

Appendix I Glossary

I-1. Sources

The following definitions were assembled from glossaries in Bolt (1978), ICOLD Bulletin 72 (1989), and EERI Committee on Seismic Risk (1984).

I-2. Terms

Acceleration Time-History

A time series of accelerations that is either recorded during an actual earthquake or synthesized to be representative of that recorded during an earthquake.

Accelerometer

A seismograph for measuring ground acceleration as a function of time.

Acceptable Risk

A probability of social or economic consequences due to earthquakes that is low enough (for example in comparison with other natural or man-made risks) to be judged by appropriate authorities to represent a realistic basis for determining design requirements for engineered structures or for taking certain social economic actions.

Active Fault

A fault, reasonably identified and located, known to have produced historical earthquakes or showing geologic evidence of Holocene (11,000 years) displacements and which, because of its present tectonic setting, can undergo movement during the anticipated life of man-made structures. Differences of opinion regarding the definition of activity are acknowledged. For the purpose of earthquake engineering application, a seismogenic or earthquake fault is distinct from other types of fractures such as those resulting from landslides, ice thrusting, groundwater withdrawal effects, etc. (Alternate: a fault that may produce an earthquake within a specified exposure time, given the assumption adopted for a specific seismic-risk analysis.)

Aftershocks

Smaller earthquakes following the largest earthquake of a series concentrated in a restricted crustal volume.

Attenuation

Decrease in amplitude and change in frequency content of the seismic waves with distance because of geometric spreading, energy absorption, and scattering. Also designates a decrease of signal magnitude during transmission, and a reduction of amplitude or energy without change of wave form.

B-value

A parameter indicating the relative frequency of occurrence of earthquakes of different sizes. It is the slope of a straight line indicating absolute or relative frequency (plotted logarithmically) versus earthquake magnitude or meiszoseismal Modified Mercalli Intensity. (The B-value indicates the slope of the Gutenberg-Richter recurrence relationship.)

Bedrock

Any sedimentary, igneous, or metamorphic material represented as a unit in geology, consisting of a sound and solid mass, layer, or ledge of mineral matter, with shear wave threshold velocities greater than 750 m/sec. Bedrock can be exposed at the ground surface or underlie soil layers.

Coefficient of Variation

The ratio of standard deviation to the mean.

Critical Damping

The least amount of damping that will prevent free oscillatory vibration in a one-degree-of-freedom system.

Damage

Any economic loss or destruction caused by earthquakes.

Damping

Resistance that reduces or opposes vibrations by energy absorption. There are different types of damping, such as material (viscous, Coulomb) and geometric (radiation) damping.

Damping Ratio

The ratio of the actual damping to the critical damping.

Design Response Spectrum

A smooth response spectrum developed from a deterministic or probabilistic ground motion analysis and used as a basis for seismic design.

Dispersion (wave)

The spreading out of a wave train due to each wave length traveling with its own velocity.

Duration

A qualitative or quantitative description of the length of time during which ground motion at a site shows certain characteristics (perceptibility, violent shaking, etc.).

Earthquake

A sudden motion or vibration in the earth caused by the abrupt release of energy in the earth's lithosphere. The wave motion may range from violent at some locations to imperceptible at others. (Alternate: The vibrations of the earth caused by the passage of seismic waves radiating from some source of elastic energy.)

Elastic Rebound Theory

The theory of earthquake generation proposing that faults remain locked while strain energy slowly accumulates in the surrounding rock, and then suddenly slip, releasing this energy.

Epicenter

The point on the surface of the earth directly above the focus (hypocenter) of an earthquake.

Equal-Hazard Response Spectrum

A response spectrum developed from a probabilistic ground motion analysis that has an equal probability of being exceeded at each period of vibration

Exceedance Probability

The probability that a specified level of ground motion or specified social or economic consequence of earthquakes will be exceeded at a site or in a region during a specified exposure time.

Expected

Mean, average.

Expected Ground Motion

The mean value of one or more characteristics of ground motion at a site for a single earthquake (mean ground motion).

Exposure Time

The time period of interest for seismic-risk calculations, seismic-hazard calculations, or design of structures. For some categories of structures such as buildings, the exposure time is often chosen to be equal to the design lifetime of the structure.

