A Tragedy To Life And Property

Introduction

Earthquakes constitute one of the worst natural hazards which often turn into disaster causing widespread destruction and loss to human life.

The effects of earthquake vary upon the magnitude and intensity. Earthquakes occur every now and then all round the world, except in some places where earthquakes occur rarely. The devastation of cities and towns is one of the effects of earthquake.

What is Earthquake?

- An Earthquake is the result of a sudden release of energy in the earth's crust that creates seismic waves.
- The seismic activity of an area refers to the frequency,type and size of earthquakes experienced over a period of time

For example:

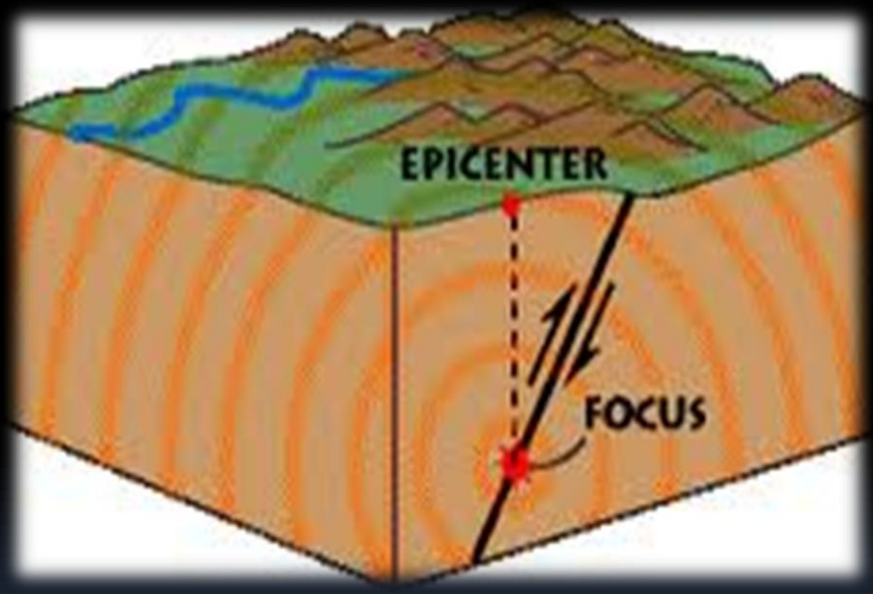
If you throw stone in a pond of still water,series of waves are produced on the surface of water,these waves spread out in all directions from the point where the stone strikes the water.

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

Terms Related To Earthquake

Focus(Hypocenter):

Focus is 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's surface that is directly above the focus ,the point where an earthquake or underground explosion originates.

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Fault Line:

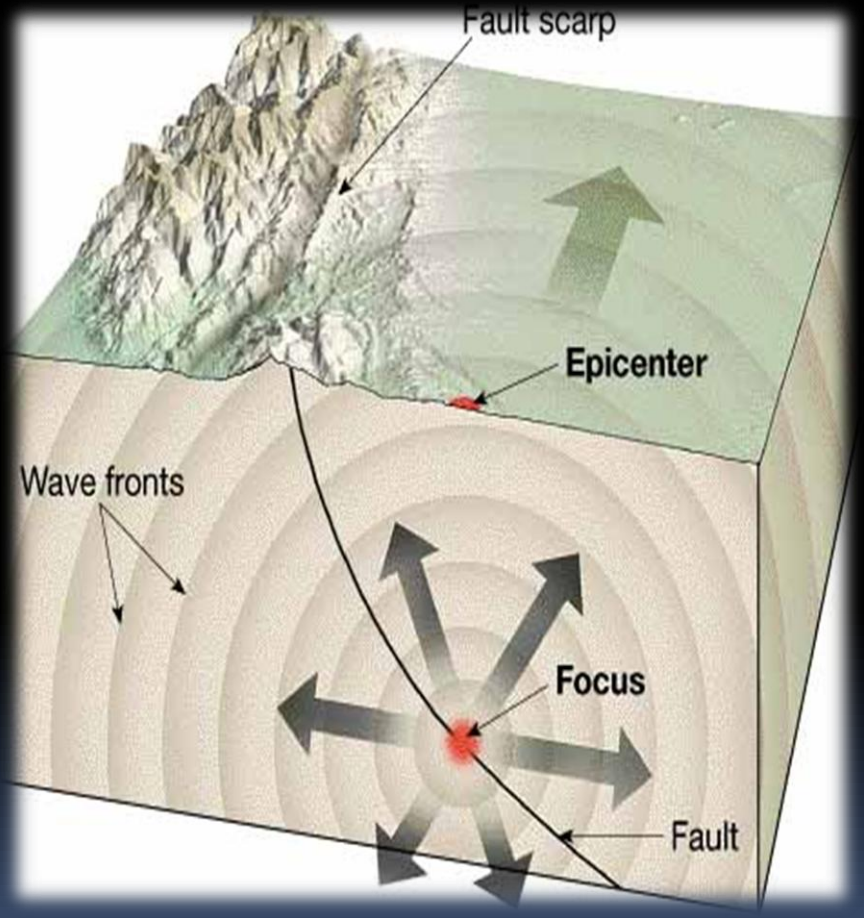
A Fault line is the surface trace of a fault, the line of intersection between the earth's surface.

