# NEHRP Responses to 2023 ACEHR Report Recommendations[1]
# NEHRP Effectiveness for FY22-23

NEHRP responses are provided below in terms of "Response and Planned Action" representing a consensus of the Program agencies, along with additional specific agency inputs to further inform ACEHR. In crafting the response, Program agencies considered how a programmatic or procedural recommendation supports the FY22-FY29 NEHRP Strategic Plan (see 'Notes') and the anticipated implementation time frame. In addressing the time frame, notations used are: short term (ST), medium term (MT), long term (LT), and ongoing (ONG). These terms will be defined during the ACEHR meeting.

| Recommendation | Type | Time Frame | Notes |
|---|---|---|---|
| 1 Understand and Communicate the Research-to-Practice Pipeline | Programmatic | | |
| a. Clarify the research-to-practice pipeline for state, local, territorial, and tribal governments, and other stakeholders (aligns with GAO-22-105016 Recommendation 7). | | see response below | Supports S.P. Focus Area 6, Goal 3, GAO |
| b. Develop a communication strategy as part of NEHRP's upcoming Management Plan, which may include for example, plans for enhanced and inclusive communication and public outreach regarding:<br>(1) seismic hazards;<br>(2) expected seismic performance of the built environment; and<br>(3) the opportunities and challenges associated with earthquake early warning systems. | | MT | Supports GAO |
| c. Act to ensure that earthquake hazard mitigation programs are effectively designed to serve the whole community, including members of vulnerable populations. | | ONG | Supports S.P. |
| d. Prioritize research regarding social vulnerability to earthquakes and related hazards. | | ONG | Supports S.P. Focus Area 6, Goal 1 Objs. 4 and 5 |
| e. Prioritize research comparing and contrasting the social equity aspects of safety-based and recovery-based earthquake performance of the built environment (in particular assessing buildings and lifeline infrastructure). | | ONG | Supports S.P. Focus Areas 2, 3, 5, and 6; Goal 1 Obj. 4 and 5; Goal 2 Objs. 8 and 9 |

**Response and Planned Action:**

**a)**

The Program agencies appreciate the invitation to clarify important strategies by which the Program ensures that new knowledge is created, translated into useful forms, and disseminated for use by state, local, territorial,

[1] https://www.nehrp.gov/pdf/2023%20ACEHR%20Report%20-%2030%20Sept%20(FINAL).pdf

and tribal governments, and other stakeholders who can use these products to reduce vulnerability and increase resilience to earthquake hazards.

The Program agencies seek to ensure that new knowledge becomes incorporated into easily discoverable products that are useful to state, local, territorial, and tribal governments (SLTTs). In general, it is not expected that SLTTs engage directly with research findings to improve resilience; rather it is expected that the Program agencies encourage and participate in the translation of new knowledge into improved tools, guidance, and codes/standards and that they also support the diffusion and uptake and adoption of those products.

It is important to emphasize that the research-to-resilience-practice pipeline is neither controlled nor solely resourced by federal agencies. Entities at many levels cooperate for broad impact. University-, government-, and NGO-based researchers conduct research and disseminate results. Professional associations seek to find and share important advances, tools, and techniques to improve design and construction practices. State and local governments decide what codes and standards to adopt. Nongovernmental organizations choose to share training materials and other tools to help communities reduce risks. The Program agencies work to inform, support, and strategically engage with such entities in various ways.

Each Program agency plays a somewhat different role in the research-to-practice pipeline, given their missions, resources, and capabilities. In coordination, the agencies improve the speed and reach of the translation and diffusion processes. Generally:

- ☐ NSF funds fundamental science and research projects in geoscience, engineering, computer science and social sciences as well as centers in various fields chosen for their potential for innovative advances in resilience.
    - NSF-funded fundamental research results are typically shared through:
        - Conferences, workshops, and white papers, including major scientific and professional association conferences and special-topic workshops. For example, the symposium to discuss findings of the November 30, 2018 Anchorage, Alaska earthquake in which scientists and engineers engaged directly with state, local and federal officials with the aim to develop best practices from the lessons learned after this earthquake.
        - Peer reviewed publications in technical/scientific journals such as *Earthquake Spectra* or the *Bulletin of the Seismological Society of America*.
        - Posting of peer-reviewed journal articles and juried conference papers in NSF's Public Access Repository Database, which has been required for research awards made after January 2016.
    - Other NSF-funded activities target direct community engagements, such as:
        - Engagement/collaboration with advisory boards and other community partners. For example, the Board of Advisors for the NSF-funded large, outdoor shake table at the University of California San Diego has helped the facility expand its industry-academia partnerships, which have led to changes in building codes.
        - Strategic public engagement activities and educational activities. For example, the disaster-relevant training modules created by the NSF-funded CONVERGE center at the University of Colorado Boulder are based on social science findings. These have been completed by more than 9,500 individuals, including members of the International Association of Emergency Managers, who receive general management training credits for completion.
        - "Industry-University Cooperative Research Centers (IUCRC) where researchers, industry groups, and government agencies collaborate extensively to set use-inspired research agendas and ensure more timely uptake of research results.
- ☐ USGS uses new data and knowledge, including information from both internal and external applied research, to produce a suite of informational earthquake products, including hazard maps, detailed descriptions of real time seismicity, rapid estimates of earthquake impact, earthquake scenarios and exercises, and more recently ShakeAlert earthquake early warning.
    - USGS products are typically delivered directly to the public and stakeholders through websites The earthquake.usgs.gov pages are among the most heavily trafficked sites in the Federal Government, receiving about 40 million requests on a typical day, with higher traffic spikes following significant earthquakes.

- Through the National Seismic Hazard Model update process, the USGS engages with stakeholders via a series of public-facing workshops and forums, gathering feedback to improve the models, and socializing model changes that impact how building codes are implemented.
- New or updated USGS products, like the recent 2023 update to the NSHM, are generally accompanied by a communications and media campaign to inform stakeholders and the public.

☐ NIST conducts and supports structural and geotechnical engineering and social science research to improve earthquake performance of the built environment to lessen deaths, injuries, and damage, and improve post-earthquake recovery of key societal services.

- NIST research products are typically disseminated via professional conferences, journal articles, and NIST-published reports and are targeted to members of the earthquake engineering community and associated professionals interested in advancing science and engineering practice for natural hazards risk mitigation. NIST focuses its efforts on key technical advances to codes, standards, and guidelines that can eventually result in improved performance of the built environment for the American public. NIST personnel are active in standards development organizations and processes to update industry-standard procedures and best practices for buildings (both new and existing) as well as critical lifelines infrastructure. For example, a pre-standard developed by NIST for fiber reinforced polymers will soon be balloted by the American Concrete Institute 369 Committee. Also, NIST funded a Disaster Resilience Research Grant to Colorado University-Boulder and Texas A&M that lead to development of the recovery assessment tool that got adopted by FEMA P-58.

☐ FEMA works with national consensus processes to translate NEHRP research results into code resources and uses research results to support the preparation, maintenance, and wide dissemination of seismic-resistant design guidance, publications, tools, and training, which is generally used by design professionals for improving seismic resilience. FEMA also uses its guidance, including the *FEMA NEHRP Recommended Seismic Provisions,* to inform building codes and standards development and update cycles to establish our nation's model building codes which are then adopted at SLTT levels to reduce losses from earthquakes. FEMA shares its products with intended users, including design professionals, through outreach such as:

- FEMA National Earthquake Technical Assistance Program
- FEMA.gov and FEMA Building Science Resource Library
- Conferences, workshops, webinars
- Gov Delivery listserv (30,000 members)
- FEMA public relations campaigns
- Papers and articles in professional journals
- FEMA participates in building code and standards development and update processes such as ASCE 7 and the I-Codes which are made through a transparent and inclusive consensus-based process that complies with the OMB Circular A-119 which are then adopted at local SLTT levels to reduce losses from earthquakes. (See this link for a helpful infographic explaining the code development process.)

