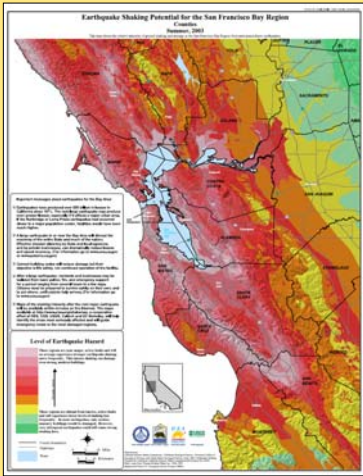




Earthquake Hazards



GROUND SHAKING

Earthquakes are inevitable in California. Many people live and work near major faults that can produce strong ground shaking. Ground shaking is affected by several things: the size of the earthquake, the type of ground the earthquake waves travel through, and the distance away from the earthquake source. Every time there is a large earthquake, scientists learn more about how the energy released from the fault affects the ground and buildings around it.

At the California Geological Survey (CGS), seismologists generate and maintain a statewide ground shaking map (such as the one shown to the left). This information is crucial to making earthquake-resistant buildings, schools, and hospitals.

The two photos to the right are of the collapsed sections of the Cypress freeway structure in Oakland caused by ground shaking from the 1989 Loma Prieta earthquake. The earthquake shaking at this location was "amplified", or increased, by the soft bay mud deposits underlying the area.



SURFACE FAULT RUPTURE

Surface rupture occurs when movement on a fault breaks through to the surface. Rupture may occur suddenly during an earthquake or slowly in the form of fault creep. Fault rupture almost always follows preexisting faults, which are zones of weakness.



The picture to the right shows surface rupture from the 1992 Landers earthquake in San Bernardino County. This rupture extended for 50 miles.

LIQUEFACTION

Liquefaction occurs when very wet soil is affected by strong ground motion. Soil particles (sand and silt) shift and separate during shaking. This reduces the ability of the ground to support the building on top of it, and may cause buildings to sink and foundations to separate.

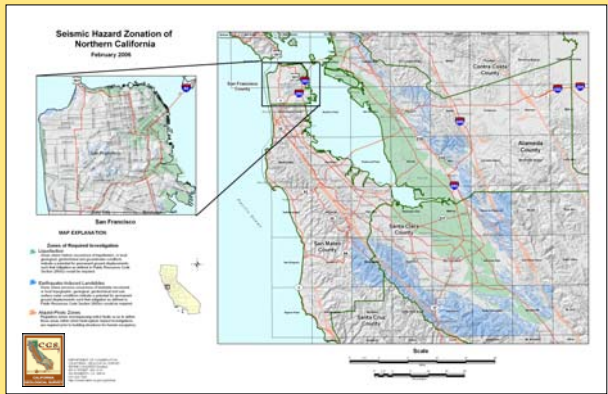


Shown in the picture to the left, liquefaction was responsible for some of the damage to buildings in San Francisco's Marina District during the 1989 Loma Prieta earthquake.

LANDSLIDES

A landslide is the downhill movement of ground caused primarily by gravity acting on weakened rock or soils. Many things can contribute to a landslide: erosion, ground water, human activity such as grading, vibrations from earthquakes, and even thunder!

The picture to the right shows a landslide along a coastal bluff in Daly City caused by the 1989 Loma Prieta earthquake.



SEISMIC HAZARD ZONE MAPS OF THE SAN FRANCISCO BAY AREA

An important responsibility of the California Geological Survey (CGS) is to produce maps that show areas that are most likely to experience liquefaction, earthquake-induced landslides, and surface fault rupture. On the map above, these zones are shown for the San Francisco Bay area. Cities and counties are required by state law to withhold building permits in these zones until a geotechnical investigation is conducted to assess the seismic hazard. If a liquefaction or earthquake-induced landslide hazard is identified, appropriate building design and/or ground improvement measures must be applied. In earthquake fault zones, proposed structures must be set back from the surface traces of the active fault.

EARTHQUAKE MYTH BUSTER –
Faults do NOT open up and swallow people during earthquakes. You've seen the images in books, movies and TV shows but that's not how it works. Faults typically do not open and shut like "jaws of death" during earthquakes. However, some earthquake hazards, like liquefaction, can cause settlement and open fissures into which people, cars, etc., could fall.

TSUNAMIS AND SEICHES

These two unusual sounding words, represent the affects earthquakes can have on water. A tsunami (Japanese word for harbor wave, pronounced sue-nah'-me) is a wave that can be generated by an earthquake, landslide, volcanic eruption, or even a large meteor! These waves can move at a rate exceeding 500 miles per hour. In smaller non-ocean water bodies like inland seas and lakes, tsunamis are most commonly formed by underwater landslides.

The shaded relief map image (left) shows the bottom of Lake Tahoe and the surface expression of the surrounding area. The features at the center of the lake are likely blocks from a landslide that originated from the west side of the lake (the total distance across the figure is approximately 20 miles).

The most devastating tsunami to affect California in recent history was the 1964 magnitude 9.2 Alaskan earthquake. The first wave struck Crescent City about 4 hours after the Alaska event, but the fourth and largest wave arrived 2 hours later. It flooded low-lying communities, destroyed homes and businesses, and killed 11 people (damage pictured right).

A seiche (Swiss-French word, pronounced say-sh) is a wave that sloshes in an enclosed body of water, such as a swimming pool, lake, or bay.

