

# EARTHQUAKE Glossary

**Aftershock**—an earthquake that follows a larger earthquake, or main shock, and originates along the same fault as the main shock.

**Amplitude**—a measurement of the energy of a wave. Amplitude is the displacement of the medium from zero or the height of a wave crest or trough from a zero point.

**Body waves**—waves that move through the body (rather than the surface) of the Earth. P waves and S waves are body waves.

**Braces or Bracing**—structural elements built into a wall to add strength. These may be made of various materials and connected to the building and each other in various ways. Their ability to withstand stress depends on the characteristics of the materials and how they are connected.

**Canopy**—a covered area that extends from the wall of a building, protecting an entrance.

**Cantilever**—a beam, girder, or other structural member which projects beyond its supporting wall or column.

**Cartographer**—a map maker.

**Cladding**—an external covering or skin applied to a structure for aesthetic or protective purposes.

**Cornice**—the exterior trim of a structure at the meeting of the roof and wall.

**Compression**—squeezing, being made to occupy less space. P waves are called *compressional waves* because they consist of alternating compressions and dilations.

**Consolidated**—tightly packed, composed of particles that are not easily separated.

**Continental drift**—the theory, first advanced by Alfred Wegener, that Earth's continents were originally one land mass, pieces of which split off and gradually migrated to form the continents we know.

**Diagonal braces**—structural elements that connect diagonal joints. These braces may be made of solid materials or flexible materials. How they function depends on what they are made of and how they are connected.

**Duration**—the length of time that ground motion at a given site shows certain characteristics. Most earthquakes have a duration of less than one minute, in terms of human perceptions, but waves from a large earthquake can travel around the world for hours.

**Earthquake**—a sudden shaking of the Earth caused by the passage of seismic waves. These waves are caused in turn by the release of energy stored in the Earth's crust.

**Earthquake hazard**—any geological or structural response to an earthquake that poses a threat to human beings and their environments.

**Elevation**—in architecture, a flat scale drawing of one side of a building.

**Epicenter**—the point on Earth's surface directly above the location (focus) of the earthquake below the surface.

**Epitaph**—an inscription on a tombstone, often intended to sum up the achievements of a person's life.

**Fault**—a break or fracture in Earth's crust along which movement has taken place.

**Focus (pl. foci)**—the point within the Earth that is the origin of an earthquake, where strain energy is first released as wave energy.

**Force**—the cause or agent that puts an object at rest into motion or affects the motion of a moving object. Gravity is a vertical force; earthquake shaking includes both horizontal and vertical forces.

**Foreshock**—an earthquake that precedes a larger earthquake, or *main shock*, and originates along the same fault as the main shock.

**Friction**—any force or combination of forces that acts in opposition to motion.

**Frequency**—the rate at which a motion repeats, or oscillates. The frequency of a motion is directly related to the energy of oscillation. In this context, frequency is the number of oscillations in an earthquake wave that occur each second. In earthquake engineering, frequency is the rate at which the top of a building sways.

**Generalization**—a general rule derived from particular instances.

**Glazing**—glass surface.

**Gravity**—the force of attraction between any two objects with mass. Gravity is especially noticeable when an object of great mass, such as Earth, attracts objects of lesser mass, pulling them toward its own center.

**Ground water**—subsurface or underground water.

**Hazard**—a risk; an object or situation that holds the possibility of injury or damage.

**Hertz (Hz)**—the unit of measurement for frequency, as recorded in cycles per second. When these rates are very large, the prefixes *kilo* or *mega* are used. A *kilohertz* (kHz) is a frequency of 1,000 cycles per second and a *megahertz* (MHz) is a frequency of 1,000,000 cycles per second.

**Horizontal load**—the sum of horizontal forces (shear forces) acting on the elements of a structure.

**Index fossil**—a fossil that, because its approximate date is known, allows scientists to determine the age of the rock in which it is imbedded.

**Inertia**—the tendency of matter to remain at rest, if at rest, or to continue moving, if in motion, unless affected by some outside force.

**Infill**—a construction method that starts with a structural steel or reinforced concrete frame and fills the empty spaces between structural elements with brick or hollow concrete block.

**Intensity**—a subjective measure of the amount of ground shaking an earthquake produces at a particular site, based on human observations of the effect on human structures and geologic features. The Modified Mercalli Intensity scale uses Roman numerals from I to XII.

**Isoseismal line**—a line on a map that encloses areas of equal earthquake intensity. It is usually a closed curve around the epicenter.

**Joint**—a break or fracture in the Earth's crust along which movement has not taken place.

**Joists**—the parallel planks or beams that hold up the planks of a floor or the laths of a ceiling.

**Lag time**—the difference between the arrival time of P waves ( $T_p$ ) and S waves ( $T_s$ ).

**Landfill**—a site where soil has been deposited by artificial means—often, where garbage or rubbish has been disposed of, then covered with dirt and compacted.

**Landslide**—an abrupt movement of soil and bedrock downhill in response to gravity. Landslides can be triggered by an earthquake or other natural causes.

