

National Earthquake Hazards Reduction Program

... a research and implementation partnership

Existing Buildings Programming Activities

Advisory Committee on Earthquake Hazards Reduction

19-20 November 2012



FEMA

NIST

National Institute of
Standards and Technology

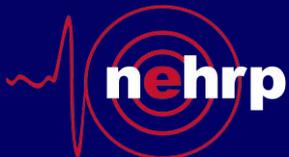


USGS
science for a changing world

national **earthquake** hazards reduction program

NEHRP Strategic Plan (1/3)

- 2003 National Research Council Report, *Preventing Earthquake Disasters – The Grand Challenge in Earthquake Engineering*:
 - “... the economical retrofit of existing structures is perhaps the most important issue facing earthquake-prone communities today ...”
 - “... a new generation of retrofit technologies that cost less than existing, less-effective techniques but preserve cultural and architectural resources and protect real estate investments from total loss is long overdue.”
- Strategic Priority: *Improve Techniques for Evaluating and Rehabilitating Existing Buildings*



NEHRP Strategic Plan (2/3)

- Strategic Priority: *Improve Techniques for Evaluating and Rehabilitating Existing Buildings*
- Ties to Objective 2: *Advance understanding of earthquake effects on the built environment.*

Projected Outcome: “... cost-effective technologies, engineering practices, and design strategies for mitigating ground failure and improving the seismic performance of structural and non-structural systems, with full consideration given to the level of seismic resilience needed.”



NEHRP Strategic Plan (3/3)

- Strategic Priority: *Improve Techniques for Evaluating and Rehabilitating Existing Buildings*
- Also ties to Objective 7: *Develop tools to improve the seismic performance of buildings and other structures.*

Projected Outcome: “New cost-effective engineering design and construction practices for new and existing buildings and non-structural building elements. With existing effective measures, these practices will be implemented by building designers, regulators, and the construction industry.”



National Research Council Report * (1/3)

- Task 13: Techniques for Evaluation and Retrofit of Existing Buildings.
 - *“...the cost of damage of buildings and their contents and the resulting business interruption or downtime typically account for the bulk of the economic loss from a large magnitude earthquake.”*
 - *“...the greatest threat to life loss in earthquakes in the U.S. is posed by existing buildings.”*
 - *“...current assessment methodologies cannot identify buildings whose performance may prevent the desirable level of resilience for individuals or communities to develop efficient overall mitigation programs.”*
 - *“...current retrofit design standards ... coupled with currently employed construction techniques, may not provide the targeted performance with adequate reliability and economy.”*

* National Earthquake Resilience: Research, Implementation, and Outreach, National Research Council, 2011



National Research Council Report (2/3)

- Task 13: Techniques for Evaluation and Retrofit of Existing Buildings.

Develop analytical methods that predict the response of existing buildings with known levels of reliability based on integrated laboratory research and numerical simulations, and improve consensus standards for seismic evaluation and rehabilitation.

- *5-yr annualized cost of \$22.9M per year; total 20-yr cost of \$543.6M*
- *Costs and timelines are detailed by “R&D Task” in NRC report – see tables E.4 & E.5 – major task areas shown on following slide*
- *Key questions:*
 - ✓ *Does ACEHR concur with the R&D tasks shown in the tables?*
 - ✓ *How would ACEHR prioritize the R&D tasks?*

National Research Council Report (3/3)

- Task 13: Techniques for Evaluation and Retrofit of Existing Buildings.

<u>R&D Task</u>	<u>R&D Task</u>
✓ Program Coordination & Management	✓ Develop fragility & consequence functions for archaic components
✓ Develop reliable tools for collapse computations	✓ Large-scale lab testing of existing building systems
✓ In-situ testing of existing buildings & components	✓ Soil-structure interaction studies
✓ Develop/deploy efficient retrofit methods/techniques	✓ Develop/deploy building rating system
✓ Develop/deploy techniques for NDE of existing construction/conditions	✓ Evaluate reliability of and update ASCE 41 procedures for PBD of existing buildings
✓ Collect/curate/archive building inventory data across the nation	✓ Performance-based retrofit of nonstructural components/systems
✓ Carbon footprint of retrofit building construction	✓ Implementation: updating standards/guidelines; risk reduction programs