Finally, the Program agencies know that it is especially important to make efforts to improve the nation's awareness and knowledge about earthquake risks in the moments, days, and months following damaging earthquakes when attention to earthquake risks and motivation to reduce them tend to be high. NEHRP officials respond to press inquiries following major earthquakes, explaining our earthquake products and risk reduction activities. Program agency officials coordinate with university-based researchers and NGO organizations, to collect ephemeral data soon after earthquake occur, so that lessons be learned for future improved resilience. Per USGS post-earthquake investigation guidance, NEHRP ensures that an earthquake clearinghouse is established where all relevant data will be available to emergency responders as well as to researchers in a timely fashion, and coordination on reconnaissance and follow-up research activities can be conducted.

For significant earthquakes that results in activation of the NEHRP Post-Earthquake Investigation Program, summary workshops are periodically convened where key findings and lessons are aggregated, made available publicly, and shared via follow-on publications. Domestic and international earthquakes offer researchers with exceptional real-world data where our state-of-the-art knowledge is tested, including on:

- performance of past and current codes and standards guidance,
- best practices for emergency communications, response, and protective action,
- understanding of soil-structure interactions and ground deformation
- technologies for data capture, translation, and communication, and

- needs for hastening critical recovery and preserving social wellbeing.

Additional Agency Notes: None

**b)**

The Program agencies are committed to developing a comprehensive communication strategy to strengthen the impacts of the Program. This strategy will be integrated into the upcoming Management Plan, identified as a medium-term action. Depending on the programmatic activity, the Program agencies will employ the communication strategy to disseminate activity results to enhance outreach and accessibility.

Additional Agency Notes: None

**c)**

The Program agencies appreciate the importance of promoting resilience for particularly vulnerable populations and commit to including this emphasis in programmatic activities where applicable. Additionally, the Program agencies will raise issues where applicable in work with other groups to promote opportunities for progress in this regard. Broadly speaking this theme resonates in the FY22-FY29 NEHRP Strategic Plan.

Additional Agency Notes: None

**d)**

The Program agencies agree that special attention to underserved populations and those who are consistently left without authority for decision-making and influencing risk mitigation is needed. Research that integrates engineering with social, behavioral, public policy, and economic sciences in an equitable manner is thus of critical importance. As such, understanding social, behavioral, public policy, and economic factors driving risk reduction measures and recovery planning and practices are supported broadly by the FY22-FY29 NEHRP Strategic Plan and several Program-Identified Focus Areas. Consequently, updates on ongoing and future programmatic activities supporting social equity, as opportunities and funding permit, will be provided during the Program update on progress supporting the NEHRP Strategic Plan.

Additional Agency Notes: None

**e)**

The Program agencies agree that resilience-driven policies and practices must address the potential for disproportionate impacts on different populations to optimize earthquake resilience of a community. This issue is especially important with emerging recovery-based performance objectives for functional recovery design. Broadly speaking, this requires focused research on social, behavioral, and economic science related to risk mitigation to better understand the social impacts of the integration of safety-based and recovery-based strategies in policies and practices to support community resilience. For codified engineering practices to support resilience, performance codes must adequately address societal expectations (see Recommendation 2 for more information). There are likely cases where available resources would be better used to mitigate risk through the prioritization of safety-based mitigation rather than recovery-based for construction of buildings and lifeline infrastructure. Promoting impacts of this research would ensure that decision makers have the information they need to evaluate available tradeoffs. As such, understanding social, behavioral, public policy, and economic factors driving risk reduction measures and recovery planning and practices are supported broadly by the FY22-FY29 NEHRP Strategic Plan and several Program-Identified Focus Areas. Consequently, updates on ongoing and future programmatic activities supporting social equity, as opportunities and funding permit, will be provided during the Program update on progress supporting the NEHRP Strategic Plan.

