

National Earthquake Hazards Reduction Program (NEHRP)
Advisory Committee on Earthquake Hazards Reduction (ACEHR)
National Institute of Standards and Technology
Boulder, Colorado
April 30-May 1, 2019
Meeting Summary

Meeting Attendance

Advisory Committee Members

Glenn Rix, Chair	Geosyntec Consultants, Inc.
Jane Bullock	Bullock & Haddow, LLC
Greg Deierlein	Stanford University
John Gillengerten	Consulting Structural Engineer
Ryan Kersting	Buehler & Buehler Structural Engineers, Inc.
Peter May	University of Washington, Seattle
Lori Peek	University of Colorado, Boulder (Day Two)
David Simpson	IRIS Consortium

Invited Speakers

Jon Heintz	Applied Technology Council
Chris Poland	Consulting Engineer

NEHRP Agency Representatives and NIST Support

Howard Harary	NIST/Engineering Laboratory (EL) Director
Luciana Astiz	NSF Program Director, Division of Earth Sciences
Jason Averill*	NIST/EL/Materials and Structural Systems Division (MSSD) Chief
Tina Faecke	NIST/EL/MSSD, NEHRP Program and Management Analyst and ACEHR Designated Federal Officer
Jonathan Godt	DOI/USGS Acting Science Advisor for Earthquake and Geologic Hazards
John Harris	NIST/EL/MSSD NEHRP Deputy Director
Katherine Johnson	NIST/EL/MSSD NEHRP AAAS Fellow for Social Science Integration
Edward Laatsch	DHS/FEMA Safety, Planning and Building Science Division Director
Mike Mahoney*	DHS/FEMA, Senior Geophysicist
Steve McCabe	NIST/EL/MSSD, NEHRP Director
Joy Pauschke*	NSF Program Director, Division of Civil, Mechanical and Manufacturing Innovation Program
Steve Potts	NIST/EL/MSSD, NWIRP Program and Management Analyst

Registered Speakers

Linda Rowan	External Affairs Director for UNAVCO
Zahraa Saiyed*	Public Policy and Advocacy Committee Co-Chair, EERI

* Participated via teleconference

Summary of Discussions

I. Opening Remarks

Howard Harary started the meeting at 8:30 a.m. MDT and welcomed everyone to the Katharine Blodgett Gebbie Laboratory. McCabe went over the meeting agenda, pointing out there would be two guest speakers – Poland and Heintz. McCabe said the agenda would be getting away from standard agency updates and would provide additional information on things like the NEHRP Reauthorization Act of 2018, signed into law on December 11, 2018. He turned the meeting over to Rix, who described the specific objectives of the meeting to:

- Develop a revised outline for the ACEHR biennial report;
- Begin writing sections of the ACEHR report containing agency-specific recommendations on the NEHRP reauthorization and strategic plan;
- Make writing assignments to continue working after the meeting ends, and
- Schedule two or three teleconferences with subject-matter experts prior to the August meeting.

II. Public Input Period

Linda Rowan - UNAVCO

Rowan gave a short presentation on how geodetic data and analysis can help with earthquake early warning and response. UNAVCO maintains the Network of the Americas (<https://www.unavco.org/projects/major-projects/nota/nota.html>) from Alaska through South America. There are 1152 GPS/GNSS stations in the network. There are 854 that are real-time GNSS sites useful for warning and surveying. Geodetic data can help determine very quickly where the greatest ground motion shaking and greatest damage is, to help with response, especially for a magnitude 7 or larger event. Geodetic data can also be used for tsunami early warning. Twenty-two stations recorded the Cook Inlet earthquake (near Anchorage, AK on November 30, 2018). UNAVCO collected high rate data from 1.5 days prior to and 1.5 days after the earthquake. UNAVCO has developed sensitivity maps of the network's detection capability for all of UNAVCO's real-time GNSS sites.