**Latitude**—the location of a point north or south of the equator, expressed in degrees and minutes. Latitude is shown on a map or globe as east-west lines parallel to the equator.

**Lifeline**—a service that performs functions vital to the life of a community. Major lifelines include transportation systems, communication systems, water supply lines, electric power lines, and petroleum or natural gas pipelines.

**Liquefaction**—the process in which a solid (soil) takes on the characteristics of a liquid as a result of an increase in pore pressure and a reduction in stress.

**Load**—the sum of vertical force (gravity) and horizontal forces (shear forces) acting on the mass of a structure. The overall load is further broken down into the loads of the various parts of the building. Different parts of a building are designed and constructed to carry different loads.

**Load path**—the path a load or force takes through the structural elements of a building.

**Loess**—an unstratified, windblown mixture of clay, sand, and organic matter, usually crumbly and buff or yellow-brown in color.

**Longitude**—the location of a point east or west of the prime meridian, expressed in degrees and minutes. Longitude is shown on a map or globe as north-south lines left and right of the prime meridian, which passes through Greenwich, England.

**Longitudinal waves**—p-waves. This term is used to emphasize that p-waves move particles back and forth in the same line as the direction of the wave.

**Love waves**—surface waves that move in a back and forth horizontal motion.

**Magnitude**—a number that characterizes the size of an earthquake by recording ground shaking on a seismograph and correcting the distance to the epicenter of the earthquake. Magnitude is expressed in Arabic numbers on the Richter scale.

**Masonry**—stone, brick, or concrete building materials.

**Masonry veneer**—a masonry (stone or brick) facing laid against a wall and not structurally bonded to the wall.

**Mass**—the quantity of matter in a body as measured by its inertia.

**Mass movement**—the movement of surface material caused by gravity.

**Meteorology**—the study of Earth's atmosphere.

**Modified Mercalli scale of 1931**—a qualitative scale of earthquake effects that assigns an intensity number to the ground shaking for any specific location on the basis of observed effects. Mercalli intensity is expressed in Roman numerals.

**Natural hazard**—any of the range of natural Earth processes that can cause injury or loss of life to human beings and damage or destroy human-made structures.

**Nonstructural feature**—a feature of a building that is not essential to its structural design and does not contribute structural strength. Examples are windows, cornices, and parapets.

**Oscillation or vibration**—the repeating motion of a wave or a material. Earthquakes cause seismic waves that produce oscillations, or vibrations, in materials with many different frequencies. Every object has a natural rate of vibration that scientists call its *natural frequency*. The natural frequency of a building depends on its physical characteristics, including the design and the building materials.

**P waves**—primary waves, so called because they travel faster than S waves, or secondary waves and arrive at the station first. These waves carry energy through the Earth as longitudinal waves, moving particles in the same line as the direction of the wave.

**Paleomagnetism**—the natural magnetic traces that reveal the intensity and direction of Earth's magnetic field in the geologic past.

**Paleoseismology**—the study of ancient earthquakes.

**Parapet**—part of a wall which is entirely above the roof.

**Path, or Load path**—the direction in which energy is distributed throughout a structure. In most structures, it should be directed toward the ground.

**Peat**—a deposit of semicarbonized plant remains in a water-saturated environment. Peat is an early stage in the development of coal.

**Period**—the time between two successive wave crests.

**Pioneer**—a person who moves into new and uncharted territory.

**Plate tectonics**—the theory that Earth's crust and upper mantle (the lithosphere) are broken into a number of more or less rigid, but constantly moving, segments, or plates.

**Portico**—a porch or covered walk consisting of a roof supported by columns

**Prediction**—a statement that something is likely to happen. A prediction is usually only as reliable as its source.

**Principle of crosscutting relationships**—the principle stating that a rock is always younger than any other rock across which it cuts. Earthquake faulting illustrates this principle: Faults are always younger than the rocks they cut.

**Principle of superposition**—The principle upon which all geologic chronology is based stating that in any sequence of sedimentary layers that has not been overturned, each layer is younger than the one beneath, but older than the one above it.

**Principle of uniformitarianism**—the fundamental principle stating that geologic processes have operated in essentially the same way throughout geological time.

**Probability**—In mathematics, the ratio of the number of times something will probably occur to the total number of possible occurrences. In common usage, an event is probable, rather than merely possible, if there is evidence or reason to believe that it will occur.

**Qualitative**—having to do with perceived qualities; subjective.

**Quantitative**—having to do with measurable quantities; objective.

**Radiometric dating**—the process of using natural radioactivity to determine the age of rocks.

**Rapid visual screening (RVS)**—a method of assessing risk that relies on external observation. An observer who is trained in RVS can derive enough information from a quick visual assessment to know if closer examination is necessary.

**Rayleigh waves**—surface waves that carry energy along Earth's surface by elliptical particle motion, which appears on the surface as a ripple effect.

**Recurrence interval**—the approximate length of time between earthquakes in a specific seismically active area.

**Resonance**—an increase in the amplitude (a measurement of the wave crest) in a physical system (such as a building) that occurs when the frequency of an applied oscillatory force (such as earthquake shaking) is close to the natural frequency of the system.

