

Glossary

abutment a support at the end of a bridge.

acceleration the rate of change of velocity of the ground or building in motion during an earthquake, commonly measured in terms of “g”—the increase in velocity of a free-falling body under the influence of earth’s gravity (approximately 32 ft/sec/sec or 980 cm/sec/sec).

acceptable (risk) amount or level that can be endured or allowed. The question of whether a risk is acceptable must be gauged against some standard of what is deemed to be adequate by a particular individual or group at a particular time. Acceptable risk can be set forth as public policy through laws or regulations.

active fault used for maps prepared under the Alquist-Priolo earthquake fault mapping program. A fault that has ruptured the ground surface during the last 11,000 years is considered active. More generally, an active fault is one that has ruptured or is moving as part of present tectonic environment.

alluvial sedimentary deposits made by streams on river beds, flood plains, and fans.

amplitude the maximum height of a wave crest or depth of a trough.

ATC Applied Technology Council.

attenuation the reduction in the amplitude of a wave over time or distance traveled.

AWWA American Water Works Association.

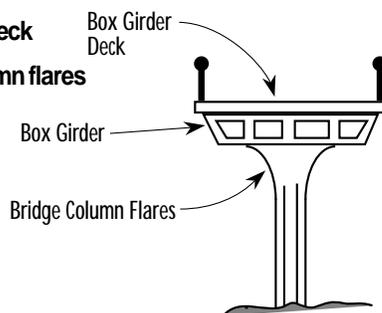
blind thrust a buried thrust fault.

BORPELS State Board of Registration for Professional Engineers and Land Surveyors.

box girder

box girder deck

bridge column flares



brittle shear failures x-shaped cracks in masonry or concrete walls, columns, or beams.

BSSC National Building Seismic Safety Council.

building designer an unlicensed technician or subprofessional that may design conventional wood-frame structures.

buried fault a fault that does not extend to the ground surface.

CalOSHA California Occupational Safety and Health Administration.

CBSC California Buildings Standards Commission.

CDMG California Division of Mines and Geology.

CEQA California Environmental Quality Act.

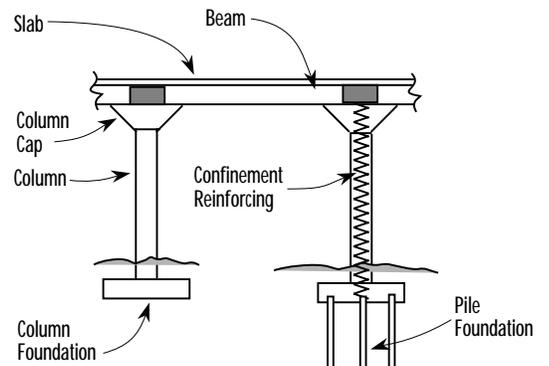
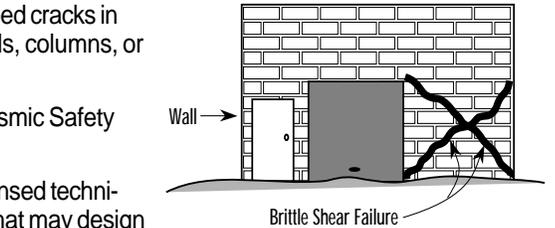
CHP California Highway Patrol.

code force level simplified design criteria for minimum earthquake resistance defined in the Uniform Building Code.

column cap

column foundation

confinement reinforcing



conventional construction wood-frame dwellings in regular configurations with 2x4 or 2x6 stud walls and not more than two stories and a basement.

COPR California Office of Planning and Research.

coseismic occurring simultaneous with an earthquake.

cripple wall a short wooden stud wall used on top of the exterior foundation to support the weight of a house and create a crawl space.

CSU California State University.

CUEA California Utilities Emergency Association.

