

Living with **EARTHQUAKES**



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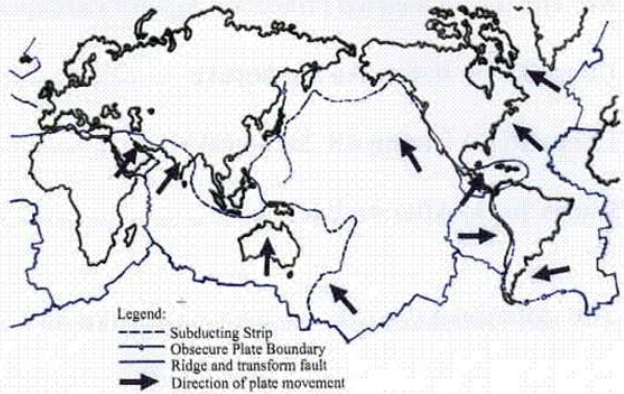
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What Are Earthquakes, And What Cause Them?

Earthquakes are sudden, rapid vibrations of the earth caused by sudden rupture and shifting of rock beneath the Earth's surface. The vibrations of the earth can range from barely noticeable to catastrophically destructive. There are three classes of earthquakes that are now recognized: tectonic, volcanic and artificially produced.

Tectonic quakes are, by far, the most common, devastating and most difficult to predict. They are caused by stresses set up by movements of a dozen or so huge plates that form the Earth's crust. Most earthquakes occur at the boundaries of these plates, where two plates slide over, under and collide against each other; some earthquakes do occur in the middle of plates.



Volcanic quakes are seldom very large or destructive; they often precede or accompany volcanic eruptions.

Artificially produced earthquakes are earthquakes induced by activities such as the filling of new reservoirs or the pumping of fluids deep into the earth through wells. This type of earthquakes can be noticeable but are hardly destructive.

Why Is There A Need To Know About Earthquakes?

Earthquakes strike without warning. They may occur at any time of the day or night. Each year, 70 to 75 damaging earthquakes occur throughout the world. In Asia during the past decade, several strong earthquakes have occurred. The following are some of them.



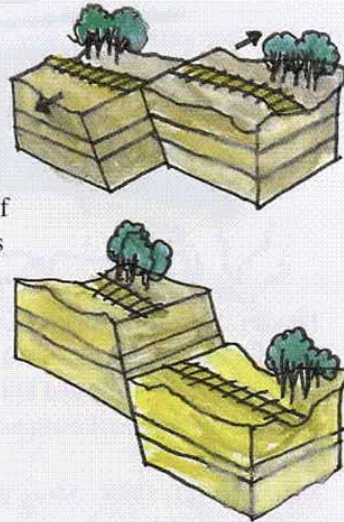
- January 26, 2001 - An earthquake occurred in a western state of India, centering in the town of Bhuj in Gujarat, an industrial and agricultural state, and killing over 10,000 people, making it one of the deadliest earthquakes in the last ten years.
- September 21, 1999 - More than 2,400 people were killed in the strongest Taiwanese earthquake in more than a decade. The earthquake hit Taiwan in the middle of the night.
- January 17, 1995 - 6,430 people died in the earthquake that ripped through Kobe and central Japan. It was the biggest earthquake to hit the country in the last 50 years.
- December 12, 1992 - An earthquake hit a string of islands in East Nusa Tenggara province of Indonesia. At least 2,200 people were killed.

What Are The Common

Effects Of Earthquakes?

Ground shaking from earthquakes can destroy structures such as buildings and bridges, resulting in death, injuries and extensive property damages; disrupt flow of gas, electric and telephone services. Buildings with foundations resting on unstable foundations are at risk because they can be shaken off their mountings during an earthquake.

Earthquakes can also trigger environmental hazards to both urban and rural areas in several ways including landslides, land faulting, liquefaction, tsunamis and flash floods. Finally, there is the formidable threat of fire.



