Earthquake: As a Natural Disaster

Introduction:

- An **earthquake** is the shaking of the surface of the Earth resulting from a sudden release of energy in the Earth's lithosphere that creates seismic waves.
- Earthquake constitute one of the worst natural hazards which often turn into disaster causing widespread destruction and loss to human life.
- The effect of earthquake vary often the magnitude and intensity. Earthquake occur every now and then all round the world, except in some places where earthquake occur rarely. The devastation of cities and towns is one of the effects of earthquake
- The seismic activity of an area refers to the frequency type and size of earthquakes experienced over a period of time.
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For example:

If you throw stone in a pond of still water,series of waves are produced on the surface of water,these waves spread out in all directions from the point where the stone strikes the water.

Similarly, any sudden disturbances in the earth's crust may produce vibration in the crust which travel in all direction from point of disturbances.

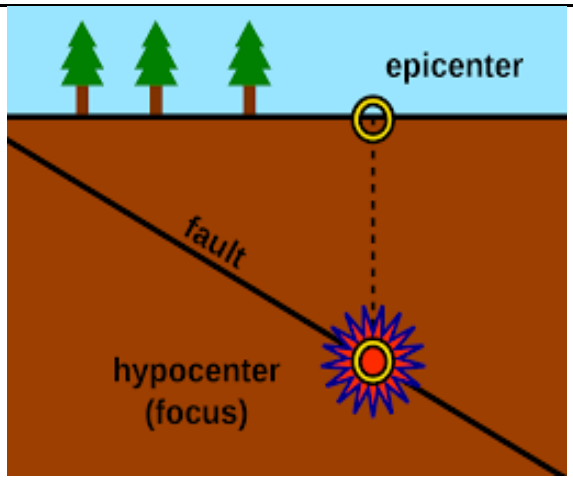
Term related to Earthquake:

Focus (Hypocenter):

Focus the point on the fault where rupture occurs and the location from which seismic waves are released.

Epicenter:

Epicenter is the point on the earth surface that is directly above the focus . The point where an earthquake or underground explosion originates.



Fault Line :

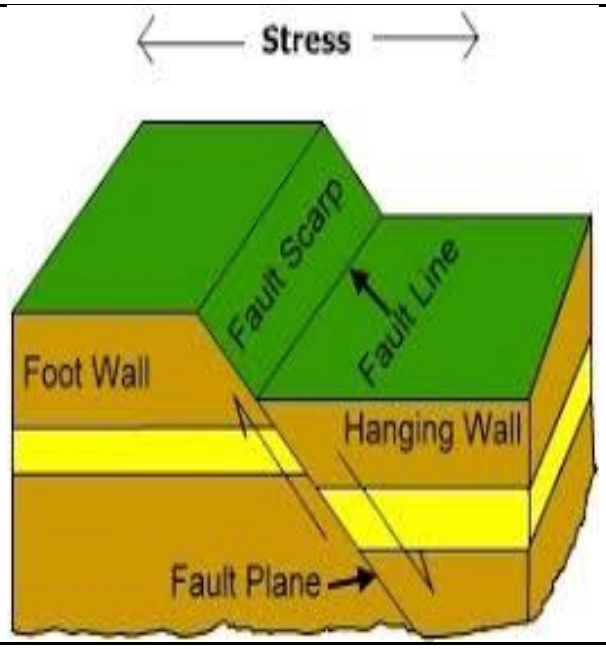
The definition of a fault line is a break or fracture in the ground that occurs when the Earth's tectonic plates move or shift and are areas where earthquakes are likely to occur.

Fault Plane:

The fault plane is the planar (flat) surface along which there is slip during an earthquake**.**

Fault Scrap:

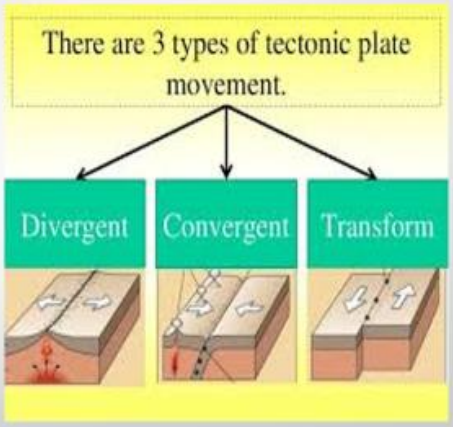
A fault scrap is the topographic expression of faulting attributed to the displacement of the land surface by movement along faults.



How Earthquake Occurs?

