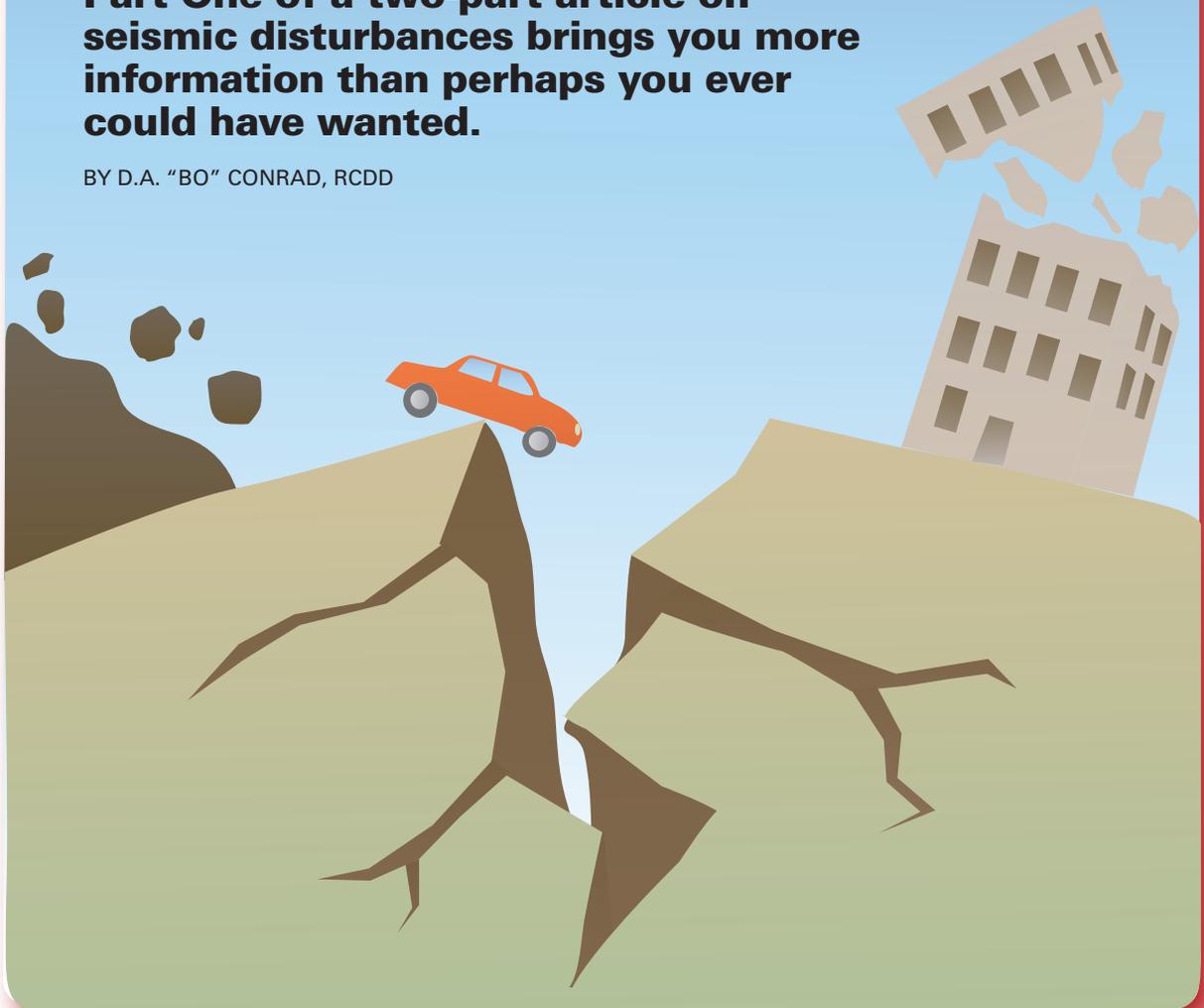


Are You 'Zoned 4' A Disaster?