Faulting - Faulting is the breaking up of land caused by an earthquake. Buildings that straddle an active fault may be damaged.

Landslides - Landslides comprise mass of soil and rocks that crumble down the slopes of mountains, hills or cliffs as a result of any shaking due to earthquake. In severe cases, people can be buried alive.



Tsunamis -Tsunamis are large ocean waves that occur when the ocean floor or coastal area is tilted or offset when it is hit by a strong earthquake. It could become a towering wall of water 15 meters high or more by the time it reaches the shore where it is capable of causing much damage, possibly destroying the entire coastal settlement.

Liquefaction - Liquefaction usually occurs in the area where the soil is soft, loose and saturated with water. As a result of shaking due to earthquake, the soil moves and behaves like quicksand affecting any structure on the surface to sink or tilt.



What Are The Recommended Protection Against Earthquakes?

Asia is very prone to earthquakes and there is a strong possibility that an earthquake may occur at anytime. Unfortunately, there is still no way to predict an earthquake. Therefore, it is crucial to learn how to prepare, in advance, before an earthquake strikes. With proper mitigation and preparedness, the damages caused by an earthquake can be minimized. Lives and properties could be saved.

Things to Do Before An Earthquake occurs

Majority of damage due to earthquakes can be prevented. Therefore a good preparation would minimize the effects of earthquakes, both injuries and financial losses.

Make sure every family member knows how to respond in case of an earthquake.

- Know the safe spots in each room - (under a sturdy table or desks, against the interior wall or a column, under a door frame).



- Practice **DROP, COVER, AND HOLD** in each safe spot.- Drop under a sturdy desk or table, hold on to its leg, and protect your eyes by pressing your face against your arms. Practicing will make these actions an automatic response. When there is an emergency, many people hesitate, forgetting what they are supposed to do. Responding quickly and automatically will help to protect you from injury.



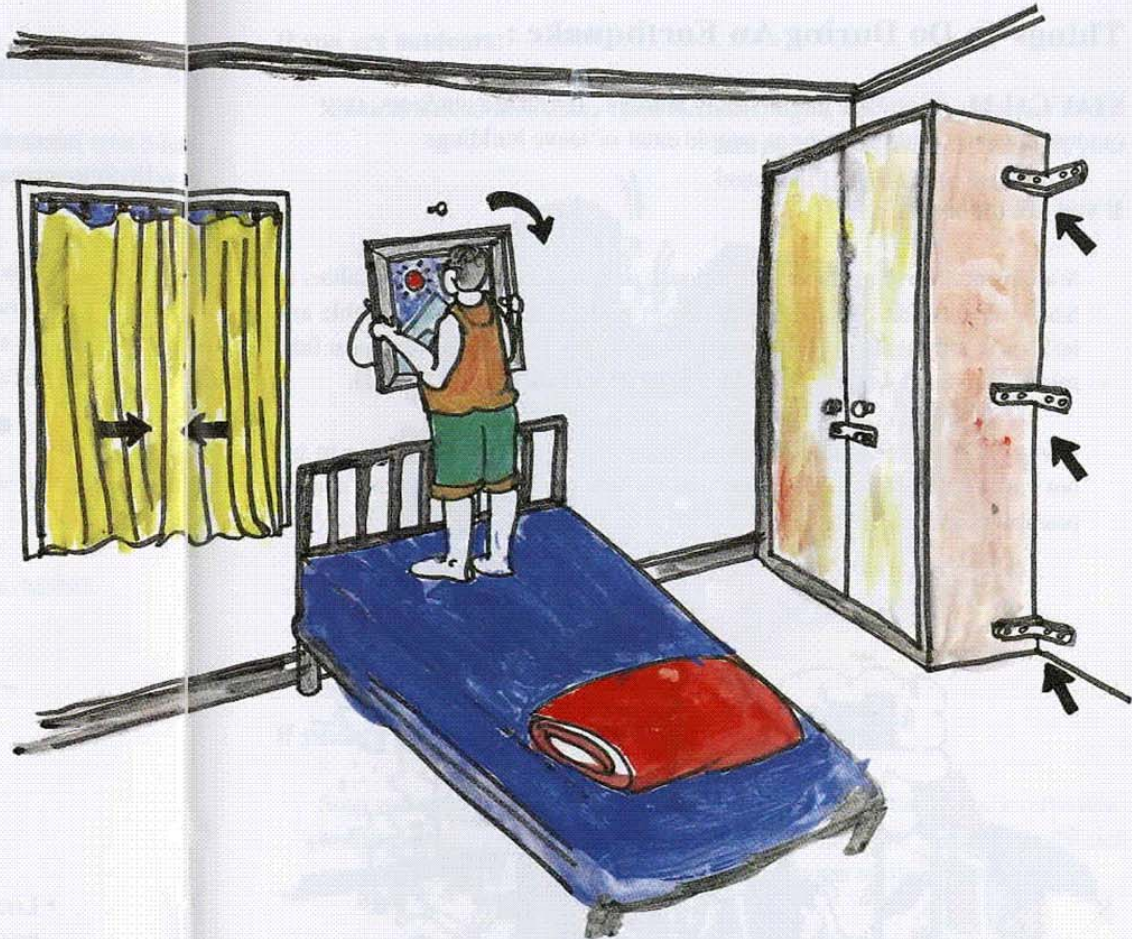
- Know the danger spots - near windows, mirrors, hanging objects, tall, unsecured furniture, shelves holding heavy objects.



