Disaster Assistance Handbook

Fourth Edition, September 2021

Acknowledgments

AIA Disaster Assistance Handbook
Fourth Edition, Published September 2021

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WELCOME FROM AIA EVP/CHIEF EXECUTIVE OFFICER, ROBERT IVY, FAIA

Today, the word "resilience" has taken on a heightened meaning. The ongoing pandemic, climate crisis, and reckoning on social and racial inequities join to create uncertainty that obscures the best way to respond to the challenges of our time. However, as designers, we know that our discipline allows us to think ahead, to prepare as best we can, and to plan for success in the face of difficulty.

It tends to be human nature to avoid disaster preparedness. For many people, catastrophic events occur elsewhere to other people, not to us, and yet the world we live in makes no promises for our safety or security. In fact, a changing climate is provoking an increasing litany of life-changing events worldwide–from historic wildfires in North America, to devastating floods in Europe, and around the world, to food shortages in Africa caused by drought. It is increasingly apparent that any one of us, no matter where you live, work, learn, or relax might experience the trauma that accompanies a catastrophic weather-related event.

The question we all must answer is: How can we find shelter in a world that is rapidly changing? More to the point of this handbook, how can we become resilient designers and planners? If you are reading this book, you are seeking solutions to contemporary society's most demanding problems: How to create resilient buildings and communities. If you are a design professional, an architect or planner, an emergency manager, government official, code expert, or simply someone interested in making the world around you safer, this handbook should help you.

Professionals have a higher standard to uphold. As architects, we pledge to protect the health, safety, and welfare of the public. Our lifelong training demands that our structures stand and indeed prevail in the face of natural disasters. However, architects alone cannot solve the resilience equation. We act best by acting together, creating relationships that can prepare us all more appropriately for the unforeseen. Our path forward demands developing, first, collective willpower, and then working toward disaster preparedness, including planning, appropriate resources, readiness for rapid deployment, and training.

Our combined skills can lead to recovery. With shared professional energies, intelligence, knowledge, and commitment joined with communities in this country and internationally our abilities to meet a broad range of challenges ahead of us grows. Post-disaster building safety evaluations and recovery planning can lead to new places that are better able to weather societal upheaval through whatever the changeable world and human nature might throw at us.

Ultimately, resilience lies at the heart of design, because the oath we take as architects demands that we protect the health, safety, and welfare of the public. Minimal solutions, often the lowest common denominators demanded by code, will not suffice.

As planners, designers, or interested citizens, our charge is listening to the powerful forces that impact the built world and use the power of design to protect the health, safety, and welfare. We hope that this handbook helps.

Robert Ivy, FAIA
EVP/Chief Executive Officer

Introduction

Purposes of this handbook

To create a safer, healthier, and more sustainable, resilient, and equitable built environment; this handbook provides guidance on preparation for and response to natural hazard events, human-made hazard events, and hybrid disasters affecting the built environment, including those stemming from emerging biological and technological threats.[1] The following groups of people play critical roles in these efforts and will gain value from this handbook:

Architects will better understand their role and how to mitigate, prepare for, respond to, and recover from disasters.

AIA chapter staff will be better prepared to engage and coordinate their architect members and provide community discourse and assistance.

Built environment professionals will learn how to work with architects and the community on disaster response and preparedness efforts.

Municipal governments will become aware of the unique ways architects assist the public and their clients before and after disaster.

These groups, working together before a disaster, honing the collective understanding of hazards, risk, and the impact on the built environment, can mitigate the potential harm that accompanies a disaster and create resilient communities that thrive. The Disaster Assistance Handbook has been designed to highlight the skills and services design professional can provide to local and state emergency management agencies and communities before, during, and after a disaster and can be used as a starting point for conversation on how to best collaborate.

Fourth edition highlights

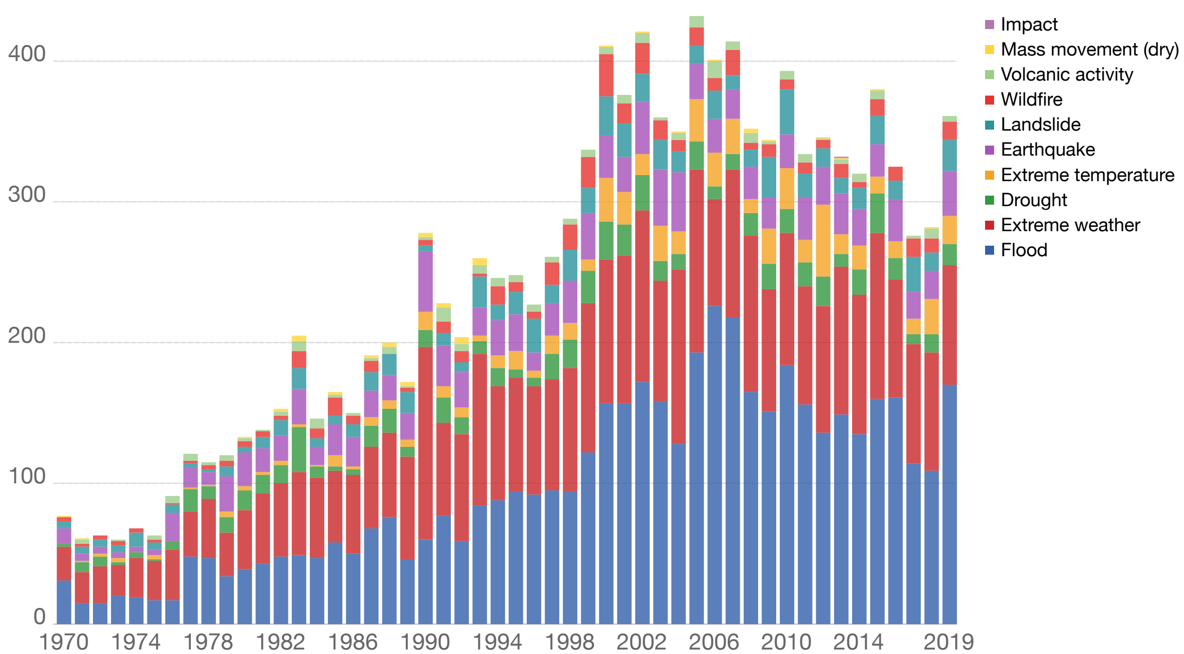
- An updated chapter on hazard mitigation and risk reduction in the built environment featuring new research, financial implications, and federal policies and programs.
- Changes in FEMA's national disaster deployment protocols, including Post-Disaster Building Safety Evaluations and associated National Incident Management System (NIMS) resource types.
- Lessons learned in the field from recent disasters.
- Replicable disaster recovery projects and initiatives to enhance community resilience.
- An extended discussion on residential construction, including recovery options and resources.
- Case studies and best practices on disaster assistance from AIA chapters and members.

[1] This document focuses on challenges and recommendations specific to the United States, but its principles are applicable beyond the USA.

Architects are an integral part of achieving community resilience in the built environment; their work lies in the intersection of the planet, places, and people. This role is more important today than it's ever been.

Hazardous weather events, including those exacerbated by climate change, are on the rise—and continue to be more erratic and frequent. The impact of these events is felt by even more people due to population growth in some of the most vulnerable parts of the country—whether it is coastal areas, seismically risky areas, or wildfire-prone areas.

The authors of the International Federation of Red Cross and Red Crescent Societies (IFRC) report World Disasters Report 2020: Come Heat or High Water found that catastrophes have been rising in number since the 1960s—and a sharp increase of 35% has been recorded since the 1990s.[2] Events include floods, tornadoes, ice storms, fires, landslides, hurricanes, and earthquakes, and the damage can range from a few uprooted trees to the near-obliteration of entire communities. All told, these incidents are becoming more and more expensive, causing billions of dollars in damage annually. The personal toll and costs to local culture and heritage are immeasurable. These challenges require a systems-based approach that balances the needs of the community and the environment.



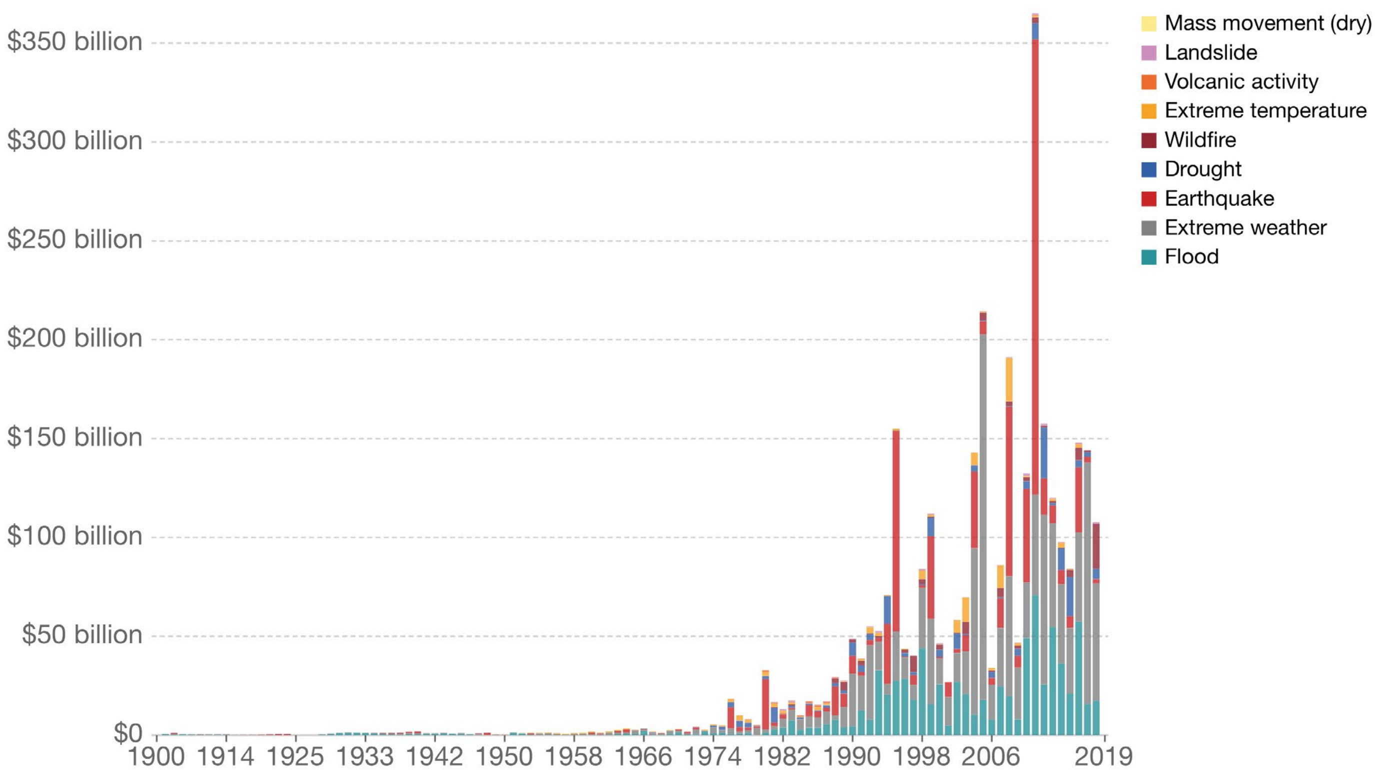
GLOBAL REPORTED NATURAL DISASTERS BY TYPE

1970 through 2019 annual worldwide natural disasters (weather and non-weather-related disasters)

SOURCE

Hannah Ritchie and Max Roser (2014) - "Natural Disasters". Published online at OurWorldInData.org. Retrieved from: 'https://ourworldindata.org/natural-disasters' [Online Resource].
Data: EMDAT (2020): OFDA/CRED International Disaster Database, Université catholique de Louvain – Brussels – Belgium

[2] Jariel Arvin, "Natural disasters are increasing. The world's poorest are left to fend for themselves," Vox, November 20, 2020. vox.com/21571842/coronavirus-pandemic-climate-change-covid-19-natural-disaster-vaccine



ECONOMIC DAMAGE BY NATURAL DISASTERS BY TYPE, 1900 TO 2019

1900 through 2019 total annual global economic damage from natural disasters (US$)

SOURCE

Graphic: Hannah Ritchie and Max Roser (2014) — "Natural Disasters". Published online at OurWorldInData.org. Retrieved from: 'https://ourworldindata.org/natural-disasters' [Online Resource].
Data: EMDAT (2020): OFDA/CRED International Disaster Database, Université catholique de Louvain — Brussels — Belgium

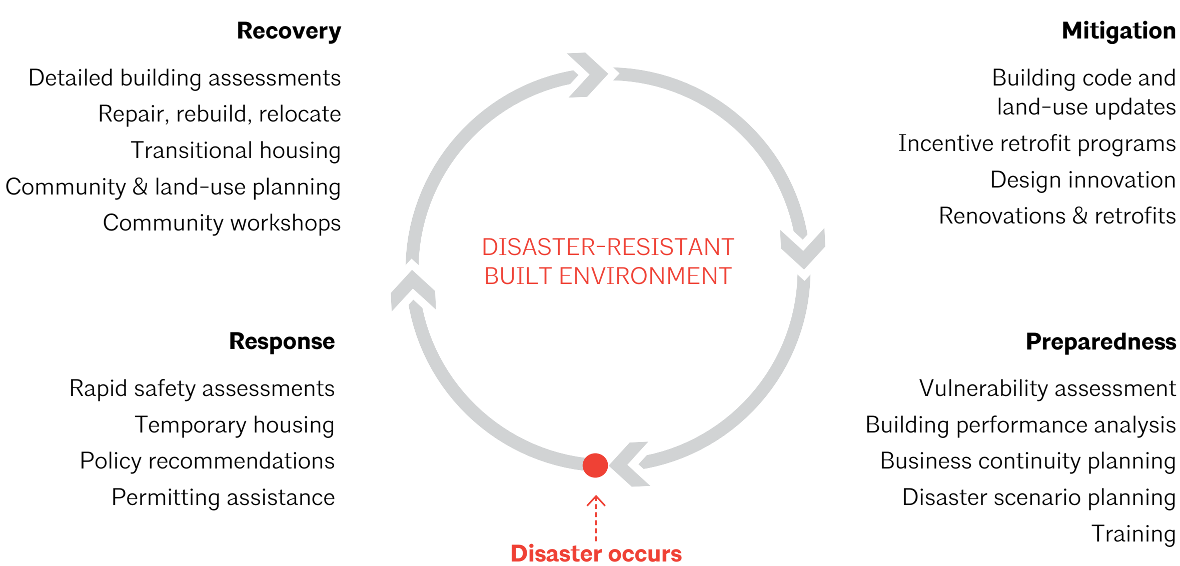
AIA's Position Statement on Resilience

"AIA supports policies, programs, and practices that promote adaptable and resilient buildings and communities. Buildings and communities are subjected to destructive forces from natural and human-caused hazards such as fire, earthquakes, flooding, sea level rise, tornadoes, tsunamis, severe weather, and even intentional attack. The forces affecting the built environment are evolving with climate change, environmental degradation, population growth, and migration; this alters long-term conditions and demands design innovation. Architects design environments that reduce harm and property damage, adapt to evolving conditions, and more readily, effectively, and efficiently recover from adverse events. Additionally, AIA supports member training and active involvement in disaster assistance efforts, providing valuable insights and aid to communities before, during, and after a destructive event."
Approved December 2017

Architects are bound by their licenses to protect public health, safety, and welfare and, to that end, employ design and systems thinking to address hazard risk and meet client performance goals.

The skill set of architects is valuable in all phases of emergency management. Architects are equipped to take action toward safer, healthier, and more sustainable, resilient, and equitable communities. Additionally, thousands of architects are trained and ready to respond alongside state and local authorities after a disaster. Architects are adept and skilled in anticipating the impacts of interventions in the built environment, including recognizing signs of potential building system and services malfunctions and failures. "Citizen architects" assist their communities through service on boards and commissions before and after a disaster to plan for hazardous events, ensure building codes are updated, and advise on responsible land use that will allow businesses and communities to assume operations more quickly after a disaster. In a state of emergency, architects and engineers work together to determine the habitability of homes and businesses, preventing further harm and injury to unsuspecting residents.

Protect the public
Architects are licensed to protect public health, safety, and welfare.



ARCHITECTS' ROLE IN THE EMERGENCY MANAGEMENT CYCLE
Examples of how architects engage in all phases of the emergency management cycle

SOURCE
Robert Thiele, AIA and the AIA Disaster Assistance Committee

Beyond the technical expertise architects bring, they are also well-positioned to provide a holistic approach to community resilience planning. Natural, social, and building systems are interdependent, and architects are trained to incorporate those system components into their design work and forge connections among diverse stakeholders. This integrated process is especially valuable during the phases of hazard mitigation, preparedness, and recovery.

ARCHITECTS' HOLISTIC APPROACH TO COMMUNITY RESILIENCE
Architects design for the interdependences of the natural, social, and built environment systems.

SOURCE
AIA

AIA DISASTER ASSISTANCE PROGRAM

Over the years architects have responded to dozens of severe hazard events nationwide and internationally through the work of the AIA Disaster Assistance Program. The AIA Disaster Assistance Program supports a nationwide network of architects who help communities mitigate, prepare for, respond to, and recover from disasters. It provides training, support, and resources for architects through local and state AIA chapters.

The Disaster Assistance Committee and AIA National have sustained the program, providing guidance, recommendations, toolkits, and training to architects, AIA chapters, and other built environment professionals. As a result, architects' disaster response processes, protocol, and training are institutionalized to strengthen chapter preparedness, foster mutual-aid relationships with jurisdictions and the larger disaster-response community, and, most importantly, equip architects with the knowledge and skills needed to be of service before and after a disaster.

Specifically, the program's work has led to the establishment of disaster assistance programs in all 50 states, Good Samaritan liability coverage in 40 states, and architects in more than 35 states and territories trained in AIA's Safety Assessment Program. Disaster and resilience education is regularly provided at the AIA National Conference; on AIA's online education platform, AIAU ; and throughout the country through AIA chapters.

Architects volunteering pre- and post-disaster exemplify AIA's Code of Ethics and Professional Conduct, Canon II, which states that "Members should promote and serve the public interest in their personal and professional activities." The program also reflects AIA's commitment to create safe, secure, and resilient communities.

The AIA Disaster Assistance Program

The AIA Disaster Assistance Program supports a nationwide network of architects who use a holistic approach to help communities before and after a disaster.

The experience gained from AIA's Disaster Assistance Program is captured in this fourth edition of the Disaster Assistance Handbook. It includes firsthand accounts of disaster response and recovery, case studies, and other best practices from AIA chapters and their architect members. This edition also includes new hazard mitigation research and federal policies and programs, changes in FEMA's national disaster deployment protocols, new resource types for architects from the National Incident Management System, and replicable disaster recovery projects and initiatives to enhance community resilience.

While this handbook is written for use by architects, AIA chapter staff, built environment professionals, and municipal governments, the intended ultimate beneficiary is the public. Working together, AIA aims to reduce risk to sustain vibrant, prosperous communities for generations to come.

ARCHITECTS RESPOND
Members of the AIA Illinois Disaster Response Team perform Building Safety Assessments after an EF 4 Tornado struck Washington, IL in 2013.

SOURCE
Eric Klinner, CAE, AIA Illinois Managing Director. Used with permission.

HISTORY OF AIA DISASTER ASSISTANCE

1972
AIA formally recognizes the role of architects in emergency response, forming the AIA Disaster Response Committee after the devastating 1972 flood in Rapid City, South Dakota.

1974
The Disaster Relief Act of 1974 establishes the presidential declaration process for federal disaster aid.

1979
The Federal Emergency Management Agency (FEMA) is created as an independent agency, lobbied for by AIA.

1988
Congress passes the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) to codify the federal role in disaster assistance and improve planning, preparedness, and coordination.

2005
Hurricane Katrina strikes the United States, raising awareness of disaster risk in the built environment.

2006
AIA establishes the Disaster Assistance Program and appoints a Disaster Assistance Committee to lead the charge.

AIA creates the Disaster Assistance Comprehensive Response System.

AIA develops model Good Samaritan legislation for licensed architects.

2008
AIA Disaster Assistance Committee launches the AIA Safety Assessment Program, uniformly training architects, engineers, and building inspectors in post-disaster building assessments.

2010
AIA Disaster Assistance Committee launches AIA State Disaster Coordinator Network to facilitate AIA engagement in disaster preparedness and response efforts on a state level.

2011
AIA joins the BuildStrong Coalition of designers, first responders, and insurance industry representatives to advocate for safer building codes and improvements to federal disaster programs.

2012
AIA partners with the former Architecture for Humanity to offer the AIA/AFH Disaster Response Plan Grant to empower chapters to work with local government agencies on planning, training, and other critical disaster relief initiatives.

2013
AIA hosts the Designing Recovery Competition, an ideas competition aimed at designing disaster-responsive homes for New York City, New Orleans, and Joplin, Missouri.

2014
AIA Board of Directors adopts position statement on resilience to address the impacts of an increasing number of natural disasters, climate change, environmental degradation, and population growth.

AIA co-authors the Building Industry Statement on Resilience, a guiding document for industry leaders to enhance the resilience of the built environment.

2016
AIA attends the White House's Conference on Resilient Building Codes, committing to creating a resilience curriculum for the professional development of architects, including resilient design and decision-making on hazard mitigation, climate adaptation, and community resilience.

2017
AIA Disaster Assistance Handbook, 3rd edition, is published.

2018
AIA launches an online resource repository and engagement site for the nationwide AIA State Disaster Coordinator Network.

AIA publishes the Resilience & Adaptation online certificate series, fulfilling 2016 White House Commitment.

Federal Disaster Recovery Reform Act (DRRA) passed into law, advocated for by AIA.

2019
P-2055 Post-disaster Building Safety Evaluation Guidance published by FEMA, co-authored by AIA.

2020
New National Incident Management System (NIMS) resource types for post-disaster building safety evaluation published, co-developed by AIA.

AIA publishes Reopening America: Strategies for Safer Buildings guidance documents in response to the COVID-19 pandemic.

2021
AIA publishes the Architect's Guide to Business Continuity, a tailored process to help design professionals withstand disruption and be better prepared to support their communities when disaster strikes.

AIA Disaster Assistance Handbook, 4th edition, is published.

Hazard, vulnerability, and risk

01

LEARN: RISK, HAZARDS, AND IMPACTS TO THE BUILT ENVIRONMENT

HAZARDS, HAZARD EVENTS, AND DISASTERS

We inhabit a wondrous, beautiful, and evolving planet. We also inhabit a hazardous planet.

There are many types of hazards that affect the biosphere of Earth. Some of these hazards are considered natural: climate and weather-related (atmospheric) events (hurricanes, floods, and tornadoes) and geologic events (earthquakes, landslides, and volcanic eruptions). Disease epidemics and insect/animal plagues are considered types of natural hazards. We also experience human-caused events (known as anthropogenic or technological hazards) caused by manufacturing, transportation, extraction, construction, land use, agriculture, and governance.

Hazards, such as hurricanes, floods, earthquakes, or winter storms, become hazard events when they impact a community. This causes direct, indirect, or consequential damage to people, natural resources, infrastructure, transportation, utilities, public resources, and assets, along with the interior and exterior of public and private property.

From time to time, this pattern of hazard event is punctuated by an impact of great intensity, causing damage of such magnitude that it overwhelms local response capacity. The result is known as a disaster. A disaster may also be an event of widespread impact. A moderate event that could be resolved locally is elevated to the level of a disaster if the extent of the event is regional in nature. In this case, local communities cannot count on assistance from neighboring cities or states because those areas are also experiencing the disaster. In this case, inter-regional help from those outside of the disaster zone is necessary.

Key concepts

- Understand the connection between risks and vulnerability and how to communicate these issues.
- Recognize how “impact modifiers” exacerbate existing or inherent hazards to new levels.
- Consider secondary hazards—the cascading impacts of a disaster in the resilience planning process.
- Recognize the role of pre-disaster hazard mitigation and resilience planning in the cycle of emergency management.

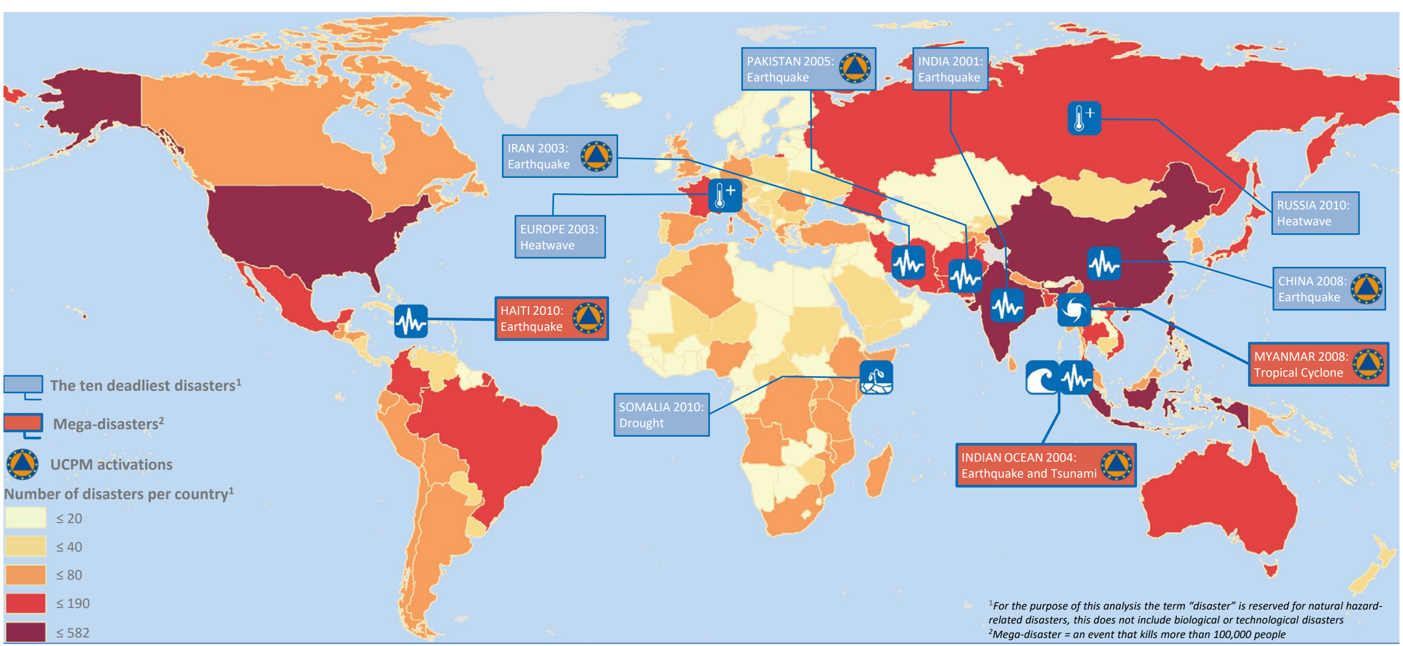
“There is no such thing as a natural disaster, but disasters often follow natural hazards.” [3]

—UNDRR PreventionWeb

[3] “Disaster Risk,” PreventionWeb. preventionweb.net/disaster-risk/risk/disaster-risk/

Hazard types

ATMOSPHERIC Climate and weather-related hazards	Flood, extreme rain event, flash flooding, ground saturation, severe storm (wind, rain, lightning, hail), severe winter weather (snow, ice, freezing temperatures), avalanche, hurricane, typhoon, tropical cyclone, storm surge, tornado, wildfire, extreme heat, drought, solar coronal mass ejection (CME)
GEOLOGIC & SEISMIC	Earthquake, tsunami/seiche, volcanic eruption, landslide, erosion, mudslide, soil liquefaction, land subsidence/sink hole
TECHNOLOGICAL & ANTHROPOGENIC Human-caused hazards	Power outage, fires, explosion, urban flooding, war, terrorism, civil unrest, infrastructure failure (dam and bridge collapse, mine collapse, structural failures), hazardous materials (HAZMAT) event, environmental pollution (air, water, soil), nuclear accident, increased likelihood and severity of climate-related natural hazards, sea level rise, increased likelihood of earthquakes due to certain fracking wastewater injection, cyber attacks on infrastructure
BIOLOGICAL & PATHOGENIC Global public health hazards	Global pandemics, local outbreaks of deadly diseases, seasonal resurgences, biological contamination of shared water/air/soil resources



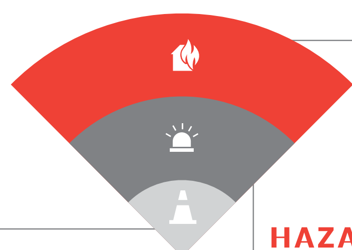
THE HUMAN COST OF DISASTERS (2000-2019)
A map of the deadliest disasters and mega-disasters incurred globally between 2000 and 2019.
NOTE: UCPM refers to the Union Civil Protection Mechanism.

SOURCE
© European Union, 2020. Map created by DG ECHO Situational Awareness Team. Sources: DG ECHO, GISCO. The boundaries and names shown on this map do not imply official endorsement or acceptance by the European Union.

It is important to understand the characteristics of a hazard event: what happens when a building interacts with the damaging components of specific hazards and how design criteria, including building shape, components, materials, and siting of the structure, affect the degree and type of damage that may result from a hazard. The architect's effectiveness before a disaster and in an emergency response is impacted by understanding inherent benefits and/or risks associated with a host of factors. Such factors include bio-climatic regions, building typology and construction systems.

This handbook primarily addresses natural hazards that cause widespread damage to the built environment, triggering a whole community response. The methodology and concepts for disaster assistance will remain basically the same regardless of whether the disaster was caused by a natural or a human-caused hazard but will undoubtedly be modified to nuanced systems of response that are site and disaster specific.

For example, a modified response will be required when an event includes chemical releases from storage tanks and pipelines, toxic waste releases from storage facilities and waste disposal sites, or radioactive and biohazardous material. The World Health Organization has named these occurrences "Natech" (natural hazard triggered technological) events.[4]



HAZARD

A hazard is something that is potentially dangerous or harmful, often the root cause of an unwanted outcome.[5] For example, an earthquake is a type of natural hazard. Communities may not be adversely affected by very small earthquakes and in fact may not even realize an earthquake occurred. In such a case, the earthquake is merely a hazard.

HAZARD EVENT

A hazard event is the occurrence (realization) of a hazard, the effects of which change demographic, economic and/or environmental conditions.[6]

DISASTER

A hazard event becomes a disaster when the impact of the hazard event is of such great intensity that it overwhelms the local capacity to respond.[7]

DISASTER: FROM POTENTIAL TO REALITY

Not all hazards result in disaster. All hazards are potentially dangerous or harmful. When a hazard occurs; it becomes a hazard event. A hazard event is considered a disaster when it interacts with a vulnerable community.

SOURCE

AIA

4 "Chemical Releases Caused by Natural Hazard Events and Disasters," The World Health Organization, 2018. apps.who.int/iris/bitstream/handle/10665/272390/9789241513395-eng.pdf?ua=1

5 FEMA Incident Command Resource Center

6 "Hazards and Disasters." IB Geography. I-study, n.d. Web. 23 Feb. 2017.

7 "Terminology." UNISDR. The United Nations Office for Disaster Risk Reduction, 30 Aug. 2007. Web. 10 Feb. 2017.

UNDERSTANDING HAZARD AND DISASTER RISK

Geographic location is the primary determinant of a community's risk for natural hazards. Communities that occupy coastal land or areas along a riverbank are at a known higher risk for flooding, those that reside in the Midwest may be susceptible to tornadoes, and those on the West Coast of the United States have a significantly higher seismic and wildfire risk. Weather-related hazard risks are evolving with climate change, including the increasing occurrence, scope of the hazard event, and intensity. The probability that a given hazard may occur is known as hazard risk.

Population increases and development also create or exacerbate hazard risk. Unmapped or poorly documented geographic hazards exist in many communities. Unmaintained private dams and levees and long abandoned mining operations can pose location-specific risk. Fresh water drawn down in Florida is leading to the development of sinkholes. Aging infrastructure in areas of low economic activity, compounded by low tax revenue, puts resident populations at risk when the infrastructure is stressed and fails.

Disaster risk, on the other hand, is determined by the overlap between hazard risk and vulnerability—the exposure and sensitivity of a community that adversely affects its capacity to adapt and recover. Community components such as populations, economies, buildings, infrastructure, and natural systems have individual vulnerabilities that interdependently and collectively contribute to the vulnerability of a community. Vulnerability is a dynamic condition, which changes over time in response to interacting variables and local factors.

A local variable that affects vulnerability and thus disaster risk is the adoption and enforcement of building codes. Adoption and enforcement rates vary across the country and around the world. In locations where codes are not enforced, buildings are more vulnerable. For instance, Nepal and Bangladesh both have adopted building codes but have experienced catastrophic building collapses. Noncompliance with the building code has been cited as one of the significant causes of building-related disasters.[8] This risk is not limited to developing countries, as was seen with the devastation caused by Hurricane Andrew in Florida in 1992.

Risk
The Department of Homeland Security Risk Lexicon defines Risk as "the potential for an unwanted outcome resulting from an incident, event, or occurrence, as determined by its likelihood and the associated consequences."

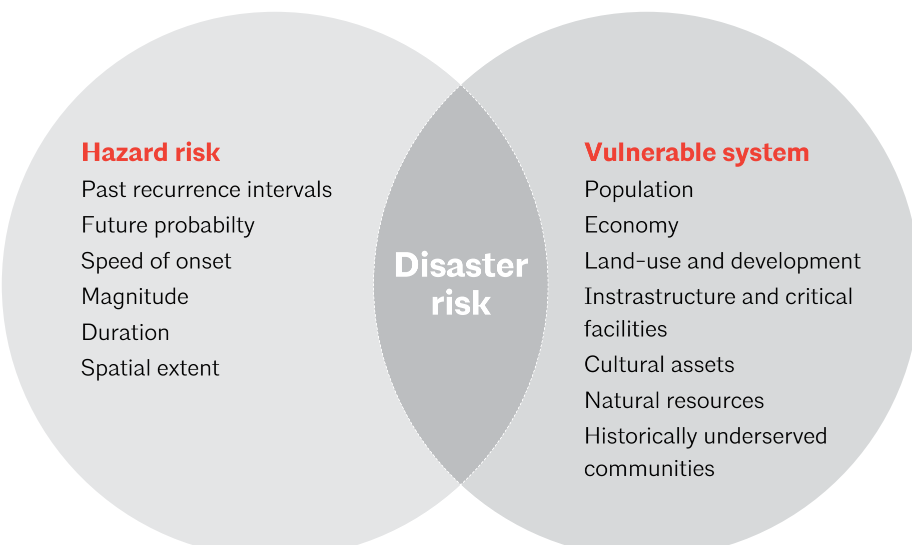
Vulnerability
The Intergovernmental Panel on Climate Change (IPCC) defines vulnerability as "the degree to which a system is susceptible to, and unable to cope with, adverse effects."

[8] Iftekhar Ahmed, et al., "Opportunities and challenges of compliance to safe building codes: Bangladesh and Nepal," *APN Science Bulletin*, November 27, 2019. apn-gcr.org/bulletin/article/opportunities-and-challenges-of-compliance-to-safe-building-codes-bangladesh-and-nepal/

While southern Florida was often considered to have one of the strongest building codes in the U.S., lack of enforcement (inadequate plan review, organizational deficiencies, shortage of inspectors, and inadequate training) contributed to widespread damage.[9] The lack of adequate and otherwise expected building performance after Hurricane Andrew marked a turning point in the U.S. This seminal event was how the country learned the relationship between increased vulnerability and lack of code enforcement. The importance of building codes in mitigating disaster risk is discussed in Chapter 2.

Vulnerability is further altered by behaviors and the actions of the community. Actions taken to reduce vulnerability may also reduce disaster risk. Determining the level of "acceptable risk" is critical to designing for the desired building performance. Acceptable risk will ascertain the projected lifespan of the building; critical functional requirements before, during, and after a hazard strikes; and the acceptable length of time to be out of service due to interruptions from hazard events.

Lastly, it is important to acknowledge the inherent inequity that some communities face in terms of their physical location within a city or region. Low-lying areas of many cities, especially those along major rivers and coastal locations, are disproportionately low-wealth communities and are also disproportionately exposed to greater risk of flooding or the myriad effects of extreme weather.[10] The vulnerability of a population may increase when located near industrial operations and highways, on slopes or highly erodible land, or in unmaintained housing.



DISASTER RISK
Disaster risk is determined by the overlap between hazard risk and the vulnerable system. The ability, resources, and/or willingness to mitigate, prepare, respond, or recover also contributes to vulnerability. By reducing the hazard risk or reducing the vulnerability, disaster risk can be reduced.

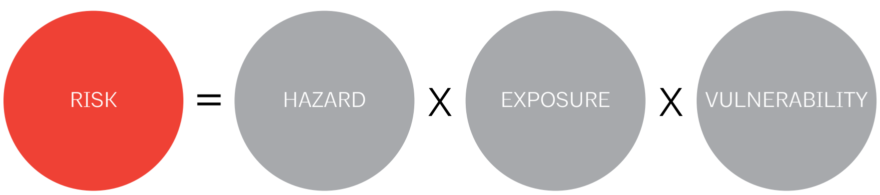
SOURCE
United States Geological Survey (USGS)

[9] Dennis S. Mileti, *Disasters by Design*, 1999, p. 129.

[10] "Disaster Technical Assistance Center Supplemental Research Bulletin: Greater Impact: How Disasters Affect People of Low Socioeconomic Status," SAMHSA. July 2017. samhsa.gov/sites/default/files/dtac/srb-low-ses_2.pdf.

Architects can study and communicate hazard impacts on the built environment with policy makers, property owners, design teams, and other stakeholders. Despite the uncertain nature associated with hazards and risks, this foresight ensures that community stakeholders can make informed and coordinated decisions on hazard exposure and mitigate future damage.

The total risk a community, building, individual, or other component faces is determined by a number of factors: (1) the probability of experiencing a certain intensity of **hazard**, (2) the stock of property and infrastructure **exposed** to a hazard, and (3) the **vulnerability** to damage of the assets exposed to the forces generated by the hazard and/or the social impact generated by the hazard.[11]



UNDERSTANDING RISK
Disaster risk is recognized as the consequence of the interaction between a hazard and the characteristics that make people and places vulnerable and exposed.

SOURCE
United Nations Office for Disaster Risk Reduction (UNDRR)

[11] "What is disaster risk," PreventionWeb. preventionweb.net/disaster-risk/risk/disaster-risk/

The actual level of risk may not be intuitive, and, therefore, the public may be unaware and ill-prepared for hazardous events. For example, in Atlanta prior to 2014, a resident may have said that there is a very low risk of an ice storm. The city did not typically prepare for winter ice and snowstorms and lacked the equipment, communication strategies, and evacuation support for such an event. Similarly, residents were not prepared to handle travel on icy roads. In January 2014, the assumed unlikely, low-probability event did occur and—given the lack of preparation—the exposure was significant. Many area residents lost power and connectivity, thousands were stranded without basic supplies, and a few died as a result of the ice storm. In turn, businesses lost revenue, schools lost attendance, and families lost income, all on top of the costs associated with broken pipes, roof damage, and road repairs.

In this case, a review of historic climate data would have revealed that Atlanta experienced similar climate events in 1973, 1982, 1983, 1993, and 2000, as reported in January 2010 in the *Atlanta Journal and Constitution*. There were precedents of the challenges that the city would face and a history that demonstrated many of the city's weaker systems, yet the city remained unprepared. This experience is not unique to Atlanta. In 2021 states across the South, including Texas and Louisiana, experienced a similar cold snap with equally dire results that impacted homes, businesses, the power grid, and energy production. This illustrates the critical need to study and effectively communicate scientific hazard and climate data so informed decisions can be made and executed.

HAZARDS: CAUSES OF DAMAGE, IMPACT MODIFIERS, AND CLIMATE CHANGE

Local factors (both natural and human-made) disrupt the status quo in ways that positively or negatively change the impact of a hazard. Climate change can exacerbate meteorological hazards and exploit deficiencies in the built environment. Understanding the compounded impacts of climate change and other physical interdependencies enables architects to design hazard mitigation measures that reduce potential damage from future routine, expected, extreme, and compounded hazard events.

