



EARTHQUAKES

Congressional Hazards Caucus Alliance Factsheet

Earthquakes are one of the costliest natural hazards facing the United States. Major earthquakes occur infrequently but can be devastating, especially when they occur in densely populated areas. Over the last hundred years, earthquake damages in the United States totaled more than \$50 billion, with just one earthquake (Northridge, CA, 1994) accounting for nearly \$40 billion of that total.¹ Earthquake monitoring and the study of earthquake ground motions are fundamental to the informed engineering of resilient buildings and lifelines.

CAUSES AND RISKS

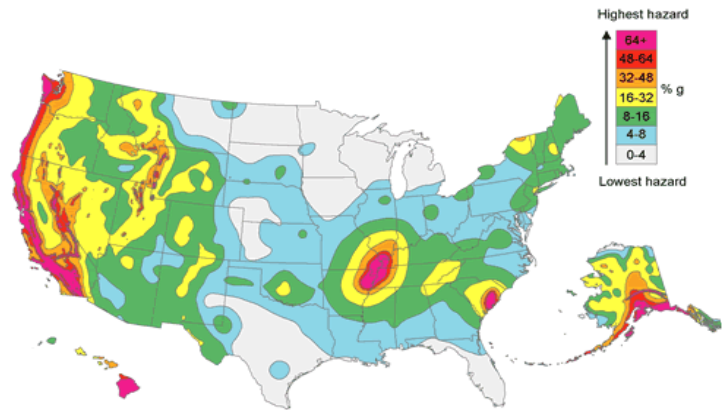
Earthquakes are caused by the sudden release of built-up stress along faults and cannot currently be predicted. Large earthquakes tend to occur most frequently along tectonic plate boundaries such as on the West Coast but also occur along less active faults in the Central and Eastern parts of the United States. Given their abrupt onset, prevention of structural damage is central to mitigating casualties and economic losses.

FEDERAL ACCOMPLISHMENTS

MONITORING & DETECTION

U.S. Geological Survey (USGS) and partner institutions provide timely monitoring of earthquakes through the Advanced National Seismic System (ANSS) and the Global Seismic Network (GSN; www.iris.edu/hq/programs/gsn). The development of these networks has dramatically improved delivery of information on earthquakes and their impacts to emergency managers and the public through products such as ShakeMap, which provides near-real-time maps of shaking intensity. These maps are fed into the Prompt Assessment of Global Earthquakes for Response (PAGER) system, which rapidly estimates fatalities and economic losses.

[1] National Geophysical Data Center / World Data Service (NGDC/WDS) Significant Earthquake Database, Boulder, CO, USA. (Available at <http://www.ngdc.noaa.gov/nndc/struts/form?t=101650&s=1&d=1>)



Above: This National Seismic Hazard Map (2008) shows the strongest shaking that has a 2% probability of occurring over 50 years.

Credit: USGS (<http://earthquake.usgs.gov/hazards/products>)

RESEARCH

Over the past 27 years, federally funded research at public and private institutions has provided insight into what causes earthquakes, determined how much risk may be posed by different historically and prehistorically active faults, and assessed how different structures respond to shaking. These insights have been critical for the development of monitoring/forecast tools as well as seismic resistant design of buildings and other infrastructure.

EARTHQUAKE RISK REDUCTION

Key accomplishments include:

- **Seismic building code** implementation, with training for design, construction, and planning professionals
- **Regional earthquake hazard consortia** throughout the country (www.fema.gov/earthquake-contacts/regional-earthquake-consortia)
- **Public preparedness education and outreach**, including:
 - Putting Down Roots in Earthquake Country preparedness handbooks (www.earthquakecountry.org/roots)
 - National Earthquake Technical Assistance Program (www.fema.gov/earthquake-training)



NEHRP

The National Earthquake Hazard Reduction Program (NEHRP), established in 1977, has supported a successful partnership between four agencies:

- National Science Foundation (NSF)
- National Institute of Standards and Technology (NIST) - Lead agency
- U.S. Geological Survey (USGS)
- Federal Emergency Management Agency (FEMA)

		NEHRP Activities		
		Research	Development	Implementation
NEHRP Agencies	NSF			
	NIST			
	USGS			
	FEMA			

National Earthquake Hazards Reduction Program

Credit: FEMA (<http://www.fema.gov/national-earthquake-hazards-reduction-program>)

ADDITIONAL RESOURCES

Congressional Research Service Report: "Earthquakes: Risk, Detection, Warning, and Research"

www.fas.org/sgp/crs/misc/RL33861.pdf

Network for Earthquake Engineering Simulation

www.nees.org

USGS Earthquake Hazards Program

earthquake.usgs.gov/hazards

Advanced National Seismic System

earthquake.usgs.gov/monitoring/anss

FEMA Earthquake Preparedness and Mitigation

www.fema.gov/earthquake

National Earthquake Hazards Reduction Program

www.nehrp.gov

www.nist.gov/el/nehrrp

CURRENT/FUTURE NEEDS

The accomplishments of the past 27 years since NEHRP began have made Americans significantly safer from earthquake hazards, but additional work is needed to make the U.S. resilient to future major earthquakes:

Expanded Research and Development

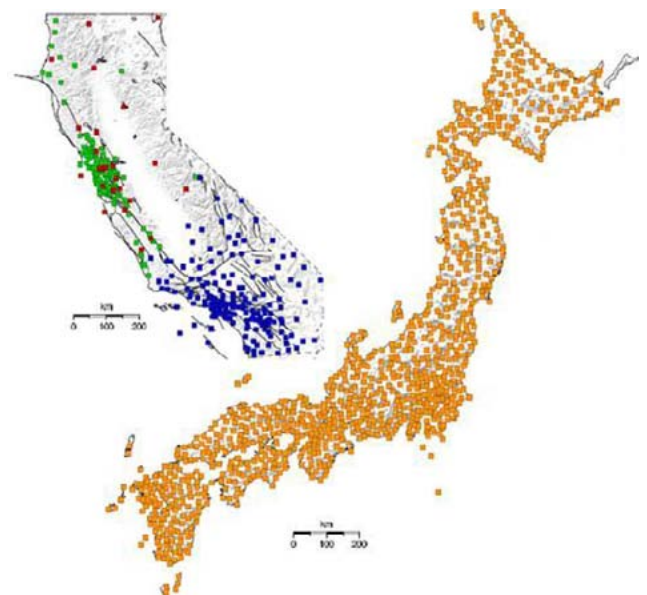
Greater understanding of the physical mechanisms and effects of earthquakes is still needed to improve long-term forecasts, as well as to advance earthquake resilient building techniques.

Earthquake Risk Reduction

Additional funding is required for expanded implementation of seismic provisions in building codes and for fostering greater awareness and preparedness for decision-makers and the general public.

Advanced National Seismic System (ANSS)

While the development of ANSS has allowed for promising innovations such as ShakeMap, PAGER, and other information tools for rapid situational awareness, the system is still only one-third complete. Denser seismic networks are needed to implement a robust earthquake early warning system, like the ones that currently operate in Japan and other countries around the world.



Above: The density of ANSS sensors in California compared to sensor density in Japan, where earthquake early warning has already been established. Note that both maps are at the same scale.

Credit: USGS (<http://earthquake.usgs.gov/research/earlywarning/nextsteps.php>)

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