- Locate safe places outdoors - In the open, away from buildings, bridges, trees, telephone and electric post and lines and overpasses.
- Identify exits and alternative exits - Always know all the possible ways to leave your house and work place in emergency situations. Practice getting out of your home or building; check and see if the planned exits are clear of obstacles.
- Know the location of the shutoff valves for water, gas, and electricity. Learn how to operate those valves.
- Learn first aid.
- Develop an emergency communication plan - in case family members are not together during the earthquake, that is, when adults are at work and children are at school.

Make the home a safe place by doing the following

- Secure heavy furnishings such as cupboards and bookcases against walls to prevent them from falling over and injuring persons.
- Keep large, heavy object and breakables on lower shelves to prevent yourself from serious injuries caused by falling objects.
- Store all flammables or hazardous liquids outside the house, in their proper containers, away from structures since earthquakes may trigger fires or explosions within the building.
- Hang heavy items such as pictures and mirrors away from beds, couches, and anywhere people sit.
- Brace overhead light fixtures to prevent them from falling during the earthquake.
- Pull down and close shutters or draw curtains as protection from flying glass, especially for windows that are near the bed in the event of an earthquake occurring at night and people are asleep.



Ensure that a stock of appropriate supply is kept

- Food and drinking water.
- First - aid kit and essential medicine.
- Flashlight with extra batteries, keep them in several locations.
- Portable radio with extra batteries. Radio will be the best source of information following the earthquake especially when the electricity power is out.

Don't forget that you also need to store adequate supplies in each vehicle in case you are driving when a tremor occurs.