Part One of a two-part article on seismic disturbances brings you more information than perhaps you ever could have wanted.

BY D.A. "BO" CONRAD, RCDD



In case of a disaster, who would be at "fault" protecting your investments?

Have you ever been in a discussion as to which natural disaster is worse? The answers typically are regional; Easterners might respond with hurricanes, Midwesterners with tornadoes, and Westerners with earthquakes. However, given the right conditions, one could experience the effects of a combination of these calamities.

Significant difference amongst them: *There is*

no weather-like forecast for earthquakes. The U.S. Geological Survey (USGS) tracks earthquake activity and redefines these areas as earthquake hazard "zones" (highest-risk areas):

- southern Alaska;
- Hawaiian islands;
- the entire West Coast (down through Mexico);
- St. Louis, Mo;
- borders between Utah, Idaho, Wyoming and Montana; and
- Charleston, S.C.

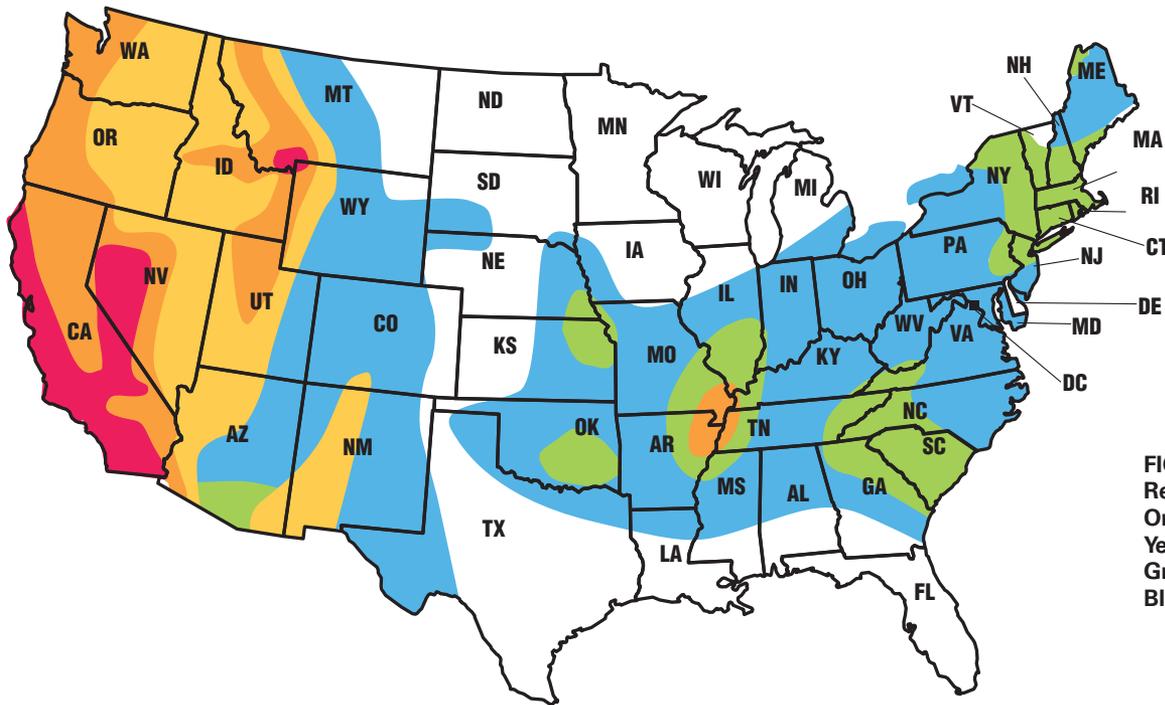


FIGURE ONE.
 Red = Zone 4
 Orange = Zone 3
 Yellow = Zone 2B
 Green = Zone 2A
 Blue = Zone 1.

