

EARTHQUAKE AS A DISASTER WITH SPECIAL REFERENCE TO PUNJAB

MANJIT SINGH

Assistant Professor of Geography
GKSM Govt. College, Tanda Urmar

WHAT IS DISASTER

DISASTER is an event which is –

- Generally unpredictable,
- Happens instantly or without giving enough time to react
- Affecting a large number of people,
- Disrupting normal life and leading to a large scale devastation in terms of loss of life and property
- Always finding the administration and affected people struggling to respond in the desired manner and
- Leaving deep socio-psychological, political and economic after effects which persist for a long time to come.

TYPES OF DISASTER

Natural Disasters

Meteorological

Topographical

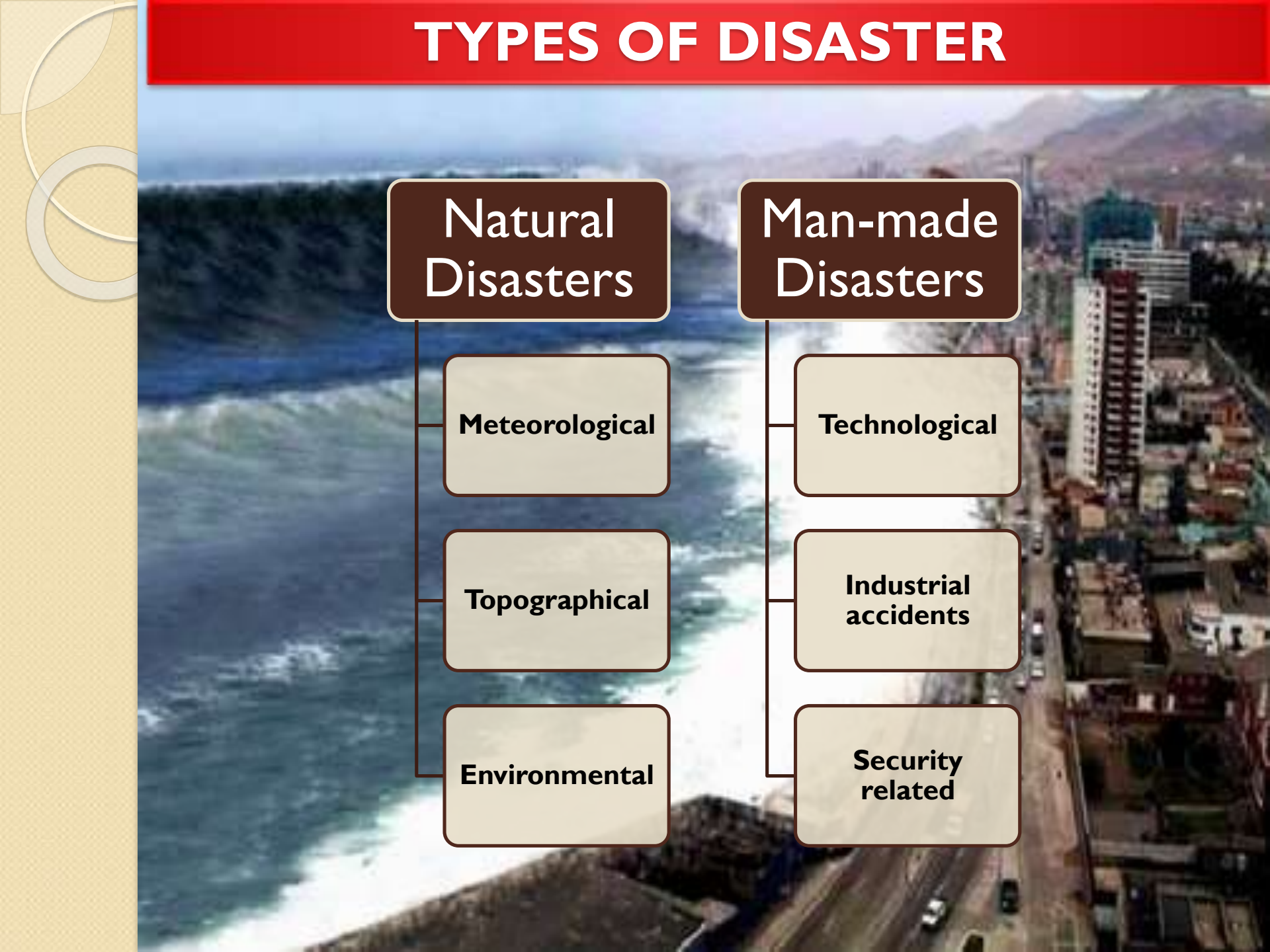
Environmental

Man-made Disasters

Technological

Industrial accidents

Security related



NATURAL DISASTERS

Floods

Earthquakes

Cyclones

Droughts

**Landslides, Pest Attacks, Forest Fires,
Avalanches etc**

TIME DURATION OF NATURAL DISASTERS

Earthquakes	->	Seconds/minutes
Cyclones	->	Days
Floods	->	Days
Droughts	->	Months

ELEMENTS AT RISK

- People
- Livestock
- Rural Housing Stock
- Houses Vulnerable
- Crops, Trees, Telephone, Electric poles
- Boats, Looms, Working Implements
- Personal Property
- Electricity, Water and Food Supplies
- Infrastructure Support

FACTORS RESPONSIBLE FOR INCREASING NUMBER OF DISASTERS

- Population Growth and Urban Development
- Development Practices
- Climatic changes
- Effect of Environmental degradation

GENERAL EFFECTS OF DISASTER

- Loss of life
- Injury
- Damage to and destruction of property.
- Damage to and destruction of production.
- Disruption of lifestyle
- Loss of livelihood.
- Disruption to essential services
- Damage to national infrastructure
- Disruption to governmental systems
- National economic loss
- Sociological and psychological after effect.

MAJOR DISASTERS IN INDIA : 1990 - 2005

YEAR	PLACES &	DISASTER	LOSS OF LIVES (APPROX)	LOSS OF PROPERTY (Rs Crore) (APPROX)
1991	Uttarkashi	Earthquake	2000	2000
1993	Latur	Earthquake	9500	6000
1997	Jabalpur	Earthquake	200	5000
1999	Chamoli	Earthquake	2000	2000
1999	Orissa	S Cyclone	9887	10000
2001	Bhuj	Earthquake	14000	13400
2004	SE India	Tsunami	15000	10000
2004	Assam & Bihar	Floods	700	5000
2005	J&K	Avalanche	350	100
2005	Mah, Guj, HP, Karnataka, T'Nadu	Floods	1569	10300
2005	J&K	Earthquakes	1336	1000
Total Losses of Major Disasters only			56542	64800