Zahraa Saiyed – Principal, Scyma Consulting and Public Policy and Advocacy Committee Co-Chair, Earthquake Engineering Research Institute (EERI)

Saiyed reported that EERI provided input on the NEHRP reauthorization language, hosted sessions on advocacy, and led efforts on the California working group on functional recovery (FR). EERI continues to work with stakeholders to understand how the community talks about FR, how to bring policy and governance impacts, and how EERI can help educate and support additional language in future policies. EERI will focus on lifeline components of FR and incorporate mortality statistics to develop improved building standards. Saiyed noted a bill in Washington State to promote functional recovery. She also asked the ACEHR to consider how to better approach public awareness, and the communication of location-specific risk.

Kersting noted that EERI and the Structural Engineers Association of California are forming a joint committee for the FR concept. McCabe added that staff from the NIST Earthquake Engineering Group are working with them to incorporate social science and economics, building on the related work that NIST has going on.

III. Agency Updates and Invited Speakers

NEHRP Overview – Steve McCabe

McCabe provided an update on NEHRP accomplishments and ongoing efforts. McCabe stated that agency responses to the September 2017 ACEHR recommendations are posted on the NEHRP website at <https://www.nehrp.gov/committees/reports.htm> for the Committee to reference in developing their 2019 report. He gave brief updates on Committee membership, the NEHRP budget, NEHRP reports, the recent NEHRP Reauthorization, the upcoming Interagency Coordinating Committee meeting date, and major NEHRP activities (visit <https://nehrp.gov/pdf/NEHRP%20Overview%20for%20April%2030,%202019%20ACEHR%20Mtg%2004262019%20-%20Final.pdf>)

Rix referred to the General Accounting Office (GAO) assessment in the latest NEHRP reauthorization and asked how GAO would approach the assessment. McCabe responded that GAO previously did a study of federal building seismic safety, assigned by Congress. GAO put together a small committee of independent experts. They conducted interviews with the community including FEMA, US Army Corps of Engineers, structural engineers involved in federal building evaluations, and NIST. The report is GAO-16-680 and is found at <https://www.gao.gov/products/GAO-16-680>. It's not clear yet how GAO will approach this assessment.

Harary stated that typically GAO will request an opening meeting with the NEHRP agencies. There is an extensive amount of work to be done, thus the three-year timeline for the assessment's completion. NEHRP agencies will have a chance to read the assessment and GAO will publish our feedback, but NEHRP won't have an opportunity to edit it.

Bullock emphasized that the Committee needs to voice our concerns about the assessment to the GAO. Harary clarified that NIST is not waiting three years for the GAO report to develop an updated NEHRP Strategic Plan. McCabe added that one reason NIST is not holding a workshop this year is because NIST has to fund the functional recovery work. Harary summarized the difference between authorization and appropriation. The authorization suggests an amount of funds to conduct work specified in the legislation, while actual funds are not provided to each agency until they are appropriated. The two levels of funding may not always be aligned. Bullock asked how much money NIST requested for fiscal year (FY) 2019. Harary explained that NIST cannot talk about what was requested, only what was included in the President's budget. Bullock asked for further explanation, stating that the President's budget contains a substantial reduction to program budgets. Harary added that there are reductions in the President's NIST budget proposal to Congress, for example some programs are entirely zeroed out; however, the NEHRP and earthquake activities were untouched.

Kersting asked what percentage of agency-requested funding is appropriated (e.g. 50% funded or 90% funded)? McCabe explained that we try to leverage our programs; we are strategic in how we go about doing our work. Laatsch added that while we (the agencies) do the best we can, we would not expect to come close to fully meeting the intentions of Congress as they are laid out. If you look at the funding previously provided, you can see that some things get funded and others don't. McCabe suggested that if you go back in history, NEHRP has come out pretty well.

