

National Earthquake Hazards Reduction Program

... a research and implementation partnership

Program Overview

Opening Plenary Session

25 July 2010



9th US National and 10th Canadian Conference on Earthquake
Engineering: *Reaching Beyond Borders*

toronto july 25-29, 2010

9ième Conférence Nationale Américaine et 10ième Conférence
Canadienne de Génie Parasismique: *Au delà des Frontières*

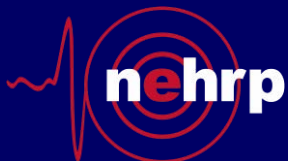


FEMA

NIST
National Institute of
Standards and Technology



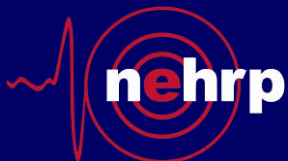
USGS
science for a changing world



national **earthquake** hazards reduction program

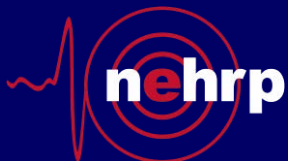
Presentation Outline

- Overview (Background, Agency Roles, Budgets)
- Agency Overviews
- Strategic Plan
- National Research Council Roadmap Study
- Recent Activities
- Q&A (if time permits ...)



National Earthquake Hazards Reduction Program

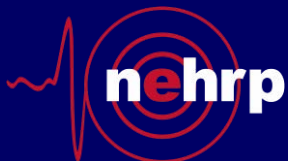
A Statutory Multi-Agency Partnership



national **earthquake** hazards reduction program

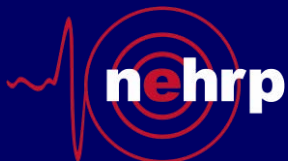
Overview

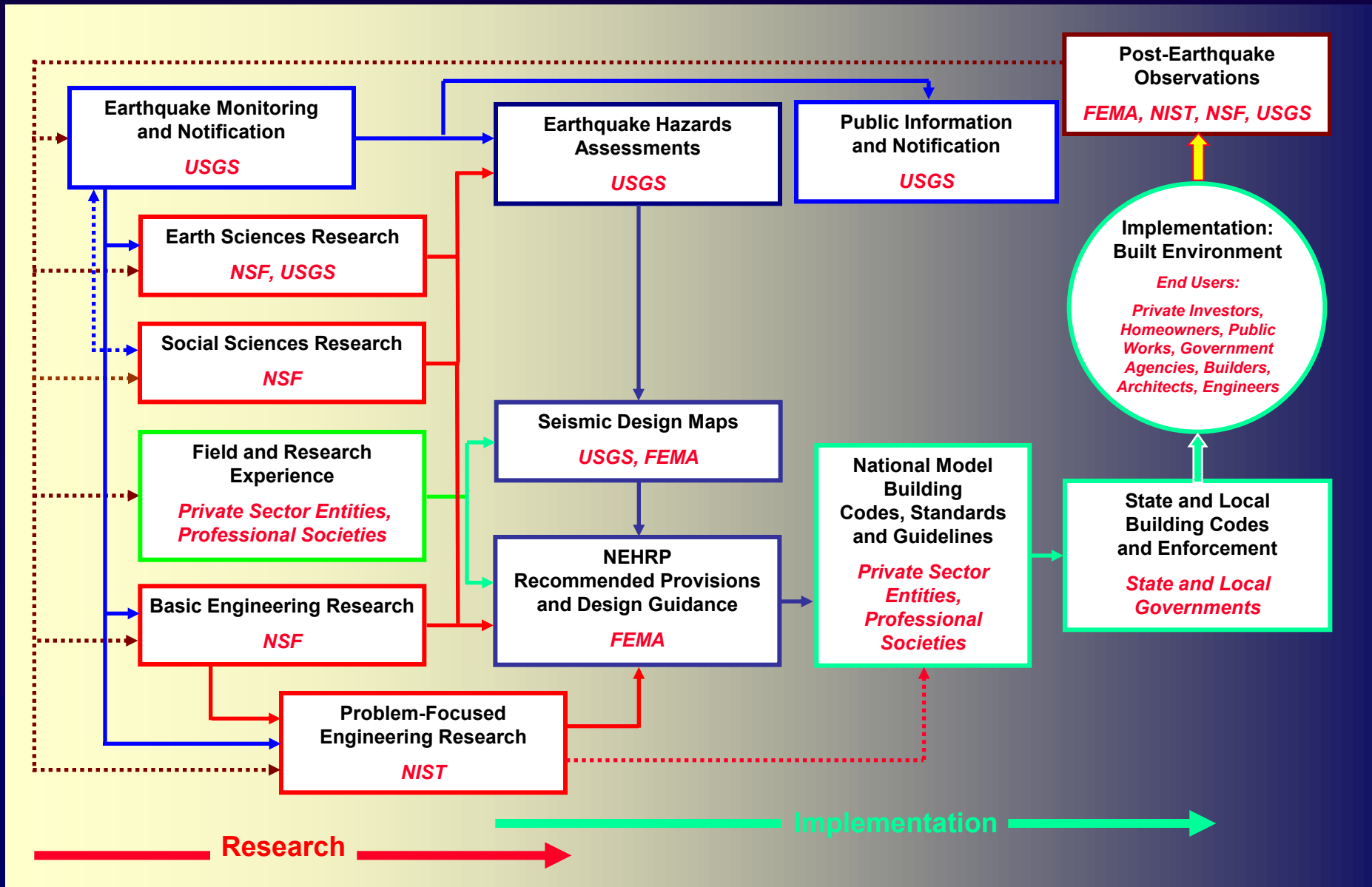
- National program first authorized by U.S. Congress in 1978.
- Overall purpose: “...to reduce the risks of life and property from future earthquakes in the United States...”
- NEHRP has been re-authorized on 2 – 5 year cycles following formal U.S. Congressional hearings. New re-authorization now in process (HR 3820). Meanwhile, agencies continue their Program activities.
- Program has no authority to establish or enforce codes and regulations, or to conduct post-earthquake response and recovery operations.