1. If Average Annual Lives Lost are Added, Figure Will go to More than

2. Adding Average Annual Losses, the Figure Will be More than

121,500

156,000 Cr

DISASTERS AFFECTING INDIA

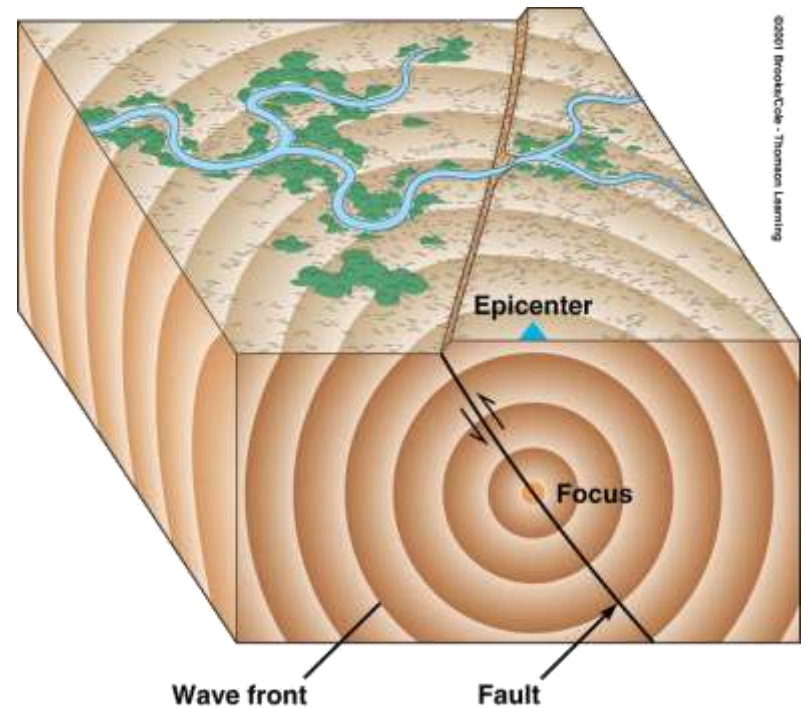
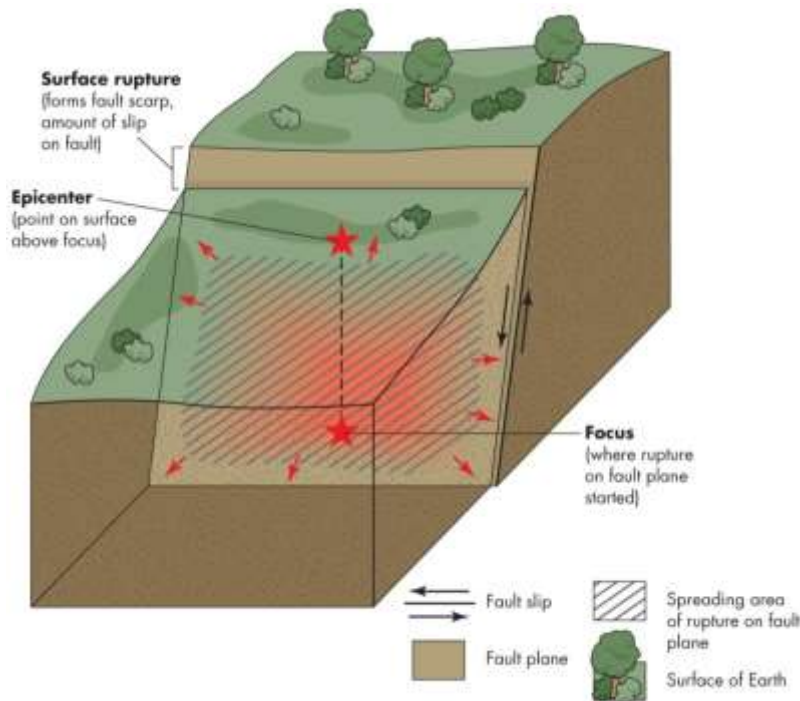
- EARTHQUAKE
- VOLCANIC ERUPTION
- TSUNAMI
- CYCLONE
- FLOOD
- LANDSLIDE
- BUSHFIRE
- DROUGHT
- MAJOR ACCIDENT (FIRE, EXPLOSION, HAZMAT)
- CIVIL UNREST

What are Earthquakes?

- The shaking or trembling caused by the sudden release of energy
- Usually associated with faulting or breaking of rocks
- Continuing adjustment of position results in aftershocks

The **Focus** and **Epicenter** of an Earthquake

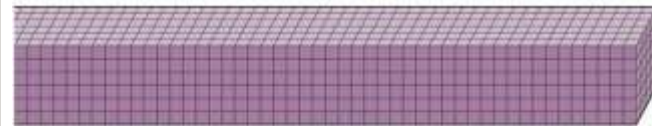
- The point within Earth where faulting begins is the focus, or hypocenter
- The point directly above the focus on the surface is the epicenter



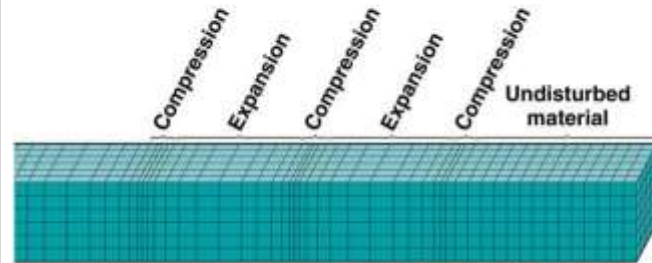
What are Seismic Waves?

- Response of material to the arrival of energy fronts released by rupture
- Two types:
 - Body waves
 - P and S
 - Surface waves
 - R and L

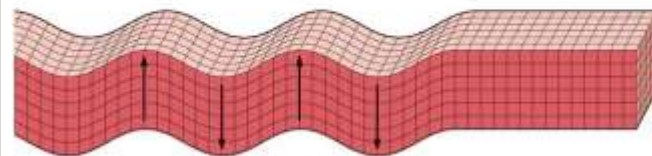
Body Waves: P and S waves



(a) Undisturbed material

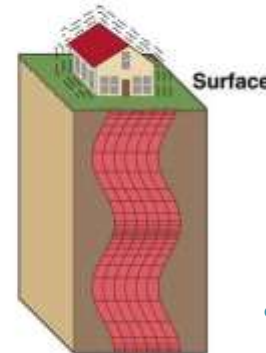


(b) Primary wave



(c) Secondary wave

©2001 Brooks/Cole - Thomson Learning



Focus
(d)

- Body waves

- **P or primary waves**

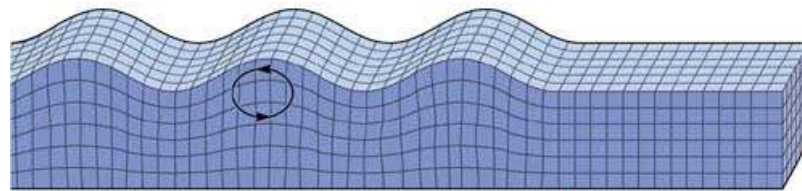
- fastest waves
- travel through solids, liquids, or gases
- compressional wave, material movement is in the same direction as wave movement

- **S or secondary waves**

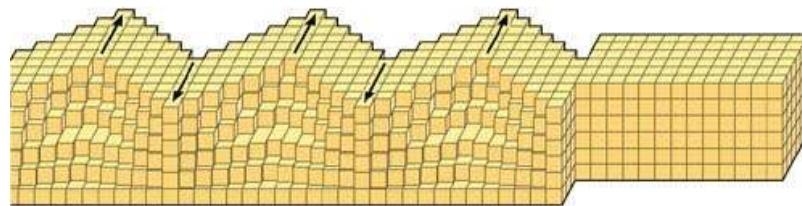
- slower than P waves
- travel through solids only
- shear waves - move material perpendicular to wave movement

