

National Earthquake Hazards Reduction Program

... a research and implementation partnership

Recent Program Developments

Opening Plenary Session

8 October 2010



FEMA

NIST

National Institute of
Standards and Technology

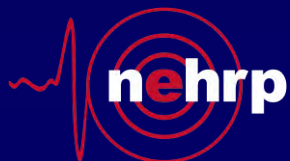
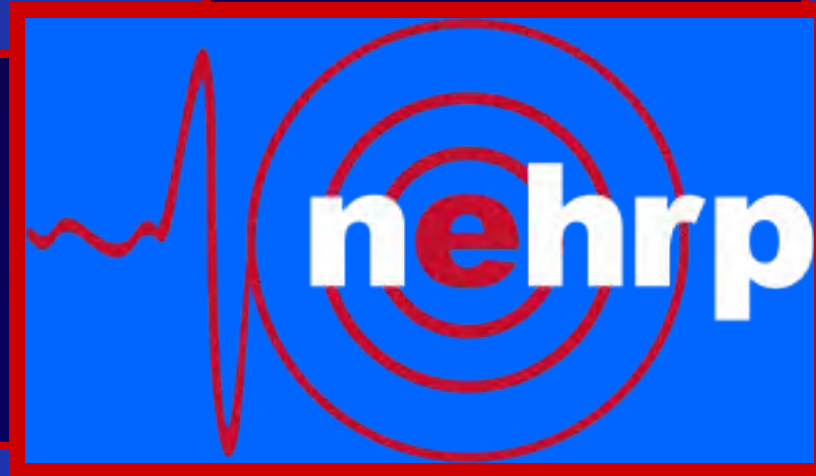