National Earthquake Hazards Reduction Program (NEHRP) Reauthorization Act of 2018 - Jay Harris

Harris presented a history of the NEHRP, and changes to the Earthquake Hazards Reduction Act of 1977 included in the NEHRP Reauthorization Act of 2018. (visit

<https://nehrgov/pdf/NEHRP%202018%20Reauthorization%20-%20ACEHR%20April%202019%20-%20Color.pdf>

Simpson explained that it's critical to have NEHRP history documented. He added that there are some important points for GAO and lessons learned. Harris stated the desire is to start a white paper on the history of NEHRP, and provide the Committee with an opportunity to comment.

Bullock stated that historically, after major earthquakes there were substantial increases in funding. We need to assess what the real financial needs are. It also might be time to look at the connection with other hazards; a multi-hazard resilience approach may be warranted. Some interesting information is available about Loma Prieta. There was a lot of politics going on in the aftermath of major earthquakes, and the Committee needs to be aware of these. Simpson said it would be useful to look at major international earthquakes and the impact that they may have had on U.S. policies to earthquake hazards reduction, and add them to the historical timeline. It has been an entire generation since a major life-threatening earthquake occurred in the U.S..

Functional Recovery Project – Katherine (Jo) Johnson

Johnson presented the Functional Recovery project on behalf of Siamak Sattar, project lead. (visit https://nehrgov/pdf/30April_1May_ACEHR_Agenda.pdf)

Bullock asked if there will be any consideration of economic impacts? Johnson said some consideration of a cost factor is likely to be included, for example with a description of how the recommended options are priced will be reported alongside each of them. She added that NIST is developing several options, and identifying limiting factors. NIST will balance the consideration of building codes with community issues such as health care. Several of the members commented that this was an excellent approach, albeit a substantial challenge.

Committee members wanted to know to whom the recommended options would be addressed. This concern will be addressed by the committee of experts that will be convened to undertake this work.

Mahoney added that FEMA plans to fund the committee of experts after they receive clarification from the NIST legal counsel on interpreting the language in the reauthorization. The charging language in the act is very vague. NIST/FEMA will develop technical and implementation options.

NSF Earthquake Program Update – Luciana Astiz

Astiz presented a description of the NSF NEHRP activities, and their response to the ACEHR recommendations for NSF. (visit https://nehrgov/pdf/NSF%20NEHRP%20ACEHR%20mtg_April%2030-May%202019.pdf)

Rix asked if there had been any discussions about bringing in other NSF Directorates. Pauschke responded that NSF has had many discussions over the years about support from the Directorate for Social, Behavioral and Economic Sciences (SBE) to the hazards reduction directorates. Hazards research is seen more as applied research and not the fundamental sociological/political issues that SBE funds.

Simpson stated that he is still astounded that NSF is reluctant to synthesize the work contributed to NEHRP and mitigation. In the work funded by NSF over 20-25 years, there have been enormous contributions, but they don't come through in the NSF updates presented to this Committee. He sees the reports from engineering and other directorates and is frustrated that NSF does not synthesize and summarize how the work funded by NSF moves NEHRP forward and contributes to earthquake risk reduction.

Pauschke responded that NSF has presented this in the past. Most of NSF's summarization is done by the awardees. There have been synthesis reports, and NSF has presented these in past presentations. Astiz said that once NSF awards the grant NSF only owns the abstract provided by the grantee and the public result the PI's provide. Simpson suggested that it is NSF's responsibility to assess what those awards are accomplishing. Astiz committed to suggest this idea to the NSF Division of Earth Sciences Director, Lina Patino.

FEMA Earthquake Program Update – Ed Laatsch

Laatsch gave an update on the FEMA Earthquake Program (EP) budget, FEMA aspects of the NEHRP Reauthorization Act of 2018, the Disaster Recovery Reform Act of 2018, the Bipartisan Budget Act of 2018, enhanced EP initiatives, and EP accomplishments. (visit <https://nehrrp.gov/pdf/FEMA%20NEHRP%20Presentation%2004-30-2019%20ver4.pdf>)

Bullock asked if anyone at FEMA is looking at affordability for earthquake insurance. Laatsch responded that earthquake insurance is modeled after the California Earthquake Authority (CEA) policy. CEA is trying to figure out how to get above 10% penetration. FEMA is planning to double that percentage by 2020 and is working to change the basic structure of flood insurance. Bullock added that FEMA tried in the 1990's to come up with earthquake insurance but couldn't get industry to agree to mitigation measures like those in the flooding program.