Surface Waves: R and L waves

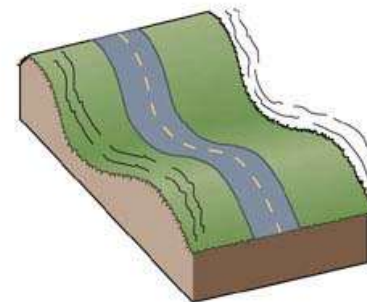
©2001 Brooks/Cole - Thomson Learning



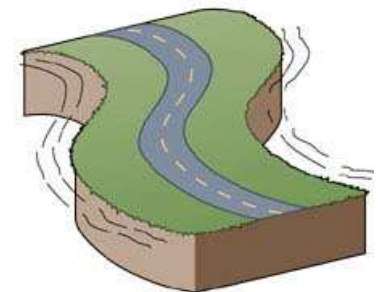
(a) Rayleigh wave



(b) Love wave



Rayleigh wave



Love wave

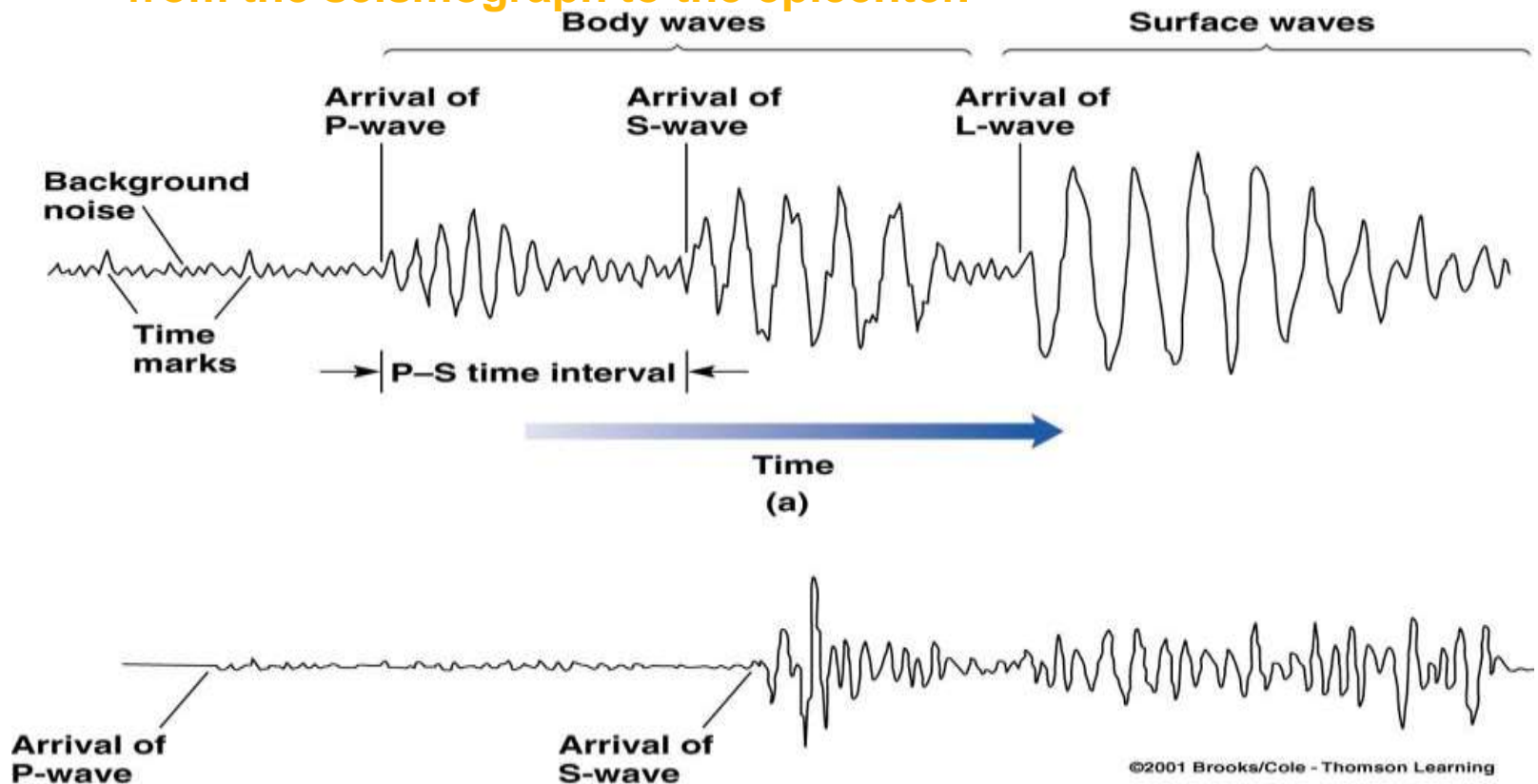
(c)

- **Surface Waves**
 - Travel just below or along the ground's surface
 - Slower than body waves; rolling and side-to-side movement
 - Especially damaging to buildings

How is an Earthquake's Epicenter Located?

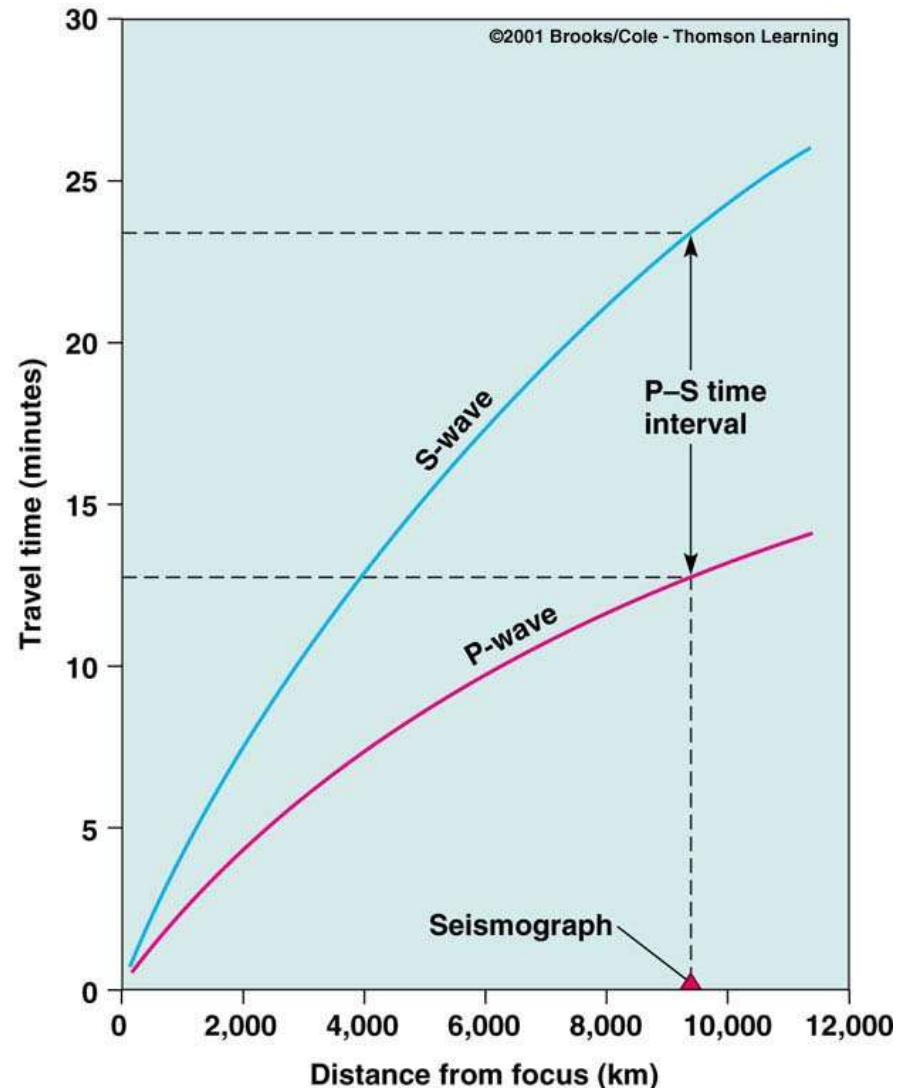
Seismic wave behavior

- **P waves arrive first, then S waves, then L and R**
- **Average speeds for all these waves is known**
- **After an earthquake, the difference in arrival times at a seismograph station can be used to calculate the distance from the seismograph to the epicenter.**



