Frequently Asked Questions

Question 01:

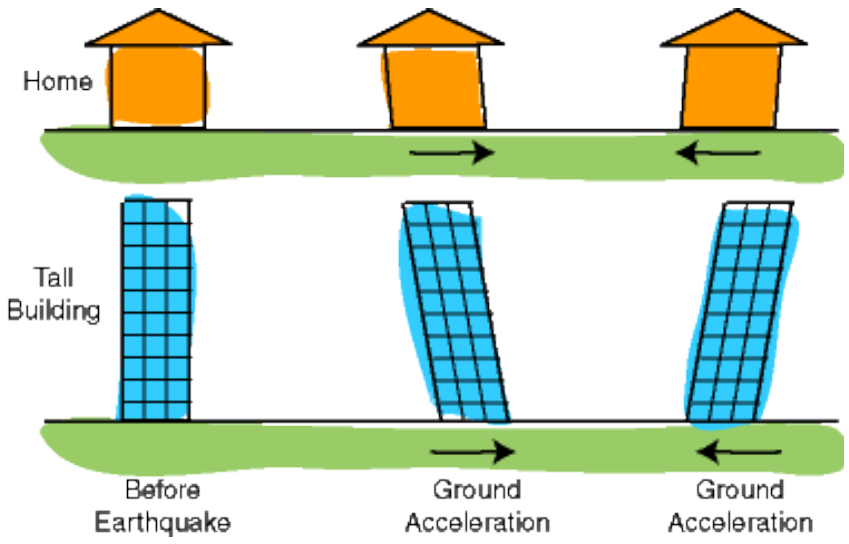
What are the various effects of earthquake on the ground? Elaborate any five.

Answer:

- Earthquake has a lot of after effects on the ground. They are majorly:
    - Ground shaking
    - Landslide
    - Ground Displacement
    - Liquefaction
    - Tsunamis
    - Aftershocks
    - Fire

Ground shaking

- The principal cause of earthquake induced damage is ground shaking.
- As the earthvibrates, all buildings on the ground surface will respond to that vibration in varyingdegrees.
- Earthquake induced accelerations, velocities and displacements can damage or destroy a building unless it has been designed and constructed or strengthened to be earthquake resistant.
- Therefore, the effect of ground shaking on buildings is a principal area of consideration in the design of earthquake resistant buildings.



Tsunamis

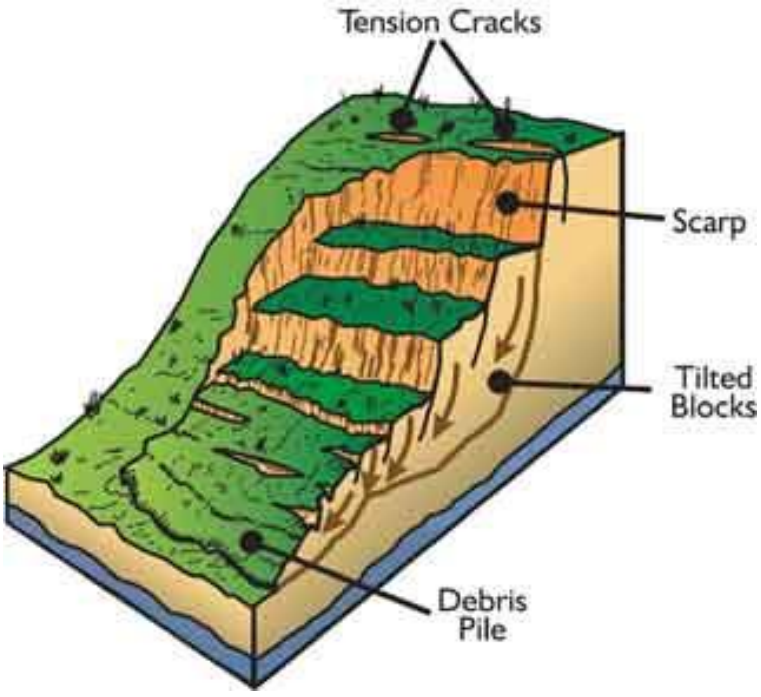
- Tsunamis or seismic sea waves are generally produced by a sudden movement of the ocean floor. As the water waves approach land, their velocity decreases and their height increases from 5 to 8 m, or even more.
- Tsunami's can be devastating for buildings built in coastal areas.

Fire

- When the fire following an earthquake starts, it becomes difficult to extinguish it, since a strong earthquake is accompanied by the loss of water supply and traffic jams.
- Therefore, the earthquake damage increases with the earthquake-induced fire in addition to the damage to buildings directly due to earthquakes.

Soil Liquefaction:

- Soil liquefaction occurs when, because of the shaking, water –saturated granular material (such as sand) temporarily loses its strength and transforms from solid to liquid.
- Solid liquefaction may cause rigid structures like buildings or bridges to sink into the liquefies soil.