Additional Agency Notes: None

| Recommendation | Type | Time Frame | Notes |
|---|---|---|---|
| 2 Build on Functional Recovery Efforts Toward Community Resilience | Programmatic | | |
| a. Existing buildings | | ONG | Supports S.P. Focus Areas 2 and 3; Goal 2 Objs. 8 and 9 |
| i. Prioritize research on methods for retrofitting existing buildings to enable functional recovery. | | | |
| ii. Prioritize research on methods for achieving functional recovery of existing buildings with benefit-cost ratios persuasive to those who own and manage existing buildings. | | | |
| iii. Prioritize communication and guidance for implementing seismic retrofit projects designed to achieve functional recovery. | | | |
| b. Lifelines | | ONG | Supports S.P. Focus Areas 2, 3, and 5; Goal 2 Objs. 8 and 9 |
| i. Restore NEHRP's commitment to and collaboration with appropriate partners to re-energize the American Lifelines Alliance. | | | |
| ii. Support stakeholder meetings and prioritize research to inform the development of lifeline design and retrofit standards that promote functional recovery of lifelines. | | | |

**Response and Planned Action:**

The Program agencies agree that a key component needed to enhance earthquake resilience of a community is resilience-based engineering strategies for the built environment that utilize stakeholder-driven recovery-based targets. Functional recovery design is a strategy currently being developed for the built environment whose goal is to reduce potential downtime of community-prioritized structures and basic services provided by lifeline infrastructure on which a community relies. Further, the services provided by lifeline infrastructure are often vital to the success of post-earthquake response and recovery efforts. Consequently, there is a need to continue development and implementation of resilience-based design and associated recovery targets that address post-earthquake re-occupancy and reduced functional recovery time for new and existing buildings as well as lifeline infrastructure. As such, resilience-based engineering of new and existing buildings and lifeline infrastructure and related activities are supported broadly by the FY22-FY29 NEHRP Strategic Plan, and several Program-Identified Focus Areas were included to advance functional recovery design procedures and metrics. Consequently, updates on ongoing and future programmatic activities supporting resilience-based engineering and functional recovery design, as opportunities and funding permit, will be provided during the Program update on progress supporting the NEHRP Strategic Plan.

In regard to lifelines in (b), the following actions will be implemented by the Program agencies.

The NEHRP Office at NIST will continue its active participation with an ongoing effort led by the National Institute of Building Sciences (NIBS), with the involvement of other key organizations, that could lead to re-energizing a lifelines-focused organization. This effort recently led to a NIBS-hosted workshop for federal

agencies and a congressional briefing that addressed the importance of lifelines in hazard resilience. The NEHRP Office at NIST will seek input from the Program agencies as needed.

Additional Agency Input: The Program agencies have made significant investments in the past few years to support advancement of functional recovery design as provided below:

**a) Existing Buildings**

Establishing a solid foundation for targeting functional recovery performance in new buildings initially allows the Program to better understand the feasibility and cost/benefit tradeoffs for application to existing buildings. Using new buildings to develop the technical capacity for functional recovery performance, and the mechanisms to implement that performance goal via the codes and standards processes permits an efficient implementation into practice. It is important to emphasize that it may not be appropriate to retrofit an existing building to address functional recovery but may likely be more cost effective, and ethical, to direct resources towards retrofitting for life safety.

Given the nascent stage of functional recovery development for new buildings, there are some parallel efforts to support functional recovery for existing buildings that have been initiated:

- NIST has published a framework to assess cost-effectiveness of recovery-based design (NIST SP-1277) that identifies what items should be included in analysis and indication of gaps needed for future improvements,
- FEMA continues to develop its P-58 series for the Seismic Performance Assessment of Buildings, with performance being measured in terms of the probability of incurring casualties, repair and replacement costs, repair time, selected environmental impacts, and unsafe placarding. The FEMA P-58 computational methodology itself is not specific to new or existing buildings. The backbone of the method is the FEMA P-58 fragility database. To the extent that an existing building is made up of components that are covered by the existing FEMA P-58 fragility database, the methodology could be used on that building,
- NIST has established a cooperative agreement with CU-Boulder and Texas A&M to assess the feasibility of achieving functional recovery through seismic retrofit of existing buildings. This work has produced two journal publications:
    - https://journals.sagepub.com/doi/10.1177/87552930231197669 and
    - https://ascelibrary.org/doi/abs/10.1061/JPCFEV.CFENG-4395,
- NIST has a new project in FY24 focusing on improving fragility data for nonstructural components, applicable to recovery time estimation for existing and new buildings, and
- NIST has awarded a grant to UCSD to develop, validate, and assess practical design method support resilience-based design to reduce the cost and impact of disasters on the built environment.