Major Statutory NEHRP Activities

- Conduct interdisciplinary research on earthquakes and earthquake effects on communities, structures, buildings, homes, and lifelines. (NSF, USGS, NIST)
- Monitor earthquake activity and characterize hazard. (USGS)
- Develop earthquake-resistant design and construction practices. (NIST, FEMA)
- Develop and promote adoption of effective model building codes and practices for earthquake resilience. (FEMA, NIST)
- Public education on earthquake risks and mitigation. (All)





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

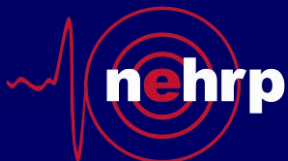
Notes:

1. ARRA funds are not included.
2. Information shown is for internal NEHRP use only. Authorized budgets will not be publicly reported with requested budgets.

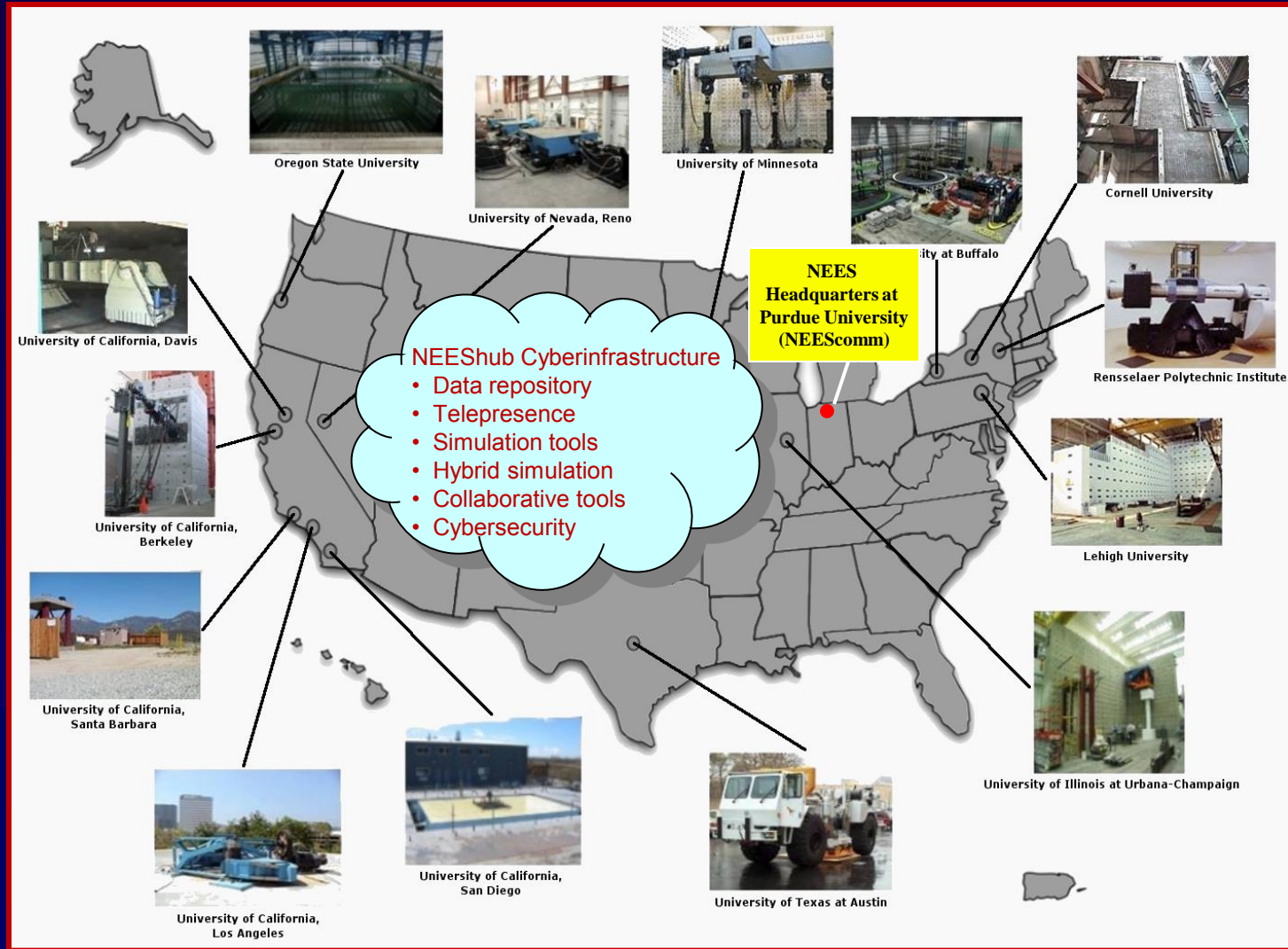


NSF: NEHRP's Primary Basic Research Arm

- **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

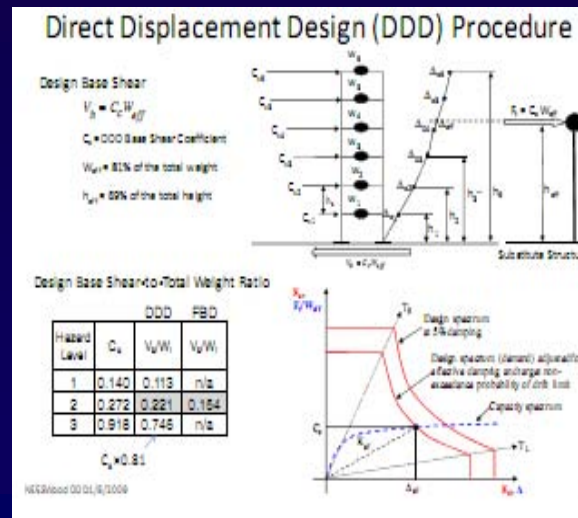


Next-Generation Earthquake Resistant Structural Systems: Performance-Based Seismic Design Philosophy for Mid-Rise Wood frame Construction

