

National Earthquake Hazards Reduction Program (NEHRP)
Advisory Committee on Earthquake Hazards Reduction (ACEHR)
National Institute of Standards and Technology (NIST)
March 25-26, 2020
Virtual Meeting Summary

Meeting Participants

ACEHR Members

Glenn Rix, Chair	Geosyntec Consultants, Inc
Lucy Arendt	St. Norbert College
Gregory Beroza	Stanford University
Jane Bullock	Bullock & Haddow LLC
Gregory Deierlein	Stanford University
Susan Dowty	International Code Council
Thomas Heausler	Consulting Structural Engineer
Ryan Kersting	Buehler Engineering, Inc.
Lisa Grant Ludwig	University of California, Irvine
Lori Peek	University of Colorado, Boulder
Jonathan Stewart	University of California, Los Angeles

Invited Guests

Heidi Tremayne	Earthquake Engineering Research Institute
Maggie Ortiz-Millan	Earthquake Engineering Research Institute

NEHRP Agency Representatives

Luciana Astiz	National Science Foundation
Bill Blanton	Federal Emergency Management Agency
John Filson	United States Geological Survey
Jonathan Godt	United States Geological Survey
Maria Honeycutt	Office of Science and Technology Policy
Mike Mahoney	Federal Emergency Management Agency
Jacqueline Meszaros	National Science Foundation
Joy Pauschke	National Science Foundation

NIST Management and Staff

Walter Copan	NIST Director
Howard Harary	Engineering Laboratory Director
Jason Averill	Materials and Structural Systems Division Chief
Judith Mitrani-Reiser	Materials and Structural Systems Associate Division Chief
Steve McCabe	NEHRP Director

Jay Harris	Acting NEHRP Deputy Director
Jazalyn Dukes	Research Structural Engineer
Katherine Johnson	Earthquake Risk Mitigation Policy Analyst
Tina Faecke	Designated Federal Officer for ACEHR
Stephen Potts	Management and Program Analyst
Siamak Sattar	Research Structural Engineer
Matthew Speicher	Research Structural Engineer

I. Welcome

Dr. Howard Harary opened the meeting at 1:00 pm EDT. He thanked everyone for participating, especially the new members, and introduced Tina Faecke as the Designated Federal Officer. He emphasized the important role of ACEHR (or Committee) in guiding NIST and NEHRP through the consensus advice of thoughtful leaders from a wide diversity of technical disciplines.

II. Opening Remarks

Dr. Walter Copan echoed comments by Dr. Harary in gratitude for the Committee’s passion to reduce seismic risk in the U.S. He welcomed three new members to ACEHR: Dr. Jonathan Stewart; Robert Ezelle, and Thomas Heausler. He also thanked Jane Bullock for her valuable and dedicated service to the Committee, as she will be completing her second term in July 2020. He reaffirmed NIST’s and NEHRP’s commitment to mitigating loss of life and property resulting from earthquakes.

III. Meeting Goals

Committee Chairperson, Dr. Glenn Rix, thanked Dr. Copan and Dr. Harary. He provided some background on the three new members. Biographies of all the ACEHR members can be found at:

<https://www.nehrp.gov/committees/members.htm>.

Rix outlined the meeting goals for the first day to include receiving agency responses to the Committee’s 2019 Biennial Report, discuss and assess the NEHRP activities reported since the August 2019 meeting, and hold a discussion of efforts to implement functional recovery. The meeting goals also included receiving an update of the *USGS Circular 1242* and begin planning for the Committee’s next biennial report.

IV. Public Input Period

Rix asked if anyone registered for the public input period. Nobody registered to speak.