CUREe California Universities for Research in Earthquake Engineering.

dangerous building see “unsafe building.”

deck loading the car and truck loads used to design or evaluate a bridge deck and its supports.

design earthquake the theoretical earthquake and its associated shaking used to establish design standards for structures—typically an earthquake whose shaking has only a 10 percent chance of being exceeded in 50 years.

design professional a licensed architect, civil engineer, or structural engineer.

design response spectrum a method of characterizing a design earthquake for use in dynamic analysis for a range of structural periods of vibration.

design specifications the criteria for the design of a structure.

design-build procedure contracting method whereby the designer is hired as part of the builder’s team.

designer of record the design professional who has signed plans to indicate that he or she is responsible for their overall adequacy.

deterministic design method a process in which one or more earthquakes are selected as the target for designing an earthquake-resistant structure. The target earthquake is usually selected by considerations of the historical seismicity record and physical characteristics of the seismic sources. Various characteristics of the target earthquake are then described in specific terms (for example, magnitude and peak ground motions). The deterministic method does not consider the likelihood of the occurrence of the target earthquake, nor does it offer any insight into the importance of the target earthquake compared to other possible seismic hazards, such as those that could be caused by smaller but closer earthquakes or larger but more distant earthquakes. Also see “probabilistic design method.”

diaphragm a horizontal or nearly horizontal bracing system, such as a floor or roof, acting to transmit lateral forces to the vertical force resisting parts of a building.

displacement the distance a point on the ground is moved during an earthquake.

DSOD Division of Safety of Dams—a division of California Department of Water Resources.

duration length of shaking during an earthquake, measured in seconds.

dynamic analysis a method of evaluating a structure’s response to ground motion that accounts for its natural tendencies to vibrate.

earthquake fault zone as used on Alquist-Priolo earthquake fault maps, it is a zone 500 feet wide on both sides of an active fault.

EERI Earthquake Engineering Research Institute.

effective peak acceleration reduced levels of acceleration after spikes of high-frequency acceleration have been truncated to account for the effect that rigid foundations tend to screen out very high frequencies recorded in free-field ground motion.

EIR environmental impact report.

elastic spectra more than one design response spectrum for structures that respond to ground shaking without damage.

engineer of record see “designer of record.”

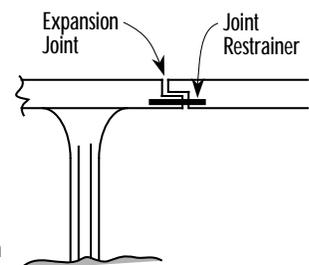
engineered fill earth fill designed by an engineer.

epicenter the point on the earth’s surface directly above the focus of an earthquake.

ERB system earthquake resistant bracing system—an anchoring system, bracing system, or other device designed and constructed, or represented as having been designed and constructed, for the purpose of protecting the health and safety of the occupants of and reducing damage to a mobile home or manufactured home in an earthquake.

essential services building any building that is used or designed to be used as a fire station, police station, emergency operations center, California Highway Patrol office, sheriff’s office, or emergency communication dispatch center.

expansion joint a gap in a structure that allows it to expand and contract with hot and cold temperatures.



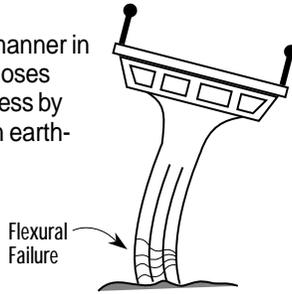
fault a fracture in rock along which there has been an observable amount of displacement.

fault rupture the breaking of the ground along a fault during an earthquake.

FEMA Federal Emergency Management Agency.

flexural failure the manner in which a structure loses strength and stiffness by bending during an earthquake.

focus the location (underground) at which fault rupture commences.



fold a bend in rock.

fracture zone a zone in which fault rupture has taken place.

free field a site with recorded groundshaking that is not influenced by the shaking of structures.

frequency number of vibrations per second.

functional-evaluation level a design specification that is intended to maintain a structure's ability to function after an earthquake.

general plan a city or county plan for the physical development of the jurisdiction.

geodetic data measured movement of the earth's crust.

geomorphic indicator land form that indicates the presence of a fault or faults.

geomorphology the description and interpretation of land forms.

