Earthquake Engineering Research Institute

Learning From Earthquakes

Summary and Outcomes of EERI's 2022 Stakeholder Workshop on Organizing Post-Earthquake Reconnaissance to Optimize Impact

Over 40 Organizations Represented

26 High Priority Coordination Goals Identified

48 Next Step Ideas for Reconnaissance Coordination Planning

New Six Category Coordination Framework

EERI LFE Strategic Working Group:

Sharyl Rabinovici (Workshop Consultant/Report Lead Author)
Mike Mieler (LFE Co-Chair)
Eduardo Miranda (LFE Co-Chair)
Judith Mitrani-Reiser (Board of Directors)
Jonathan P. Stewart (Board of Directors)
Heidi Tremayne (Executive Director)
Maggie Ortiz-Millan (Staff Lead)
Caitlin Cullman (Project Assistant)

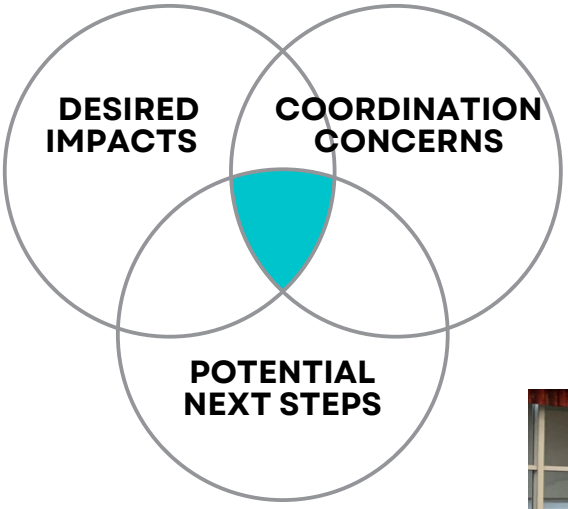
WORKSHOP OBJECTIVES

EERI's Learning From Earthquakes (LFE) Strategic Working Group invited about 175 earthquake reconnaissance researchers and practitioners to a half-day workshop in July 2022. The aim was to clarify important needs and potential next steps for improving earthquake reconnaissance coordination in *advance* of the next Big One.

Through several activities, invitees were asked to imagine themselves two years after a major quake occurs in the U.S. Participants then followed this hypothetical through three lines of inquiry:

- What **IMPACTS** do they want to see resulting from the scientific reconnaissance activities conducted in the aftermath of the quake?
- During the reconnaissance period for that major U.S. earthquake, what kinds of coordination **CHALLENGES OR GAPS** do they think might affect our ability to achieve those impacts?
- Given the desired impacts and coordination needs just discussed, what coordination **NEXT STEPS** would they or their organization most benefit from or want to be involved in in the coming months following this workshop?

THEMES



PROCESS

The workshop involved three different information exchange activities, each involving different, overlapping sets of participants and interaction.

First, invitees were invited to fill out a ***pre-event questionnaire***, which allowed anyone to give input on the topics to be covered at the workshop, even if they couldn't attend in person. Sixty five people responded. The Working Group then analyzed this information and integrated it into the content and activities conducted at the workshop.

Second, key leaders in earthquake reconnaissance presented at a ***technical session*** at the 12th National Congress on Earthquake Engineering (12NCEE) about what their organizations are doing. Third, a series of interactive exercises and in depth discussions took place at the ***half-day in-person workshop***, with 55 people in attendance from over 40 organizations.

This report summarizes findings from the pre-event questionnaire and workshop aspects of this effort. To organize the large amount of resulting information, the Working Group used a framework of six opportunity areas for reconnaissance coordination, as described on the next page.

Small groups at the Workshop discuss their coordination concerns.

Earthquake Engineering Research Institute

OPPORTUNITY AREAS FOR RECONNAISAANCE COORDINATION

WORKFORCE

Who plans and carries out reconnaissance research. What roles do they play, how are people trained, what is their expertise?

RESEARCH AGENDA

Knowledge creation objectives. The work that's planned and done and topics to be investigated, including when, who is involved, and how that agenda is set.

PLANS & PROTOCOLS

How organizations will jointly approach knowledge creation and information sharing in all phases of reconnaissance, such as roles, logistics, resource allocation, and communications.

DATA COLLECTION & MANAGEMENT

Data collection practices, both in the field and remote, including technologies, platforms, formats, storage, security, and shared access.

OUTPUTS & DISSEMINATION

The products of the research process and how they are disseminated. What formats, audiences, messages, and channels are used?