V. ACEHR Legislative Responsibilities and Membership

Dr. Jay Harris provided an overview of ACEHR’s legislative responsibilities, and an update on current and underrepresented membership focus areas. A copy of his presentation is available at:

https://nehrp.gov/pdf/JHarris%20ACEHR%20Membership%20Slides%20032520_FINAL.pdf

Dr. Greg Beroza noted the absence of voting seismologists on the Committee and asked how aggressively NIST is pursuing new seismologists for consideration. Harris responded that NIST is actively pursuing two seismologists as a priority for onboarding new members, and hopes to begin their vetting process soon. In addition to filling our seismologist vacancies, NEHRP is also searching for someone in the emergency management and policy focus areas. This winter, NEHRP will begin recruiting social scientists, as Dr. Lori Peek and Dr. Lisa Ludwig are

approaching the end of their second terms. Before Ryan Kersting and Dr. Greg Deierlein complete their second terms in 2022, NEHRP will evaluate structural engineer candidates.

VI. NEHRP Responses to the 2019 ACEHR Report Recommendations

Dr. Steve McCabe presented NEHRP (or Program) agency responses (https://nehrp.gov/pdf/NEHRP%20Responses_09-26-19%20ACEHR%20report_FINAL.pdf) to the three recommendations identified by the Committee in their September 2019 Biennial Report (https://nehrp.gov/pdf/September_2019_ReporttotheNISTDirector.pdf). Rix asked the Committee if they had any questions. There were none.

Rix asked if the Program had considered the ACEHR's offer to assist in the review process of the draft NEHRP Strategic Plan update. McCabe and Harris responded that the Program is currently focused on content and organization. When the report takes shape, the Program will solicit ACEHR's feedback. Rix said the Committee would be glad to help.

VII. NEHRP Activity Report by Strategic Plan Goals

Harris provided an overview of the current and draft updated NEHRP Strategic Plan Goals and reported NEHRP activities since the last ACEHR meeting based on the updated goals:

https://nehrp.gov/pdf/JHarris%20NEHRP%20Update%20-%20ACEHR%20032520_FINAL%20rev.pdf

Rix appreciated the level of effort and the alignment of agency information with the draft updated Strategic Plan Goals. Dr. Lori Peek echoed Rix's comments about the utility of the information integration. She asked who the audience is for the information being reported for Goal 1. Harris said each agency contributes to Goal 1 and has a specific audience for their products. USGS, for example, documents where, why, and how earthquakes happen. Their audience can be the public or other NEHRP agencies. FEMA might use their information to provide guidance, if for example, the earthquake caused soil underneath a building to become liquefied, thus creating a hazard. Mike Mahoney added they may use the information to develop maps for building codes. Dr. Jacqueline Meszaros said NSF is advancing the basic science that can be picked up down the line in the life cycle of prevention and mitigation. Dr. Jonathan Godt added that USGS picks up the basic science that NSF develops, brings it into the applied realm, and hands it over to the other NEHRP partners. The ultimate customer is society at large. Peek responded that the basic science undergirds everything else and the discussion was a beautiful articulation of the integration of the work, across Goals 2, 3, and 4.

Jane Bullock complimented the integrated presentation of agency work. She was disappointed, however, that the word "implementation" was not in the text. She said ACEHR wants communities to do implementation as a result of the Program's work. The Committee recognizes it's the most difficult thing to do, but the Program has a lot of important things to say about building standards. ACEHR would like more action towards implementing mitigation practices. Finally, she recommended adding budget numbers to the goals.

Harris said the Program will provide knowledge, tools, and guidance on how to decrease consequences. He emphasized it's up to communities to take action to reduce risks. The Program can't enforce action but can help people understand the consequences of not adopting recommendations. A good example is the city of Anchorage, AK. There's currently disagreement within the region about whether some localities should enforce building codes. The Program can produce the tools communities need to help decision makers. Bullock recommended the Program develop a handbook of model ordinances oriented to local officials. A tremendous

moment of opportunity occurs right after the earthquake, and she's not sure all the agencies have been effective at capitalizing on that.