All hazards directly impact communities through damaging components—in hurricanes, for example, the damaging components are wind and water. Wind pressure can damage buildings in either positive (force) or negative (suction) ways, and wind itself can generate vortices and eddies along individual surfaces and by forces applied across entire surface areas (e.g. roofs and facades). Wind is also capable of lifting up objects and pieces of damaged buildings, generating windborne debris capable of causing projectiles to inflict collateral damage and even death. Hydrodynamic pressure, hydrostatic pressure, wave impact, and floating debris impact can be identified as specific causes of water damage. Anticipating the triggers of resulting damage generated by a given hazard leads to better building performance simulation.

Return periods, recurrence intervals, exceedance probabilities, and expected frequency of occurrence

Each of these terms has special meaning and can cause confusion and frustration when communicating risk to people outside fields of research. Codes and standards must rely on scientific data to justify increased design safety requirements. However, code nomenclature does not need to be used when speaking with a client or the public.

Using qualitative terminology, such as "routine" or "expected" allows for fluid communication that can capture emotions and intuitions without overwhelming nontechnical audiences with numbers that could be misunderstood. For example, a 100-year flood might sound like it happens once every 100 years, but it actually indicates a 1% chance of flooding occurring in any single given year.

When choosing numbers, remember to convert them to time periods that are more relatable (e.g., a 30-year mortgage). The probability of a 100-year flood occurring over 30 years is 26%. There is a slightly better than 1 in 4 chance that the house will flood during the financing period—which is why banks require flood insurance.

Defining event occurrences

To further delineate risk, hazard events are categorized[12] by their regularity as referenced in policy and building codes for design and planning purposes. What constitutes a Routine, Expected, or Extreme event is shifting as climate change is bringing more extreme weather, more often.

Routine events

Likely to occur within a lifetime, with an approximately 50 percent or higher chance of occurring in 50 years.

Expected events

Anticipated to occur once during the life of a structure or system with approximately a 10 percent chance of actual occurrence in 50 years. This is typically the hazard level used in codes and standards, though depending on the building component, a higher design level may be required to provide the needed level of safety and functionality post-disaster.

Extreme events

Those that have a lesser probability; approximately a 2-3 percent chance of occurring in 50 years.

[12] Listed categorization adapted from NIST Community Resilience Planning Guide, nist.gov/community-resilience/planning-guide

It is equally important to know that local natural or human-made features and characteristics of a community may modify a hazard's impact. Characteristics of a community—such as the presence of high-rise buildings; common construction practices or material assemblies; adjacency and density of structures; hills, valleys, and other topographic features; and vegetation (tree canopy), among others—are all capable of altering how a specific hazard component, such as wind or water, interacts with and affects the community. These features are impact modifiers.

Impact modifier
A local natural or human-made feature or characteristic of a community that alters the severity of a hazard.

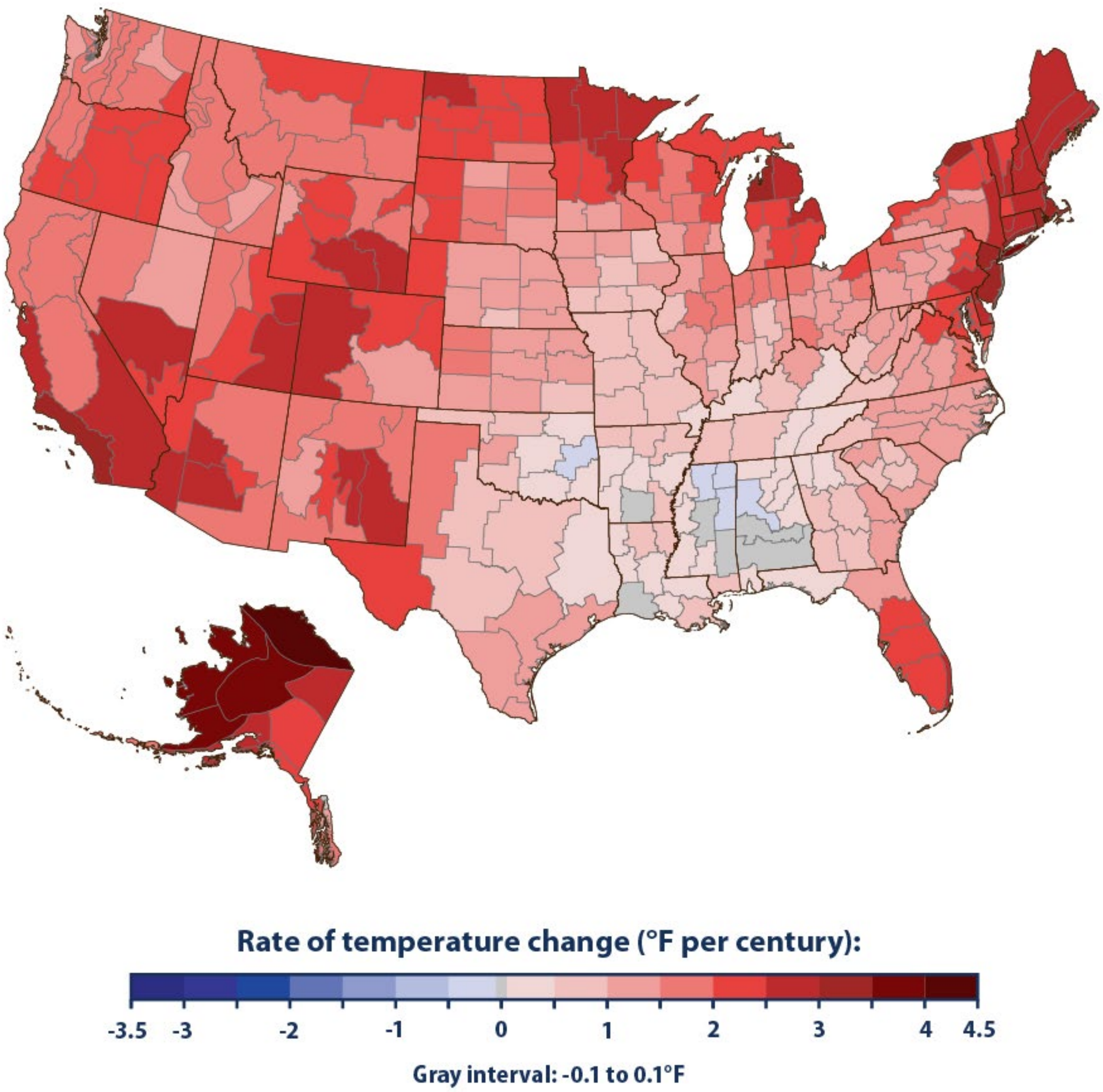
As communities grow and change, local impact modifiers may take on more significance. According to the American Society of Civil Engineers (ASCE), there are over 91,000 dams in the United States. Dams are given a hazard-potential rating; a high-hazard-potential rating means that if failure were to occur, there would likely be deaths and extensive property damage. "Over the last 20 years, the number of high-hazard-potential dams has more than doubled as development steadily encroaches on once-rural dams and reservoirs."[13] Lack of maintenance coupled with increased development and climate-induced increases in rainfall intensity are placing more communities at risk.

Also an impact modifier, climate change is exacerbating the impacts of hazards related to a warming atmosphere, acidification of the ocean, and rising sea levels. For example, in coastal urban communities, sea level rise is increasing the height and speed of storm surge and breaking waves making them more damaging upon impact. Compounding this phenomenon are anthropogenic factors related to extraction and destruction of natural systems, such as mangroves along the Gulf Coast, which naturally mitigate the effects of storm surges. In other regions, global warming is changing precipitation patterns and temperature extremes, contributing to an increase in the frequency and intensity of both extreme rain events and drought. Events such as "flash drought" and "wildfire" are becoming more common each year. These environmental changes create new conditions that intensify hazard impact and further challenge planning and response efforts.

Compounding events can also be considered an impact modifier that exacerbate impacts and complicate response and recovery efforts. One example of a compounded event is the confluence of a pandemic, such as COVID-19, with other occurring natural hazard disaster events. During the 2020 hurricane season, guidelines based on the Centers for Disease Control and Prevention's social distancing standards were estimated to reduce evacuation shelter capacity by as much as 60%.[14]

[13] "2021 Report Card for America's Infrastructure," American Society of Civil Engineers (ASCE). infrastructurereportcard.org/cat-item/dams/

[14] Abby Wendle, "U.S. Disaster Response Scrambles to Protect People from Both Hurricanes and COVID-19," NPR, July 22, 2020. npr.org/2020/07/22/893286668/u-s-disaster-response-scrambles-to-protect-people-from-both-hurricanes-and-covid

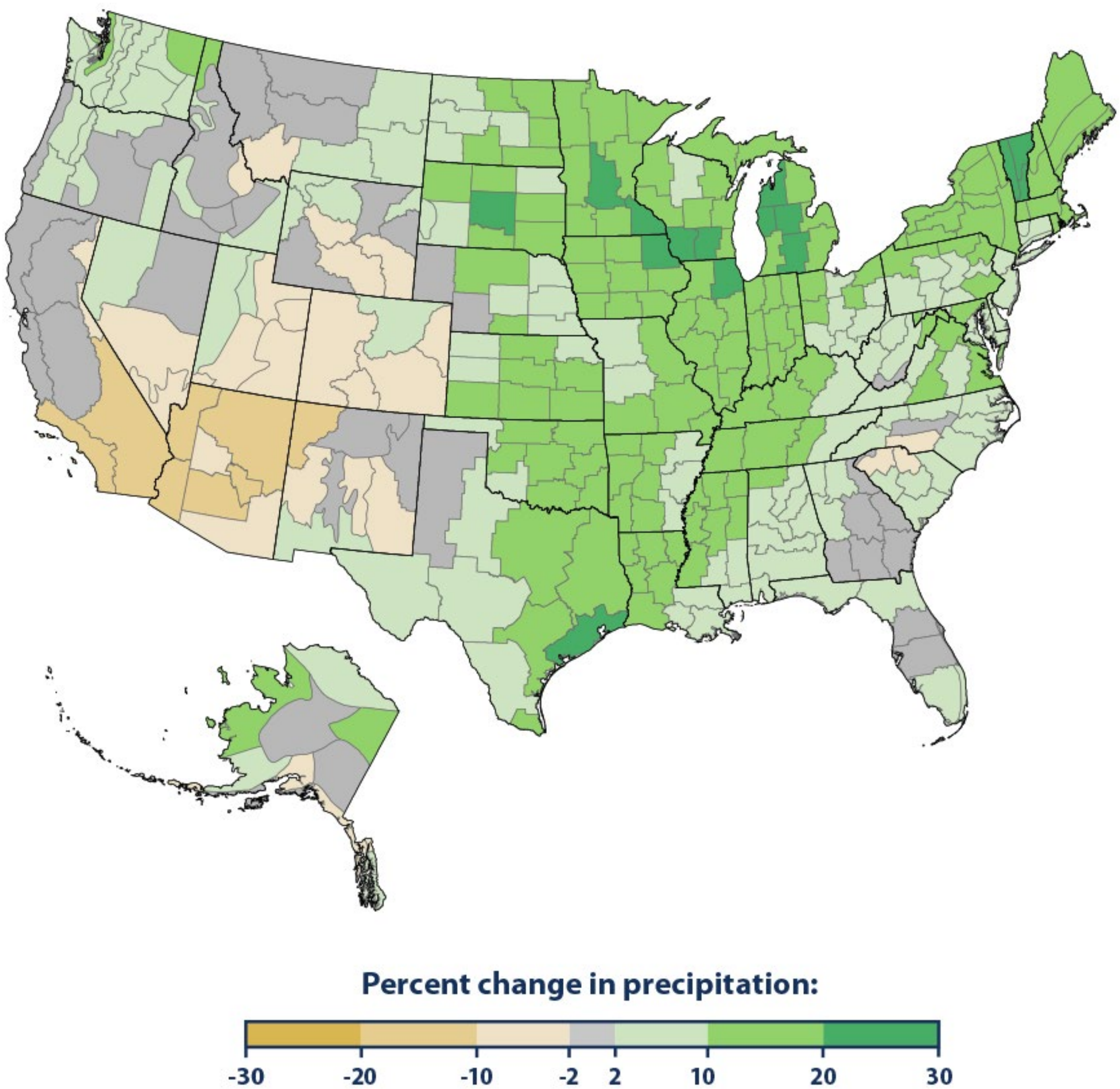


OBSERVED U.S. TEMPERATURE CHANGE

This figure shows how annual average air temperatures have changed in different parts of the United States since the early 20th century (since 1901 for the contiguous 48 states and 1925 for Alaska). The data is delineated by climate divisions, as defined by the National Oceanic and Atmospheric Administration.

SOURCE

EPA



OBSERVED U.S. PRECIPITATION CHANGE

This figure shows the rate of change in total annual precipitation in different parts of the United States since the early 20th century (since 1901 for the contiguous 48 states and 1925 for Alaska). The data is delineated by climate divisions, as defined by the National Oceanic and Atmospheric Administration.

SOURCE

EPA

HAZARD MULTIPLIERS: SECONDARY HAZARDS

Many environmental hazards induce or trigger secondary hazards or what is commonly referred to as cascading effects. These vary by location and are to be taken into consideration during planning, hazard mitigation, and response efforts. Secondary hazards can range in scale as major hazard events themselves or nuisances that exacerbate damage—such as power outages caused by windstorms and the leaking of unhealthy toxins affecting public human health and environmental ecosystems, such as water supply, etc.

The building code cannot be relied upon to account for secondary hazards. For example, subduction zone earthquakes can cause tsunamis and large landslides and may be followed by aftershocks. These multi-hazard events are not specifically addressed in building codes. For example, building codes only take into account the initial seismic event; there is no mechanism to account for the reduced performance of a building as events occur. This is evidenced by a building subjected to earthquakes—it may "survive" the initial quake but then fail when an aftershock occurs. It is thus important to consider secondary and tertiary hazards as well as the initial event.

Other examples of acute secondary hazards include fires caused by downed power lines or ruptured gas pipes because of an earthquake. The potable water supply system, either within the building or within the community, may also be damaged after an initial event. This has far-reaching consequences, including loss of the fire suppression system, interior water damage, and the inability to cook, bathe, or use the sanitary system. Hazards often result in the release of hazardous materials from dislodged containers, excessive mold growth, garbage spills, debris, and displaced disease-carrying vermin.

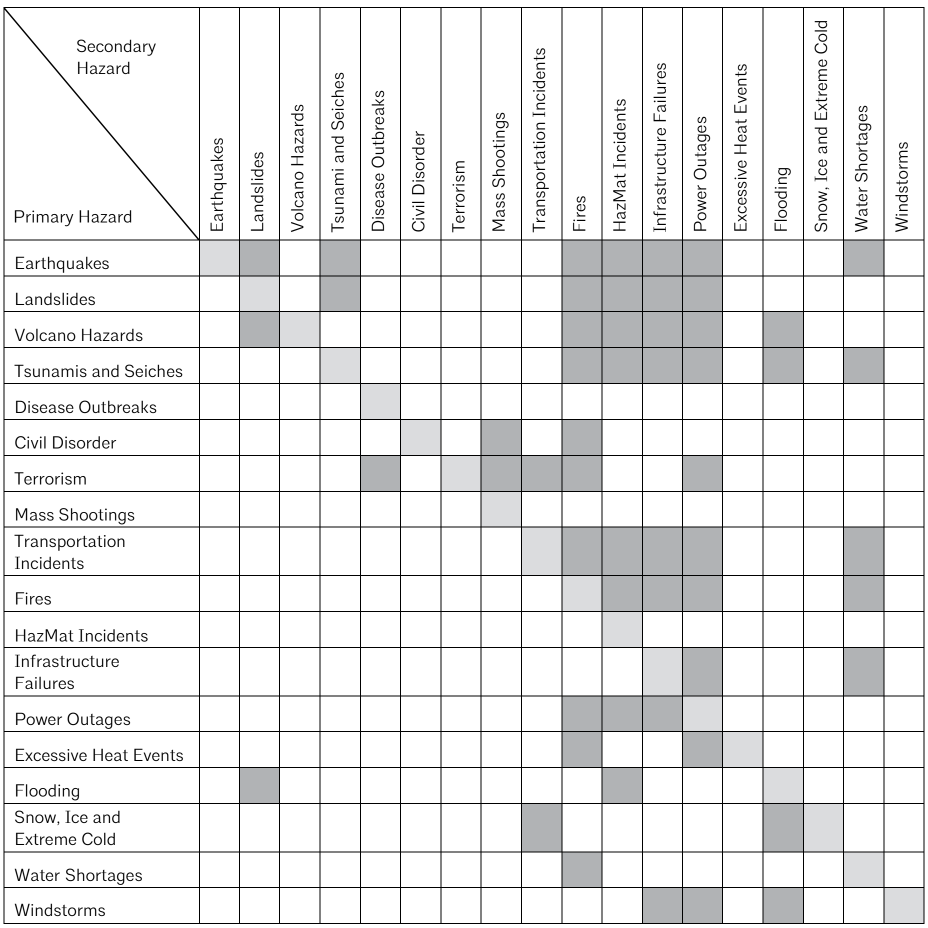
The sources of secondary hazards aren't always present at the building or property site; some of these hazards are hidden until they become problems due to failings at adjacent properties. Neighboring buildings may have collapse or fall potential, or buildings may contain explosive materials or toxic chemicals that once released cause massive amounts of cascading damage. Secondary hazards could be an upstream contamination of a water supply or the flooding that occurs due to a sudden heavy snow melt. An architect's ability to foresee and visualize the impacts of secondary hazards on building function will enable them to identify the best areas to focus hazard mitigation strategies and plan for the unexpected factors associated with a disaster event.

Cascading effects[15]
The dynamics present in disasters in which the impact of a physical event or the development of an initial technological or human failure generates a sequence of events in human subsystems that result in physical, social, or economic disruption. Thus, an initial impact can trigger other phenomena that lead to consequences with significant magnitudes.

The AIA Architecture and Design (A&D) Material Pledge

The first rule in disaster response is to stay safe and not add to the disaster by becoming another casualty. As with disaster response, architects have an opportunity to ensure their designs do not add to the disaster should the building experience a hazard event. One way to reduce negative consequences is through specifying appropriate materials that can withstand identified hazard risks and by eliminating the use of substances that are hazardous or may become hazardous after exposure to water or fire. Learn more with the AIA Architecture and Design (A&D) Material Pledge.

[15] Gianluca Pescaroli and David Alexander, "A definition of cascading disasters and cascading effects: Going beyond the 'toppling dominos' metaphor." *Planet@Risk*, 2(3), 58-67, Global Risk Forum GRF Davos, 2015.



CASCADING EFFECTS

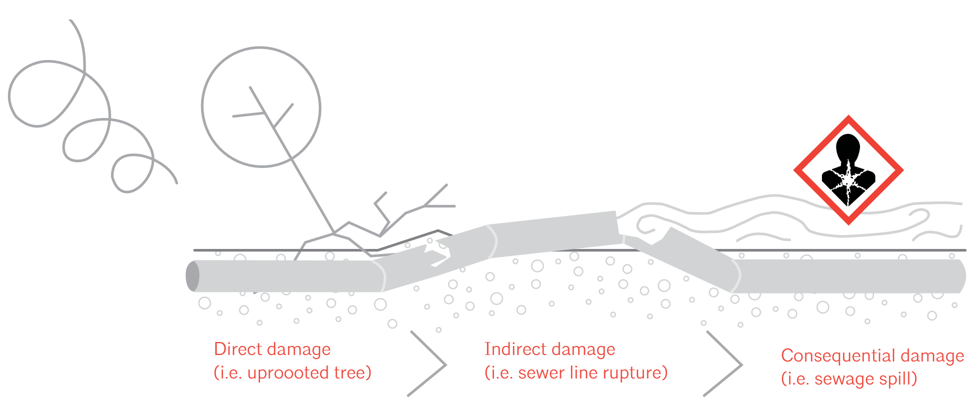
Secondary hazards vary by location. In this example from the city of Seattle, the initial event or primary hazard (far left column) triggers secondary hazards shown as medium probability (light grey) or high probability (dark grey). Author's note: In addition to the effects noted, earthquakes may cause flooding if a dam breaks or a sewer line is damaged. Flooding can lead to water shortages if drinking water becomes contaminated.

SOURCE

Office of Emergency Management, city of Seattle. Used with permission.

DIRECT, INDIRECT, AND CONSEQUENTIAL DAMAGE

Direct damage caused by the impact of a hazard can trigger secondary hazards, and both of these in turn may bring about consequential damage. For example, extreme winds during a storm can uproot a tree (direct damage), which ruptures a sewer line as the tree uproots itself and the sewer pipe above it (indirect damage). The pipe break can then cause a sewage spill—a health hazard (consequential damage)—and temporarily disable the building plumbing, making the building uninhabitable until the sewer line is repaired.



BUILT ENVIRONMENT HAZARD IMPACTS

The direct damage caused by the impact of a hazard can trigger secondary hazards, and both of these in turn may bring about consequential damage. Direct, indirect, and consequential impacts must be considered when assessing the damage and destruction that could be caused by a disaster.

In addition to considering the damage that may occur from hazard events that are historically likely to happen, the impacts of an evolving climate must also be evaluated. Changing climatic effects, including increased flooding, storm surge, drought, and wildfires, pose significant challenges for buildings and the infrastructure that enables their operation. In 2021 the American Society of Civil Engineers gave the United States' infrastructure a C- score.[16] Many infrastructure systems, like energy, transportation, water, and sanitation, are at maximum capacity, undersized, out-of-date, or have not been built or upgraded to accommodate extensive growth and load changes that developed regions have placed upon existing systems. Failure of these systems could leave a building without power, water, sanitation, or access to the broader community.

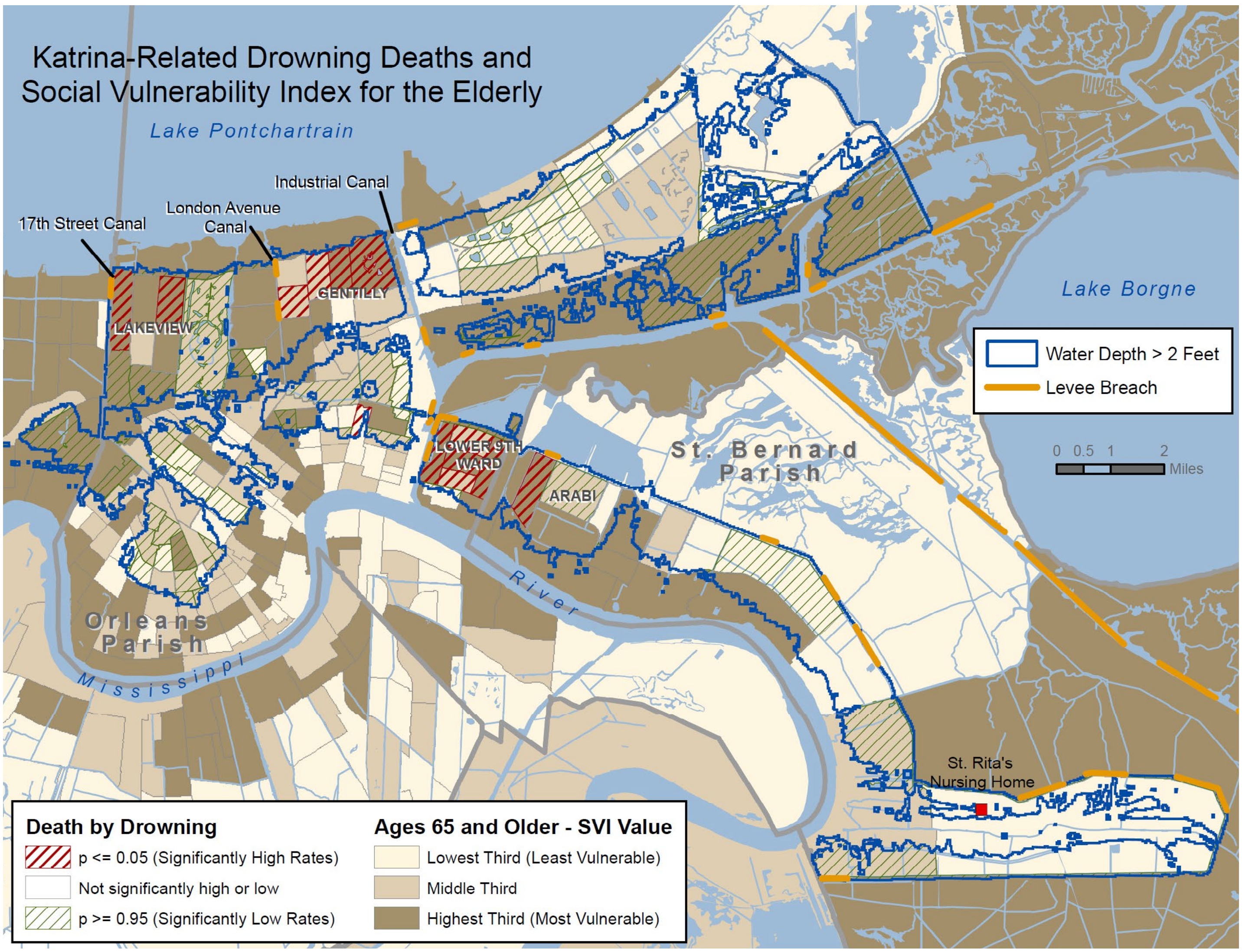
In buildings, climate change might mean older roofs are unable to support increasing snow loads, and seals at entry doors and windows may be insufficient to resist wind-driven rain. Flooding and sea level rise can cause scouring at the foundation, compromising the integrity of a structure's foundation that may not be immediately visible. Power outages may cause indoor temperatures to rapidly rise or quickly plummet to uninhabitable levels. Additionally, mechanical systems and stormwater management systems may be undersized to cope with extreme heat and increased levels of precipitation, placing additional strain on already stressed utilities. Stormwater issues associated with aged, combined stormwater sewer systems or under-sized infrastructure allow for the backflow of sewage into buildings, which poses a substantial human health, safety, and welfare hazard.

These are just a few examples of how climate impacts can severely inhibit building function and demonstrates why it's critical to design with climate change in mind. Furthermore, it is important to note that often these building vulnerabilities and infrastructural factors (aged levees, combined sewer systems, failing bridges, etc.) that compound disaster events are disproportionately associated within areas of cities and regions inhabited by vulnerable populations. For example, the study "A Social Vulnerability Index for Disaster Management" revealed significantly higher rates of death from drowning occurred in the areas of New Orleans that were home to those age 65 and older.

"The built environment is life's infrastructure; it reflects who we are... it protects and enhances our ethical and societal needs, yet all the while it contributes to our vulnerabilities."

— Dr. Lee Bosher, 2016

[16] 2021 Report Card for America's Infrastructure," American Society of Civil Engineers (ASCE). infrastructurereportcard.org/cat-item/dams/



KATRINA-RELATED DROWNING DEATHS AND SOCIAL VULNERABILITY INDEX FOR THE ELDERLY

Overlay of Katrina-related drowning deaths and the elderly social vulnerability index (SVI) value (i.e., percentile rankings for population older than age 65).

SOURCE

Barry E. Flanagan, et al., "A Social Vulnerability Index for Disaster Management," *Journal of Homeland Security and Emergency Management*, 8(1), 2011.

FINANCIAL IMPACTS

Climate change poses a growing financial risk. It is estimated that the flood risk in Florida could devalue exposed homes by $30–$80 billion, or 15% to 35%, by 2050,[17] leaving lenders and reinsurers with potentially catastrophic financial losses. In California, wildfires, which have destroyed homes and businesses, have created an insurability crisis for real estate in the affected regions; the combined losses from the 2017 and 2018 wildfire season wiped out 26 years' worth of underwriting profit Californian insurers had made, leaving them with over $10 billion in losses.[18] And without insurance, banks won't write mortgages.[19] They are wise to be leery: "Large disasters can cause abrupt devaluations of property and mortgage values, representing a substantial risk for lenders who retain mortgages on their books."[20]

In 2020, natural disasters[21] in the U.S. accounted for $95–97 billion in losses, and of that amount, only $67 billion of the losses were insured. While property insurance coverage is relatively common in the U.S., it is much less so in low-wealth communities of the U.S. and in many of the developing nations across the world. Since insurance is rare in other countries (ranging from 0.5% to 4.3% in Latin America and the Caribbean), immigrants may be unfamiliar with the product.[22] Immigrants may save or pool money to purchase a property outright and, thus, inadvertently avoid the mandatory property insurance coverage required by a bank for a mortgage. Mandatory insurance can function as a risk signal. Others may utilize an individual tax identification number (ITIN) mortgage,[23] which will require property insurance but not an explanation of the policy.[24] A lack of coverage, or understanding of what is covered by homeowners insurance, can create a layer of financial vulnerability for first-generation populations who may not speak the country's language.

Even within the U.S., many properties are underinsured or may be uninsured for certain hazards; exacerbating the potential loss of generational wealth from sustained damage and/or loss of home value due to extreme weather and climate impacts.. A recent analysis by CoreLogic estimated that 64% of homeowners don't have enough insurance and that they are underinsured by an average of 27%.[25] Lack of flood and earthquake insurance are also common gaps. It is estimated that only 5% of single-family homeowners in the U.S. have flood insurance.[26] Even a property that is properly insured is still subject to deductibles that may range from thousands to tens of thousands of dollars per occurrence.

[17] "Will mortgages and markets stay afloat in Florida?" McKinsey Global Institute, April 27, 2020. mckinsey.com/business-functions/sustainability/our-insights/will-mortgages-and-markets-stay-afloat-in-florida

[18] Eric J. Xu, FCAS, Cody Webb, and David D. Evans, "Wildfire catastrophe models could spark the changes California needs," Milliman White Paper, October 2019. assets.milliman.com/ektron/Wildfire_catastrophe_models_could_spark_the_changes_California_needs.pdf

[19] Margaret E. Peloso, Sarah E. Fortt, and Lindsay Hall, "Credit for Climate Action," Harvard Law School Forum on Corporate Governance, April 28, 2021. corpgov.law.harvard.edu/2021/04/08/credit-for-climate-action/

[20] Charlie Wowk, "Burning Down the House: How Inadequate Climate Risk Disclosures and Information Asymmetries Threaten to Disrupt the U.S. Mortgage Market," Global Financial Markets Center, Duke University School of Law, February 11, 2011. sites.law.duke.edu/thefinregblog/2021/02/11/burning-down-the-house-how-inadequate-climate-risk-disclosures-and-information-asymmetries-threaten-to-disrupt-the-u-s-mortgage-market/

[21] "Record hurricane season and major wildfires – The natural disaster figures for 2020," Munich Re, January 7, 2021. munichre.com/en/company/media-relations/media-information-and-corporate-news/media-information/2021/2020-natural-disasters-balance.html

[22] "Insurance premiums as a share of gross domestic product in selected countries in Latin America and the Caribbean in 2019," statista. statista.com/statistics/1131908/latin-america-insurance-penetration-rate-country/

[23] "In Latino community, money pools a different approach to lending," Cronkite News. September 19, 2013. cronkitenewsonline.com/2013/09/popular-in-latino-community-money-pools-a-community-approach-to-lending-saving/index.html

[24] "Guide to Home Insurance Under Undocumented Status," The Simple Dollar, December 3, 2020. thesimpledollar.com/insurance/home/guide-to-home-insurance-under-undocumented-status/

[25] "Homeowners May Be Underinsured for Weather-Related Disasters," Real Trends, June 27, 2019. realtrends.com/homeowners-may-be-underinsured-for-weather-related-disasters/

[26] "The flood insurance gap in the United States," Munich Re, August 28, 2020. munichre.com/topics-online/en/climate-change-and-natural-disasters/natural-disasters/floods/the-flood-insurance-gap-in-the-us.html

Damages due to increasingly frequent hazard events can interrupt business continuity for months, crippling a community's economy and local government's budget. Communities that have strong economies typically return to operation more quickly, but studies show that some companies can afford to be out of service for only three days before losing their market share. For example, Kobe, Japan, once one of the largest container ports in the world, was damaged by a 6.9 magnitude earthquake in 1995. While the city regained function, it did so with a 20% loss in economic activity and has never regained its leading position.[27] Even when no physical damage occurs to an asset, profitability is reduced when operating time or supply chains are disrupted.

Since the real estate, building, and construction sector creates these built assets, the building industry will be front and center as the nation discovers, through enhanced disclosure transparency, the full measure of the risks faced. In May 2021 President Biden issued an Executive Order on Climate-related Financial Risk, seeking to "advance consistent, clear, intelligible, comparable, and accurate disclosure of climate-related financial risk."[28] As lenders and insurers become increasingly aware of the climate risk liabilities in their portfolios, they will look to the construction sector to assure them that the investments they are making are secure.

[27] William duPont IV, Ilan Noy, Yoko Okuyama, and Yasuyuki Sawada, "The Long-Run Socio-Economic Consequences of a Large Disaster: The 1995 Earthquake in Kobe," *PLoS ONE*, 10(10), 2015, e0138714. doi:10.1371/journal. pone.0138714.

[28] "President Biden Issues Federal Direction on Disclosure of Climate-Related Financial Risk," *The National Law Review*, May 25, 2021. natlawreview.com/article/president-biden-issues-federal-direction-disclosure-climate-related-financial-risk

ENVIRONMENTAL IMPACTS

A community's natural environment is also adversely impacted by a hazard event. Post-disaster, large amounts of debris need to be removed, transported to landfills, and treated if hazardous, all of which increases greenhouse gas emissions.[29] Eroded soil, destroyed vegetation, and contaminated water degrade the natural environment that people depend upon. Repairs and replacement of existing buildings and infrastructure are costly economically and particularly detrimental environmentally, contributing to future adverse climate impacts.

Disasters such as wildfires, floods, and tornadoes can completely defoliate forests. Wildlife may be killed directly by the disaster or impacted indirectly through changes in habitat and food availability. Endangered species are especially vulnerable when habitat is destroyed. Water quality is impacted when sewage treatment facilities flood, affecting people, plants, and animals. When debris enters reservoirs and waterways, it can change the water chemistry. Beaches and barrier islands move and change shape due to storm surges, some totally disappearing. Riverbanks erode during flash flood events, and streams and rivers cut new channels, sometimes stranding aquatic species.

Extreme heat is a growing problem for wildlife that is unable to adapt or migrate. Higher temperatures and extreme drought conditions have triggered tree mortality, as seen in Western states. Warming temperatures allow expanding ranges of insects, such as bark beetles. Drought and insect infestation increase the susceptibility of forests to wildfire. The National Oceanic and Atmospheric Administration reported that Alaska's statewide average temperature was 7.9° F above average in 2019. The extreme heat decreased the amount of oxygen in the water, causing fish to suffocate and killing large numbers of salmon in the state.[30]

[29] "Waste Management Planning to Mitigate the Impact of Climate Change," EPA. epa.gov/homeland-security-waste/waste-management-planning-mitigate-impact-climate-change

[30] "Climate Change, Natural Disasters, and Wildlife," National Wildlife Federation, November 2019. nwf.org/~/media/Documents/PDFs/Environmental-Threats/Climate-Change-Natural-Disasters-fact-sheet.ashx?la=en&hash=DFC7F87116E03583B1F81B3A64CB88FEF55039BC

CLASSIFICATION OF NATURAL HAZARD EVENTS: MINOR, MAJOR, AND CATASTROPHIC

There is a saying in the disaster response world: "All disasters are local." The response hierarchy is described by emergency managers as "federally supported, state managed, and locally executed."

The Stafford Act (1988) regulates federal activity associated with disasters. Per the Stafford Act, the Federal Emergency Management Agency (FEMA) is tasked with coordinating federal government relief efforts as well as those from nongovernmental and nonprofit organizations.[31]

Minor events are usually within the capability of the local unit of government to handle. When the disaster's impact exceeds that ability, it is considered a major event. Fortunately, not all hazard events result in a disaster. According to the federal government, a major natural or human-caused hazard event becomes a "disaster" when the affected state's governor requests a "disaster declaration" and the president grants it. (See Chapter 4: Disaster Response for additional detail.) A catastrophic event is one that is expected to result in nationwide impacts over a prolonged period of time, such as a pandemic or region-wide event like Hurricane Katrina.

A major disaster declaration also triggers actions from other federal and state agencies and nongovernmental organizations, including AIA's Disaster Assistance Program. AIA's responses differ from state to state depending on its organizational structure. Volunteers trained through the AIA Safety Assessment Program (or equivalent) may be called up at the behest of a local jurisdiction or upon activation by the state.

The insurance industry has a different definition of disaster. The term "catastrophe" in the property insurance industry denotes a natural or man-made disaster where claims are expected to reach or exceed $25 million. As noted above, damage is often not covered by insurance, so a significant disaster per the Stafford Act may not rise to the level of an insurance catastrophe, such as an East Coast seismic event where few earthquake policies are sold. The opposite may also occur: A severe hailstorm will be classified as an insurance catastrophe but will not even be considered a local disaster due to its limited disruption.

Event classifications

Minor event
A disruption; local response capability is adequate

Major event
A serious disruption; state and/or federal response required

Catastrophic event
A natural or manmade incident, including terrorism, that results in extraordinary levels of mass casualties, damage, or disruption severely affecting the population, infrastructure, environment, economy, national morale, and/or government functions. A catastrophic incident could result in sustained nationwide impacts over a prolonged period of time and significantly interrupts governmental operations and emergency services to such an extent that national security could be threatened.[32]

[31] "National Response Framework," Homeland Security, May 2013.

[32] Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-288) as amended, FEMA, January 2016.

Natural catastrophe losses in the United States from 2006–2015, listed by peril

EVENT	FATALITIES	ESTIMATED OVERALL ECONOMIC LOSSES (U.S. $B)	ESTIMATED INSURED LOSSES (U.S. $B)
Severe convective storm/thunderstorm	1,424	$216	$175
Tropical cyclone	568	$267	$124
Wildfire, drought, heatwave	328	$95	$63
Flooding, flash flood	298	$44	$10
Winter storm and cold waves	514	$31	$18
Earthquake and geophysical	51	$2	$0.7
Total	3,183	$700	$390

Original data source: Munich Re, NatCatSERVICE

Aggregated data from the Insurance Information Institute: iii.org/table-archive/21420
See website for caveats regarding data for each year.

EMERGENCY MANAGEMENT STAGES AND THE BENEFITS OF RESILIENCE AND CLIMATE ADAPTATION

Historically, the emergency management model begins with the occurrence of a hazardous event. However, as the emergency management profession matured, the model evolved to begin with identification of the hazards followed by pre-disaster hazard mitigation. Experience has shown that the addition of hazard mitigation and planning can be a more cost-effective approach. The National Institute of Building Sciences' Multi-Hazard Mitigation Council report, *Natural Hazard Mitigation Saves: 2019 Report*,[33] found that every dollar spent by the federal government on hazard mitigation saves six dollars in recovery. This study and its 2005 precursor, in part, made the case for the increasing attention on resilience and climate adaptation.

Resilience is the dynamic quality of an entity at a given place and time. In an ever-changing environment, resilience is an aspired state of functioning for buildings, landscapes, infrastructure, and other pieces of the built and unbuilt environment that is based upon:

1) awareness of vulnerabilities;

2) knowledge and past experience;

3) preparedness and readiness for action; and

4) availability of resources.

Resilience is underscored by a continual effort to reduce risk. Understanding vulnerabilities and interdependencies will inform efforts and actions to enhance resilience and reduce risk. The concept of climate adaptation recognizes that certain disruptions are caused by slow and sometimes permanent changes in the environment that will require innate flexibility and adjustment in order to be resilient. AIA encourages practices that enhance resilience and climate adaptation to confront hazard risk and disasters.