CHANGES IN POLICY & PRACTICES

The influences that reconnaissance outputs have on the world, such as reduced risk via attitude changes, improved laws, design methods, or building practices.

FINDINGS REPORT
Stakeholder Workshop on Organizing Post-Earthquake Reconnaissance to Optimize Impact

WORKFORCE

We need a multi-disciplinary, inclusive, well-prepared, and sustainable reconnaissance workforce.

PREPARATION

Not all of the reconnaissance workforce is sufficiently ready, especially for working in interdisciplinary teams and doing ethically- and community- grounded research. A variety of difficulties exist in assuring adequate professional development and effective knowledge transfer from one generation of researchers to the next.

INCREASED PARTICIPATION

A variety of difficulties exist to involving more people in reconnaissance. There is a need to provide opportunities for a wide swath of engineers and researchers to participate in reconnaissance activities (especially early career, diverse A/E/C professions).

EFFECTIVE INTER-DISCIPLINARY TEAMS

Disciplinary involvement in coordination planning and reconnaissance in general are too narrow. We want improved overall interdisciplinary cooperation during all reconnaissance phases, including IT/data sciences, public health, applied and social systems scientists.

BROADER INVOLVEMENT

There is a lack of plans for how we involve and get information to potential volunteers and inform researchers about how to join and deploy. Especially missing seems to be information technologists and potential users (e.g., emergency managers, building officials, and affected communities).

NEXT STEP IDEAS

- Create and publish formal reconnaissance preparation expectations and protocols.
- Encourage reconnaissance organizations to be even more proactive in getting the organization and its employees more informed and ready to participate.
- Encourage taking responsibility for personal readiness to participate.
- Create lists of reconnaissance scientists, volunteers, organizations, and past and potential participants with contact and expertise information.
- Conduct targeted recruitment to expand those lists, filling in gaps and get those people up to speed and involved.
- Consider and address barriers to participation.
- Start building multi- and interdisciplinary teams in advance of an earthquake.
- Consider who are the vital stakeholders beyond the scientists and initiate targeted, sustained relationship-building.
- Find ways to involve stakeholders beyond the scientists in reconnaissance agenda-setting, operational planning and results-sharing that will affect them in all phases.
- Conduct region-specific reconnaissance coordination summits.

FINDINGS REPORT
Stakeholder Workshop on Organizing Post-Earthquake Reconnaissance to Optimize Impact

RESEARCH AGENDA

We want clarity and agreement about what is most important to study together to advance hazard understanding and get solutions implemented.

ADVANCE GEOPHYSICAL KNOWLEDGE

Concerns exist about site access, redundant effort, consolidating and getting information quickly into the hands of users, and assuring findings get translated into policy change.

UNDERSTAND STRUCTURAL PERFORMANCE

There are issues in the selection of sites and topics of study, for instance, how to avoid redundancies of effort, the "sexy damage" problem, and crowding at certain sites and missing data collection about “non-events” and less visible impacts.

MORE INTER-DISCIPLINARY & LONGITUDINAL RESEARCH

There are concerns about forming and operating effective interdisciplinary teams, such as overlooking opportunities to work together, getting the right discipline mix, and how to fund and merge their deep experiences into better understandings of multi-dimensional disaster causes and impacts.

PRIORITIZE RELEVANCE FOR RISK REDUCTION

There are gaps in our understanding of community, emergency manager, and other user needs, capabilities, and potential roles. Also, there is an ambiguous level of commitment to addressing equity and vulnerable population needs through our research emphases and processes.

NEXT STEP IDEAS

- Consolidate any (already available) “grand challenges” type of documents with specific application to reconnaissance.
- To reduce over-focus on high-interest sites, write up a challenge to develop a cooperative structure for triaging and distributing efforts in the field.
- Develop list of research needs, questions, and potential study designs to support creation and implementation of functional recovery standards.
- Map out potential post-event research projects in advance that can address key identified knowledge gaps, for instance in the following areas:
  - Seismology, geophysics, and hazards
  - Structural performance, including non-events and evaluating retrofits and code changes over time
  - The socially constructed nature of natural hazard vulnerability, human and economic impacts both monetary and intangible
  - Environmental aspects of damage and recovery.
  - Recovery tactics and trajectories.
  - Longitudinal and post-event phenomena.

EERI

FINDINGS REPORT
Stakeholder Workshop on Organizing Post-Earthquake Reconnaissance to Optimize Impact

PLANS & PROTOCOLS

Through inclusive cross-boundary pre-event planning and iterative practice in working together, we will collaborate efficiently in all reconnaissance phases to magnify the scientific and societal value of our efforts.

