Earthquake Shaking Potential for California

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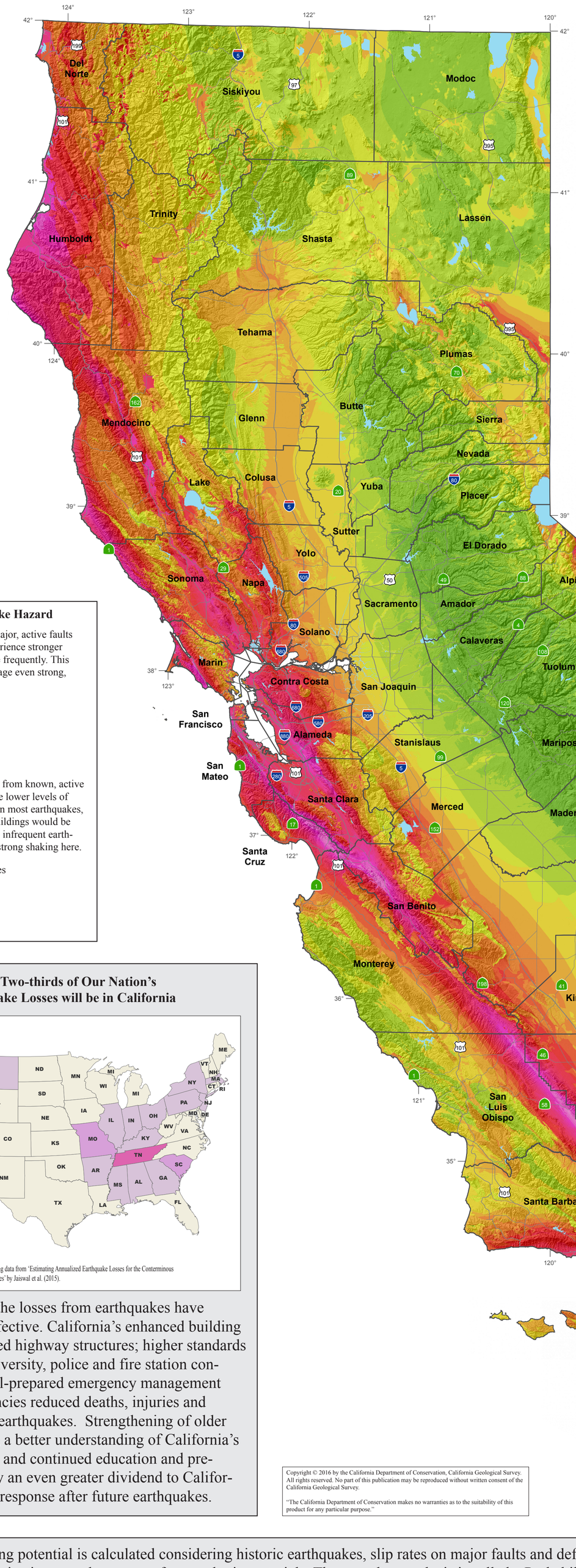
D. Branum[1], R. Chen[1], M. Petersen[2] and C. Wills[1]

[1]California Geological Survey, [2]United States Geological Survey

This map shows the relative intensity of ground shaking in California from anticipated future earthquakes. The shaking potential is calculated as the level of ground motion that has a 2% chance of being exceeded in 50 years, which is the same as the level of ground-shaking with about a 2500-year average repeat time. Relatively long-period (1.0 second) earthquake shaking is shown here. Long-period shaking affects tall, relatively flexible buildings, but also correlates well with overall earthquake damage. Although the greatest hazard is in areas of highest intensity as shown on the map, no region is immune from potential earthquake damage. Expected long-term average earthquake damage in California exceeds $3 billion per year.

Important messages about earthquakes for Californians to remember:

- **Earthquakes have produced over $55 billion in losses in California since 1971. The next large earthquake may produce even greater losses, especially if it affects a major urban area. California's two largest urban centers – the San Francisco Bay Area and the Los Angeles metropolitan area – lie in the State's highest hazard zones.**
- **A large earthquake in or near a major urban center in California will disrupt the economy of the entire state and much of the nation. Effective disaster planning by State and local agencies, and by private businesses, can dramatically reduce losses and speed recovery.**
- **Current building codes substantially reduce the costs of damage from earthquakes, but the codes are intended only to prevent widespread loss of life by keeping the buildings from collapsing, not to protect the building from damage.**
- **If the Northridge or Loma Prieta earthquakes had occurred closer to a major population center, fatalities would have been much higher. Earthquakes in Japan in 1995 (over 5,000 deaths), Turkey in 1999 (over 20,000 deaths), and China in 2008 (over 70,000 deaths) produced catastrophic death tolls.**
- **After a large earthquake, residents and businesses may be isolated from basic police, fire, and emergency support for a period ranging from several hours to a few days. Citizens must be prepared to survive safely on their own, and to aid others, until outside help arrives.**
- **Maps of the shaking intensity after the next major earthquake will be available within minutes on the internet. The maps will guide emergency crews to the most damaged regions and will help the public identify the areas most seriously affected.**



Level of Earthquake Hazard

These regions are near major, active faults and will on average experience stronger earthquake shaking more frequently. This intense shaking can damage even strong, modern buildings.