geophysical data information gathered from a specified area—physical properties and relationships unique to the area mapped by one or more methods.

girder a horizontal structural member that spans supports.

green tag a placard that describes a post-earthquake safety evaluation of a building that is safe for occupancy.

ground deformation permanent alteration of the ground surface.

ground displacement the distance a point on the ground moves during earthquake shaking.

hardening generally no longer used—includes retrofitting, strengthening, or bracing to resist earthquakes.

hazard a natural phenomenon, such as shaking or ground deformation (liquefaction, landslides, and settlement), resulting directly or indirectly from earthquakes that can cause injury or harm. Buildings that might collapse are structural hazards; light fixtures, shelving, and

sprinkler systems that might fail are nonstructural hazards.

hazardous building a building that a qualified professional has determined to have a high likelihood of posing a significant threat of death or injury from total collapse, partial collapse, falling hazards, blocked passages, or the release of hazardous materials in the event of a major earthquake. Hazardous buildings are not so unsafe as for governments to preclude occupancy.

HCD Department of Housing and Community Development.

high-deposition electrode a tool that welds steel members of a structure quickly.

hinge a bridge support that allows ends of girders to rotate.

hinge restrainer a bridge design or retrofit measure that keeps hinges from spreading apart too much during shaking.

historic building any building deemed important to the history, architecture, or culture of an area as determined by an appropriate governmental agency.

HUD Department of Housing and Urban Development.

HVAC heating, ventilation, and air conditioning.

ICBO International Conference of Building Officials.

inspection review of construction in progress to ensure compliance with approved plans and specifications.

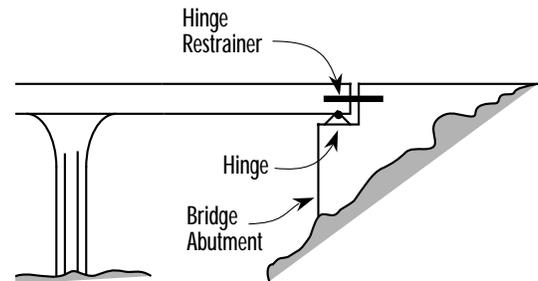
intensity a measure of ground shaking obtained from the damage done to structures, changes in the earth's surface, and reports of persons' experience of the shaking.

JCAHO Joint Committee on the Accreditation of Healthcare Organizations.

joint restrainer a bridge design or retrofit feature that keeps bridge joints from spreading apart too much during shaking (see "expansion joint").

joists small beams supporting a roof or floor.

landslide the perceptible downward sliding or falling of a relatively dry mass of earth, rock, or mixture of the two.



