

## Disaster management ,CC14 , Sem 6

### Earthquake

**Earthquake**, any sudden shaking of the ground caused by the passage of seismic waves through Earth's rocks. Seismic waves are produced when some form of energy stored in Earth's crust is suddenly released, usually when masses of rock straining against one another suddenly fracture and "slip." Earthquakes occur most often along geologic faults, narrow zones where rock masses move in relation to one another. The major fault lines of the world are located at the fringes of the huge tectonic plates that make up Earth's crust.

Little was understood about earthquakes until the emergence of seismology at the beginning of the 20th century. Seismology, which involves the scientific study of all aspects of earthquakes, has yielded answers to such long-standing questions as why and how earthquakes occur.

About 50,000 earthquakes large enough to be noticed without the aid of instruments occur annually over the entire Earth. Of these, approximately 100 are of sufficient size to produce substantial damage if their centres are near areas of habitation. Very great earthquakes occur on average about once per year. Over the centuries they have been responsible for millions of deaths and an incalculable amount of damage to property.

### **Causes of earthquakes**

Earth's major earthquakes occur mainly in belts coinciding with the margins of tectonic plates. This has long been apparent from early catalogs of felt earthquakes and is even more readily discernible in modern seismicity maps, which show instrumentally determined epicentres. The most important earthquake belt is the Circum-Pacific Belt, which affects many populated coastal regions around the Pacific Ocean—for example, those of New Zealand, New Guinea, Japan, the Aleutian Islands, Alaska, and the western coasts of North and South America. It is estimated that 80 percent of the energy presently released in earthquakes comes from those whose epicentres are in this belt. The seismic activity is by no means uniform throughout the belt, and there are a number of branches at various points. Because at many places the Circum-Pacific Belt is associated with volcanic activity, it has been popularly dubbed the "Pacific Ring of Fire."

A second belt, known as the Alpide Belt, passes through the Mediterranean region eastward through Asia and joins the Circum-Pacific Belt in the East Indies. The energy released in earthquakes from this belt is about 15 percent of the world total. There also are striking connected belts of seismic activity, mainly along oceanic ridges—including those in the Arctic Ocean, the Atlantic Ocean, and the western Indian Ocean—and along the rift valleys of East Africa. This global seismicity distribution is best understood in terms of its plate tectonic setting.

### **Natural forces**

Earthquakes are caused by the sudden release of energy within some limited region of the rocks of the Earth. The energy can be released by elastic strain, gravity, chemical reactions, or even the motion of massive bodies. Of all these the release of elastic strain is the most

important cause, because this form of energy is the only kind that can be stored in sufficient quantity in the Earth to produce major disturbances. Earthquakes associated with this type of energy release are called tectonic earthquakes.

1. Major earthquakes are very much less frequent but are most destructive. It usually do not occur alone; when one such earthquake happens, there is usually another one at a nearby location. An earthquake also has foreshocks. These are smaller earthquakes that happen in the same place before the larger earthquake follows.
2. 4. Effects of an Earthquake: 1. Earthquake causes damage to the building, bridges, dams... 2. Earthquake in many cases can cause great loss of life. 3. Earthquake can also cause floods and landslides. Landslides, triggered by earthquake, often cause more destruction than the earthquake themselves. 4. If the earthquake happens to be beneath the ocean floor, they can lead to a tsunami.
3. 5. Causes of Earthquake: Perhaps the earth is made up of three layers. At its heart is a core of iron, consisting of a solid sphere surrounded by a layer of hot, molten iron. Around the core is a mantle of soft, paste like rocks. And over the mantle rests the hard layer of rocks we call the crust. This crust is not a uniform, faultless shell. It is more like a jigsaw of blocks that fit together. The huge blocks that make up the crust are called tectonic plates.
4. 6. The heat inside the earth sets up a current in the mantle, keeping it in constant motion. This makes the plates of the crust move continually. The movement sometimes causes the edges of the plates to grind against each other with a lot of force.
5. 7. They may then get deformed, displaced, crushed or fractured. They may also slide under each other or move apart. Such changes in the plates send a set up vibrations through the crust, causing what we call an earthquake.
6. 8. Other causes: Earthquakes can occur due to reasons other than plate movements. Volcanic activity can cause earthquakes, as can human activities like nuclear explosions carried out underground. The collapse of mines has also been known to cause minor earthquakes. Dams: The build-up of pressure due to the storage of a large amount of water in the reservoirs behind large dams is considered to be a potential cause of earthquakes.
7. 9. Tsunamis: Tsunami is a Japanese word meaning 'harbour wave'. Earthquakes below the sea can cause tsunamis. The waves are usually not very high in the deep sea, where they originate. But when they reach the coast, they rise high like massive walls of water. They sweep over the land, submerging everything in sight within a very short time. And when they recede, they take with them everything that they have touched.
8. 10. Weak points: Over millions of years, the movements of the tectonic plates have created mountains and valleys on the surface of the earth. They have also created certain weak points, called faults, in the crust. Most faults occur along the boundaries of the tectonic plates and these are the zones where earthquakes occur. Earthquake activity in Pakistan is mainly concentrated in the north and western sections of the country, along the boundary of the Indian plate and the Iranian and Afghan micro-plates.
9. 11. Faults (Pakistan): • The Chaman Fault runs along Pakistan's western frontier with Afghanistan from Kalat, in the northern Makran range, past Quetta and then on to