Fault

A fracture or zone of fractures in rock along which the two sides have been displaced relative to each other parallel to the fracture. The total fault offset may range from centimeters to kilometers.

Fault Plane

The plane that most closely coincides with the rupture surface of a fault.

Focal Depth

The vertical distance between the epicenter and the hypocenter.

Focus

See Hypocenter.

Free Field

The regions of the ground surface not influenced by man-made structures. Also designates a medium that contains no structure (free-field profile), or a region where boundary effects do not influence the behavior of the medium significantly.

Frequency

Number of hertz or equivalent cycles per second.

Geologic Hazard

A geologic process (e.g., landsliding, liquefaction, soil compaction, surface fault rupture) that during an earthquake or other natural event may produce adverse effects in structures.

Hertz

The unit of frequency equal to one cycle per second or 2π radians per second.

Hypocenter

The point within the earth at which an earthquake initiates.

Intensity

A numerical index describing the effects of an earthquake on man-made structures or other features of the surface of the earth. The assignment of intensity values is subjective and is influenced by the quality of construction, the ground surface condition, and the individual perception of the observer. Different intensity scales are used in various countries, such as the Modified Mercalli Intensity scale, which is the most widely used in the United States.

Left-lateral Fault

A strike-slip fault on which the displacement of the far block is to the left when viewed from either side.

Liquefaction (of Soil)

Process of soil behaving like a dense fluid rather than a wet solid mass during an earthquake.

Love Waves

Seismic surface wave with only horizontal shear motion transverse to the direction of propagation.

Magnitude (of Earthquakes)

A measure of earthquake size, determined by taking the common logarithm (base 10) of the largest ground motion recorded during the arrival of a seismic wave type and applying a standard correction for distance to the epicenter. Three common types of magnitude are Richter (or local) (M_L), P body wave (m_b), and surface wave (M_s). Moment magnitude (M_W), which is directly determined from the logarithm of the seismic moment (see definition below), is another type of magnitude often used.

MCE

The Maximum Credible Earthquake.

MDE

The Maximum Design Earthquake.

Mean Recurrence Interval, Average Recurrence Interval

The average time between earthquakes or faulting events with specific characteristics (e.g., magnitude ≥ 6) in a specified region or in a specified fault zone.

Mean Return Period

The average time between occurrences of ground motion with specific characteristics (e.g., peak horizontal acceleration $\geq 0.1g$) at a site (equal to the inverse of the annual frequency of exceedance).

Moment (of Earthquakes)

The rigidity of rocks times the area of faulting times the amount of slip. A measure of earthquake size.

Near-Field Motion

Ground motion recorded in the vicinity of a fault.

Normal Fault

A dip-slip fault in which the rock above the fault plane has moved downward relative to the rock below.

OBE

The Operating Basis Earthquake.

Oblique-Slip Fault

A fault that combines some strike-slip motion with some dip-slip motion.

PGA

Peak Ground Acceleration.

P-Wave

The primary or fastest wave traveling away from a seismic event through the rock, and consisting of a train of compressions and dilations of the material.

Period (Wave)

The time interval between successive crests in a sinusoidal wave train; the period is the inverse of the frequency of a cyclic event.

Phase

The angle of lag or lead of a sine wave with respect to a reference. The phase response is the graph of the phase shift versus frequency.

Plate (Tectonic)

A large, relatively rigid, segment of the lithosphere of the earth that moves in relation to other plates over the deeper interior. Plates meet in convergence zones and separate at divergence zones.

Plate Tectonics

The theory of plate movement and interaction; the attempt to explain earthquakes, volcanoes, and mountain building as consequences of large horizontal surface motions.

Rayleigh Waves

Seismic surface waves with ground motion only in a vertical plane containing the direction of propagation of the waves.

Refraction (Wave)

The departure of a transmitted wave from its original direction of travel at an interface with a material of different wave velocity.