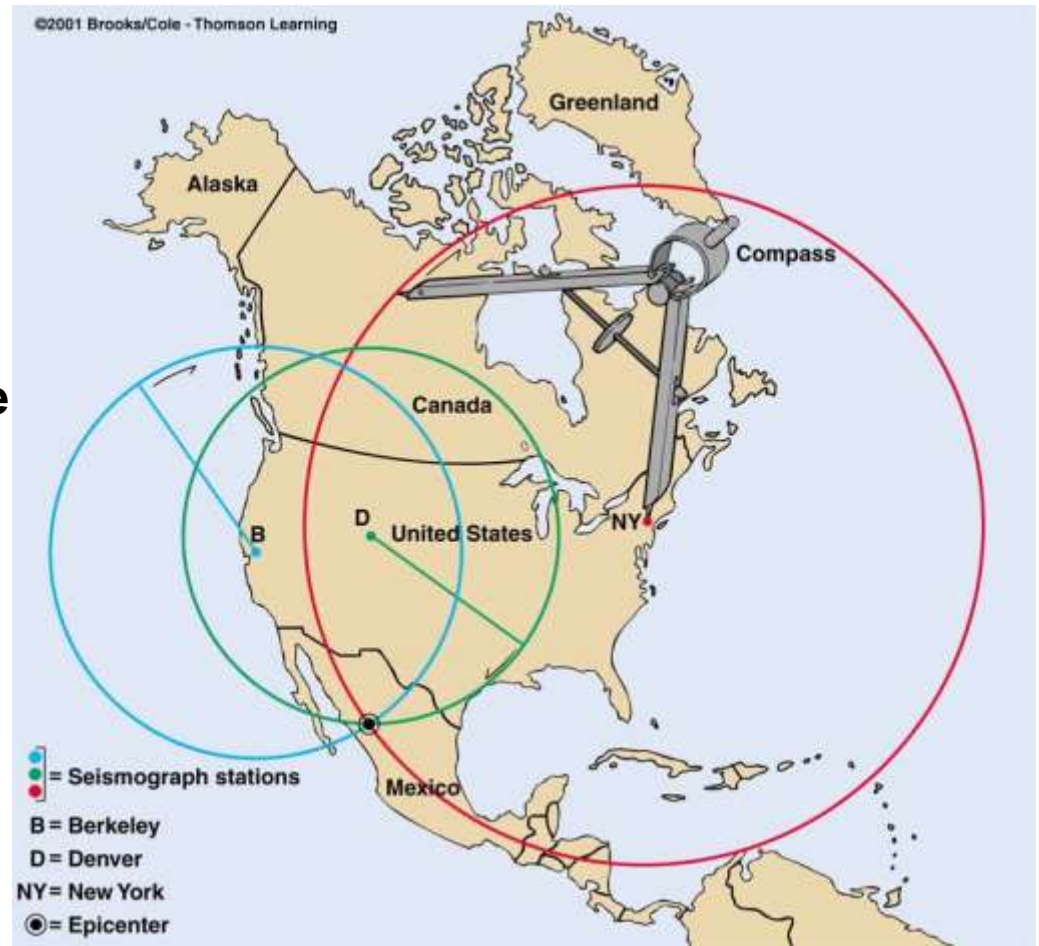
How is an Earthquake's Epicenter Located?

Time-distance graph showing the average travel times for P- and S-waves. The farther away a seismograph is from the focus of an earthquake, the longer the interval between the arrivals of the P- and S-waves

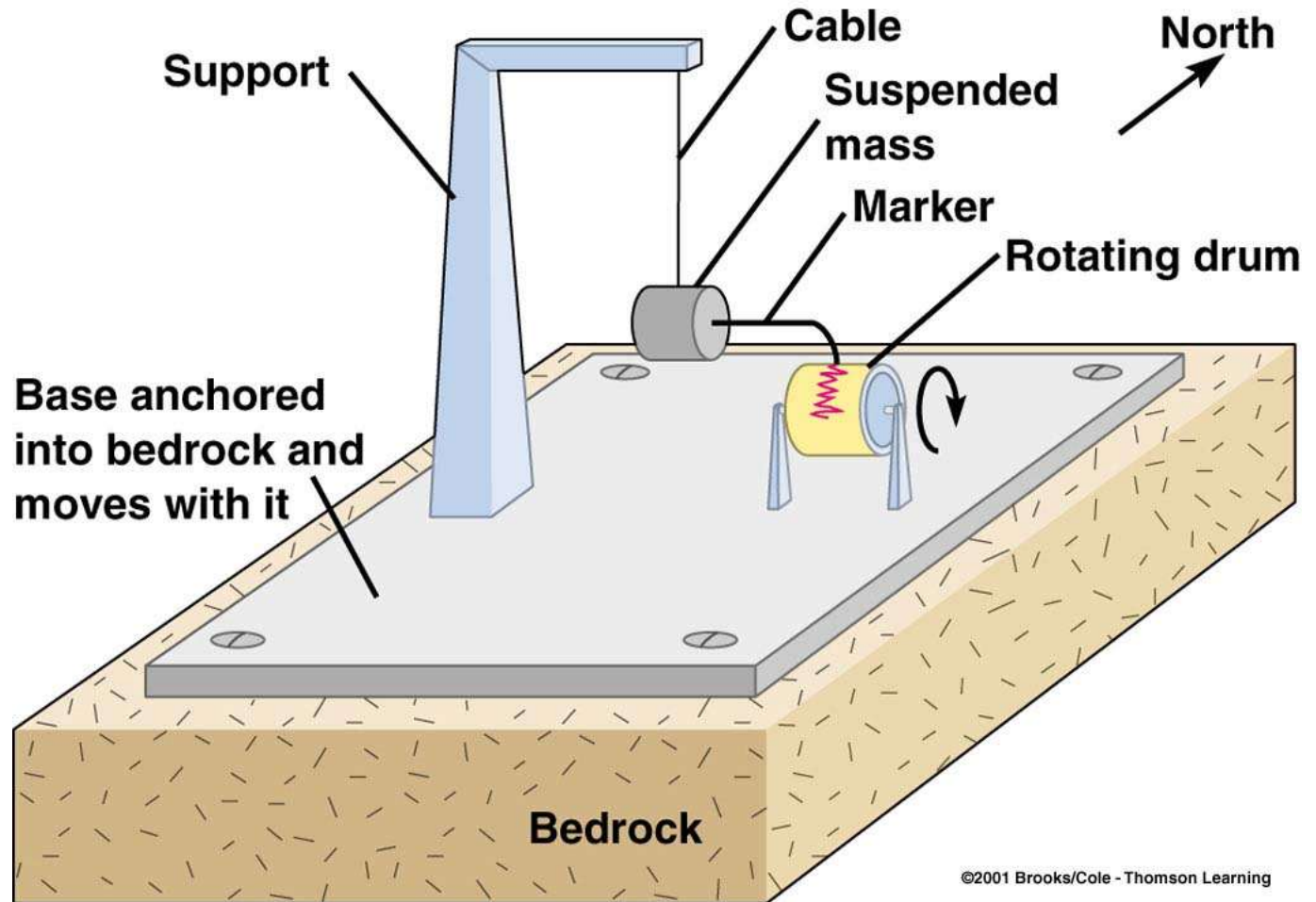


How is an Earthquake's Epicenter Located?

- Three seismograph stations are needed to locate the epicenter of an earthquake
- A circle where the radius equals the distance to the epicenter is drawn
- The intersection of the circles locates the epicenter



Seismographs record earthquake events



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 other seismic sources.

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



Causes Of Earthquake

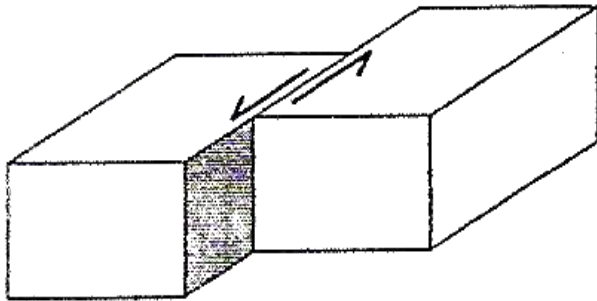
The **primary cause of an earthquake is faults** on the crust of the earth.