- landsliding** the occurrence of landslides in an earthquake, often carrying buildings, trees, and roads along with it.
- lateral slip** horizontal movement along a fault.
- lateral spreading** sideways movement of earth materials and overlying structures during an earthquake.
- lateral force path** the sequence of elements and connections in a structure that is meant to carry and distribute side-to-side forces.
- lateral force resisting system** the part of the structural system assigned to resist side-to-side forces.
- left lateral fault** a strike-slip fault on which the displacement of the far block is to the left when viewed from either side.
- licensing board** term used for boards of registration in the Department of Consumer Services such as the Board of Registration for Professional Engineers and Land Surveyors, Board of Architectural Examiners, Board of Registration for Geologists and Geophysicists, and Contractors' State Licensing Board.
- life safety** the building performance objective that is the primary basis for building code requirements.
- lifelines** services that are vital to the health and safety of the community and the functioning of an urban industrial society (electric power lines, water lines, gas lines, roads, communication channels, railroads).
- liquefaction** the process that occurs when earthquakes shake loose, wet, sandy soil so it loses strength, allowing building foundations to sink or sloping ground to move laterally.
- magnitude** a measure of an earthquake's size in terms of the energy released.
- major engineered buildings** large, complex buildings that have been designed by architects or engineers.
- microseismicity** the occurrence of small-magnitude earthquakes.
- minimum-performance bridge** a bridge for which failure or loss of function would have acceptable consequences after a design earthquake.
- moderate earthquake** earthquake between magnitudes 5.5 and 7.0.
- moment magnitude (M_w)** a measure of earthquake size in terms of the leverage of the forces across the area of the fault slip. The rigidity of the rock times the area of faulting times the amount of dip.
- mutual aid** cooperation among government agencies to provide resources to a stricken agency in a disaster.
- near field** a mathematical term describing the shaking associated with a propagating wave. It is determined by analyzing seismograms recorded close to a fault.
- near-source area** the area of the ground surface lying above and adjacent to the fault plane. Its horizontal extensions from the fault are about the same as the depth of the rupture on the fault. When the fault is inclined, the area on the ground surface is described by the vertical projection of the fault plane to the surface plus depth-related extensions. In instances where the fault does not break the ground surface, the near-source area also includes the ground surface lying above the extension of the fault plane to the surface. The ground surface in the near-source area generally will be warped permanently by the movement of the fault.
- near-source effects** ground motion in the near-source area is characterized by high accelerations, pulses of large velocity, and permanent tectonic displacement. The nature of ground motion is related to the direction and mechanics of the fault rupture as well as the path of the seismic wave to the surface. The characteristics of near-source shaking do not follow the "normal" attenuation relationships used to describe shaking at more distant points.
- NEHRP** National Earthquake Hazards Reduction Program.
- NIBS** National Institute for Building Standards.
- NOAA** National Oceanic and Atmospheric Administration.
- nonductile** brittle, prone to sudden instability, loss of strength, stiffness, failure, and collapse.
- nonductile concrete frame** concrete beams and columns used in structures built before 1973.
- nonlinear response** the way a building reacts to ground shaking.
- nonstructural elements** referring to ceiling, mechanical, electrical, and architectural building elements.
- nonstructural hazard** nonstructural elements that might fail in an earthquake.

- OASIS** Operational Area Satellite Information System—a statewide emergency management information system.
- occupiable** referring to a structure that can be occupied without excessive risk to life after a disaster.
- OSHPD** Office of Statewide Health Planning and Development.
- out of plane** perpendicular to a wall.
- out of plumb** not straight up and down, skewed, or distorted.
- peak acceleration** maximum rate of change of velocity during shaking.
- peer review** review by professionals with similar expertise in a specific subject area.
- performance objectives** what an owner wants his or her building to achieve during a design earthquake.
- period** the time interval between crests in a wave pattern.
- permanent ground deformation** a general term for the process of making folds in rocks—the faulting, shearing, compression, or extension of rocks as the result of various earth forces.
- phase velocity** the velocity with which an observable wave or wave crest is propagated through a medium—the product of wavelength and frequency.
- pilaster** column embedded in a wall.
- pile foundation** a steel, wood, or concrete element driven down through earth to provide support for a structure (see “column cap”).
- plan check** review of construction plans for conformance with the code.
- plan review** same as plan check.
- portable classroom** manufactured building for educational purposes.
- post-tensioned** tightened after concrete has cured and hardened.
- posting** placing a warning placard or notice on a hazardous, potentially hazardous, unsafe, or dangerous building. Notices on hazardous or potentially hazardous buildings should warn those who enter or pass nearby of the risk that the building presents; those on unsafe or dangerous buildings should prohibit entry as well as warning passersby.
- potentially hazardous building** a building that is one of a general type that has historically performed poorly in earthquakes and can pose a significant threat of death or injury from total collapse, partial collapse, falling hazards, blocked passages, or the release of hazardous materials in the event of a major earthquake.
- prereduced spectra** response spectra that have been reduced for a specific design criteria.
- precast concrete** plain or reinforced concrete element cast in other than its final position in the structure.
- pressure ridge** active small folds in rock related to tectonic pressure.
- prestress condition losses** reduced tension in steel due to slip, creep, and elastic shortening.
- prestressed concrete** reinforced concrete in which internal stresses have been introduced to reduce potential tensile stresses from loads.
- probabilistic design method** analysis of the earthquake hazard that addresses the questions of how strongly and how often the ground will shake by considering all possible earthquakes that might affect the site. The range of ground motions at a site resulting from earthquakes that might occur on a variety of seismic sources is estimated by using an attenuation function to translate to the site through distance the ground motions associated with earthquakes that are considered. The rate of earthquake occurrence on each seismic source is also considered. Also see “deterministic design method.”
- probability** a quantitative description of the likelihood of an event occurring (for example, a hazard). Probabilities are derived by statistical methods. For example, the chance of a coin toss coming up heads is expressed as 50 percent, 50-50, or 1 in 2; all three expressions represent the same probability. Hazards, risks, and vulnerability are usually expressed and discussed in terms of the probability over a period of time. Frequently, the probabilities of earthquakes on different faults in an area are combined to determine the overall probability of earthquakes of a certain magnitude occurring in a given area. For example, geologists believe that there is a 67 percent chance that a magnitude 7 or greater earthquake will occur on one of the three major faults in the San Francisco Bay Area in the next 30 years.
- PUC** Public Utilities Commission.