Kersting applauded the new presentation format, and reiterated that mitigation is key. He asked if the NEHRP agencies could offer policy guidance for mitigation, funding, and model ordinances. Harris reiterated that the Program can provide information and knowledge, and can encourage communities to take action, but cannot enforce anything.

VIII. Functional Recovery Update

McCabe and Mahoney provided an update on the status of the Functional Recovery work:

https://nehrp.gov/pdf/McCabe-Mahoney%20Functional%20Recovery%20Pres%20to%20post_ACEHR%20mtg_03-25-20.pdf

Dr. Maria Honeycutt appreciated the multi-hazard perspective and sees an opportunity to bridge with the Community Resilience Program. Mahoney agreed, indicating the Program is walking a fine line between the mandate from Congress, and opportunities to incorporate the multi-hazard perspective throughout the report. Honeycutt offered to reach out to the hazard specific coordinating bodies once the report is done. McCabe said Susan Dowty has been working through the International Code Council (ICC) with a subset of the building code community. The National Institute of Building Sciences (NIBS) and the Building Seismic Safety Council (BSSC) can also identify areas where this can move forward as there is a need for broad buy-in. Mahoney added that through the Performance Based Seismic Design Project, FEMA identified things they want to include in future activities. Mitrani-Reiser said that outside of the Program activities there are a lot of other programs that look at the co-benefits of mitigation actions. Rix asked if those groups are pursuing this independently, or if they are working together. McCabe said people want to see the final report before moving forward. Mahoney added the ICC developed a great roadmap at their meeting in California last summer. They worked with NIBS and coordinated with David Bonowitz, a structural engineer in the Bay Area, and with the Earthquake Engineering Research Institute (EERI) on that activity.

Peek asked if the Program is trying to collaborate with building officials, building managers, school leaders, and health care leaders. McCabe said NIST and FEMA selected people for the Project Technical and Project Review Panels with expertise in some of those areas. John Schelling, Regional Hazard Mitigation Planning Manager in Seattle, is one example. We targeted people at the grass roots level, such as Marissa Aho, who is the Chief Resilience Officer for Houston. We involved people from different perspectives to participate in our workshops and review panel. Workshops were held in five different cities, to get different regional perspectives. Mahoney added that every constituency wasn't captured, for example schools, but are working to include such stakeholders moving forward.

Dowty added that the ICC developed a seismic functional recovery portal on their website (<https://www.iccsafe.org/advocacy/seismic-functional-recovery/>). It includes resources, recent events, and links to the ACEHR website. There is also a video of Ryan Kersting talking about functional recovery, an EERI white paper, and an Immediate Occupancy report from NIST. It is a one-stop shop for anything related to seismic recovery.

ACEHR MEETING SUMMARY – Day Two
March 26, 2020 (1:00-4:00 pm, EDT)

I. Meeting Opening

Rix opened the meeting and covered the goals for the second day of the Committee meeting, which included: learning about the new management structure of the statutory programs in the Materials and Structural Systems Division at NIST, receiving an update of *USGS Circular 1242*, summarizing the role of EERI in NEHRP Post-Earthquake Investigations, and planning for the Committee’s next biennial report .

II. Overview of NIST Statutory Programs

Dr. Judith Mitrani-Reiser gave a presentation of the newly reorganized NIST Engineering Laboratory Statutory Programs: https://nehrrp.gov/pdf/Judy%20Disaster_Statutory_Programs_ACEHR%20mtg_032520_FINAL.pdf

Peek asked what NIST has learned about risk communication and structural failures that have been incorporated into the risk reduction goals of the statutory programs. Mitrani-Reiser referenced NIST’s National Construction Safety Team (NCST) investigative work (<https://www.nist.gov/topics/disaster-failure-studies/national-construction-safety-team-ncst>). Previous investigations focused on better characterization of the hazard itself and structural performance. The NCST Act (the Act) instructs the NCST to also look at building systems, or the non-structural components. Characterizing both the structural and building system performance has, therefore, become a key area of the NCST’s work.