**b) Lifelines**

Recovery of lifeline systems is a complex problem that requires long-term, multi-party, and coordinated efforts. There are four key accomplishments to note regarding this topic:

- NIST developed a two-volume report that provides lifelines system owner/operators a framework for initiating design of functional recovery for their water, wastewater, or electric power systems (NIST SP 1310 and 1311),
- FEMA is developing a framework to establish lifeline infrastructure system service recovery objectives for seismic resilience (FEMA P-2234),
- NIST hosted a national stakeholder workshop on functional recovery of transportation systems (NIST SP-1295), and
- Creation of an investment planning tool for enhancing post-disaster performance and improving resilience for highway networks (currently under review).

| Recommendation | Type | Time Frame | Notes |
|---|---|---|---|
| 3 Promote and Expand the Use of Earthquake Scenarios | Programmatic | | |
| a. Promote and expand the use of earthquake scenarios to: | | ONG | Supports S.P. Goal 2, Obj. 6; Goal 3, Obj. 13 |
| i. Understand earthquake impacts, including on vulnerable communities. | | | Supports S.P. Focus Area 6; Goal 1, Objs. 4, 5 |
| ii. Enhance earthquake education and community engagement, emergency drills, and exercises to promote effective earthquake awareness. | | | Supports S.P. Goal 3, Obj. 13 |
| iii. Improve risk assessments, and mitigation, response, and recovery planning. | | | Supports S.P. Goal 2, Objs. 6, 8, 9 |

**Response and Planned Action:**

The Program agencies agree that an earthquake scenario is a powerful tool to help understand the potential consequences of a large-scale earthquake, the distribution and magnitude of impacts to a community, and the physical and societal vulnerabilities to such consequences. Earthquake scenarios play a fundamental role in enhancing education and outreach activities to support community preparedness, response, and recovery. As such, earthquake scenarios and related activities are key features in the FY22-FY29 NEHRP Strategic Plan, specific sections identified in the 'Notes' section above. Consequently, updates on ongoing and future programmatic activities supporting earthquake scenarios and related activities, as opportunities and funding permit, will be provided during the Program update on progress supporting the NEHRP Strategic Plan.

Additional Agency Notes: USGS is regularly involved in national earthquake exercises managed by FEMA, as scientific experts on USGS earthquake products, impact, and aftershock forecasts. Maintaining this relationship is a priority for both FEMA and USGS. USGS also prioritizes improving earthquake impact products that are the foundation of many of these exercises, including ShakeMap, ShakeCast, and PAGER.

See the USGS Scenario database – https://earthquake.usgs.gov/scenarios/

See the FEMA library of Hazus-generated risk assessments – https://hazards.fema.gov/hazus-loss-library/library

See the FEMA National Level Exercises (NLE) from previous years – https://www.fema.gov/emergency-managers/planning-exercises/nle/previous, including NLE 2022 for a large rupture along the Cascadia Subduction Zone (CSZ) fault line

Useful resources on scenarios and underlying data and products are also included here: https://cbworden.github.io/shakemap/manual3_5/shakemap_archives.html

| Recommendation | Type | Time Frame | Notes |
|---|---|---|---|
| 4 Prioritize Essential Research and Problem-Focused Studies | Programmatic | | |
| a. Central and Eastern United States (CEUS) Research | | ONG | Supports S.P. Goals 1 and 2 |
| i. Prioritize research on the needs of CEUS earthquake risk reduction, including basic research to improve source characterization, ground motion modeling, building code provisions, and lifeline infrastructure vulnerabilities. | | | |
| b. Research Subduction Zone (SZ) Earthquakes and Hazards | | ONG | Supports S.P. Focus Area 1 |
| i. Prioritize essential research on SZ earthquakes and their impacts on the built environment. | | | |
| ii. Prioritize development and implementation of offshore sensors and datasets to facilitate research advances. | | | |
| iii. Identify opportunities for more collaboration between the agencies and the academic community around SZ earthquake hazards, such as the use of offshore sensors for both research and earthquake early warning. | | | |