Resilience

The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions.[34]

Climate adaptation

The adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.[35]

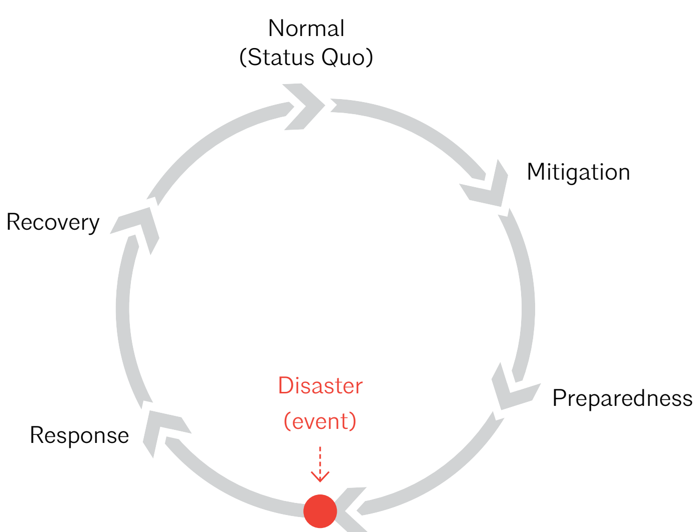
[33] *Natural Hazard Mitigation Saves: 2019 Report*, National Institute of Building Sciences, December 2019. http://2021.nibs.org/files/pdfs/NIBS_MMC_MitigationSaves_2019.pdf

[34] C.B. Field, V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley, "IPCC, 2012: Glossary of terms. In: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC)," Cambridge University Press, https://archive.ipcc.ch/pdf/special-reports/srex/SREX-Annex_Glossary.pdf

[35] "Glossary A-D." Intergovernmental Panel on Climate Change.

FEMA DEFINITIONS[36] OF DISASTER CYCLE

There are four widely accepted phases of emergency management. These are listed below. While there is a general progression from one phase to the next for a single disaster, there is no clean break from one phase to the next, and multiple phases can progress at a moment in time. Additionally, multiple disasters may occur at one time, and each may exist in a unique stage. Even with the nuances of individual and multiple disasters, it is helpful to understand the periods of the disaster cycle and what constitutes each phase.



EMERGENCY MANAGEMENT CYCLE
The sequence of this handbook follows the emergency management cycle.

SOURCE
National Institute of Standards & Technology

Hazard mitigation

Any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards.

Hazard mitigation measures are often formed by lessons learned from prior incidents. Hazard mitigation involves ongoing actions to reduce exposure to, probability of, or potential loss from hazards. Measures may include zoning and building codes, floodplain buyouts, and analysis of hazard-related data to determine where it is safe to build or locate temporary facilities. Hazard mitigation can include efforts to educate governments, businesses, and the public on measures they can take to reduce loss and injury.[37]

Preparedness

Actions taken to plan, organize, equip, train, and exercise to build and sustain the capabilities necessary to prevent, protect against, mitigate the effects of, respond to, and recover from threats and hazards.

Response

Those capabilities necessary to save lives, protect property and the environment, and meet basic human needs after an incident has occurred.

Recovery

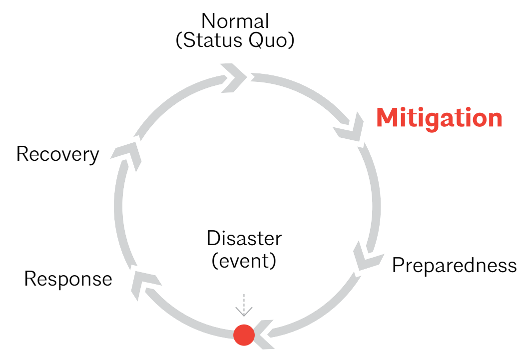
Those capabilities necessary to assist communities affected by an incident to recover effectively, including, but not limited to, rebuilding infrastructure systems; providing adequate interim and long-term housing for survivors; restoring health, social, and community services; promoting economic development; and restoring natural and cultural resources.

[36] Glossary, FEMA. fema.gov/about/glossary

[37] Hazard mitigation, to reduce risks or lessen consequences, can include purchasing the appropriate type of property insurance for the hazard. Insurance cannot eliminate risks to persons or property and can only reduce the financial effects of an event. It is critical to understand where insurance can be used to balance the risk equation. Insurance can also be a bit of an unknown. A decade ago fire insurance was available and affordable; in some Western states it may now be expensive or unavailable due to the increase in wildfires. It will typically be best to avoid the most hazardous locations and build in resilient features where appropriate.

Hazard risk reduction and mitigation

02



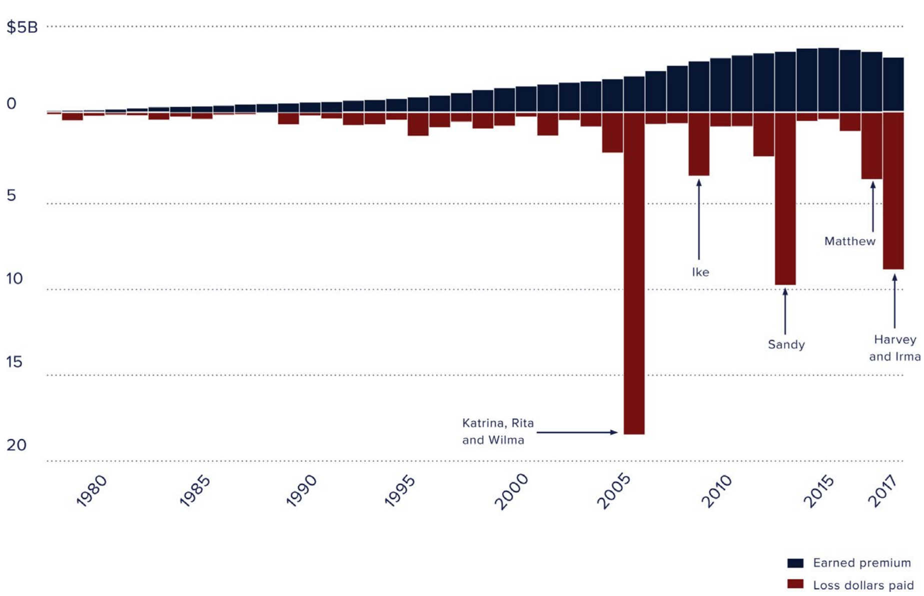
LEARN: HAZARD MITIGATION CONTEXTUALIZED

ACT: HAZARD MITIGATION STRATEGIES FOR BUILDINGS AND COMMUNITIES

OVERVIEW

Natural hazard events, such as floods, earthquakes, tornadoes, hurricanes, or wildfires, do not necessarily need to be disasters. If there is regular holistic community preparation for natural hazards, lives and economies can be preserved. As discussed in Chapter 1, disaster stems from the overlap between the hazard and the vulnerable systems (such as people, buildings, or infrastructure) that must withstand the impacts of the hazard—the smaller the overlap, the smaller the risk. Hazard mitigation diminishes this overlap by reducing vulnerability and therefore risk.

Reducing risk minimizes lives lost and injured, reduces property damage, saves money in repairs and recovery, and allows operations and functionality to return to normal more quickly. 40–60% percent of businesses do not reopen after a disaster and another 25% fail within one year, according to FEMA.[38] Effective risk reduction enhances business continuity, ensuring supply chain operations and enabling a community to get the goods and services it needs. The nation cannot afford to ignore the value of hazard mitigation and risk reduction in creating resilient, adaptive communities in the face of a changing climate.



NATIONAL FLOOD INSURANCE PROGRAM PREMIUMS AND LOSSES

Comparison of National Flood Insurance Program (NFIP) premiums and payouts (1978–2018)

SOURCE

First Street Foundation

Key concepts

- Review local risk data through a community-wide, holistic, systems-based lens.
- Discern the coordinating roles of federal, state, and local governments in risk management.
- Understand how zoning and land use choices impact community resilience goals.
- Recognize the difference between minimum performance requirements reflected in building codes and the opportunity for enhanced resilient design by integrating hazard mitigation strategies.
- Understand the process of conducting a building vulnerability assessment and how it can inform hazard-reduction performance goals.
- Recognize the value of individual buildings in contributing to community resilience. Draw upon community vulnerability assessments to inform building vulnerability assessments.

[38] "Building Codes Save: A Nationwide Study. Losses Avoided as a Result of Adopting Hazard-Resistant Building Codes," FEMA, November 2020.

WHY HAZARD RISK REDUCTION AND MITIGATION

The increasing impact of disasters on society, the economy, cultural and natural resources, and the built environment provides sufficient justification for undertaking a hazard risk reduction program. The cost of doing nothing in the face of a changing climate is too high. Preparing strategically for future events requires approaches to building and community design that are based on probable events in addition to consideration of the limited historic data that exists. This requires innovative design and intervention by architects, engineers, municipalities, and public policy makers.

The federal government recognizes hazard mitigation is essential

The federal government recognizes the value of hazard mitigation measures. FEMA is the U.S. government agency with the responsibility to prepare for, prevent, respond to, and recover from disasters, and this includes many of the nation's hazard mitigation activities.[39] According to the Hazard Mitigation Act of 2000—a modification to the Stafford Act—to be eligible for certain types of non-emergency disaster assistance, including funding for hazard mitigation projects, a state hazard mitigation plan must be approved by FEMA.

Through development of the state plan, risks and vulnerabilities are identified by local and state agencies as well as stakeholders. Long-term strategies for protecting communities are then prioritized by local and state agencies. Local jurisdictions need to have their own hazard mitigation plans in order to qualify for public assistance and hazard mitigation assistance. Due to a federal policy enacted in 2016, states and jurisdictions are integrating the effects of climate change into their hazard mitigation plans or have created separate climate adaptation plans. Many jurisdictions recognize the importance of planning for — and funding — mitigation at the state and local level.

Hazard mitigation makes good economic sense

When the risks associated with primary hazards, cascading effects, and community interdependencies are considered over the service life of a building, hazard mitigation becomes good business. Consider the fact that, given current housing trends, half of the recently built homes are expected to last for more than 100 years.[40] The natural environment these homes inhabit will experience notable changes over this 100-year period. Curiously though, most states do not require an architect's or engineer's stamp for the design of one- and two-family homes, potentially increasing their vulnerability. In any building type—whether residential or commercial—the full building life cycle is the timeframe that needs to be kept in mind when working toward disaster-resistant design and construction.

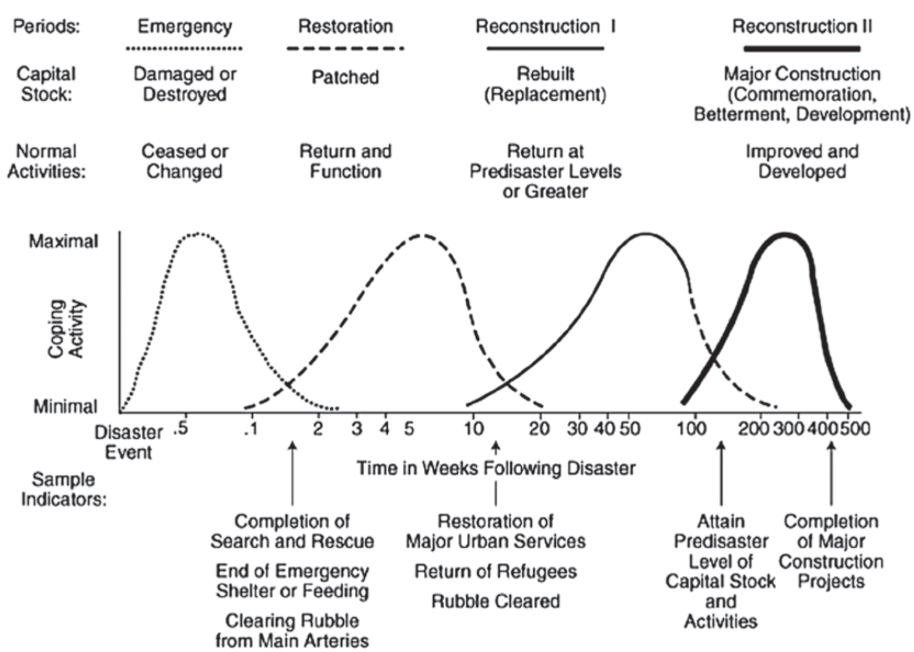
[39] "About the Agency," FEMA, May 11, 2016.

[40] Paul Emrath, "Data Imply Most Homes Last More than a Century," Eye on Housing, National Association of Home Builders, October 17, 2016. eyeonhousing.org/2016/10/data-imply-most-homes-last-more-than-a-century/

Hazard mitigation measures, when based upon a comprehensive vulnerability assessment, offer the most direct opportunity for property owners, tenants, and occupants to act in their best self-interest. Too often risk reduction tactics focus on the narrow parameters that comprise ready responses (i.e., house-elevation in flood prone areas) but fail to see the larger exposure that exists (i.e., bridge and roadway collapse leading to inability to access individual buildings and vulnerable neighborhoods). As climate change impacts become more pronounced, infrequent events may become a feature of everyday life, such as a sunny day flooding in coastal communities, and require a longer-term risk reduction approach, such as planned relocation (also called managed retreat). Thus, it is important to assess the full scope of vulnerabilities and interdependencies before determining hazard mitigation strategies.

“We need to invest now in preparedness to mitigate future protection needs and prevent further climate caused displacement. Waiting for disaster to strike is not an option.”

—Filippo Grandi,
UN High Commissioner for Refugees



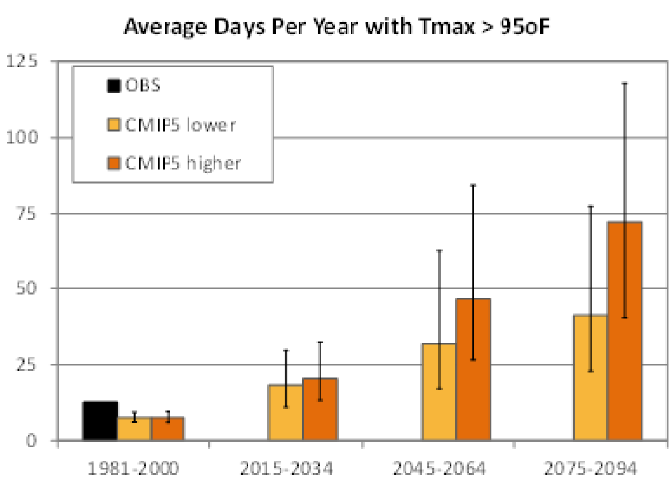
THE LONG TIME TO RECOVERY
Why risk reduction, hazard mitigation, and design for functional recovery is critical.

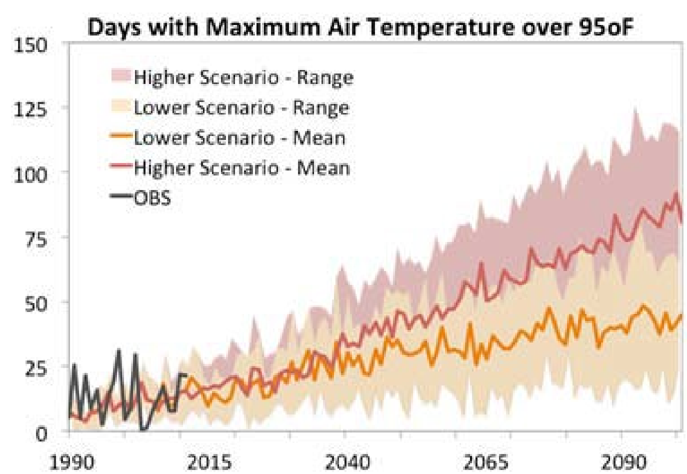
SOURCE
R. Kates and D. Pijawka, “From Rubble to Monument: The Pace of Reconstruction,” in *Reconstruction following Disaster*, ed. J. Eugene Haas, Robert W. Kates, and Martyn Bowden, 1–23 (Cambridge: MIT Press, 1977), 4. Copyright holder: University of Colorado.

Codes may not adequately address hazard risk reduction and mitigation

One of the key methods of minimizing the impact of disasters is to adopt modern building codes and beyond-code standards that enhance hazard resilience beyond a life safety threshold. However, 65% of counties, cities, and towns across the U.S. have not adopted modern building codes,[41] and only 32% of disaster-prone jurisdictions have adopted disaster-resistant building codes.[42] In communities without strong codes, hazard risk reduction and mitigation can only be advanced through proactive design and retrofit projects.

It is also important to recognize that the hazards addressed in building codes are based on a historical perspective. Due to the short and incomplete nature of our historical disaster catalogues (most records go back much less than 100 years and omit extreme events), we have an incomplete picture of possible events. For example, the International Code Council uses climate zones based on observations of annual precipitation and average temperatures from 1961 through 1990 to specify insulation levels for condensation control and has not updated these observations in 26 years.[43] Furthermore, modern codes do not address the greater extremes of temperature, precipitation, and weather-related events caused by an increasingly sporadic and unpredictable global climate. Actual structural loads from snow, water, or wind during the service life of a building may exceed the design criteria derived from the codes. This is due in part to the fact that building codes have relied on historical observations, not forward-looking climate information.[44] Therefore, even buildings built to the latest edition of the code may be inadequate for the climate of the near future. This impact is more pronounced for existing buildings and those built prior to adoption of milestone code updates for specific hazards.





EXAMPLE OF CLIMATE CHANGE DATA FROM THE CITY OF WASHINGTON, DC

Observed (black) and projected days per year with daytime maximum air temperature under higher (orange) and lower (yellow) future scenarios with uncertainty ranges. Currently, building codes do not incorporate this type of forward-looking climate data.

SOURCE

Climate Projections & Scenario Development. Climate Change Adaptation Plan for the District of Columbia, p. 28

[41] "Building Codes Save: A Nationwide Study of Loss Prevention," FEMA, November 2020. fema.gov/sites/default/files/2020-11/fema_building-codes-save_study.pdf

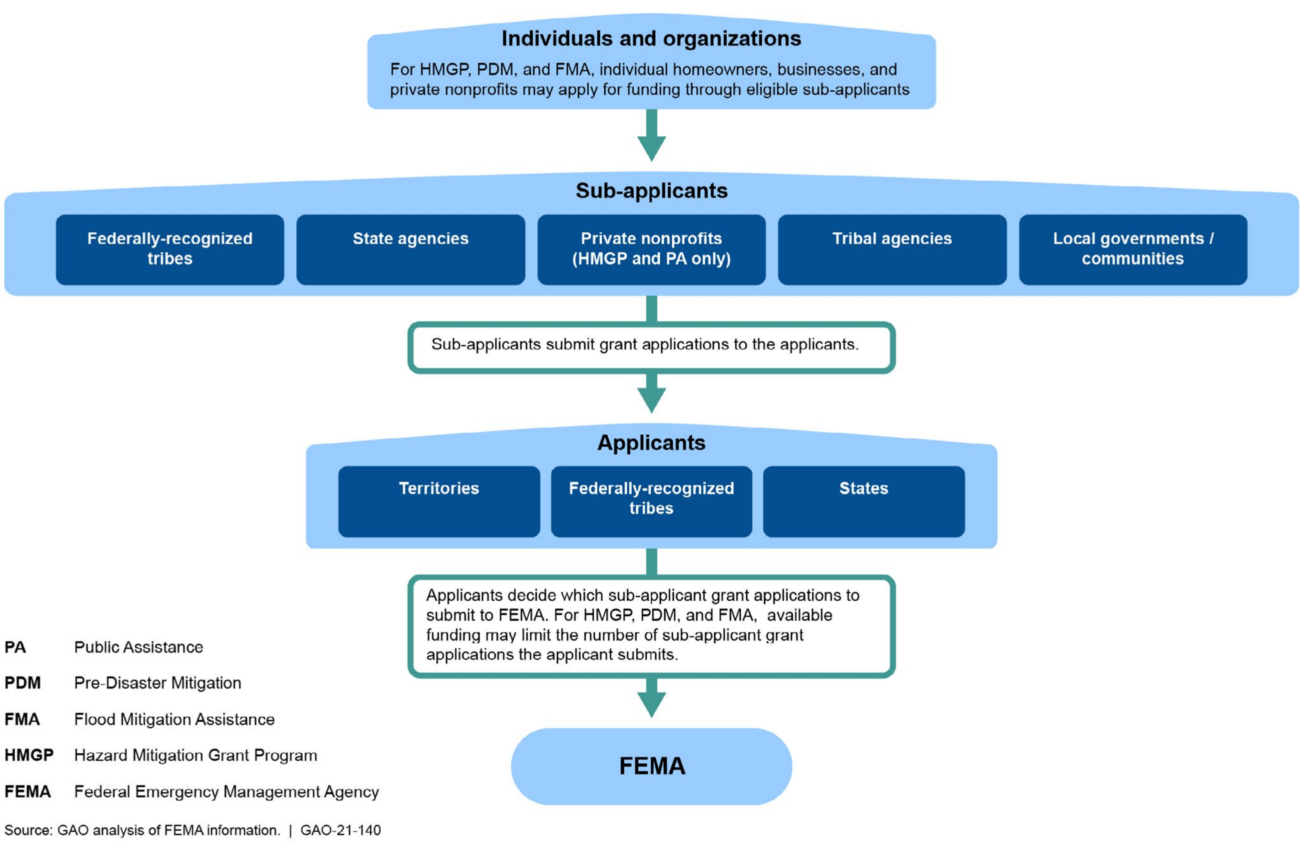
[42] National Mitigation Investment Strategy (NMIS), FEMA, August 14, 2019. fema.gov/sites/default/files/2020-10/fema_national-mitigation-investment-strategy.pdf

[43] *Climate Change: Improved Federal Coordination Could Facilitate Use of Forward-Looking Climate Information in Design Standards, Building Codes, and Certifications*, U.S. Government Accountability Office, November 30, 2016.

[44] Ibid.

FEDERAL, STATE, AND LOCAL HAZARD MITIGATION

Federal, state, and local governments have laws, policies, and programs in place to address hazard mitigation. These programs are typically divided into two sections: pre-disaster and post-disaster mitigation. FEMA's Hazard Mitigation Grant Program (HMGP) provides grants to states and local governments to implement long-term hazard mitigation measures after a presidentially declared disaster. In this program, homeowners and businesses may only apply for a grant as a sub-applicant; in partnership with a territory, federally-recognized tribe, or state government.

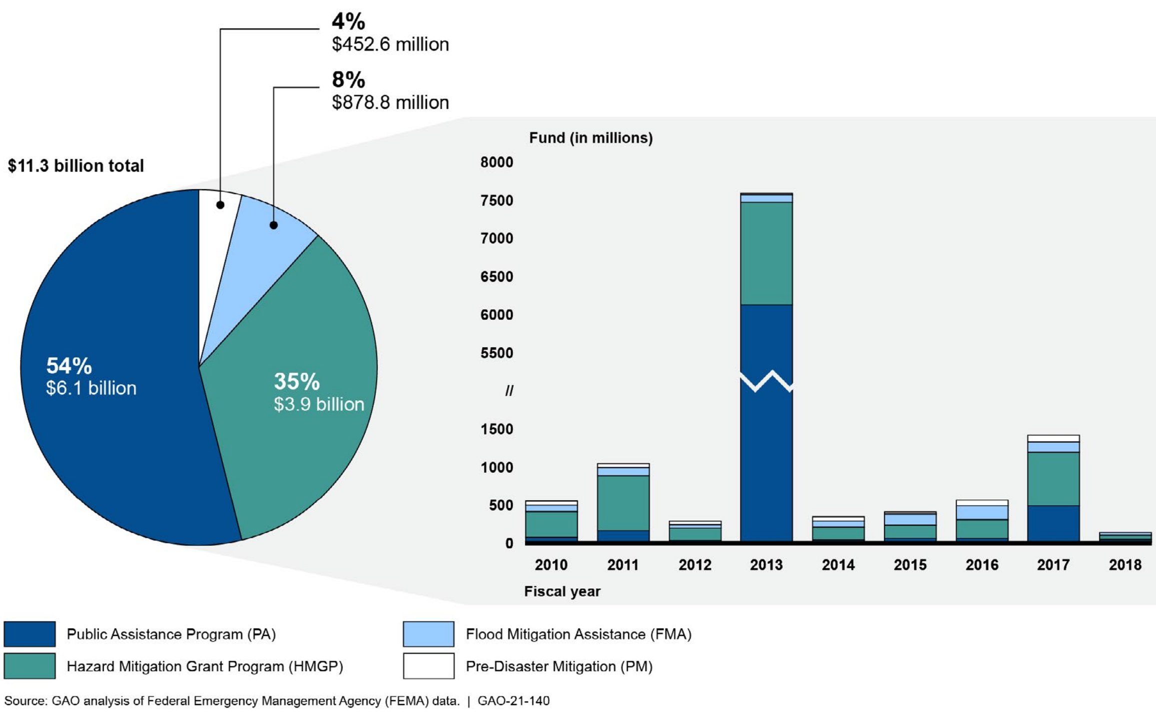


HAZARD MITIGATION GRANT APPLICATION STRUCTURE
FEMA's Hazard Mitigation Grant Program (HMGP) provides grants to states and local governments to implement long-term hazard mitigation measures after a presidentially declared disaster.

SOURCE
GAO-21-140 Disaster Resilience, p. 11

The majority of FEMA Hazard Mitigation Grant funding has historically been offered through the Public Assistance (PA) Program and then through HMGP. States that meet higher hazard mitigation planning criteria may qualify for a higher percentage under the Disaster Mitigation Act of 2000.[45]

Recognizing the value of hazard mitigation, in 2013 the Stafford Act was amended to include a requirement for pre-disaster mitigation planning. This led to FEMA's Pre-Disaster Mitigation Grant Program (PM), which was designed to help communities implement a pre-disaster hazard mitigation program by providing grants to planning initiatives and projects that would reduce future losses. As can be seen, pre-disaster mitigation funding was a small portion of overall federal hazard mitigation grant funding. In fiscal year 2020, PM was replaced with a new pre-disaster mitigation grant program called Building Resilient Infrastructure and Communities (BRIC).



FEMA HAZARD MITIGATION GRANT OBLIGATIONS, FISCAL YEARS 2010-2018.

Pre-disaster mitigation funding was a small portion of overall federal hazard mitigation grant funding. In fiscal year 2020, PM was replaced with a new pre-disaster mitigation grant program called Building Resilient Infrastructure and Communities (BRIC).

SOURCE

GAO report: *Disaster Resilience: FEMA Should Take Additional Steps to Streamline Hazard Mitigation Grants and Assess Program Effects*, p. 14

[45] "Mitigation Funding in the FEMA Public Assistance Program," Disaster Recovery Today, Adjusters International, November 17 2016.

FEMA's Building Resilient Infrastructure and Communities (BRIC) program

As a result of amendments to the Disaster Relief and Recovery Act of 2018, the Pre-Disaster Mitigation program was replaced in fiscal year 2020 with the Building Resilient Infrastructure and Communities (BRIC) program. The BRIC program increases the amount of funding available for pre-disaster mitigation, the time in the disaster cycle when hazard mitigation investment spending is most effective. BRIC's guiding principles are: supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency.

Since the BRIC program promotes creative solutions, partnerships, and a mix of funding sources to address community resilience, there are many ways that architects can contribute to a successful grant application and execution of the project. FEMA has shifted to targeting "community lifelines" that "enable the continuous operation of critical government and business functions" and are "essential to human health and safety or economic security," and the BRIC program focuses on mitigating the vulnerabilities of communities. As problem solvers and active members of their community, architects can lead or participate in a team with government stakeholders that formulates a project and submits a comprehensive and innovative grant application.

BRIC projects can target flood control, utility and infrastructure projection, the installation of saferooms and shelters, or multiple hazard retrofits. As a technical professional, an architect can observe conditions, present corrective alternatives, provide technical writing, and provide a host of complementary application support. So too can architects manage the project, file progress reports, oversee contractors, inspect work, manage contracts, and close out the project.

As with other programs, each state has a different governmental structure dictating which department or agency is responsible for developing and submitting a BRIC application to the federal government. Begin by contacting the governor's office or the state hazard mitigation officer to find out the contact person and agency responsible for the BRIC application. The BRIC application process is competitive among states on an annual basis, and by statute, only states, territories, and federally recognized tribes that have had a major declaration in the past seven years are eligible to apply.

U.S. Department of Housing and Urban Development (HUD) hazard mitigation funding

Another major player in funding hazard mitigation is the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant Mitigation (CDBG-MIT) Program. In February 2018, Congress appropriated $12 billion dollars in Community Development Block Grant (CDBG) funds specifically for hazard mitigation activities for qualifying disasters in 2015, 2016, and 2017. HUD was able to allocate an additional $3.9 billion, bringing the amount available for hazard mitigation to nearly $16 billion. The CDBG-MIT Program allows eligible grantees to use this assistance in areas impacted by recent disasters to carry out strategic and high-impact activities to mitigate disaster risks and reduce future losses.[46]

State hazard mitigation plans

When applying for certain types of non-emergency disaster assistance, FEMA requires a hazard mitigation plan.[47] These requirements are part of the laws, regulations, and policy surrounding hazard mitigation planning. As of March 31, 2021, all 50 states, the District of Columbia, and five territories (American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and U.S. Virgin Islands) have FEMA-approved state hazard mitigation plans. In addition, over

[46] Community Development Block Grant Mitigation Program, HUD Exchange, US Department of Housing and Urban Development. hudexchange.info/programs/cdbg-mit/

[47] Mitigation Planning and Grants, FEMA, fema.gov/emergency-managers/risk-management/hazard-mitigation-planning/requirements

24,100 local units of government have developed hazard mitigation plans. But only 14 states have earned FEMA approval for their enhanced state hazard mitigation plan. An enhanced plan recognizes the additional capacity of the state hazard mitigation officer's office, needing less federal assistance in managing hazard mitigation assistance grant programs. As a benefit, states with an enhanced plan are eligible for an additional 5% of funding in addition to the 15% under a standard plan.

Architects, like all community members, have the opportunity to engage in the development and periodic update of municipal and state hazard mitigation plans, climate adaptation plans, and/or resilience plans. The plans are publicly available and typically identify the most relevant high-, medium-, and low-risk hazards. These plans can assist with hazard and risk identification when working at the individual building scale. Hazard mitigation, climate adaptation, and resilience plans vary in their complexity and depth, but they often refer to critical facilities and construction type—useful references for further study when engaging in new construction or renovations.

State and local hazard mitigation incentive programs

Hazard mitigation incentive programs are often developed at the state and local level in response to the hazard risks identified in the state hazard mitigation plan. Examples[48] include:

» Hazard-specific retrofit incentive programs, including Oregon's Seismic Rehabilitation Grant Program, California's Residential Mitigation Program, the city of Berkeley's Retrofit Grants program, and South Carolina Safe Home program.

» Programs that encourage hazard-mitigation retrofits during energy upgrades, such as the Enhabit program in Portland, Oregon, or the under development (2021) King County, Washington, C-PACER program.

» Programs that offer insurance incentives, such as the California Earthquake Authority's Brace + Bolt retrofit grant and insurance discount program, or for enhanced construction practices, the Insurance Institute for Business & Home Safety's FORTIFIED program, which is used in Alabama, Connecticut, Florida, Georgia, Louisiana, Maryland, Mississippi, New Jersey, New York, North Carolina, Oklahoma, Rhode Island, South Carolina, and Texas.[49]

» Programs that offer free hazard mitigation, retrofit assessments and certifications, such as the Wildfire Partners Program in Boulder County, Colorado, which can be used as proof of hazard mitigation to reduce insurance premiums.

Public-private partnerships

In addition to formal federal programs, some public-private partnerships have emerged to fund hazard mitigation and resilience, including the 2013 Rebuild by Design Competition and the 2014 HUD National Disaster Resilience Competition. In the Rebuild by Design program, architects took part in multidisciplinary teams of academics, scientists, and design professionals to study and propose alternative ecosystem and development strategies for disaster-affected areas. In a similar manner, projects initiated under the National Disaster Resilience Competition represent a multidisciplinary, systems approach to hazard mitigation that challenges existing protocol that often silos budgets, sectors, and departments.

Successful in both community engagement and outcomes, these programs created new dialogues that catapulted the conversation about risk and vulnerabilities into a more comprehensive approach to community resilience. These programs inspired the Global Partnership for Resilience, a partnership between the Rockefeller Foundation, USAID, and the Swedish International Development Agency, and also spurred the formation of the Rebuild by Design organization, which uses collaborative research and design to increase community resilience.

[48] A summary of these programs is available in the Appendix.

[49] "Protecting Your Home Reduces Risk and Can Lower Insurance Costs," FORTIFIED, A Program of IBHS.

PROPER LAND USE: THE FIRST LINE OF DEFENSE

Many of the nation's cities were built in close proximity to waterways for agricultural purposes or to transport goods and services, yet many of these often-convenient locations are also quite vulnerable to weather-induced hazards and climate change impacts. These cities have grown over time, placing more people in harm's way, all while new methods of conducting business and modern transportation have developed.

Land use and development decisions are the first line of defense for a disaster-resilient building. In a resilient community, comprehensive plans, hazard maps, land use, and zoning regulations reflect cohesive and coordinated objectives to make residents and business owners aware of hazards, reduce risk, and encourage migration to low-risk areas.

Certain land use and zoning issues can contribute to vulnerability. How community interdependencies and compounded effects impact vulnerability needs to be considered and then addressed in land use regulations and infrastructure investment in order to reduce risk. In land-strapped cities across America, developers have resorted to constructing much-needed affordable housing in areas previously deemed unbuildable. These areas are typically in the least desirable regions or parts of cities, such as flood-prone land, industrial districts, or zones that lack adequate services.

Some communities experience chronic flooding due to outdated, outgrown, or undersized infrastructure. In some areas, transportation options are limited for those who rely on public transit, posing a greater challenge for disaster evacuees.

It's critical, especially when considering changes to land use and zoning regulations, that architects, planners, and stakeholders acknowledge that developing in high-risk areas will require more hazard mitigation interventions. Buildings and associated infrastructure built in hazard-prone areas, therefore, will necessarily cost more to construct and maintain. One tool to help identify risk associated with a geographic area is FEMA's National Risk Index. This tool allows users to gage the risk of 18 natural hazards at county and census tract levels to better understand hazard risk.

HAZARD MITIGATION AT SCALE: REGIONAL, LOCAL, NEIGHBORHOOD, AND SITE

Certain hazard mitigation strategies considered at the site or building scale may not be efficient for a whole community at risk and may even cause undesirable consequences, or maladaptation. If one property owner builds a flood barrier, the riverine flood waters may be displaced to neighboring properties. Community-wide levee systems can also displace water and may cause flooding in up- or downstream cities or in "sacrificial" areas of their own town. Furthermore, hazard mitigation infrastructure may inadvertently encourage new or additional development in an area that could become high risk should that hazard mitigation infrastructure fail. If carefully planned and maintained, community-scale hazard mitigation measures like levees, greenways, and sea walls not only protect more people, buildings, and infrastructure but also enable the community to spend its hazard mitigation dollars more equitably and effectively.

Key hazard mitigation questions

» What is covered in the city plan?

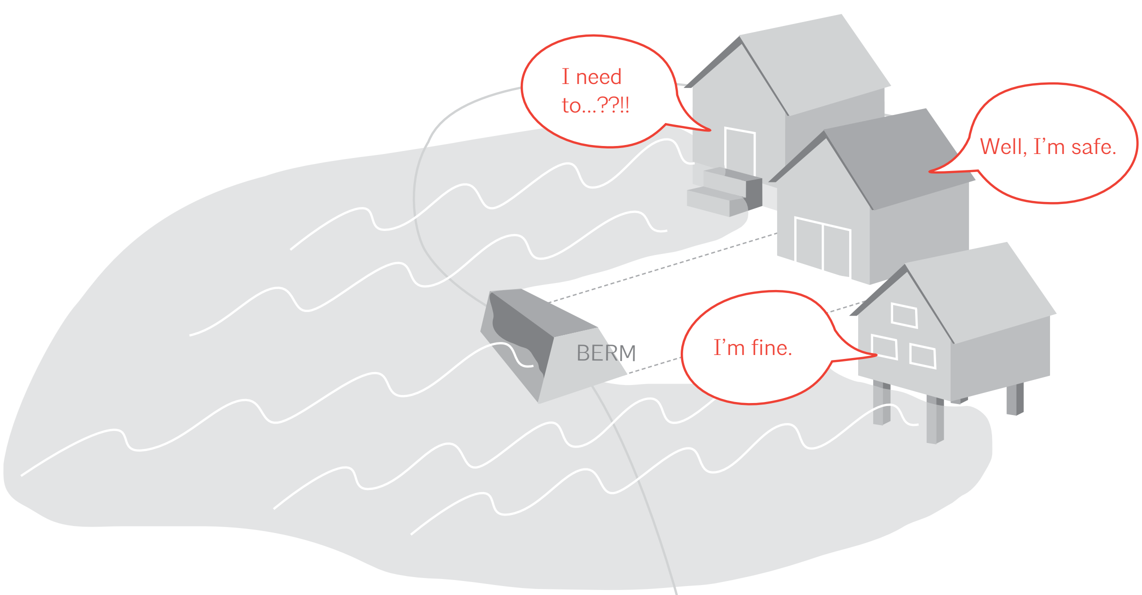
» How does it impact the project?

» What could the owner do to leverage the planned investments?

» What risks are not yet addressed?

» How does financing fit into the equation?

» Who are the key stakeholders to engage?



THE POTENTIAL FOR MALADAPTATION
Hazard mitigation tactics implemented at the building scale may result in maladaptation, causing harm to neighboring structures or communities.

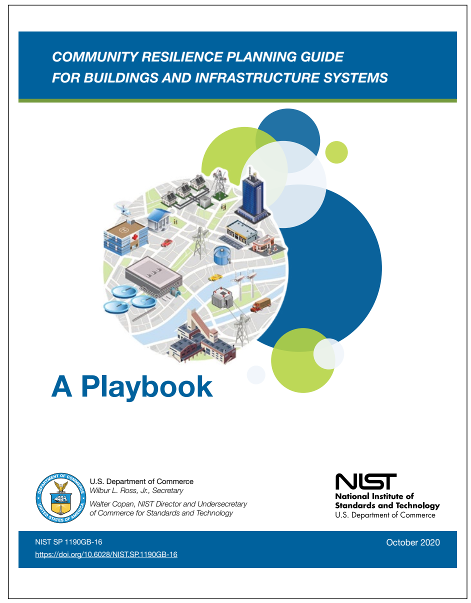
SOURCE
Illya Azaroff, FAIA. Used with permission.

Community resilience planning to address system interdependencies

The National Institute of Science and Technology (NIST) offers one methodology for considering community-scale interdependencies: the NIST Community Resilience Planning Guide for Buildings and Infrastructure Systems . This six-step planning process characterizes the social and economic dimensions of the community, identifies dependencies and cascading consequences, and analyzes building and infrastructure performance.

Understanding interdependencies is a critical component to community resilience planning. For example, identification of interdependencies with the power infrastructure will become increasingly important as the U.S. moves toward "the electrification of everything." This trend is expected to accelerate as the need to transition from fossil fuels to renewable resources becomes more apparent given the warming climate. With increased electrification comes additional risk, as was seen during the Texas 2021 winter storm, where over 50 people died due to lack of power. The fragility of the power grid must be considered when planning for on-site resilience. The Texas example should not be thought of as an isolated event; much of the nation's electrical grid was built during the 1950s and '60s and is approaching the end of its service life. "Over the past decade, the number of U.S. electricity outages has doubled," according to a Wall Street Journal article on the topic.[50] Furthermore, the country's nuclear power generation infrastructure, often located seaside for easy access to water needed for cooling reactors, is vulnerable to rising sea levels, coastal subsidence, and worsening storm surge.

Other types of infrastructure, transportation, health care services, and more also play critical roles in community resilience. Risk reduction can be applied at multiple scales—building or site specific, block or neighborhood, or community or regional level. When Hurricane Katrina struck the Gulf Coast in 2005, hospitals in Baton Rouge, Louisiana, admitted patients who evacuated from the coast. Baton Rouge area hospitals now plan their hazard response teams' readiness to accommodate climate evacuees from the more exposed southern region. Similarly, earthquakes in Japan that closed Toyota manufacturing facilities have potential supply chain impacts on American Toyota distributors. In this case, the earthquake occurred in Japan, but the business impact was also felt in the United States.[51] This way of thinking about interconnected systems changes the contextual understanding of risk and vulnerability and provides a foundation for effective hazard mitigation strategies.



COVER OF THE NIST COMMUNITY RESILIENCE PLANNING GUIDE

NIST provides a number of documents designed to assist communities in planning, prioritizing, and implementing measures to strengthen resilience and improve a community's ability to Build Back Better after damaging events.

SOURCE
NIST Community Resilience Planning Guide for Buildings and Infrastructure Systems: A Playbook

[50] Amy Myers Jaffe, "The Electrification of Everything: What You Need to Know," *The Wall Street Journal*, May 15, 2021. wsj.com/articles/electrification-of-everything-11620843173

[51] Chris Bruce, "Japanese earthquakes send ripples through auto industry," Autoblog. April 18, 2016.