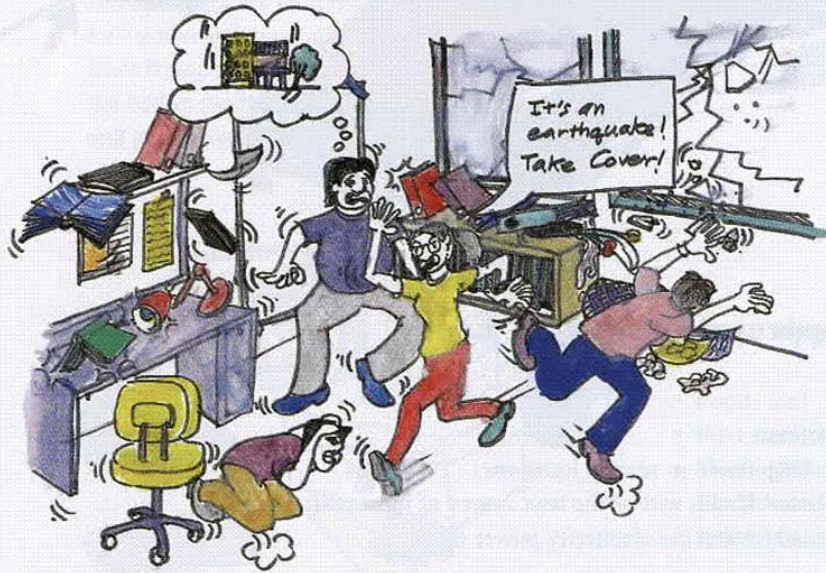
Things To Do During An Earthquake :

STAY CALM. If you are indoors, stay indoors. If you are outdoors, stay outdoors. Many injuries occur as people enter or leave buildings.

If you are indoors:

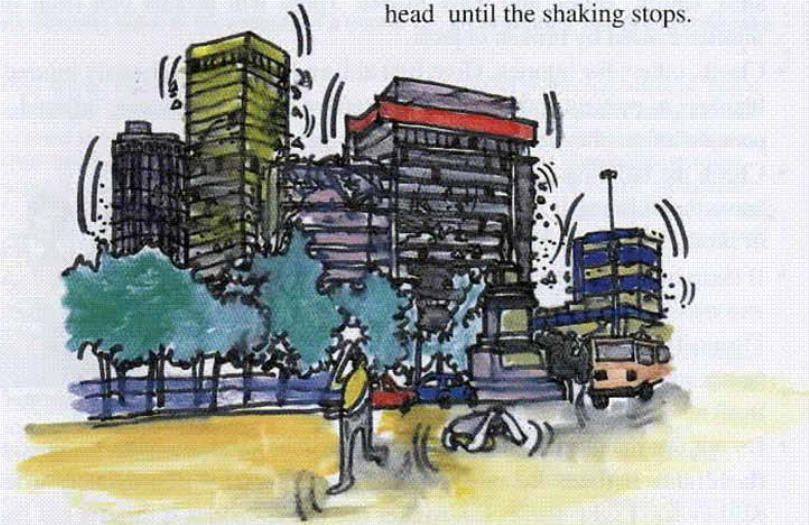
Stay inside. Move away from windows, doors, tall cabinets, breakables or heavy objects that could fall. Take cover under a desk or sturdy table and hold on or stay against an interior wall or column. Remember that most fatal injuries are head wounds, therefore, **DROP, COVER AND HOLD.**

If you must leave a building, do so in an orderly manner. Rushing to get out can result in injuries. Do not use the elevator. As a precaution against possible fires, use the stairs.



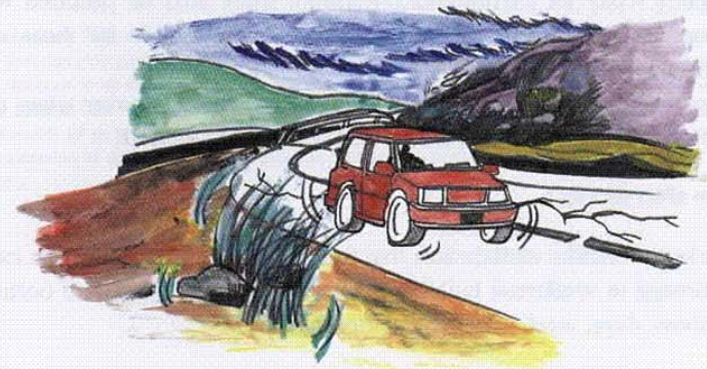
If you are outdoors:

Move to a clear area away from the trees, signs, buildings, electrical wires and poles. **DROP AND COVER** your head until the shaking stops.



