

Earthquakes

Earthquakes are caused by the release of built-up pressure inside the Earth's crust. An earthquake's power is measured on [the Richter scale](#) using an instrument called a seismometer.

The effects of an earthquake can be devastating - they can destroy settlements, change landscapes, and cause many deaths.

Causes

An **earthquake** is the shaking and vibration of the Earth's crust due to movement of the Earth's plates (plate tectonics). Earthquakes can happen along any type of plate boundary.

Earthquakes occur when tension is released from inside the crust. Plates do not always move smoothly alongside each other and sometimes get stuck. When this happens pressure builds up. When this pressure is eventually released, an earthquake tends to occur.

The point inside the crust where the pressure is released is called the focus. The point on the Earth's surface above the **focus** is called the epicentre.

Earthquake energy is released in seismic waves. These waves spread out from the focus. The waves are felt most strongly at the epicentre, becoming less strong as they travel further away. The most severe damage caused by an earthquake will happen close to the **epicentre**.

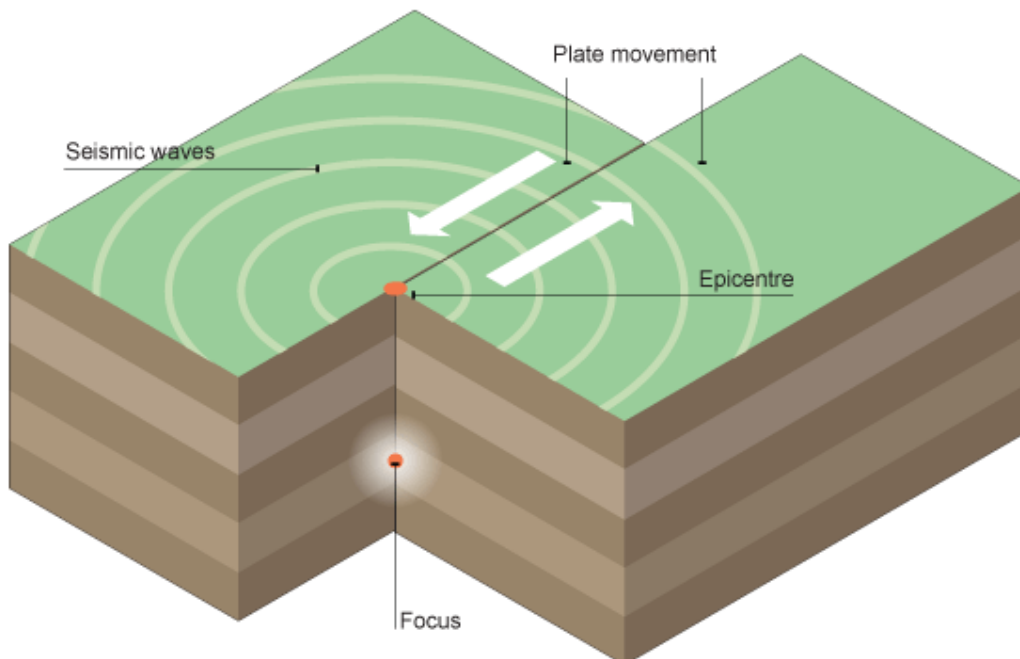


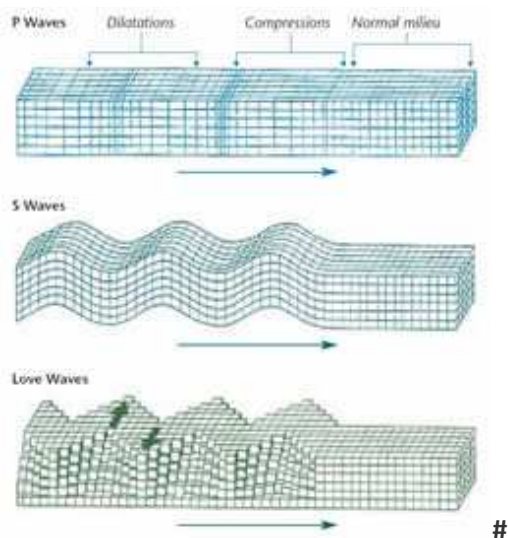
Diagram of an earthquake

Types of seismic waves

Primary waves (or P waves) are the fastest moving waves. They can pass through solids, liquids and gases easily. As they travel through rock, the waves move tiny rock particles back and forth -- pushing them apart and then back together -- in line with the direction the wave is traveling. These waves typically arrive at the surface as an abrupt thud.