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

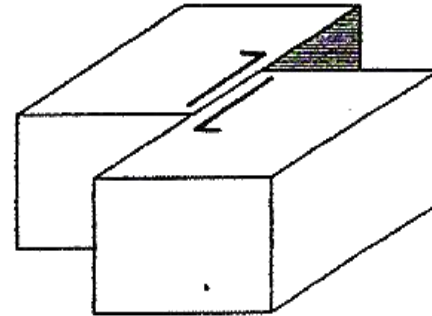
□ This movement may occur rapidly, in the form of an **earthquake** or may occur slowly, in the form of **creep**.

□ 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.

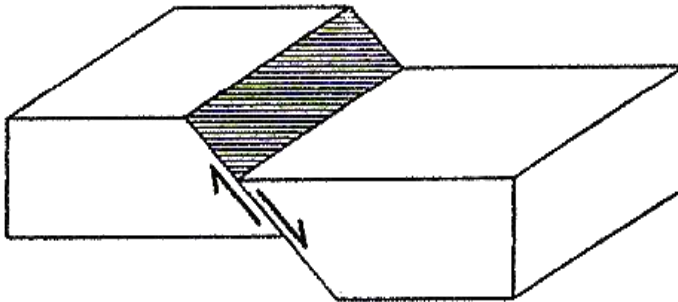
TYPES OF FAULT



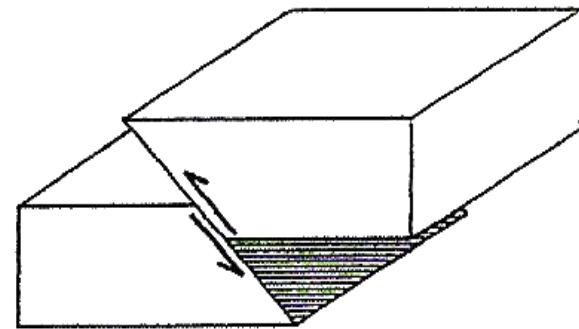
Left-lateral strike-slip fault
($\lambda = 0^\circ$)



Right-lateral strike-slip fault
($\lambda = 180^\circ$)



Normal dip-slip fault
($\lambda = -90^\circ$)

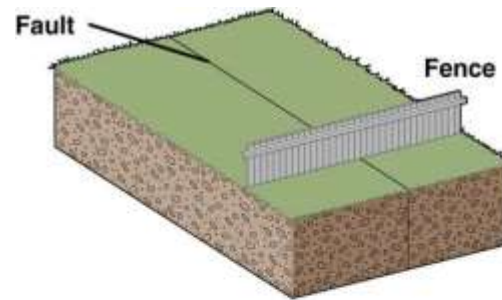


Reverse dip-slip fault
($\lambda = 90^\circ$)

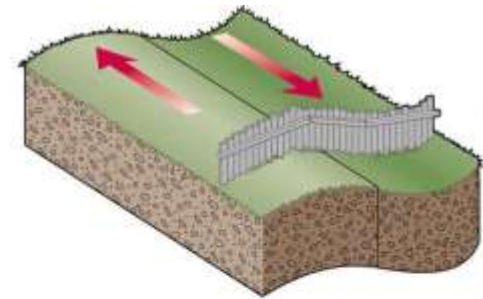
What is the **Elastic Rebound Theory**?

Explains how energy is stored in rocks

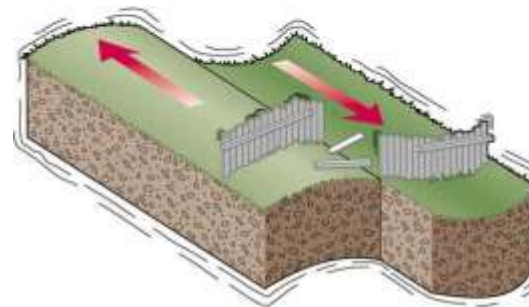
- Rocks bend until the strength of the rock is exceeded
- Rupture occurs and the rocks quickly rebound to an undeformed shape
- Energy is released in waves that radiate outward from the fault



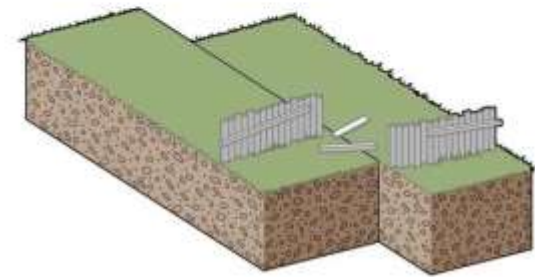
Original position



Deformation



Rupture and release of energy



Rocks rebound to original undeformed shape

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.

Volcanic Quake



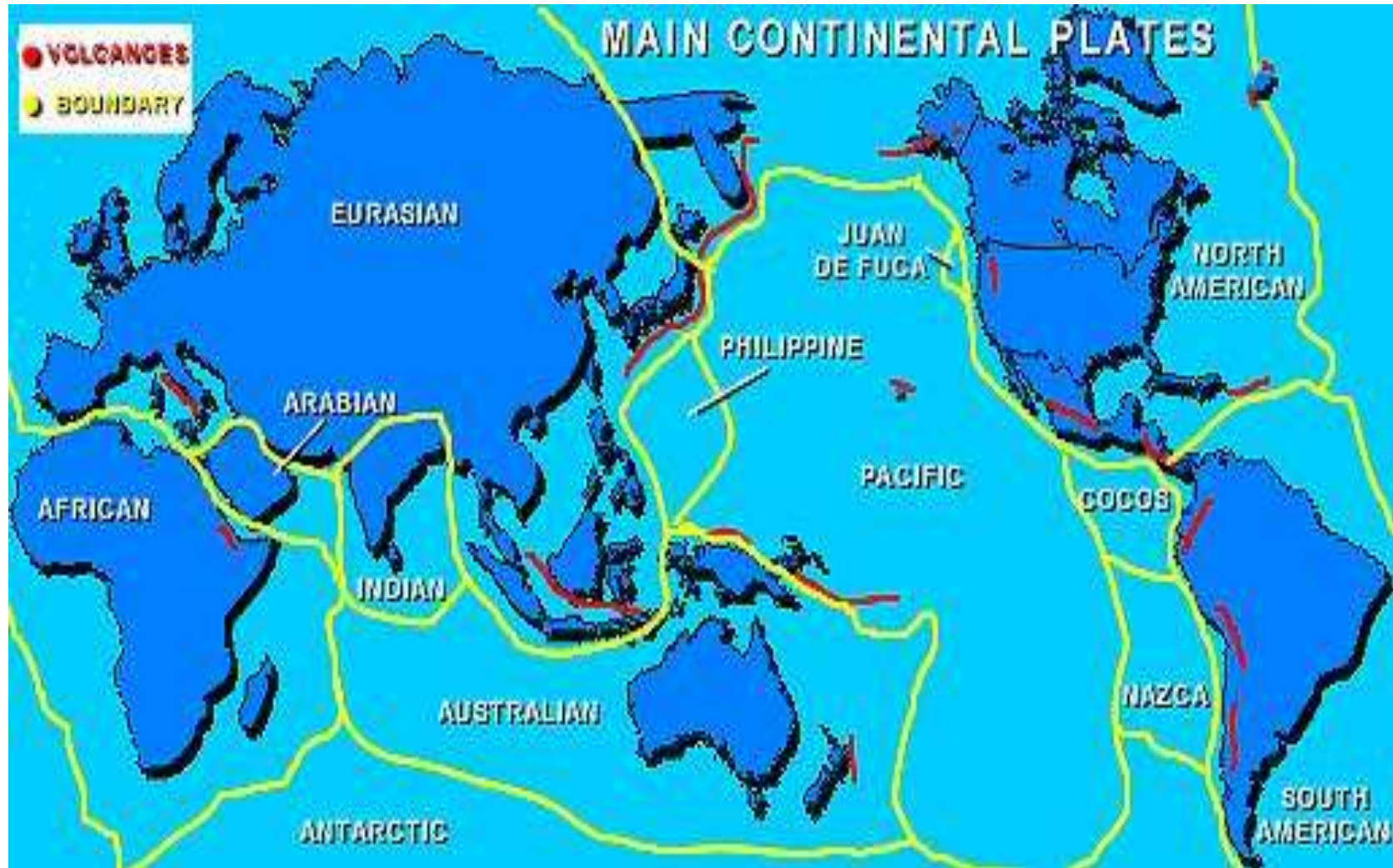
Tectonic cause:

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](#)

MAJOR PLATES OF THE EARTH



EARTHQUAKE CLASSIFICATION

MAGNITUDE

CLASSIFICATION

$M \geq 8.0$

Great Earthquake

$7.0 \geq M < 8.0$

Major / Large

$5.0 \geq M < 7.0$

Moderate Earthquake

$3.0 \geq M < 5.0$

Small Earthquake

$1.0 \geq M < 3.0$

Micro Earthquake

$M < 1.0$

Ultra Micro Earthquake

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

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.

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.

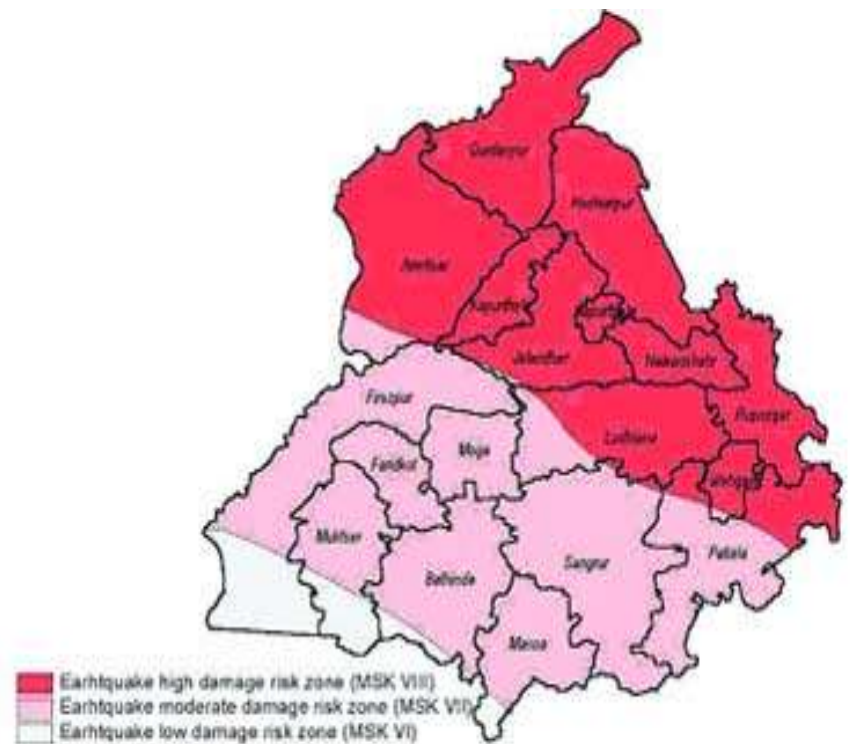
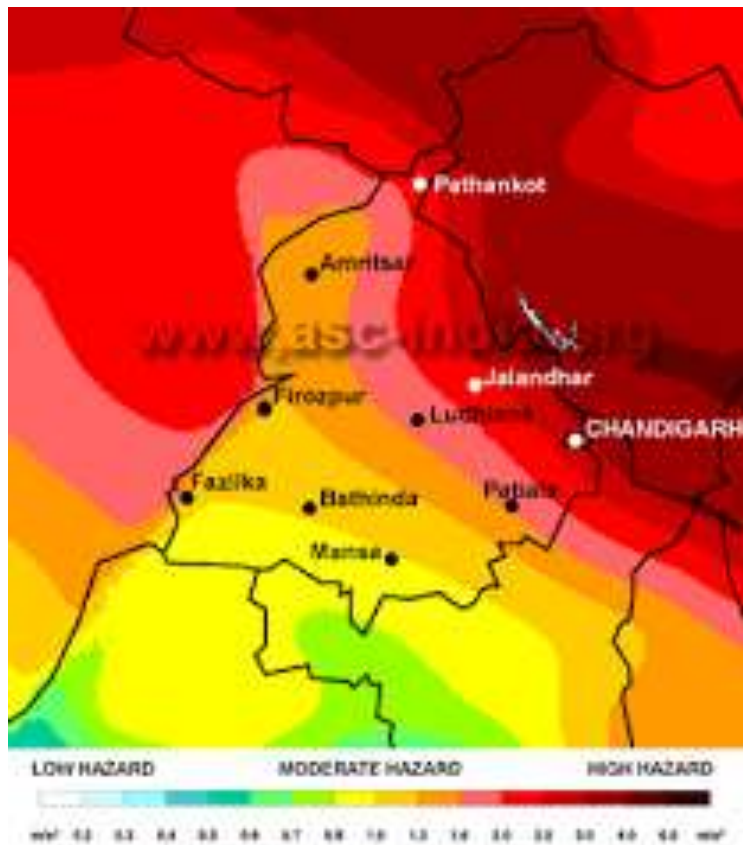
STATE DISASTER MANAGEMENT PLAN PUNJAB



**DEPARTMENT OF REVENUE, REHABILITATION AND
DISASTER MANAGEMENT
GOVERNMENT OF PUNJAB**

Fig: 2.1.6

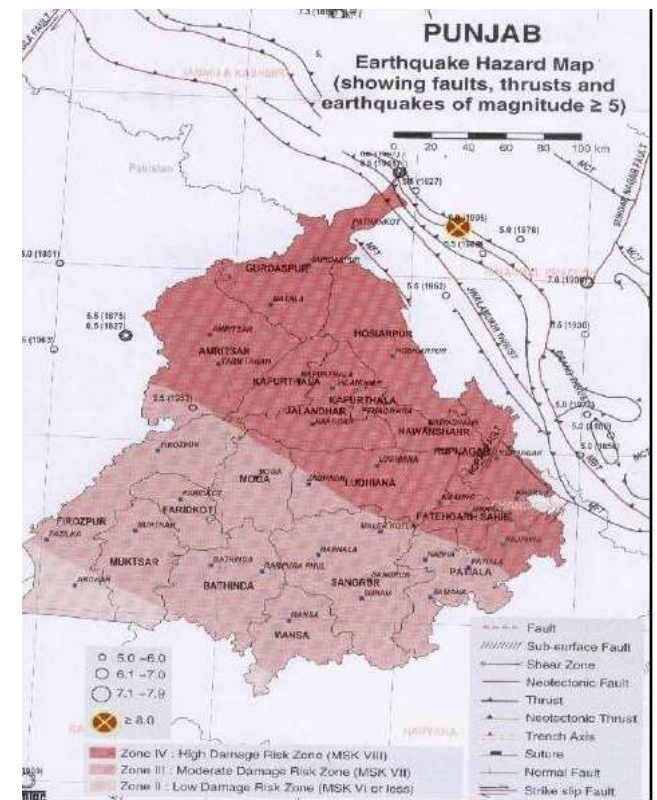
Seismic Zone of Punjab



From the earthquake hazard map given in the above, it is seen that about 50 percent of the area of the state in the north, consisting of Amritsar, Gurdaspur, Hoshiarpur, Jalandhar, Kapurthala, Ludhiana, Patiala and Rup Nagar districts is liable to MSK Intensity VIII

about 45 percent could have Intensity VII. An earthquake of M 5.5 occurred in Kapurthala district in 1952

much larger earthquakes of M 7.0 to 8.0 have occurred in Himachal Pradesh at about 50 to 60 km from the State boundary, which could cause moderate to heavy damage in the districts of Gurdaspur, Amritsar and Hoshiarpur. Earthquakes of $M > 5.0$ that are known to have occurred in

