Summary of Results from the NEHRP Workshop on Meeting the Challenges of Existing Buildings, San Francisco, California, September 19-20, 2007

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This information was developed through a process that involved research, interviews, and a 2-day workshop (*NEHRP Workshop on Meeting the Challenges of Existing Buildings*, September 2007) that included the active participation of over 90 individuals representing the viewpoints of engineering practitioners, researchers, regulators, building owners, and public policy experts. Documentation of this process and information used as a basis for identifying and setting priorities are provided in the companion ATC-71 Reports, *NEHRP Workshop on Meeting the Challenges of Existing Buildings, Part 1: Workshop Proceedings, Part 2: Status Report on Seismic Evaluation and Rehabilitation of Existing Buildings, Part 3: Action Plan for the FEMA Existing Buildings Program*, and the ATC-73 Report, *Prioritized Research for Reducing the Seismic Hazards of Existing Buildings*.

ATC-71, *Part 3: Action Plan for the FEMA Existing Buildings Program*

Arriving at a prioritized list of activities involved the identification of current challenges associated with existing buildings and the collection of information describing the current status of seismic evaluation and rehabilitation practice in the United States. Resulting priority needs were divided into five thematic areas that facilitated the generation of activities to address them. These are:

1. Facilitate Framework to Update Existing Building Standards

2. Develop and Improve Actionable Understanding of Earthquake Risk

3. Develop Simplified Evaluation and Rehabilitation Procedures

4. Improve Education and Training of Engineering Professionals

5. Develop New Products

Activities were then developed to address needs in each of these thematic areas in alignment with NEHRP Strategic Objectives and Strategic Priorities.

A total of 28 activities were defined for consideration within FEMA's Existing Buildings Program. These activities were prioritized to reflect their urgency for supporting the ongoing programs of other strategic partners as well as the anticipated duration of the activity. The prioritization process resulted in 11 activities for initiation in the near-term, 8 activities for initiation in the mid-term, and 7 activities for initiation in the long-term. The plan is anticipated to encompass a 10-year time frame. A summary outline of recommended activities by thematic area and priority (near-term, mid-term, and long-term) is as follows:

1. **Facilitate Framework to Update Existing Building Standards**

   - Activity A5: Support Development of Standards Update Framework (near-term)

   - Activity A7: Develop Consensus Code Change Proposals to Align the Provisions of the IBC, IEBC, and IRC (near-term)

   - Activity A11: Framework for Convening Issue Teams to Move Research into Practice (near-term)

   - Activity A13: Develop Recommendations for Treatment of Earthquake Hazard Issues for Existing Buildings (mid-term)

   - Activity A16: Define Test Beds and Case Studies (mid-term)

   - Activity A18: NEHRP Existing Building Workshop Support (mid-term)

   - Activity A19: Coordinate Recommendations for Evaluation & Rehabilitation of Nonstructural Components (mid-term)

2. **Develop & Improve Actionable Understanding of Earthquake Risk**

   - Activity A3: Monitor Use of ASCE 31 and ASCE 41 for Projects Triggered by Codes (near-term)

   - Activity A4: Develop Community Building Inventories (near-term)

   - Activity A6: Enhance LEED Ratings for Resilience (near-term)

   - Activity A10: Develop & Promote Earthquake Risk Communication Tool (near-term)

   - Activity A17: Develop and Disseminate Policies and Guidance for Various Mitigation Approaches (mid-term)

   - Activity A21: Benchmark Model Building Expected Performance (long-term)

   - Activity A25: Prepare White Paper on Seismic Rehabilitation and Social Vulnerability (long-term)

   - Activity A26: Develop Methodology for Tracking the Progress of Earthquake Risk Reduction (long-term)

3. **Develop Simplified Evaluation and Rehabilitation Procedures**

   - Activity A8: Develop Simplified Evaluation and Rehabilitation Guidance (Regional Module) (near-term)

   - Activity A24: Develop Simplified Rehabilitation Guidance (General Module) (long-term)

4. **Improve the Education & Training of Engineering Professionals**

   - Activity A9: Develop Seismic Evaluation & Rehabilitation Example Applications (near-term)

   - Activity A12: Promote Incremental Seismic Rehabilitation Guidance (mid-term)

   - Activity A14: Develop Nonlinear Analysis Modeling Guidelines (mid-term)

- Activity A15: Promote Education and Training of Engineering Professionals (mid-term)

5. **Develop New Products**

- Activity A1: Develop Earthquake Performance Rating System for Buildings (near-term)