Secondary waves (also called shear waves, or S waves) are another type of body wave. They move a little more slowly than P waves, and can only pass through solids. As S waves move, they displace rock particles outward, pushing them perpendicular to the path of the waves. This results in the first period of rolling associated with earthquakes. Unlike P waves, S waves don't move straight through the Earth. They only travel through solid material, and so are stopped at the liquid layer in the Earth's core.

Unlike body waves, **surface waves** (also known as long waves, or simply L waves) move along the surface of the Earth. Surface waves are to blame for most of an earthquake's damage. They move up and down the surface of the Earth, rocking the foundations of man-made structures. Surface waves are the slowest moving of all waves, which means they arrive the last. So the most intense shaking usually comes at the end of an earthquake.



Measurement of earthquakes



The aftermath of an earthquake, Golcuk, Western Turkey

The power of an earthquake is measured using a seismometer. A seismometer detects the vibrations caused by an earthquake. It plots these vibrations on a seismograph.

The strength, or magnitude, of an earthquake is measured using the Richter scale. The Richter scale is numbered 0-10:

- ✓ Earthquakes measuring just one or two on the scale are very common and can happen everyday in places like San Francisco. These earthquakes are so small that people cannot feel them, they can only be picked up by a seismometer.
- ✓ Earthquakes measuring around seven or eight on the Richter scale can be devastating. The earthquake in China's south-western Sichuan province in May 2008 measured 7.8 on the Richter scale.

Effects of an earthquake



Clearing rubble after an earthquake, Bhuj, India

Earthquakes can destroy settlements and kill many people. Aftershocks can cause even more damage to an area. It is possible to classify the impacts of an earthquake, by taking the following factors into account:

- ✓ short-term (immediate) impacts
- ✓ long-term impacts
- ✓ social impacts (the impact on people)
- ✓ economic impacts (the impact on the wealth of an area)
- ✓ environmental impacts (the impact on the landscape)

	Social impacts	Economic impacts	Environmental impacts
Short-term (immediate) impacts	People may be killed or injured. Homes may be destroyed. Transport and communication links may be disrupted. Water pipes may burst and water supplies may be contaminated.	Shops and business may be destroyed. Looting may take place. The damage to transport and communication links can make trade difficult.	The built landscape may be destroyed. Fires can spread due to gas pipe explosions. Fires can damage areas of woodland. Landslides may occur. Tsunamis may cause flooding in coastal areas.
Long-term impacts	Disease may spread. People may have to be re-housed, sometimes in refugee camps.	The cost of rebuilding a settlement is high. Investment in the area may be focused only on repairing the damage caused by the earthquake. Income could be lost.	Important natural and human landmarks may be lost.

Effects are often classified as primary and secondary impacts. Primary effects occur as a direct result of the ground shaking, eg buildings collapsing. Secondary effects occur as a result of the primary effects, eg tsunamis or fires due to ruptured gas mains.

Factors affecting the impact of an earthquake

- ✓ Distance from the **epicentre** – the effects of an earthquake are more severe at its centre.
- ✓ The higher on the Richter scale, the more severe the earthquake is.
- ✓ Level of development (**MEDC** or **LEDC**) – MEDCs are more likely to have the resources and technology for monitoring, prediction and response.
- ✓ Population density (rural or urban area). The more densely populated an area, the more likely there are to be deaths and casualties.
- ✓ Communication - accessibility for rescue teams.
- ✓ Time of day influences whether people are in their homes, at work or travelling. A severe earthquake at rush hour in a densely populated urban area could have devastating effects.
- ✓ The time of year and climate will influence survival rates and the rate at which disease can spread.

Kobe, Japan, 1995 – MEDC

On 17th January 1995, an earthquake struck Kobe, a heavily populated urban area in Japan. It measured 7.4 on the Richter scale and occurred as a result of plate movement along the boundary between the Philippines Plate, Pacific Plate and Eurasian Plate.

Effects: Key Fact - primary effects happen immediately. Secondary effects usually occur as a result of the primary effects.

Primary effects	Secondary effects
35000 people injured. Buildings and bridges collapsed despite their earthquake proof design.	Buildings destroyed by fire when the gas mains fractured. 316000 people left homeless and refugees moved into temporary housing.

Responses

These can be divided into short and long term.

Short term	Long term
People were evacuated and emergency rations provided. Rescue teams searched for survivors for 10 days.	Many people moved away from the area permanently. Jobs were created in the construction industry as part of a rebuilding programme.