The Act also directs the NCST to assesses the communication strategies employed for building occupants to decide how best to evacuate and/or shelter. The first NCST investigation of the World Trade Center was limited to a couple of buildings. Then NIST investigated the Station Nightclub fire was limited to a single building. Later, the NCST investigation of the Joplin Tornado expanded the scale of what NIST is doing. The current Hurricane Maria NCST investigation expanded that even further. We’re looking at messaging that local leaders provided to households, and are interviewing households to determine which were the most trusted sources of information they used to make decisions. We’re also looking at how failure of telecommunication lifelines led to failure of message delivery.

Finally, the NCST is doing a deep dive on actual injury mechanisms and how building failures caused people to perish. In summary, the type of hazard and scale of the impact has affected the scope of each investigation, but the themes have been consistent throughout.

III. Post-Earthquake Investigations

Updates to USGS Circular 1242

Godt provided an overview on *USGS Circular 1242*, including its history, why it needs to be updated, and recommendations received during the March 2020 National Earthquake Conference listening session: https://nehrrp.gov/pdf/USGS-Godt_Update-1242_ACEHR_25March2020.pdf.

Stewart asked if an NSF funded extreme events reconnaissance (EER) would be considered a NEHRP agency. Meszaros said the EER’s are not federal agencies, but NSF is committed to ensuring good coordination with their distributed community of university scientists. Beroza said that at the last SESAC meeting, he heard how USGS’s ability to respond to the Ridgecrest earthquake was stretched to the limits. He asked if USGS has the capacity to

respond to another earthquake like this. Godt has since explained that Beroza's remarks likely referred to a limitation in their IT infrastructure and not about an agency's general response to the event. The USGS web pages were down for several hours following the first shocks, and then again after secondary shocks because there was so much traffic on their site. These issues are currently being addressed by USGS. Godt reminded the audience to keep in mind that the Ridgecrest earthquake occurred over a holiday weekend during July 4th, which may also explain some of the IT infrastructure overload. The USGS is working with the NEHRP agencies to develop the most efficient ways to get information to decision makers immediately following an event. The combination of stronger IT infrastructure and better information sharing processes will ensure decision makers across NEHRP agencies are well prepared for future earthquake events.

Peek asked if USGS is thinking about using virtual reconnaissance, and people who want to volunteer to work from their desks. Godt replied we know the capacity of people going to the field is really limited. Harnessing broad capacity from virtual, citizen science, and social media is a challenge, but worth thinking about. The plan that is being updated may include those activities to fill some of the gaps discussed. Questions include:

- How do you get that synthesized, distilled and communicated to decision makers on the ground as things are unfolding?
- How do we get scientific information inserted to emergency response?

Godt added that the *USGS Circular 1242* talks about learning from earthquakes for future challenges rather than informing emergency response.

Federal Coordination and Tabletop Exercises

Harris presented a framework for federal coordination and tabletop exercises. The framework includes questions about coordination between NEHRP agencies and partners, funding, and site access. These factors affect the level of federal agency reconnaissance and coordination. A key question is how we measure the effectiveness of tools, products, and knowledge we have to improve regional or community resilience.

He showed a photo he took of the Torre O'Higgins office building in Concepción, Chile while doing reconnaissance with ASCE after the 2010 earthquake. It was brand new in 2008 and then suffered extensive damage two years later rendering it unusable. They deconstructed it down to the eighth floor and rebuilt it. Harris suggested this is a very good measure of community resilience. Typically, one-, two-, and three-year reporting is done following an earthquake event, but we need to consider going back after 10 years to see what recovery steps are taken by the community to regain "normalcy" as this was an example of what can happen over time.