Fault plane:

Fault plane are the crackes or sudden slips of the land .

Fault Scrap:

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



Causes Of Earthquake

The primary cause of an earthquake is **faults** on the crust of the earth.

"A Fault is a break or fracture b/w two blocks of rocks in response to stress."

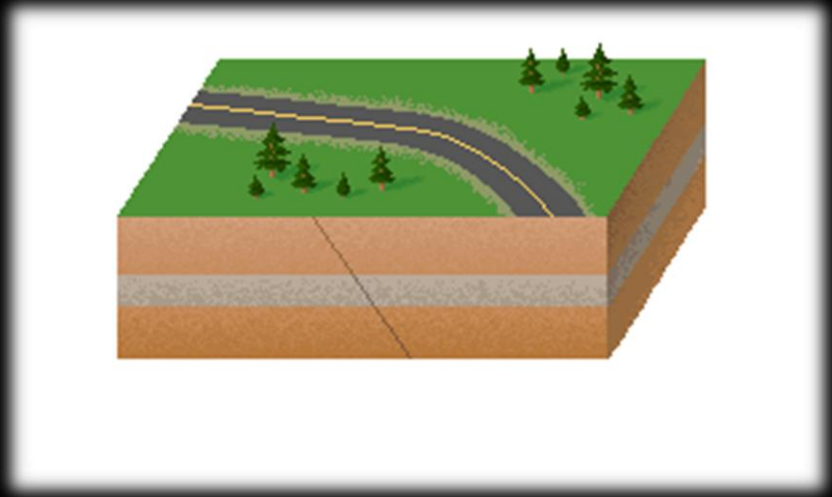
- This movement may occur rapidly, in the form of an **earthquake** or may occur slowly, in the form of **creep.**

- Earth scientists 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.

Classification Of Faults

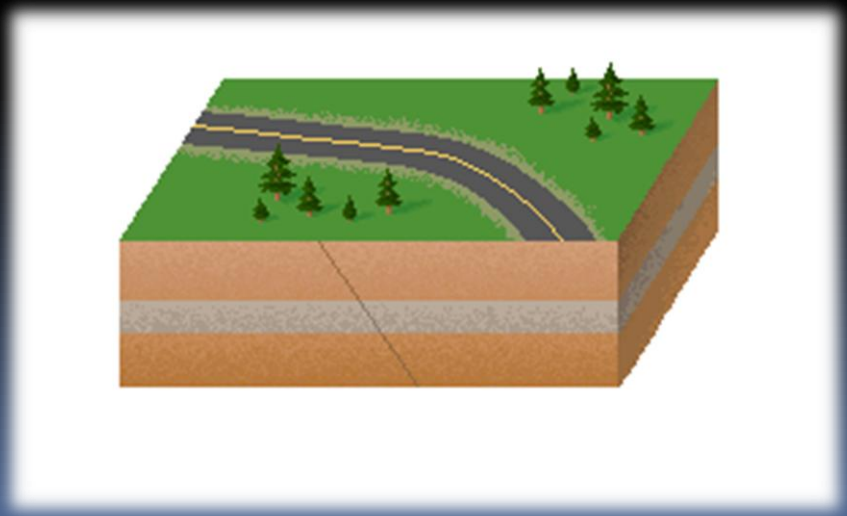
Normal fault:

a dip-slip fault in which the block above the fault has moved downward relative to the block below.



Thrust (reverse)fault:

a dip-slip fault in which the upper block, above the fault plane, moves up and over the lower block.



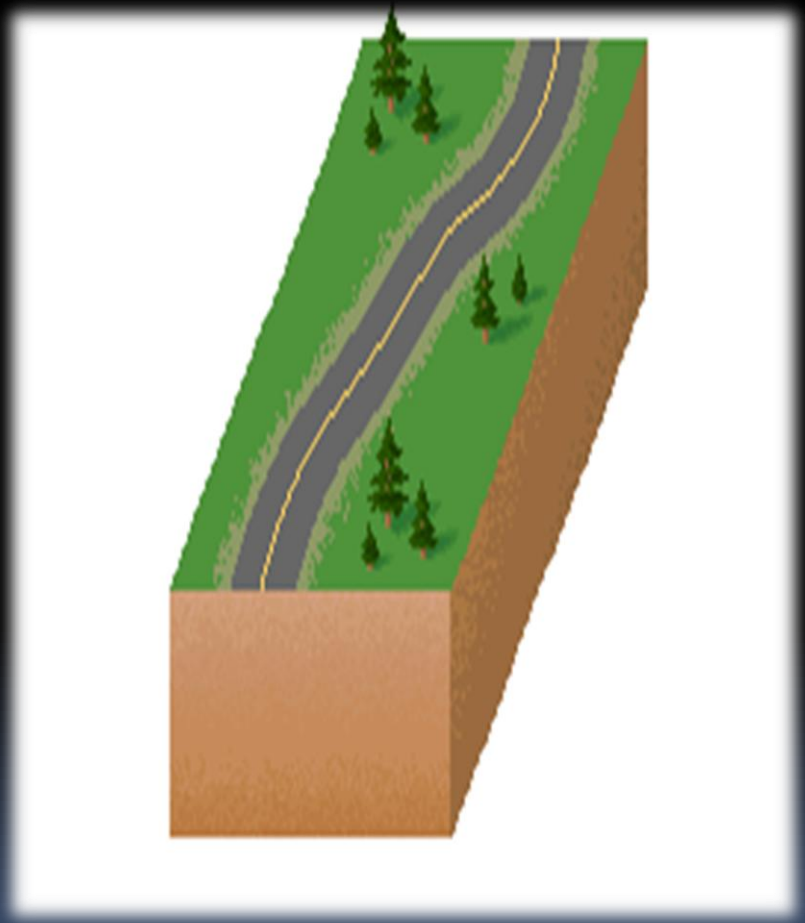
Strike-slip fault:

- **A left-lateral strike-slip fault :**

It is one on which the displacement of the far block is to the left when viewed from either side.

- **A right-lateral strike-slip fault:**

It is one on which the displacement of the far block is to the right when viewed from either side.



Some major causes of earthquakes on basic of its causes are:

- Surface causes
- Volcanic causes
- Tectonic causes

Surface cause:

Great explosions, landslides, slips on steep coasts, dashing of sea waves , avalanches , railway trains, heavy trucks, some large engineering projects cause minor tremors. some of them are man made, other are natural.

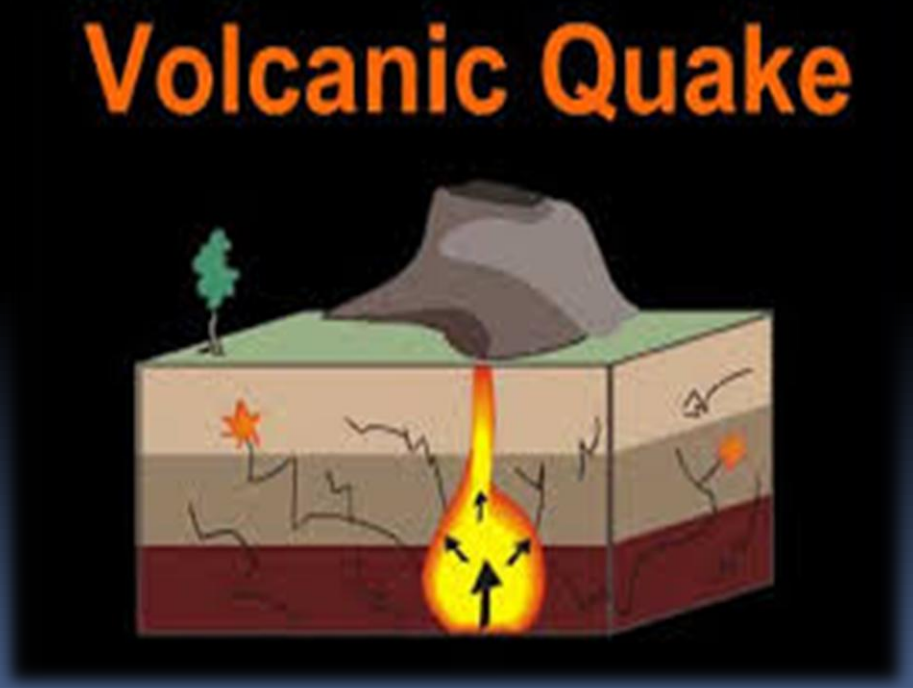
Volcanic cause:

Volcanic eruptions produce earthquakes. Earthquakes may precede, accompany and frequently follow volcanic eruptions.

They are caused by sudden displacements of lava within or beneath the earth crust.

There are two general categories of earthquakes that can occur at a volcano:

- volcano-tectonic earthquakes
- long period earthquakes.



Tectonic cause:

Structural disturbances resulting in the parts of the lithosphere is the main cause of this type of earthquake.