Are earthquakes everywhere? It sure seems so! From 1975-1995 only Florida, Iowa, North Dakota, and Wisconsin did not experience an earthquake. Yes—the other 46 states had at least one each.

Alaska is the most earthquake-prone state (it even has icequakes!), with a 7.0 magnitude (7M) earthquake at least once every year. A magnitude 8M strikes the state once every 14 years, on average.

About: Network Equipment-Building System

Data from these zones is used to develop requirements for building design and building codes. In the 1970s, the Bellcore (now Telcordia® Technologies) Network Equipment-Building System (NEBS) was developed to specify environmental design guidelines for

- (1) personnel safety;
- (2) protection of property; and
- (3) operational continuity.

Objective: Make it easier for a vendor to design equipment compatible with telecommunications equipment used in the central offices of RBOCs (Regional Bell Operating Companies) and LECs (Local Exchange Carriers).

IMPORTANT: NEBS is considered an industry stan-

dard, but *is not a legal requirement*.

Something called the Telecommunications Carrier Group (TCG) was created by the four largest U.S. telecoms (AT&T, Verizon, BellSouth, and Qwest) TCG's objective is to synchronize NEBS standards across the industry. Here's where that effort stands:

NEBS Level 1—for office-class environments having minimal degradation. This means a very low threshold of equipment hazards and network degradation by addressing: (1) personnel, (2) equipment safety requirements, but not (3) operability requirements of GR-63-CORE and GR-1089-CORE. This level is primarily used for getting prototypes into lab trials. RBOCs require all equipment deployed by CLECs to be Level 1-certified.

NEBS Level 2—addresses equipment operability in a controlled environment (think data centers) that will not be subjected to environmental stress and disaster recovery. Due to ambiguity, this level of certification is rarely used.

NEBS Level 3—originated from Bellcore special report, SR-3580. Equipment must meet all general requirements of GR-63-GORE and GR-1089-GORE. Note that Verizon and AT&T do not follow NEBS Level

3 or SR-3580, instead using their own modified NEBS checklist).

NEBS Physical Protection GR-63-CORE (and its counterpart ANSIT1.329-2000) is the most frequently referenced “earthquake” standard. It contains strict specifications for generic telecommunication (switching) equipment requirements to maintain mission-critical operations; Spatial requirements, heat, fire and smoke, earthquake/vibration, acoustic noise, thermal, handling/transportation, airborne/airflow patterns, illumination, failure severity levels, testing and certification requirements.

Note that we’ve skimmed it here, as there are many other NEBS specifications for outside and inside applications! The following two are most commonly referenced:

- *NEBS Electromagnetic Compatibility and Electrical Safety Generic Criteria for Network Telecommunication Equipment GR-1089-CORE* describes EMC/EMI, ESD, and electrical safety requirements.
- NEBS Generic Physical Design Requirements for Telecommunications Products and Equipment is GR-78-CORE.

What is an earthquake fault zone?

The UBC (Universal Building Code) defines five earthquake zones; from Zone 0, which represents *no substantial earthquake risk* to the worst-case severity level commonly, referred to as seismic “Zone 4.” Note: *The UBC is the only building code that still makes use of such “zones.”*

These fault zones areas are plotted on topographical maps around active faults. See Figure One.

A seismic zone map is based on a statistical compilation of the number and the magnitude of past earthquakes. It is an indication—*not a prediction*—of where the next earthquakes most likely will occur, how often, and the possible magnitude.

Note that there is no direct correlation between seismic zones and Richter scale. However, history has shown that the worst earthquakes usually occur in the higher seismic zones.

“Zones,” does not necessarily mean the “fault” line since the exact location is difficult to isolate.

What is a fault?

A fault is a fracture in the crust of the earth along which one side has moved relative to the other side. Most faults are the result of repeated displacements over a long period of time.