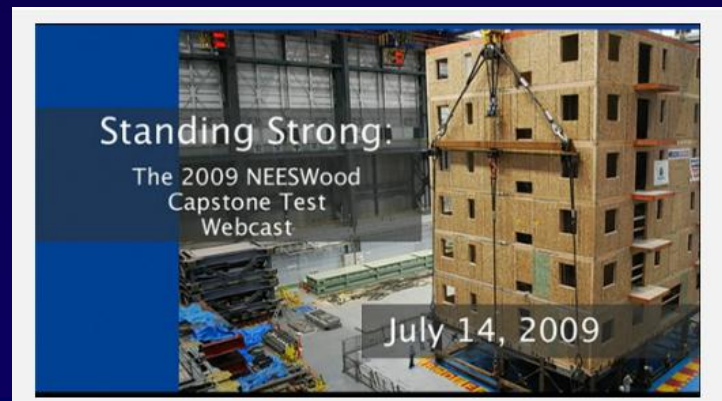
Benchmark two-story town house woodframe tests using University at Buffalo NEES dual shake tables (2006)



New design approach using test results (2007-2008)



Validate methodology with capstone full-scale, six story woodframe building tests using E-Defense shake table in Miki, Japan (June and July 2009)



E-Defense shake table test

NEES dual shake table tests

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 (increased future focus)
- Enhanced design productivity and interoperability development (future focus)

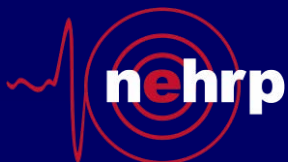
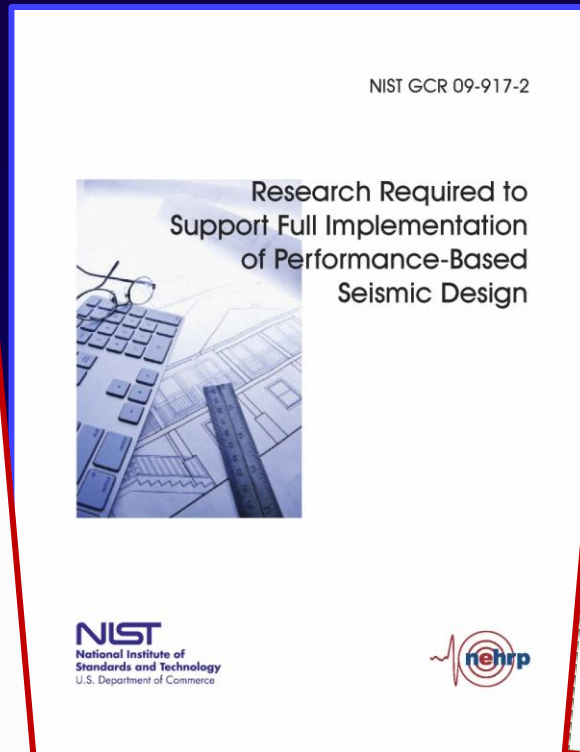


NIST goal: ~ 50/50 in-house/extramural split

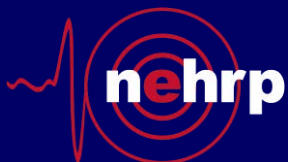
Research → Practice



Recent NIST Publications

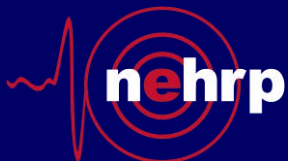
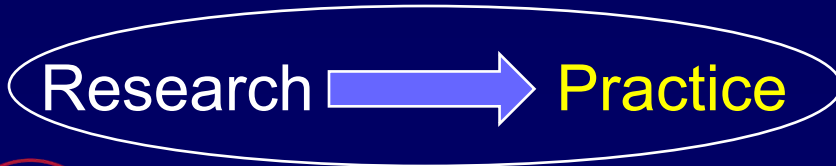
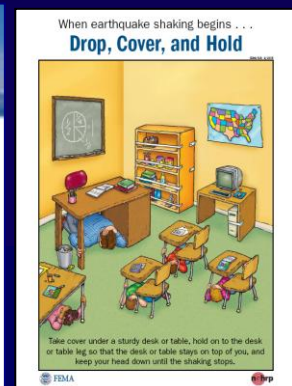
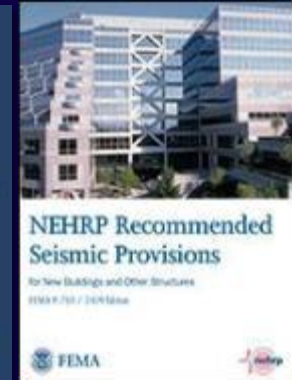