ENDURING AND EVOLVING COOPERATIVE PROGRAMS

There are ambiguous roles and unclear priorities and plans of approach among key reconnaissance organizations, which causes confusion and potential overlaps, gaps, and inefficiencies.
There is a lack of consistent, shared plans for formal coordination with officials at local, state and federal levels.

WELL PRACTICED CROSS-BOUNDARY OPERATIONS

There is a sense of a lack of operational response plans that everyone seeking to do research can share, point to, and make their own plans based on.
There are coordination issues to be resolved around international participation in helping and learning after a US event and how US experts help for events abroad.

CLEAR COMMUNICATION SYSTEMS

There are concerns about having sufficient communication systems, tools, and protocols in place, well-funded and maintained over time. There may be confusion for the public and local actors due to communication gaps within and among reconnaissance teams and responders.

SUSTIANABLE FUNDING

Concerns exist about there being adequate, stable, scalable, and equitably-distributed funding and resource support for earthquake reconnaissance research, including for smaller and/or rural events.

NEXT STEP IDEAS

- Conduct a community asset mapping/landscape analysis.
- Establish MOUs that lay out cross-boundary expectations, roles, and commitments.
- Create regular opportunities to build relationships and exchange information and ideas.
- Establish frequent routines of practicing together —across and within organizations, disciplines, regions, and jurisdictional levels.
- All organizations conducting reconnaissance should have and proactively exchange operational plans.
- Initiate a collective effort to plan for communication needs, roles, timelines, and develop the necessary supporting infrastructure and protocols within the reconnaissance research community.
- Initiate an effort to identify funding sources and champions--new and existing--including the private sector and philanthropy.
- Identify and better publicize opportunities to coordinate with NSF-funded research networks.
- Widely publicize the USGS Circular 1423 update.

EERI

FINDINGS REPORT
Stakeholder Workshop on Organizing Post-Earthquake Reconnaissance to Optimize Impact

DATA COLLECTION & MANAGEMENT

We want to create new and useful data sets, methods, and tools, with centralized access points and sharable platforms so that data is accessible, impactful, and well-maintained.

USEFUL NEW DATA SETS, METHODS, AND TOOLS

TThere are concerns about how to avoid or jointly address data collection impediments, and a sense that we are not as prepared as we could be in advance for how to operate together in any particular region, issue, or types of sites.

SHARED DATA STANDARDS, PLATFORMS, AND ACCESS

There is a lack of commonly shared platforms, standardized data collection methods, technologies, and formats, and whether we have sufficient documentations tools ready for everyone to use.

CENTRALIZED WEBSITE

There is currently no definitive information repository for any given quake, and many redundant sites. There is a lack of arrangements for decentralized data access and sharing. We need both public- and scientific-facing web pages.

NEXT STEP IDEAS

- Create opportunities for researchers to gather to discuss how to unify discipline- and topic- specific data collection practices.
- Develop technology solutions for identified data sharing needs.
- Better define the concept of “information exchange interface” to be implemented in future recon through LFE and clearinghouse activities, especially as it relates to the new centralized earthquake-specific NEHRP websites.
- Outline an initial set of questions for recon orgs to populate the resource parts of the website.
- Create a data structure for listing all the data-collecting organizations/teams, sites, and activities that will be filled out during active reconnaissance periods.
- Initiate a well-thought well coordinated distributed image repository.
- Work on developing an open-source, geo-located database that would allow for input and sharing of observations.
- Identify the data platforms, datasets, data collection infrastructure, etc. that the various players are using.

EERI

FINDINGS REPORT
Stakeholder Workshop on Organizing Post-Earthquake Reconnaissance to Optimize Impact

OUTPUTS & DISSEMINATION

We want to create timely, enduringly-useful research products, reports, and information sharing events that meet a range of different audiences' needs.

INFLUENTIAL & WIDELY USED PUBLICATIONS

There are a variety of concerns about creating overlapping reports, reaching only limited audiences and missing others, and other dissemination concerns such as over-proliferation of reports, timeliness, need responsiveness to different audiences.

UTILITY TO RESPONSE & REBUILDING

There is a lack of shared protocols for community interactions and joint operations for working with local non-experts. How will we manage relationships and two-way communications with locals (e.g., sharing findings and getting information from them) to maximize the usefulness of our work to their goals?

COMPREHENSIVE IMPACT MAPS & DATABASES

There is a sense that we may miss some critical data gathering opportunities, especially to document human and economic impacts.