**Response and Planned Action:**

The Program agencies agree that focused research is needed to make impactful innovations to advance seismic risk reduction in a) regions of the central and eastern United States and b) regions susceptible to subduction zone earthquakes. Outcomes of research will allow the Program to implement improved hazard assessments, risk mitigation and communication strategies, and develop products for situational awareness for these regions. In regard to item (a), programmatic activities focused on central and eastern U.S. regions, including the impacts of multiple hazards on preparedness, response, and recovery strategies, are supported broadly the FY22-FY29 NEHRP Strategic Plan. Likewise, advancing earthquake science for subduction zone regions is a Program-Identified Focus Area in the Strategic Plan. Consequently, updates on ongoing and future programmatic activities supporting seismic risk reduction in these regions, as opportunities and funding permit, will be provided during the Program update on progress supporting the NEHRP Strategic Plan.

Additional Agency Input: The Program agencies have made significant investments in the past few years to support advancement of seismic risk reduction within these two topical areas as provided below:

**a) Central and Eastern United States (CEUS) Research**

NSF (with NRC and DOE) support the USArray in the central U.S. (http://www.usarray.org/ceusn). USGS subsequently adopted and integrated the N4 seismic network for the CEUS into the Advanced National Seismic System (ANSS). USGS has completed a significant body of research related to the recent update and release of the National Seismic Hazard Model (e.g., amplification caused by site effects associated with Gulf and Atlantic Coastal Plain sediments). Both NSF and USGS have funded significant research and monitoring associated with induced seismicity in the CEUS over the past decade, and these activities continue – including, most recently, in association with a magnitude 5.1 earthquake near Prague, Oklahoma, where USGS deployed strong motion sensors in collaboration with ANSS partners at the Oklahoma Geological Survey. NSF has also funded research in the region to investigate the effects of geologic complexity on induced seismicity. As another example, NSF also funded a “RAPID” proposal associated with the 2021 Sparta, North Carolina earthquake, leading to perhaps the first-ever observations of surface rupture in the CEUS (e.g.,

https://par.nsf.gov/servlets/purl/10386208). Several new catalyst geohazards centers are located in the CEUS. The USGS also runs an external grants research panel specifically focused on the CEUS (https://www.usgs.gov/programs/earthquake-hazards/science/external-grants-overview). NIST supported a workshop focused on seismic practice needs in the CEUS, which resulted in NIST GCR 23-041: *Seismic Practice Needs for Buildings and Lifeline Infrastructure Located in the Central and Eastern United States* (2023). This report summarizes the issues presently impeding advancement of seismic practice in the CEUS and presents a roadmap of research and practice-related projects to address the identified issues. In addition, NIST supported the designs of several existing and new steel buildings located in the CEUS to be used for research and which are hosted on the building design database on www.nehrp.gov. FEMA continues to support its CEUS earthquake regions and the Central United States Earthquake Consortium.

The Scientific Earthquake Studies Advisory Committee (SESAC) will receive an overview of recent and ongoing USGS activities in the CEUS at the next SESAC meeting in May 2024.

**b) Research Subduction Zone (SZ) Earthquakes and Hazards**

NSF announced in September 2023 that a new subduction zone-focused research center, the Cascadia Region Earthquake Science Center (CRESCENT, https://cascadiaquakes.org/), has been awarded approximately $15M over the next 5 years. NSF also continues to invest in the SZ4D group (https://www.sz4d.org/). Similarly, USGS provides significant in-kind contributions to both groups via the involvement of its scientists in a variety of working groups, committees, and leadership positions within the structures of these organizations. The Cascadia CoPes Hub (https://cascadiacopeshub.org/) is another NSF-funded research center with a subduction zone related focus, working to help Pacific Northwest coastal communities prepare for and adapt to coastal hazards.