- Activity A2: Develop Rehabilitation Cost Guidance (Update FEMA 156 and FEMA 157) (near-term)

- Activity A20: Develop Business Continuity Earthquake Planning Guidelines (long-term)

- Activity A23: Develop Guidelines for Seismic Rehabilitation of Historic Structures (long-term)

Implementation of the activities recommended in this Action Plan is intended to achieve the following objectives:

- Facilitate technical improvements to existing building codes and standards for seismic evaluation and rehabilitation;

- Increase the number of seismically at risk buildings being identified and rehabilitated;

- Address the highest priority impediments to more widespread seismic evaluation and rehabilitation of existing buildings as identified by representatives of existing building stakeholder communities; and

- Support dissemination of NEHRP-sponsored basic and applied research to improve the climate for more widespread seismic evaluation and rehabilitation to reduce future earthquake losses.

ATC-73, *Prioritized Research for Reducing the Seismic Hazards of Existing Buildings*

For this proposed NEES Prioritized Research Program for Reducing the Seismic Hazards of Existing Buildings, the Vision is: *Substantial Reduction of Casualties and Other Losses from Existing Buildings in Earthquakes.*

The prioritized list of research needs is intended to:

- Identify and prioritize existing research needs, from the perspective of practicing seismic design professionals and in support of the recently established NEES program, to foster development of more effective existing building evaluation and rehabilitation techniques; and

- Identify the barriers to the mitigation of earthquake risk to existing buildings and develop action plans to improve seismic rehabilitation guidance and its implementation.

More than 50 specific research needs were identified, grouped into categories, ranked in terms of relative importance, and assigned to one or more of the following coordinated goals, listed in order of importance:

Goal 1: Establishment of a Coordinated Research Program

Goal 2: Mitigation of Building Collapse Risks

Goal 3: Advancement of Guidelines and Standards for Existing Buildings

Goal 4: Communication of Earthquake Risks

Goal 5: Calibration of Engineering Tools with Realistic Data

Goal 6: Development of New Materials and New Building Systems

Goal 7: Development of Building Investigative Technologies

Of critical importance to workshop participants was the need to establish a coordinated research program (Goal 1), which would involve the announcement of the highest priority research needs, as identified by the profession; solicitation of pre-proposals to address the highest priority research needs; evaluation of the pre-proposals and selection of those offering the greatest potential to address critical issues; submission of full proposals for the successful pre-proposals; awarding of grants; creation of advisory panels consisting of a cross-section of researchers, practitioners, and government and industry representatives to review work on the awarded projects; and coordination of research carried out on the awarded projects.

Of the more than 50 research needs identified, 12 were categorized as highest priority (see Table 1).

Table 1   Highest Priority Research Needs

Overall Priority Ranking	Research Need	Goal
1	Fragility data for structural and nonstructural components and systems, and a consistent framework for developing and establishing such data	Goal 3: Advancement of Guidelines and Standards for Existing Buildings
2	Development of a nonproprietary building rating system	Goal 4: Communication of Earthquake Risks
3	Risk-based approaches to selection of ground motions for evaluation of buildings	Goal 3: Advancement of Guidelines and Standards for Existing Buildings
4	Full- or large-scale shake table testing of complete building systems	Goal 2: Mitigation of Building Collapse Risks Goal 5: Calibration of Engineering Tools with Realistic Data
5	In-situ testing of the behavior of existing buildings	Goal 2: Mitigation of Building Collapse Risks Goal 5: Calibration of Engineering Tools with Realistic Data
6	Uniform method for development of acceptance criteria in guidelines and standards	Goal 3: Advancement of Guidelines and Standards for Existing Buildings
7	Behavior and performance data on innovative structural materials and systems for use in seismic analysis and design	Goal 6: Development of New Materials and New Building Systems
8	Improved analytical platforms for next-generation nonlinear analysis and quantification of risk	Goal 3: Advancement of Guidelines and Standards for Existing Buildings
9	Information on soil-foundation-structure interaction effects on input ground motion	Goal 3: Advancement of Guidelines and Standards for Existing Buildings
10	New tools for non-destructive investigation of building components	Goal 7: Development of Building Investigative Technologies
11	Identification and inventory of buildings that are collapse risks, by type and region	Goal 2: Mitigation of Building Collapse Risks
12	Soil-foundation-structure interaction (deformations, capacity, and behavior under extreme loading)	Goal 3: Advancement of Guidelines and Standards for Existing Buildings