

**Advisory Committee on Earthquake Hazards Reduction**  
**National Earthquake Hazards Reduction Program**

January 10, 2013

The Honorable Patrick D. Gallagher  
Director  
National Institute of Standards and Technology  
Building 101, Room A1134  
100 Bureau Drive  
Gaithersburg, MD 20899-1000

Dear Dr. Gallagher:

We are pleased to submit our annual report to you and the Interagency Coordinating Committee (ICC) on the effectiveness of the National Earthquake Hazards Reduction Program (NEHRP), as stipulated in our committee charter and Public Law 108-360.

For the past 6 years, the Advisory Committee on Earthquake Hazards Reduction (ACEHR) has been meeting and carrying out its charge to advise the program on its effectiveness, management coordination, and implementation activities, as well as on new trends and developments. We have presented comprehensive reports with multiple recommendations in 2008, in 2010, and most recently in 2012. In 2009 and 2011, our reports were supplementary in nature and reflected specific developments that were occurring at the time. We have observed that all of our reports have been well received and that our recommendations have been implemented as time and funding have permitted. We share with NEHRP an overall frustration with the impact that the national budget stalemate is having on the program's ability to implement its mandate and strategic plan.



Since the completion of our 2012 report, the committee met once at NIST headquarters on November 19 and 20. We welcomed five new members, conducted a workshop on the engineering needs for existing buildings, and received briefings from each of the NEHRP agencies. The briefings included a comprehensive summary of the NEHRP Consultants Joint Venture research projects and each agency's initial response to the recommendations presented in our 2012 report. The committee appreciates the efforts being made by each agency given the current funding constraints and understands that implementation of most of our 2012 recommendations is awaiting sufficient funding. All materials presented at the November meeting, as well as a summary of the meeting, are available on the NEHRP.gov website.

Our 2012 report provided a complete overview of NEHRP and included an update on the related trends and developments observed by committee members. We developed a set of key recommendations derived from the NEHRP strategic plan and the newly published National Research Council road map entitled, *National Earthquake Resilience: Research, Implementation, and Outreach*. Our 2012 report continues to stand as a current assessment of NEHRP.

This 2013 report, similar to earlier reports issued during the year following a comprehensive report, is supplementary in nature. It focuses only on four specific topics that came up during our November meeting that we believe need immediate attention along with the recommendations provided in 2012. These issues concern the need to preserve the National Science Foundation (NSF)-funded George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES), to reinvigorate the implementation component of NEHRP, to develop a building performance rating system that can stimulate mitigation activities, and to assess the implications of recently published findings about induced seismicity.

### **Future of NEES**

Large-scale, multi-user experimental facilities are essential to increasing the resilience of the United States by supporting the development of better seismic hazard estimates, by building knowledge about the vulnerability of the natural and built environments, and by developing standards and innovative construction technologies. NEES facilities are designed to study the performance of natural and built environments subjected to earthquake effects. Networked facilities linked with a dedicated and focused cyberinfrastructure enhance efficiency and access, thereby increasing and accelerating learning.

ACEHR notes that NEES operations have enabled giant advances in understanding the vulnerability of older systems; in developing new, highly resistant systems; in modeling nonlinear systems in the natural environment; and in advancing simulation capabilities. These advances are reflected in standards widely used by engineers nationally. NEES is approaching

the final year of NSF's original 10-year plan of support for the network. NSF is in the process of implementing the "NEES2" plan for supporting the operation and management of earthquake engineering research infrastructure during fiscal years (FY) 2015–2019. ACEHR urges continued support for those elements of the NEES infrastructure and collaboratory that have demonstrated their effectiveness during the past 8 years of multi-user research, as well as continued support, at current or increased levels, for research that uses these facilities. The committee also recommends that NEHRP explore the development of cooperative use of this unique infrastructure by the four NEHRP agencies.

### **Implementation Component of NEHRP**

Since the inception of NEHRP, the Federal Emergency Management Agency (FEMA) has played a pivotal role in implementing the earthquake risk reduction measures developed by NEHRP and its partners. This has involved preparing State and local governments for responding to and recovering from earthquakes and other disasters, promoting the development and adoption of building codes and the implementation of improved practices in the design professions, and advocating for all-hazards preparedness in our homes, workplaces, and communities. FEMA has been the conduit for delivering NEHRP's risk-reduction products to State and local governments and the practitioner community through its regional offices and its work in developing guidelines and templates. No other NEHRP agency has provided this interface between those engaged in scientific research and development (R&D) and those with "on the ground" responsibility for mitigating and preparing for the potential effects of earthquakes.<sup>1</sup>