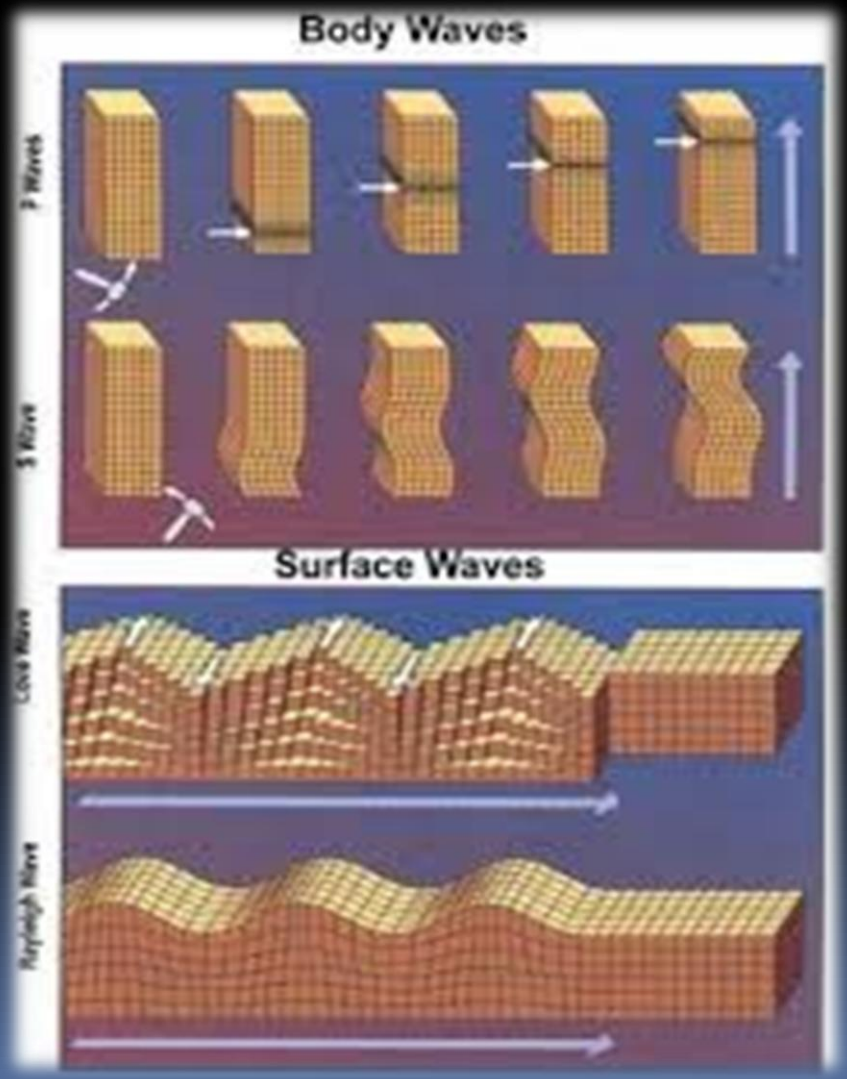
Most of the disastrous earthquakes belong to this category and occur in areas of great faults and fractures. Sudden yielding to strain produced on the rocks of accumulating stress causes displacements especially along old fault zones known as great transform faults.

Plate Boundary Overview.flv

Waves produced due to Earthquake

Seismic waves produced due to earthquake are basically divided into two major types:

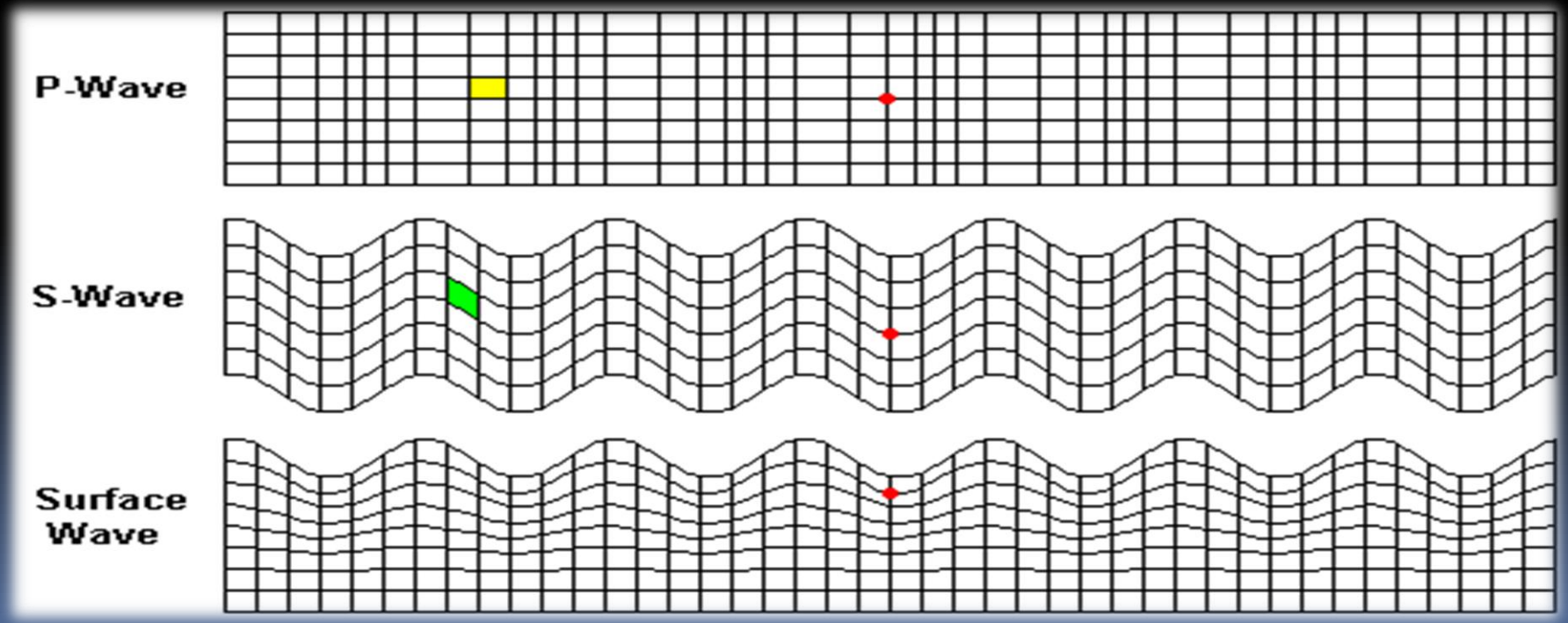
- Body waves
- Surface waves



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**

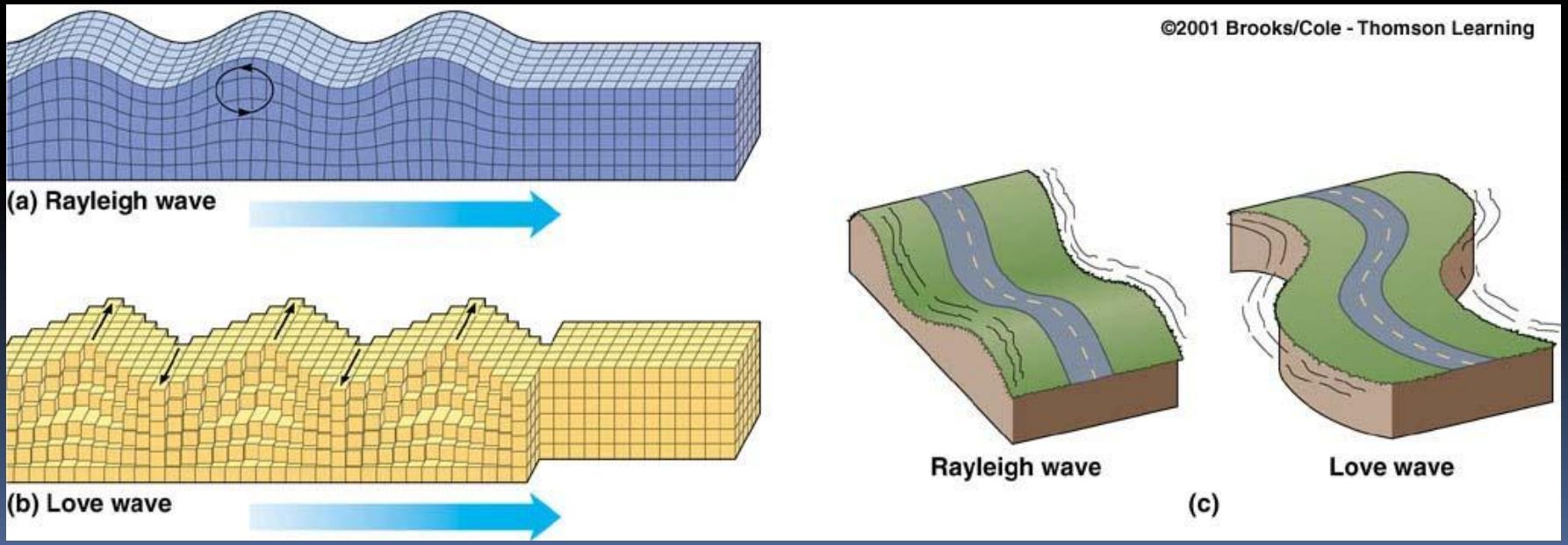


Primary Waves (P-waves)	Secondary Waves(S-wave)
High frequency	High frequency
Short Wavelength	Short Wavelength
Longitudinal waves	Transverse waves
Pass trough both solids and liquids	Can not move through liquids
Move forwards and backwards as it compressed and decompressed	Move in all direction from 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**



Love Waves	Rayleigh wave
Guided waves	Guided waves
Displacement is parallel to the free surface	Displacement is perpendicular to love-wave displacement
Love wave is faster	Rayleigh wave is slower
Causes horizontal shifting of the earth surface.	Ground move in circular motion.