USGS
science for a changing world

national **earthquake** hazards reduction program

National Earthquake Hazards Reduction Program

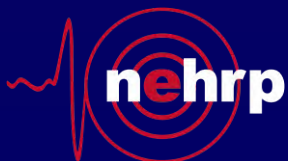
A Statutory Multi-Agency Partnership

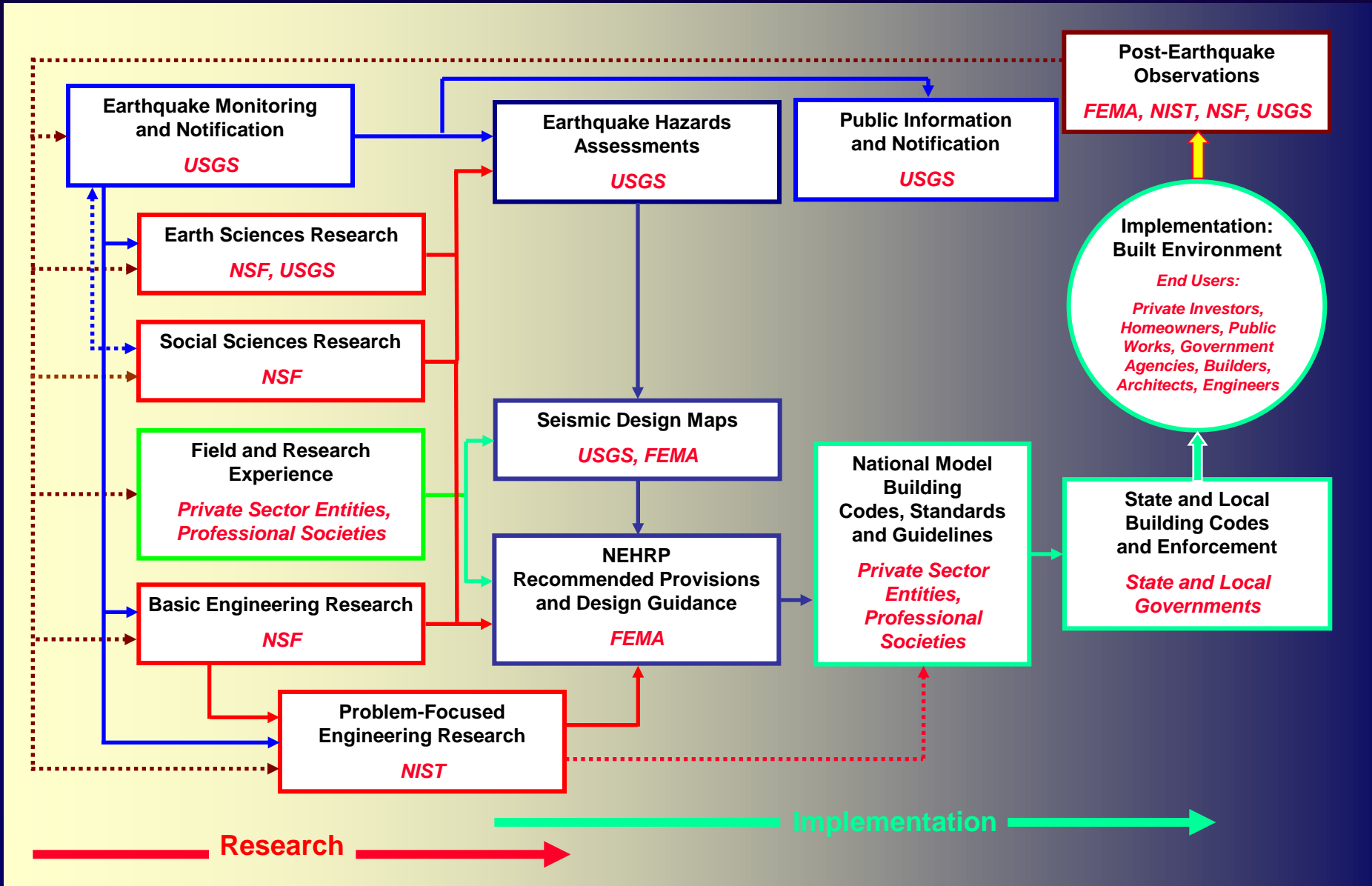


national **earthquake** hazards reduction program

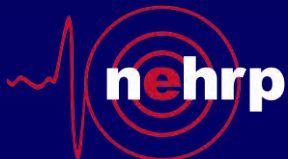
Legislative Overview

- Overall purpose: “...to reduce the risks of life and property from future earthquakes in the United States...”
- NEHRP first authorized by U.S. Congress in 1978.
- NEHRP typically reauthorized on 2 – 5 year cycles.
- Last reauthorization: PL 108-360 (2004).
- New reauthorization now in process: HR 3820 passed in March 2010 and referred to Senate.
- Agencies continue Program activities.
- Program not authorized to establish or enforce codes and regulations, or to conduct post-earthquake response and recovery operations.





NEHRP Impact on the Built Environment



national earthquake hazards reduction program

2005-2011 NEHRP Agency Budgets

Enacted Agency NEHRP Budgets (\$M)

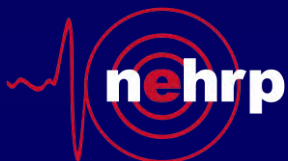
FY	FEMA	NIST	NSF	USGS	NEHRP Total
2005	14.7	0.9	53.1	58.4	127.1
2006	9.5	0.9	53.8	54.5	118.7
2007	7.2	1.7	54.2	55.4	118.5
2008	6.1	1.7	53.6	58.1	119.5
2009	9.1	4.1	55.0	61.2	129.4
2010	9.0	4.1	55.3	62.8	131.2

Requested Agency NEHRP Budgets (\$M)

FY	FEMA	NIST	NSF	USGS	NEHRP Total
2011	9.0	4.1	53.8	62.3	129.2

Notes:

1. ARRA funds are not included.
2. Agencies currently operating under a Continuing Resolution through 12/3/10.
3. Agencies currently preparing FY 2012 budgets for inclusion in Administration's 2012 Budget Request.