Community-wide vulnerability

Understanding the limitations of dependent systems also illuminates community-wide vulnerability. For example, transportation infrastructure can be overwhelmed, damaged, or destroyed. The evacuation of densely populated areas is now seen as unrealistic. When Hurricane Irma was approaching Florida, a record 7 million residents created gridlock while trying to take shelter in states to the north.[52] Similarly, during the Paradise, California, wildfire, residents were trapped trying to flee through the single road that led out of town. Population and infrastructure capacity are significant factors when determining emergency response strategies and demand for resilient building and community hazard mitigation strategies.

While focusing on the larger community context may be effective, in some cases the architect may only have the power to influence a single structure. Borrowing from the medical profession, the architect's first charge is "primum non nocere," or "first, do no harm." Whatever the addition or alteration to the built environment is, as designed it should strive to minimize impact on the existing built and natural environment. For instance, cut and fill operations of soil on-site should not result in flooding of adjacent properties. Similarly, combustible exterior finish materials should not be specified on a building in the wildland-urban interface so as to avoid increasing the local fire danger.

The role of individual building owners in community resilience

An individual building owner will likely have to interpret how a particular site or facility fits into the larger hazard mitigation framework and what is required for the owner's compliance and leverage of that framework. Some building owners manage multiple properties, and the risks associated with a given location may differ significantly depending on microclimates, topographies, vegetation, neighboring property composition, local infrastructure, etc. Therefore, each property should have a unique vulnerability assessment and hazard mitigation strategies within a comprehensive approach that the owner and architect design. This may include business continuity redundancies, increased investments in one facility over another, differing community support structures, and prioritization of projects in a long-term hazard mitigation plan. When business functions cross multiple cities and states, or even countries, the hazard mitigation plans must do so as well.

Some owners may design for functional recovery to ensure business operations are minimally interrupted. When this level of resilience is achieved, an individual building or structure could serve as a larger community asset by providing a safe haven for the populace. While typically this role has been carried out by municipal buildings such as schools, private structures could also serve this purpose. Whether or not the building is a designated emergency shelter, it is important for private property owners to consider what it would mean for their building to be unable to function for days, weeks, or months and develop building performance criteria accordingly. Critical facilities such as hospitals already do this in many locations, but more private owners may wish to consider doing the same.

[52] Greg Allen, "Lessons from Hurricane Irma: When to Evacuate and When to Shelter in Place," NPR, June 1, 2018.

An example of a private facility sheltering displaced persons occurred in Houston when Jim “Mattress Mack” McIngvale opened his furniture store as an emergency shelter for people fleeing Hurricane Katrina, those flooded out by Hurricane Harvey, and people impacted by Tropical Storm Imelda. The buildings were designed to be flood-proof, were elevated, and have bathrooms, showers, and an in-store restaurant.[53] During the 2021 winter storm, which resulted in widespread power outages, McIngvale again invited people to shelter in his stores, which were heated by a diesel-fueled generator.[54]

Architects have the opportunity in planning and design to enable clients to improve their decision-making while reducing the likelihood of losses. Architects can help clients determine how the state and local projects and plans support, or don’t, their personal and/or business continuity and what needs to be done in addition to, but also in concert with, these larger-scale plans. In doing so, architects can leverage their abilities to connect complex systems to bring new value to clients while further reinforcing the key tenets of health, safety, and welfare.

[53] Jennifer Calfas, “Meet the Man Who Turned His Furniture Stores into Shelters for Harvey Victims,” *Time*, August 30, 2017. time.com/4922108/hurricane-harvey-mattress-mack-houston/

[54] Sasha Pezenik and Emily Shapiro, “‘Mattress Mack’ opens stores for Houstonians amid dangerous winter storm: ‘We’re here for them,’” GMA, February 18, 2021. abcnews.go.com/US/mattress-mack-opens-stores-houstonians-amid-dangerous-winter/story?id=75928606

RELATIONSHIP OF CONTEMPORARY CODES AND STANDARDS TO DISASTER RESISTANCE

The adoption, application, and enforcement of current model building codes is the first step in reducing vulnerability, increasing public safety, and affording minimal property protection; however, it is important to note that building codes are only minimum requirements.

Building code development

The International Code Council updates its model building codes every three years through a consensus-based code development process. These model building codes are the basis for the most frequently used codes governing design and construction. Other codes- and standards-producing bodies, such as the American Society of Civil Engineers (ASCE); the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE); the National Fire Protection Association (NFPA); and the International Association of Plumbing and Mechanical Officials (IAPMO), also make regular updates. These standards, referenced by the building code, provide critical details and carry the same force of law as the adopted code. Throughout this section, the term "building code" will be used to encompass both code and standards requirements.

New building science is one of the primary reasons building codes and standards are updated. Building performance analyses conducted post-disaster often inform these new requirements. For example, a study of damage from the 2013 Moore, Oklahoma, tornado determined that the root of failure for residential structures was often the garage. Garage doors are also a common failure point identified in other FEMA Mitigation Assessment Team (MAT) reports. The city of Moore used these findings to support the development and adoption of code requirements that enable residential buildings to survive an EF2 tornado.[55]

Increased disaster frequency and intensity can also spark code changes. Wildfires in California prompted the state to strengthen its code to mitigate future damage. The state energy code was modified to address wildfire-generated smoke. For high-rise residential and low-rise residential projects, operable windows are no longer acceptable means of ventilation. Air filtration systems, designed to meet ASHRAE Standard 62.2, Ventilation and Acceptable Indoor Air Quality in Residential Buildings, are now required. While the intent of the requirement is hazard mitigation, an architect will likely want to consider ensuring screens are provided so that natural ventilation (on non-wildfire days) can be utilized. This is important as natural ventilation may be the only option available should the energy grid be compromised by an earthquake, wildfire, or cyber terrorist.

Example reference standards

The following are example reference standards used in tandem with the hazard provisions of the model building code:

- ASCE 24 Flood Resistant Design and Construction
- ASCE 7 Minimum Design Loads and Associated Criteria for Buildings and Other Structures
- ICC 500 Standard for the Design and Construction of Storm Shelters
- ICC 600 Standard for Residential Construction in High Wind Regions

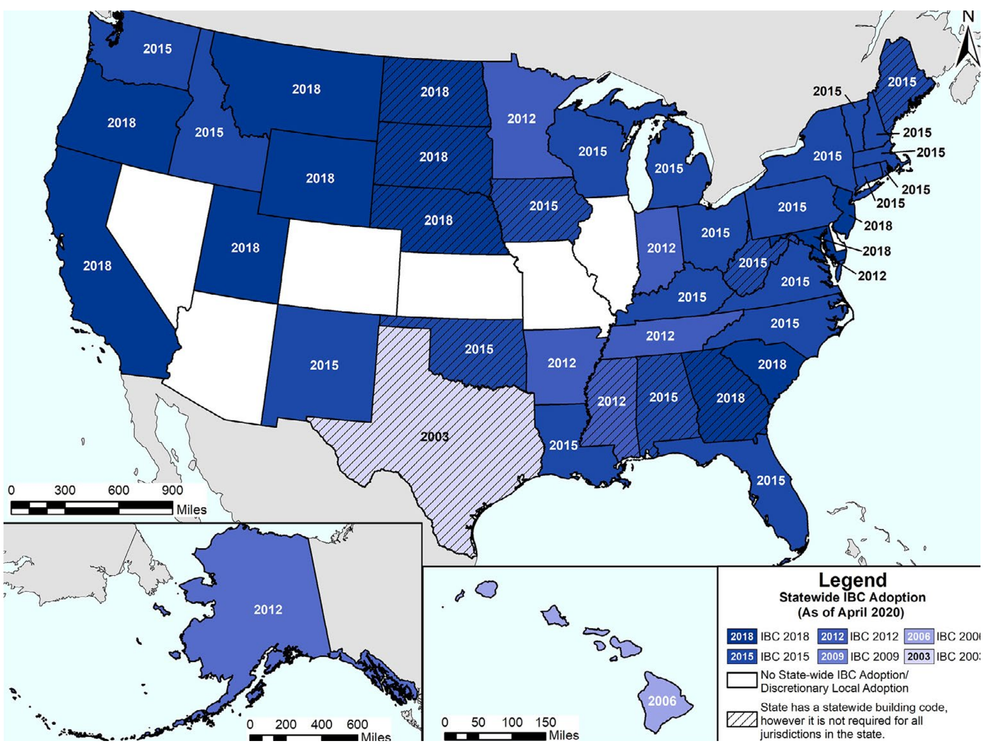
[55] Jacob McCleland, "Five Years After Tornado, Moore's Stronger Building Codes Haven't Hurt Market," KGOU, May 25, 2018. kgou.org/weather-and-climate/2018-05-25/five-years-after-tornado-moores-stronger-building-codes-havent-hurt-market

Often, it's not a lack of technical knowledge but a lack of political will or perceived economic impact that creates the obstacle for disaster-resilient building code development. The Louisiana State University Hurricane Center conducted a study of the residential wind damage caused by Hurricane Katrina in 2005. It indicated that "economic losses," which include damage to buildings and contents, would have been reduced an estimated 75% if buildings in the affected area had protected openings, improved roof-deck connections, and improved roof-to-wall connections.[56]

Building code adoption

In about half of the U.S. states, building codes are adopted by the state, and all jurisdictions must enforce the version of the code that the state requires. The other states and territories have a mix of state-recommended minimum versions that a jurisdiction must use if they choose to adopt a code (hashed lined states) or no requirements whatsoever (states in white).

The adoption process requires review and a legislative process to turn the model code into law. This results in codes that can be two to three cycles behind the most recently published model code. A state may cede its authority to the local jurisdictions so they may adopt whatever code they wish. Even when a state adopts a statewide code, enforcement of the code may not be mandatory.



STATE-LEVEL ADOPTION OF THE IBC AS OF APRIL 2020

In about half of the U.S. states, building codes are adopted by the state, and all jurisdictions must enforce the version of the code that the state requires. The other states and territories have a mix of state-recommended minimum versions that a jurisdiction must use *if* they choose to adopt a code (hashed lined states) or no requirements whatsoever (states in white).

SOURCE

Building Codes Save: A Nationwide Study, p. 3-3, November 2020

[56] "Residential Wind Damage in Hurricane Katrina Improved Building Codes and Construction Practices," Louisiana State Hurricane Center, October 3, 2005.

Some communities, if allowed by state law, are proactively adopting more stringent building codes and standards, as Moore did. Disaster-related damage can result in an increase in mortgage delinquency rates and a decline in property values and thus a decrease in real estate tax revenues.[57] Strong codes can minimize the property damage from an event and the economic impact on the community. Unfortunately, more often, communities are adopting amendments that reduce the stringency of the code, often due to pushback from powerful lobbying associations. Therefore, conversations with building owners on the limitations of code performance and effective hazard mitigation measures are necessary to support specific owner-identified performance goals.

The 2021 Rating the States study by the Insurance Institute for Business & Home Safety (IBHS) revealed that while some building codes are getting more stringent, other states remain susceptible to market and political pressures to eliminate certain sections of the code or defer adoption of the most recent code. From 2018 to 2021 the rating scores of two of the 18 states most vulnerable to catastrophic hurricanes along the Atlantic Coast and the Gulf of Mexico actually decreased,[58] and a majority of states studied showed no improvement whatsoever.

“Opt-out” clauses in state codes provide loopholes for local jurisdictions for specific code requirements. As a result, local jurisdictions within the same state can vary in the level of protection provided by a code. Understanding what provisions have been deleted (and their effect) is critical for assuring resilient performance. Licensed architects and engineers, as well as trained building officials and inspectors, are an important part of the process of checks and balances that safeguard the intent of building codes.

Enforcement: The effectiveness of building codes

Adopting the most up-to-date code, or one that has stronger provisions, is just the first step in creating an effective building code. Adoption of building codes is not sufficient if the communities adopting the codes do not have the capacity to enforce them. It is estimated that the U.S. is poised to lose 80% of its construction industry workforce between 2019 and 2032.[59] As first recognized after Hurricane Andrew (1992),[60] proper code enforcement by trained inspectors is critical for ensuring resilience. Unlike police and fire departments, building departments tend to lack the resources, particularly human resources, to ensure public safety.

[57] Nino Abdaladze, “How Natural Disasters Affect Property Taxes,” Donald W. Reynolds National Center for Business Journalism, October 29, 2019. businessjournalism.org/2019/10/how-natural-disasters-affect-property-taxes/

[58] “Rating the States,” IBHS, 2021. ibhs.org/public-policy/rating-the-states/

[59] National Building Code Assessment Report. Building Code Effectiveness Grading Schedule, ISO, 2019. verisk.com/siteassets/media/downloads/underwriting/location/2019-bcegs-schedule.pdf

[60] “Building Codes Save: A Nationwide Study,” FEMA, November 2020, pp 3-5. fema.gov/emergency-managers/risk-management/building-science/building-codes-save-study

The actual effectiveness of building codes and their enforcement is evaluated by research institutions and organizations like the Insurance Services Office, Inc. (ISO). The ISO Building Code Effectiveness Grading Schedule (BCEGS) assesses the building codes in effect and how the community enforces its building codes, with special emphasis on mitigation of losses from natural hazards. Municipalities with well-enforced, up-to-date codes generally demonstrate better loss experience, both monetarily and in terms of human suffering. Reducing catastrophe-related damage lowers insurance premiums, which can provide strong incentives for communities to adopt and rigorously enforce effective building codes.[61]

The 2017 hurricane season revealed the benefit of stronger, well-enforced building codes. Florida homes designed and constructed to comply with the Florida Building Code (FBC) met expectations by performing well structurally. FEMA's Hurricane Irma MAT report[62] noted that "though not widespread, wind-induced structural damage to main wind-force resisting systems was observed in older (pre-FBC) residential construction and included roof failure and loss of exterior walls." Irma also impacted Puerto Rico, where building codes were several editions out-of-date and there were an "inadequate number of trained, certified building inspectors," both of which contributed to $1 billion in widespread damage.[63] Building codes are only as effective as the mechanisms in place to apply, update, and enforce them.

HOME BUILT UNDER OUTDATED BUILDING CODES AND STANDARDS
Roof structure loss and collapse of the second-floor exterior wall and adjacent deck incurred after Hurricane Irma by a pre-FBC home.

SOURCE
FEMA Mitigation Assessment Team Compendium Report: 2017 Hurricane Season, pp. 3-12, Figure 3-8

[61] *National Building Code Assessment Report*. Building Code Effectiveness Grading Schedule, ISO, 2019. verisk.com/siteassets/media/downloads/underwriting/location/2019-bcegs-schedule.pdf

[62] "Mitigation Assessment Team Report. Hurricane Irma in Florida. Building Performance Observations, Recommendations, and Technical Guidance," FEMA P-2023, FEMA, December 2018. fema.gov/sites/default/files/2020-07/mat-report_hurricane-irma_florida.pdf

[63] "Innovative Solutions for Post-Disaster Code Enforcement — Development of Sustainable Permitting, Inspections and Building Code Programs," National Institute of Building Sciences, January 8, 2019. portal.nibs.org/files/wl/?id=dNBZI5D4UdBGovm2XTvb3mnVI5zZIuE8

Rural communities also often lack zoning or building codes and struggle to enforce codes that are in place, thereby missing out on opportunities to reduce disaster risk.[64] It is even more difficult for rural, smaller, and less affluent communities because they lack the resources and capacity to provide basic services and infrastructure, let alone the ability to equip planning and building departments. Even remote building inspections may be impossible due to the lack of broadband internet access in approximately 35% of the U.S. as of 2021. Beyond even basic building code adoption or enforcement, the U.S. is still struggling to meet basic needs, such as provision of clean water and sanitary sewage systems, in rural areas with extraordinarily high levels of persistent poverty, particularly in the Delta and Appalachian regions, on tribal lands, and colonias, where the most marginalized communities reside.

The housing in rural and marginalized communities often has not been built in compliance with building codes, and the buildings tend to be older and inadequately constructed or maintained and include a large number of manufactured homes (mobile homes). When faced with the increased intensity of natural hazard events, these communities are especially vulnerable to losses of life and property. The damages wrought have extremely long-term effects on public health and wealth, contributing to further marginalization over time.[65] Investments in infrastructure, new housing, and the capacity to adopt and enforce resilient building codes and standards are essential in order to reduce risk for and marginalization of low-wealth communities.

Federal government and the building code

The federal government cannot mandate code adoption; that is a right reserved for the states. But that does not mean that the federal government is unconcerned about building codes. Numerous studies have been commissioned to assess the value and impact of codes. In recent years, the federal government has recognized the role of building codes in reducing the enormous economic loss associated with natural disasters and has instituted new policies for encouraging up-to-date model code adoption and enforcement to reduce potential loss for those accessing disaster recovery funds. Such efforts include the BRIC program and FEMA's Public Assistance Required Minimum Standards policy, which requires code-minimum standards be used for Public Assistance projects. Thanks to Section 1235(b) of the Disaster Recovery Reform Act of 2018 (DRRA), which amended the Stafford Act, FEMA's Public Assistance program now requires adherence with "the latest published editions of relevant consensus-based codes" for repair, restoration, or replacement projects.

Additionally, GAO's report Climate Change: Improved Federal Coordination Could Facilitate Use of Forward-Looking Climate Information in Design Standards, Building Codes, and Certifications recognizes the need for building codes to reflect climate projection data.

[64] "Building resilience in rural America," UNDRR PreventionWeb, February 23, 2021. preventionweb.net/news/view/76205
[65] Ibid.

Even the minimum code improves resilience

FEMA found that "currently, less than half of jurisdictions have hazard-resistant codes,"[66] and that more than half of U.S. states have no statewide mandatory code; however, adoption and enforcement of the latest edition of codes has been proven to reduce damage from a number of hazards. For every $1 spent building to modern building codes and standards, such as the most current edition of the International Building Code and the International Residential Code, there is an 11:1 overall benefit-cost ratio.[67] Additional benefits accrue when incorporating above code hazard mitigation measures and when retrofitting structures.

Benefit-cost ratios vary for specific hazards, as shown in the table below from the National Institute of Building Sciences' "Natural Hazard Mitigation Saves 2019 Report," a study supported and partially funded by The American Institute of Architects. Hazard mitigation protects investments in buildings, systems, infrastructure, and functionality to better prepare for disaster situations. As the frequency and intensity of natural disasters increases, this ratio may continue to increase as the total costs of doing nothing are better understood and the level of indirect impacts are calculated.

National Institute of BUILDING SCIENCES™

	ADOPT CODE	ABOVE CODE	BUILDING RETROFIT	LIFELINE RETROFIT	FEDERAL GRANTS
Overall Benefit-Cost Ratio	11:1	4:1	4:1	4:1	6:1
Cost ($ billion)	$1/year	$4/year	$520	$0.6	$27
Benefit ($ billion)	$13/year	$16/year	$2200	$2.5	$160
Riverine Flood	6:1	5:1	6:1	8:1	7:1
Hurricane Surge	not applicable	7:1	not applicable	not applicable	not applicable
Wind	10:1	5:1	6:1	7:1	5:1
Earthquake	12:1	4:1	13:1	3:1	3:1
Wildland-Urban Interface Fire	not applicable	4:1	2:1	not applicable	3:1

NIBS HAZARD MITIGATION BENEFIT-COST RATIO
NIBS estimated national average benefit-cost ratio for five types of hazard mitigation across five different perils.

SOURCE
National Institute of Building Sciences

[66] "Building Codes Save: A Nationwide Study," FEMA, November 2020.
[67] "Natural Hazard Mitigation Saves 2019 Report," NIBS, December 2019, nibs.org/projects/natural-hazard-mitigation-saves-2019-report

Disasters outpace code changes

While the model building code is far better than no code, it cannot be overstated that model building codes are minimum standards for building design and construction and therefore typically do not address extreme events such as Category 4 hurricanes or EF3 tornadic wind conditions. As noted in FEMA's 2020 Building Codes Save: A Nationwide Study, the primary purpose of building codes "is to establish the minimum requirements to protect life safety and reduce property damage up to a design event." This is commonly interpreted as meaning that the building must be designed to stay standing long enough for the occupants to escape. There is no implied promise that a code-compliant building will function for its intended purpose after the event. And if the building does stay standing after the event, it may be substantially damaged.

Building owners and the public often are unaware of these limitations. By understanding the expected code-compliant performance (or lack thereof), architects help clients and the community understand the true risk potential for their locale. For those who are not satisfied with the minimal protection afforded by the code, a building vulnerability assessment offers a more thorough understanding of building performance issues that can be addressed through hazard mitigation. Additional measures and beyond-code performance specifications are needed to design for the resilience required to ensure continuity of operations and property protection.

Disaster-resilient strategies can be extremely cost effective over the building service life when incorporated into the initial project planning and design. Constructing new buildings to higher standards (e.g., code-plus programs) generally costs from less than 1% more for large buildings to up to 5% more for a small structure.[68] These percentages will vary depending on the baseline code in force, the hazard being addressed, and the level of risk to be mitigated.

Approximately 80% of existing buildings were built before 2000 when codes contained fewer hazard provisions. This means that there are vulnerabilities inherent in the building stock. This is true across typologies and particularly so for single family homes. Older homes are less likely to have been built to any building code, architects are less likely to have been involved, and there are fewer qualifications required for builders doing renovations and additions. This is more pronounced in rural areas and small towns, but it is also true in major cities today.

Retrofitting existing buildings to increase their resilience can be more difficult than designing new, but the benefits can be lifesaving. Seismic retrofitting of soft-story construction is considered so important to life safety that some California communities require it. Routine maintenance and replacement of building components are an excellent opportunity to reduce risk, enhance building performance, and increase potential for post-disaster functionality. Building performance enhancements can include seismic, wind, water, and wildfire resistance alongside energy conservation.

[68] "Code-Plus Programs For Disaster Resistance," Insurance Institute for Business & Home Safety, Whole Building Design Guide, August 2016. wbdg.org/resources/code-plus-programs-disaster-resistance

BUILDING VULNERABILITY ASSESSMENTS

Vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects.[69] Considering the rising frequency and intensities of natural hazards, shifting patterns of urbanization, and manmade crises, it is becoming clear that some buildings may be unable to meet the effects of a changing environment. Which buildings are the most vulnerable? Older buildings that have deteriorated or perhaps yet-unbuilt buildings that are being proposed for vulnerable sites. Vulnerability is not just a physical parameter but is interdependent with the environment, society, and economics.

It is the architect's responsibility to discuss project-specific hazard risks with the client[70] so they can make informed design and development decisions. While determining risk and vulnerability may be complex endeavors, there are established techniques and workflows for conducting vulnerability assessments. Above all, vulnerability assessments are essential for mitigating risk and establishing resilient design criteria. Additionally, a vulnerability assessment helps valuate the additional safety measures that hazard mitigation strategies call for, which are over and above those called for in minimum code compliant structures. A building that can operate through a disaster reduces or eliminates the economic impact of a shutdown for a business or family.

Both existing buildings and new projects should be evaluated for vulnerability. Existing buildings may have been built to comply with older codes—or even to no code in some cases. As vulnerability is a dynamic quality that changes over time, what sufficed in the past may be insufficient in the future as information regarding hazards and design loads evolve. Vulnerability may increase with age as components decay, when an occupancy takes on a greater importance, or when contents are deemed critically important (e.g., computer servers). New projects can benefit as well when vulnerability assessments inform site selection, identify building systems that may be susceptible to damage, and help to determine optimal building form and structural load criteria. Vulnerability assessments help designers and owners target the most effective hazard mitigation strategies for building retrofits.

Vulnerability assessments

Vulnerability assessments identify the vulnerable assets in harm's way and will determine the potential consequences stemming from those vulnerabilities. Key questions include:

- What is the desired service life of the building?
- How long can the building or business afford to be out of service due to disruption?
- What is essential to meet acceptable operational requirements?

Learn more

[69] "Definitions of key terms," IPCC. archive.ipcc.ch/publications_and_data/ar4/wg2/en/frontmattersg.html

[70] AIA Code of Ethics 2.401 states, "When performing professional services, Members shall make reasonable efforts to inform their clients of the potential environmental impacts or consequences the Member reasonably believes may occur as a result of work performed on behalf of the clients."

RISK REDUCTION TACTICS IN THE BUILT ENVIRONMENT

Two ways to reduce damage and injury from a hazard event in the development and building design process are hazard avoidance by choosing to build in a less vulnerable area or understanding the hazard and designing for it. Avoiding the hazard by locating away from it is an obvious risk-reduction tactic. For example, instead of building in a floodplain, locate on higher ground. Risk avoidance is a critical tactic during site selection, especially if land use and zoning policies do not reflect the client's level of risk tolerance. It is important that architects work more directly on hazard avoidance in order to minimize the likelihood of future losses. Some hazards impact large geographic areas, such as earthquakes, hurricanes, and winter storms, and cannot be easily avoided.

If a building must occupy a vulnerable site, hazard mitigation measures that prepare the building for the anticipated disaster conditions can be utilized. These are permanent or temporary measures that reduce damage from a specified hazard. For example, buildings in coastal Florida are designed to withstand certain category wind speeds for storms and hurricanes. An increasing subtlety in this tactic is the tiered responsibility for design performance. For example, when is it best to design with evacuation in mind as compared to designing for sheltering in place? These tiers of decision-making are interconnected and together form an effective hazard mitigation tactic.

Risk transfer tools such as insurance are a common way to address risk, but insurance does not reduce damage or injury—only financial loss. The benefits of physical risk reduction measures may be economic (reduced insurance premiums or maintenance costs) but may also include intangible benefits such as reputational risk (businesses), personal safety, peace of mind, and the protection of irreplaceable personal belongings, specialized equipment, or data. Beyond their work on individual buildings, architects can share these insights on hazard impacts, built environment vulnerabilities, and hazard mitigation strategies and apply the learning to inform community plans, programs, and initiatives.

The benefits of risk reduction are both economic and personal and should be considered carefully. Homeowners who build to higher standards can benefit from increased occupant safety, reduced repair and replacement costs, reduced insurance costs, lowered temporary relocation costs, reduced risk of losing irreplaceable personal belongings, and increased resale values.

Hazard avoidance
Choosing to build in a less vulnerable area

Hazard mitigation
Strategies that lessen the effects or consequences of an incident.

Risk transfer
A risk management technique where the financial risk of loss is transferred to an insurance company.

Example hazard mitigation strategies

The NIBS Natural Hazards Mitigation Saves Study shows the following risk reduction measures have a positive return on investment for certain geographies. Architects can help to clarify the interconnection of various codes, standards, and recommendations to fit the needs of each unique situation. Learn more hazard mitigation strategies.

FLOODS	» Build higher than 2015 IBC requirements in flood-prone areas. A home in a special flood hazard area is constructed to 3 feet above base flood elevation (BFE). » Wet floodproof basements. » Relocate homes to a safer location outside the special flood hazard area. » Retrofit equipment, including relocating HVAC above the base flood elevation.
HURRICANE & WIND EVENTS	» Comply with the Insurance Institute for Business & Home Safety (IBHS) FORTIFIED Hurricane Standards. » Add engineered tie downs to manufactured buildings.
EARTHQUAKE	» Retrofit homes by anchoring the sill plate to the foundation wall. » Secure furnishings, fixtures, equipment (water heaters), and contents.
FIRE	» Remove vegetation from the home ignition zone. » Build new buildings to comply with the International Wildland-Urban Interface Code.

Traditionally, higher value homes translates into higher annual property taxes. Some communities have successfully remedied this problem by reducing the tax rate applied to privately-created building values while increasing the tax rate applied to publicly-created land values.The lower tax on buildings makes it cheaper to construct, improve and maintain buildings; incentivizing higher performance. The higher tax on land value helps keep land prices more affordable by reducing the profit from land speculation. The tax on land value also encourages development of high-value locations, which tend to be infill sites, thereby reducing sprawl and its negative effects. This tax shift can help make both buildings and land more affordable and encourage more resilient building practices. [71] [72]

In addition to the benefits a homeowner receives, businesses can benefit from earlier reopening; avoidance of damage to important documents, building contents, and specialized equipment; less adjustment to promised delivery dates; maintenance of business reputation; and reduced loss of staff and customers to more prepared competitors.

Governmental agencies can realize all the benefits of homeowners and businesses along with reduced costs of emergency services like police, fire, search and rescue, and emergency shelters.

The greatest benefit to everyone is increased peace of mind.

[71] Rybeck, Rick. “Financing Infrastructure with Value Capture: The Good, The Bad & The Ugly.” Strong Towns. strongtowns.org/journal/2018/2/20/financing-infrastructure-with-value-capture-the-good-the-bad-the-ugly

[72] Rybeck, Rick. “Avoiding Mis-Givings: Recycling Community-Created Land Values for Affordability, Sustainability, and Equity.” Journal of Affordable Housing. Volume 28, Number 2. 2019.

ADVOCATING FOR COMMUNITY RESILIENCE THROUGH HAZARD MITIGATION

Architects, engineers, and planners that leverage hazard avoidance, employ hazard mitigation strategies to reduce risk, and raise awareness of risk transfer mechanisms not only provide a valuable service but contribute to the health and safety of the whole community. These allied professions support local, tribal, and state governments by proactively reaching out to their communities and volunteering their expertise before disasters occur. This can happen in a number of capacities—including by educating their clients, advocacy in public forums (supporting stronger codes and ordinances), civic participation (planning boards and commissions), and engaging with community groups working toward resilience.

One example is the Resilience Building Coalition. In 2014, The American Institute of Architects and the National Institute of Building Sciences, along with 21 building industry organizations, committed to significantly improve the resilience of buildings, infrastructure, public spaces, and communities through research, education, advocacy, disaster response, and planning with the Building Industry Statement on Resilience. Since then, the coalition, known as the Resilience Building Coalition, has grown to 53 organizations representing over 1.8 million members committed to working together to manage the stresses and withstand the shocks before, during, and after disasters. The statement has been the impetus for hundreds of resilience education workshops, resources, and conferences; new resilience and climate adaptation certificate programs; formation of disaster-response alliances; and advocacy efforts that have passed state and federal legislation to require hazard mitigation, management, and recovery strategies. Such efforts help drive and complement change at local, national, and international scales.

Opportunities to engage in community hazard mitigation include:

Becoming a hazards expert

» Review and become familiar with the city, county/parish, and state hazard mitigation plan.

» Participate in the development and/or update of the state hazard mitigation plan and encourage these plans to be incorporated into local comprehensive/master plans as well as local zoning and land use regulations. Over 23,800 local governments have current (FEMA-approved or approvable-pending-adoption) local hazard mitigation plans. When the plan is undergoing an update, volunteer to assist in the process.[73]

Leveraging knowledge of design regulations

» Participate in code development and public awareness of code benefits, limitations, and beyond-code standard alternatives. This could be through the state or local building code commission, AIA Codes Advocacy program, or the International Code Council's national organization or local chapter.

» Participate on local land use and zoning commissions or boards. Governments balance goals and priorities for land use, and architects can advise on safe zoning and building parameters, particularly for the highest-hazard areas. This will become even more important as climate change increases risk in coastal, wildfire-prone, high-heat, and other hazard-prone communities.

» Contribute to the development of local design guidelines. Support local efforts to enhance resilience by adopting or encouraging code-plus standards.

» Discuss the value of incorporating an all-hazards assessment in the building permitting process to raise awareness of hazard risk exposure and encourage hazard mitigation.

[73] "Hazard Mitigation Plan Status," FEMA. fema.gov/emergency-managers/risk-management/hazard-mitigation-planning/status

Becoming a citizen architect

- Work with legislators or support legislative initiatives that encourage pre-disaster mitigation planning and construction strategies, such as mandatory or incentivized hazard mitigation retrofit programs, requiring the incorporation of future climate conditions into government-funded projects, or requiring an architect's stamp for all buildings located in high-hazard areas regardless of occupancy type. Opportunities exist at both state and national levels.

- Advocate for a state and local climate adaptation plan. Ensure that the built environment is addressed in the plan so that all stakeholders know how to prioritize hazard mitigation and climate adaptation strategies.

- Work at the state or local level to assist in developing contractor education and license criteria that addresses hazard mitigation. Contractors who better understand why certain construction materials and details reduce damage are key to mitigating damage. For example, simply confirming anchor bolts are correct (spacing, washer size) can keep a structure from shaking off its foundation. Ensuring that hurricane straps are in place and adequately fastened with enough nails can keep a roof from blowing off in a windstorm.

Expanding networks

- Support or volunteer with state agencies or nongovernmental organizations, like the Federal Alliance for Safe Homes (FLASH) and the Insurance Institute for Business & Home Safety (IBHS), that are working on public awareness of hazards and disaster risk reduction.

- Partner with local universities and professional organizations on research and outreach initiatives.

- Engage with local and statewide environmental and community-based organizations, coalitions, and collaboratives; land and water trusts involved in flood, sustainability, housing, and climate change issues; and initiatives to promote sustainability and resilience benefits.

AIA Position Statement on Building Codes and Standards[74]

AIA supports regulation by a single set of comprehensive, coordinated, and contemporary building codes and standards that establish sound threshold values of health, safety, and the protection of the public welfare throughout the United States and abroad. To that end, AIA espouses the development and adoption of model building codes that:

- Include participation by architects and the public in a consensus process;
- Are the product of informed education and research;
- Are without favoritism or bias to any special interest;
- Include provision for a prompt appeals procedure for all that might be aggrieved;
- Are cost-effective in relation to public benefit; and
- Promote building code provisions that set performance rather than prescriptive criteria.

Approved December 2016

[74] "Directory of Public Policies and Position Statements," The American Institute of Architects, May 2019.

ADDITIONAL HAZARD MITIGATION RESOURCES

Federal, state, and local hazard mitigation
Hazard Mitigation Grant Program (HMGP)

ASFPM—No Adverse Impact

Guides to Expanding Mitigation

Building Resilient Infrastructure and Communities (BRIC)

Relationship of contemporary codes and disaster mitigation
National Building Code Adoption Tracking Portal

The Building Code Effectiveness Grading Schedule (BCEGS)

IBHS 2021 Rating the States

GAO report "Climate Change: Improved Federal Coordination Could Facilitate Use of Forward-Looking Climate Information in Design Standards, Building Codes, and Certifications"

FEMA Public Assistance Required Minimums Standard Policy

Highlights of ASCE 24-14 Flood Resistant Design and Construction

I-Codes and ASCE 24 Checklist

Wildfire mitigation

Effective Use of the International Wildland-Urban Interface Code

Building vulnerability assessments
AIA Resilience and Adaptation Certificate Series Course 5: Conducting Vulnerability Assessments

FEMA Risk Assessment

Analyzing natural hazard threats
FEMA Flood Maps

State/local hazard mitigation plan (available on the state government website)

Analyzing climate change threats
National Climate Assessment

NOAA Sea Level Rise Viewer

Design for hazard mitigation: Technical guidance and rating systems
AIA Hazard Mitigation Design Resource page

AIA Climate Change Adaptation Design Resource page

For a list of technical resources and rating systems, please see Appendix.

Risk transfer and insurance
The Insurance Information Institute (III)

Leveraging financial incentives in design for construction and operations
A Roadmap to Resilience Incentivization

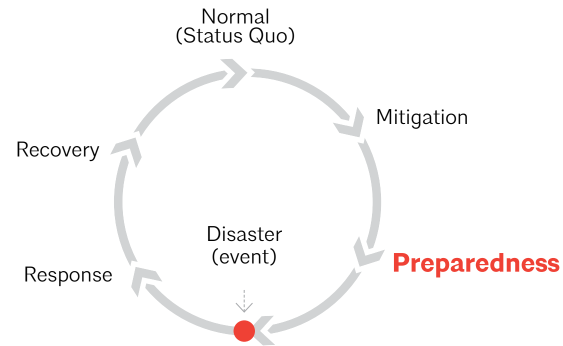
Developing Pre-Disaster Resilience Based on Public and Private Incentivization

An Addendum to the White Paper for Developing Pre-Disaster Resilience Based on Public and Private Incentivization

Rhode Island Infrastructure Bank

Emergency and disaster preparedness

03



LEARN: COMMUNITY-WIDE EMERGENCY PREPAREDNESS

ACT: PREPARING FOR EMERGENCIES AND DISASTERS

OVERVIEW

The preparedness phase is a critical component of the emergency management cycle as it will determine the effectiveness of disaster-response capabilities. Scenario plans, emergency response drills, and exercises are good methods for uncovering interdependencies to address and incorporate into pre-disaster mitigation and resilience planning. This is applicable at both the community level and the individual building scale. Establishing and maintaining relationships between operatives in the emergency management/response effort is as essential as the training to respond. When buildings remain safe and resilient to the impacts of hazards, communities will reduce their vulnerabilities and needed level of response.

Architects, by virtue of their training and education, are qualified to engage in and provide assistance during the preparedness phase of the emergency management cycle. Architects may work to enhance a community's preparedness by advocating through AIA for legislation that enhances preparedness, such as Good Samaritan laws. Leveraging AIA's State Disaster Assistance Program can streamline response by organizing networks of disaster-trained built environment professionals. Individually, architects can enhance preparedness efforts by becoming more informed about their state's specific system and structure of emergency response as well as the Emergency Management Assistance Compact (EMAC). By training to respond and developing an emergency plan, architects can lead through example.

Key concepts

» Understand the structure, elements, and utility of the national preparedness system, including the chain of command under which it operates.

» Identify stakeholders that architects collaborate with during the preparedness phase in anticipation of response activities.

» Understand the components of an AIA State Disaster Assistance Program and how to get involved.

» Be aware of the disaster preparedness education, training, and certification programs available to architects.

» Understand the opportunities and responsibilities of architects in disasters, including emergency preparedness and business continuity planning, advocacy, and community engagement.

POLICY AND ADVOCACY FOR ENHANCED DISASTER PREPAREDNESS

AIA supports advocacy efforts at the local, state, and federal levels. Through the creation of state disaster assistance programs and advocating for state adoption of AIA's model Good Samaritan legislation, AIA creates opportunities for architect members to meet their ethical obligation[75] to the public to render assistance after disasters or in other emergencies. AIA provides example memorandums of understanding (MOUs) that can be used with state emergency management officials to provide architects and design professionals with a formal process for responding to a disaster within their state.

AIA has advocated for modifications to the Stafford Act, which governs how FEMA operates, and has assisted in updating the National Incident Management System (NIMS) resource types to establish common qualifications for architects and other building safety assessment professionals. AIA supports enhancement of the Emergency Management Assistance Compact (EMAC)[76] and other formal agreements that allow credentialed architects to provide pro bono post-disaster building safety assessments to affected areas across state boundaries.

THE NATIONAL PREPAREDNESS SYSTEM

The American Institute of Architects aligns the AIA Disaster Assistance Program with federal policies, including the National Preparedness System, the National Preparedness Goal, and the National Response Framework. These federal systems were developed in 2013 and updated in 2020 to better prepare communities and the nation for disaster. The National Preparedness Goal is to have "a secure and resilient nation with the capabilities required across the whole community to prevent, protect against, mitigate, respond to, and recover from the threats and hazards that pose the greatest risk."[77] To achieve this goal, the National Preparedness System outlines a process of six steps for communities to utilize:[78]

1. Identifying and assessing risk
2. Estimating capability requirements
3. Building and sustaining capabilities
4. Planning to deliver capabilities
5. Validating capabilities
6. Reviewing and updating

[75] Ethical Standard (ES) 2.2 Public Interest Services: Members should render public interest professional services, including pro bono services, and encourage their employees to render such services. Pro bono services are those rendered without expecting compensation, including those rendered for indigent persons, after disasters, or in other emergencies.

[76] See Chapter 4, Authorizing Aid: Volunteers and the Emergency Management Assistance Compact, for additional details on EMAC.

[77] "National Preparedness Goal," FEMA, July 5, 2016.