Kersting asked what can be done to encourage adoption of codes for existing buildings. Laatsch responded that FEMA ties them to organizational goals and priorities, like saving lives, resilient futures, etc. Senior leaders care about the big picture. If you can explain to a mayor how you can help create a lasting and resilient community in the face of the next disaster, you may get an audience.

Kersting stated that building codes need to be done in conjunction with mitigation plans. Laatsch, who runs the Mitigation Planning Program, said FEMA is going to measure progress by how many communities actually take action on their plan, rather than just creating a plan and checking the box to get a grant.

Gillengerten asked if FEMA has been able to determine how to integrate the lifelines group back into this process. Laatsch said FEMA is going to look at past efforts and determine what to do, based on agency priorities. He added that FEMA is currently underfunded but is strategizing on how to do things differently. A major cost study was conducted at FEMA, resulting in four critical initiatives. Only one of the four requested critical initiatives was approved.

Development of Next Generation Performance-Based Seismic Design Procedures for New and Existing Buildings (FEMA P-58-5) - Jon Heintz

Following up on a prior ACEHR request, Heintz gave an update on the ATC-58 Project Series on seismic performance assessment and design, the FEMA P-58-5 expected performance of code-conforming buildings project, and next steps. (visit https://nehrrp.gov/pdf/00_FEMA%20P-58-5_Performance_Heintz_2019-04-30.pdf)

Kersting said the codes have been developed in a thoughtful way, the paradigm is shifting, but the work is not done yet. He said the Committee's report needs to address communities' requests for resilience. For example, the Committee needs to make it clear that the difference between risk category two and four is not just strength and stiffness. Heintz said that good seismic design is based on stable ductile performance. But ductility is damage; code conforming buildings will experience damage. There is a disconnect between current seismic design paradigms and resilience concepts. A damaged building may

no longer meet the code it was designed under – the Committee needs to consider what that means for resilience.

It was suggested that the Committee consider the work from New Zealand (Elwood's QuakeCore <http://www.quakecore.nz/>) where they are explicitly considering residual strength and repairability of structural components (this provides a link between historic seismic design paradigms and future resilience).

Simpson asked about the statistics. Heintz said they used a parametric design to vary the strength and stiffness metrics of the current code (ASCE 7-10). It's all about testing the levers in the code, presuming a certain level of detailing you get from average moment frame and shear wall systems.

Deierlein said that the presentation showed different repair times, not re-occupancy times. Heintz responded that re-occupancy time can be much less than repair time because you can be in the building during repairs. He noted, however, that impeding factors are real. The methodology explains how you can infer re-occupancy times from repair times. The position of the project is that impeding factors are important, but completely random and highly uncertain. In terms of computational methodology, the project team chose to stop at repair time.

USGS Earthquake Program Update - Jonathan Godt

Godt provided an update on the USGS Earthquake Program FY19 budget, Earthquake Early Warning (EEW), program priorities, and the upcoming Anchorage Earthquake Conference. (visit https://nehrrp.gov/pdf/USGS%20pres-ACEHR%20mtg_April30-May%201%202019_.pdf)

Simpson said that both EEW and the Alaska investigation were not included in the last President's budget but put back in by Congress afterward. So potentially, the President's budget is not as pessimistic as some may think.