USGS also continues significant internal investment in Subduction Zone Science(SZS), guided by the USGS Subduction Zone Science Plan (https://pubs.usgs.gov/publication/fs20173024), with approximately $2M in annual appropriated funding to SZS activities, and additional annual one-time investments in seafloor geodesy (close to $2M over the past several years, for the acquisition of a new waveglider, and several new GNSS-A seafloor monuments), lacustrine paleoseismology, and Distributed Acoustic Sensing technology research. In Fiscal Years 2022-2025, budgetary increases for subduction zone science were included in the President's budget requests but were ultimately not appropriated in FY22-FY24. Subduction zone science is also prioritized in the USGS external grants annual research priorities (https://d9-wret.s3.us-west-2.amazonaws.com/assets/palladium/production/s3fs-public/media/files/FY24-Research-Priorities.pdf).

Finally, NSF has continued to fund development and deployment of seafloor optical strain meters, geodetic, and magnetotelluric instrumentation, as well as recently funding additions to the Ocean Observatories Initiative oceanic cable (https://new.nsf.gov/news/enabling-key-oceanographic-science-21st-century), which among other research targets will add broadband and strong motion seismometers to nodes on the cable, providing data that may have exciting applications to earthquake early warning.

| Recommendation | Type | Time Frame | Notes |
|---|---|---|---|
| 5 Review International Earthquake Response and Lessons Learned | Programmatic | | |
| a. Review and report to ACEHR lessons learned from the 2023 Kahramanmaraş, Türkiye Earthquake Sequence, including an after-action review of how the draft revision of USGS Circular 1242 was used, with attention to coordination across agencies and sectors and the speed of response. | | ST | Supports S.P. Goal 4, Obj. 15 |

**Response and Planned Action:**

The Program agencies welcome the opportunity to brief ACEHR on NEHRP's post-earthquake investigation coordination activities associated with the 2023 Turkey-Syria earthquake sequence. Recently, these coordination efforts were the subject of a special session at the Fall 2023 American Geophysical Union meeting (https://agu.confex.com/agu/fm23/meetingapp.cgi/Session/211993). The following additional actions will be implemented by the Program agencies.

1) USGS, as lead of the NEHRP Post-Earthquake Investigations Program, will lead, with collaboration from the other Program agencies, several special sessions at the upcoming annual meeting of the Earthquake Engineering Research Institute in April 2024 (e.g., https://2024am.eeri-events.org/program/new-call-for-poster-abstracts-general-and-turkey-earthquakes-anniversary). This conference, and the special NEHRP-related events, will represent the "1-year on" meeting called for in NEHRP post-earthquake investigation coordination plan (USGS Circular 1242 and its upcoming replacement, soon to be published).
2) Delivery of the after-action review summary to ACEHR will take place at an ACEHR meeting in FY25.

Additional Agency Inputs: None

| Recommendation | Type | Time Frame | Notes |
|---|---|---|---|
| 6 Prioritize Research on Earthquake Insurance to Make It More Affordable and Attainable | Programmatic | | |
| a. Prioritize research on innovative approaches to making earthquake insurance more affordable and attainable, working with public agencies and private companies. | | ST/MT | Supports S.P. Goal 1, Obj. 5 |

**Response and Planned Action:**

The Program agencies agree that earthquake insurance coverage is a challenging issue, notably in regions that have not experienced a large earthquake in generations. Outside of indirectly supporting the industry through earthquake-damage claims reduction by advancement of building codes, risk assessment tools, and cost-benefit analyses, the Program has not been directly involved in financial computations nor regulating the affordability of earthquake insurance. The following actions will be implemented by the Program agencies.

Our engagement with the earthquake insurance is supported by Objective 5 in the FY22-FY29 NEHRP Strategic Plan. Seismic risk reduction is only possible if preparations are made, vulnerabilities are reduced, and recovery processes are carefully considered and planned. As such, private and public sectors (e.g., the National Association of Insurance Commissioners) could help with issues related to federal, state, and local financial mechanisms, such as the availability and affordability of earthquake insurance at the national level.

In the short term, the Program will invite external presentations to provide information on the earthquake insurance industry, current challenges, and potential innovations.

In the medium term, pending available resources, the Program will support a workshop to assist in identifying and prioritizing needed research to support earthquake insurance affordability and attainment (e.g., https://centralusquakesummit.org/about/). Whether a workshop is a Program-wide or a specific agency-motivated workshop will be dependent upon programmatic needs.