An “**active fault**” is one that has ruptured in the past 11,000 years. A **fault trace** is the line on the earth’s surface that may be identified by roads, drainages, and other features on the ground. Most earthquakes occur at depths of less than 80 km (50 miles) from the Earth’s surface.

Example: See Figure Two. California’s San Andreas fault is not a sin-

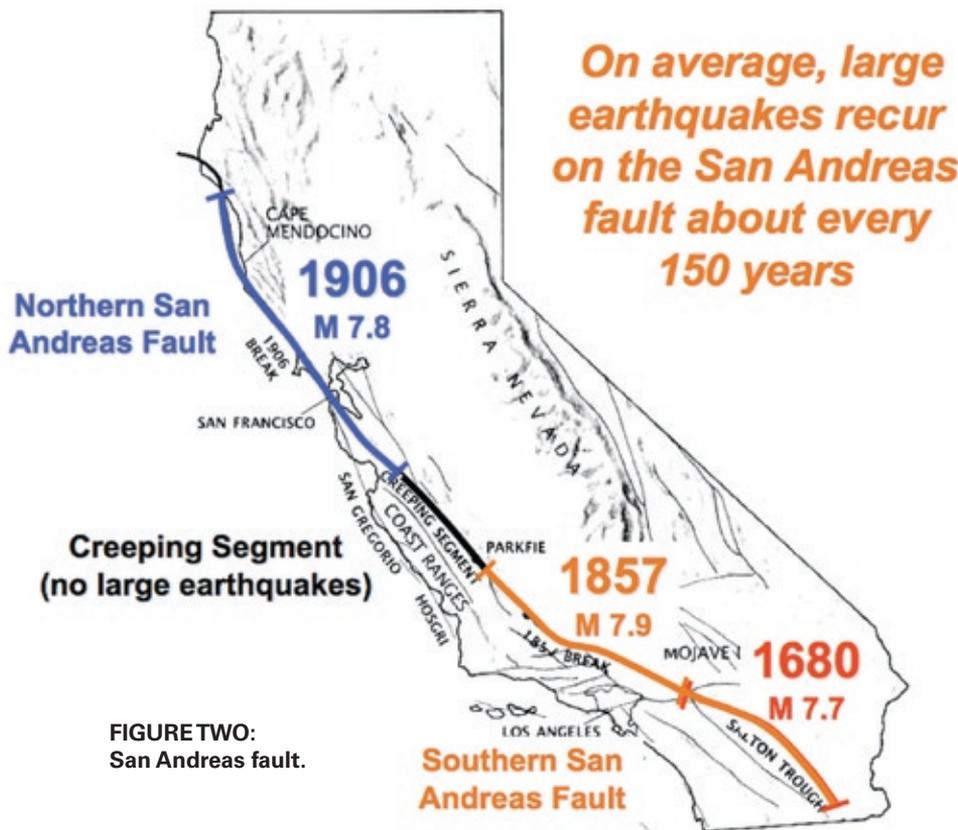


FIGURE TWO:
San Andreas fault.



FIGURE THREE: A surface rupture.

gle, continuous fault, but rather a fault zone made up of many segments. The fault system is more than 800 miles long, and in some spots is as much as 10 miles deep. Movement may occur along any of the many fault segments along the zone at any time.

Surface rupture (see Figure Three) occurs when movement on a fault deep within the earth breaks through to the surface. The 1992 Landers Earthquake, in San Bernardino County, had surface ruptures extending for over 50 miles having displacements from an inch to 20 feet.

Alternatively, the Loma Prieta Earthquake of 1989 caused major damage in the San Francisco Bay Area, but exhibited no significant surface ruptures. Movement is along the axis of the plane (not perpendicular). Accordingly, only crevices, lateral spreading and landslides will, if any, result.

Alquist-Priolo fault zones

Alquist-Priolo Earthquake “fault zones” are California regulatory zones that encompass surface traces of active faults that have a

potential for future surface fault rupture. If a property is not developed, a fault study may be required before the parcel can be subdivided or before most structures can be permitted.