FEMA's NEHRP Contributions



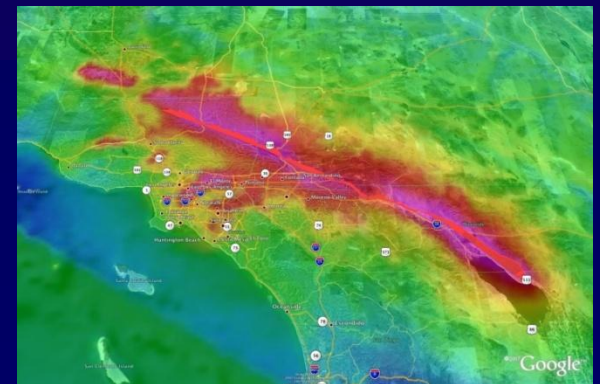
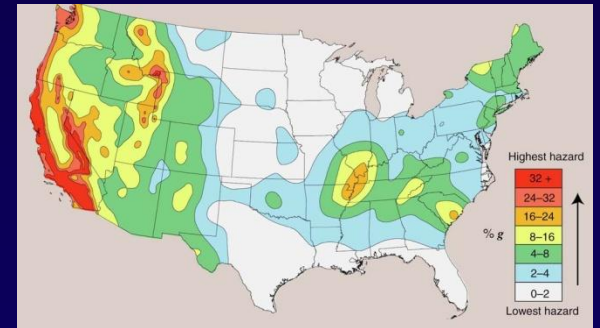
FEMA's NEHRP Activities

- Guidance Development (new and existing buildings)
- Building Codes and Standards
- Training (current, planned and future strategy)
- Outreach (strategic communication)
- State and Local Coordination (NETAP, EMPG, State Assistance)
- Partnerships (consortia, EERI)

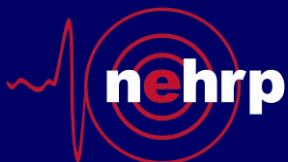
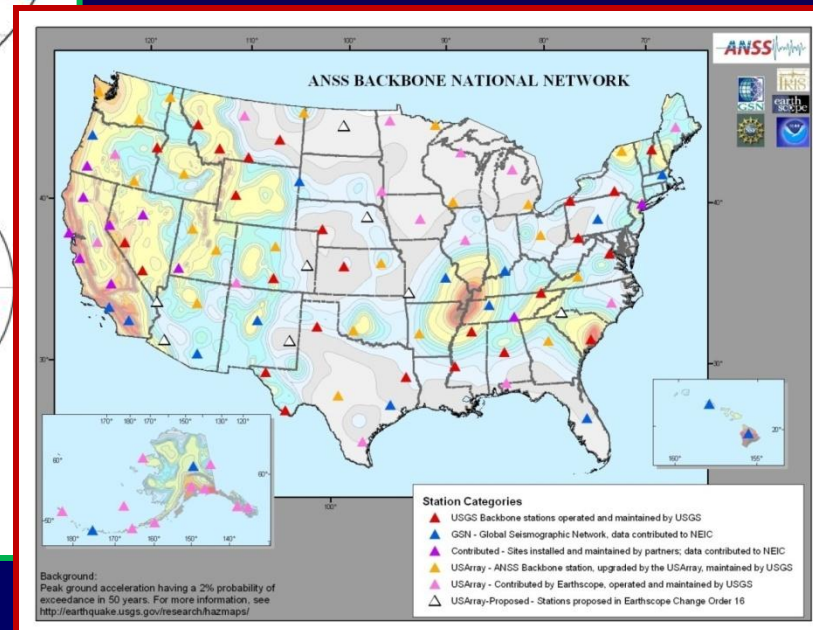
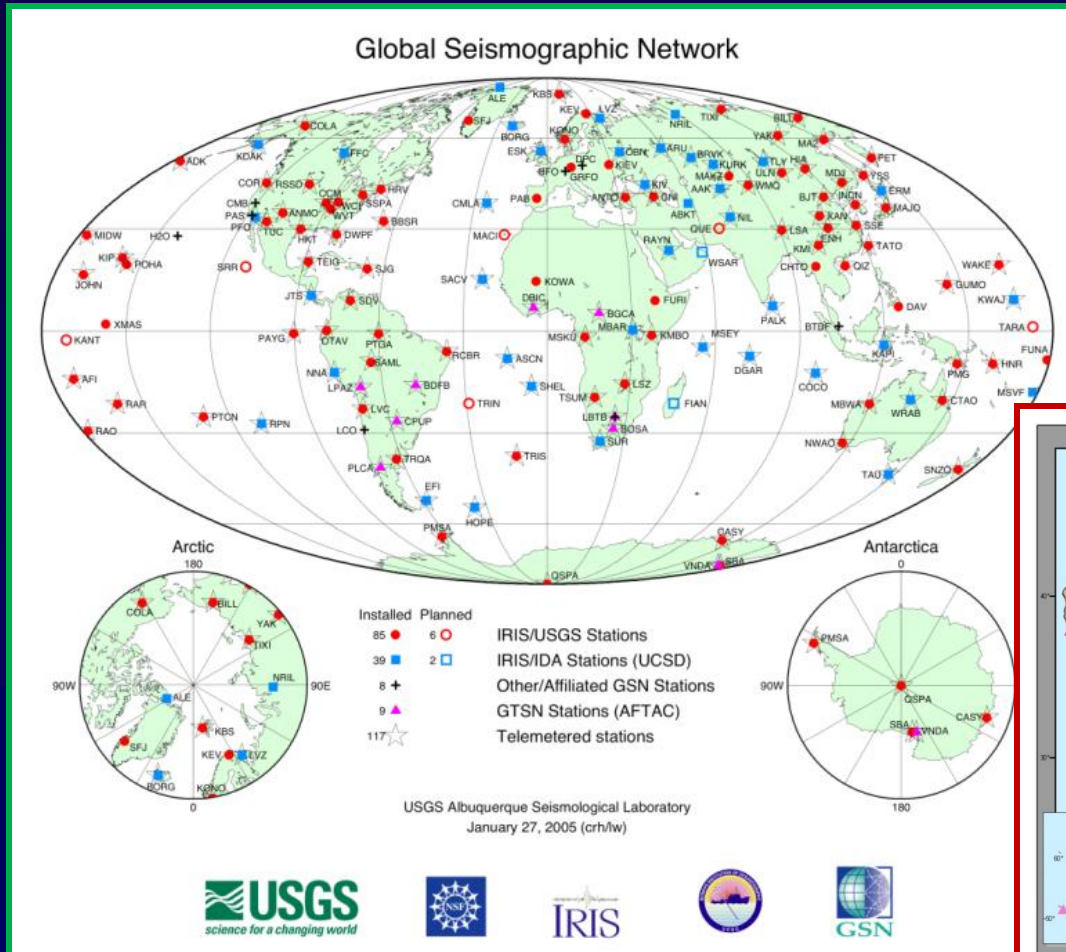


The USGS Role in NEHRP

- Provide earthquake monitoring and notifications,
- Assess seismic hazards, and
- Conduct targeted research needed to reduce the risk from earthquake hazards nationwide.



