Department of Conservation

CGS (/CGS/Pages/Index.aspx) > Regional Geologic Hazards and Mapping Program (/cgs/rghm/Pages/Index.aspx) > PSHA (/cgs/rghm/psha/Pages/Index.aspx)

Earthquake shaking hazards are calculated by projecting earthquake rates based on earthquake history and fault slip rates, the same data used for calculating earthquake probabilities. New fault parameters have been developed for these calculations and are included in the report of the Working Group on California Earthquake Probabilities (/cgs/rghm/psha/Pages/sr_228.aspx). Calculations of earthquake shaking hazard for California are part of a cooperative project between USGS and CGS, and are part of the National Seismic Hazard Maps. (http://earthquake.usgs.gov/research/hazmaps/) CGS Map Sheet 48 (revised 2008) shows potential seismic shaking based on National Seismic Hazard Map calculations plus amplification of seismic shaking due to the near surface soils.

- **Uniform California Earthquake Rupture Forecast, version 3 (UCERF3), CGS SR 228 (/cgs/rghm/psha/Pages/sr_228.aspx)**
- **Earthquake Shaking Potential for California (Map Sheet 48) (2008) (/cgs/information/publications/ms/Documents/MS48_revised.pdf)**
- **Uniform California Earthquake Rupture Forecast, version 2 (UCERF2), CGS SR 203 (/cgs/rghm/psha/Pages/sp_203.aspx)**
- **Updated! Probabilistic Seismic Hazards Ground Motion Interpolator (2008) (http://www.quake.ca.gov/gmaps/PSHA/psha_interpolator.html)**
- **Interactive Fault Parameters Map (/cgs/rghm/psha/fault_parameters/htm/Pages/index.aspx)** (2002)
- **Revised 2002 California Seismic Shaking Analysis** (/cgs/rghm/psha/fault_parameters/pdf/Documents/2002_CA_Hazard_Maps.pdf)
  Detailed description of changes since publication of OFR 96-08. Requires Acrobat Reader to view. Click here (http://www.adobe.com/products/acrobat/readstep.html) to download)
  Contents of Appendix A (not included in main text PDF above):
  - A Faults (/cgs/rghm/psha/fault_parameters/pdf/Documents/A_flt.pdf)
  - B Faults (/cgs/rghm/psha/fault_parameters/pdf/Documents/B_flt.pdf)
  - C Faults (/cgs/rghm/psha/fault_parameters/pdf/Documents/C_zones.pdf)
  - References (/cgs/rghm/psha/fault_parameters/pdf/Documents/references.pdf)
- Probablistic Seismic Hazard Assessment for the State of California-Open File Report 96-08 (/cgs/rghm/psha/ofr9608/Pages/index.aspx)

Probabilistic Seismic Hazard Map

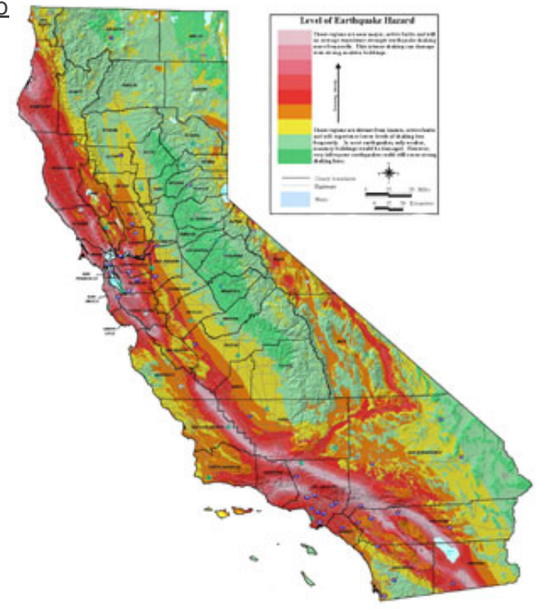
(/cgs/rghm/pshamap/Pages/pshamain.aspx)

A probabilistic seismic hazard map is a map that shows the hazard from earthquakes that geologists and seismologists agree could occur in California. It is probabilistic in the sense that the analysis takes into consideration the uncertainties in the size and location of earthquakes and the resulting ground motions that can affect a particular site.