- The Primary cause of an earthquake is faults on the crust of the earth.
- A fault is a break or fracture between two blocks of rocks in response to stress.
- This movement may occur rapidly in the form of an earthquake or may occur slowly in the form of creep.
- Earth scientist use the angle of the fault with respect to the surface (known as the dip) and the direction of slip along the fault to classify faults.

- Movement in narrow zones along plate boundaries causes most earthquakes. Most seismic activity occurs at three types of plate **boundaries—divergent, convergent, and transform.**
- As the plates move past each other, they sometimes get caught and pressure builds up. When the plates finally give and slip due to the increased pressure, energy is released as seismic waves, causing the ground to shake. This is an **earthquake.**



Classification of Faults:

Normal Faults:

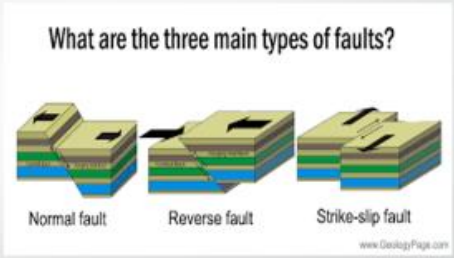
A geologic **fault** in which the hanging wall has moved downward relative to the footwall. **Normal faults** occur where two blocks of rock are pulled apart, as by tension.

Reverse Faults:

Reverse faults are exactly the opposite of normal **faults**. If the hanging wall rises relative to the footwall, you have a **reverse fault**. **Reverse faults** occur in areas undergoing compression.

Strike –slip Faults:

Strike-slip fault, in geology, a fracture in the rocks of Earth's crust in which the rock masses **slip** past one another parallel to the **strike**



Causes of Earthquake:

Types of Earthquakes

Mainly, there are four types of earthquakes namely tectonic, volcanic, collapse and explosion.

- **Tectonic earthquake:**
- **Volcanic earthquake:**
- **Collapse earthquake:**
- **Explosion earthquake:**

- **Tectonic earthquake:**

This occurs when due to geological forces on rocks and the adjoining plate's cause's physical and chemical change and results in the breaking of the Earth's crust.

- **Volcanic earthquake:**

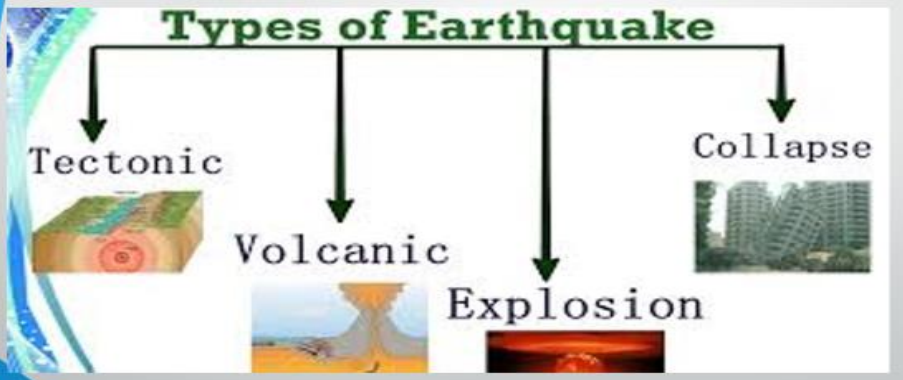
Results from tectonic forces and occurs in conjunction with volcanic activity.

- **Collapse earthquake:**

are generally small earthquakes that occur in underground caverns and mines caused by the seismic waves which are produced from the explosion of rock on the surface.

- **Explosion earthquake**:

Occur due to the detonation of a nuclear or chemical device.



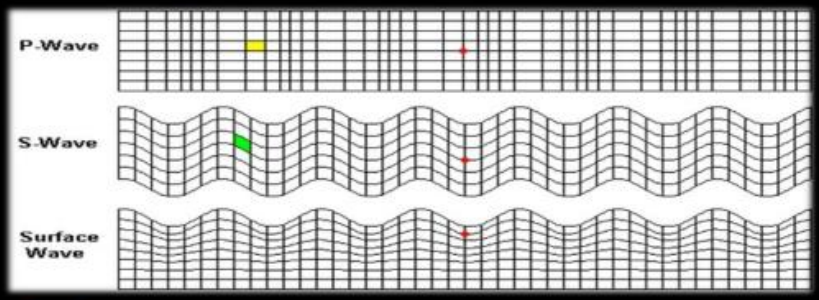
Types of Seismic waves:

- The two main **types of waves** are
- **Body waves**
- **Surface waves**
- Body **waves** can travel through the earth's inner layers, but surface **waves** can only move along the surface of the planet like ripples on water. **Earthquakes** radiate **seismic** energy as both body and surface **waves**.