Strength Of Earthquake

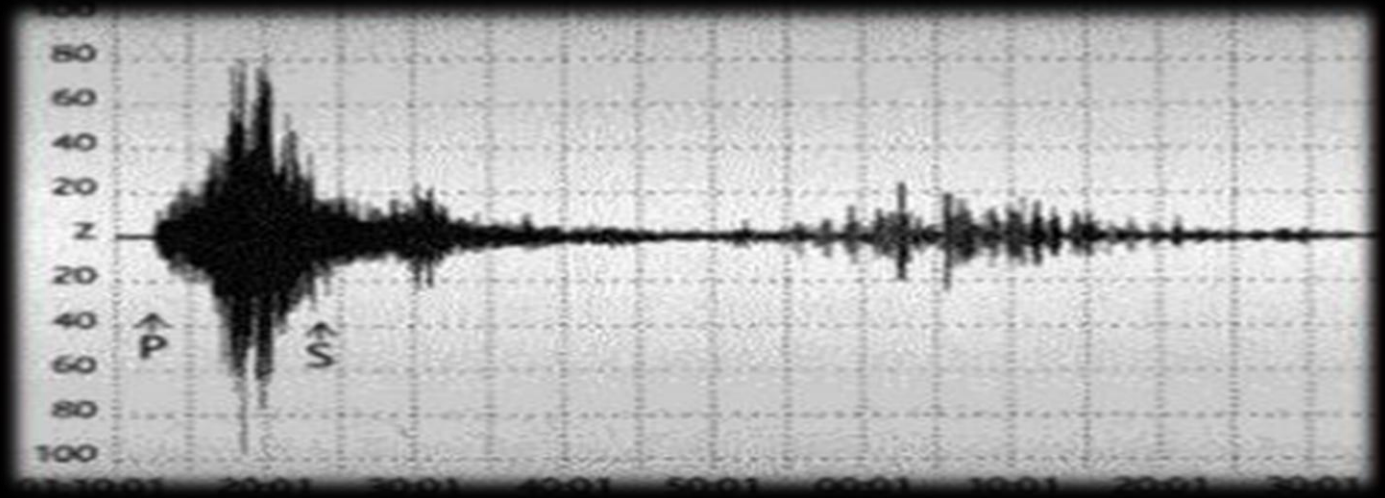
The intensity and strength of an earthquake is measured on Richter scale,the scale invented by Charles Richter California ,USA in 1935.which categories earthquake on the basis of energy released.

Defintion:

“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.”

Scientists measure the strength of earthquakes using machines known as **seismographs.**

- **Seismology** 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

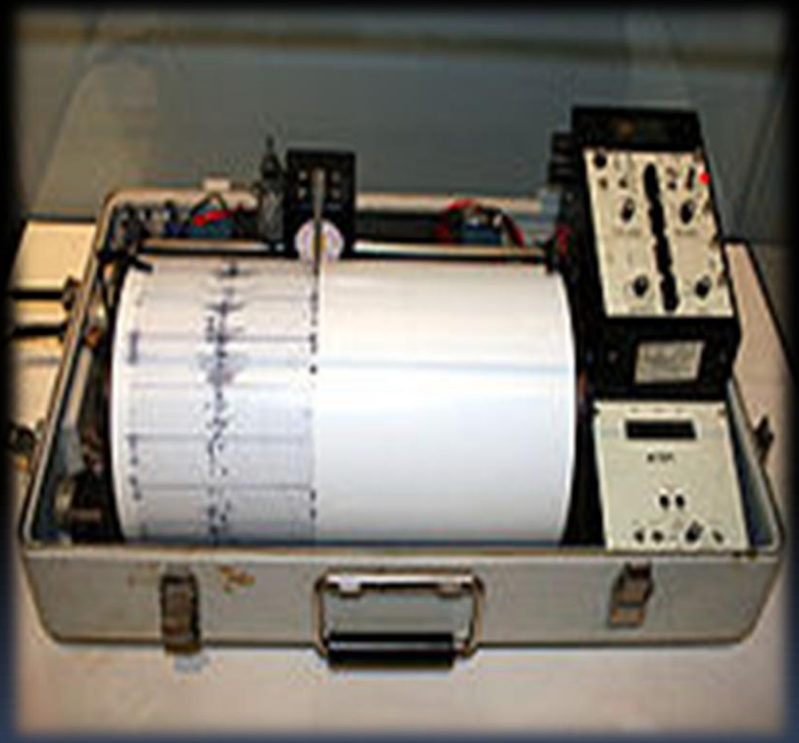
Amount of energy released during different Earthquake:

Intensity Of Earthquake On Richter Scale:	Energy Release (Amount Of TNT):
1.0	170 Grams
2.0	6 Kilogram
3.0	179 Kilogram
4.0	5 Metric Tons
5.0	179 Metric Tons
6.0	5643 Metric Tons
7.0	179100 Metric Tons
7.5	1 Mega Tons
8.0	564300 Metric Tons

Seismometers-The measurement of earthquake

- **Seismometers** are instruments that measure motions of the ground, including those of seismic waves generated by earthquakes, volcanic eruptions, and otherseismic sources.