FINDINGS SHARING EVENTS

It is not clear for events what the best formats, timing, and content are for different audiences and information-sharing purposes. There are risks of redundancy or incosnistent messaging.

IMPROVED HAZARD MODELS & UPDATED RISK MAPS

It is not clear who is responsible for making sure that new data and lessons learned are integrated into updated models and maps for other at-risk locations.

NEXT STEP IDEAS

- Examine the needs of information users, including which pathways, timelines, and the necessary supporting infrastructure will best reach them, such as nightly briefings or findings summits.
- Create a standardized (and hopefully simplified) method of reporting reconnaissance findings for professional audience communities.
- Have EERI subcommittees list out critical datasets for reconnaissance teams to collect.
- Collect and streamline protocols for activation in a database to be used to direct individuals and organizations on a cohesive framework response plan.
- Consider pathways for integrating reconnaissance data into other tools such as FEMA HAZUS and RiskMAP.
- Conduct region-specific reconnaissance coordination summits a few months later after a major quake.

FINDINGS REPORT
Stakeholder Workshop on Organizing Post-Earthquake Reconnaissance to Optimize Impact

CHANGES IN POLICY & PRACTICES

Our reconnaissance work supports recovery and increased resilience via new policy and construction practices backed by increased public understanding. The effectiveness of reconnaissance research and mitigation efforts improves after every quake as we learn.

INCREASED PUBLIC UNDERSTANDING

Besides technical reports, there is not enough effort placed in the assembling and publishing of less technical material for the general public.

It is unclear, given the LFE historical mission to learn from major events, how much researchers should prioritize and take responsibility for sharing information with the public.

UPDATED REGULATIONS, CODES, AND CONSTRUCTION PRACTICES

There is a lack of shared protocols for community interactions and joint operations that include local non-experts. How will we manage relationships and two-way communications with locals (e.g., sharing findings and getting information from them)?

APPLY FINDINGS TO RECOVERY AND RESILIENCE

There are challenges around how structural findings and recommended repairs can best inform the work of local builders, developers, permitting processes, FEMA Public Assistance, HUD CDBG-DR and other programs.
It is unclear how findings about structural and ground failures can be integrated into post-event mitigation and recovery.

CLARIFIED R&D AGENDA

There is no clear plan for how new data and lessons learned will be used to interate priorities and resource allocation going forward for the rreconnaissance research community, nor to evaluate and iteratively improve how we work together and influence science and society.

NEXT STEP IDEAS

- Share report backs and publications for non-technical audiences to build awareness and facilitate momentum in implementing better codes/ resilient buildings.
- Create organizational and inter-organizational response plans for intentionally engaging the public.
- Improved “peace time” communications with social and main media outlets on messaging.
- Develop a database and/or archive of post-event After-Action Reports and lessons learned.
- Initiate better coordination between FEMA Public Assistance/HMA/406 Mitigation and FEMA NEHRP/EERI regarding post-event recovery advisories, Community Education and Outreach (CEO), and PA/406 processes.

Earthquake Engineering Research Institute

EERI RECONNAISSANCE ROLES & OPPORTUNITIES

WORKFORCE

Training: Grow in-person and virtual training opportunities for EERI members, especially by leveraging training modules developed by partners to train EERI members and potentially collaborate on creating new ones.

Pipeline: Engage early career members in the LFE program to build the reconnaissance workforce pipeline, for instance through the EERI Younger Members Committee, the Virtual Earthquake Reconnaissance Team, LFE Travel Study Program, and LFE subcommittees.

Recruitment: Conduct targeted outreach to recruit/partner with individuals with essential knowledge and skills that are currently missing from the workforce (IT, emergency managers, building officials, and affected communities).

RESEARCH AGENDA

Topic-Focused Reconnaissance Agendas: LFE subcommittees can develop important topics for reconnaissance studies agendas based on their topics of expertise (e.g. housing, schools, etc.). New LFE subcommittees could be formed around identified research areas for which EERI members have special interest and skills.

Research Needs Workshops: EERI will convene post-earthquake research needs workshops to create research agendas based on impacts, following how it organized workshops for the 2010 Haiti Earthquake, 2010 Chile Earthquake, the 2011 Tohoku Earthquake and Tsunami, and the 2010-11 Canterbury Earthquake Sequence. More recently, EERI hosted one-year anniversary events for the 2018 Alaska Earthquake and the 2019 Ridgecrest Earthquake Sequence.