purlins see joists.

quality assurance program a plan to maintain minimum levels of construction quality.

red tag a placard that describes a post-earthquake safety evaluation for a damaged building that is unsafe to enter or occupy.

relocatable classroom manufactured building on a temporary foundation. Also see “portable classroom.”

residual stress internal stresses in building elements left over from a manufacturing or erection process.

response spectra graph showing how a range of structures will respond to given ground motions.

retrofit to strengthen, brace, remove excess mass, or otherwise reduce or alter the seismic response of existing structures.

return period the frequency with which a natural hazard can be expected to occur. This term is often misunderstood. If an earthquake of a specified magnitude on a particular fault has a calculated return period of 500 years, it means that, on average, over a very long period, the event will occur once every 500 years. It does not mean that events of the same or an even larger magnitude cannot occur more frequently than once in every 500 years or that other nearby faults will not have similar earthquakes. It does not preclude such events' occurring twice or more within a short time as happened in the San Fernando Valley between 1971 and 1994. Since many locations are threatened by several faults, the return period for strong shaking can be much shorter than the return period for an earthquake on a specific fault.

reverse fault the rock above the fault plane (hanging wall) moves up and over the rock below (foot wall). See Figure 10.

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

Riley Act law requiring state and local governments to issue building permits and to inspect building construction.

risk exposure to a hazard and the probable outcome of combining a given hazard and a given vulnerability. The level of risk can be described as the probability of a specified loss over a given time. All Californians are exposed to

earthquake hazards and are therefore at risk, though their individual levels of risk vary considerably.

roof screen a wall intended to shield roof-mounted equipment from view.

SAC Joint Venture a joint venture involving the Structural Engineers Association of California, the Applied Technology Council, and California Universities for Research in Earthquake Engineering.

safety-evaluation level a design specification that intends to maintain life safety but tolerates damage during earthquakes.

sag pond ponds occupying depressions along active faults.

sand boil extrusion of sand onto the ground through fractures produced by earthquake shaking.

SEAOC Structural Engineers Association of California.

Secretary for State and Consumer Services a member of the Governor's Cabinet responsible for the State and Consumer Services Agency.

seiche an oscillation of a body of water in an enclosed basin.

Seismic (base) isolation a method of decoupling or isolating structures from their supports to reduce the transmission of ground motions to structures.

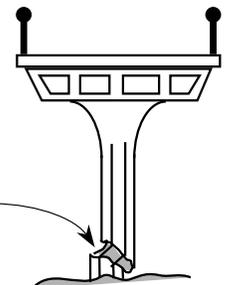
Seismic Hazards Mapping Act a statewide seismic hazard mapping and technical advisory program to assist cities and counties in fulfilling their responsibilities for protecting the public health and safety from the effects of strong ground shaking, liquefaction, landslides, or other ground failure hazards caused by earthquakes.

SFM Office of the State Fire Marshall.

shallow fill graded earth material used to raise or equalize the level of the ground, but limited in depth to several feet.