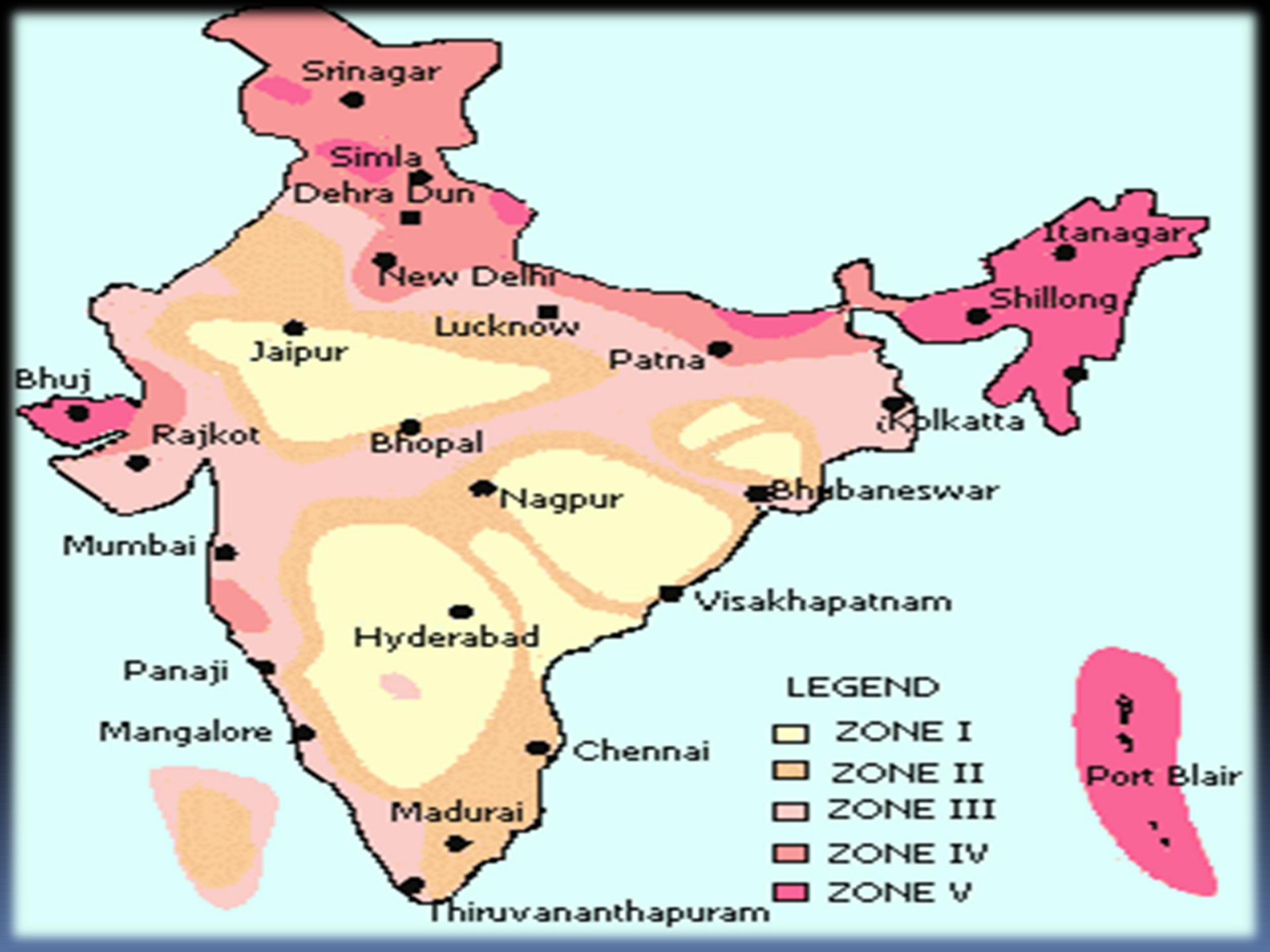
- Seismometers may be deployed at Earth's surface, in shallow vaults, in boreholes, or underwater.



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.


Srinagar
Simla
Dehra Dun
New Delhi
Lucknow
Jaipur
Patna
Bhuj
Rajkot
Bhopal
Nagpur
Mumbai
Hyderabad
Visakhapatnam
Panaji
Mangalore
Chennai
Madurai
Thiruvananthapuram
Itanagar
Shillong
Kolkatta
Bhubaneswar
Port Blair
LEGEND
ZONE I
ZONE II
ZONE III
ZONE IV
ZONE V

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

- 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
- 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.