PLANS & PROTOCOLS

State Earthquake Clearinghouses: As a managing partner of several state earthquake clearinghouses, EERI will continue to update and improve clearinghouse response plans and conduct training and outreach to ensure the community is aware of plans and how to engage. Also through state clearinghouses, EERI will work with state partners to outreach to absent stakeholders such as emergency managers and GIS professionals.

Reconnaissance Activation Exercises: Given EERI's role in state clearinghouses and the NEHRP Post-Earthquake Investigations Plan, EERI is well-positioned to lead regular earthquake exercises to practice the community response to a US earthquake. These should address the needs of different subsets of the reconnaissance community, for instance by holding discipline-, region-, or reconnaissance phase- specific exercises.

Coordination Workshops: With its multi-disciplinary membership, EERI is a natural community convener and can works with partners to organize follow-up events to tackle some of the major coordination concerns identified in this report and elsewhere.

Earthquake Engineering Research Institute

MORE EERI ROLES

DATA COLLECTION & MANAGEMENT

Virtual Clearinghouse Websites: EERI quickly stands up virtual earthquake clearinghouse websites after quakes with a significant reconnaissance response. These websites go live quickly and serve as a good short-term platform for sharing preliminary reconnaissance data.

Long-term Data Curation: EERI recognizes that other partners have more resources to support data curation and long-term archiving. EERI will work with partners such as DesignSafe, FEMA, USGS, and state geological surveys to develop best practices for long-term data storage, access systems, and curation archiving.

Reconnaissance Data Papers: EERI will encourage the publication of data papers on curated reconnaissance datasets through its flagship peer-reviewed publication, *Earthquake Spectra*.

OUTPUTS & DISSEMINATION

Reconnaissance Briefing Webinars: EERI hosts multi-disciplinary reconnaissance briefing webinars to update members and the broader reconnaissance community on preliminary findings. Webinars often include relevant partners conducting reconnaissance.

Meeting and Conference Sessions: EERI organizes technical program sessions on recent reconnaissance findings at its annual meetings, the National Earthquake Conference, and the National Conference on Earthquake Engineering.

Impacted Community Outreach: EERI is committed to sustained engagement with earthquake-affected communities throughout the clearinghouse activation process (pre-event, during and after reconnaissance) through findings reports, briefings, and presentations.

Reconnaissance Reports: EERI teams produce interim and conclusive scientific reports and cooperate in creating multi-organization summary reports.

CHANGES IN POLICY & PRACTICES

Public Policy and Advocacy Committee: Through collaboration between LFE and EERI's Public Policy and Advocacy Committee, EERI can leverage earthquake events to advocate for national advances in seismic safety building EERI Board-approved Policy Position Statements.

The PPA Committee has also developed training modules for EERI members and the broader community to become citizen advocates for these issues. Based on earthquake impacts, the PPA can also make specific policy recommendations that are relevant and timely.

EERI Regional Chapter Advocacy: With training from the Public Policy and Advocacy Committee, EERI's regional chapter members are well-positioned to advocate for local change based on lessons learned from earthquakes.


EARTHQUAKE WARNING!

This Building is in Violation of the Requirements of the San Francisco Building Code Regarding Earthquake Safety.

地震警告!

¡ADVERTENCIA DEL TERREMOTO!

Earthquake Engineering Research Institute

EERI RESOURCES

Learning from Earthquakes Website

LFE Earthquake Archive

California Earthquake Clearinghouse Website

Idaho Earthquake Clearinghouse Plan

Past Event Webinar Recordings

The Earthquake Engineering Research Institute (EERI) is a nonprofit membership organization that connects those dedicated to understanding earthquake risk and increasing earthquake resilience in communities worldwide. EERI envisions a future where communities worldwide understand their earthquake risk and act to improve their resilience to earthquakes and other hazards. Our mission is to provide our members with the technical knowledge, leadership and advocacy skills, collaborative networks, and multidisciplinary context to achieve this vision. This report has been produced through EERI's Learning From Earthquakes (LFE) program. The mission of the LFE Program is to accelerate and increase learning from earthquake-induced disasters that affect the natural, built, social and political environments worldwide. For more information, visit http://www.learningfromearthquakes.org/about.

The EERI Learning from Earthquakes program is funded through the support of EERI members and the generous contributions of LFE Endowment Fund Donors.

The development of this report was supported with funding under a grant (EMW-2021-CA-00017-S01) from FEMA and the U.S. Department of Homeland Security.

Any opinions, findings, conclusions, or recommendations expressed in this report are the authors' and do not necessarily reflect the views of EERI, the authors' organizations, donors, or funding agencies.