**Retrofitting**—making changes to a completed building to meet needs that were not considered at the time it was built; in this case, to make it better able to withstand an earthquake.

**Richter magnitude**—the number that expresses the amount of energy released during an earthquake, as measured on a seismograph or a network of seismographs, using the scale developed by Charles Richter in 1935.

**Richter scale**—the magnitude scale developed by Charles Richter in 1935 as a means of categorizing local earthquakes.

**Rigid connections**—connections that do not permit any rotation of the structural elements they connect.

**Rotation**—turning from side to side.

**Run-up elevation or height**—the highest altitude above the tide line, in meters, that the water reaches as it is forced up on land by a tsunami.

**S waves**—secondary waves; waves that carry energy through the Earth in very complex patterns of transverse (crosswise) waves. These waves move more slowly than P waves (in which the ground moves parallel to the direction of the wave), but in an earthquake they are usually bigger.

**Sag pond**—a small body of water occupying an enclosed depression formed by fault movement.

**Sand boil**—a forcible ejection of sand and water from saturated soil, caused by strike-slip an earthquake or heavy flooding.

**Saturated**—having absorbed water to the point that all the spaces between the particles are filled.

**Sediment**—material that has been transported by wind, water, or ice and come to rest in a new location.

**Sedimentary deposits**—accumulations of small solid particles that originated from the weathering of rocks and that have been transported or deposited by wind, water, or ice.

**Seismicity**—earthquake activity.

**Seismic**—of or having to do with earthquakes.

**Seismic sea wave**—a tsunami generated by an undersea earthquake.

**Seismic zone**—a region in which earthquakes are known to occur.

**Seismogram**—the record of earthquake ground motion recorded by a seismograph.

**Seismograph**—an instrument that records vibrations of the Earth, especially earthquakes.

**Seismograph station**—a site at which an array of seismographs is set up and routinely monitored.

**Seismology**—the scientific study of earthquakes.

**Shaking**—rapid horizontal vibration of the base of the model, simulating an earthquake. In an actual earthquake, of course, shaking occurs in many directions.

**Shear force**—force that acts horizontally (laterally) on a wall. These forces can be caused by earthquakes and by wind, among other things. Different parts of a wall experience different shear forces.

**Shear walls**—walls added to a structure to carry horizontal (shear) forces. These are usually solid elements, and are not necessarily designed to carry the structure's vertical load.

**Sill plate**—the structural member at the base of a wood frame building that joins the building to its reinforced concrete foundation.

**Slump**—a type of landslide in which a block of rock or soil moves along a curved surface and rotates.

**Soft stories**—stories in a building, usually lower stories with many openings, that are poorly supported or braced, and hence vulnerable to collapse.

**Stick-slip movement**—a jerky, sliding movement along a surface. It occurs when friction between the two sides of a fault keeps them from sliding smoothly, so that stress is built up over time and then suddenly released.

**Strata (s. *stratum*)**—layers of rock or other materials formed at different periods in geologic time.

**Strike-slip faulting**—fault movement in which the fault is horizontal.

**Structural elements or structural features**—a general term for all the essential, non-decorative parts of a building that contribute structural strength. These include the walls, vertical column supports, horizontal beams, connectors, and braces.

**Studs**—upright pieces in the outer or inner walls of a building to which panels, siding, laths, etc. are nailed or bolted.

**Subduction**—the process in which one lithospheric plate is forced down under another plate and drawn back into the Earth's mantle.

**Surface waves**—waves that move over the surface of the Earth. Rayleigh waves and Love waves are surface waves.

**Tilt-up building**—a building constructed of reinforced concrete panels that are poured and cast at the building site, allowed to dry, then tilted up into place and joined together by welding. Roofs frequently collapse on these one- or two-story buildings when they are not joined to the walls securely enough to withstand earthquake shaking.

**Topography (*adj. topographic*)**—the shape of the land; the contours and the arrangement of surface features that characterize a region.

**Torsion**—twisting or turning. A building must be resistant to extreme torsion to resist earthquake damage.

**Transverse waves**—waves that vibrate particles in a direction perpendicular to the wave's direction of motion (S waves).

**Tsunami**—a destructive ocean wave created by an earthquake or other large-scale disturbance of the ocean floor; a seismic sea wave. This Japanese word has the same form in both the singular and the plural.

**Unconsolidated**—loosely arranged, not cemented together, so particles separate easily.

**Unreinforced masonry**—brick, stone, or adobe walls without any steel reinforcing rods or other type of reinforcement. Buildings of this type were probably built before 1940.

**Variable**—in a scientific experiment, any one element of a design that can be altered to test the effect of the alteration on the rest of the system.

**Veneer**—an outside wall facing of brick, stone, or other materials that provides a decorative surface but is not load-bearing.

**Vertical load**—the impact of vertical force (gravity) acting on the elements of a structure.

**Wave height**—the vertical distance in meters from a wave's crest to its trough. (This measurement will be twice the amplitude measured for the same wave.)

**Wavelength**—the horizontal distance between two successive crests, measured in meters.