[78] For further summaries and details of each step, see fema.gov/emergency-managers/national-preparedness/system

THE NATIONAL INCIDENT MANAGEMENT SYSTEM (NIMS)

In addition to the National Response Framework, The American Institute of Architects integrates the processes and procedures outlined in the National Incident Management System (NIMS)[79] to be able to work together more effectively with all levels of government, nongovernmental organizations, and private entities to protect against, mitigate, respond to, and recover from incidents. NIMS facilitates interstate disaster response through the use of resource typing. NIMS provides a coordinated method by which communities can plan for, request, and receive resources (equipment, teams, units, and personnel) before, during, or after a disaster strikes under common expectations. The FEMA National Integration Center (NIC) is responsible for establishing and maintaining the Resource Typing Library Tool[80] of resource definitions, which includes the development of resource types to define the minimum capabilities of building safety evaluation teams and personnel.[81] Learn more about the resource types specific to providing building safety evaluations in Chapter 4: Response.

The NIMS resource database contains a list of succinctly defined resources. By creating standard definitions, a state or unit of local government can be assured they will receive the precise type of assistance they need. Resources may be deployed within a state, within a region, within the country (including U.S. territories), or even internationally. Interstate assistance may be coordinated through state-to-state compacts or agreements, federal agreements, or sub-geographic plans. An example of an interstate mutual aid compact is the Emergency Management Assistance Compact (EMAC), which is administered by the National Emergency Management Association and further discussed in Chapter 4.

COMMUNITY EMERGENCY RESPONSE TEAM (CERT)

FEMA and disaster experts recommend that people be prepared to survive on their own for at least three days. As the frequency and severity of disasters has increased, some experts are predicting that it may be a week or more until outside help arrives. As FEMA states, “You Are the Help Until Help Arrives.” CERT is a community preparedness program that educates individuals on local hazard risk and trains members in fire safety, light search and rescue, team organization, and disaster medical operations.[82] This training enables CERT members to assist fellow community members post-disaster when first responders have not yet arrived. While CERT doesn’t require any architectural expertise, it does connect architects to their communities, inform on local hazards and emergency plans, and introduce the entities architects will be cooperating with as part of the AIA State Disaster Assistance Program.

[79] See fema.gov/national-incident-management-system for more information.
[80] preptoolkit.org
[81] See appendix for further detail on Building Safety Assessment Team Resource Types
[82] “Community Emergency Response Teams,” FEMA, August 2016.

PARTNERSHIPS IN PREPAREDNESS

Coordination and communication networks that are developed before a disaster enable a faster, more efficient, and more productive response effort. Architects develop formal or informal agreements with local and state governments, including building departments, emergency managers, fire marshals, and public health officials, to ensure that architects and their building industry colleagues are prepared, trained, and ready to be of service after a disaster. By establishing relationships early—before the disaster arises—all parties gain a better understanding of the skills each brings.

Architects can build and maintain relationships with stakeholders, including government staff, nonprofit and community leaders, and business and civic organizations (chamber of commerce, Rotary), in the town, city, or state. These relationships may already exist within a business or personal context and are valuable starting points for disaster preparedness discussions.

First responders, the authority having jurisdiction (AHJ), and other organizations may not readily recognize the value the design professional brings as part of the emergency management response plan. The Disaster Assistance Handbook has been designed to highlight the skills and services design professional can provide to local and state emergency management agencies during a disaster and can be used as a starting point for conversation on how to best collaborate.

Building relationships

Relationships with state and county emergency management officials, fire service officials (fire marshals, chiefs, etc.), local government officials, the state's National Guard, and other stakeholders are critical for ensuring architects are incorporated and deployed in disaster response missions.

Engaging with the state municipal league, a state's mayor's association, or associations of county commissions builds institutional awareness of the aid architects can provide. Attending, speaking at, or even exhibiting at their events is a great opportunity to create awareness of AIA Disaster Assistance volunteers as a resource. Observing or participating in drills, such as Vigilant Guard (see Case Study), or "tabletop exercises" is another avenue to enhance relationships.

Coalitions of building industry organizations comprised of architects, engineers, ICC chapters, and others may work together to advocate for Good Samaritan legislation or memorandums of understanding (MOU) to provide liability protection and authorize services.

The American Red Cross, insurance companies, the Small Business Administration (SBA), faith-based organizations (e.g., Voluntary Organizations Active in Disaster (VOAD)), and others have specific responsibilities post-disaster, and by understanding what those duties are, architects can collaborate with them on efforts before and after the disaster.

AIA STATE DISASTER ASSISTANCE PROGRAM: PREPARING TO PROVIDE BUILDING SAFETY ASSESSMENTS

The AIA Disaster Assistance Program supports a nationwide network of architects who help communities prepare for, respond to, and recover from disasters. State or local governments often do not have the resources to respond to a major disaster and rely upon additional outside resources to meet the needs of the community. During response and recovery, legislation that limits liability, clear guidance to volunteers on workers compensation regulations and legal representation, and the portability of licensure across state lines can allow communities to recover faster by providing protections that enable architects to service affected communities.

DISASTER EVALUATOR TEAM
Post-disaster building safety evaluation volunteers in Paradise, California, in 2018.

SOURCE
Lester Meu, AIA. Used with permission.

Each state is different

In the United States, each state or commonwealth has its own unique governance structure. These unique governments approach disaster assistance in a variety of ways. Some structure their post-disaster building safety evaluation response programs at the state level, through legislation and regulation. Other states rely on local governments to organize and implement disaster response and assistance programs. All jurisdictions can benefit from collaboration with professional organizations.

Organizations like AIA can aid with volunteer recruiting, local training events, periodic readiness checks, and other functions valuable to the deploying agency. Because of the variation from state to state, state and local AIA chapters are in the best position to offer assistance and lead or coordinate in-state volunteer deployments.

AIA chapter staff and AIA State Disaster Coordinators are familiar with state-specific requirements, such as the state statutes governing disaster responders. These statutes can be radically different from state to state, such as containing language requiring National Council of Architectural Registration Boards certification (in Rhode Island), requiring volunteers to be members of a Mobile Support Unit (in Georgia), or requiring volunteers to be registered with a local Department of Emergency Management (in Washington) or associated with a state program (in Oregon). Additionally, in times of crisis a governor may issue emergency declarations or executive orders that supersede, supplement, or clarify state statutes.

The AIA State Disaster Assistance Program

Typically rooted within the state chapter, a State Disaster Assistance Program is a collaboration between AIA and local or state emergency officials to formally prepare architects to enter the incident management framework in the event of a disaster. As of 2018, every state AIA chapter has identified a volunteer AIA State Disaster Coordinator to interface with emergency management officials and help AIA chapters across the state prepare for disaster.[83]

A model state disaster assistance program includes:

1. Standard of training
2. Liability coverage
3. Clarity on protections available: Workers' Compensation and legal representation
4. Activation of volunteer network (In-State)
5. Portability of licensure

[83] AIA Component [Chapter] Accreditation. Advocacy Requirement 4: State Component: Appoint a volunteer AIA State Disaster Coordinator to interface with emergency management officials, to help components around the state prepare for potential natural or other disasters.

Standard of training: New guidance

In 2018 AIA successfully lobbied for the inclusion of language in the federal Disaster Recovery Reform Act (DRRA) requiring FEMA to “develop and publish guidance, including best practices, for post-disaster assessment of buildings by licensed architects and engineers.” This included two key provisions:

» including architects in the NIMS resource typing definition as defined resources on building safety assessment teams (multiple resource types by skill set), and

» defining building safety assessments to expand beyond structural integrity to include habitability aspects of damage that could affect safe occupancy.

AIA’s efforts were important steps in creating a nationally accepted standard that detailed the qualifications to provide holistic building safety assessments, from proposing the DRRA draft legislation language to contributing to the new NIMS resource type definitions to co-authoring the Post-disaster Building Safety Evaluation Guidance (P-2055). These new policies and resources are unlocking opportunities for architects to volunteer to assist communities across the nation.

Compliance with the training and educational requirements noted in the NIMS resource is recommended rather than required guidelines for AHJs. The Stafford Act revisions and the publication of FEMA’s Post-disaster Building Safety Evaluation Guidance (P-2055) provides a formalized framework for the training and qualifications of volunteers performing post-disaster evaluations. This new guidance was developed to help state and local governments, as well as AIA disaster assistance programs, that were previously faced with gaps or inconsistencies in training standards, roles and responsibilities, and qualifications for post-disaster teams.

But my state doesn’t experience major disasters

While many kinds of hazard events can be anticipated—earthquakes in California, tornadoes in the Great Plains, hurricanes on the Gulf and Atlantic coasts—some disasters are truly unanticipated.

AIA encourages all architects to take and update their post-disaster building safety assessment training to enable them to respond to hazard events where and when needed. Volunteers from states with relatively few natural hazards may be called upon to assist states or regions that experience widespread catastrophic events. Hurricane Katrina affected some 90,000 square miles of the United States, causing major flooding as far away as New York. Assistance from 200 building code and structural assessment personnel from nine states was required.

Training programs

While an architect's education and experience qualifies them to provide a host of services for new and existing construction, the AIA Disaster Assistance Program provides specialized training to volunteers to respond to disaster situations prior to deployment of post-disaster building safety evaluations.

The education backbone of AIA's Disaster Assistance Program is the building safety assessment program training based on the Applied Technology Council (ATC) methods for seismic, windstorm, and flood damage evaluation, an industry standard and a NIMS-approved training course.

In 2008 AIA National collaborated with California's Office of Emergency Services (Cal OES) to adapt and adopt the California Safety Assessment Program (Cal OES SAP) as AIA's national training standard for certification as a post-disaster building safety evaluator. The AIA SAP training is an all-hazards training for architects and other built environment professionals to perform post-disaster building safety evaluations as volunteers for mutual aid following a disaster. The training certification program is managed by Cal OES with cooperation from professional organizations such as AIA and Structural Engineers Association of California (SEAOC).

AIA Safety Assessment Program Training

Initial certification by Cal OES is valid for five years from the date of the Cal OES SAP Evaluator Training or if deployed following a declared disaster, five years from the date(s) of deployment. Renewal for an additional five years is also available online at the Cal OES website.

Rules of engagement

"Rules of engagement" (ROE) is a term used by the military operationally to "conduct warfare in compliance with international laws and within the conditions specified by the higher commander." ROE is sometimes used in disaster response since a disaster scene is often described as a battlefield or similar war scene.

The National Incident Management System (NIMS) is the adopted and accepted ROE for disasters. Without it, the response to or work at a disaster scene would lack the necessary organization to be effective and efficient. This system allows for chain of command, goal setting and tracking, planning for resources, and tracking of costs and efforts.

Design professionals volunteering at a disaster need to understand these ROE and the necessity of maintaining them. Knowing the assignment, the time allotted to do it, and who to report to is key. Creative solutions might be welcomed within tasks and assignments, but the structure, chain of command, and reporting systems in the NIMS and its command structure (ICS-Incident Command System) provide the ROE discipline for the application of resources. Understanding and adhering to these rules is a necessary part of the disaster response.

The Cal OES assessment program complies with the Incident Command System (ICS) protocol and NIMS. The three safety assessment trainings offered through the Cal OES program are evaluator training, coordinator training, and evaluator train-the-trainer training. These roles are defined by Cal OES and used in their training materials. The NIMS resource types have different names but similar functions. For instance, a Cal OES "SAP evaluator" would be known as a NIMS "post-disaster building safety evaluator."

Throughout this handbook the reader will encounter the terms "SAP volunteer," "safety assessment evaluator," and "post-disaster safety assessment evaluator." The terms are used to indicate a professional who has been trained and certified by a state or national program to perform evaluations that determine the structural and habitability condition of a building impacted by a disaster event.

AIA SAP TRAINING IN COLUMBUS, OHIO
In 2008 AIA National collaborated with California's Office of Emergency Services (Cal OES) to adapt and adopt the California Safety Assessment Program as AIA's national training standard for certification as a post-disaster building safety evaluator.

SOURCE
Photo by Rose Grant, AIA. Used with permission.

Credentials and qualifications of post-disaster volunteers will vary by state; however, most programs require architects and engineers to be licensed in the state where they are volunteering. Per the NIMS resource typing, trained professionals educated and working in the profession of architecture and engineering who are not yet licensed are permitted to volunteer if they are assisting under the supervision of a licensed professional. In all cases, the authority having jurisdiction can establish minimum requirements—such as requiring licensure of all professionals involved in evaluations, or that they are employed by a state or local government. A state or local jurisdiction could limit responders to those licensed in that particular state—not providing for portability of licensure. In states with extensive contractor testing and licensing requirements, the state could choose to accept those credentials as well.

Common training programs for post-disaster engagement include:

»

Evaluator training
As described previously, Cal OES offers one of the original training programs, based on ATC methods and aligned with NIMS requirements. Some states and organizations have developed their own training and certification programs, which may or may not be based on the ATC method or Cal OES program.

Coordinator training
This training is provided by the Cal OES program and is geared toward government officials who would be coordinating post-disaster building safety evaluations. In the NIMS system, the coordinator role is known as the post-disaster building safety evaluation strike team leader. This is a separate role from AIA's State Disaster Coordinator who is tasked with leading an AIA chapter's Disaster Assistance Program.

Evaluator train-the-trainer program

This program, provided by Cal OES, trains instructors to offer the Cal OES SAP Training.

FEMA Incident Command System (ICS) training

ICS is the organizing mechanism that develops a plan, communicates it as a series of tasks, schedules work efforts to ensure efficiency over a long duration, and allows ongoing evaluation of progress toward the final goal of recovery. Understanding of ICS is a requirement in all disaster operations and is dictated by the Stafford Act. It can be used at all levels of disasters. While NIMS includes the following FEMA-offered courses in the post-disaster building evaluation resource types, individual state requirements vary.

» IS-100: Introduction to the Incident Command System

» IS-200: ICS for Single Resources and Initial Action Incidents

» IS-700: National Incident Management System, an introduction

» IS-800: National Response Framework, an introduction

NFPA training

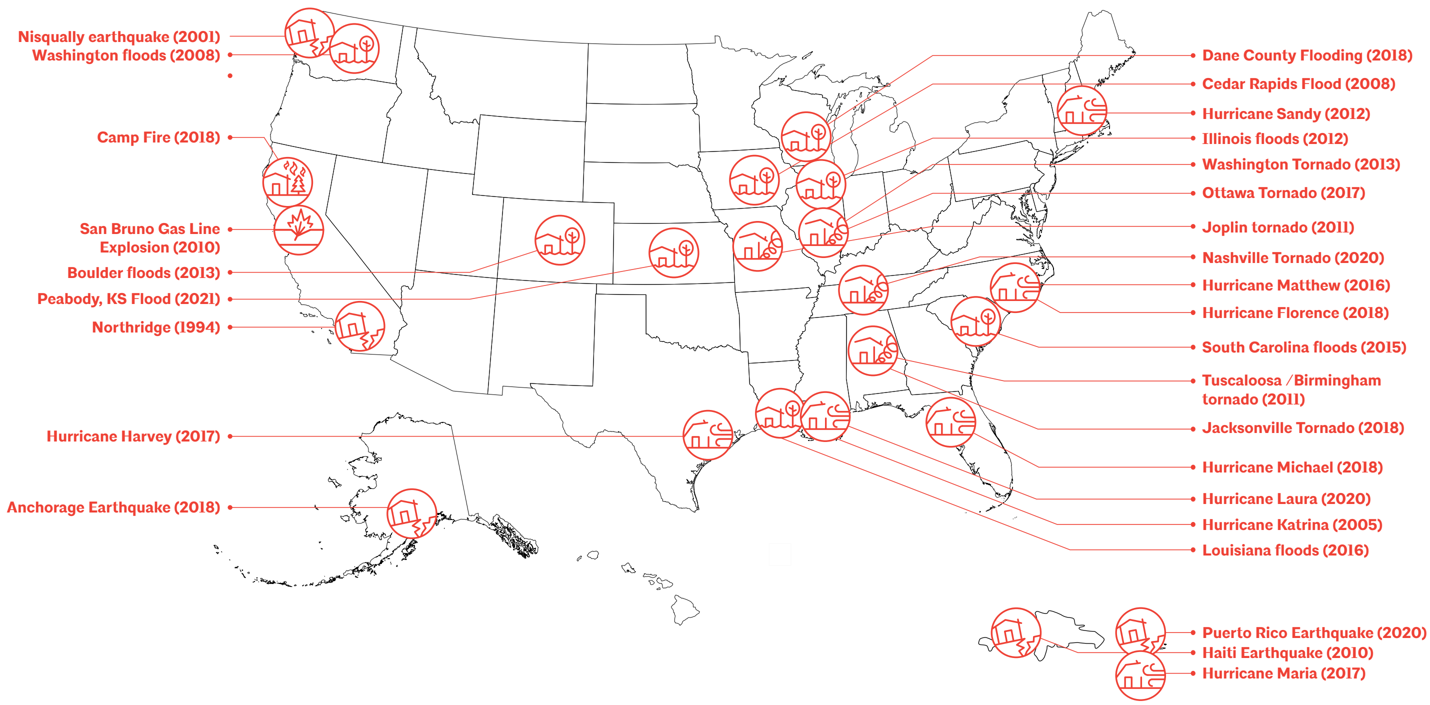
NFPA training focuses on fire incidents, wildfire planning and response, and hazardous materials (haz-mat) and weapons of mass destruction.

Other training

First aid, CPR, urban search and rescue (USAR), and other specific response resources—often in specialized areas that could be involved in disasters, such as geotechnical engineering or drone operation, may require additional training.

Continuing education

AIA provides education on building safety assessments, hazard mitigation, climate change impacts, and community design at the AIA National Conference, online through AIA's educational platform AIAU, and by AIA chapters throughout the country.



MAP OF AIA RESPONSE EFFORTS

Architects have responded to a wide range of hazard events across the nation. Disasters know no boundaries and can occur at any place and at any time. Whether it is windstorms, floods, earthquakes, or wildfires, post-disaster building safety evaluation training enables architects and allied professionals to assist wherever the need arises.

SOURCE

AIA

Liability coverage

Major disasters can quickly overwhelm the capacity of local officials and dedicated staff who provide medical care, emergency services, utility repairs, and building safety. Many states have extended liability protection to medical professionals and other professionals who are needed during a crisis. This liability protection allows these professionals to volunteer more readily and gives the public access to crucial services and skills during major disasters. Similarly, a number of states have adopted Good Samaritan laws intended to provide liability protection to licensed architects for voluntary services provided during a government-declared disaster.

The first step in a building safety assessment mission is to determine if the state has a Good Samaritan law or equivalent and, if so, what level of liability protection it affords architects. Not all Good Samaritan laws are the same. Services, length of time, and required credentials can vary from state to state. Part of any architect's preparation to serve in a disaster assistance role is to determine the specifics of the disaster location's Good Samaritan law.

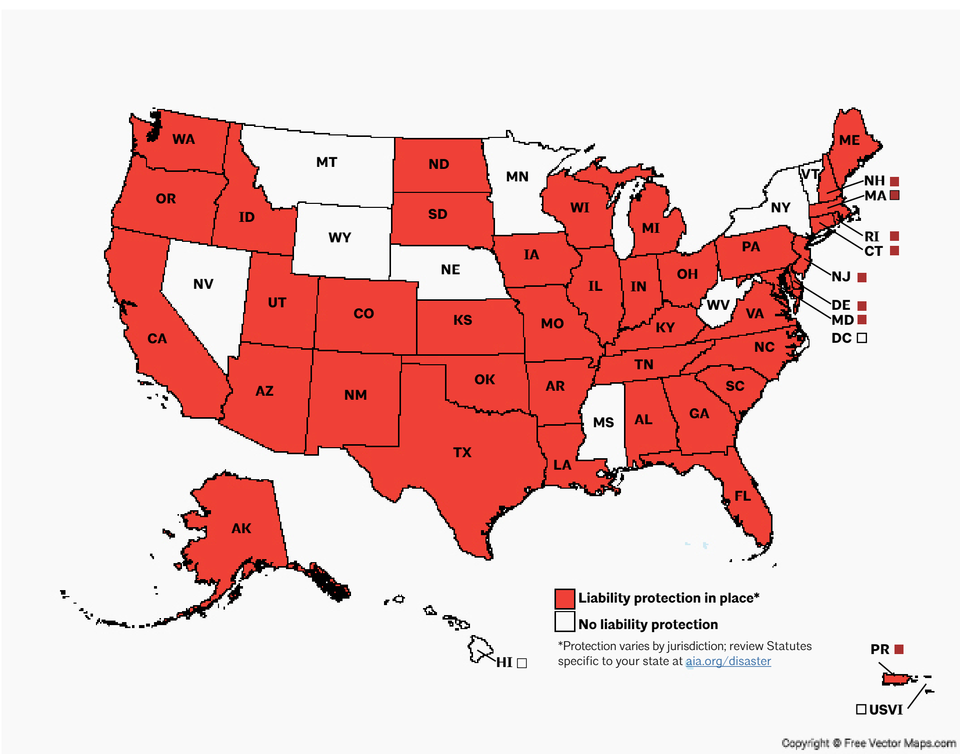
AIA's model Good Samaritan law includes language to protect an architect "who voluntarily, without compensation (other than expense reimbursement) provides architectural services, or professional engineer who voluntarily, without compensation (other than expense reimbursement), provides engineering services related to a declared national, state, or local disaster … at the direction or request of or with the approval of a national, state, or local public official, law enforcement official, public safety official, or building inspection official. …" It goes on to state that the design professionals "shall not be liable for any personal injury, wrongful death, property damage, or other injury or loss of any nature related to the licensed architect's or professional engineer's acts, errors, or omissions in the performance of any architectural services (in the case of a licensed architect) or engineering services (in the case of a professional engineer) for any structure, building, facility, project utility, equipment, machine, process, piping, or other system, either publicly or privately owned."

Good Samaritan protection

Though Good Samaritan laws may provide liability protection for specific, AHJ-requested post-disaster services, such as building safety assessments, they don't necessarily protect architects performing other disaster-related volunteer work such as resilience activities, rebuilding, and other pro bono services. The AIA B106-2020 is a standard form of agreement between owner and architect for pro bono services and is available as a free document for use on any size project. Other resources include the Institute Guidelines to Assist AIA Members, Firms and Components [Chapters] in Undertaking Pro Bono Service Activities.

This does not mean that an architect cannot be named in a lawsuit, but ultimately, even if a suit is filed, architects are not held liable unless there is evidence of grossly negligent or willful misconduct. As of the writing of this publication, AIA knows of no lawsuits or significant injuries incurred by architects providing post-disaster safety assessments.

Several AIA chapters nationwide have pursued and achieved Good Samaritan legislation, some based on AIA's model law, and at times in collaboration with engineers, and code officials who desire to be of service or those local agencies that benefit from the emergency services of volunteers. The AIA Good Samaritan Statute Compendium is regularly updated with a list of state laws as well as AIA's model law.



AIA LIABILITY PROTECTION MAP
As of this printing, 40 states and Puerto Rico provide a degree of liability protection to architects volunteering post-disaster.

SOURCE
AIA

Clarity on other available protections: Workers compensation and legal representation

Volunteers should understand that should they become injured or otherwise harmed as a result of their volunteerism, Good Samaritan legislation or other legislated professional liability protection do not typically address workers' compensation coverage. Depending on state law and any memoranda of understanding (MOU) between state agencies and nongovernmental disaster assistance organizations or individuals, protections and benefits may or may not extend to the organizations, companies, or firms that engage the disaster responders deployed on a volunteer basis. It is important for volunteers to do their own research and to understand their risks and seek professional advice where they are uncertain. If a volunteer is deployed via EMAC, EMAC provides that the requesting state cover the tort liability and the responding state cover the workers' compensation liability.[84]

Every state, the District of Columbia, and U.S. territories have enacted workers' compensation laws that are administered by the jurisdiction, and as such each program has its own requirements and penalties.[85] Coverage and benefits vary widely from state to state: "coverage of volunteers can depend on whether they are considered 'employees' and whether state laws expressly exclude coverage for volunteers."[86] In general, workers' compensation programs provide benefits to workers who are injured during the scope and course of their employment but not necessarily for volunteers deployed by those jurisdictions.[87]

If the individual is volunteering under the state or local AHJ, an understanding of responsibility benefits all parties and should be identified in existing state legislation or defined in an MOU or other agreement before volunteer services are rendered.[88] In most cases, the AIA state disaster assistance coordinator will be able to provide specific information on workers' compensation coverage.

Per state legislation, disaster responders are often considered state employees for the period of their deployment and/or for the period of the declared disaster. Being considered a state employee via that enabling legislation is often the nexus for workers' compensation eligibility and may afford the disaster responder legal representation in the event a third party commences litigation against the disaster responder for alleged misconduct and damages suffered by that third party.

Even legislation providing some measure of immunity (i.e., Good Samaritan legislation) for the disaster volunteer does not prevent a third party from commencing litigation against the disaster responder.[89] If the state where the disaster response work is being conducted does not provide legal representation, the disaster volunteer may be faced with finding and financing their own legal defense. Volunteers should investigate the parameters of legal representation that may or may not be present in state statutes regarding legal actions brought against disaster workers and may need to seek the advice of an attorney to determine their risk.

[84] Wilfredo Lopez, JD, Stacie P. Kershner, JD, and Matthew S. Penn, JD, "EMAC Volunteers: Liability and Workers' Compensation," ncbi.nlm.nih.gov/pmc/articles/PMC4667549/

[85] "Key Federal and State Laws Regarding Emergency Volunteers," Atho astho.org/Programs/Preparedness/Public-Health-Emergency-Law/Emergency-Volunteer-Toolkit/Key-Federal-and-State-Laws-Regarding-Emergency-Volunteers/

[86] Ibid.

[87] "Workers' Compensation Issues in Emergencies,"Athos, astho.org/Programs/Preparedness/Public-Health-Emergency-Law/Emergency-Authority-and-Immunity-Toolkit/Workers--Compensation-Issues-in-Emergencies-Fact-Sheet/

[88] Consult with the state department of labor on the administration of workers' compensation.

[89] Andrew Leonatti, "What 'Reasonable' means," Law Info, lawinfo.com/resources/personal-injury/what-are-good-samaritan-laws.html#:~:text=-Good%20Samaritan%20laws%20don't,liable%20for%20personal%20injury%20damages

Activation of a volunteer network (In-state)

AIA State Disaster Assistance Program administration is led by the relevant AIA state chapter or a strong local chapter. In either instance, a member champion, known as an AIA state disaster assistance coordinator, aids AIA Chapter staff in leading the chapter's disaster assistance program. Disaster assistance coordination includes maintaining rosters of potential volunteers, organizing training, and providing communication between AIA staff, state emergency management, and other governmental officials as well as outreach to allied building professionals.

Depending on the size, density, or topography, a local disaster assistance coordinator may be named to manage and build critical relationships with municipal leaders. In addition, disaster assistance coordinators are often supported by an AIA chapter's disaster committee or other related program.[90] For example, AIA New York's Design for Risk and Reconstruction Committee and AIA Miami's Resilience and Adaptation Committee work year-round to train, educate, and prepare architects and allied professionals with updated hazard information and emerging practices to promote hazard mitigation and resilience.

Components of a typical disaster assistance memorandum of understanding (MOU)

1. **Introduction**: Describes the project and applicable statutes and regulations. Identifies parties to the disaster assistance MOU.

2. **Purpose of the disaster assistance MOU**: Describes why the disaster assistance MOU is necessary. For example: "Due to the continuing threat of disasters, natural and manmade emergencies, there is a need for a means to assist the state or local governments in assessing the safety and serviceability of buildings within their jurisdiction."

3. **Roles and responsibilities of all parties**: Describes the emergency management incident command system in the state and the roles and expectations of the parties, typically:
    a. Chain of command
    b. Training and qualification requirements for volunteers
    c. Maintaining the roster of trained, qualified volunteers
    d. Volunteer activation responsibility and methodology
    e. Tools, supplies, and equipment
    f. Financial reimbursement
    g. Food and lodging

4. **Other provisions**: Describes other provisions that fall outside the scope of roles and responsibilities, such as how to address conflicts of interest, how to handle confidential information, how disputes will be resolved, etc. For disaster assistance, this section typically addresses:
    a. Liability protection
    b. Workers' compensation
    c. Legal representation

5. **Designation of the representatives and administration of the disaster assistance MOU**: Identifies who will sign the disaster assistance MOU, alternates for those individuals, and how the disaster assistance MOU will be amended or terminated. Determines if there is a time limitation or required renewal date for the MOU.

[90] See Appendix for a list of state and local disaster assistance and resilience committees.

Developing a memorandum of understanding (MOU) to be signed between the entity providing volunteer services and the state or local AHJ will aid in establishing a set of clear expectations and methods for enabling post-disaster engagement. The AIA state disaster assistance coordinators may help develop MOUs with the AHJ to formalize the response capabilities of architects. In many ways, the MOU will reflect and formally document the five components of a typical state disaster assistance program. The MOU identifies the parties, references applicable state statutes, and identifies the roles and responsibilities of all parties in preparing for and responding to disasters. MOUs can also include allied professionals such as structural engineers and civil engineers.

When a state disaster assistance program has been established and a hazard event is forecast, notifications may be sent to volunteers in advance so they can be prepared to protect their families and businesses and respond when called upon. This proactive communication minimizes confusion and the number of queries. In parallel, AIA State Disaster Coordinators contact the appropriate state or local emergency management agency to convey readiness and capabilities of the AIA State Disaster Assistance Program.

There are times when the hazard event or the disaster cannot be forecast or exceeds the level of anticipated need. This can occur on a weekend, or at night, with the expectation that the need will be filled quickly. Maintaining a roster of trained personnel, able to volunteer on short notice, is essential. The advent of NIMS resource typing underlines the importance of maintaining credentials to assure that requests for resources can be met efficiently and accurately.

It is important to understand that the management and control of any disaster begins at the lowest level of government, but all levels of government operate in concurrence with established protocols that are followed by FEMA and the emergency management agencies of the states. This established "chain of command" is integral to disaster operations. The building blocks of this protocol begin with the understanding of the Incident Command System (ICS) and the response framework of NIMS. Deputization and direction of the authority having jurisdiction (AHJ) is required for volunteers to operate at the disaster scene. No one should self-deploy to disaster zones.

ARCHITECTS PREPARE TO DEPLOY
Members of the AIA Alabama State Disaster Assistance Team (L to R): James E. "Butch" Grimes, AIA, AIA AL State Disaster Coordinator; Joseph "Wes" Wesley, AIA; Bruce N. Lanier III, AIA; and Arch Trulock, AIA.

SOURCE
Larry A. Vinson, CAE, AIA Alabama Executive Director. Used with permission.

Portability of licensure

During a large-scale disaster, state legal limitations on the practice of architecture may inhibit adequate response and resources. Local architects licensed in the state where the disaster occurs may not be available to volunteer, as they may be in the area affected by the disaster and themselves in need of assistance. Out of state architects who may want to volunteer face a legal challenge to volunteer because they may be deemed to be practicing architecture without a license, as architects in the United States must be licensed by each individual state. Generally, subject to individual state law definitions, evaluating building structures after a disaster event will likely be considered the practice of architecture. To overcome this legal barrier in this critical yet temporary situation, the state licensing board that governs the practice of architecture, or other relevant state agency, may adopt regulations that allow out-of-state licensed architects to serve as "emergency workers" or otherwise provide for their limited practice in the state during a disaster declaration. The National Council of Architectural Registration Boards maintains a model regulation entitled "Qualifications for Practice Under Disaster Declaration" that the state can adopt (see Appendix).

Out-of-state architects volunteering through EMAC will be subject to the policies and protocols of the state-to-state agreement.[91] Article V of the compact states that "Whenever any person holds a license, certificate, or other permit issued by any state party to the compact evidencing the meeting of qualifications for professional, mechanical, or other skills, and when such assistance is requested by the receiving party state, such person shall be deemed licensed, certified, or permitted by the state requesting assistance to render aid involving such skill to meet a declared emergency or disaster, subject to such limitations and conditions as the governor of the requesting state may prescribe by executive order or otherwise."

[91] "EMAC Legislation," EMAC emacweb.org/index.php/learn-about-emac/emac-legislation

RECOVERY PLANNING

As discussed further in Chapter 5, the recovery phase after the disaster can be long and arduous. Communities that recover faster are those that have built resilience in, such as through risk-smart land use planning, stronger building codes, and effective building code enforcement. Logically then, the time to plan for recovery is before the disaster.

Being prepared goes beyond a plan to respond by having a framework in place to facilitate recovery. Local government, agencies, and the private sector must be equipped with an organizational plan and framework that defines the structure, process, roles, policies, and comprehensive community objectives to address the unique recovery needs of their community. They must be positioned to capture and capitalize on available recovery assistance resources to rebuild stronger and implement hazard mitigation measures, and they must be aligned to strengthen local resilience, sustainability, accessibility, and social equity goals. Benefits of local pre-disaster recovery planning can be found in FEMA's Pre-Disaster Recovery Planning Guide for Local Governments 2017.

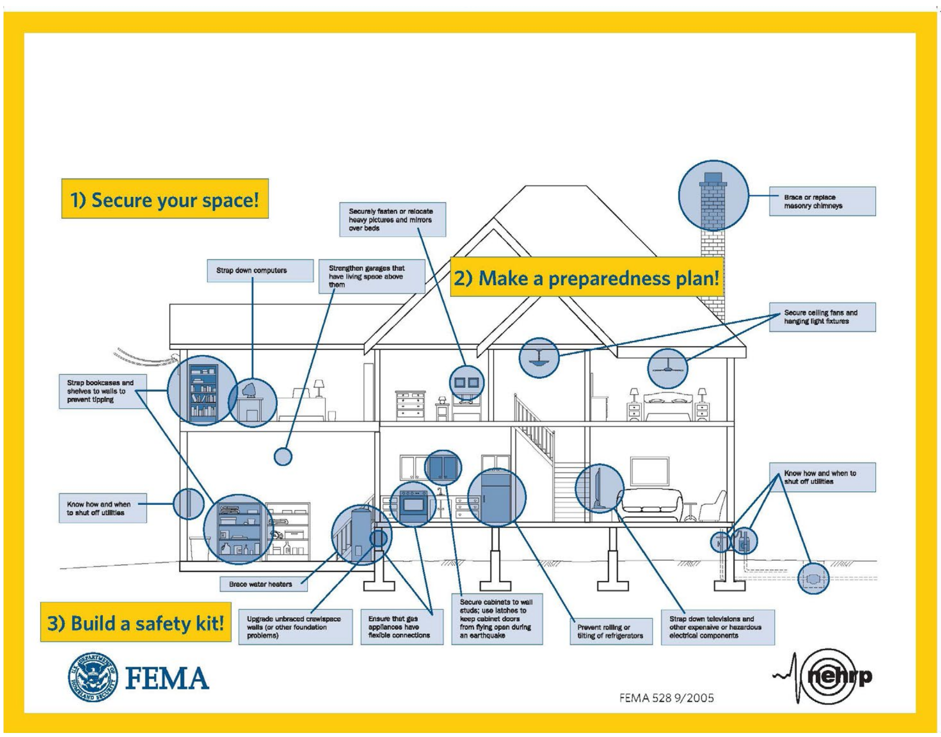
Pre-disaster recovery planning, emergency preparedness planning, and hazard mitigation planning are symbiotically linked. While different in their focus, the shared objective of increased resilience and increased adaptive capacity allows recovery, emergency preparedness, and hazard mitigation planning to reinforce one another for greater benefits during recovery. Hazard mitigation plans, as discussed in Chapter 2, support pre-disaster recovery planning and emergency preparedness planning by providing information for identifying hazards, risks, and needs. They can be used to determine priority activities and policies to be undertaken as part of disaster response and recovery when resources and opportunities are available to rebuild with a more resilient approach. Pre-disaster recovery plans can support hazard mitigation plans by preemptively embedding mechanisms for implementation into the decision processes that occur in the complex recovery environment.

DISASTER AND HAZARD SCENARIO PLANNING, DRILLS, AND EXERCISES

Architects have partnered with engineers, emergency planners, and other community leaders to engage in disaster scenario planning and other preparedness exercises for their community. Disaster scenario planning offers jurisdictions an opportunity to measure capabilities and to test their vulnerabilities around various hazards. Often this happens within the Office of Emergency Services when developing hazard mitigation plans but can also be accomplished by concerned experts, as occurred in **San Diego** (see Case Study).

Scenario planning can also occur in tandem with other efforts, such as a public awareness campaign, as was the case in Washington state. As part of the Great Shakeout, AIA Washington adapted a FEMA diagram to communicate earthquake preparedness actions homeowners can take to enhance the safety of their home. At the same time, the state conducted a tabletop exercise to better understand how Washington would fare during a large earthquake. An architect trained in AIA's Safety Assessment Program was asked to audit the exercise, observing the response actions and providing valuable insight for future planning. Efforts like these provide further benefit by networking allied professionals, raising public awareness, and deepening government commitment to hazard mitigation and preparedness actions.

Scenario planning and execution can also provide community planners and emergency management personnel and architects with an opportunity to develop a rapport and an appreciation for the skills the various parties bring to the table. Architects can also use those exercises to practice the in-field coordination that is vital to successful post-disaster action before the "big event" occurs, as was done in Rhode Island's **Vigilant Guard** exercise (see Case Study). To be invited to and participate in these exercises, architects, through their state disaster assistance program, can reach out to the director of their emergency management agency or other government agency charged with managing emergencies.



PUBLIC AWARENESS

AIA Washington State participated in the public awareness campaign the "Great Shakeout" by distributing this home earthquake preparedness information and other resources.

SOURCE

AIA Washington and FEMA

EMERGENCY PREPAREDNESS PLANS AND BUSINESS CONTINUITY PLANS

Systemic preparedness will not only increase safety and protect assets but will increase the likelihood of business continuity. When individuals and organizations are able to continue operations after a disaster or even during an emergency incident, such as a pandemic, it improves a community's ability to recover. Disaster preparedness begins at the individual level. Architects and other emergency responders can lead by example by having a family emergency plan and a business continuity plan in place. When such a plan is in place, individuals are better able to assist others post-disaster. Additionally, architects can easily incorporate these plans in the programming stage for any new or renovation project. Architectural and engineering firms that do this planning for their own firms are better able to discuss these issues with clients and assess the design implications. AIA has released The Architect's Guide to Business Continuity as a resource to ensure firms are able to serve their clients through disruptions.

The COVID-19 pandemic highlighted a new aspect of the need for a business continuity plan. In a matter of weeks in the spring of 2020, the economy went from thriving to almost completely shut down. Construction work stopped, everyone, except essential occupations, were either not working or attempting to work from home. This represented a completely different challenge—it tested the ability of people to work together without being together. Continuity plans that called for stress testing a company's ability to access data remotely and collaborate virtually were helpful to many businesses impacted by the pandemic.

ADDITIONAL PREPAREDNESS RESOURCES

The National Preparedness System
The National Preparedness System

The National Preparedness Goal

The National Response Framework

AIA State Disaster Assistance Program: Preparing to provide building safety assessments
AIA Safety Assessment Program Training (SAP)

AIA Guide to Developing a Disaster Assistance Memorandum of Understanding (MOU). Contact resilience@aia.org for access.

Community Emergency Response Team (CERT)

FEMA P-2055 Post-disaster Building Safety Evaluation Guidance

Recovery planning
FEMA Pre-Disaster Recovery Planning Guide for State Governments

FEMA Pre-Disaster Recovery Planning Guide for Local Governments

Disaster scenario planning, drills, and exercises
Great Shake Out

Critical Power Failure Scenario

Emergency preparedness and business continuity plans
The Architect's Guide to Business Continuity

Emergency communication plan guide

FEMA National Continuity Programs

American Red Cross How to Prepare for Emergencies site

IBHS Open for Business-EZ toolkit

NFPA 1600 Standard on Continuity, Emergency, and Crisis Management

A Day in the Life of a deployed post-disaster building safety evaluator

Disaster assistance volunteers' natural instinct is to put training to use whenever disaster strikes, yet the majority of hazard events don't warrant volunteer assistance. Post-disaster building safety evaluators are considered "second responders," providing services after first responders, such as police, fire, EMS, and urban search and rescue (USAR). Before building safety evaluators arrive, crews will already be clearing streets for access and restoring utilities, and residents may be beginning cleanup, locating belongings, and assessing the impact on their lives.

Emergency personnel and volunteers alike operate within the overall disaster response framework. Among other things, this ensures efficient use of resources, personal safety, and the eligibility of volunteer hours toward federal disaster assistance matching funds. It may be several days after the event before a post-disaster building assessment deployment commences. This "day in the life" composite is drawn from various deployments so that volunteers and the officials who deploy them know what to expect.