NSF: NEHRP's Primary Basic Research Arm

- **Directorate for Geosciences (GEO)**
 - Incorporated Research Institutions for Seismology (IRIS)
 - Southern California Earthquake Center (SCEC)
 - Fundamental Research on Earthquakes (Unsolicited Proposals)
 - EarthScope Facility (Related non-NEHRP activity)
- **Directorate for Engineering (ENG)**
 - George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES) Facility - Operations and Research
 - Unsolicited Proposal Research Programs
 - ✓ Hazard Mitigation and Structural Engineering
 - ✓ Geotechnical Engineering
 - ✓ Infrastructure Management and Extreme Events
 - ✓ Natural Hazards Center
- **Post-earthquake reconnaissance (GEO and ENG)**



NEES for the Engineering Community



NIST: ATC “Roadmap” Philosophy

Combined in-house and extramural program has six primary focus areas, consistent with “Roadmap:”

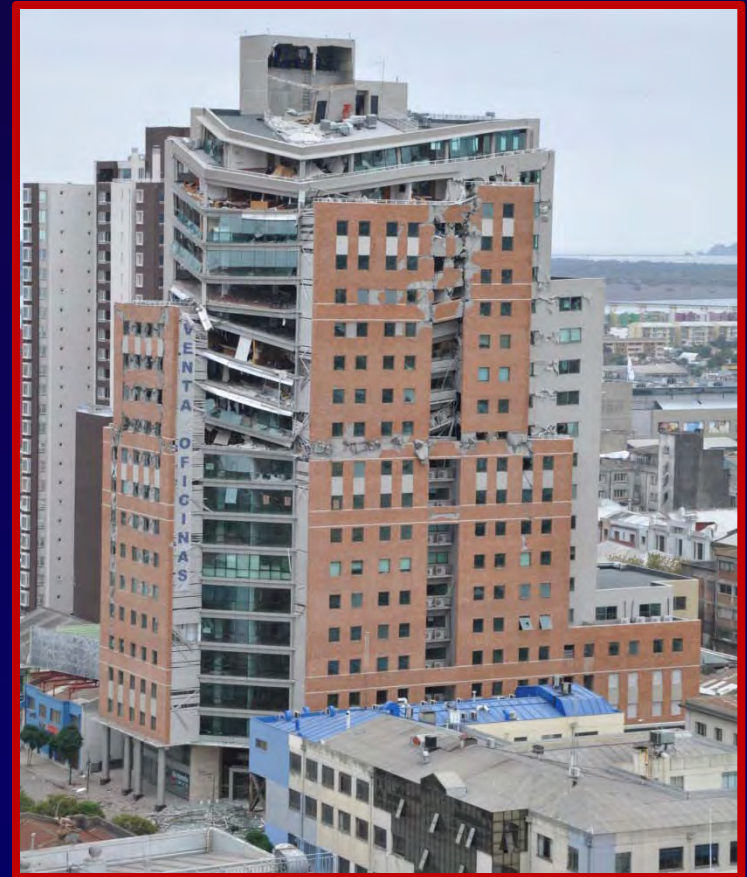
- Technical support for building code development
- Performance-based seismic design development
- National design guidelines development
- Evaluated technology dissemination
- Development of improved evaluation and strengthening for existing buildings (potential increased future focus)
- Enhanced design productivity and interoperability development (future focus)



NIST goal: ~ 50/50 in-house/extramural split

Current NIST Research Emphases

- In-House
 - Performance-Based Design Methodologies
 - Improved Prescriptive Provisions for Building Codes.
 - Nonlinear Seismic Analysis of Structures
 - Performance of Buildings in Central/Eastern U.S.

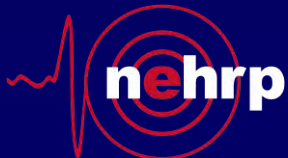


Current NIST Research Emphases

- Extramural (NEHRP Consultants Joint Venture)
 - Techbriefs (Composite Diaphragms, Special Shear Walls)
 - Procedures for Selecting/Scaling Ground Motions for NRHA
 - Improved Characterization/Modeling of Soil-Structure Interaction
 - Improved Structural Response Modification Factors
 - Chile Earthquake – Related Studies
 - Mid-America Cost-Benefit Studies



Interested researchers may apply at "Opportunities for Consultants," <http://www.nehrp-consultants.org> !