Landslides:

- Landslides are considered a natural hazard, meaning that they are natural occurrences that cause threat or damage to human activity or the environment.
- Landslides are defined as "the downward and outward movement of slope-forming materials including rock, soil, artificial fill, or a combination of these" This action may be set into motion by many factors such as flooding, earthquakes, volcanic activity, and human manipulation of the Earth's surface.

Question 02:

Explain in detail with example about the importance of site selection and development in seismic design.

Answer:

- The choice of site for a building from the seismic point of view is mainly concerned with the stability of the ground.
- Past earthquakes show that site condition significantly affects the building damage.
- Earthquake studies have almost invariably shown that the intensity of a shock is directly related to the type of soil layers supporting the building.
- Structures built on solid rock and firm soil frequently fares better than buildings on soft ground.
- This was dramatically demonstrated in the 1985 Mexico City earthquake, where the damage on soft soils in Mexico City, at an epicentral distance of 400 km, was substantially higher than at closer locations.
- From studies of the July 28, 1957 earthquake in Mexico City, it was already known for example that the damage on the soft soils in the centre of the city could be 5 to 50 times higher than on firmer soils in the surrounding area.
- Another example occurred in the 1976 Tangshan, China earthquake, in which 50% of the buildings on thick soil sites were razed to the ground, while only 12% of the buildings on the rock subsoil near the mountain areas totally collapsed.

- Rigid masonry buildings resting on rock may on the contrary show more severe damage than when built on soil during a near earthquake as in Koyna (India) earthquake of 1967 and North Yemen earthquake of 1980.
- Lessons learned from recent earthquake show that the topography of a building site can also have an effect on damage.
- Buildings built on sites with open and even topography are usually less damaged in an earthquake than buildings on strip-shaped hill ridges, separated high hills, and steep slopes
- The choice of site for a building from the seismic point of view is mainly concerned
- with the stability of the ground.
- To have several blocks on terraces than have one large block with footings at very different elevations.
- A site subject to the danger of rock falls has to be avoided.
- Very Loose Sands or Sensitive Clays are liable to be destroyed by the earthquake so
- much as to lose their original structure and thereby undergo compaction. This would result in large unequal settlements and damage the building.
- Therefore, a site with sufficient bearing capacity and free from the above defects should be chosen and its drainage condition improved so that no water accumulates and saturates the ground close to the footing level.

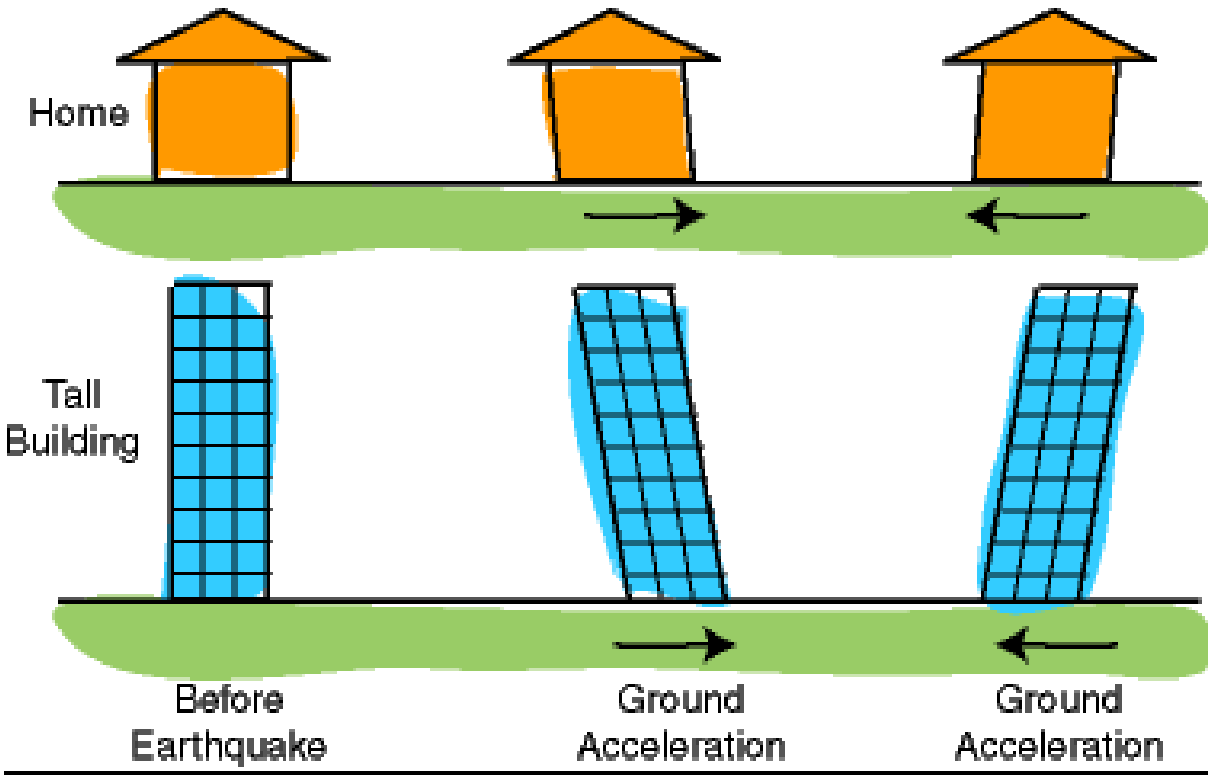
Question 03:

Explain in detail about ground shaking and ground failure.