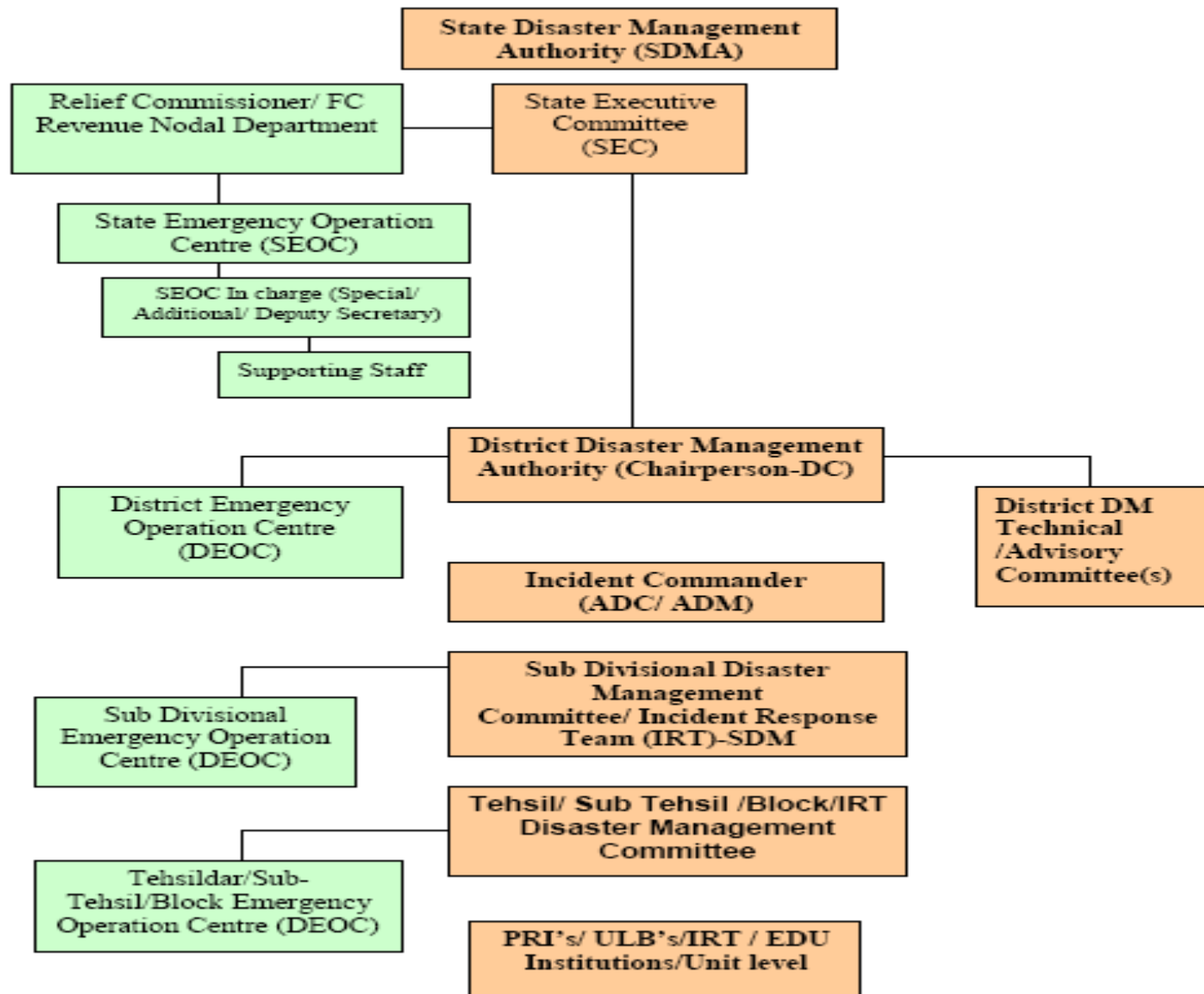


State Disaster Management Authority

1.	Honourable Chief Minister	Ex-Officio Chairperson
2.	Hon'ble Revenue Minister	Ex-Officio Vice-Chairperson
3.	Principal Secretary, Home	Member
4.	Principal Secretary, Finance	Member
5.	Principal Secretary, Local Government	Member
6.	Financial Commissioner, Revenue	Member
7.	P.S.C.M	Member
8.	Chief Town Planner, Punjab	Member
9.	G.O.C. in Chief, Western Command or any other Army Officer not below the rank of Major General	Member

District Level Disaster Management Authority

S.No.	Officials	Designation
1.	Deputy Commissioner	Ex-Officio Chairperson
2.	Chairperson of the Zila Parishad	Co-Chairperson
3.	President of Mayor of the ULB at District Headquarters	Co-Chairperson
4.	Senior Superintendent of Police	Member
5.	Chief Medical Officer	Member
6.	Superintending engineer (PWD)	Member
7.	District Food Supplies and Controller	Member
8.	Additional Deputy Commissioner (General)	C.E.O.-cum-Member



Gram Panchayat/Village Disaster Management Committee

The response plan has been subdivided into the following sections

- a) Response Management Arrangements
- b) State Disaster Response Plan
- c) Emergency Support Functions

Village Level DM Teams: The village level DM Teams of 20 volunteers of each village is planned to be trained on all types of Disasters and improvisations. They will be trained on temporary flood protection jobs as well.

Proposed Composition of Village teams

Drivers owning tractors- 4

Electricians- 2

Plumbers- 1

Para medical individual- 2 (Preferably one lady)

Individual having net knowledge- 1

Male (Individuals between 18 to 45 years- 8

Females (between 18 to 40 yrs) - 2

DISASTER MANAGEMENT CYCLE

PRE-DISASTER

DURING DISASTER

Preparation



POST-DISASTER

Preparedness -- activities prior to a disaster.
Examples: preparedness plans; emergency exercises/training; warning systems.

Response -- activities during a disaster.
Examples: public warning systems; emergency operations; search and rescue.

Recovery -- activities following a disaster.
Examples: temporary housing; claims processing and grants; long-term medical care and counseling.

Mitigation - activities that reduce the effects of disasters.
Examples: building codes and zoning; vulnerability analyses; public education.



ACTION PLAN FOR EARTHQUAKE

Action Points	EARTHQUAKE
PLANNING AND PREPARATION	Identification of earthquake prone areas
IDENTIFICATION OF PROBLEMS	<ul style="list-style-type: none">➤ Loss of human life➤ Casualties buried under fallen debris➤ Destruction and damage to buildings➤ Disruption of communication by land, sea and air➤ Disruption of civic amenities e.g. electricity, water, transport, medical, telephones➤ Civil supplies etc.➤ Large scale fires➤ Floods in certain areas.➤ Landslide in hilly areas.➤ Disposal of human bodies and animals.➤ Exposure to disease and danger of epidemics.➤ Breakdown of law and order.➤ Breakdown of normal Government machinery in affected areas due to Government servants themselves being affected by earthquake.➤ Loss of morale.➤ Movement of population.

ADVANCE
PREPARATORY
ACTION PLAN

- Preparation of Plans and skeleton organization in advance.
- Training of personnel.
- Establishment of alternative means of mobile communications.
- Mobilization of Fire Services including auxiliary firemen.