NIST Earthquake Engineering Group Program Update – Steve McCabe

McCabe gave an update of the NIST Earthquake Engineering Group (2EG) Program which covered progress in the areas of existing buildings, earthquake design in wind communities, performance-based seismic design of new buildings, support for NEHRP, and outreach activities. (visit <https://nehrrp.gov/pdf/NIST%202EG%20Presentation%20for%20April%2030%202019%20ACEHR%20Mtg%2004262019%20Final.pdf>)

Deierlein referenced the reauthorization and asked if there were anything else that would cause you to rethink your program. McCabe said there was nothing in terms of technical content, but clearly there's a need for more emphasis on lifelines. FEMA is moving ahead aggressively, and NIST will ensure that our portfolio of work includes partnering with FEMA in the area of lifelines. The NIST 2EG needs to leverage partnerships, such as with FEMA as well as the resilience and structures groups at NIST, and to combine technical skills with social science skills. Deierlein added that the durability of underground pipe systems is an area that lacks expertise in academia. Harary said that NIST has work going on in the Community Resilience Program, and the SmartGrid Program that can be a part of this. There's a lot of opportunity for NIST/EL resources to be brought to bear.

McCabe added that historically NEHRP looked at building elements and subsystems then ran tests to get performance data, and then worked up to doing analysis of complete buildings. Now we're broadening this beyond traditional structural engineering to incorporate emerging research in lifelines, economics

and social science. NIST recognizes that we need to communicate the results of these analyses to many levels of decision makers and provide realistic estimates of how much additional risk reduction will cost.

NEHRP Strategic Plan – Steve McCabe

McCabe gave an overview of the NEHRP Strategic Plan, and suggested an approach to updating it. (visit <https://nehrp.gov/pdf/NEHRP%20Strategic%20Plan%20Update%20ACEHR%20Meeting%20April%2030-May%201%202019.pdf>)

Kersting referenced Objective 12 (promote the implementation of earthquake-resilient measure in professional practice and in private and public policies) and getting local and state agencies to implement changes, saying that we're doing a good job with other things, but not mitigation. We're not seeing many people choose to do better than code for new buildings, or to retrofit better than they need to on existing buildings. He asked how we can encourage people to do better on voluntary efforts, or whether we need to make it mandatory. He added that it's happening from an environmental sustainability standpoint, but it's not happening for earthquakes. McCabe added that the typical building owner assumes their building will be fine. Rix said it gets back to educating the public prior to the earthquake which seriously damages the building. Bullock suggested using the disaster relief fund. She said the bill now has mitigation requirements, which could be made more stringent. They're using federal funds to rebuild these buildings.

NEHRP Direction after 2018 Reauthorization – Chris Poland

Poland provided an opinion of the expanded direction NEHRP has been given to address the needs of community resilience, as directed in the NEHRP Reauthorization Act of 2018. He also offered a vision of a community resilience-based strategic plan, and included priority actions to implement it. (visit https://nehrp.gov/pdf/Poland%20pres-ACEHR%20mtg_April%2030-May%201%202019.pdf)

Bullock said the Rockefeller Foundation that started the 100 Resilient Cities program <https://www.100resilientcities.org/> has decided not to continue. There were a lot of plans, but not enough action. Poland agreed, saying the Rockefeller Foundation also brought in the concept of chronic stressors, not just shocks. Poland thought its focus didn't really deal with the built environment very well. The idea was these cities would pick up the ball and run with it, which some of them may be doing.

Deierlein asked Poland for his thoughts about selecting performance targets to assist a community with functional recovery. Poland said that when developing the NIST Community Resilience Planning Guide¹, the NIST Community Resilience Fellows helped the three communities and their stakeholders identify the necessary social services and functions to assist in recovery. Each community presented the impact of a different natural hazard that they had experienced and identified what had happened, and what the community did not want to happen again. The communities identified their desired recovery times. After comparing a predicted outcome with their desired target, they would reassess their target timeline. Their timelines were heavily based on local expectations and experiences, but not very scientific. He noted, however, that it is the nontechnical information communities will base their decisions upon.

¹ The NIST [Community Resilience Planning Guide for Buildings and Infrastructure Systems](#) provides a practical and flexible approach to help all communities improve their resilience by setting priorities and allocating resources to manage risks for their prevailing hazards.

