rock or regolith occurs along a curved surface due to oversteepenning.

ii) Rock & Debris Slides: Debris basic meaning ⟶ remains/wreck/waste

Debris are loose natural material, especially broken pieces of rock. Such slides happen when rocks or debris slide down a preexisting surface.

iii) Rock & Debris Fall:

These kind of slides happen when a piece of rock falls down the slope. Debris fall are similar except they involve a mixture of soil, regolith and rocks. At the base there is an accumulation of fallen materials known as “talus”.

iv) Flow:

Flows occur when the material, soil, and/or rock, behave more like a liquid or fluid. Flows occur due to a large amount of water or ice present in the soil or material.

2. Slow movements: Slow movements are also further classified into three types:

i) Creep:

Creep is a very slow mass movement that goes on for years or even for centuries. It is the slow downslope movement that occurs on every slope that is covered with loose, weathered material. This is a very common landslide that occurs often, but can rarely be felt because of very slow motion.

ii) Solifluction: Basic meaning ⟶ "Soil Flow"

Solifluction is the flow of saturated soil downslope at a rate of few millimeters or a few centimeters per day or per year.

iii) Permafrost: Basic meaning ⟶ permafrost is a thick surface layer of soil that remains below the freezing point throughout the year and occur mostly in the Polar Regions.

It is a slow land slide due to slowly melting of permanent frozen ground.

Protective measures of landslide:

Following are the protective measures of landslides;

- Draining water from slopes
- Revegetation of plants that have deep roots
- Terracing redistributes mass among a slope and reduces the slope angle

- Retaining wall can catch debris or stabilize regolith
- Rock bolts can be stabilize coherent masses

QUESTION NO.4

Difference between Fault, Joint & Fold:

FAULT: Fracturing and displacing a rock strata. **JOINT**: A fracture on a rock without noticeable movement or in which no displacement has occurred**. FOLDS:** When the strata bent and buckle, in response to the compression force, these are called folds.

(a) Cause of normal faults to the crust:

As a result of tensional stress, normal faults are created in a series on the surface of crust. In such case, the down dropped blocks form grabens and the uplifted blocks form horsts on the crust.

(b) Fold in Sedimentary Rocks:

Sedimentary rock is the type of rock in which folds develop. In structural geology, a **fold** occurs when one or a stack of originally flat and planar surfaces, such as **sedimentary** strata, are bent or curved as a result of permanent deformation.

(c) Effect of Faulting on Outcrop:

Faulting is essentially a process of rupturing and displacement along the plane of rupture. Its effects may involve- 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 displacements and shifts in the continuity of the same rocks in certain regions.

(d) ANSWER: I will go for option **"d"** *i-e Must* be avoided to possible extent to be belt on all three.

QUESTION NO.5

TUNNEL on the basis of Geology:

In Geology, tunnels may be defined as underground routes or passages driven through the ground without disturbing the overlying soil or rock cover.

GEOLOGICAL INVESTIGATIONS FOR TUNNELS:

Following are the Geological Investigations for tunnels:

Alignment (Selection of tunnel route):

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.

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.

Selection of Design for the Tunnel

The Ultimate dimensions and design parameters of a proposed tunnel are controlled, beside other factors, by geological constitutions 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 then by any other single factor. D-shaped or horse-shoe shaped maybe conveniently adopted but these shapes would be particularly unsuitable in soft ground or even in weak rocks with unequal lateral pressure. In those cases circular outline maybe the first choice.

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 is also the supporting system of the excavation, all estimates about the cost of the project would depend on geological details.

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.

OR AB JO SLIDE AANE WALA HAI...

THANK YOU SIR.. WILL ALWAYS REMEMBER THIS ☺