SHBSB State Historical Building Safety Board (within the Division of the State Architect).

shear internal stress in building elements that creates diagonal tension and compression.



- shear failure** the manner in which a structure loses strength and stiffness through diagonal tension and compression during an earthquake.
- shear wall** a wall designed to resist lateral forces parallel to the plane of the wall (sometimes referred to as a vertical diaphragm).
- shell construction** thin-walled elements used to form structures.
- shotcrete** pneumatically applied concrete.
- sill plate** the wood wall member that rests on a foundation.
- single-column pier** one tall, slender vertical bridge support.
- slab** a thin, horizontal structural element.
- slump** the downward slipping of a mass of rock or unconsolidated material.
- SMIP or CSMIP** California Strong Motion Instrumentation Program (Division of Mines and Geology, Department of Conservation).
- SoCalGas** Southern California Gas Company.
- spread footing** a foundation that supports structural loads by bearing on soil.
- strike-slip fault** a fault whose displacement is entirely horizontal.
- structural engineer** a civil engineer with a minimum of three additional years of experience in structural design and with successful completion of a 16-hour examination administered by the Board of Registration for Professional Engineers and Land Surveyors.
- structural hazard** structural elements, such as beams and columns, that might fail in an earthquake.
- subsidence** settling of the ground surface downward without moving sideways. Subsidence can occur during an earthquake when the underlying soil consolidates from shaking.
- subtle fault** faults with evidence of recent displacements and deformations that have been hidden by geologic processes such as erosion by wind and water.
- supporting abutment** a structure at the approach to a bridge.
- surface fault rupture** a fault that breaks the surface of the earth.
- tectonic** large-scale deformation of the outer part of the earth's crust resulting from forces in the earth.
- tectonic compression** compression caused by tectonic forces.
- thrust fault** a reverse fault that is characterized by a low angle of inclination with reference to a horizontal plane.
- tilt-up** a building with concrete walls cast on a slab at the building site and then raised into place.
- Title 24** California regulations that include the building code and all state amendments to the code.
- Title Act** State law that authorizes licensed professionals to use a particular title.
- topography** the general configuration of a land surface, including its relief and the position of its natural and fabricated features.
- tsunami** earthquake-caused water wave.
- UBC** Uniform Building Code.
- UC** University of California.
- UCLA** University of California at Los Angeles.
- uncertainty** the condition of having a degree of unreliability. Probabilities that are derived statistically depend on the amount and accuracy of the data being used; the smaller the amount of information or the more inaccuracies, the greater the uncertainty. Simple probability analyses of a coin toss have little or no uncertainty; complex probability statements for earthquakes have significantly larger degrees of uncertainty. Thus, actual probabilities or return periods are somewhat uncertain and may be considerably higher or lower than the calculated estimate.
- unsafe building** a building that has conditions or defects described as "structurally unsafe or not provided with adequate egress, or which constitutes a fire hazard, or [is] otherwise dangerous to human life" (Uniform Building Code, Sect. 102, 1991 ed.). Dangerous buildings are further defined in Section 302 of the Uniform Code for Abatement of Dangerous Buildings (1991 ed.). These buildings are unsafe to occupy.
- URM** unreinforced masonry building.
- URM infill** non-load-bearing unreinforced masonry that is supported by frames.

velocity measured in inches or centimeters per second, refers to the rate of ground motion.

vulnerability a measure of the adverse consequences that might occur to an object as a result of exposure to a hazard, usually expressed as a probability of failure or collapse from a specific level of shaking in an earthquake. A building or other structure that may not withstand a level of shaking to which it may be exposed is vulnerable. Given the same hazard exposure, weaker buildings are more vulnerable than stronger buildings.

waffle-slab floor a concrete structural system with square voids resembling a waffle.

weak story one in which the story's strength is less than 80 percent of that of the story above.

wedge fill shallow fill on a hillside.

wing wall a side wall projecting from a main wall.

yellow tag a placard describing a post-earthquake safety evaluation of a damaged building that is only safe for limited use.