Gillengerten referenced McCabe's earlier presentation about the NEHRP Strategic Plan where he talked about the process and getting others involved, and asked if Poland had any advice. Poland said he was a little concerned when someone said NEHRP would hire a consultant to help with the strategic plan update. He thinks the ACEHR ought to have a lot to say about that.

Overview of the 2018 Cook Inlet Earthquake in Alaska - Jay Harris

Harris gave an overview of the event, key takeaways, connections they made with the community during the deployment, and impacts of the event. (visit <https://nehrrp.gov/pdf/Cook%20Inlet%20Earthquake%20-%20ACEHR%20April%202019%20-%20Color.pdf>)

Kersting asked if Harris could comment on discussions with the public or agency managers about their perceptions. Harris said that the strength demand from the magnitude 7.1 (M7.1) earthquake on November 30, 2018 was only about one-quarter of the design level for most buildings in Anchorage. They saw some articles that said Anchorage should be thanking the code writers and engineers, but the ground motion data indicates that they may be missing the success measures. The emergency managers, on the other hand, realized they were lucky. The structural engineers and school districts also recognized this wasn't a design-level event, and if it had been a little shallower, this could have turned out differently. There was a large population of people who seem to not fully understand the seismic risk in Anchorage.

Gillengerten asked if they were trying to determine how well the codes protected nonstructural components, adding that since Northridge, the building codes have changed four or five times, and this is the first time a new installation would have experienced significant ground shaking. Harris said an assessment of buildings built before and after code updates is under development. Gillengerten said that would be helpful, especially since ASCE 7 is getting ready to tweak code provisions again

IV. Concluding Remarks - Structuring the Document

Rix gave some instructions to the Committee for the second day's work on writing their recommendations report. He suggested the Committee include some assessment of what NEHRP has done but should primarily be forward-looking about what agencies can do to further their respective missions. He said the Committee needs to identify actual opportunities for further collaboration, with specific examples. One opportunity he said, is to better integrate social science concepts into all facets of work by the four NEHRP agencies. Another opportunity is to consider how we provide focus for research activities, to answer the needs of the end user. Finally, ACEHR needs to consider integration of policy development and implementation.

Simpson suggested that instead of looking at recommendation's agency-wide, the Committee should look at it problem wide. He said that is one thing the Committee did in their last report. He suggested the Committee write a letter to the ICC for immediate things that need to be done.

DAY TWO

I. Planning Next Steps to Finalize the Report

Rix proposed a series of calls over the next few months to finalize the Report. The Committee decided to work on individual sections and committed to not making any decisions or come to consensus without the entire group. The Committee will try to have monthly subject-matter conference call between June

and August – but no consensus information will be provided by the Committee until they convene in August. These are discussions among small groups working on the report.

II. Interim Letter to the NIST Director

Rix recalled the suggestion from Day 1 that the Committee write a letter to the NIST Director emphasizing how important the ICC meeting is and to convey a couple of key comments. He said that Peter May drafted a letter, which the Committee discussed during the meeting and finalized.

III. ACEHR 2019 Biennial Report

Rix updated the outline developed during the March 12, 2019 ACEHR webinar gave the following writing assignments:

- NEHRP Past section – John Gillengerten and Peter May
- NEHRP Present section - Ryan Kersting and Jim Goltz
- NEHRP Future - Jane Bullock and Greg Deierlein

The groups worked individually, then reconvened and made edits as a Committee to the individual sections. Rix maintained a master copy of the draft sections. As the Committee members prepared to leave, Rix suggested they take a copy of the edited sections from the discussions and put them into a draft report format with headings. Bullock suggested the Committee use a bulleted format, as previous ACEHR reports were not too attractive to read.

Bullock suggested using a word other than “recommendations” in the report. The NEHRP agencies are overworked, and if the Committee uses the word “recommendations”, the agencies have to provide formal responses. She offered to come up with alternative wording, for example, implementation suggestions or opportunities.

IV. Adjournment

The Committee adjourned at 1:00 p.m. Mountain Time.