Additional Agency Inputs: While FEMA does have an allowable activity in their NEHRP State Assistance Grant Program Notice of Funding Opportunities regarding the promotion of earthquake insurance, FEMA currently does not have the necessary resources to enable it to prioritize research on earthquake insurance.

| Recommendation | Type | Time Frame | Notes |
|---|---|---|---|
| 7 Update the NSF Synthesis Report | Procedural | | |
| a. Update the 2017 "NSF Synthesis Report" every other year to coincide with the ACEHR biennial report cycle. The report should be similar to that generated in 2017 and highlight NEHRP-specific funded research. | | ST | |

**Response and Planned Action:**

NSF appreciates this recommendation intended to ensure that ACEHR has a sound appreciation for the NSF's role in and contributions to NEHRP as it undertakes to develop its biennial reports. The following action will be implemented by NSF.

Considering the current timeline for ACEHR, NSF will deliver an updated synthesis report, as described above, in time for ACEHR to begin developing its FY23-FY25 report outline, and then every two years thereafter. Delivery of this NSF report will be determined in consultation with ACEHR.

Additional Agency Input: None

| Recommendation | | Type | Time Frame | Notes |
|---|---|---|---|---|
| 8 | Finalize and Disseminate the NEHRP Biennial Report | Procedural | | |
| | a. Finalize and disseminate the latest draft of NEHRP's Biennial Report so that it may be considered by ACEHR as it prepares its own biennial report. | | ST | |
| | b. Provide ACEHR members with the annual or biennial budget numbers that typically appear in the NEHRP Biennial Reports (e.g., distribution by agency and strategic goal). | | ST | |

**Response and Planned Action:**

The Program agencies agree that having the most current programmatic information as it becomes available is useful for ACEHR to effectively perform their responsibility. The following actions will be implemented by the Program agencies.

a) The NEHRP and ACEHR biennial reports cover the same biennial period. As such, the completion times of the reports are not concurrent; the ACEHR report is completed within the biennial period whereas the NEHRP report is completed after. A draft provided within the biennial period would also need to be made public to be considered by ACEHR. With that said, the NEHRP report is a summation of information provided during the Program updates given to ACEHR during the biennial period. Therefore, the Program updates will be revised from *periodic* (i.e., activities occurring between ACEHR meetings) to *cumulative* over the biennial period to enhance the usability of this information for the ACEHR report.

b) Updates on authorized and appropriated annual budgets will be added as a specific item to the Program updates by the NEHRP Office at NIST provided at ACEHR meetings.

Additional Agency Inputs: None

| Recommendation | Type | Time Frame | Notes |
|---|---|---|---|
| 9 Update the NEHRP Website | Procedural | | |
| a. Modernize the NEHRP website informed by user-centered design. Process-wise, this should include working with key stakeholders (e.g., state, local, tribal, and territorial governments) and principal users (e.g., ACEHR members), to assess their NEHRP-related information needs and uses. | | ST/MT | Supports S.P. Goal 3, Obj. 14 and Goal 4, Obj. 18 |

**Response and Planned Action:**

The Program agencies agree that the NEHRP website, supported by the NEHRP Office at NIST, is an effective mechanism to support access to NEHRP-related information that may assist stakeholders. Maintaining the website is a continuous effort and major updates to the website require the availability of trained staff and financial resources. A recent change to the website includes the introduction of two new sections: 1) a high-level summary of activities of an Earthquake Investigations Committee stood up in response to activation of the NEHRP Post-Earthquake Investigations Program, and 2) a repository for information related to and publications of the Interagency Committee on Seismic Safety in Construction. Additional actions for enhancing the website are identified below.

In the short term, the NEHRP Office at NIST will support two actions for NEHRP.gov:

1) develop and implement an updated, user-centered front page; and
2) modernize the online library and its database.

In the medium term, the Program will assess additional website needs based on evaluation of the communication strategy being evaluated as part of the pending NEHRP Management Plan (see Recommendation 1).

Additional Agency Inputs: None