



What Are Earthquake Hazards?

Earthquakes really pose little direct danger to a person. People can't be shaken to death by an earthquake. Some movies show scenes with the ground suddenly opening up and people falling into fiery pits, but this just doesn't happen in real life.

The Effect of Ground Shaking

The first main earthquake hazard (danger) is the **effect of ground shaking**. Buildings can be damaged by the shaking itself or by the ground beneath them settling to a different level than it was before the earthquake (**subsidence**).



FIGURE 1 - THESE MEN BARELY ESCAPED WHEN THE FRONT OF THE ANCHORAGE J.C. PENNY'S COLLAPSED DURING THE 1964 GOOD FRIDAY EARTHQUAKE.



FIGURE 2 - ONE SIDE OF THIS ANCHORAGE STREET DROPPED DRASTICALLY DURING THE 1964 GOOD FRIDAY EARTHQUAKE.



FIGURE 3 - THESE BUILDINGS IN JAPAN TOPPLED WHEN THE SOIL UNDERWENT LIQUEFACTION.

Buildings can even sink into the ground if soil liquefaction occurs. **Liquefaction** is the mixing of sand or soil and **groundwater** (water underground) during the shaking of a moderate or strong earthquake. When the water and soil are mixed, the ground becomes very soft and acts similar to quicksand. If liquefaction occurs under a building, it may start to lean, tip over, or sink several feet. The ground firms up again after the earthquake has past and the water has settled back down to its usual place deeper in the ground. Liquefaction is a hazard in areas that have groundwater near the surface and sandy soil.

Buildings can also be damaged by strong surface waves making the ground heave and lurch. Any buildings in the path of these surface waves can lean or tip over from all the movement. The ground shaking may also cause landslides, mudslides, and avalanches on steeper hills or mountains, all of which can damage buildings and hurt people.

Ground Displacement

The second main earthquake hazard is **ground displacement** (ground movement) along a fault. If a structure (a building, road, etc.) is built across a fault, the ground displacement during an earthquake could seriously damage or rip apart that structure.

From *Figure 4* you can tell that the San Andreas Fault is a **right-lateral** transverse (strike-slip) fault because the other side of the road (on the opposite side of the fault) has moved to the right, relative to the photographer's position.



FIGURE 4 - THIS ROAD, WHICH CROSSES THE SAN ANDREAS FAULT, WAS CUT IN HALF BY THE 1906 EARTHQUAKE. ONE END OF THE ROAD SLID 20 FEET (6.5 METERS) PAST THE OTHER DURING THE QUAKE.

Flooding

The third main hazard is **flooding**. An earthquake can **rupture** (break) dams or levees along a river. The water from the river or the reservoir would then flood the area, damaging buildings and maybe sweeping away or drowning people.



FIGURE 5 - THE SEWARD, ALASKA, RAILROAD YARD WAS A TWISTED MESS AFTER BEING HIT BY A TSUNAMI IN 1964. THE TSUNAMI WAS TRIGGERED BY THE GOOD FRIDAY EARTHQUAKE.

Tsunamis and seiches can also cause a great deal of damage. A **tsunami** is what most people call a tidal wave, but it has nothing to do with the tides on the ocean. It is a huge wave caused by an earthquake under the ocean. Tsunamis can be tens of feet high when they hit the shore and can do enormous damage to the coastline. **Seiches** are like small tsunamis. They occur on lakes that are shaken by the earthquake and are usually only a few feet high, but they can still flood or knock down houses, and tip over trees.

Fire

The fourth main earthquake hazard is **fire**. These fires can be started by broken gas lines and power lines, or tipped over wood or coal stoves. They can be a serious problem, especially if the water lines that feed the fire hydrants are broken, too. For example, after the Great San Francisco Earthquake in 1906, the city burned for three days. Most of the city was destroyed and 250,000 people were left homeless.



FIGURE 6 - SAN FRANCISCO BURNING AFTER THE 1906 EARTHQUAKE.

Most of the hazards to people come from man-made structures themselves and the shaking they receive from the earthquake. The real dangers to people are being crushed in a collapsing building, drowning in a flood caused by a broken dam or levee, getting buried under a landslide, or being burned in a fire.

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FIGURES 1 AND 2 FROM WALKER, 1982; FIGURES 3 AND 4 FROM BOLT, 1993; FIGURE 5 FROM *TSUNAMI!*, UNIVERSITY OF WASHINGTON, 1997; FIGURE 6 FROM SHEDLOCK & PAKISER, 1997. ALL OTHER CONTENT IS ©2007 MICHIGAN TECHNOLOGICAL UNIVERSITY. PERMISSION GRANTED FOR REPRODUCTION FOR NON-COMMERCIAL PURPOSES.