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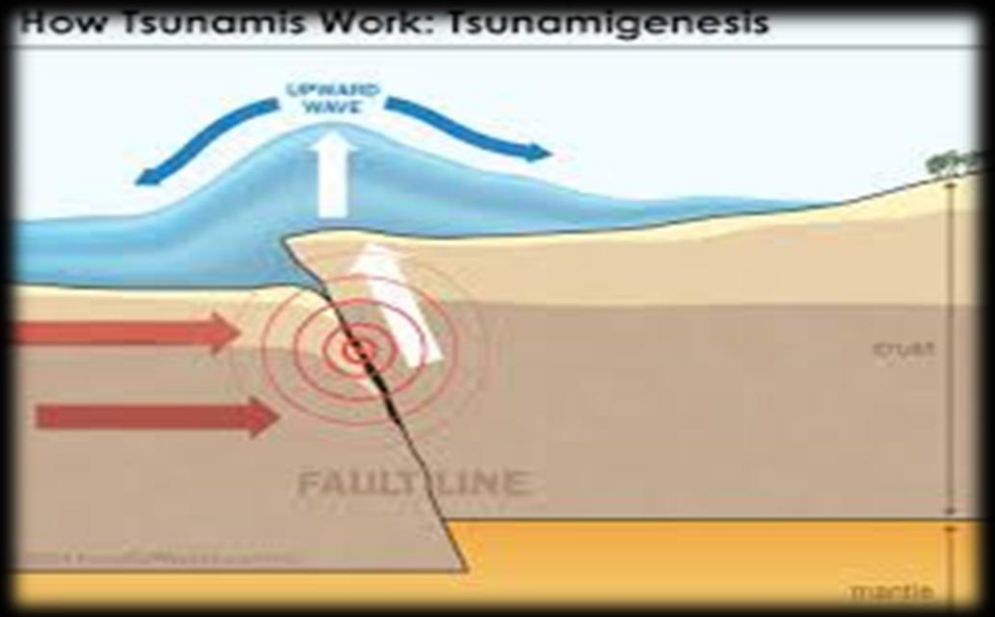
Landslides

Shaking and ground rapture

Fires

Soil liquefaction

Tsunami



Floods

Earthquake Safety Rules

If you are in house;

• Don’t use lift for getting down from building.

• Be prepared to move with your family.

If you are in shop ,school or office;

• Don’t run for an exit.

•Take cover under a disk/table.

•Move away from window glass.

•Do not go near electric point and cable. Keep away from weak portion of the building and false ceiling.

If you are outside;

• Avoid high buildings , walls , power lines and other objects that could fall and create block.

• Don’t run through streets.

• If possible , move on to an open area away from hazard including trees.

If you are in vehicle;

• Stop in a safe open place.

• Remain inside vehicle.

• Close window , doors and vents.

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.

Cont..

- 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.

Date	Place	Scale	Damage
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.


Picture Of Search And Rescue Phase Of Latur
Earthquake 1993

Helpless man being trapped under debris


disaster picture from Kashmir earthquake
2005

Earthquake
Case study: Bhuj Earthquake 26th January 2001

- Date: 26th January ,2001
- Origin line: 08 hrs.46 min. 42.9 sec. IST
- Epicenter: Latitude 23.40° N Longitude 70.28°E
- Magnitude: 7.7
- Focal Depth: 25 kms.


Pakistan
New Delhi
Nepal
Hyderabad
Bhachau
Bhuj
Ahmedabad
India
Bombay
Arabian
Sea

- On the morning of **January 26, 2001**, the Nation's 52nd Republic Day, a devastating earthquake occurred in the **Kutchh** district of the state of Gujarat.

- The earthquake was felt as far away as Delhi in the north, Kolkata in the east.

- **Bhuj town** and the village **Bhachau,** 60 km east of Bhuj, were the worst affected and many other areas of Gujarat including its state headquarters Ahmedabad, were badly affected.

Damage assessment

- There were more than 20,000 deaths and 167,000 people injured Four districts of Gujarat lay in ruin and altogether, 21 districts were affected.
- Around 300,000 families and at least 3 million children under 14 aged were affected.

- Around 600,000 people were left homeless.

- In the city of Bhuj, more than 3,000 Population of the city lost their lives; the main hospital was crushed and close to 90% of the buildings was destroyed.

- There was significant damage to infrastructure with facilities such as hospitals, schools, electric power and water systems, bridges and roads damaged or destroyed.


Damage to high rise building in Bhuj
Paras Shah / AP


5 year old girl recovers at a hospital in Bhuj on Monday after Friday's massive earthquake.
Saurabh Das / AP

Local response

- The response within India was immediate. The national and state governments quickly provided assistance in many forms including cash, medical supplies, communications teams, shelters, food, clothing, transport and relief workers.

- There were more than 185 non-government organizations (NGOs), mostly Indian charities, which undertook earthquake-related activities

International response

- Search and Rescue teams soon arrived from Switzerland, United Kingdom, Russia and Turkey to find and rescue survivors buried under debris.
- Relief teams and supplies soon followed from 38 countries as well as United Nations agencies and many international NGOs such as the Red Cross.
- The world bank and Asian development bank sanction loans in less than three months after the earthquake.

Relief And Reconstruction

- Gujarat earthquake emergency reconstruction project (GEERP) was started by GSDMA(Gujrat State Disaster Management Authority), with financial help from world bank, Asian development bank, govt of India and other donor agencies.

- Several state governments came forward to participate in, the reconstruction work in different villages.

- The UN system, multilateral and bilateral agencies, NGOs and the corporate sector participated in the relief and reconstruction work.

Cont…

- Government of Gujarat provided assistance in the form of materials and cash to about 218,000 families.
- NGOs supplemented the efforts by providing shelter to about 7000 families.
- About 65 NGOs were active in kutch alone who adopted 211 villages and constructed 32,297 houses at the cost of Rs. 185.80 crores.
- The technical support was made available to the owners who were provided loan to reconstruct the houses.

Major Earthquakes of the World