If a property *is* developed for commercial or residential, the Alquist-Priolo Act requires that all real estate transactions within a fault zone be disclosed by the seller to prospective buyers. California’s Natural Hazards Disclosure Act of 1998 requires that sellers of real property and their agents provide prospective buyers with a “natural hazard disclosure statement” when the property is being sold lies within one or more zones.

What does this have to do with those of us in the datacom and telecom

business? Vendors may be required to have California’s Office of Statewide Health Planning and Development (OSHPD) pre-approval (OPA) numbers for IT infrastructure products.

Additionally, the Alfred E. Alquist Hospital Facilities Seismic Safety Act of 1983, establishes, under the jurisdiction of the California Office of Statewide Health Planning and Development, a program of seismic safety building standards for certain hospitals constructed on and after March 7, 1973.

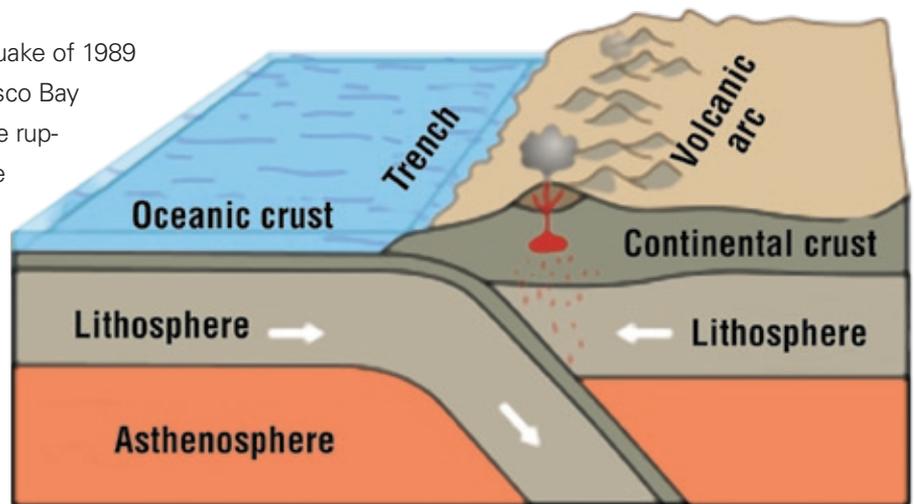


FIGURE FOUR: Convergence of land and ocean.

SB 306 authorizes certain hospital owners who do not have the financial capacity to bring certain buildings into compliance by 2013 to, instead, replace those buildings by Jan. 1, 2020.

Explanation of Figure Six

California's 200-year earthquake history is divided into three nearly equal time periods, distinguished by red, blue, and green on the map (Figure Six), to show the changes in earthquake occurrence and identification with time.

Since 1800, as we can see, earthquakes capable of damaging unreinforced buildings have occurred at least six times in each of these regions: Los Angeles to San Fernando, San Francisco Bay to Santa Cruz, and Eureka to Cape Mendocino.

Epicenters of 800 magnitude-5-or-greater temblors are shown, including some centered offshore of California, as well as in bordering regions of Nevada, Oregon, and Mexico.

California, on the average, has experienced one 6M or greater earthquake each year since 1950. It also shows that some areas have been relatively quiet seismically in the last 90 years but were very active in the previous 100 years.