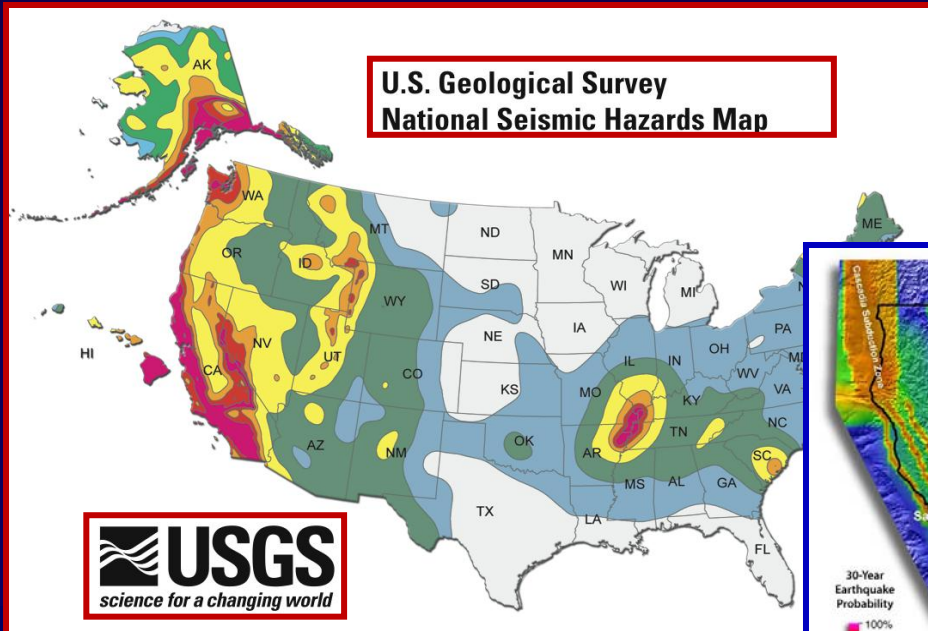
USGS provides rapid information on earthquakes worldwide



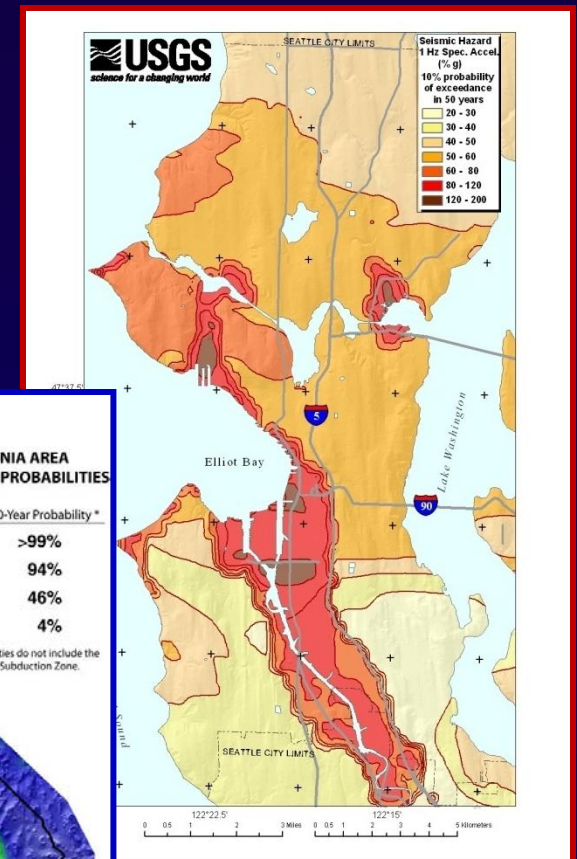
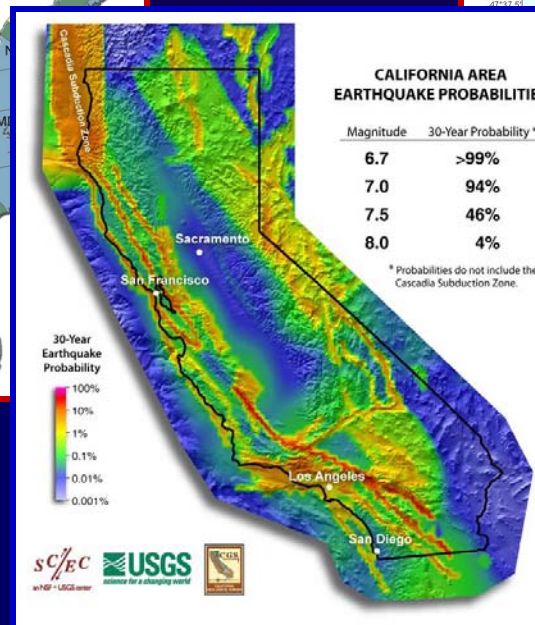
USGS seismic hazard assessments:

National, regional, urban

U.S. National Seismic Hazard Maps

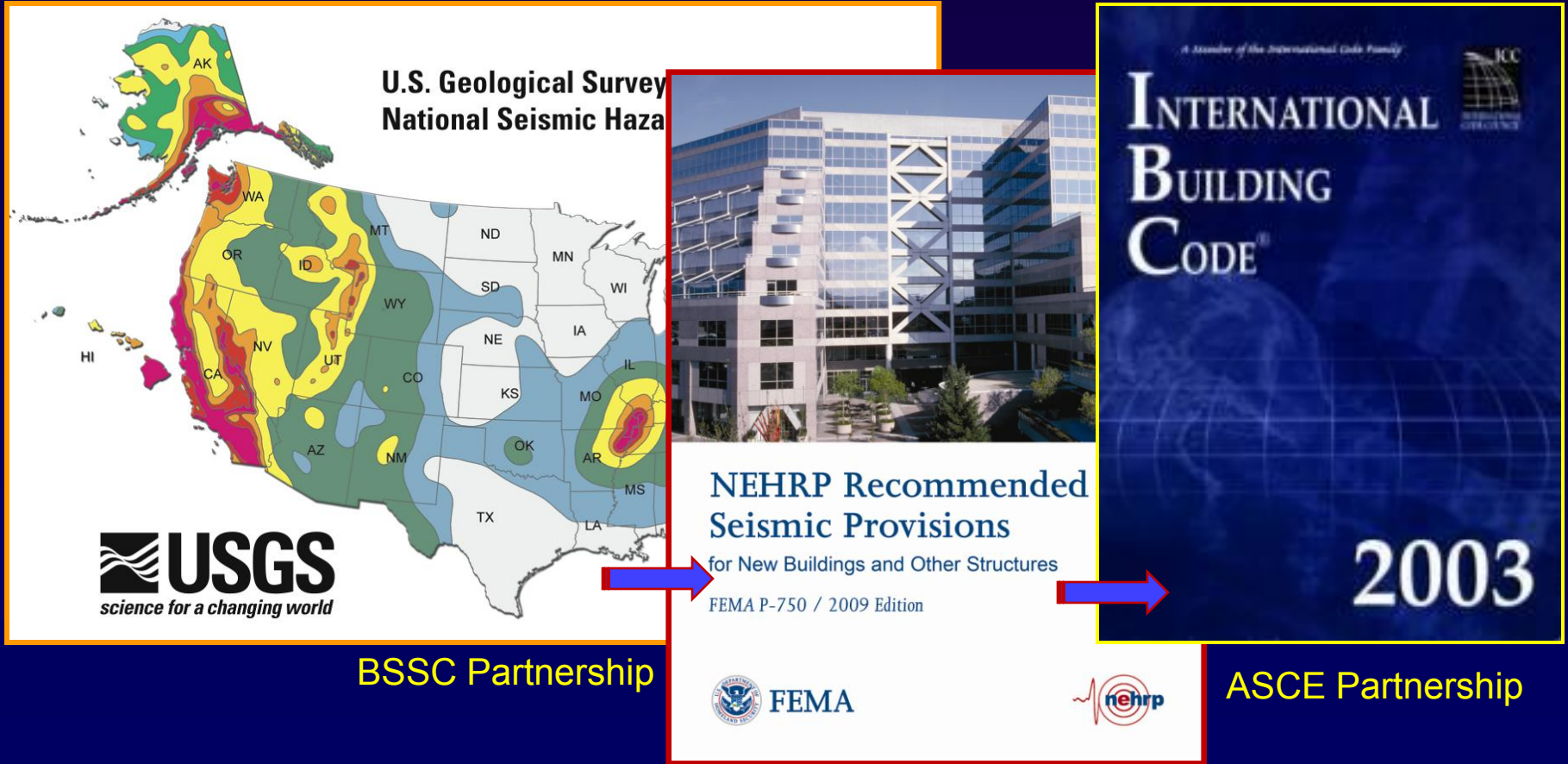


Uniform California Earthquake
Rupture Forecast

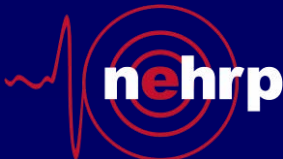


Seattle urban
hazard map

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

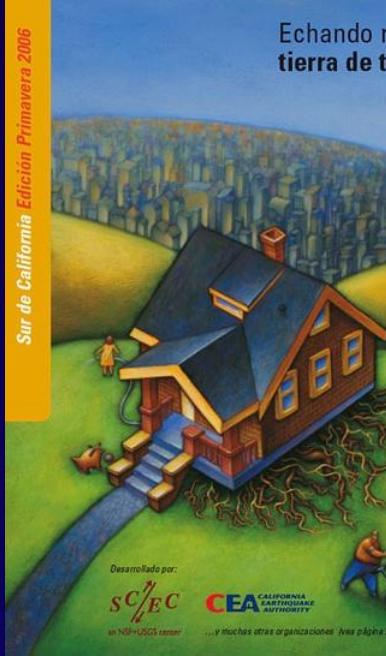


Recommended Provisions, ASCE 7, and International Building Code based on the USGS national seismic hazard map



Putting Down Roots in Earthquake Country

Sur de California Edición Primavera 2006



Echando raíces en tierra de terremotos



Putting Down Roots in Earthquake Country
Your Handbook for the San Francisco Bay Region

General Information Product 15

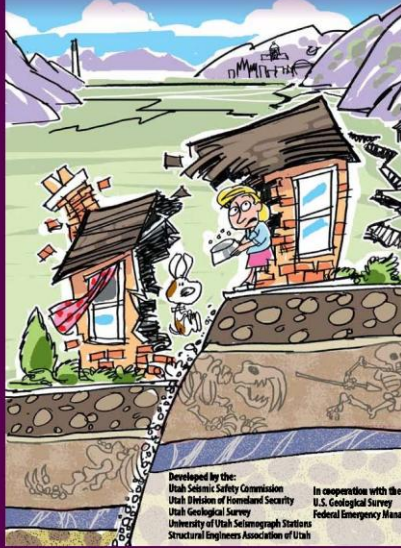
Developed by:

- American Red Cross, Bay Area Chapter
- Association of Bay Area Governments
- California Earthquake Authority
- California Geological Survey
- Earthquake Engineering Research Institute
- Governor's Office of Emergency Services
- San Francisco Office of Emergency Services and Homeland Security
- Southern California Earthquake Center
- Structural Engineers Association of Northern California
- University of California Berkeley
- U.S. Department of Homeland Security, Federal Emergency Management Agency
- U.S. Geological Survey

U.S. Department of the Interior
U.S. Geological Survey

Utah Seismic Safety Commission
American Red Cross, Pacific Gas & Electric and many more...

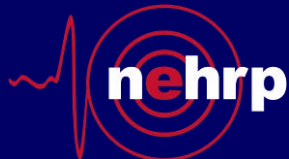
Putting Down Roots in Earthquake Country
Your Handbook for Earthquakes in Utah



Developed by the:
Utah Seismic Safety Commission
Utah Division of Homeland Security
Utah Geological Survey
University of Utah Seismograph Stations
Structural Engineers Association of Utah

In cooperation with the:
U.S. Geological Survey
Federal Emergency Management Agency

Putting Down Roots for the Central US (coming soon)



national earthquake hazards reduction program

California-wide public preparedness drill

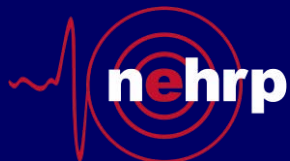


The Great
Southern California

Shake Out



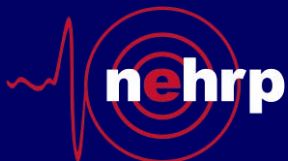
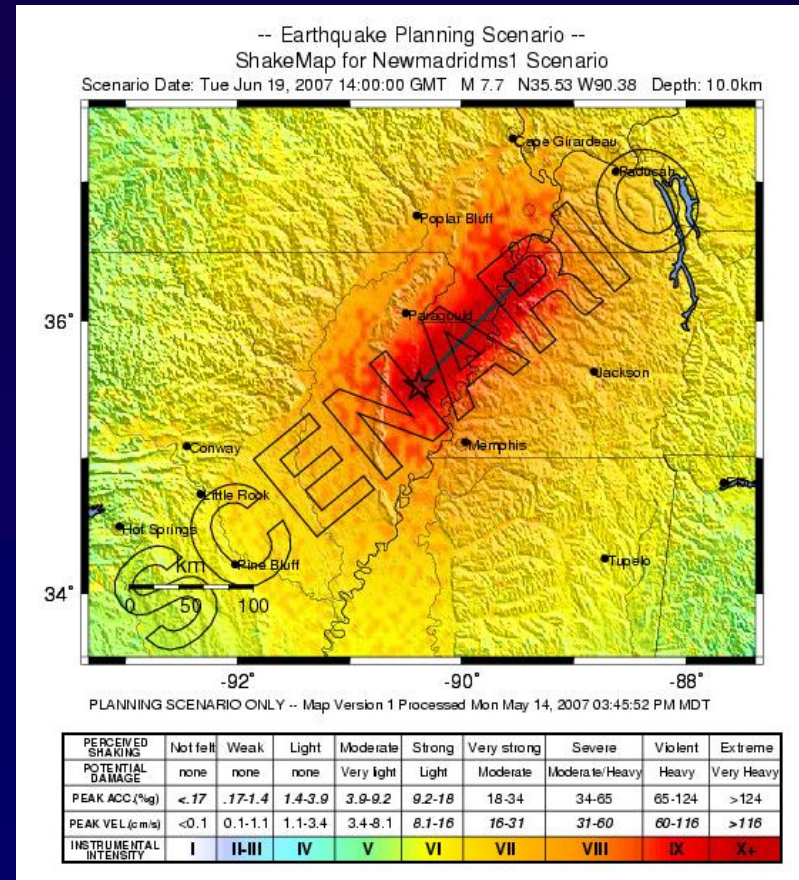
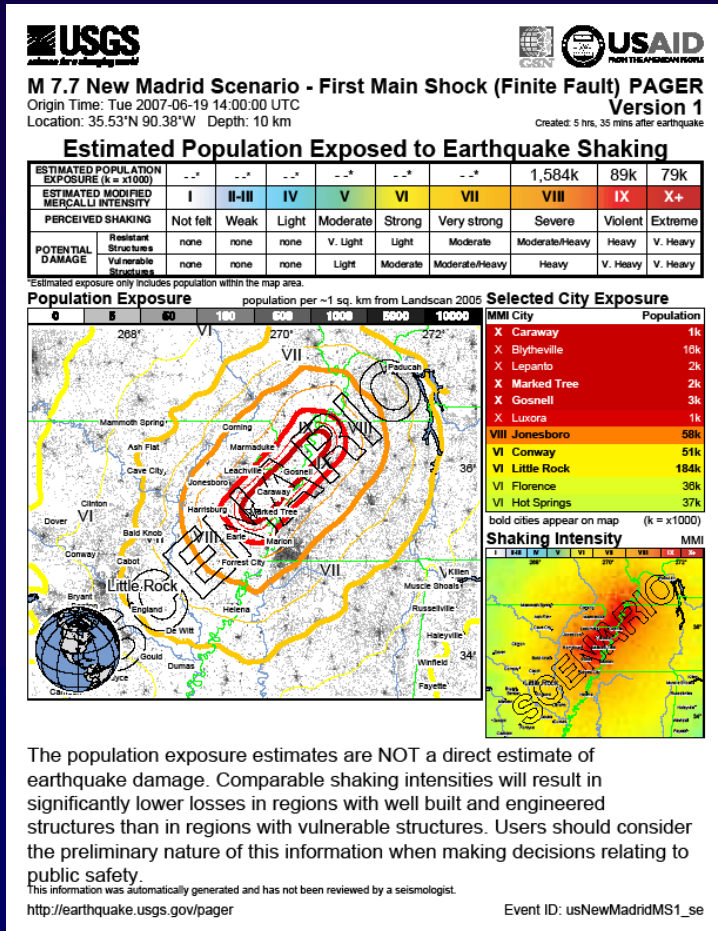
October 15, 2009