Regrettably, ACEHR has observed in recent years an ongoing erosion of financial support within FEMA for pre-earthquake mitigation and preparedness efforts. This is diminishing FEMA's capacity to support the vital implementation component of NEHRP. In FY 2001, FEMA allocated \$15 million to carry out its NEHRP responsibilities. By FY 2010, the budget allocation

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<sup>1</sup> *The following were presented as FEMA NEHRP responsibilities at ACEHR's November 2012 meeting:*

- *Promote implementation of research results*
- *Promote better building practices*
- *Operate program of grants and assistance for the States*
- *Support implementation of comprehensive earthquake education and awareness program*
- *Assist Federal agencies and private-sector groups in preparation and dissemination of seismic design guidance and in development of performance-based design guidelines*
- *Develop, coordinate, and execute the National Response Plan*
- *Develop approaches to combine earthquake hazards reduction with other natural and technological hazards*
- *Provide preparedness, response, and mitigation recommendations to communities after an earthquake prediction has been made*
- *Enter into cooperative agreements or contracts to establish demonstration projects on earthquake hazard mitigation*

for NEHRP had decreased to \$8.98 million, and since then it has declined by an additional 42 percent, to \$5.2 million in FY 2013.

These cuts have reduced support for State and local mitigation and preparedness programs, and for the regional earthquake consortia, which have been an important source of mitigation advocacy. NEHRP staffing has been reduced in FEMA's national and regional offices; these personnel have been the face of NEHRP among State and local governments and a visible and accessible resource in support of NEHRP implementation activities. Reduced support for seismic risk mitigation programming targeted to buildings and lifelines has also diminished FEMA's role in creating a safer built environment.

NEHRP is like a three-legged stool, supported by basic research, applied R&D, and implementation activities. These three legs, grounded in the earth sciences, engineering, and the social sciences, work together to reduce earthquake risk and strengthen earthquake resilience in many ways. FEMA's diminishing support for NEHRP has weakened the implementation leg of the stool, which NEHRP cannot stand without. Unless and until FEMA's support can be strengthened, NEHRP is in need of a supplementary source of support for its vital implementation function.

### **Building Performance Rating System**

Over the past 10 years there have been several workshop-based efforts to outline the challenges, solutions, and research needs associated with earthquake engineering. These efforts have focused on issues ranging from meeting the challenges of existing buildings to developing a plan for national earthquake resilience. Their products include the following:

- *ATC-57, The Missing Piece: Improving Seismic Design and Construction Practices*
- *ATC-71, NEHRP Workshop on Meeting the Challenges of Existing Buildings*
  - *Part 1: Workshop Proceedings*
  - *Part 2: Status Report on Seismic Evaluation and Rehabilitation*
  - *Part 3: Action Plan for the FEMA Existing Buildings Program*
- *ATC-73, NEHRP Workshop on Meeting the Challenges of Existing Buildings, Prioritized Research for Reducing the Seismic Hazards of Existing Buildings*
- *NIST GCR 09-917-2, Research Required to Support Full Implementation of Performance-Based Seismic Design*
- *National Research Council, Grand Challenges in Earthquake Engineering Research, A Community Workshop Report*
- *National Research Council, National Earthquake Resilience: Research, Implementation, and Outreach*

Dozens of research needs are outlined and prioritized in these reports. A common thread throughout these documents, however, is the importance of giving communities and decision makers, such as private-sector facility owners and public-sector institutions, an understanding of how seismic risk relates to the built environment; a framework that, for instance, could be used for measuring, monitoring, and evaluating the existing building stock and rating the code-based design of new buildings. Several of the reports specifically reference the need to develop a uniformly acceptable building performance rating system that would provide this type of information in a concise, consistent, and understandable fashion. To be truly useful, such a system would need to be simple with minimal gradation, similar to the LEED Green Building Rating Systems.<sup>2</sup> This system would take into account building performance measures such as repair costs, repair time, potential for unsafe placards, likelihood of casualties, and collapse potential given different levels of earthquake ground shaking. Finally, development of the rating system would require participation and, ultimately, buy-in from all the stakeholders that would use or be impacted by it.

Creating a simple building performance rating system will require a technical foundation that can be used to set the initial rating categories and to assess the performance of existing buildings and code-designed new buildings. While assessment tools currently exist, this technical foundation requires the development of improved assessment and analysis tools to better predict structural and nonstructural behavior and to benchmark the expected performance of code-designed buildings.

### **Implications of Induced Seismicity**

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<sup>2</sup> For more information, see the U.S. Green Building Council website at <http://new.usgbc.org/>.

We appreciate the opportunity to communicate our findings and recommendations to you and stand ready to respond to any questions or comments that may arise.

Sincerely,

Chris D. Poland, PE, SE, NAE  
Chair  
Advisory Committee on Earthquake Hazards Reduction  
National Earthquake Hazards Reduction Program

DRAFT