The maps are typically expressed in terms of probability of exceeding a certain ground motion. For example, the 10% probability of exceedance in 50 years maps depict an annual probability of 1 in 475 of being exceeded each year. This level of ground shaking has been used for designing buildings in high seismic areas. The maps for 10% probability of exceedance in 50 years show ground motions that we do not think will be exceeded in the next 50 years. In fact, there is a 90% chance that these ground motions will NOT be exceeded. This probability level allows engineers to design buildings for larger ground motions than what we think will occur during a 50-year interval, which will make buildings safer than if they were only designed for the ground motions that we expect to occur in the next 50 years.

View/Download a copy of Earthquake Shaking Potential map shown at right:
PDF version (/cgs/rghm/psha/Documents/shaking_18x23.pdf) JPEG version (/cgs/PublishingImages/shaking_18x23[1].jpg)View/Download a copy of Regional Earthquake Shaking Potential maps similar to above: (pdf files)
North Coast (http://www.seismic.ca.gov/pub/intensitymaps/ncoast_county_print.pdf) San Francisco Area (http://www.seismic.ca.gov/pub/intensitymaps/sfbay_county_print.pdf) Central Coast

(http://www.seismic.ca.gov/pub/intensitymaps/ccoast_county_print.pdf) Los Angeles Area (http://www.seismic.ca.gov/pub/intensitymaps/la_county_print.pdf) San Diego Area (http://www.seismic.ca.gov/pub/intensitymaps/sd_county_print.pdf)

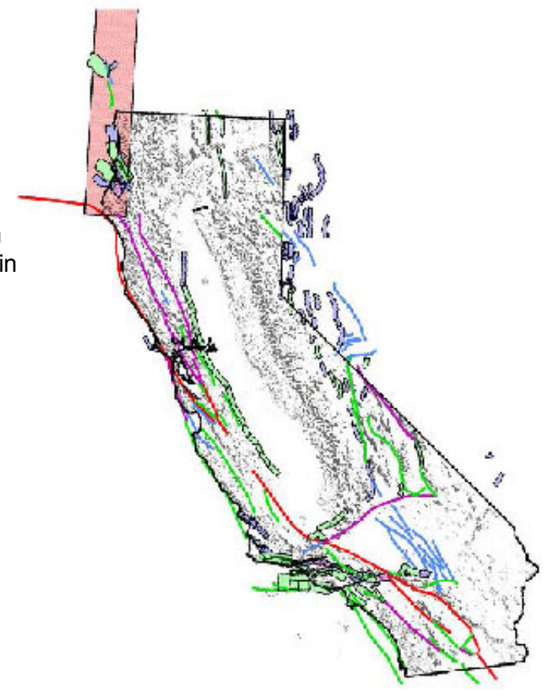


Seismic sources

(/cgs/rghm/psha/fault_parameters/htm/Pages/index.aspx)

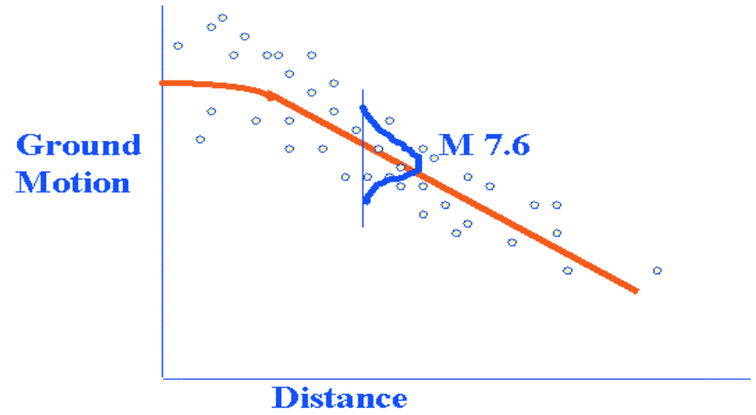
The probabilistic seismic hazard models consider earthquakes on faults and in background sources (random earthquakes). The activity rates for earthquakes along the faults are related to the slip rate (how fast one side of the fault slides past the other side). The activity rates and other fault parameters are shown in Table 1. In the seismic source model, the faster the fault slips the more likely the fault is to generate earthquakes. The length or area of the fault rupture is used to determine an expected magnitude for the fault. This is an important factor since larger earthquakes occur much less frequently and tend to use up more stored energy (moment) than smaller earthquakes. The fault points used for the development of the seismic source model can be downloaded through a license agreement.

The earthquake catalog for magnitudes greater than 4 are used to describe where the future large earthquakes may occur. We recognize that we have not included all faults in this analysis that could generate an earthquake. Therefore, we use a random background earthquake component that accounts for these sources that have not been included in the model. The catalog of earthquakes that we used can be downloaded through a license agreement.