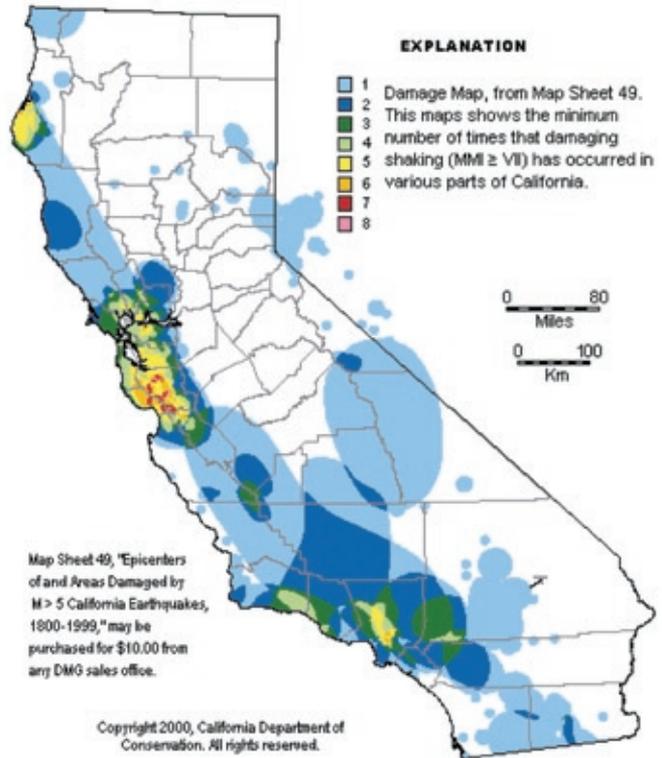


FIGURE SIX. Damage from earthquakes in California

Richter Scale & Magnitude (M)

The Richter scale is not a physical device, but a mathematical formula (developed in 1935 by Charles F. Richter, California Institute of Technology). The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded on a seismogram at a certain period.

It is estimated that there are 500,000 detectable earthquakes in the world each year. U.S. Geological Survey (USGS) scientists describe the Hayward fault in the Bay Area of California as a tectonic time bomb, due (any time now) for another magnitude-6.8-to-7.0 earthquake.

Magnitude is a number that defines the relative size of an earthquake, measured by the maximum motion as recorded by a seismograph. The magnitude is the same no matter where you are, or how strong or

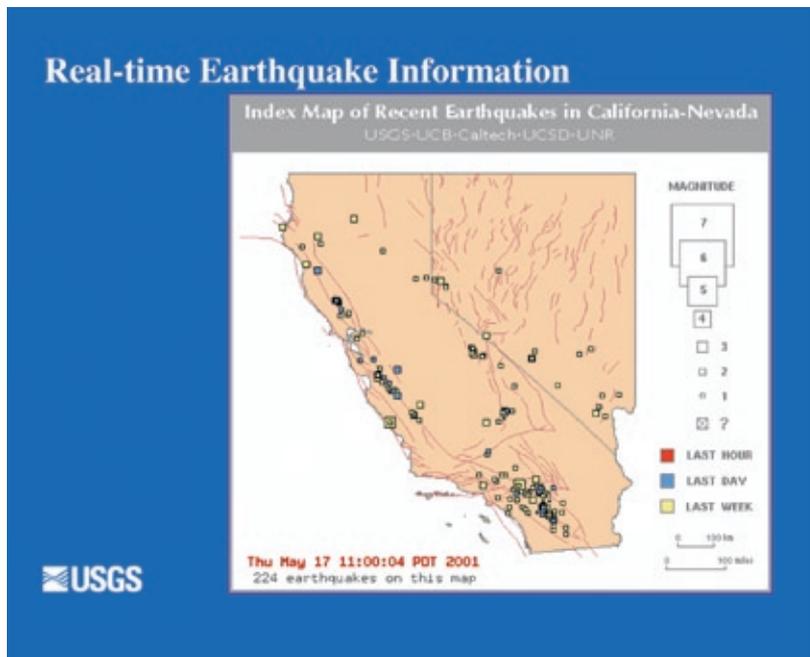


FIGURE FIVE. Earthquake event information.