Answer:

Ground shaking:

- The principal cause of earthquake induced damage is ground shaking. As the earthvibrates, all buildings on the ground surface will respond to that vibration in varyingdegrees.
- Earthquake induced accelerations, velocities and displacements can damage or destroy a building unless it has been designed and constructed or strengthened to be earthquake resistant.
- Therefore, the effect of ground shaking on buildings is a principal area of consideration in the design of earthquake resistant buildings.



Ground Failure:

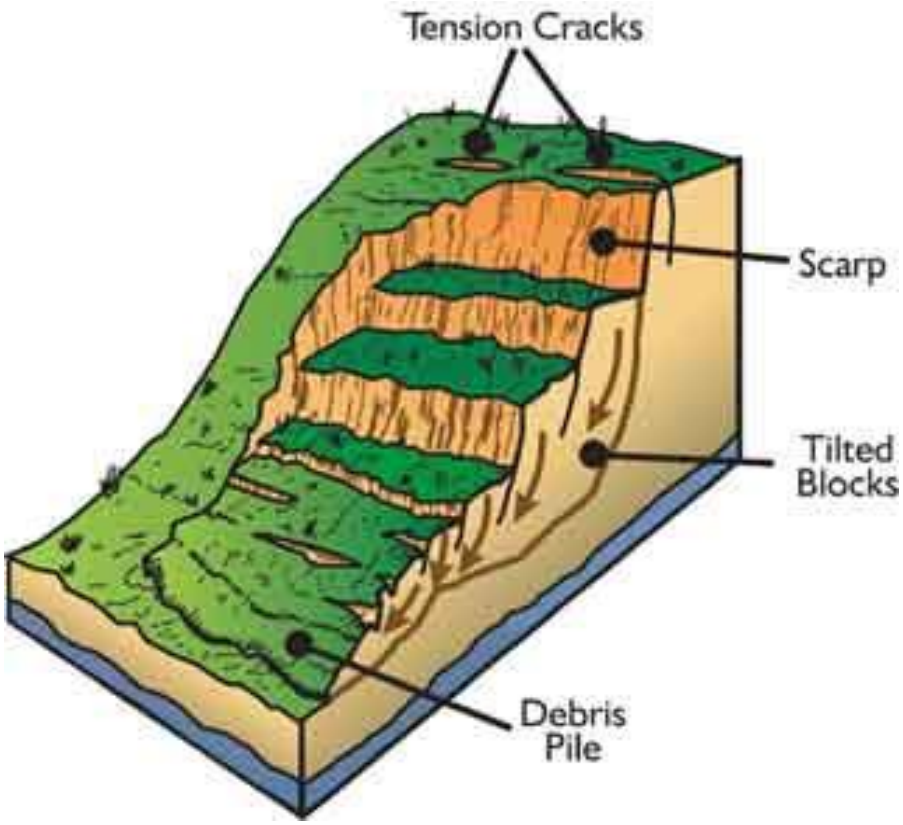
- Earthquake-induced ground failure has been observed in the form of ground rupture along the fault zone, landslides, settlement and soil liquefaction.
- Ground rupture along a fault zone may be very limited or may extend over hundredsof kilometers. Ground displacement along the fault may be horizontal, verticalor both, and can be measured in centimeters or even metres.
- A building directly astride such a rupture will be severely damaged or collapsed.
- While landslide can destroy a building, the settlement may only damage the building.
- Soil liquefaction can occur in low density saturated sands of relatively uniform size. The phenomenon of liquefaction is particularly important for dams, bridges, underground pipelines, and buildings standing on such ground.

Question 04:

What are landslides? How do they occur? Elaborate.

Answer:

- Landslides are considered a natural hazard, meaning that they are natural occurrences that cause threat or damage to human activity or the environment.
- Landslides are defined as "the downward and outward movement of slope-forming materials including rock, soil, artificial fill, or a combination of these" This action may be set into motion by many factors such as flooding, earthquakes, volcanic activity, and human manipulation of the Earth's surface.
- The manner in which matter is moved during a landslide is dependent on the composition of the land mass, the amount of water saturation that has occurred, and the cause of the initial energy forces that power it.



- Landslides are a risk factor around the world.

- The main criteria for a landslide is a slope or cliff, and as was discussed above, slides may be put into motion by a few different triggers.
- Following the massive earthquake in China on May 12, 2008, landslides persisted across the area, creating a second blow of destruction to the people, structures, and environment involved.