- Kabul, Afghanistan. • A fault also runs along the Makran coast and is believed to be of the same nature as the West Coast fault along the coast of Maharashtra, India.
10. 12. Earthquakes in Pakistan: • The earthquake that struck Azad Kashmir, Islamabad, and Khyber Pakhtunkhwa in 2005 occurred in a place (Muzaffarabad). It registered a moment magnitude of 7.6 and had a maximum intensity. More than 80,000 people died in the earthquake. • The 2013 Baluchistan earthquakes took place in late September in southwestern Pakistan. The mainshock had a moment magnitude of 7.7 and had a maximum intensity (Very Strong). At least 825 people were killed and hundreds more were injured.
  11. 13. 0 10,000 20,000 30,000 40,000 50,000 60,000 70,000 80,000 90,000 Graph Casualties in Pakistan
  12. 14. Measuring an Earthquake: Earthquakes usually start at a depth of less than 100 km below the ground. The point of origin, called the seismic focus, is located with the help of seismographs. (an instrument that measures and records details of earthquakes, such as force and duration).
  13. 15. Vibrations spread out from the Focus, like ripples in a pool of water. The location on the surface of the earth directly above the focus is called the epicenter. It normally bears the brunt(shocks) of the destructive power of these vibrations. That is to say, this is where the maximum damage normally occurs. The extent of the damage depends on the strength of the vibrations or the energy associated with them. It also depends on the density of population (how many people live in an area) and the way buildings are constructed. The nature of the soil is another factor which determines the extent of damage. If the soil is loose and damp, the damage is greater than if it is hard and firm. This is why the severity of an earthquake is measured in two ways—in terms of its magnitude and in terms of its intensity.
  14. 16. Richter scale: The magnitude of an earthquake depends on the energy of the vibrations. It is measured by seismographs on a scale called the Richter scale. Ranging from 1 to 10, for indicating the intensity of an earthquake. Mercalli intensity scale: The Mercalli intensity scale is a Seismic Scale used for measuring the intensity of an earthquake. It measures the effects of an earthquake.
  15. 17. Protection against earthquake: • All the building in seismic zones need be designed so that they can withstand major tremors(shakes). It is advisable to make the structure simple so that it is 'Quake Safe'. • Since some building may catch fire, it is necessary that all the building have their fire fighting equipment in order. • Safer places indoors, as well as outdoors, must be clearly identified.
  16. 18. • An emergency communication plan should be made available. . Disaster management supplies (like flashlights, first aid box etc.) should be available on hand.
  17. 19. Safety Precautions during Earthquake: For a person present inside of a building: 1. Take shelter under a table and stay there till the shaking stops. 2. Stay away from tall and heavy objects that may fall on you. 3. Do not get up, if you are in bed. Protect your head with pillows.
  18. 20. 4. Stay indoor until shaking stops and it is safe to move outside. Most of injuries occur when people, inside the building, attempts to move to a different location within the building or try to leave it. For a person caught outside in the open: 1. Find a clear spot, away from buildings, trees, bridges and overhead power lines. Drop to the ground. 2. Do not come out, if in a moving vehicle. Drive slowly to a clear spot and stay inside. Come out only when the tremors stop.
  19. 21. Safety Precautions After the Earthquake: 1. Stay calm for a while. Expect after shocks. These shocks can cause additional damage. 2. Beware of possible tsunami, if

you live in coastal area. 3. Carefully inspect utilities/supplies. 4. Use telephones only in emergency. 5. Stay away from damaged areas. 6. Help the injured ones.