Body waves:

Body waves travels through the interior(body) of earth as they leave the focus. Body waves are further divided into following types:

- Primary (P) waves
- Secondary(S) waves



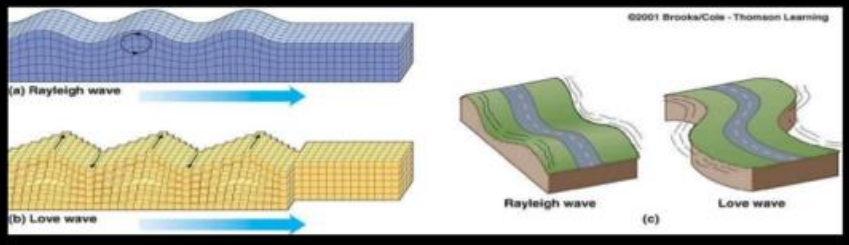
Properties

Primary Waves (P-waves)	Secondary Waves(S-wave)
High frequency	High frequency
Short Wavelength	Short Wavelength
Longitudinal waves	Transverse waves
Pass trough both solids and liquids	Can not move through liquids
Move forwards and backwards as it compressed and decompressed	Move in all direction from their source
P-wave is faster	S-wave is more slower than P-wave
First P-wave arrive	After P-wave,S-wave is arrive

Surface Wave:

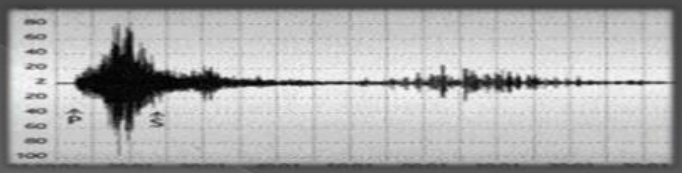
Surface waves travels parallel to the earth's surface and these waves are slowest and most damaging. Surface wave are divided into following types:

- Love waves
- Rayleigh waves



Strength of Earthquake:

- The intensity and strength of an earthquake is measured on Richter scale , the scale invented by Charles Richter California, USA in 1935.which categories earthquake on the basic of energy release.
- Definition:
- The logarithm to base ten of the maximum seismic wave amplitude recorded on a standard **Seismograph** at a distance of 100 kilometers from the earthquake epicenter.
- **Seismograph** is the scientific study of earthquakes and the propagation of elastic waves through the Earth.

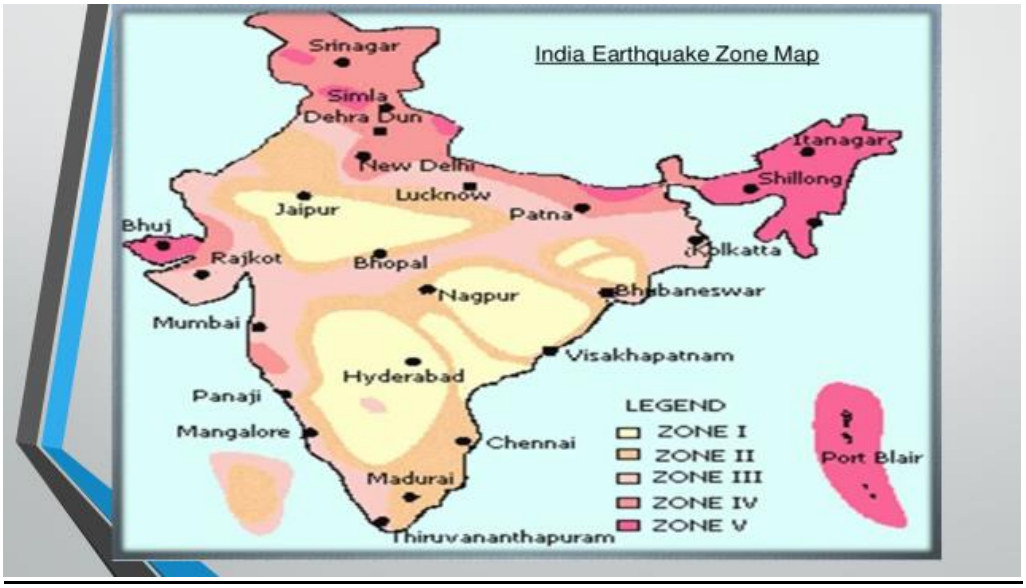


GROUP	MAGNITUDE
Great	8 and Higher
Major	7-7.9
Strong	6-6.9
Moderate	5-5.9
Light	4-4.9
Minor	3-3.9
Very Minor	<3.0

Types Of Zones

The earthquake zoning map of India divides India into 4 seismic zones Based on the observations of the affected area due to Earthquake India divided into four types of zones:

- Zone - II: This is said to be the least active seismic zone.
- Zone - III: It is included in the moderate seismic zone.
- Zone - IV: This is considered to be the high seismic zone.
- Zone - V: It is the highest seismic zone.