Response Spectrum

A plot of the maximum values of acceleration, velocity, and/or displacement response of an infinite series of single-degree-of-freedom systems subject to a time-dependent dynamic excitation, such as but not limited to ground motion. The maximum response values are expressed as a function of undamped natural period for a given damping. Approximate response spectrum acceleration, velocity, and displacement values may be calculated from each other assuming a sinusoidal relationship between them. When calculated in this manner, these are sometimes referred to as pseudo-acceleration, pseudo-relative velocity, or pseudo-relative displacement response spectrum values.

Reverse Fault

A dip-slip fault in which the rocks above the fault plane move up and over the lower rocks, so that older strata are placed over younger strata. A low-angle (less than 45 deg from horizontal) reverse fault is termed a thrust fault.

Right-Lateral Fault

A strike-slip fault on which the displacement of the far block is to the right when viewed from either side.

Risk (Seismic)

The relative risk is the comparative earthquake hazard from one site to another. The probabilistic risk is the odds of earthquake occurrence within a given time interval and region.

S-Wave

The secondary seismic wave, traveling more slowly than the P-wave, and consisting of elastic vibrations transverse to the direction of travel. It cannot propagate in a liquid.

Seismic Hazard

Any physical phenomenon (e.g., ground shaking, ground failure) associated with an earthquake that may produce adverse effects on human activities. In the context of a probabilistic ground motion analysis (often termed a probabilistic seismic hazard analysis, or PSHA), hazard refers to the probability or frequency of exceeding a certain amplitude of ground motion.

Seismicity

The occurrence of earthquakes in space and time.

Seismic Risk

The probability that social or economic consequences of earthquakes will equal or exceed specified values at a site, at several sites, or in an area during a specified exposure time.

Seismic Wave

An elastic wave in the earth usually generated by an earthquake source or explosion.

Seismograph

An instrument for recording as a function of time the motions of the surface of the earth that is caused by seismic waves.

Seismology

The study of earthquakes, seismic sources, and wave propagation through the earth.

Seismoscope

A simple seismograph recording on a plate without time marks.

Seismometer

The sensor part of the seismograph, usually a suspended pendulum.

Slip (Fault)

The relative motion of one face of a fault relative to the other.

Standard Deviation

The square root of the variance of a random variable.

Strain (Elastic)

The geometrical deformation or change in shape of a body. The change in an angle, length, area, or volume divided by the original value.

Stress (Elastic)

A measure of the forces acting on a body in units of force per unit area.

Stress Drop

Initial shear stress acting across a fault plane minus the residual shear stress across the same fault plane after occurrence of slippage.

Strike-Slip Fault

A fault in which movement is principally horizontal.

Strong Ground Motion

The shaking of the ground made up of large-amplitude seismic waves of various types.

Strong Motion

Ground motion of sufficient amplitude to be of engineering significance in the evaluation of damage due to earthquakes.

Subduction Zone

A dipping ocean plate descending into the earth away from an ocean trench. It is usually the locus of intermediate and deep earthquakes defining the Benioff zone.

Surface Wave (of Earthquakes)

Seismic waves that follow the earth's surface only, with a speed less than that of S-waves. There are two types of surface waves: Rayleigh waves and Love waves.

Swarms (of Earthquakes)

A series of earthquakes in the same locality, no one earthquake being of outstanding size.

Synthetic Acceleration Time-History

An acceleration time-history that is not recorded during an actual earthquake but is developed to be representative of one that could be recorded during a design earthquake. One form of synthetic time-history is modified from a recorded time-history using spectrum matching techniques so that its response spectrum is a close match to the design response spectrum. Another form of synthetic time-history is developed from ground motion modeling methods to be similar to a time-history that might be recorded during an actual earthquake. Such modeling methods simulate the rupture process at the earthquake source and the seismic wave propagation from the earthquake source to the site.

Tectonic Earthquakes

Earthquakes resulting from sudden release of energy stored by major deformation of the earth.

Tectonic Province

A geologic area characterized by similarity of geologic structure and earthquake characteristics.

Tectonics

Large-scale deformation of the outer part of the earth resulting from forces in the earth.

Tsunami

A long-period ocean wave usually caused by sea floor movements in an earthquake.

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Variance

The mean squared deviation of a random variable from its average value.

Wavelength

The distance between two successive crests or troughs of a wave.