The call up

I'm a weather geek. Springtime in the Midwest does that to people. Storms bring the potential for heavy rain and flash flooding. But it's the tornadoes that keep me awake at night. So, when my social media feed lit up, the news that a tornado had struck a city a few counties away was not unexpected. Watching the Twitter feed, I could tell it was bad, likely an EF3. Time to prepare.

When a disaster is local, volunteers can commute to the disaster zone. This places less of a strain on lodging, meals, and transportation resources. Even when I have deployed longer distances to large-scale disasters, I have tried to be as self-sufficient as possible, so I'm not an additional burden on local resources already stretched thin by the disaster.

Tornadoes can occur any time of the year; spring is common, but I have deployed in November too. Earthquakes also know no season and occur without warning. With hurricanes you generally have an idea they are on their way, but sudden strengthening can turn a tropical storm into a Category 3 overnight. Because volunteers may have limited warning, I keep a "go bag" ready with what I need: supplies, PPE, credentials, field manuals, etc.

GO BAG, PACKED AND UNPACKED

Ready to respond, my "Go Bag" packed and unpacked. A comprehensive list of items that might be included in this bag are listed in the Appendix.

SOURCE

Rose Grant, AIA. Used with permission.

A Day in the Life of a deployed post-disaster building safety evaluator (continued)

As I suspected from the initial field reports, the damage was significant, and the impacted community needed volunteer building safety evaluators to help assess whether or not the impacted buildings were safe to occupy. The morning following the tornado, our AIA state disaster coordinator sent an email to all the credentialed evaluators in the surrounding counties describing the request of the authority having jurisdiction (AHJ), including:

» The number of volunteers needed

» Required volunteer qualifications and type of assessment (rapid or detailed)

» Location(s) and approximate number and type of buildings

» The anticipated length of deployment

» The anticipated working conditions, including relevant health and safety protocols

» If expenses would be reimbursed, including lodging or meals

Our AIA state disaster coordinator also shared information to help me determine whether or not to volunteer:

» The level of protection afforded by the state's Good Samaritan Law

» Whether workers' compensation and legal representation would be provided

If I was qualified and willing to volunteer, the email asked me to send our AIA state disaster coordinator my availability for deployment over the coming days.

Orientation

Within a few hours of sharing my availability, I received an email with instructions to report to an incident command post the very next morning and a reminder to bring requisite credentials: ID, SAP badge, a copy of my architectural/ engineering license, and documentation of training.

Upon arrival, the other volunteers and I waited patiently as the response organization addressed a few urgent matters. We spent the time familiarizing ourselves with the situation and getting to know each other. We saw the stress on the faces of the locals at the Emergency Operations Center (EOC) who were coordinating everything from newly arriving dump trucks and food donations to fielding calls from out-of-state relatives looking for news on their kin. I try to remember that the people responsible for receiving and organizing volunteers may themselves be sleep-deprived victims who were directly affected by the disaster.

Our day began with a briefing and orientation, led by a local emergency management person who was joined by the city's building official (and designated strike team leader). Next, we registered, provided our contact information and credentials, were checked in, and had our architectural license numbers recorded. Prior to heading into the field, all the evaluators were deputized by the AHJ to act as its representatives so that we could legally placard buildings.

EVALUATORS GATHER AT A TABLE FOR BRIEFING

Pre-deployment briefing at the EOC

SOURCE

Janine Glaeser, AIA. Used with permission.

A Day in the Life of a deployed post-disaster building safety evaluator (continued)

The group reviewed assessment methodologies, which were, as is typical, aligned with ATC-45 (had this been a seismic event, we would have used ATC-20). Standard rapid assessment forms, paper in our case, not digital, were provided, and we reviewed the forms for those team members who were responding for the first time.

The EOC briefing room was the emergency response vehicle truck bay. Large local GIS maps, tax maps, and similar location resources were displayed on walls and tables. We were briefed on the layout of the city and the location of the impacted areas. Team maps that illustrated the extent of damage and locations targeted for the day's work of conducting assessments were reviewed and distributed.

Assessment teams of two (some were three) building safety evaluators were formed. When possible, these assessment teams were composed of a various mix of disciplines (architects, engineers, and code officials). Diversity of experience is also considered, pairing experienced evaluators with first-timers. Each team was given an identification number for assignments and reporting. Occasionally, teams may be assigned a particular type of building (commercial, residential, institutional, etc.), but in our case the tornado had traveled through a residential area. The location assignments and team IDs were noted on a master map at the command post, which was used to coordinate and track our overall progress.

In an average eight-hour day, each team was expected to provide rapid evaluations, including the interior, for 10–15 buildings total, spending approximately 20–30 minutes at each. The city provided official building placards (Unsafe, Restricted Use, or Inspected) with the city seal. I've also seen these on colored paper when more durable placards have not yet been printed. We also received a supply of paper assessment forms as they were not yet capable of supporting a digital platform.

In the field

Once we deployed to the assigned assessment area, the volunteer teams had to show credentials to gain access. We found a safe place to park within the assigned area, avoiding debris, electrical power crew trucks, or areas where others were working. We also kept clear of active streets or utility lines. Our vehicle served as a home base, but we did most of our work on foot. My well-broken-in steel-toe shoes were critical for navigating the debris that was still on the ground. My backpack held extra supplies, like my flashlight and staple gun, and my clipboard was large enough to hold placards and assessment forms. The teams shared the initial supplies, which were limited, though the AHJ had more printed while we were in the field.

While assessing structures, we frequently met the property owner. Unlike hurricanes where people evacuate, after tornadoes residents are often sheltering nearby and return to their homes to salvage whatever they can. When we approached a home where the owner or occupant was present, we provided them with our credentials and an explanation of our role as a post-disaster building safety evaluator.

We found that it helped to clarify that building safety evaluators are volunteers. We were there on behalf of the AHJ with a specific job to do and were not associated with an insurance company or FEMA. We also explained that the resulting placard was a legal notice based on a rapid assessment, which would provide the local authorities with a general classification of the extent of damage.

With each building evaluation we began with an assessment of the immediate surroundings and site, followed by the building exterior and interior, when possible. When we had a third team member, they spoke with the occupant, who often had questions, building information, or their experience to share, while the other team members conducted the rapid assessment.

Once the assessment was completed and recorded on the form, we mounted the appropriate placard. We were respectful of the property when affixing placards, looking for locations we could use that would not leave a permanent mark.

A Day in the Life of a deployed post-disaster building safety evaluator (continued)

As our team went about our assessments, we rotated responsibilities and monitored the level of exhaustion and cumulative stress. When possible, we found a bit of shade and took a short break and rehydrated. While it's called a rapid assessment, a methodical approach, and treating the task as a marathon rather than a sprint, is important, particularly if volunteers are expecting to be deployed for several days.

It is a good practice to stay hydrated, take breaks, and have regular, nutritious meals, preferably outside of the disaster area (which is easier with smaller-scale events like tornados). We were able to gather with the other teams and the local building inspectors in a nearby unaffected restaurant for lunch. We used this time to share lessons from the field and tips or strategies we had developed. This was also the time we checked in for safety, shared information on our progress, "downloaded" (verbally in our case) data to incident command, recharged our cell phones, and replenished supplies. The break was short, just enough time to eat, attend to personal needs, and get our new assignments for the remainder of the day. Strike team leaders or technical supervisors may also use this time to provide some quality control by comparing some of the completed assessment forms from each of the various teams and provide feedback based on how each team is completing their work.

After the break, the teams headed back out to the field. In the early phases of a disaster, building safety evaluators may be one of the few groups besides utility restoration crews, debris-removal teams, emergency personnel, and property owners allowed into an area. Later, insurance adjusters and private contractors making emergency repairs (electricians, roofers, etc.) will be working in the area as well as volunteers salvaging, cleaning up, tarping roofs, and rebuilding.

At the end of the day we reported back to the EOC staging area to sign out. Signing out is critical for several reasons—it ensures that the teams are back safely from the field, and it records the time we spent doing the assessments. Our volunteer work is considered a contributory expense for the AHJ, which allows them to meet the matching dollars needed to qualify for federal disaster relief funding.

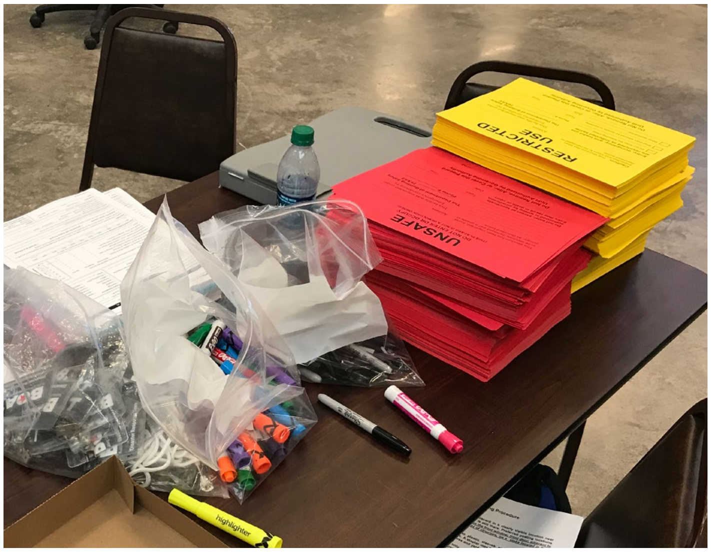
PLACARDING
A building safety evaluator posts a Restricted Use placard on a damaged house.

SOURCE
Kenneth Filarski, FAIA. Used with permission.

A Day in the Life of a deployed post-disaster building safety evaluator (continued)

As we checked out, we returned any leftover supplies for inventory/replenishment and use the next day, turned in our assessment forms, and shared any additional findings (e.g., expect a phone call from the owner of a specific address). There was a short debriefing meeting with the strike team leader, city engineer, building official, and other AHJ staff. They recorded the teams' progress on the master map so the next day could be planned effectively. Then it was back to the car for the long drive home and off to bed—because I was going to do it all over again the next day.

As an architect, I am fortunate to have the skills, expertise, and knowledge that can help keep people safe and let them, when at all possible, return to their homes, if only so that they can retrieve medications, important papers, or precious mementos. Most of the people I help have never met an architect or engineer. They are often amazed that we have chosen to volunteer our time to help strangers. They are grateful for our assistance helping the AHJ quickly assess the damaged homes and businesses in their neighborhood. Deployments such as this may be one of the most physically and emotionally draining things I've ever done, but the rewards and satisfaction of knowing I'm helping people in need and using my technical expertise in service of others make it an amazing experience.

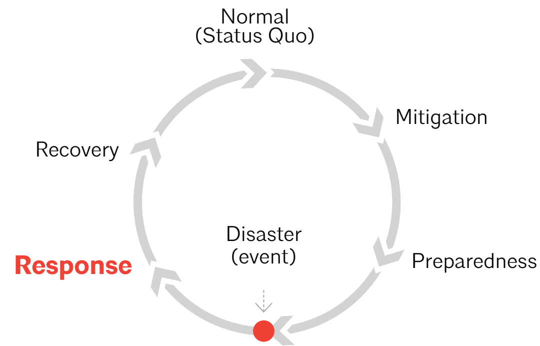


PLACARDS AND ASSESSMENT FORMS
Supplies ready for building safety evaluator field operations.

SOURCE
Shawn Gillen, AIA. Used with permission.

Disaster response

04



LEARN: ROLES AND RESPONSIBILITIES IN THE AFTERMATH OF A DISASTER

ACT: RESPONDING TO DISASTERS IN THE BUILT ENVIRONMENT

OVERVIEW

A successful disaster response begins with proper preparation. Immediately following a disaster, neighbors help neighbors and emergency personnel secure the area and ensure that all residents are safe. Urban search and rescue operations begin along with windshield assessments through neighborhoods to ascertain the overall extent of damage. National Guard and law enforcement, fire departments, and power company workers clear neighborhoods and buildings for security or extreme health hazards after they have completed search and rescue for people and animals. Government agencies and nongovernmental organizations establish shelters and community service centers.

When the demand for response resources and personnel exceeds the capacity and capabilities of local government in a declared disaster, only then will architects be called by local or state officials for volunteer assistance. Architects and other built environment professionals who may be called within a day or weeks of the initial hazard, in this sense, are second responders.

As second responders, post-disaster building safety evaluators are responsible for providing a critical function—the assessment of the structural viability and habitability of buildings. By evaluating these factors, the health and safety risk to the public can be determined. In cases where it is deemed safe to do so, the assessments help to return as many people to their homes and businesses as possible. This relieves pressure on temporary shelters and aids in a faster recovery for the impacted community.

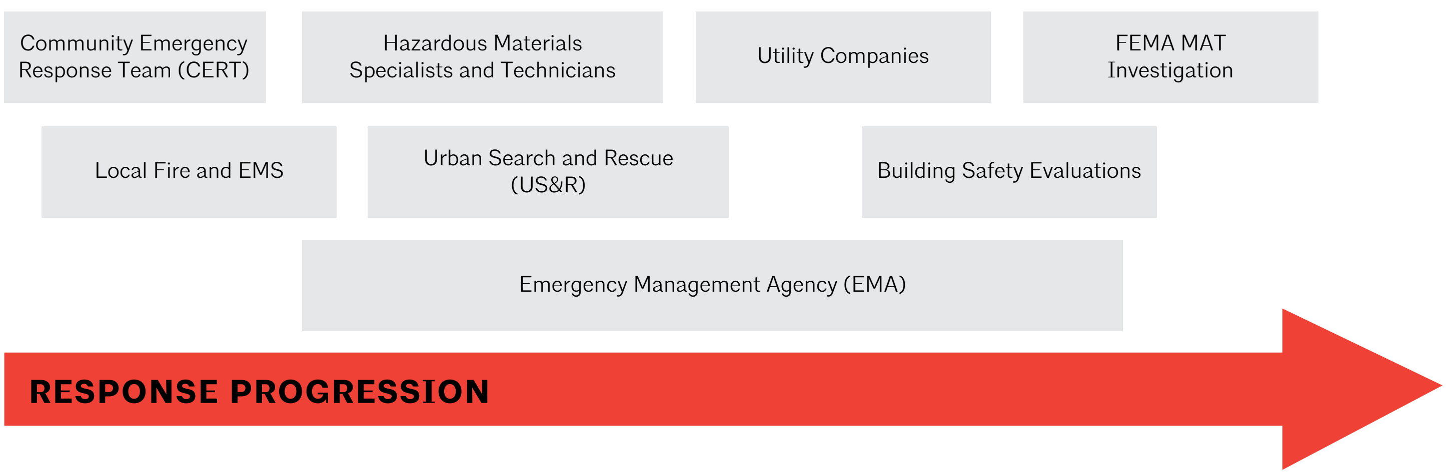
Key concepts

» Understand the “bottom-up” approach to disaster response employed by the Incident Command System (ICS).

» Recognize the various public and private sector roles in disaster response.

» Be aware of the multiple building assessments that occur post-disaster and the utility of each.

» Understand the process by which licensed design professionals engage in response efforts.



RESPONSE PROGRESSION

A disaster response of any size will result in the presence of multiple agencies and resources. Some are in the initial response category, some respond further into the duration of the event.

Among them:

- Local fire and EMS.
- Municipal/county/regional/state emergency management agency (EMA)
- Community Emergency Response Team (CERT)
- Hazardous materials specialists and technicians
- Urban Search and Rescue (US&R)
- Building Safety Assessments performed by disaster-trained architects, engineers, and building officials

All could be involved in a disaster response at varying degrees dependent upon the severity of the disaster and its impact.

SOURCE

FEMA P-2055 Post-disaster Building Safety Evaluation Guidance, November 2019

FEDERAL, STATE, AND LOCAL GOVERNMENT ROLES

FEMA, the federal agency charged with management and coordination of disaster response, has established protocols for command and control of emergency response situations that carry through all the way to the local level.

The Incident Command System (ICS) is the foundation of emergency management protocol throughout the country. Under the ICS, the lowest level of government impacted by the disaster is always responsible for the management of the emergency response within its jurisdiction. Through the declaration of a disaster, the lowest level jurisdictions can request disaster assistance from the next higher level of government. Many cities, counties, and states have departments of emergency management that coordinate interdepartmental response efforts.

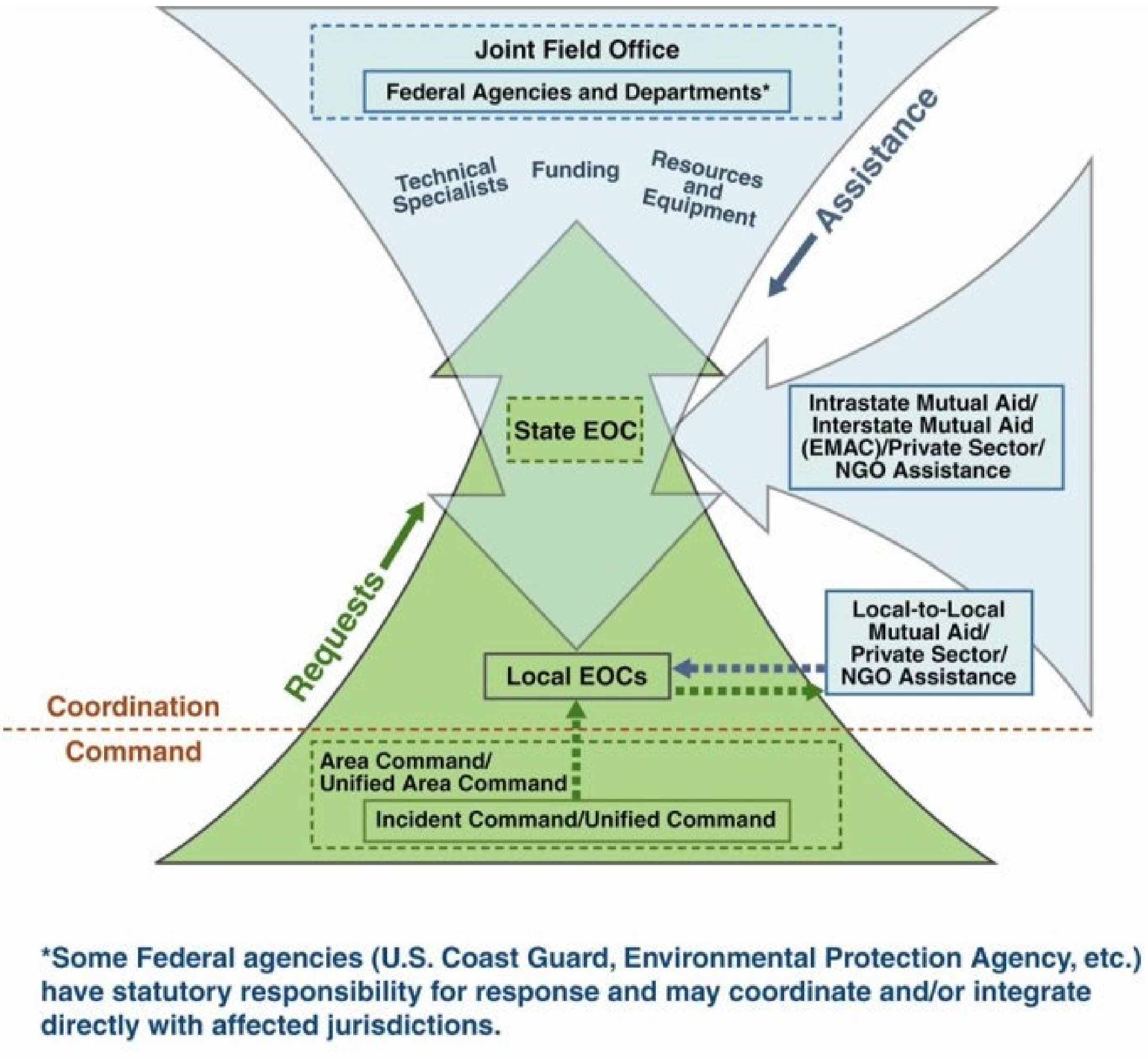
Control of operations starts with the incident commander, and each succeeding level of government provides support for those locally driven priorities. In a non-localized, diffused event, the emergency manager at the emergency operations center (EOC) will consolidate the requests of incident commanders and may provide overall direction. This is to distribute resources where they are needed most. In this case, architects and engineers may respond to a request for assistance either from the state or local jurisdiction. Thus architects, often residents of larger cities, may be called to volunteer duty in smaller towns throughout the state.

States can use intergovernmental agreements, memoranda of agreement/understanding, intrastate legislation, or gubernatorial executive orders to deploy tribal personnel, private resources, and volunteers. Many states have their own mutual aid agreements but interact with EMAC. However, EMAC does not cover interstate aid before a formal disaster declaration by a Governor.

Local and out-of-state volunteers of all kinds may be involved in a number of activities, such as immediate care, providing emergency shelter materials, removing debris, and assessing structures. These volunteers may be from a governmental entity (e.g., FEMA, National Weather Service), a university research team, or an NGO such as AIA.

“Bottom-up” approach

The lowest level of government closest to the disaster is always responsible for the management of the emergency response within its jurisdiction. AIA’s Disaster Assistance Program has a similar structure and is typically coordinated at the state level by AIA state chapters, as shown in the Organizational Structure of Disaster Response image on page 103.



THE FLOW OF REQUESTS AND ASSISTANCE DURING LARGE-SCALE DISASTERS VIA THE INCIDENT COMMAND SYSTEM.

Private sector post-disaster building safety evaluators would enter the flow from the right side, via local-to-local assistance or through EMAC.

SOURCE

National Incident Management System, December 2008, p. 36

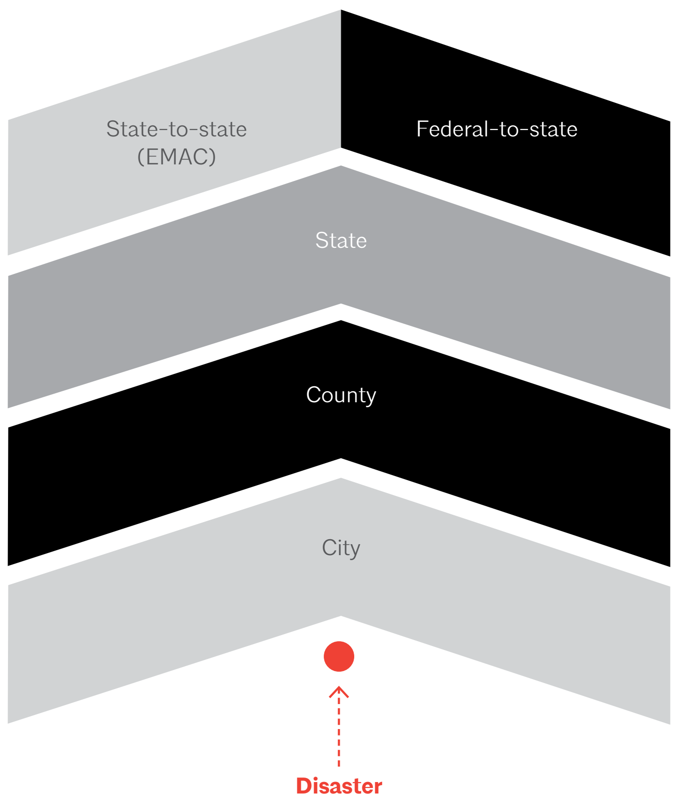
AUTHORIZING AID: VOLUNTEERS AND THE EMERGENCY MANAGEMENT ASSISTANCE COMPACT

All 50 states, the District of Columbia, Puerto Rico, Guam, and the U.S. Virgin Islands have enacted legislation to become EMAC members. Membership in EMAC allows for any of these states or territories to request resources from other states via their emergency management office under the authority of the governor of the state once a disaster declaration has been made. EMAC provides an organized structure through which a state can request aid such as personnel, services, equipment, and supplies from other states during an emergency. The utilization of in-state resources, including volunteers, is most efficient and economical because the state requesting aid through EMAC is responsible for reimbursement of EMAC mission costs.

Typically, only state or local government employees are deployed under EMAC. However, any state with legislation to authorize volunteers as temporary agents of the state may legally deploy them under EMAC. Under Articles 5 and 6 of EMAC, those individuals sent under EMAC 1) have immunity from liability, 2) have workers' compensation coverage, and 3) maintain their professional licenses and certifications for the duration of the declared state of emergency. Whether one is volunteering in-state or operating under EMAC, NGOs—including AIA Disaster Assistance Program volunteers—must be authorized by the AHJ to invoke any legal or workers' compensation protections.

FEMA and EMAC recognize that private sector volunteers provide critical assistance after a disaster, but not all mutual aid teams or volunteer personnel are deployable through EMAC. Many states' EMAC laws do not provide protections (e.g., professional liability) for private sector personnel. Before requesting or providing mutual aid assistance, it is important to make sure that the EMAC laws in the requesting and assisting states provide for the use and protection of private sector volunteer responders. FEMA has developed fact sheets, organized by FEMA region, with details for each state and territory to help inform stakeholders of legislative limitations associated with deploying through EMAC.

EMAC establishes a common language and universal system for providing assistance under pre-agreed terms and conditions. FEMA maintains a Resource Typing Library Tool (RTLT), which identifies over 450 NIMS resource typing definitions (including post-disaster building safety evaluators) that form the basis for an EMAC request. See Appendix for more information on the Post-disaster Building Safety Evaluators NIMS Resource Type.

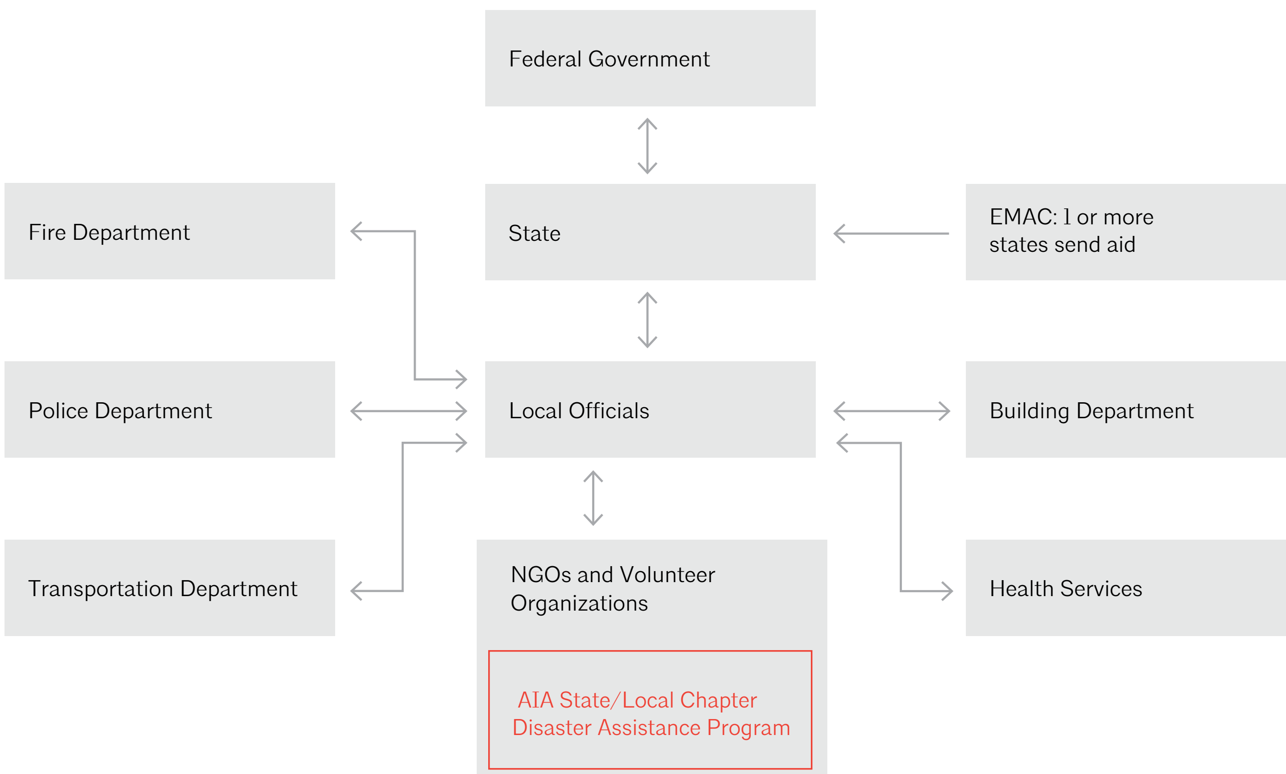


SEQUENCE OF DISASTER ASSISTANCE REQUESTS

All disasters are local. After a declared disaster, the lowest-level jurisdiction can request disaster assistance from the next higher level of government as well as from other states via the Emergency Management Assistance Compact (EMAC).

SOURCE

AIA



ORGANIZATIONAL STRUCTURE OF DISASTER RESPONSE

A partial organizational structure for emergency response. AIA is one of many NGOs/volunteer organizations. Depending on the state and situation, AIA disaster assistance coordinators may report to a state emergency management agency or local building department to deploy for building safety assessments or other requested duties. AIA National supports AIA chapters throughout to provide additional expert guidance or training as needed.

SOURCE

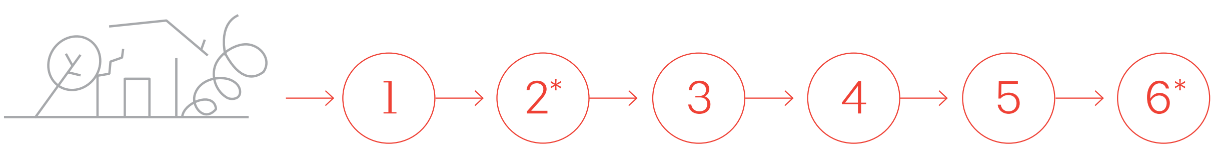
AIA

ASSESSING THE POST-DISASTER BUILDING STOCK

When responding to disasters, on average, a building may be evaluated up to six times by different organizations and for different reasons. The city surveys a building for public safety, the Red Cross and NGOs confirm scope and need for resources and disaster services, insurance companies evaluate it to process a claim, FEMA or an authorized agent determines extent of damage for disaster assistance grants, and architects and engineers determine structural condition and habitability (rapid or detailed assessments) and scope of repairs (architectural or engineering analysis).

One of the first actions taken after a disaster event is a systematic and cursory observation of the affected area to assess the scope and scale of the disaster damage. Typically, these observations are performed as a "drive by" or what is referred to by FEMA as a "windshield or reconnaissance" survey. These are visual observations from an emergency vehicle (either by ground or by air) to determine the nature and extent of infrastructure and building damage in the affected area and to prioritize regions that should be evaluated further. Buildings and structures are normally not posted with placards during a windshield assessment.

In addition to the information gathered about the buildings, the windshield assessment also tells officials where to send emergency personnel to conduct search and rescue and tend to medical situations, address downed power lines, remove trees and debris, and restore bridge and road access. Until roads are clear and floodwater recedes, volunteers and residents will not be permitted to enter impacted areas. Drone and satellite technology has begun to be utilized to perform windshield-like assessments to gain rapid situational awareness of and to photo document disaster areas. Crowdsourced data and social media posts are also being used to gather field intelligence, often in real time. This is especially helpful to first responders when access to a disaster area is limited and, according to some research, may result in an expedited recovery process.[92]



Buidling damaged in disaster

*Role of architect

SIX ASSESSMENTS

1. Windshield Assessment
2. Post-disaster Rapid Evaluation,* also called Building Safety Assessment
3. Emergency services needs assessment
4. Assessment by Insurance Adjustor
5. Preliminary Damage Assessment
6. Post-disaster Detailed Evaluation, Engineering Evaluation or Complex Structural/Architectural System Condition Evaluation*

(Demonstrates typical sequence, may vary)

POST-DISASTER BUILDING SAFETY EVALUATION

Post-disaster, each damaged building is evaluated on average six times. Post-disaster Rapid Evaluations and Detailed Assessments are performed by architects or other qualified built environment professionals. In some cases, the rapid evaluation may be accepted by FEMA as sufficient documentation for the preliminary damage assessment. Not shown: building performance assessments by university research teams.

[92] "American Red Cross Study Shows Drones Used for Disaster Recovery Can Save Lives and Help Rebuild Communities," Measure, a 32 Advisors Company, April 2015. measure.com/news-insights/american-red-cross-and-measure-study-shows-drones-can-save-lives-and-help-rebuild-communities

After the authority having jurisdiction of the disaster area deems the site to be accessible for second responders, evaluators, and other volunteer organizations to enter and start their work, the post-disaster building evaluation can begin. These evaluations are called the "rapid evaluation," the "detailed evaluation," and the "engineering evaluation."[93]

A rapid evaluation is done by a coordinated team (or teams) of trained building assessment personnel such as architects, structural engineers, professional engineers with a specialization in structures, or building officials/building inspectors. It provides an initial evaluation of damage and safety so the building can be posted as Inspected, Restricted Use, or UNSAFE. The rapid evaluation also helps identify buildings requiring a more detailed evaluation and will document any necessary restrictions on the building access and/or use.

Detailed evaluations are conducted on critical buildings, such as fire and police stations, hospitals, jails, shelters, and the emergency operations center. The functionality and safety of these buildings is such that the rapid assessment phase is skipped. Detailed evaluations are also done by a coordinated team (or teams) of trained building assessment personnel and are more extensive than rapid evaluations. Buildings reported as questionable or where the condition is not obvious during the rapid evaluation may be candidates for a detailed assessment. This level of evaluation is conducted when directed by the AHJ.

When an engineering evaluation is requested for a damaged building, this is done by licensed professionals hired by the building owner or AHJ and can involve the use of the post-disaster assessment report data, construction drawings, and new structural calculations. The evaluation report should consist of a final determination of the extent of building damage present and how to stabilize and repair the building to allow for safe occupancy and use. This level of detailed analysis is not conducted by volunteers but rather is required by the AHJ of the building owner prior to allowing re-occupancy.

SOFT STORY COLLAPSE DURING THE 2010 MEXICALI EASTER EARTHQUAKE
Soft story buildings consist of large, unreinforced openings on their ground floors and are susceptible to failure during an earthquake due to their inability to withstand large lateral forces. When the first floor collapses, the upper levels are no longer supported and will also collapse.

SOURCE
Robert Thiele, AIA. Used with permission.

[93] "Post-Disaster Building Safety Evaluation Guidance; Chapter 2.2" FEMA P-2055, November 2019.

Architects: A NIMS post-disaster building safety evaluation resource

As a result of AIA's work on the Federal Disaster Recovery Reform Act (DRRA), FEMA was directed to "develop a National Incident Management System (NIMS) Resource Typing (RT) Building Safety Assessment Team and associated job titles." (See Chapter 2). FEMA, working with the AIA and other stakeholders, published the following new and revised resource types that can be requested to perform post-disaster building evaluations:

» Post-Disaster Building Safety Evaluation Strike Team Leader

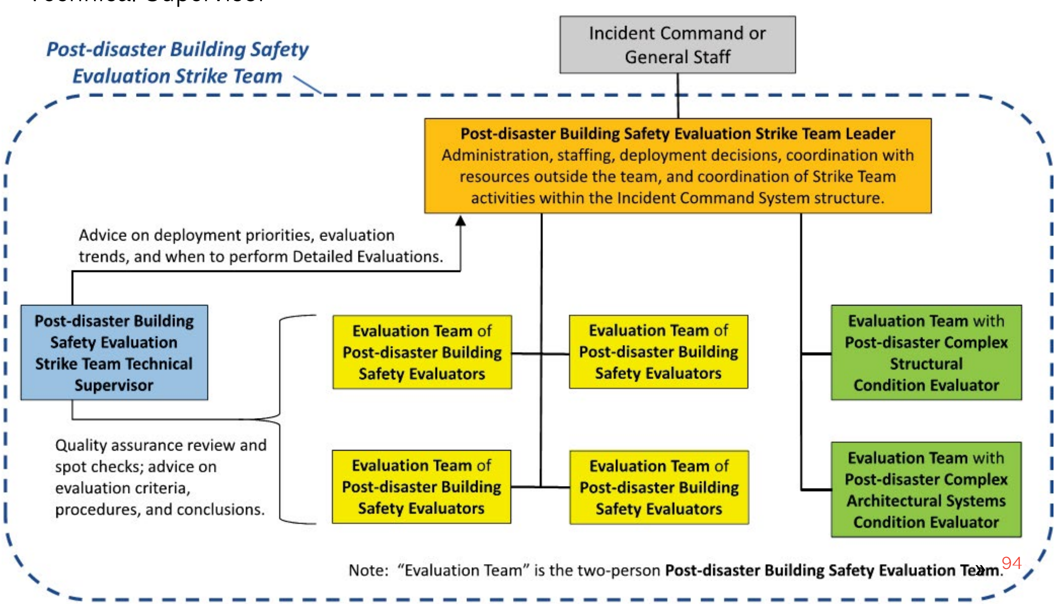
» Post-Disaster Building Safety Evaluation Strike Team Technical Supervisor

» Post-Disaster Building Safety Evaluator

» Post-Disaster Complex Architectural System Condition Evaluator

» Post-Disaster Complex Structural Condition Evaluator

These resource types define the roles of licensed design professionals and others in the disaster response effort. Architects are now recognized as being qualified to serve as evaluators, strike team leaders, technical supervisors and complex architectural system condition evaluators. These resource types can be requested by the impacted jurisdiction through mutual aid compacts, such as EMAC.



POST-DISASTER BUILDING SAFETY EVALUATION STRIKE TEAM ORGANIZATIONAL STRUCTURE

Example organization of a post-disaster building safety evaluation strike team. Post-disaster Building Safety Evaluation Strike Team describes the entire collection of resources assigned to conduct and manage post-disaster building safety evaluations. At a minimum, it will typically include the Post-disaster Building Safety Evaluation Strike Team Leader, the Strike Team Technical Supervisor, and a set of two-person Evaluation Teams of Building Safety Evaluators. In larger incidents, there may be a small number of Evaluation Teams that include a Post-disaster Building Complex Structural Condition Evaluator or a Post-disaster Complex Architectural Systems Condition Evaluator.

SOURCE

FEMA P-2055 Post-disaster Building Safety Evaluation Guidance, p. 5-10

[94] The Post-disaster Building Safety Evaluation Team NIMS resource type is made up of two people that perform the field evaluations and post buildings. Typically, they are comprised of two Post-disaster Building Safety Evaluators. The number of teams will depend on the scale of the incident and the extent of damage. In some cases, an Evaluation Team will be comprised of a Post-disaster Building Complex Structural Condition Evaluator and a Post-disaster Building Safety Evaluator. In other cases, an Evaluation Team will be comprised of a Post-disaster Complex Architectural Systems Condition Evaluator and a Post-disaster Building Safety Evaluator.

ARCHITECTS AS DISASTER RESPONDERS

AIA chapters contribute to the post-disaster response by supporting their architect members and communities. Chapters may reach out to ensure the safety of their members, seek to understand and accommodate firm needs to enable business continuity, and manage communications and media relations. Member champions that fulfill the role of AIA State Disaster Coordinator organize disaster response efforts for their state by working in collaboration with AIA chapters and emergency management officers to coordinate volunteers and align response efforts with the needs articulated by the AHJ.

The AIA Disaster Assistance Program is committed to equipping architects with the skills and training needed to perform assessments of homes and buildings for safety and habitability, ideally before homeowners, residents, and workers re-enter the building. AIA requires each AIA state chapter to prepare to respond to disasters by designating an AIA State Disaster Coordinator and asks states to develop their own program to:

» train architects in disaster-response protocol

» advocate for Good Samaritan legislation or similar for liability protection of volunteers

» provide clarity on volunteer workers' compensation and legal representation

» propose policies that promote portability of licensure for out-of-state volunteers

» create a communications network of trained volunteers

» build relationships with government officials tasked with post-disaster response

Before responding, it is critical that a Good Samaritan law or other liability protection is in place (see Chapter 3 for more detail). For states that do not provide liability protection for architects, architects can become deputized as contractors of the state or local government by way of an executive order (as was done in Mississippi after Hurricane Katrina in 2005) or through EMAC. Unless a state grants an architect state employee status (whether by executive order or statute), a private architect volunteer would not receive the liability waiver and workers' compensation protection. Without an adequate Good Samaritan law in place or other legal indemnification, AIA state disaster assistance programs are reluctant to send volunteers.