Increasing intensity

These regions are distant from known, active faults and will experience lower levels of shaking less frequently. In most earthquakes, only weaker, masonry buildings would be damaged. However, very infrequent earthquakes could still cause strong shaking here.

County Boundaries

Highways

Water

N
W E
S

0 25 50 75 100 Kilometers

0 25 50 75 100 Miles

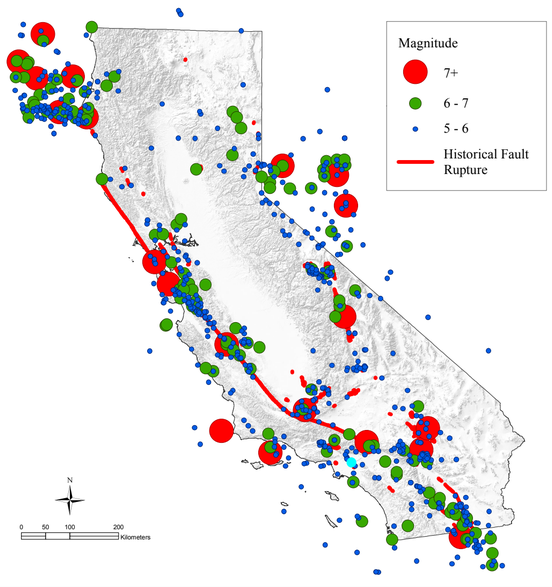
Over Two-thirds of Our Nation's Earthquake Losses will be in California

Plotted using data from 'Estimating Annualized Earthquake Losses for the Conterminous United States' by Jaiswal et al. (2015).

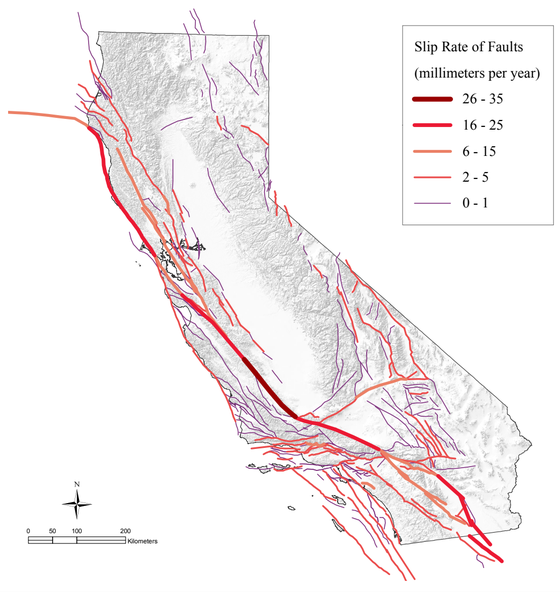
Efforts to reduce the losses from earthquakes have already proved effective. California's enhanced building codes; strengthened highway structures; higher standards for school and university, police and fire station construction; and well-prepared emergency management and response agencies reduced deaths, injuries and damage in recent earthquakes. Strengthening of older buildings, gaining a better understanding of California's earthquake threat, and continued education and preparedness will pay an even greater dividend to Californians in speeding response after future earthquakes.

Earthquake shaking potential is calculated considering historic earthquakes, slip rates on major faults and deformation throughout the region, and the potential for amplification of seismic waves by near-surface geologic materials. The complete analysis is called a Probabilistic Seismic Hazard Analysis. The resulting earthquake shaking potential is used in developing building code design values, estimating future earthquake losses and prioritizing earthquake retrofit.

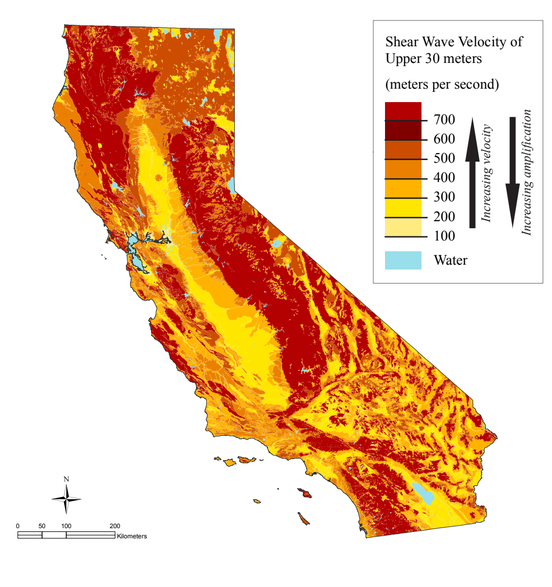
Historic earthquakes since 1769: The rate of historic earthquakes is used to estimate the rate of future earthquakes and to check the rate of future earthquakes calculated from other data.



Slip rates of major faults: The rate of earthquakes on faults is governed by the size of the fault and the rate that one side moves relative to the other. Larger faults can produce larger earthquakes, and faults with higher slip rates can generate more frequent earthquakes.



Surface geologic materials: Seismic waves may be amplified by near-surface materials. Soft soils – those with low shear wave velocity – amplify shaking compared with hard rock. A geologic map of California showing units with different shear wave velocity can be used to estimate seismic amplification.



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Graphics by J.E. Bird

California Professional Licenses:

D. Branum - Geologist No. 7821
R. Chen - Geologist No. 8598
M. Petersen - Geologist No. 6754, Engineering Geologist No. 2129
C. Wills - Geologist No. 4379, Engineering Geologist No. 1423

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