- Plans of rescue of casualties trapped under-debris.
- Provision of hospital, medical and nursing staff.
- Medical plans for improvised first aid posts and emergency hospitals.
- Removal of Debris.
- Emergency sanitation, alternative supplies of water, salvage and custody of valuables, procurement, distribution accounting of gift stores, care of animals etc.
- Provision of welfare facilities

AFTER AN EARTHQUAKE	<ul style="list-style-type: none">➤ Instant reaction➤ Establishment of Control➤ Military Assistance➤ Corpse Disposal➤ Medical➤ Epidemics➤ Salvage➤ Deployment of Resources➤ Outsides Relief➤ Camp-work and Employment➤ Information
---------------------	--

REHABILITATION

1. Damage Assessment.
2. Restoration of personal belongings, vehicles/other resources requisitioned etc.
3. Repair of damaged roads/bridges/buildings any other etc.
4. Control of spread diseases any epidemic.
5. Provision of safe drinking water.
6. Checking of public buildings from safety point of view.
7. Restoration of normal community functions.
8. Dispelling any rumors as to the safety of the area affected.

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 desk/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 are aware of people who 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 be better and more capable of helping others.
- ◆ Do not walk around the streets to see what is happening. Keep the streets clear so rescue vehicles can access the roads easily.

WHAT TO DO IN AN EARTHQUAKE

BEFORE



Prepare the needed materials such as flashlight, first aid kit, battery-powered radio and fire extinguisher.



Keep sufficient knowledge about earthquakes and first aid. Practice "Drop, cover, hold" or earthquake drills.



Identify a place where to go during an earthquake and where to meet after it.



Don't leave heavy and fragile objects on shelves. If it will fall, neither heavy furniture and appliances to the walls or floor.

DURING



**DROP
COVER
HOLD**



Don't use the elevator.



Don't use matches, candles or any flame.



If you're currently stay in the street, avoid getting into trees, poles, buildings, powerlines or anything that might fall.



AFTER



Check yourself for injuries and help others. Stay on the radio and don't use phones unless necessary.



Check water, gas and electrical lines for damages.



Be careful of broken things and stay away from damaged places.



Expect aftershocks.

BE PREPARED & DON'T PANIC!

POSSIBLE EFFECTS



Tsunami



Volcano Eruption



Fire



Landslide

EMERGENCY HOTLINES

Philippine Emergency Telephone Number
911

National Disaster and Risk Reduction and Management Council
611-5486, 911-1985, 911-0888, 911-1873

Bureau of Fire Protection
129-5186, 422-6016

Red Cross
780-5226, 527-0888, 527-8080 to 88

Philippine
639-2-888 to 78

Awareness films by NDMA INDIA



NDMA INDIA Earthquake Preparedness Films



NDMA INDIA - Earthquake (are you ready)



Video on Earthquake, Jhooke Dhako Pakdo, NDMA

Video on Earthquake, Saavhan



Video on Earthquake, Saavhan



Video on Earthquake, Saavhan



NDMA INDIA Earthquake (Dost Annu - Hindi)



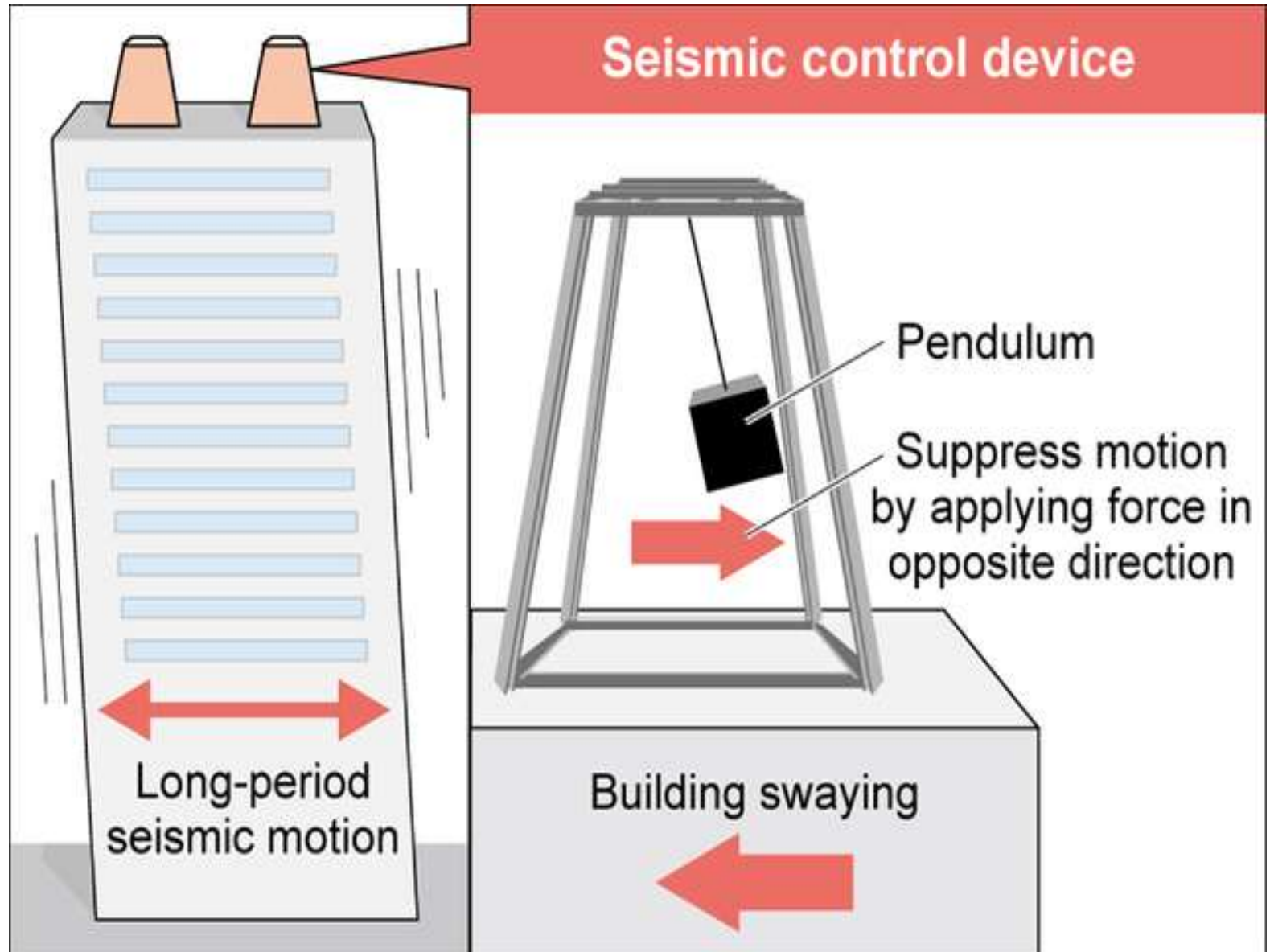
Earthquake - Tayyari Mein Hai Sam



Earthquake - Non Structural Damage (En



Seismic control device



- Why role of students is important?

Young

Energetic

Link between Knowledge Sphere and Society

Wide Vision

Resourceful

Active

Responsible

SET POSITIVE EXAMPLE


- Walk The Talk – Do What Is Advocated
- Coordinate, Partner, Collaborate, Network, Share
- Become a Disaster Resistant University
 - Conduct University Risk Assessment
 - Develop Hazards Risk Management Program
 - Network, Coordinate and Communicate
 - Disaster Resistant New Construction
 - Retrofit of Existing Structures
 - Soft (Non-Structural) Mitigation

EDUCATION IS KEY

- “...although knowledge does not guarantee power over natural catastrophe, it is a prime requisite of disaster prevention.” (Alexander 2000, 249)
- “Human history becomes more and more a race between education and catastrophe.” (H.G.Wells)

SCHOOL MUST FORM THE SPECIALIZED TEAMS FOR DISASTER MANAGEMENT

- **Disaster Awareness Team**
- **Public Training Team**
- **Rescue Team**
- **First Aid Team**
- **Rehabilitation Team**



THANK YOU