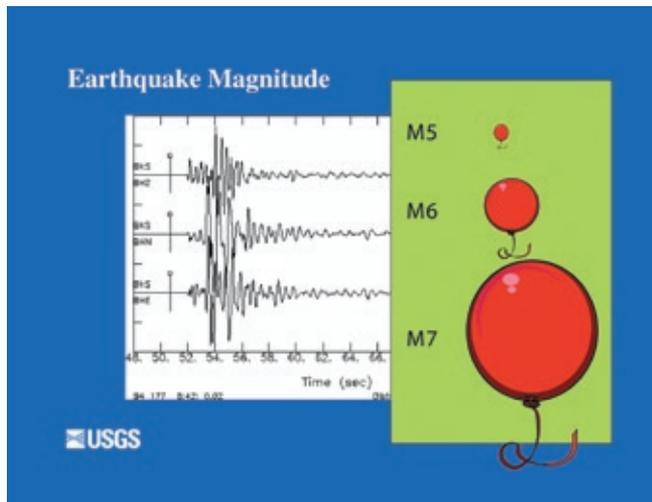


FIGURE SEVEN: A look at the difference in Magnitude between M5, M6, and M7 quakes.

weak the shaking was in various locations.

Magnitude is expressed in whole numbers and decimal fractions.. Because of the logarithmic basis of the scale, **each whole number increase in magnitude represents a tenfold increase** in measured amplitude.

Most earthquake waves have a frequency of less than 20 Hz lasting seconds to 2 minutes so are usually not audible. The rumbling noise heard during an earthquake is most likely the building and its contents moving and bouncing around. ⚡

Conrad is a Richmond, Va.-based datacom consultant and trainer.

EARTHQUAKE RECORDS: DEVASTATING

- **The largest recorded earthquake in the USA:** A magnitude 9.2 that struck Prince William Sound, Alaska, on Good Friday, March 28, 1964.
- **Largest in the world:** A magnitude 9.5 in Chile on May 22, 1960.
- **Deadliest recorded earthquake:** One that hit central China in 1556 killed an estimated 830,000 people. In 1976 another deadly earthquake struck in Tang Shan, China, where more than 250,000 people were killed.

EARTHQUAKE FACT SHEET

- It was recognized as early as 350 BC by the Greek scientist Aristotle that **soft ground shakes more than hard rock** in an earthquake.
- In 1663, European settlers experienced their **first earthquake in America**.
- When the Chilean earthquake occurred in 1960, **seismographs recorded seismic waves that traveled all around the Earth**. These seismic waves shook the entire earth for many days! This phenomenon is called the free oscillation of the Earth.
- The **interior of Antarctica has icequakes** which, although they are much smaller, are perhaps more frequent than earthquakes there. Icequakes are similar to earthquakes, but occur within the ice sheet (instead of the land underneath the ice). Polar observers say they can hear the icequakes—and see them on the South Pole seismograph station—but they are much too small to be seen on enough stations to obtain a location.
- The **average rate of motion across the San Andreas Fault Zone** during the past 3,000,000 years is two inches per year. This is about the same rate at which your fingernails grow. Assuming this rate continues, scientists project that Los Angeles and San Francisco will be adjacent to one another in approximately 15 million years.
- Although both are sea waves, a **tsunami and a tidal wave** are unrelated phenomena. A tidal wave is a shallow water wave caused by the gravitational interactions between the Sun, Moon, and Earth. A tsunami is a sea wave caused by an underwater earthquake or landslide (usually triggered by an earthquake) displacing the ocean water.
- It is thought that more damage was done by the resulting fire after the **1906 San Francisco earthquake** than by the earthquake itself.
- A **seiche** (pronounced “saysh”) is what happens in the swimming pools of Californians during and after an earthquake. It is “**an internal wave oscillating in a body of water.**” In other words, it is the sloshing of the water in a swimming pool, or any body of water, caused by the ground shaking in an earthquake. It may continue for a few moments or hours, long after the generating force is gone. A seiche can also be caused by wind or tides.