Earthquake Prediction

Earthquake prediction is usually defined as the specification of the time , location , and magnitude of a future earthquake within stated limits.

But some evidence of upcoming Earthquake are following:

- Unusual animal behavior
- Water level in wells
- Large scale of fluctuation of oil flow from oil wells
- Foreshocks or minor shocks before major earthquake
- Temperature change
- Uplifting of earth surface
- Change in seismic wave velocity

Effect of Earthquake:

- The primary **effects** of earthquakes are:
- Ground shaking
- Ground rupture
- Landslides
- Tsunamis
- Liquefaction
- Fires are probably the single most important secondary **effect** of earthquakes.

Effect Of Earthquake

- Loss of life and property
- Damage to transport system i.e. roads, railways, highways, airports, marine
- Damage to infrastructure.
- Chances of Floods – Develop cracks in Dams

Effect Of Earthquake

- Chances of fire short-circuit.
- Communications such as telephone wires are damaged.
- Water pipes, sewers are disrupted
- Economic activities like agriculture, industry, trade and transport are severely affected.

Disaster Management Cycle (Earthquake)

Earthquake Preparedness:

- Secure furniture so that it can not fall over and fall down.
- Plan safety measures to avoid injuries.
- Confirm the strength of your house and walls.
- Always be ready to extinguish fires.
- Prepare emergency supplies in advance.
- Take steps for fire prevention and early detection.
- Discuss emergency planning with your family.
- Know potential hazards in your area.
- Train yourself for emergency

Response during Earthquake:

Response during Earthquake:

Response After Earthquake:

After An Earthquake

- Keep calm, switch on the transistor radio and obey instructions.
- Keep away from beaches and low banks of river. A huge wave may sweep in
- Do not re enter badly damaged buildings and do not go near damage structures.
- Turn off the water, gas and electricity.
- Do not smoke, light match or use a cigarette lighter
- Do not turn on switches there may be gas leak or short circuit
- If there is any fire, try to put it out or call fire brigade.

Response After Earthquake:

After An Earthquake

- Do not drink water from open containers without having examined it.
- If you aware of people have been buried, tell the rescue team. Do not rush and try not to worsen the situation.
- Avoid places where there are loose electric wires and do not come in contact with any metal object.
- Eat something. You will better and more capable of helping other.
- Do not walk around the streets to see what is happening. Keep the streets clear so rescue vehicles can access the roads easily.

Recovery action after Earthquake:

- Restore daily life
- Reconnecting with others,
- Repairing damage,
- Rebuilding community.
- Renovation work
- Removal of Debris
- Rescue People
- In the days and weeks that follow a big **earthquake**, your family, friends and neighbors can come together to start the process of **recovery**.

Mitigation measures for earthquake:

Mitigation measures include:

- Hazard mapping.
- Adoption and enforcement of land use and zoning practices.
- Implementing and enforcing building codes.
- The mitigation strategy is made up of three main required components:
- mitigation goals, mitigation actions,
- action **plan** for **implementation**.
- These provide the framework to identify, prioritize and implement actions to reduce risk to hazards.

Mitigation measures for earthquake:

- Create a Flexible Foundation. One way to resist ground forces is to "lift" the **building's** foundation above the earth.
- Counter Forces with Damping.
- Shield **Buildings** from Vibrations.
- Reinforce the **Building's** Structure.
- The most common (and effective) **mitigation** measures are the enforcement of seismic codes,
- land-use zoning,
- and engineering works to strengthen existing structures and stabilize hitherto unstable **ground**.
- Some measures are applicable to new development while others to existing development.

Earthquakes in History

Date	Place	Scale	Damage
April 25,2015	Kathmandu,Nepal	7.9	Massive devastation leads to death of more than 6000 people
Sept 2, 1993	Latur (maharashtra)	6.3	Large areas of Maharashtra rocked. 10,000 people lost lives.
May 22, 1997	Jabalpur (Maharashtra)	6.0	40 person killed and over 100 injured.
March 29, 1999	Nandprayag	6.8	widespread destruction in chamoli , rudraprayag and other areas. Massive loss of human life.
Jan. 26, 2001	Bhuj (gujrat)	7.8	Tremors left by India and its neighboring countries. Over 1 lakh people killed. Huge loss to property and infrastructure.
Oct. 8, 2005	Muzzaffarabad in Pakistan occupied Kashmir	7.4	Heavy damage to life and property. Death toll about one lakh in Pakistan and nearly 2000 in India.