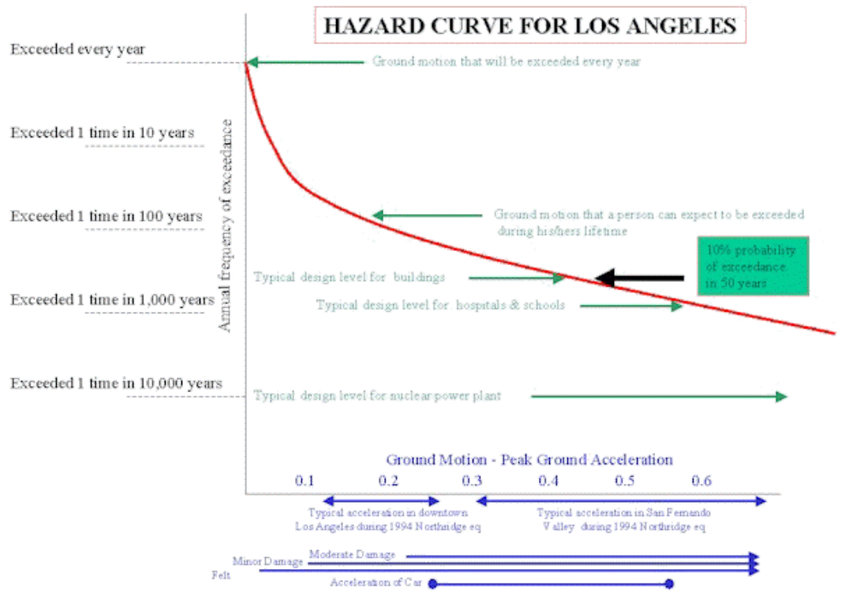
Ground motions

The ground motion is determined from attenuation relations that relate the magnitude and distance from the site to the rupture. Typically ground motions tend to attenuate (or become smaller) as the waves travel away from the source. There are exceptions to this rule. For example, a wave may be amplified by soft sediments or by a deep basin. Historical earthquake records of ground shaking have been used to generate mathematical attenuation relations that describe how the ground motions attenuate with distance and for different sizes of earthquakes and different styles of faulting. Several different attenuation relations are used to generate the ground motions in the seismic hazard analysis. For our analysis we have used attenuation relations by Boore et al. (1997), Sadigh et al. (1997), Abrahamson and Silva (1997), Campbell and Bozorgnia (2003), and Spudich et al. (1999). All of these attenuation relations may be found in Seismological Research Letters, Volume 68, Number 1, January/February, 1997.



Hazard Curve

Hazard curves show the probability of exceeding different ground motion values at a site. For example, the 10% probability of exceedance in 50 years is one point on a hazard curve. The hazard curves are important for comparing the hazard at different sites. Some sites may have a high probability of exceeding small ground motions, but a very small probability of exceeding large ground motions. These curves are important for understanding the types of ground motions that one can expect to exceed at a site. Also the hazard curve is important for determining the expected losses. Losses can be caused by freqent smaller events or from less freqent large events. An example of a Hazard Curve is shown below.



California Geological Survey

Quick Hits

Recent California Earthquakes (http://earthquake.usgs.gov/earthquakes/map)

CGS Information Warehouse (http://www.quake.ca.gov/gmaps/WH/index.htm)

CGS Publications Database (/cgs/publications/Pages/SearchCGSPubs.aspx)

CGS Library Catalog (/CGS/library/Pages/Library_catalog.aspx)

CGS Digital Archive (http://cgsdigitalarchive.conservation.ca.gov/)

Gold! (/cgs/geologic_resources/gold/Pages/Index.aspx)

Contact Us (/cgs/Pages/contactUs.aspx)

- PSHA Ground Motion Interpolator (2008) (http://www.quake.ca.gov/gmaps/PSHA/psha_interpolator.html)
- Earthquakes (Recent & Historic) (/cgs/rghm/quakes/Pages/index.aspx)
- Probabilistic Seismic Hazard Assessment for the State of California (OFR 96-08) (/cgs/rghm/psha/ofr9608/Pages/index.aspx)

- Loss Estimation (/cgs/rghm/loss/Pages/index.aspx)
- Seismic Shaking Hazard Maps of California (/cgs/rghm/psha/Pages/pga.aspx)

Related Documents and Links