NIST is currently discussing a two-level reconnaissance. The *USGS Circular 1242* describes Program-level reconnaissance where all NEHRP agencies work together to share information and facilitate the reconnaissance to the community or region. There are times, however, when agencies conduct their own mission specific reconnaissance. NIST, for example, participated in reconnaissance missions to Chile and Japan with EERI and ASCE, and also led the reconnaissance to Cook Inlet in Anchorage. NIST is contemplating how agency-level reconnaissance efforts fit with a coordinated NEHRP-level reconnaissance. For example, the NCST may call on the Program to look at the failure of a particular building.

Harris said the Program is considering how to strengthen federal coordination. NIST, through NEHRP, would like to collaborate with other agencies that do reconnaissance. While USGS does a great job coordinating the calls at

the beginning of an earthquake event, there are other agencies that do work we don't hear about until there's a conference or workshop. For example, The Federal Highway Administration was in Alaska one day after the Cook Inlet earthquake to provide their Departments of Transportation with funding to fix roads. Another agency we'd like to collaborate with is the Department of Health and Human Services (HHS), especially the Continuity of Emergency Medical Operations Program which ensures hospitals can continue to function. Harris supported Godt's idea about having the Applied Technology Council (ATC) lead the NEHRP agencies and partners in the development of the update to the *USGS Circular 1242*.

Harris suggested that if ATC were to manage the update, they could also set up a tabletop exercise with FEMA. There are several exercises in the works, and the Program could join forces and incorporate the outcomes into the update. McCabe said NIST considered the Salt Lake exercise scheduled in January of 2021 as a great opportunity to test what we know and don't know. Mitrani-Reiser added that over the past couple of years all the federal agencies that have disaster research programs meet once per year to discuss how to collaborate. The HHS has been one of our closest collaborators providing access to information on continuity of health care services in schools and shelters regardless of hazard type. She expects that this strong relationship will continue, while NIST is actively engaging with other agencies to bring into the working group. Examples of future partners include the National Institutes of Health Disaster Research Response Program called DR2 (<https://dr2.nlm.nih.gov/training-exercises>); they ran an exercise in Houston prior to Hurricane Harvey. NIST has also been discussing a tabletop exercise in 2021, in collaboration with the National Institute of Environmental Health Sciences and the University of Washington. They have a strong existing framework NIST can use (<https://www.washington.edu/populationhealth/strategic-areas/furthering-humanitarian-assistance-and-disaster-relief/>).

Heidi Tremayne referenced the Cascadia Rising exercise scheduled for 2022 (<https://mil.wa.gov/asset/5cfa9f459ddb7>) as a good opportunity to strengthen federal coordination. Mike Mahoney commented that the Salt Lake City exercise in 2021 is a federal-level exercise. That means it's one step below a national level exercise, which is done every two years. The "Great Salt Shake" is being planned right now (<https://www.shakeout.org/utah/>). If the Program wants to be a player, we need to get to the table soon, but we are not there now. If we want to continue to go out into the field, we need to coordinate up front. Until recently, FEMA ran disaster programs through the Federal Coordinating Official (FCO), but now the FCO reports to the Department of Homeland Security. Getting access to a site after a disaster is much different now than in the past, and this update is desperately needed.

Rix said Goal 4 of the draft NEHRP Strategic Plan update has to do with post-earthquake response. He asked if there are some connections between Goal 4 and the updated *USGS Circular 1242*. Harris said yes, there is continuity between the plan, the circular, and agency policies.

Role of EERI in NEHRP Post-Earthquake Investigations

Heidi Tremayne, Executive Director of EERI, continued the discussion describing EERI's mission, their role in the *USGS Circular 1242*, responses to recent earthquakes, and future Program needs and opportunities: https://nehrrp.gov/pdf/Heidi%20presentation%20to%20post_ACEHR%20mtg_03-26-20.pdf).