WATER-DAMAGED CEILING DUE TO HURRICANE HARVEY IN 2017
A post-disaster rapid evaluation can reveal potential habitability concerns, such as evidence of waterlogged ceilings and attic insulation, which can be a fall danger and health hazard.

SOURCE
Shawn Gillen, AIA. Used with permission.

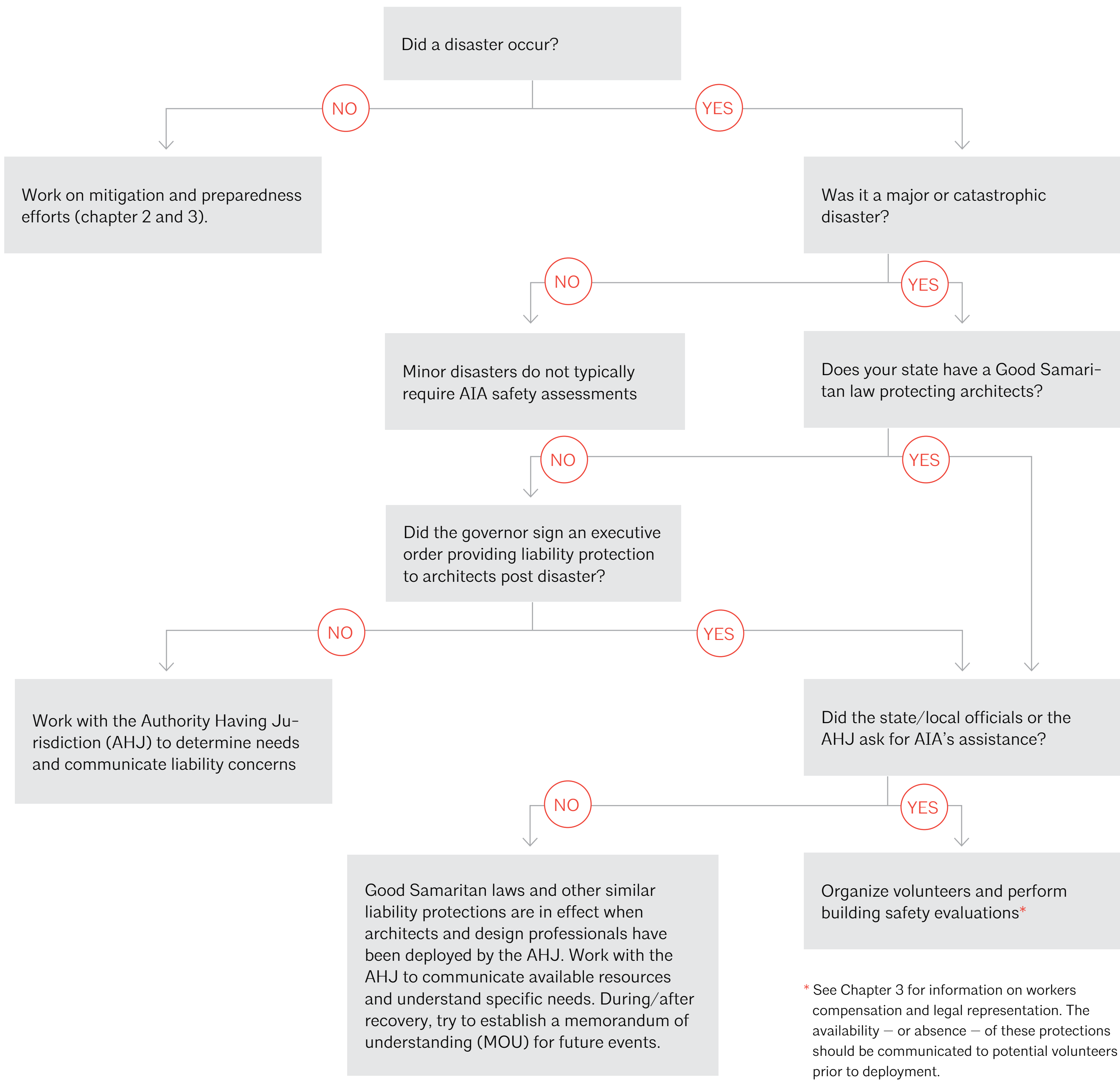
When liability protection has been afforded to volunteers and an AHJ has requested assistance, the AIA disaster assistance coordinator can begin preparations for the building safety (or rapid) assessments. The AIA State Disaster Coordinator is typically the point of contact between the AHJ and the AIA chapter(s) staff and their architect members. Coordinators activate their volunteer networks to determine their capacity to respond to an AHJ's request for assistance.

In response to large-scale disasters regionally, it is common for AIA to quickly facilitate a safety assessment training day for architects, engineers, and building officials to increase the number of trained volunteers prepared for the fieldwork ahead. After Hurricane Harvey in 2017, over 150 architects, engineers, and building inspectors across Texas participated in an AIA safety assessment training to prepare them to evaluate homes and businesses.

Volunteers serving as building evaluators need to be aware of, and prepared for, the conditions they will encounter. The volunteer's health and safety are of primary importance. Anyone anticipating fieldwork should be up-to-date on vaccinations, especially tetanus, as debris can often hide rusty nails and other safety hazards. Volunteers should dress for the appropriate conditions and weather and bring a first-aid kit. A list of clothing, supplies, and tools commonly used by volunteers can be found in the Appendix.

TORNADO DAMAGE
Tornado-force wind may have blown out the garage door, further causing damage to the home's interior when positively pressurized forces seek a way to escape. Joints, corners, and transitions of building planes have more edges and are therefore more vulnerable to uplift forces.

SOURCE
Rachel Minnery, FAIA. Used with permission.



DETERMINING AIA'S ROLE IN DISASTER RESPONSE
Next steps for an AIA chapter: A typical post-disaster decision-making process of an AIA chapter's disaster assistance program

What a volunteer needs to know

The decision to volunteer for a post-disaster deployment is a critical choice. A trained evaluator commits to applying this training in an environment that can be physically and mentally challenging. Post-disaster evaluation deployments require a commitment that demands focus.

The AHJ requesting volunteers will determine the parameters for the deployment, such as:

» length of deployment

» number of volunteers needed

» required volunteer qualifications

» whether or not expenses will be reimbursed

» whether or not lodging will be provided

» whether or not meals will be provided

The AHJ may also set expectations for volunteers for the deployment, which may include the ability to:

» operate in the field for periods of 12 hours or more

» work in conditions of excessive heat, cold, humidity, and/or rain

» walk long distances and on uneven ground

» arrange travel (and pre-pay)

» share housing (in less than ideal quarters, such as a tent)

» subsist on limited food choices (MREs [military meal ready to eat]) potentially without the ability to address special dietary needs

» take time away from family and friends (several days to a week)

» take unpaid time away from a job (several days to a week)

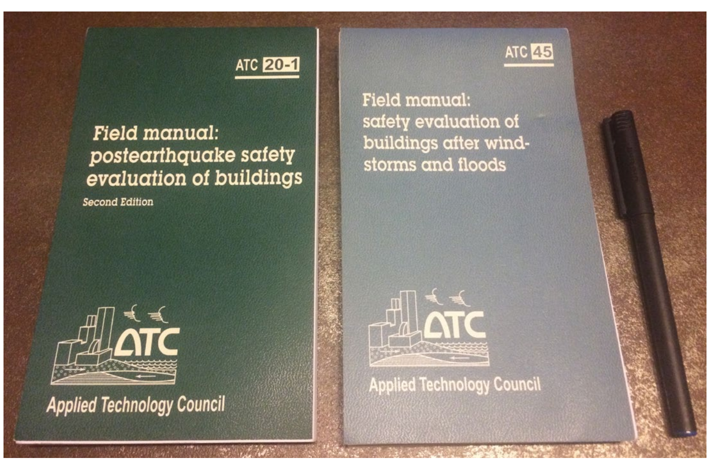
» face mentally (and emotionally) demanding situations

Volunteer's field resources

The disaster-stricken area may be overwhelmed by the number of strangers appearing in the community at its darkest hour. Although a business card may be an easy form of identification to show a homeowner, the appropriate state-authorized volunteer ID is the only personal identification that should be used. It is important to communicate the role of the post disaster building safety evaluator as an authorized agent of the jurisdiction. For this reason, volunteer teams may have a city staff member with them.

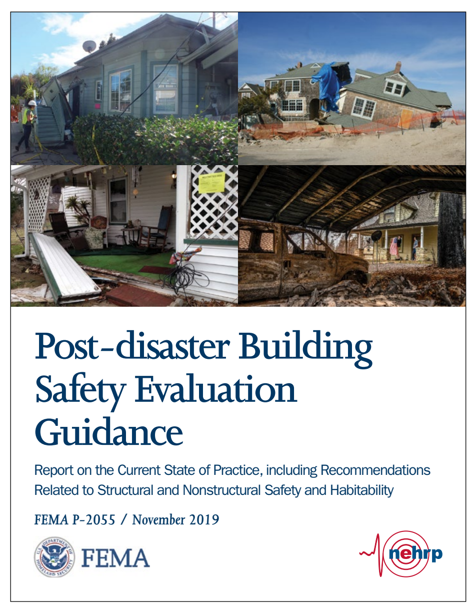
The authors do not anticipate that this Handbook or the equally large Cal OES Safety Assessment Evaluator Training Manual and FEMA P-2055 Post-disaster Building Safety Evaluation Guidance document will be brought into the field. The Applied Technology Council (ATC) provides assessment forms, building placards, and guidance publications for rapid safety assessments after floods, windstorms, and earthquakes. The ATC-20-1 Field Manual: Post-Earthquake Evaluation of Buildings and ATC-45 Field Manual: Safety Evaluation of Buildings After Wind Storms and Flood are pocket-sized references and a valuable tool for many types of hazards, including fire, snow, and landslide.

In addition to personal safety equipment, building evaluators should have field office supplies (see list in Appendix) with them; however, the AHJ typically provides maps and official documents, including building placards and assessment forms. Many jurisdictions now use digital tools on handheld devices such as the Collector App and Arc GIS.



EVALUATOR RESOURCES
ATC pocket-sized field manuals are a valuable tool for many types of hazards, including floods, windstorms, earthquakes, fires, snowstorms, and landslides.

SOURCE
AIA



P2055 POST-DISASTER BUILDING SAFETY EVALUATION GUIDANCE COVER
FEMA P-2055 Post-disaster Building Safety Evaluation Guidance includes best practices for post-disaster evaluation of buildings by licensed architects and engineers to ensure that design professionals properly analyze the structural integrity and livability of buildings and structures after an array of natural hazard events, including earthquakes; hurricanes; floods; tornadoes; tsunamis; landslides and other land instabilities; volcanoes; snow, hail, and ice storms; fire; and damage from explosions.

SOURCE
FEMA

POST-DISASTER BUILDING SAFETY ASSESSMENT PROCESS

When an AHJ has requested assistance, able and willing volunteers will meet with the AHJ coordinator to be deputized and receive their orders before performing assessments. After meeting with the AHJ representative, teams are deployed to a designated area for the day to conduct building safety assessments for identified structures, complete the building assessment forms, and convey the same summarized information on the appropriate placard: GREEN INSPECTED, YELLOW RESTRICTED USE, or RED UNSAFE. These placards inform building owners and potential occupants and passersby of the condition of the building.

The AHJ will determine the level of assessment to be conducted, rapid or detailed, or a mix of both depending on the amount and type of impacted building stock and number and skills of volunteers available. Volunteers are most often tasked with evaluating homes and small businesses. Large commercial and institutional buildings may have their own architectural or engineering firms on retainer or as contracted consultants. In this case, the AHJ may accept the evaluation determination (engineering assessment) provided by the owner's consultant. For these large or more complicated buildings, the AHJ may bypass the rapid assessment and request an evaluation by a specialist.

It is important to note that the method of documentation of the building assessments needs to be established by the authority having jurisdiction and communicated to the teams of evaluators so that the reporting submitted to FEMA complies with its requirements. ATC assessment forms commonly utilized by FEMA and local jurisdictions can be found in the Appendix. The forms catalog information such as the construction type, number of stories above/below ground, approximate footprint area (square footage), primary occupancy type, and observed damage conditions for the building site, exterior, and interior. Building evaluators may also refer to standard field manuals, ATC-20-1 and ATC-45, that describe the forms and provide examples.

During the assessment, particularly with older buildings, evaluators may notice dings, dents, stains, and damage not associated with the hazard event. When the cause may be unclear, evaluators should utilize professional judgement or recommend additional investigation. If prior damage represents a hazard that affects a structure's post-disaster safety or habitability, it should be noted on the assessment form and placard. It is important to remember that building evaluators are assessing health and safety concerns only. All other questions are referred to the AHJ.

WIND DAMAGE
Improperly fastened metal roof edge flashing uplifted by wind forces at the building edge lead to exposure of the exterior soffit edge and ultimately to air and moisture entering the building.

SOURCE
Rachel Minnery, FAIA. Used with permission.

Building evaluators are not to provide an estimate for repair work. These services may not be covered under the Good Samaritan law, and combining safety assessment and repair estimates would nullify any reimbursements for safety assessment activity by FEMA. Furthermore, these services are not "best practices," as estimating results can differ widely between different locations. The size and scale of the disaster as well as the availability of qualified repair workers and contractors will further alter a highly volatile recovery situation. Additionally, an evaluator should avoid sharing opinions about what may or may not be covered by insurance.

Whether conducting rapid or detailed assessments, accurate records of volunteer time (hours), location of service, and their assessment productivity should be kept and reported to the authority having jurisdiction at the end of each day. Volunteer hours will be included in the reporting process to FEMA for reimbursement of eligible costs associated with the disaster response and recovery through the PA Grant Program. For most disasters, the local government is required to pay 25% of the disaster expenses to be eligible for FEMA's 75% federal cost share assistance. The ICS 214 Activity Log form is used in many jurisdictions as the record of volunteer time as it lists those assigned to the team, the activities of the team, location, and the operational period of date, starting time, and ending time of the team.

INSPECTED
LAWFUL OCCUPANCY PERMITTED

This structure has been inspected (as indicated below) and no apparent structural hazard has been found.

☐ **Inspected Exterior Only**
☐ **Inspected Exterior and Interior**

Report any unsafe condition to local authorities; reinspection may be required.

Inspector Comments:

Facility Name and Address:

Date
Time

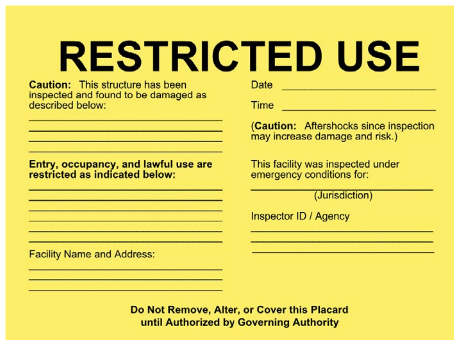
(**Caution:** Aftershocks since inspection may increase damage and risk.)

This facility was inspected under emergency conditions for:
(Jurisdiction)

Inspector ID / Agency

Do Not Remove, Alter, or Cover this Placard until Authorized by Governing Authority

Buildings can be damaged yet remain safe for use and occupancy. If damage is cosmetic, or the safety of a building was not significantly changed by the disaster, it will be posted with a green placard reading INSPECTED. Utilities may be temporarily unavailable, but otherwise the building is safe to occupy and access. Note that an INSPECTED placard is not a guarantee against potential structural failure from aftershocks or other future events; it only means that the building survived the last event.



RESTRICTED USE

Caution: This structure has been inspected and found to be damaged as described below:

Entry, occupancy, and lawful use are restricted as indicated below:

Facility Name and Address:

Date
Time

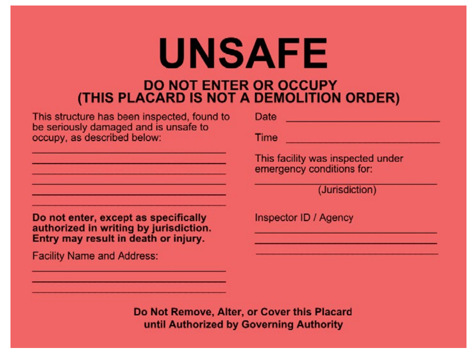
(**Caution:** Aftershocks since inspection may increase damage and risk.)

This facility was inspected under emergency conditions for:
(Jurisdiction)

Inspector ID / Agency

Do Not Remove, Alter, or Cover this Placard until Authorized by Governing Authority

When there is some risk associated with damage in all or part of the building, a yellow placard is used. The placard indicates the specific restriction (i.e., entry permissions, duration of occupancy, use, access excluded to only certain portions of the building, etc.). When the extent of damage is uncertain or cannot be ascertained within the time and resources available to a rapid evaluation team, the building is posted with a yellow placard reading RESTRICTED USE, indicating additional inspection requirements and clearly noted restrictions on use or occupancy.



UNSAFE
DO NOT ENTER OR OCCUPY
(THIS PLACARD IS NOT A DEMOLITION ORDER)

This structure has been inspected, found to be seriously damaged and is unsafe to occupy, as described below:

Do not enter, except as specifically authorized in writing by jurisdiction. Entry may result in death or injury.

Facility Name and Address:

Date
Time

This facility was inspected under emergency conditions for:
(Jurisdiction)

Inspector ID / Agency

Do Not Remove, Alter, or Cover this Placard until Authorized by Governing Authority

Buildings damaged by a disaster that pose an imminent safety threat under expected loads or likely conditions, like future rainfall or aftershocks, are posted with a red placard reading UNSAFE. A larger area beyond the property lines may need to be protected and should be indicated as such on the form. Alternatively, a relatively sound building may be tagged red due to a falling hazard or an adjacent unsafe structure or condition.

Note: a red placard is not a demolition order.

INSPECTED, RESTRICTED USE, AND UNSAFE PLACARDS

After teams conduct rapid building safety assessments, they will complete the building assessment forms and convey the same summarized information on the appropriate placard: GREEN INSPECTED, YELLOW RESTRICTED USE, or RED UNSAFE. These placards inform building owners and potential occupants and passersby of the condition of the building. AIA Safety Assessment Program training will discuss the types of damage encountered in the field and how to determine which placard to use. During a response effort, assessment forms and placards will be provided by the authority having jurisdiction (AHJ).

SOURCE

FEMA P-2055 Post-disaster Building Safety Evaluation Guidance, p. 2-4

Rapid post-disaster building safety assessments

The AHJ will determine whether a rapid evaluation consists of an exterior-only or exterior and interior assessment and then communicate that to the evaluators before they are sent into the field. ATC-20-1 and ATC-45 provide additional guidance on interior assessments. For most damage, an assessment of both interior and exterior is needed to identify potential hazards, yet access to the interior may be precluded for a variety of reasons. The evaluator must exercise caution, use their professional judgement, and clearly indicate that which was not able to be evaluated. Assessment teams do not enter buildings that they have deemed to be, and have tagged, UNSAFE.

In a rapid assessment, the post-disaster habitability of homes and businesses are evaluated, providing a high-level overview of basic usability. A structure and its site are evaluated for damage that may pose a health or safety risk to the public, including falling hazards (unstable structures), risk of fire or electrocution, and interior environmental conditions.

Determination of habitability will vary by disaster and will be defined by the AHJ as there will be a number of local factors that will be taken into account. Generally, habitability is described as a structure that provides shelter from the elements, potable water, and access to sanitary sewer (or portable toilets). In large-scale disasters where the natural water stores are contaminated, but structures are otherwise habitable, temporary water delivered to a block or site may suffice.

Section 4.6 of FEMA P-2055 lists levels of functionality that can serve as potential temporary standards an AHJ could adopt to determine habitability. SPUR, a nonprofit public policy organization in the San Francisco Bay Area, developed minimum habitability requirements for occupancy after an earthquake. And FEMA's P-2090 Recommended Options for Improving the Built Environment for Post-Earthquake Reoccupancy and Functional Recovery Time defines reoccupancy for a building that has gone through an earthquake as one that is "safe to enter and use for shelter, although it might not be ready to support basic functions or normal use."

DISPLACED HVAC DUCTWORK
Displaced heat ductwork from the 2018 M 7.1 Anchorage, Alaska, earthquake. While minor in nature, this type of damage, if unrecognized, could lead to issues with the ability to maintain adequate temperatures in the living area.

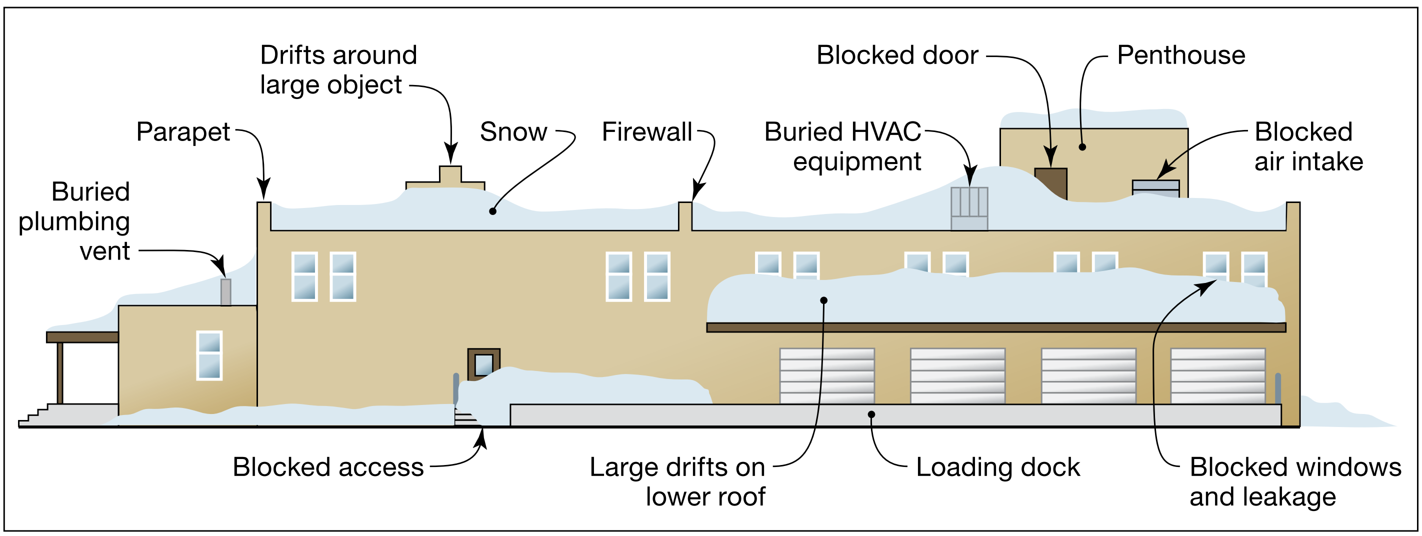
SOURCE
Lawrence Jorgensen, AIA. Used with permission.

SEISMIC DAMAGE
Foundation collapse due to liquefaction during the 2010 Mexicali Easter Earthquake.

SOURCE
Diane Murbach. Used with permission.

FEMA also has a definition of habitability of residential structures: those that are safe, sanitary, and functional in order to set a baseline for its post-disaster Individual Assistance grant program. “Safe” refers to “being secure from disaster-caused hazards,” “sanitary” means free of “disaster-caused health hazards,” and “functional” refers to being “capable to be used for its intended purpose.” FEMA notes that functional does not explicitly mean that all systems and services are in working order.[95]

By evaluating structures to ensure occupancy can be permitted and thereby returning people to their homes more quickly, emergency shelters and community kitchens can close and reduce the strain on the government, NGOs, and supplemental resources. In addition, the posted warning signs in unsafe areas narrow the recovery focus to areas with greatest need.



UNBALANCED SNOW AND DRIFTING ON A TYPICAL COMMERCIAL BUILDING

Drifting snow can create habitability issues, such as blocked exits, buried HVAC equipment, and excessive loading that could lead to a sudden collapse.

SOURCE

FEMA P-957 Snow Load Safety Guide, p. 2-4, Figure 1a, wbdg.org/FFC/DHS/femap957.pdf

[95] P-2055 Post-disaster Building Safety Evaluation Guidance, FEMA, p. 4-1.

Detailed post-disaster building safety assessments

Depending on the extent of damage, building occupancy, previously identified hazards, or other risk factors, the AHJ may request a detailed assessment of the building. These assessments are critical for structures such as the local emergency operations center, community shelters, or other high-occupancy buildings, as well as police and fire stations. Other "essential" facilities may include lumber/hardware stores, grocery stores, and pharmacies. Detailed building assessments follow a similar yet more extensive observation process than rapid assessments.

Detailed building assessments may also be triggered by a rapid assessment that revealed a known or potential hazard warranting more evaluation to determine safety. In lieu of rapid assessments, lifeline infrastructure facilities always receive a detailed assessment. These specialized facilities (e.g., water treatment plants, airports) will only be evaluated by professionals who specialize in their design and construction.

To support consistency in the level of training and expertise necessary for particularly complex situations, the 2020 NIMS building safety evaluation resource types provide minimum standards for two newly defined roles, the complex architectural system condition evaluator (CASCE) and the complex structural condition evaluator. While the complex structural condition evaluator is primarily focused on the structural integrity of the building, the CASCE has a broader scope. The CASCE conducts detailed evaluations of systems—such as fire safety systems, environmental systems, building envelope systems, communication systems, accessibility and building transportation systems, and others—to assess the disaster's impact on habitability and occupancy.

While building safety assessments are technical in nature, an emotional aspect may also be present. Victims have just suffered losses—sometimes small, in the best-case scenario, and sometimes overwhelmingly large, in the worst-case scenario. Those affected by the disaster are under great stress and may still be in shock. Architects should not try to offer counsel that they are not trained and qualified to provide, but they may find that listening to the victim may offer some consolation.[96]

Finally, observing damage to buildings provides an enormous opportunity to learn about building performance. It will assist practitioners in better understanding construction failure forensics. These are a learning opportunity for volunteers and those they work alongside to share lessons learned. Before too much time passes, volunteers are encouraged to collect and share notes on what performed well as well as the observed failures. Analysis of damage patterns may be the subject of future educational programing at AIA chapters or conferences and will inform best practices for disaster-resistant design and construction.

BUILDING WITH RED PLACARD

The red placard marked “unsafe” is posted on the porch column of this home, so people approaching may be informed before they approach a falling hazard or unstable structure. Openings in the building envelope can be vulnerable to lateral forces; both the glazing and installed window system need to be resistant to wind and water forces.

SOURCE

Rachel Minnery, FAIA. Used with permission.

[96] For more, see “Day in the Life” in Chapter 3.

OTHER TYPES OF BUILDING DAMAGE ASSESSMENTS

Post-disaster damage and engineering assessments

In some cases, an engineering assessment is performed to determine critical and complex damage. This assessment includes opening wall and ceiling cavities to examine structural supports and bracing, and other necessary activities that are outside the scope of the rapid or detailed assessments. Typically, engineering assessments are fee-for-service work to establish a scope for repairs, reconstruction, or retrofitting as a basis of design and in most jurisdictions are required to be submitted for permitting to execute damage repairs and alterations.

Building owners may also contract with an architectural firm to conduct a damage assessment to better understand the scope of building damage. These professionals are paid for their services by the building owner and are not part of the voluntary post-disaster assessment process. While they may be required to report their findings to the AHJ, they are not acting as agents of the AHJ and are not allowed to post (placard) the structure. The architect may call on other experts to inform the assessment, including environmental specialists and structural, geotechnical, and civil engineers.

Some building owners retain on-call experts who are familiar with their buildings to assist post-disaster. In states such as California, health care facilities and school districts may use paid assessment professionals.

With proper training, architects have the opportunity to participate in all types of post-disaster building. Architects can utilize their knowledge of updated hazard maps and newly adopted building and zoning codes to complete feasibility studies for repairs, retrofits, reconstruction, or relocation. Architects with knowledge of building codes and floodplain regulations may provide those services to communities that temporarily require additional assistance.

Federal aid building damage assessments

Other damage assessments that are similar in nature and timing of the building safety assessments are preliminary damage assessments (PDAs) and FEMA Individuals and Households Program (IHP) damage inspections.

If an event is significant, a separate damage assessment is typically completed by a joint federal, state, territorial, or tribal[97] PDA team. The PDA determines the extent of the disaster, assesses its impact on individuals[98] and public facilities,[99] and includes the cost estimates as they relate to the types of federal assistance that might be needed for response and recovery. The information collected is used by the state as a basis for the governor's request and by FEMA to document the recommendation made to the president. If the disaster has risen to the level of a "major disaster," a presidential declaration can be requested. This declaration makes supplemental federal disaster assistance available to impacted individuals and businesses.

It is important to note that the PDA teams only do a cursory evaluation of a property, noting if it has been affected (cosmetic damage), has minor damage, has major damage, or has been destroyed.[100] This level of detail can be obtained from windshield surveys, drone imagery, or in some instances satellite imagery. This is insufficient information for a proper safety assessment that will result in the placarding of a structure. It is designed to collect enough data to support a request to the president for a disaster declaration. If rapid building safety evaluations have begun prior to the start of the PDA process, that information can help inform the PDA team's report.

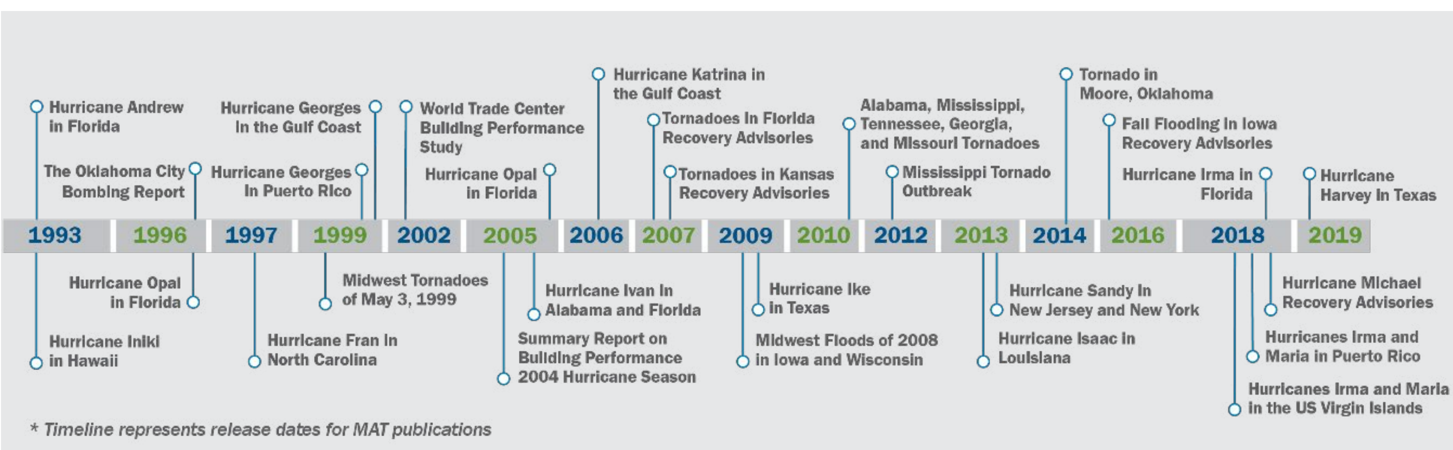
[97] 44 CFR »206.33 — Preliminary damage assessment
[98] 44 CFR »206.48(b) — Factors for the Individual Assistance Program
[99] 44 CFR »206.48(a) — Public Assistance Program
[100] PDA Pocket Guide, FEMA, May 2020, fema.gov/sites/default/files/2020-07/fema_preliminary-disaster-assessment_pocket-guide.pdf

In areas where a federal disaster declaration has been issued, and once PDA documentation is submitted and typically after rapid/detailed assessments have been completed, FEMA will conduct inspections of damaged homes to determine if the damage is covered under the [FEMA Individuals and Households Program (IHP)](fema.gov/assistance/individual/program).[101] If the damage is covered and the homeowner is eligible, FEMA will provide a limited monetary grant of assistance for temporary housing, repairs to owner-occupied primary residences, and uninsured or underinsured personal property. The FEMA IHP program does not cover all types of damage and limits repairs to those that result in a home that is safe, sanitary, and functional.[102] Grants are currently capped at $34,900.[103]

FEMA Mitigation Assessment Team program

After major natural disasters FEMA may launch a Mitigation Assessment Team (MAT) to determine points of failure. MAT members include private sector specialists, such as engineers, architects, and building code officials, who have been contracted by FEMA to conduct this work. The investigations evaluate building performance and infrastructure response to the event.[104]

After the investigation is complete the team works closely with local and state officials to 1) develop recommendations for improvements in building design and construction, 2) develop recommendations for code development and enforcement, and 3) identify hazard mitigation activities that will lead to greater resistance to hazard events.



FEMA MAT REPORT TIMELINE, BY REPORT RELEASE DATE.
MAT investigations evaluate building performance and infrastructure response to a hazard event.

SOURCE
FEMA

[101] Individuals and Households Program, FEMA, fema.gov/assistance/individual/program

[102] Possible Sheltering and Housing Assistance for Disaster Survivors, FEMA, fema.gov/assistance/individual/sheltering-housing-options

[103] Notice of Maximum Amount of Assistance Under the Individuals and Households Program, Federal Register, October 2018, federalregister.gov/documents/2018/10/22/2018-22884/notice-of-maximum-amount-of-assistance-under-the-individuals-and-households-program

[104] Mitigation Assessment Teams Building Stronger and Safer, FEMA, February 2021, fema.gov/sites/default/files/documents/fema_mat_fact-sheet_2021.pdf

FEMA building code and floodplain management administration and enforcement[105]

The Disaster Recovery Reform Act of 2018 (DRRA), amendments to the Stafford Act, authorized FEMA to "provide assistance to state and local governments for building code and floodplain administration and enforcement, including inspections for substantial damage compliance." DRRA also called for funding temporary paid positions "to facilitate the implementation and enforcement of adopted building codes."

FEMA developed Policy FP 204-079-01 to provide communities with the resources needed to effectively administer and enforce state and locally adopted building codes and floodplain management ordinances for a period of no longer than 180 days after the date of the major disaster declaration. The resources provided include funding for eligible work in the following categories:

» Building Code Administration

» Code Enforcement

» Floodplain Management Ordinance Administration and Enforcement

» Substantial Damage Determinations (Flood Damage)

These temporary positions are open as "extra hires" or under contract to the local AHJ. Architects with the requisite skills are eligible to be hired under this program with costs for travel, accommodations, and per diem paid by the AHJ and reimbursable from FEMA. These positions are also reimbursable through EMAC should resources from another state be needed. Architects should be prepared to demonstrate that they possess the skills necessary for performing the funded tasks listed in FEMA Policy FP 204-079-01.

105 Building Code and Floodplain Management Administration and Enforcement, FEMA, fema.gov/sites/default/files/2020-10/fema_building-dode-flood-plain-management-ddministration-enforcement-policy_drra-1206_signed_10-15-2020.pdf

ADDITIONAL DISASTER RESPONSE RESOURCES

Federal, state, and local government roles
Incident Command System (ICS)

National Incident Management System (NIMS)

NIMS Resource Typing Library Tool (RTLT)

National Incident Management System Fact Sheet for Private Sector Organizations

Emergency Management Assistance Compact
Emergency Management Assistance Compact (EMAC)

National Building Code Adoption Tracking Portal with interactive EMAC information

Disaster response in the built environment
FEMA Damage Assessment Operations Manual

FEMA Building Science Library

FEMA Annual Mutual Aid for Building Department (MABD) Fact Sheets

Performing building safety assessments and other emergency services
ATC-20 Field Manual

ATC-45 Field Manual

Safety Assessment Program (SAP) Manual, also received during SAP training

FEMA P-2055 Post-disaster Building Safety Evaluation Guidance

Disaster recovery

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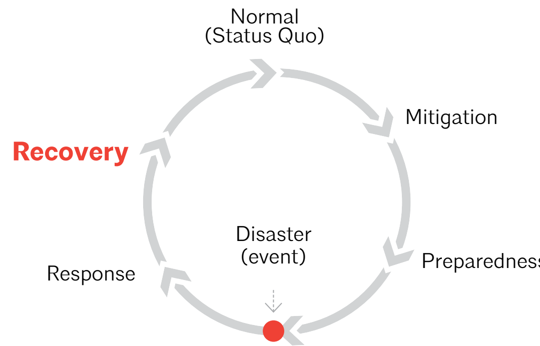


LEARN: THE COMPLEXITIES OF DISASTER RECOVERY

ACT: ENGAGING IN DISASTER RECOVERY

LEARN: A MORE RESILIENT DISASTER RECOVERY FOR ALL

OVERVIEW

Choices made during recovery, after the immediate security, safety, and health needs of the community are addressed, ought to make a community more resilient to future hazards. While the disaster recovery phase technically follows the disaster response phase, recovery coordination commences immediately and often overlaps with response efforts depending on location or activity. For example, debris removal—a recovery activity—may be necessary for first responders to gain access to an impacted area.

Lesser-damaged areas may begin cleanup and repair efforts within a day of an event, while the harder-hit areas continue with search and rescue. Eventually the impacted areas, as well as the entire community, begin the work of long-term recovery. Federal funds, which may only become available during the post-disaster recovery phase, provide opportunities for communities to Build Back Better by adopting hazard mitigation strategies.

Many of the challenges that exist during the response phase continue to manifest during the recovery phase. For example, locations with dense populations typically have little space to accommodate what could be a very high number of displaced individuals, families, and businesses. After Hurricane Sandy, as many as 776,000 people were displaced.[106] Impacted communities may struggle with the peace, safety, and health of residents because of close proximity, debris, and/or uncontained sewer and agricultural waste.

Shifting leadership, governance, and political priorities at a local, state, or federal level may also come with challenges to achieving full recovery after disaster events. This particularly occurs when recovery stretches over election cycles.

Key concepts

» Understand the challenges to Building Back Better, with special emphasis on residences.

» Be aware of the technical services architects can provide during disaster recovery.

» Be inspired by the ways that architects have created new opportunities within disaster recovery to make their communities more vibrant and resilient.

Build Back Better (BBB)

The United National General Assembly defines BBB as the use of the recovery, rehabilitation and reconstruction phases after a disaster to increase the resilience of nations and communities through integrating disaster risk reduction measures into the restoration of physical infrastructure and societal systems, and into the revitalization of livelihoods, economies, and the environment.

[106] Danielle Baussan and Miranda Peterson, “Lessons from the Storm: Climate Displacement Three Years After Hurricane Sandy,” Center for American Progress, 2015.

Disaster recovery for vulnerable populations is of particular concern due to the higher potential for drastic changes to life circumstances, including the location of one's home, community, or place of work, as well as the challenges that are presented by heirs property and land tenure issues that can bottleneck or prevent families from getting access to post-disaster recovery support and funding.[107] Worldwide "extreme weather events, such as abnormally heavy rainfall, prolonged droughts, desertification, environmental degradation, or sea-level rise and cyclones are already causing an average of more than 20 million people to leave their homes and move to other areas in their countries each year," according to the UN Refugee Agency.[108] It is therefore critical for architects who are devising post-disaster recovery solutions that may be intended as temporary to keep an eye toward the potential long-term hazard mitigation possibilities of their proposed solutions, taking into account issues of health, safety, economic consequences, and long-term disaster resilience in these solutions.

The recovery phase is a time when existing homes can be modified to increase their disaster resilience. These hazard mitigation actions will save lives and reduce the long-term recovery costs of future events. Architects can be excellent sources of assistance to public officials in setting policy (e.g., advocating for newer and/or stronger codes) and in the development of strategic approaches to home repair and replacement. For these reasons, a good deal of this chapter will focus on this building type.