If you are in a vehicle:

Stop and remain inside until the shaking stops. Avoid buildings, overpasses, bridges, power lines, and roads beside ravines and cliffs in which landslides may occur. Be cautious of possible road damages while you proceed.



Things To Do After An Earthquake:

- Check yourself for injuries.
- Protect yourself from further hazards by putting on long pants, a long-sleeved shirt, sturdy shoes, and work gloves. These will protect you from further injuries caused by broken objects.
- Check others for injuries. Give first aid, and cover the seriously injured with blankets to prevent shock. Do not attempt to move seriously injured persons unless they are in immediate danger if they are there.
- Check the building for damages. You may have to leave the building if it is seriously damaged or prone to collapse in the aftershock.
- If there is fire, call the fire department and try to extinguish the fire. Eliminate fire hazards. If there is heavy smoke, crawl to get out of the building, fresh air will be closer to the floor.
- Do not use matches, turn off electrical switches and use battery - operated flashlights if there is possible gas leak especially immediately after the earthquake. Light sparks can trigger fire or explosions if there is gas leak.
- Inspect the utilities in the building. Shut off their valves if there is damage. If the water pipes are damaged, avoid using water from the tap, as it may be unsafe.
- Clean up spilled medicine, gasoline or other flammable liquids immediately. Leave the area if you smell gas or fumes from other chemicals.
- Do not use the telephone unless there is an immediate, life-threatening emergency. After an earthquake, telephone lines will be jammed with emergency telephone calls. Please keep the lines available for those with immediate needs.
- Be prepared for aftershocks. Plan on where you will take cover when they occur. Each time you feel one, **DROP, COVER AND HOLD!**



Earthquake Intensity

Modified Mercalli Scale (1931)

Seismic intensity refers to the strength of a tremor at a given location during an earthquake.

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| <p>I. Only felt by seismographs and very few people who are favorably placed to sense tremors.</p> <p>II. Only felt by a few people at rest on upper floors. Objects that are made to move easily shake.</p> <p>III. Noticeably felt by persons on the top floors of office buildings. Standing vehicles rock slightly. Most people do not think it is an earthquake.</p> <p>IV. Most people indoors feel the earthquake. Dishes, window panes, and doors shake. Stationary vehicles rock hard.</p> <p>V. Almost all people feel the earthquake. Sleepers wakened. Poorly placed objects fall. Pendulum clocks stop.</p> <p>VI. Felt by all. Many frightened and run outdoors.</p> | <p>VII. Almost all people run outdoors. Poorly placed objects or poorly designed walls and other things suffer some damage.</p> <p>VIII. Solidly constructed buildings suffer some damage. Chimneys, monuments, and walls fall., furniture falls over. Sand or mud ejected slightly. Changes in well water.</p> <p>IX. Solidly constructed buildings suffer heavy damage, and some collapse. Conspicuous cracks in ground.</p> <p>X. Most stone structures destroyed. Major cracks and fissures in ground. Railroad tracks bent.</p> <p>XI. Few buildings survive. Bridges damaged, large fissures in ground. Much destruction.</p> <p>XII. Ground undulates. Objects thrown into air.</p> |
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Earthquake Magnitude

Magnitude

Magnitude (M) is the measurement of an earthquake's energy. If the magnitude increased by 1, then the energy of the earthquake increases about 30 fold. Devised by C.F. Richter in 1935. Magnitude is an index of the seismic energy released by an earthquake, expressed in terms of the motion that would be measured by a specific type of seismograph located 100 km from the epicentre of an earthquake. Nowadays several magnitude scales are in use. They are based on amplitudes of different types of seismic waves, on signal duration or on the seismic movement.

What are aftershocks?

Aftershocks are smaller earthquakes that follow the main shock and can cause further damage to weakened buildings. Aftershocks can continue to occur in the first hours, days, weeks, or months after the quake.