NIST Grant Activities

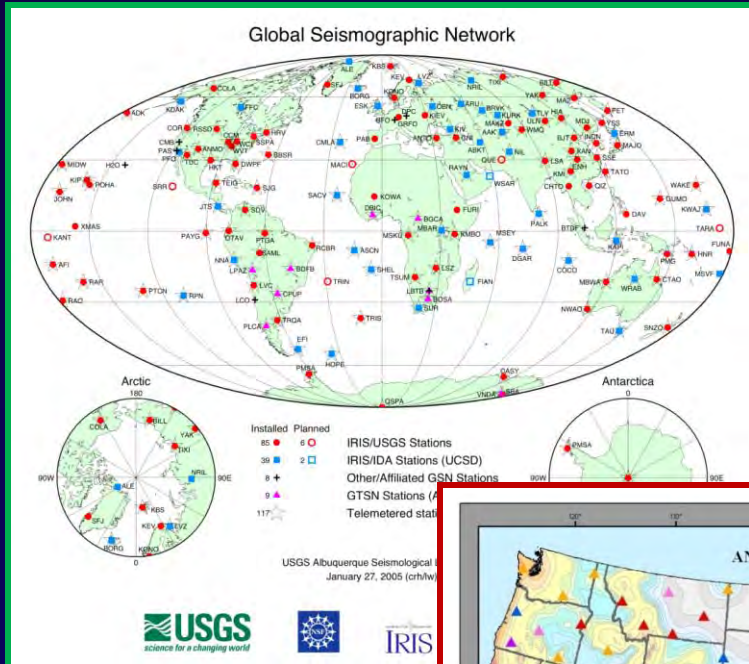
- **ARRA Research Grants**

- PBSD Methods and Tools for Reinforced Masonry Shear Wall Structures (UCSD)
- Development & Evaluation of PBEE-Compliant Structural Systems (VT)
- Modeling Natural Disaster Risk Management (U DE)



- **Construction Grant:** Expansion of the Center for Civil Engineering Earthquake Research Facilities at UNR

USGS: Earthquake Monitoring & Notification



National Earthquake Information Center



Earthquake Shaking

M 7.0, SOUTH ISLAND OF NEW ZEALAND

Origin Time: Fri 2010-09-03 16:35:46 UTC (04:35:46 local)
 Location: 43.53°S 172.12°E Depth: 5 km

Red Alert

PAGER
Version 8

Created: 4 days, 21 hours after earthquake

ANSSI

Estimated Fatalities

Green alert level for shaking-related fatalities. There is a low likelihood of casualties.

Estimated Economic Losses

Red alert level for economic losses. Extensive damage is probable and the disaster is likely widespread. Estimated economic losses are 0-4% GDP of New Zealand. Past events with this alert level have required a national or international level response.

Estimated Population Exposed to Earthquake Shaking

ESTIMATED POPULATION EXPOSURE (k = x1000)	..*	2k*	129k*	86k	139k	298k	20k	2k	0
ESTIMATED MODIFIED MERCALLI INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	V. Light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy
	Resistant Structures	Vulnerable Structures	none	none	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy

*Estimated exposure only includes population within the map area.

Population Exposure

Structures:
 Overall, the population in this region resides in structures that are highly resistant to earthquake shaking, though some vulnerable structures exist. The predominant vulnerable building types are light wood frame and concrete/cinder block masonry construction.

Historical Earthquakes (with MMI levels):

Date	Dist. (km)	Mag.	Max Shaking (MMI)	Deaths
1994-06-19	68	5.9	VIII(12)	0
1984-06-24	146	6.1	VIII(18)	0
1990-02-10	118	6.0	VIII(81)	0

Selected City Exposure

MMI City	Population
VIII Rolleston	3K
VIII Burnham	1K
VII Darfield	2K
VII Woodend	3K
VI Leeston	1K
VI Christchurch	364K
V Timaru	28K
IV Oamaru	13K
IV Greymouth	9K
III Blenheim	27K
III Wanaka	4K

bold cities appear on map (k = x1000)