Dr. Lucy Arendt asked what is needed to enable greater focus on longer term resilience reconnaissance in addition to the more traditional reconnaissance undertaken in the near-term after an earthquake. Mitrani-Reiser said there is a challenge in traditional funding resources and the timing for typical grants to do longitudinal studies in general. NIST manages internal research objectives and plans to tackle things internally

and in cooperation with grants that have longer time windows. The NIST Center of Excellence (COE), headquartered at Colorado State University (<http://resilience.colostate.edu/>) was funded for five years and was recently renewed for another five years. NIST and the COE are working together to tackle our longitudinal studies. The NIST COE needs data to validate and support community resilience modeling; modeling platforms being developed by other researchers also need empirical data for validation. This longitudinal effort is focused in Lumberton, North Carolina and tracking household dislocation. NIST and the COE returns to the same area year-after-year, and documents the recovery of households and businesses, and the decision making regarding whether they shut down or returned. NIST and the COE would lose some of that information if they just did immediate reconnaissance and didn't come back year after year. NIST and the COE is training the next generation to consider the long tail of an event's recovery. These strategies are being developed regardless of hazard type, and are shared across hazard programs.

Rix asked for more information about the business resilience pilot for the Anchorage earthquake. Tremayne responded that EERI assessed how to best measure business resilience over time through reconnaissance methods. EERI developed a survey for businesses and piloted it for the South Napa earthquake. They have since deployed it in AK where they surveyed a series of businesses and it can be repeated over time. The survey is built using a question bank which can be applied to different earthquakes. People from several disciplines and perspectives developed it, and reviewed by an Institutional Review Board. EERI has talked to a few Chambers of Commerce so they may modify it for different groups in the future. EERI spent five years developing the question bank and now have enough surveys to develop case studies in business resilience and recovery. EERI will continue this work so it will evolve over time.

Dr. Greg Deierlein said that advances in earth science are made possible by data streams from motion sensors that had a limited set of data fields. He asked if there is any work on high resolution models. Mitrani-Reiser said that simulated and remotely sensed data can both be used before boots are on the ground. These two sources are already integrated, even though there's a lot of room for improvement. There's still a lot of capability to help the teams going out in the field to scope their work. Mitrani-Reiser said that they've been working with various tools at NIST in each of their hazard programs and are also improving our database technology to release to the public and make the data useful. We need a very clear understanding when NIST receives data from other agencies about the permissions that accompany the data.

IV. Preliminary Planning for the 2021 ACEHR Biennial Report

Rix gave an overview of how the reports have been generated in the past and asked the Committee what they believe the broad themes should be for the next report.

Peek suggested there is a challenge to continue advocating for earthquake risk reduction activities in the face of unemployment and other uncertainties. McCabe recommended having a factual, somewhat dispassionate discussion in the report about the need for investment in science, engineering, and community.

Rix suggested the brain drain that we discussed in the 2019 report is clearly not going away and should also be one of the themes. Kersting said that Functional Recovery is also not going away. Arendt added that during this pandemic, communities must make decisions about what's best for them. There are some common cultural norms around what people consider essential and we can draw some lessons from where we are most interested.

Dr. Lisa Grant Ludwig said her background is in earthquake science, but she has been working recently as the Chair of Population and Disease Prevention at the University of California Irvine (UCI). The UCI was several weeks ahead of everyone else in terms of taking action and preparing for the worst, and there are some overlapping themes with earthquakes. There are big impacts in terms of appreciation for low probability/high impact events, and we can learn from how people are responding. For example, entire university communities in California where there are schools of medicine/nursing have mobilized to find and provide personal protective equipment for friends and colleagues who are literally on the front lines. Would a similar phenomenon occur in the aftermath of an earthquake? There could be people supporting those responding, even by people who were affected by the earthquake.

V. Next Meeting

The next meeting will be planned for early Fall (second half of October or early November).

VI. Meeting Closure

Harary thanked the Committee for their wonderful contributions. He suggested it's been one of the best ACEHR meetings. The meeting adjourned at 4:00 pm EDT.