

# California Geological Survey

## **Working Group on California Earthquake Probabilities**

In 2007 the California Geological Survey (CGS) participated in the Working Group on California Earthquake Probabilities (WGCEP). This is the latest in a series of Working Groups (WGCEP 1988, 1990, 1995, and 2003) that were established to evaluate the probability of future large earthquakes in California. The current WGCEP is a joint committee composed of staff from the USGS, the Southern California Earthquake Center, and CGS, with funding support from these agencies and the California Earthquake Authority. CGS geologists and seismologists contributed to the collection of information on faults and historic seismicity, and to the development of models in which that information is used to calculate seismic hazards. WGCEP 2007 prepares the statewide forecast by adopting previous Working Group results where possible, and updates past results only when compelled to by new data, or by necessity to conform the analysis to a uniform statewide approach and with the National Seismic Hazard Map Program (NSHMP) assessment.

The WGCEP 2007 report differs from past WGCEP efforts by:

- reporting earthquake probability for the entire state of California instead of regions;
- using uniform methodology across all regions;
- using the same earthquake rate model as the NSHMP;
- compiling and using updated, uniform, and publicly accessible statewide data;
- developing new methods to make models more rigorously adherent to observational data, particularly fault slip rates (moment balanced);
- making analysis tools and data available through a public, web-based interface.

Seismic hazard models developed by the WGCEP were incorporated into the National Seismic Hazard Maps, and delivered to the Building Seismic Safety Council and the California Earthquake Authority (CEA) in October 2007. These models are the primary seismic hazard background for incorporation into future building codes, through the BSSC, and for calculating earthquake insurance rates through CEA. Reports of the WGCEP, including new estimates of the probability of significant earthquakes on California's faults will be completed in early 2008.

## **Southern California Earthquake Planning Scenario**

CGS is participating in the Multi-Hazard Demonstration Project (MHDP), an "earthquake planning scenario" for a 7.8 magnitude event on the south-central segment of the San Andreas Fault. CGS has analyzed earthquake ground failure hazards in select focus areas where numerous utility and transportation lifelines either cross or are near the area of the scenario fault rupture. The scenario earthquake ruptures the San Andreas fault from Lake Hughes in the Transverse Range to Bombay Beach at the north end of the Salton Sea. CGS has concentrated specifically on earthquake triggered displacements of identified existing or potential landslides within two focus areas: 1) Cajon Canyon Focus Area in the eastern Transverse Ranges; and, 2) San Geronio Pass Focus Area near Palm Springs. The stability analyses performed involved: 1) evaluating and selecting landslides and slopes within the focus areas that are most likely to impact roadway, railway, and utility lifelines; 2) creating topographic profiles across selected slopes; 3) inferring subsurface geologic and hydrologic conditions from stereo aerial photograph geomorphic analyses and field reconnaissance, and preparing geologic cross-sections along topographic profiles; 4) performing static slope stability analyses to refine subsurface geologic interpretations and material strength characteristics; 5) performing pseudo-static slope stability analyses to determine yield acceleration for each slope; and 6) estimating ranges of seismically induced slope displacements.

The analyses show that, in the Cajon Pass area, several lifelines, including high-voltage powerlines, railroads, natural gas lines and fiber-optic conduits will be impacted by earthquake-induced landslides. In addition, large road-cut slopes could be the source for rockfall hazards for Interstate 15. Large fill prisms constructed for I-15 will have seismic compression/settlement and possibly have lateral failures during the scenario event. Along Interstate 5 north of Santa Clarita there will be rockfalls at various cut-slopes, but the scenario ground motions are not large enough to trigger significant movement at existing landslides near Pyramid Lake. In the San Geronio Pass area, Interstate 10 and high-voltage power lines will be impacted by landslide movement. The landslide displacement estimates will be combined with the modeled shaking and surface fault displacement to estimate lifeline damage from the earthquake and time-to-repair.

### **Other Activities**

During the past year, CGS reviewed 340 geologic/seismic hazard reports for new school construction and 43 for new hospital construction or retrofit of existing hospitals for compliance with the California Building Code.

On October 30, 2007, the California Earthquake Prediction and Evaluation Council (CEPEC) met and advised the Governor's Office of Emergency Services that the M5.4 Alum Rock earthquake had significantly increased the likelihood of a damaging earthquake along the Hayward fault and/or the Calaveras fault. With the passage of time, the likelihood that the Alum Rock earthquake was a foreshock of a larger event had naturally decreased. However, recent earthquake history in California suggested to CEPEC that the possibility of further activity remained. The 1992 Landers earthquake was preceded by the Joshua Tree earthquake, 2 months earlier. And the 1989 Loma Prieta earthquake was preceded by the Lake Elsinore earthquakes, 2 and 16 months earlier. Therefore, CEPEC advised OES that the likelihood of damaging earthquake activity along the Hayward or Calaveras fault will continue to be elevated, albeit at a lower level, over the next year or so. CEPEC did not recommend any specific action at that time except the awareness that potential for further activity exists and that the citizens of California should maintain a prudent level of earthquake preparedness.

*Submitted by John G. Parrish, Director and State Geologist, California Geological Survey*