Event ID: us2010atbj

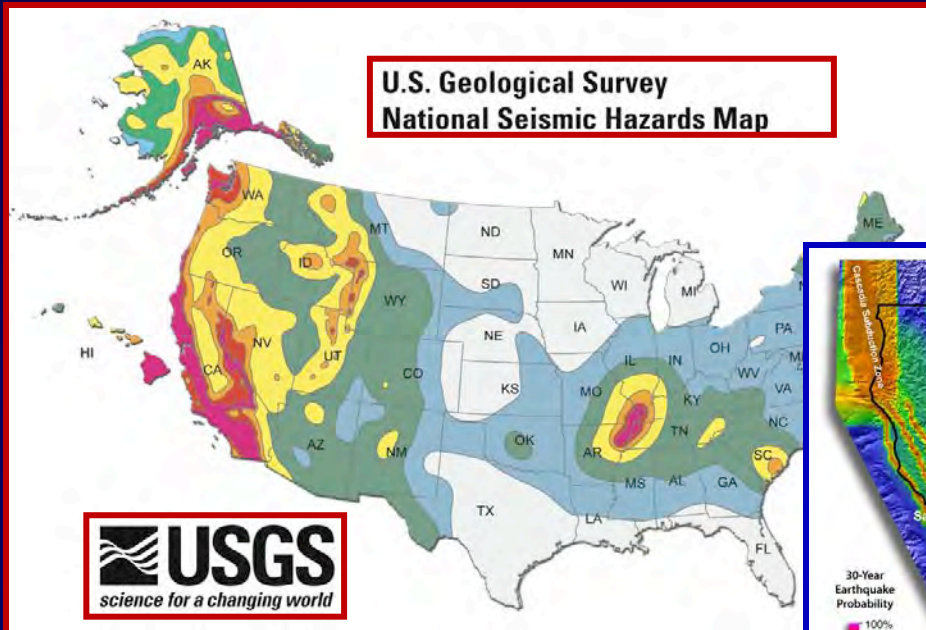
PAGER content is automatically generated, and does not consider secondary hazards in loss calculations. Limitations of input data, shaking estimates, and loss models may add uncertainty.
<http://earthquake.usgs.gov/pager>



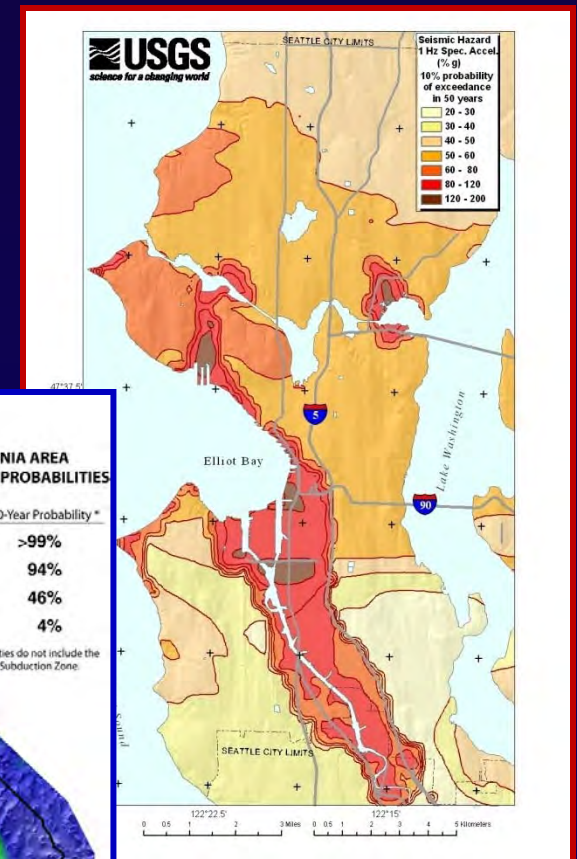
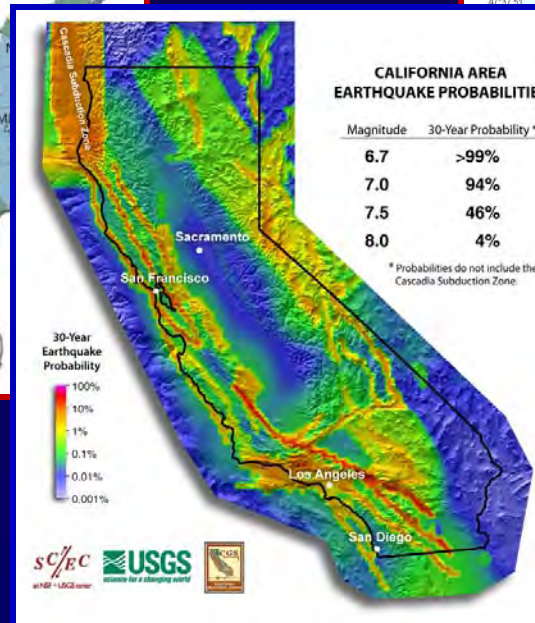
USGS seismic hazard assessments:

National, regional, urban

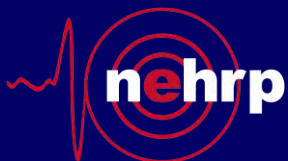
U.S. National Seismic Hazard Maps



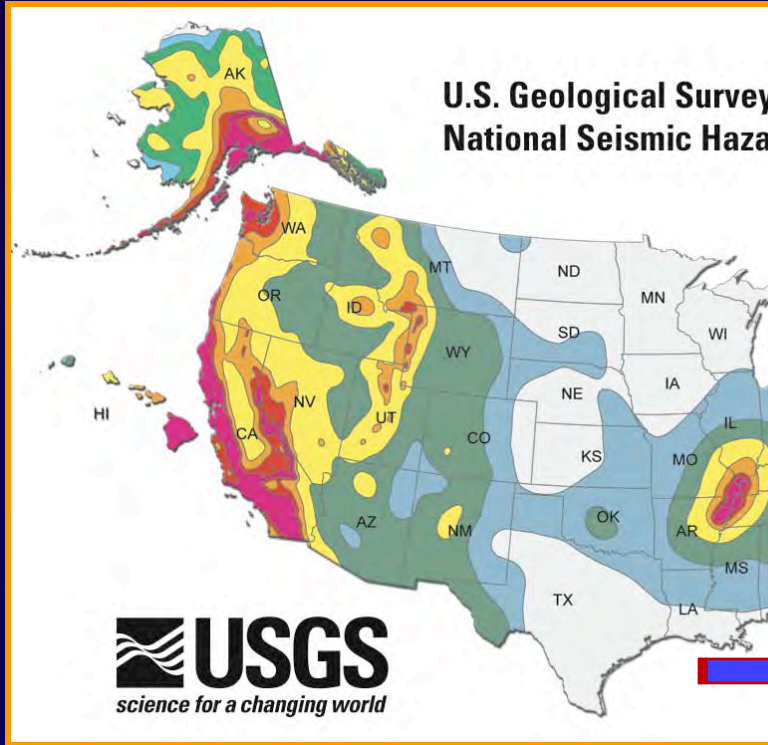
Uniform California Earthquake
Rupture Forecast



Seattle urban
hazard map



USGS & FEMA: Translating USGS national hazard maps into model building codes



BSSC Partnership



NEHRP Recommended Seismic Provisions

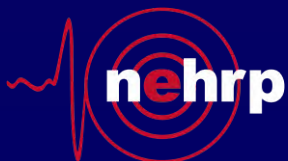
for New Buildings and Other Structures

FEMA P-750 / 2009 Edition



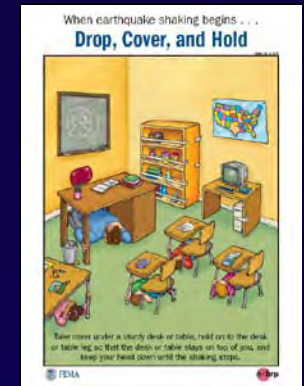
ASCE Partnership

Recommended Provisions, ASCE 7, and International Building Code based on the USGS national seismic hazard map