national earthquake hazards reduction program

FEMA National Level Exercise 2011 Based on New Madrid earthquake

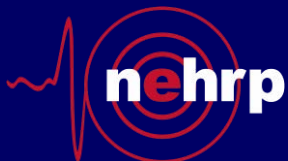
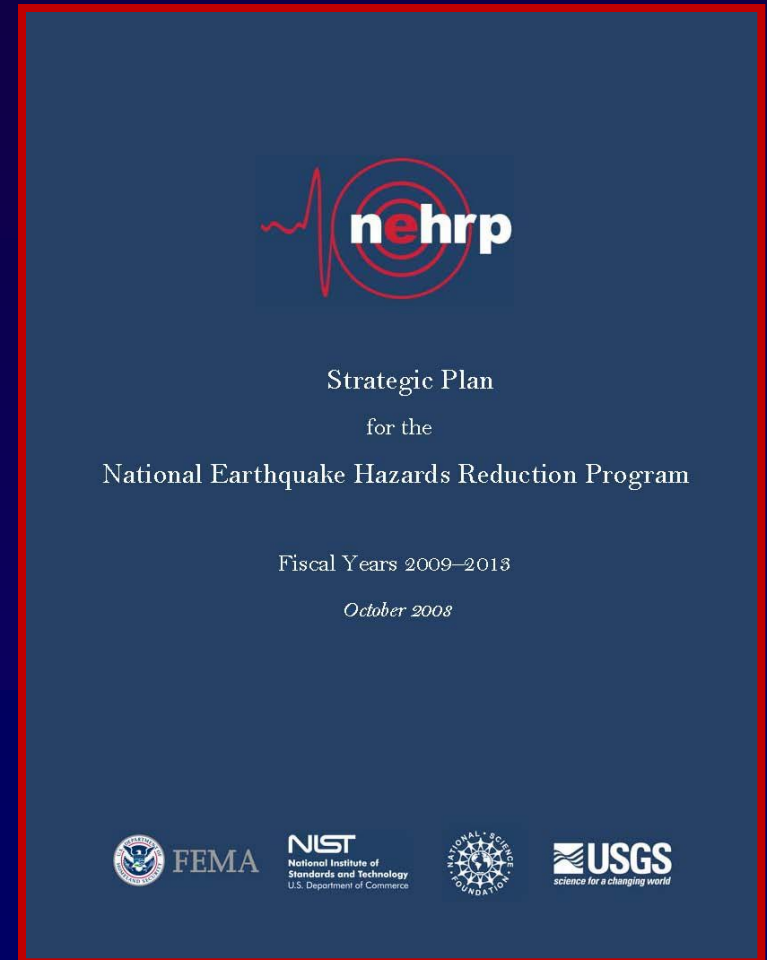
Scenario ShakeMap and PAGER prepared for SONS07 emergency response exercise



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

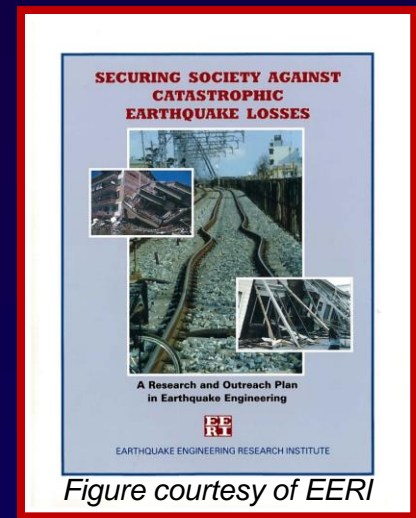
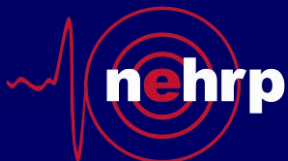


Figure courtesy of EERI

Recent Activities

- **FEMA** completed the 2009 *Recommended Provisions for Seismic Regulations* to support the development of revised building codes.
- **USGS** has initiated major instrumentation upgrades to the Advanced National Seismic System (ANSS), supported with ARRA funding.
- **NSF** awarded new operations cooperative agreement to Purdue University for the Network for Earthquake Engineering Simulation (NEES) (known as *NEEScomm*).
- **NIST** increased its research efforts in support of performance-based seismic engineering and proceeded with staff buildup activities.



Recent Activities (continued)

- Proposed 2011 **NIST** initiative, *Disaster-Resilient Buildings and Infrastructure*, will support post-earthquake reconnaissance and database management.
- **FEMA and NIST** initiated a formal interagency process to develop closely coordinated research and knowledge transfer activities.
- **NIST & NSF** made additional research grant awards under ARRA.
- **NEHRP** co-sponsored Chile earthquake structural engineering meeting with ASCE and PEER (June 2010).



Thank You!

www.nehrp.gov

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.



NEHRP Recommended Seismic Provisions

for New Buildings and Other Structures
FEMA P-750 / 2009 Edition



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=4105.

² FEMA, Foreword to the 2009 *Provisions*, accessed via www.fema.gov/library/viewRecord.do?d=4105.