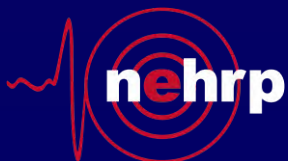


national earthquake hazards reduction program

FEMA's NEHRP Activities



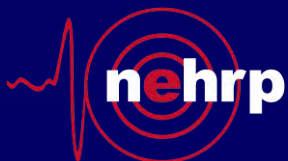
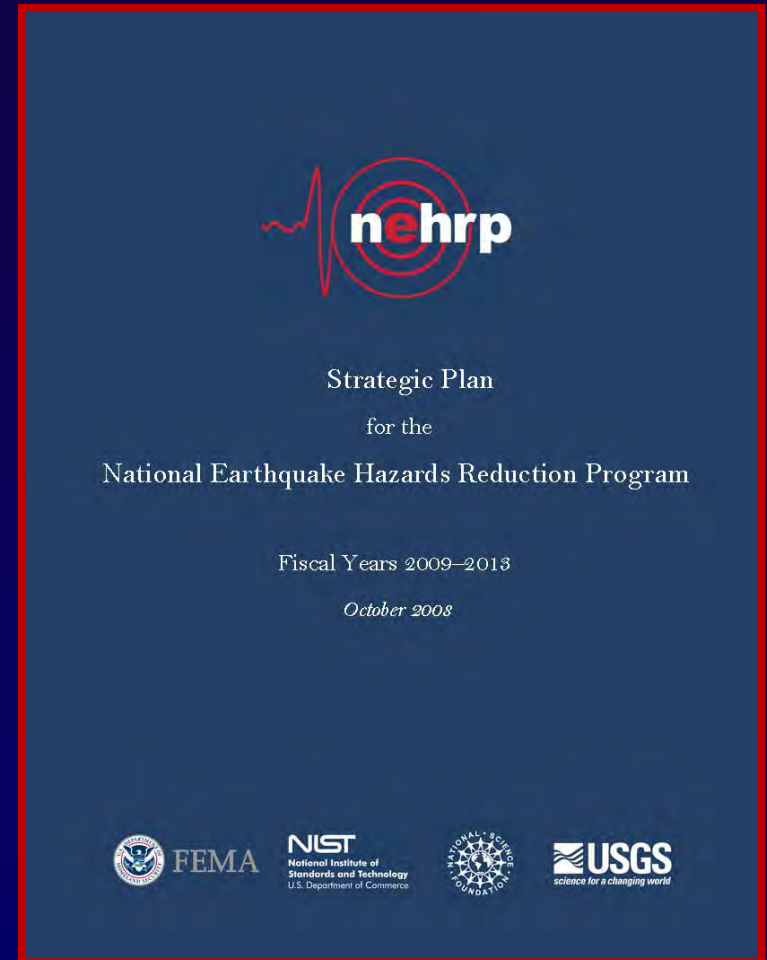
- State and Local Coordination (NETAP, EMPG, State Assistance)
- Partnerships (consortia, EERI)



NEHRP Strategic Plan

A national vision for the future:

A nation that is earthquake-resilient in public safety, economic strength, and national security.



National Research Council Study

2003 EERI Report

- Developed 20-yr research & outreach plan for earthquake engineering, with broad discussion of national needs, listing of broad task/activity areas, & rough estimation of costs for tasks/activities

Post-2003

- Advances have occurred
- Pace of change may not have matched that envisioned in EERI report
- Costs have changed
- New NEHRP Strategic Plan is seen by earthquake professionals as addressing broad national needs

Study Purpose:

- Provide an independent technical roadmap to implement strategic goals, objectives, outcomes, and priorities identified in the NEHRP Strategic Plan, to be used by the NEHRP agencies as an informational reference document in program planning

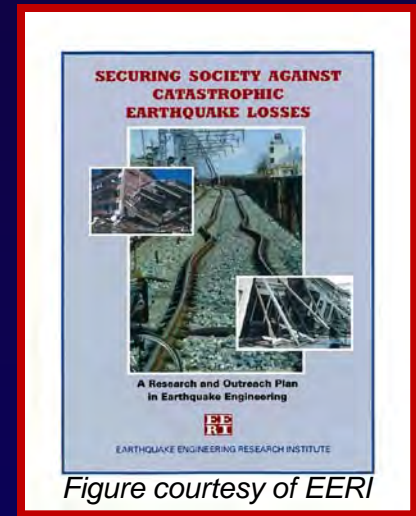


Figure courtesy of EERI



Once Again Pushing the Envelope

The 2009 NEHRP Recommended Seismic Provisions for New Buildings and Other Structures

Since it was first published in 1985, the *NEHRP Recommended Seismic Provisions for New Buildings and Other Structures* (the *Provisions*) has always sought to push the envelope of earthquake safety by advancing the effectiveness and acceptance of seismic design standards. Early on, the envelope was empty and easily pushed, because seismic design provisions were largely absent from industry standards and from the model building codes adopted by states and localities.

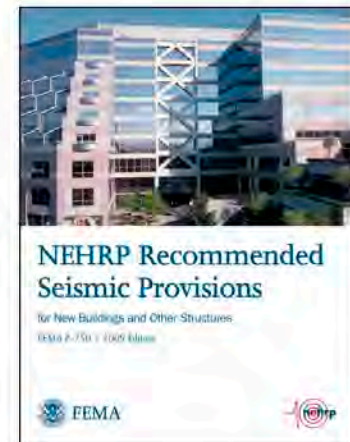
Successive editions of the *Provisions*, published by the Federal Emergency Management Agency (FEMA), began to fill the envelope with code-ready design requirements. The envelope swelled further as industry groups such as the American Concrete Institute and the American Institute of Steel Construction incorporated seismic measures into their national design standards. By the early 2000s, the envelope bulged with the addition of the increasingly complete seismic requirements included in *Minimum Design Loads for Buildings and Other Structures* (ASCE/SEI 7), the preeminent U.S. structural design standard maintained by the American Society of Civil Engineers (ASCE).

FEMA found the envelope harder to push as *Provisions* updates became preoccupied with the congruence between the *Provisions* and ASCE/SEI 7. This led to a major change in the 2009 edition of the *Provisions* (FEMA P-750). By adopting the latest (2005) edition of ASCE/SEI 7 as the reference standard to be updated in the 2009 *Provisions*, instead of revising the previous (2003) edition of the *Provisions*, the developers of FEMA P-750 enabled the *Provisions* to again push the envelope and "resume its role as the resource for introducing new knowledge, innovative concepts, and design methods to improve national seismic standards and codes."¹

A Collaborative and Voluntary Tour De Force

In 2004, FEMA contracted with the Building Seismic Safety Council (BSSC) through the council's parent organization, the National Institute of Building Sciences, to develop the 2009 *Provisions*. A unique national resource established in 1979, the BSSC is a voluntary council of representatives from more than 60 organizations interest-

ed in the seismic safety of the built environment. BSSC members include organizations representing the building materials industries, trade and professional groups, code- and standards-developers, public agencies, researchers, and other interests.



By 2005, the BSSC had recruited more than 200 national experts to assist in updating the *Provisions*. These volunteers were organized into the 2009 Provisions Update Committee (PUC) and a dozen associated technical subcommittees and ad hoc issue teams. It was these volunteers, working with the BSSC's Board of Direction, member organizations, and staff, as well as with personnel from FEMA and NEHRP, who developed the 2009 *Provisions*. "Americans unfortunate enough to experience the earthquakes that will inevitably occur in the future will owe much, perhaps even their lives, to the contributions and dedication of these individuals."² Consensus on the *Provisions* was achieved through ballots conducted at subcommittee, PUC, and BSSC-member levels.

¹ FEMA, from the abstract describing the 2009 *Provisions* in the online FEMA Library at www.fema.gov/library/viewRecord.do?d=4118

² FEMA, Foreword to the 2009 *Provisions*, accessed via www.fema.gov/library/viewRecord.do?d=4118

Thank You!

www.nehrp.gov