"Disasters triggered 24.9 million new displacements around the world in 2019. This is equivalent to almost the entire population of Australia. Disaster displacement occurs in every country, and it can affect anyone. Populations with underlying vulnerabilities, however, suffer the most." [109]

—United Nations Office for the Coordination of Humanitarian Affairs

[107] Hannah Dreier and Andrew Ba Chan, "The Real Damage: Why FEMA is denying aid to Black families that have lived for generations in the Deep South," Washington Post, July 11, 2021, washingtonpost.com/nation/2021/07/11/fema-black-owned-property/

[108] "Climate Change and Disaster Displacement," The UN Refugee Agency. unhcr.org/en-us/climate-change-and-disasters.html

[109] "Inclusive Data On Disaster Displacement Must Include Indigenous People," United Nations Office for the Coordination of Humanitarian Affairs (OCHA). reliefweb.int/report/world/inclusive-data-disaster-displacement-must-include-indigenous-people

CHALLENGES TO BUILDING BACK BETTER

The opportunities in recovery

As FEMA's 2020 Building Codes Save report explains, the preponderance of properties damaged in disasters are single-family homes, and thus many of those properties will require post-disaster attention as this building type is not traditionally designed by architects or engineers (as previously discussed in Chapter 2). In both the response phase (as safety assessment volunteers) and the recovery phase (as volunteers and as hired consultants), architects can serve as valuable assets to an impacted community. By responding to and assessing local damage, design professionals learn the weaknesses of the community's building stock. They can then use their knowledge of resilience to help reduce the impact of future events, especially on residential construction.

Regulations to guide resilient repair and reconstruction

After a disaster, communities often ask, "how can we prevent this from happening again?" Disasters illuminate weaknesses throughout a community and therefore provide information that can be used to update hazard risk data, maps, community plans, and technical requirements, such as building codes.

Building codes, land use, and other regulations are often revisited during the recovery phase. This was the case in Moore, Oklahoma, where, after three devastating tornadoes, and a total of five within five years, the city strengthened the current model building codes so that new homes would be able to withstand winds of up to an EF2 tornado without the potential for collapse.[110] Policy updates during the recovery phase may be necessary to create future resilience. Architects can help evaluate proposed short-term policy decisions that may have long-term impacts.

Conversely, some jurisdictions, in a race to return to normal, will waive building permits, code requirements, and inspections—under the assumption that this will expedite the rebuilding process. While code officials are often overwhelmed with permit applications, including applications with variance requests, after a disaster; their enforcement of building codes and standards for public safety and disaster resistance are of utmost importance. Architects can inform the Authority Having Jurisdiction (AHJ) of an impacted community that, under the Disaster Recovery Reform Act of 2018, the AHJ can request assistance to add capacity to overwhelmed building departments. After a disaster, AHJs can request trained and certified mutual aid responder teams of designers, building inspectors, building code officials, and floodplain managers through intrastate or interstate mutual aid, via the Emergency Management Assistance Compact (EMAC) or state equivalent,[111] to assist with building code administration, code enforcement, floodplain management ordinance administration and enforcement, and substantial damage determinations for flood-impacted properties after a presidentially declared disaster (see Chapter 4).

Zoning presents limitations — as well as opportunities — for buildable areas and density. For example, creation of new subdivisions of land, setback restrictions, and limits (or prohibitions) on the construction of accessory dwelling units[112] (ADUs) are strategies that require coordination. Existing zoning regulations that require homes to be a specific size can be problematic if an un- or under-insurance situation leaves homeowners with insufficient funds to rebuild. HOA-imposed aesthetic requirements can limit the potential for resilient housing solutions post-disaster (e.g., allowing only wood shake shingles in a wildfire-prone area). Historical zoning regulations, development patterns, and disparate investment may have pushed marginalized populations into high-hazard areas or enhanced risk around them. Special care must be taken during disaster recovery to avoid perpetuating these inequities and, rather, to seek opportunities to reduce risk for vulnerable populations going forward.

110 Kevin M. Simmons and Paul Kovacs, "Real Estate Market Response to Enhanced Building Codes in Moore, OK." risk.ou.edu/downloads/news/Simmons-MooreAndNormanD-I-DPaper.pdf

111 "Mutual Aid for Building Departments," FEMA Fact Sheet, May 2021. fema.gov/sites/default/files/documents/fema_mabd-overview-fact-sheet-2021.pdf

Other regulations that guide post-disaster redevelopment are the local floodplain management provisions. For residents of a community to qualify for flood insurance through FEMA's National Flood Insurance Program (NFIP), the community must adopt and agree to enforce floodplain management regulations. Benefits to that community include access to federally backed mortgages as well as disaster assistance and hazard mitigation grants. The challenge is that after a flood, FEMA might reassesses the risk based on the extent of flooding, and this may result in a change in floodplain boundaries or even coastlines.

Recording hazard event impact data and a remapping of hazard risk might occur after major events. A change in hazard risk is likely to be reflected in future hazard-related insurance premiums for buildings. In the case of flooding, after its reassessment, FEMA may designate new areas as higher-risk areas, or it may raise the Base Flood Elevation (BFE), which then requires a change in the minimum elevation of the finished floor. Again, these updates can create anger and confusion as well as unexpected additional recovery costs, especially if the structure was substantially damaged, which is defined as occurring when the total cost of repairs is 50% or more of the structure's market value before the disaster occurred.

The Standard Flood Insurance Policy[113] cover the increased cost of compliance with local building codes and floodplain ordinances, and in some cases, FEMA may provide additional funding to elevate damaged houses to meet requirements for the new flood elevations. This is intended to make communities less vulnerable to repetitive losses and more resilient to future flood events.

The disaster recovery process offers the opportunity for individuals, organizations, and communities to work together to reassess previous planning and design decisions in terms of how those decisions can enable a more resilient response during a disaster. One of the challenges, however, is that most residents and business leaders are focused on returning to operations as quickly as possible after a hazardous event, which may prevent them from fully engaging in a resilient disaster recovery process.

112 HUD defines "accessory dwelling units" (ADUs), also referred to as accessory apartments, second units, or granny flats, as an "additional living quarters on single-family lots that are independent of the primary dwelling unit." "Accessory Dwelling Units: Case Study," HUD. huduser.gov/portal/publications/adu.pdf

113 "National Flood Insurance Program Summary of Coverage," FEMA. nh.gov/insurance/consumers/documents/summary_cov.pdf

GOVERNMENT-SPONSORED REPAIR AND REBUILDING PROGRAMS

Local leadership, often in collaboration with state and federal agencies, will develop ad hoc repair and rebuilding programs for their citizens that enable homeowners and businesses to access recovery dollars. FEMA leads the Community Planning and Capacity Building Recovery Support Function (CPCB RSF) of the National Disaster Recovery Framework, which supports and builds the recovery capacities and community planning resources of local, state, and tribal governments. Funding for these programs often comes from the federal government, but local authorities manage the grant program.

Various federal agencies may be involved in the recovery process. For example, the **U.S. Army Corps of Engineers** (USACE) assists by providing technical assistance, engineering expertise, and construction management to impacted communities. Debris management, temporary housing, critical public facilities restoration, and emergency infrastructure assessments are also disaster response missions of the USACE. The **Department of Transportation** (DOT) may provide funding to integrate resilience into the transportation recovery process. The **U.S. Department of Housing and Urban Development** (HUD) leads the Housing Recovery Support Function (RSF) and supports community recovery using existing or expanded programs like the Community Development Block Grant Disaster Recovery Program (CDBG-DR), which provides flexible grants to help cities, counties, and states recover from presidentially declared disasters, especially in low-income areas.

FEMA provides public assistance to state, local, and tribal governments and certain types of nonprofits to recover from disasters. This includes reimbursement for costs related to the repair or replacement of disaster-damaged facilities. The agency is limited by the Stafford Act to replacement costs and certain improvements that are required by adopted codes or other policies. Eligible communities may supplement FEMA funds with other funding sources. Federal funding assistance leads to a variety of project types, including acquisition (i.e., “buy outs”), rehabilitation, elevation (in floodplains), and reconstruction.

Recovery programs may be technically focused, such as New York City’s Build It Back program. The program provided rebuilding funding and technical assistance to homeowners, landlords, and tenants in the five boroughs where homes and properties were damaged by Hurricane Sandy. Other research and planning focused programs, like HUD’s public-private partnership Rebuild By Design, work to incorporate hazard mitigation goals (see Chapter 2).

Federal agency programs

The **U.S. Department of Agriculture (USDA)** serves as a primary lender for buildings and infrastructure in rural America. USDA Rural Development is made up of three branches: Rural Housing Service, Rural Business Service, and Rural Utilities Service. Together these branches finance over $234 billion of single and multifamily rental housing, essential community facilities, water and waste programs, electrical cooperatives, broadband services, business loans, and renewable energy infrastructure. In addition to standard mortgage lending, the USDA offers a number of disaster assistance programs.

The **U.S. Small Business Administration (SBA)** provides loan financing to businesses of any size, including private companies; sole practitioners; nonprofit organizations; and homeowners and renters affected by declared disasters, including civil unrest and natural hazard events. Their funding is designed specifically for losses that are not covered by FEMA programs or insurance. For example, in 2020 the SBA provided loans to mitigate the impacts of COVID-19 on small businesses. Funding can support physical damages, hazard mitigation assistance, economic injury, and military reservist loans for companies dealing with the absence of employees in the military deployed during disaster. SBA funding can be useful for design professionals who themselves have faced losses and need assistance for their practice to recover from a disaster event.

RECOVERY: WHERE ARCHITECTS ENGAGE

Community-scale planning and recovery

The aftermath of a disaster, while devastating, also provides an opportunity for communities to reimagine their future. Architects and planners can guide and initiate this visualization process with community stakeholders, facilitating the conversation and synthesizing ideas and recommendations that arise.

Architects can also aid with recommended design strategies to incorporate resilience principles and leverage synergies between sustainability or climate change mitigation goals and hazard mitigation. By looking at multifaceted design features (for example, designs that provide energy conservation as well as storm protection), businesses and communities can receive daily benefits while also mitigating risk.

AIA Design Assistance Teams (DATs)

One program that has institutionalized community-engaged planning and design is the AIA Communities by Design. This program brings customized teams of multidisciplinary experts and architects—known as Design Assistance Teams (DATs)—to assist communities with design and planning recommendations, from addressing unfocused growth and neighborhood decline to creating a vision and plan for rebuilding after a disaster. The DAT program is funded by the AIA as a public service to communities and all team members serve pro bono. Together, community members and the team of experts work to find design solutions to create healthier, safer, and more vibrant places.

DATs always begin with a request for assistance from the local jurisdiction. The DAT process is flexible but typically has four parts or phases, some of which may overlap. The first two phases, which are critical to the overall success of the DAT effort, consist of community coalition building and an initial meeting between the AIA team leader, AIA staff, and the community steering committee members. Typically, these first two phases take three to six months to complete.

Phase three, the team visit, normally takes place about six months after a community's initial contact with AIA, depending on how quickly the community can organize broad-based support. A multidisciplinary team of six to eight professionals visits the community and listens to the concerns and ideas of residents, local organizations, and community leaders before preparing a report that is presented in a public meeting.

The fourth and final phase, implementation, can take as long as needed to meet local needs and priorities. Some communities invite DAT teams back to evaluate progress toward implementation after initial efforts have been completed.

All communities can benefit from the DAT process as they seek to address their unique shocks and stresses. DATs have led to billions of dollars of economic investment and growth, including new construction and development, new public agencies and organizations, new parks and open space, new zoning ordinances, political change, affordable housing, commercial and economic revitalization, preservation of historic districts, landmark preservation, pedestrian systems, comprehensive plans, changes in growth patterns, and cessation of inappropriate development. Project teams have worked on projects in places such as Portland, Oregon's Pearl District, East Nashville, and Santa Fe on the Railyard Redevelopment.

The DAT methodology has inspired numerous AIA chapters. For example, AIA California historically had a "CDAT" program that adapted the methodology specifically for post-disaster wildfire communities. Local design assistance efforts involving public participation occurred in **Greensburg, Kansas** (see Case Study), and Joplin, Missouri, after their 2007 and 2011 tornadoes, respectively. In New Jersey, the local AIA chapter used the methodology to lead a recovery process in Camp Osborn in Brick Township following Hurricane Sandy. These examples, and the many Design Assistance Teams that have worked with communities across the nation since 1967, demonstrate the opportunity that lies in a public participation process to create community resilience goals that reduce risk and promote thriving, sustainable communities for all.

The DAT program has created a formula that requires three key ingredients to ensure success.

INTERDISCIPLINARY TEAMS

Community and social systems are too complex to be understood by any single profession. The integration of teams is vital to ensure the quality and credibility of the work.

DESIGN PROCESS

The design process involves all elements of the community, from the initial formative stages through the development fo implementation strategies.

PUBLIC PARTICIPATION

Communities belong to the people who live in them. The DAT brings together people who are experts in their field, but the citizens bring together the people who are experts in their community.

THE DESIGN ASSISTANCE TEAM FORMULA

The DAT program has created a formula that requires three key ingredients to ensure success. It is a holistic, participatory design process for creating a community vision. Communities take part in the DAT program both before a disaster to make their communities safer and healthier, as well as after a disaster to provide a holistic approach to recovery.

SOURCE

AIA

Informational events

When disasters occur, people are faced with making swift and complicated decisions that have long-term results, often with little information to guide them. To assist people in this very stressful time, local governments may host informational events and services like local assistance centers or community meetings. The purpose of these events is to provide information on available services for individuals and businesses displaced by the hazard event, including health needs, education, housing, case management, mental health services and registration for FEMA and other state program assistance. AIA chapters and architects have participated in informational events like these to offer pro bono advisory services not connected with any firm or contracted work.

Architects serve an important role at informational events by assisting home and business owners in the difficult and often confusing process of navigating post-disaster undertakings. Architects can help them understand everything from debris removal to government policies and data, from recovery planning to the rebuilding process. Architects can help stakeholders understand their opportunities to strengthen homes and businesses to limit potential damage in future events. They can also educate owners about small changes in rebuilding that can save energy and money over time.

One example of rebuilding professionals, including architects, contractors, and insurance representatives, providing information and answering questions at community meetings can be found in **Sonoma County**, California, in the form of Fire Recovery Centers after the 2017 Tubbs Fire. Fire Recovery Centers provided affected community members with printed information and pro bono advice regarding the rebuilding process. These centers allowed property owners to discuss topics like permitting, green rebuilding, accessory dwelling units (ADUs), kit homes, and whole neighborhood rebuilding (see Case Study).

Similarly, AIA Baton Rouge hosted a panel Q&A session with building officials, architects, contractors, real estate experts, mortgage specialists, the Small Business Administration, FEMA, and others to answer residents' questions after the August 2016 flooding that left one-third of the state underwater.

Create relationships before a disaster

Disasters tend to bring out the best and the worst in humanity. Disaster victims and the local agencies that serve them are legitimately wary of offers of help from unknown groups and outsiders. Design professionals may be seen as "ambulance chasers" if a role and relationship has not already been established.

Immediately after a disaster event, agencies do not have time to vet potential participant organizations. It is important for AIA chapters wishing to offer help to their communities during the recovery phase to build relationships with local emergency response leaders and organizations prior to a disaster.

When Community Assistance Goes Virtual

In 2020, after the devastating San Mateo and **Santa Cruz** County fires and during COVID-19 lockdowns, architects in Santa Cruz developed virtual methods to assist their community. They used internet platforms to communicate internally and to assist the public. These architects offered website links to instructional materials and answers to frequently asked questions.

Local architects even offered short, virtual pro bono consultations for homeowners in need. Home and business owners were referred by county supervisors and the County Planning Department. Applicants signed a waiver and architects arranged virtual meetings with them. Some of these virtual practices worked so well they are being incorporated into standard, non-quarantine disaster recovery recommendations (see Case Study).

Codes and policies

Post-disaster, local communities are typically more open to new policy ideas that can enhance the way buildings are designed and built. In reacting to the effect that a disaster has on the community, local jurisdictions can adopt updated or enhanced building codes and regulations that can be used during the rebuilding process. Policy decisions made during the recovery phase may have long-term consequences and will impact the way rebuilding and hazard mitigation strategies are implemented.

By contributing their expertise, architects can make their communities safer and healthier. In some cases, this may be through city work groups, roundtables, or forums that address issues such as land use and zoning, building codes and standards, and rebuilding policies.

After Hurricane Sandy hit the East Coast in 2012, architects collaborated with a wide range of professional organizations to inform the policies, codes, and investments later made in recovery. The effort, dubbed the **Post Sandy Initiative**, successfully advocated for a number of building policies that enhanced the health and safety of residents, including emergency exits at the first floor above flood elevation, block- and neighborhood-wide flood-proofing as an alternative to flood-proofing individual buildings, and the dry flood-proofing of nonresidential lobbies (see Case Study). This type of post-Sandy policy work continued when architects from New York, New Jersey, Connecticut, and Rhode Island formed a multistate **AIA Regional Recovery Team** comprised of community leaders, public agencies, architects, engineers, planners, and other stakeholders. The goal was to develop policies that would enable a rapid recovery and produce resilient communities prepared for the next storm or catastrophic event. This collaboration resulted in the establishment of a municipal summit on resilience, enhanced interstate cooperation, and numerous code and governmental practice changes that affected the entire region (see Case Study).

In **Sonoma County**, California, after the wildfires in 2017, building professionals provided insights and information to support the need for changes to fees and regulation for accessory dwelling units (ADUs). These changes then allowed for an increased number of permits issued for ADUs, quickly increasing the number of habitable dwelling units, and became a model for other jurisdictions throughout the state. Beyond ADUs, architects and engineers worked with building officials on a weekly basis to communicate real-time issues and to help streamline permitting processes (see Case Study).

Building-scale technical assistance

During the recovery process, architects can provide owners with a professional assessment of the extent of damage to their homes and businesses. Architects and associated design professionals can perform detailed damage assessments and provide relevant documentation to insurance companies, municipal offices, and other agencies (e.g., FEMA, SBA, etc.). The damage analysis and a building vulnerability assessment assist in making recovery decisions that define a scope of work that support the client's goals. A feasibility study is then used to weigh options to repair, rebuild, retrofit, or relocate.

Architect-led technical assistance takes many forms. For example, as part of the post-Hurricane Sandy NYC Build It Back program, architects were hired by homeowners to explain and apply technical requirements of rebuilding to ensure compliance with updated land use and building codes—or to develop alternate compliance paths when the existing structure was physically unable to meet the new code. AIA NY, along with other architectural nonprofit organizations, also engaged with the public in 2012 as a driving force behind the **Sandy Design Help Desk**, which brought technical assistance to residents after Hurricane Sandy (see Case Study).

Another instance of an architect-led technical assistance effort occurred after an EF5 tornado struck **Greensburg, Kansas**, in 2007. As part of the recovery effort, AIA Kansas convened a green products trade show to expose residents to the range of options available for rebuilding (see Case Study). These are just some of the many technical assistance projects undertaken by architects in disaster recovery.

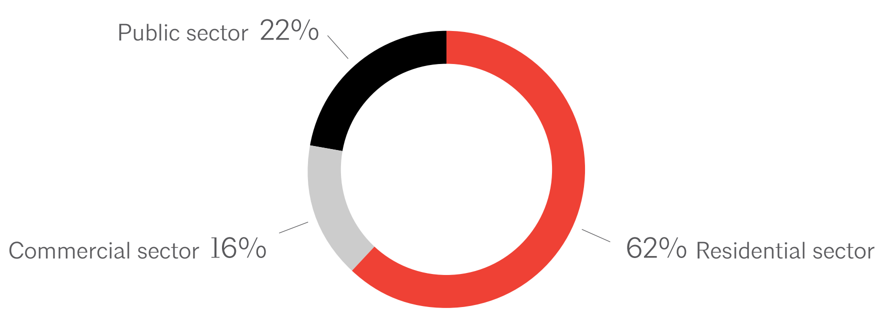
In their own practice, architects may build on their response phase services (eg. post-disaster damage and engineering assessments, see Chapter 4) by assisting clients in coordinating remediation contractors, working with insurance companies, designing repair or retrofit needs, and other recovery design services.

RESIDENTIAL CONSTRUCTION

The April 2019 "Expected Costs of Damage from Hurricane Winds and Storm-Related Flooding"[114] study by the Congressional Budget Office (CBO) estimated annual costs of $54 billion in disaster damage. Of that expected annual economic loss, $34 billion was apportioned to the residential sector, $9 billion to commercial businesses, and $12 billion to the public sector. The CBO predicts that "private insurance coverage for wind damage, federal flood insurance, and federal disaster assistance would cover roughly 50 percent of losses to the residential sector and 40 percent of losses to the commercial sector." Expected annual damage to the residential sector far exceeds losses to the commercial and public sectors combined. And fully 66% (over $13 billion) of the annual residential flood damage losses are expected to be uncompensated.

Many building types benefit from the involvement of an architect, building codes, and inspections during the building's design and construction. However, single-family homes exhibit a wide variation in design and construction quality, which can impact their performance during a disaster event.

As of 2019, the median age of owner-occupied single-family homes in the U.S. was 39 years.[115] This varies from state to state, but fully half of the country's homes were constructed prior to 1980. While first published in 1971, adoption and enforcement of the CABO One and Two Family Dwelling Code, published by the Council of American Building Officials (CABO), did not become common in many parts of the country until 1980.[116]



TOTAL EXPECTED ECONOMIC LOSSES TO THE U.S. ECONOMY FROM HURRICANE WINDS AND STORM-RELATED FLOODING

The Congressional Budget Office (CBO) estimated annual costs of $54 billion in disaster damage. Of that expected annual economic loss, $34 billion was apportioned to the residential sector, $9 billion to commercial businesses, and $12 billion to the public sector.

SOURCE

Congressional Budget Office, April 2019, cbo.gov/system/files/2019-04/55019-ExpectedCostsFromWindStorm.pdf

[114] "Expected Costs of Damage from Hurricane Winds and Storm-Related Flooding," Congressional Budget Office, April 2019. cbo.gov/system/files/2019-04/55019-ExpectedCostsFromWindStorm.pdf

[115] Na Zhao, "Age of Housing Stock by State," National Association of Homebuilders, Eye on Housing, March 26, 2021. eyeonhousing.org/2021/03/age-of-housing-stock-by-state-3/

[116] "Part 1 of a Study of the HUD Minimum Property Standards for One- and Two- Family Dwellings and Technical Suitability of Products Programs," National Institute of Building Sciences, March 2003, p. 8. huduser.gov/publications/pdf/mps_report.pdf

Therefore a majority of homes in the U.S. were built at a time when construction practices did not incorporate hazard resistance. Additionally, codes from 1980 to 2000 were similarly bereft of hazard-resistant requirements due to their acceptance of conventional and empirical provisions (i.e., non-engineered methodologies). For instance, the wind provisions in codes from the early 1980s to mid-1990s were not as refined as current wind criteria. As a result, some load conditions of the older codes fell significantly short of current criteria.[117]

One of the many hurdles that displaced people from low-wealth communities face is that both their homes and their land is vulnerable to future events due to location and topography. Architects can be especially helpful in assisting homeowners in decision-making about repairs, retrofits, rebuilding, and relocation.

Disaster recovery efforts in Rural America can be especially challenging as high levels of endemic poverty coupled with increasing natural disasters reduce these communities' already limited financial resources. Of the almost 400 U.S. counties experiencing persistent poverty, defined as 20% or more of the population has lived in poverty for at least the last 30 years, 80% of them are in rural America. For rural African American, Native American, and Latinx communities, the percentage of people living in poverty doubles and even triples in some places.[118] When hit by natural disasters, these populations experience overwhelming recovery challenges. Of particular concern is the fact that while devastating at the local level, many events cannot be declared federal disasters due to the low number of impacted individuals (low population density), making them ineligible for federal recovery funds. Without federal assistance resources, these communities may be the most in need of assistance from the design community and the special skills architects can provide.

Single family housing recovery options and resources

With the increasing size and intensity of natural hazard events, the number of shelters needed to temporarily house all residents whose homes incurred substantial damage may require a regional response. As outlined in Chapter 4, a goal of post-disaster building safety evaluations is to identify houses that are capable of post-disaster occupancy. Trained building safety evaluators—architects, engineers, and building officials—are critical resources for these determinations.

In response to Hurricane Sandy, FEMA established the Sheltering and Temporary Essential Power (STEP) pilot program, enabling residents to return to or remain in their homes as a form of shelter while permanent repairs are completed. This program was designed to reduce the number of people in shelters or in the Transitional Shelter Assistance Program. It means that the role of architects as both second responders as well as agents of long-term recovery is even more crucial. Because most people will want to return to their homes, it is in the best interests of local, state, and federal governments to help make this happen in a safe manner.

117 "Building Codes Save: A Nationwide Study," November 2020, p. 5-5.

118 "Persistent Poverty," The Housing Assistance Council. ruralhome.org/our-initiatives/persistent-poverty/

Temporary-to-permanent housing post-disaster

Recovery assistance may take the form of temporary housing, especially when the structure has been determined to be uninhabitable. Most commonly, this includes housing impacted individuals with family or friends, in hotel rooms paid for by individuals, nonprofits, or governments or in existing vacant apartments through programs such as HUD's Public Housing Authorities. In a widespread, high-severity event, temporary housing can unintentionally become long-term housing. This issue arose during the response to Hurricane Katrina when FEMA trailers were deployed to house displaced people. Because of the widespread nature of the damage, people were allowed to live in the FEMA-provided travel trailer for up to 45 months. Typically, FEMA provides temporary housing for a period of up to 18 months.

When temporary housing must be utilized for such an extended period, it underscores the need to build back in a more resilient way. When a temporary shelter is purposedly designed for disaster response, architects can be essential in offering flexible solutions so that it could eventually become permanent housing. An example of this can be seen in the work of Alejandro Aravena whose "half-finished house"[119] allows governments to provide housing at a low price while still creating quality homes in the wake of a disaster.

Post-disaster nongovernmental housing providers

During the recovery phase there will be a variety of organizations helping the impacted community recover, often with a focus on residential construction. These groups offer additional opportunities for architects to engage, whether doing hands-on rebuilding, coaching, teaching construction methods, or helping residents navigate city hall (permits, appeals, etc.).

The fifth largest homebuilder in the nation is Habitat for Humanity (HFH), an international organization with chapters in many locations. Its primary goal is building homes for people who are unable to afford market-rate homes. In addition to building homes in communities across the country, HFH also has a national post-disaster response component. Sometimes, week-long trips will focus on post-disaster recovery efforts through its Disaster Risk Reduction and Response program, providing an opportunity for architects and non-architects alike to engage in the recovery process.

Assistance from architecture design-build programs

Universities, colleges, community colleges, and high school vocational schools with building industry programs may have student research or assistance programs. Several schools of architecture are home to design-build programs, such as those at Yale, Virginia Tech, University of Kansas, University of Utah, Parsons, and Auburn University.

A program that specifically focuses on housing affordability is Auburn University's Rural Studio based in Hale County, Alabama, one of the nation's most impoverished areas at the nexus of Appalachia and the Delta region, within the Black Belt. The Studio has incorporated FEMA tornado shelters that double as bathrooms in houses, especially where occupants have mobility challenges that prevent them from easily accessing a remote or community shelter in the event of a tornado. The homes also exemplify high-performance design, meeting the Passive House Institute US (PHIUS); Department of Energy's Zero Energy Ready Homes; and the high-wind, hurricane, and hail resilience standard FORTIFIED Home.

Programs like these have the potential to inspire students to create solutions to the many challenges to housing affordability that are compounded by disaster events in communities across the U.S. Community officials, in conjunction with university programs and with the assistance of local architects, may wish to assess the capacity and roles of each of these groups in potential response to disasters. Some could be helpful in providing resilience-focused repairs or bringing homes up to the most current IRC or another beyond-code standard. Other programs, like the Rural Studio's Front Porch Initiative, may be approached by communities seeking to mitigate risks before disaster events.

[119] Ariana Zilliacus, "Half A House Builds A Whole Community: Elemental's Controversial Social Housing," ArchDaily, October 24, 2016.
https://archive.curbed.com/2015/11/10/9901718/5-architecture-schools-with-designbuild-programs

Alternative housing options

Alternative housing solutions, such as manufactured homes, may expedite rehousing of some displaced individuals. Unfortunately, manufactured homes are highly susceptible to damage from wind forces and impacts of flying debris. The risk of fatality during a tornado is 10 times as high for manufactured home residents as for residents of site-built homes.[120] Observations from past earthquakes suggest that manufactured homes are two to five times more vulnerable than site-built wood frame houses.[121]

A manufactured home, which is built on a chassis, is considered a vehicle and as such is a depreciating asset. In the long run, manufactured housing, while affordable and available, can become one of the many contributors to generational poverty.

To help combat this inequity, architects can provide technical information on manufactured home foundation design. A permanent foundation permits the home to be titled as real property when built on land that is owned by that homeowner. Special designs for permanent foundations are provided by HUD,[122] allowing architects to use their knowledge and expertise to assist disadvantaged homeowners.

The term "Katrina Cottage" became a household term in the years of disaster recovery post-Katrina. Offering modular system building construction techniques, these small homes (approximately 400–700 sf) were built with private financial support and some FEMA funding[123] but had difficulty being accepted by impacted communities.[124] The cottages were too small to meet the minimum size requirements of zoning ordinances in some cases and were blocked by planning boards, community groups, and neighbors who were concerned that they would lower property values.[125] In the years since Katrina, smaller homes have become more common as construction costs have increased, suggesting that Katrina Cottages might find greater acceptance today. A National Association of Homebuilders survey found that more than half of adults surveyed (53%) said "yes" or "maybe" when asked if they would ever consider buying a small home, defined as one less than 600 square feet.[126]

Geared towards people experiencing homelessness in Seattle, The Block Project offers an architect-designed accessory dwelling unit (ADU) kit-of-parts that can be securely installed on the property of a neighbor who is willing to host a person living on their land. While this model very much relies on extreme neighborly generosity that may not be scalable, or practical, in other places, it could be a useful model in severely disaster-impacted areas. At 175 square feet in size, these dwelling units, or something similarly designed by an architect, could be deployed in disaster response and perhaps later evolve into permanent housing depending on the associated legal implications of the situation.

The RAPIDO model by Community Development Corporation of Brownsville (CDCB) in Texas and its partners is an example of disaster response housing that is designed to transition into viable long-term disaster recovery housing. It offers a deployable temporary shelter that can later be expanded into permanent housing. Additionally, CDCB's MiCasita program integrates financial planning for the expansion of homes over time.

[120] Kevin D. Ash, et al., "Structural Forces: Perception and Vulnerability Factors for Tornado Sheltering within Mobile and Manufactured Housing in Alabama and Mississippi," Weather, Climate, and Society, May 21, 2020. journals.ametsoc.org/view/journals/wcas/12/3/wcasD190088.xml

[121] "Historical Damage Demonstrates Manufactured Home Earthquake Vulnerability," AIR Currents, October 23, 2017. air-worldwide.com/publications/air-currents/2017/Understanding-the-Seismic-Vulnerability-of-Manufactured-Homes/

[122] "Permanent Foundations Guide for Manufactured Housing," HUD. hud.gov/program_offices/administration/hudclips/guidebooks/4930.3G

[123] "Future Directions of FEMA's Temporary Housing Assistance Program," Department of Homeland Security Office of Inspector General, December 2011. oig.dhs.gov/assets/Mgmt/OIG_12-20_Dec11.pdf

[124] Francis X. McCarthy, "FEMA Disaster Housing: From Sheltering to Permanent Housing," Congressional Research Service, August 27, 2010, p. 21. google.com/books/edition/_/j6tGSeAj9RUC?hl=en&gbpv=1&pg=PA1&dq=Katrina+Cottages

[125] Christopher Swope, "Road to Katrinaville," Governing, April 2009, pp. 30-33. governing.com/archive/road-to-katrinaville-feature.html

[126] Rose Quint, "Tiny Homes Might Have Potential Buyers," NAHB, Eye on Housing, February 7, 2018. eyeonhousing.org/2018/02/tiny-homes-might-have-potential-buyers/

Innovative products and technologies

Those impacted by disaster are eager to return to normal and to find Build Back Better answers. One of the challenges after a disaster is that creative solutions may not be able to address all short-and long-term issues. Public officials may be approached by private companies with ideas for creating 3D-printed homes or homes built from recycled or repurposed materials, such as shipping containers. While the ideas may be exciting to the public, the products may not be designed in compliance with building codes, have unreasonable construction costs, or have unidentified material health risks.

While innovation is the heart of modern society's success, new technology brings with it challenges for housing value appraisal, insurability, and difficulties in repairing or replacing systems and products that are not a part of the standard homebuilding construction system. Overcoming these difficulties and testing new products and methods at the rapid pace of disaster recovery can be difficult. Architects can assist their local communities by vetting these proposals by asking the relevant questions regarding code compliance, health and safety concerns, durability, and hazard resistance attributes.

LEARNING FROM DISASTER FOR A MORE RESILIENT RECOVERY

Reassessment of risk is one of the purposes of a state Hazard Mitigation Plan (HMP), which is typically updated on a five-year cycle. The state HMP takes into account the impacts post-disaster and the recommended means and methods of mitigating those effects in the future. Capturing learnings from the disaster informs this process and enhances the HMP so it can serve as the most up-to-date resource for future events. This is yet another opportunity for architects to offer their input and expertise on how to update the HMP.

FEMA Mitigation Assessment Team (MAT) reports capture both building performance successes and failures via a post-disaster forensic review. Because a hazardous event will not affect all buildings the same, understanding the specific impacts on a given building will better inform owners who are then able to incorporate the most cost-effective resilient recovery strategies. For example, after Hurricane Sally made landfall in Alabama, enhanced roof resilience construction techniques[127] proved to be effective in eliminating damage. This information helps architects and building officials as they explain the value of hazard mitigation design attributes.

As disasters continue, the lessons they teach only gain importance. It is at this time that observations on what failed, and what survived, can inform the changes needed to ensure that in the next disaster the impacts are not as severe, fewer buildings are damaged, fewer people are left homeless, and the community can recover more quickly. Together architects, engineers, government partners, and community members can build a healthier, more equitable, and more resilient world.

[127] Dennis Pillion, "Alabama's nation-leading 16,000 Fortified roofs held up well to Hurricane Sally," Mobile Real-Time News, September 27, 2020. al.com/news/mobile/2020/09/alabamas-nation-leading-16000-fortified-roofs-held-up-well-to-hurricane-sally.html

ADDITIONAL DISASTER RECOVERY RESOURCES

Government-sponsored repair and rebuilding programs
Community Planning and Capacity Building Recovery Support Function

Community Recovery Management Toolkit

HUD Community Development Block Grant Disaster Recovery Program

NYC Build it Back Program

Rebuild by Design

From Tragedy to Triumph—Rebuilding Green Homes after Disaster

Rebuilding After Disaster: Going Green from the Ground Up

Recovery: Where architects engage
AIA NY Post Sandy Initiative Report

More information on the Center for Communities by Design

AIA's Flood Recovery Resources

AIA's Wildfire Recovery Resources

Case studies

CASE STUDIES

Design for hazard mitigation: the Iowa State Fairgrounds, 2004

A CASE STUDY BY THOMAS HURD, AIA

Disaster Assistance Committee Chair 2015-2016 | Disaster Assistance Committee member 2012-2014

PHASE
Hazard mitigation

HAZARD TYPE
Tornado

SERVICES
Architectural design services

COMPENSATION
Project funded through FEMA Hazard Mitigation Grant Program (HMGP) for the state of Iowa

The Iowa State Fair draws tens of thousands of visitors every August and falls during the March-to-November tornado season. According to the National Climatic Data Center, the State of Iowa ranked sixth in the number of tornadoes across the nation with 1,974 events between 1950 and February 2004. In Polk County alone (home to the Iowa State Fair and the capital city of Des Moines), 49 tornadoes have been confirmed since 1950. Though the complex itself has never been hit by a tornado during the State Fair, in 1998, it was hit by a record high-wind event that caused extensive damage. Without a tornado shelter, the campground offered little protection for campers during a tornado or high-wind event, thus allowing the high potential for casualties should a tornado event strike the campground.

Recognizing this fact, the Iowa Emergency Management Division (EMD) and the Iowa State Fair jointly applied for a grant through FEMA's Hazard Mitigation Grant Program (HMGP) to build a structure for the Iowa State Fair Complex that would provide emergency shelter as well as additional facilities—including showers, restrooms, an office, and a meeting room. The application was accepted, with 75 percent of the cost of the shelter covered by FEMA's HMGP. The remaining costs were funded by the State Fair.

After project funding was secured, the Iowa EMD worked with the College of Design at Iowa State University and Tom Hurd, AIA, of Spatial Designs Architects and Consultants to design and construct the shelter to FEMA P-361 standards. The shelter offers unique design features that provide excellent wind resistance, and have garnered interest from a design standpoint as it doesn't resemble a typical bunker. The curved surfaces force the wind around the shelter on all sides, thus alleviating wind pressure at specific points. On the east side of the structure, a concrete canopy mounted on concrete piers provides weather protection. Campers have enjoyed the extra restroom, shower, laundry and meeting facilities included within the structure, and the structure also provides all the peace of mind that there's a safe haven in the occasion of a tornado or high wind event. This shelter was planned as a prototype for other shelters across the State of Iowa and can also serve as an example of how to address the safety and wellbeing of campers across the US.

The unique shape of the shelter's curved surfaces force the wind around the shelter on all sides

SOURCE
Thomas Hurd, AIA. Used with permission.

Canopies mounted on concrete piers designed to withstand 250-mph winds provide weather protection

SOURCE
Thomas Hurd, AIA. Used with permission.

Resilient Building Design Guidelines: City of Hoboken, 2015

A CASE STUDY BY JOHN A. MILLER, PE

2021 AIA Disaster Assistance Committee member

PHASE
Hazard mitigation

HAZARD TYPE
Flood, hurricane, sea level rise, storm surge, urban flooding

SERVICES
- Community planning
- Technical assistance

COMPENSATION
Project funded through HUD CDBG-DR funding for the state of New Jersey

In the three years after Hurricane Sandy made landfall on the New Jersey coast, the city of Hoboken conducted a comprehensive evaluation of its development plans, codes, and regulations to ensure the safety of its residents and first responders. The review examined ways the city could work to ensure continuous operations, that businesses could function without substantial interruption, and that neighborhoods would suffer less property damage and emotional toll from flooding. Sandy exposed the underlying vulnerabilities associated with aging utility infrastructure, power security, coastal flooding, and localized flooding.

As part of this evaluation, the city held a Design Guidelines Development Workshop in April 2014 to receive input from developers and architects who had been personally impacted by Sandy. Topics of discussion included historic and older building costs, pedestrian experience, regulatory definitions, structural difficulties of adding another story to residences, height restrictions, accessibility, stormwater detention, energy redundancy, and resiliency.

Issues discussed that influenced the design guidelines and concurrent regulatory changes to Hoboken's ordinance were:

- allowing the addition of another floor to offset abandonment of a lower flood-prone level,
- the use of garages as stormwater detention areas,
- incentives to promote flood resiliency retrofits,
- the examination of financial incentives, and
- the promotion of success stories.

In 2015 the city of Hoboken published the Resilient Building Design Guidelines, a document informed by the three-year analysis and the workshop and designed to provide an overview of the laws and regulations governing construction within the city's flood-prone areas. The guide builds on lessons learned from major flooding experienced in Hurricanes Irene (2011) and Sandy (2012) as well as the expected impacts of sea-level rise and heavier downpours a warming climate will bring to the municipality. In addition, the guidelines provide an overview of the approval process for repairs, improvements, and new construction and provide flood-resilience strategies for residents, property and building owners, developers, and businesses.

Designers and builders use the design guidelines to make post-hazard mitigation buildings relate well to one another while preserving connectivity with a pedestrian-friendly streetscape and enhancing the character of Hoboken's neighborhoods. Importantly, the guidelines can be used immediately after a flood event; they provide standards for emergency work that follow damage. The guidelines also

- serve as a manual on how to achieve resilience for homes, redevelopment, and new construction;
- provide guidance on best practices to protect against flooding;
- provide a step-by-step process for approval in floodplains for rehabilitation, retrofitting commercial space, substantial damage and substantial improvements, and new construction;
- provide strategies for reducing flood insurance premiums; and
- provide information on using flood-resilient design, including building materials, designing below the design flood elevation (DFE), floodproofing measures, protecting utilities and mechanical systems, parking requirements, and foundation design.

By using these guidelines, owners can recover with appropriate techniques and materials that reduce vulnerability in future flood events while preserving the charming urban character of the city.

Having design guidelines already in place before a disaster will make recovery and rebuilding easier and encourage resilient rebuilding. The city believes that over time, the enforcement of the new regulations and implementation of the recommendations in the document will promote a more resilient and sustainable city of Hoboken.

The city of Hoboken believes that the Resilient Building Design Guidelines could be valuable to other urban communities in New Jersey and beyond.

Hurricane scenario exercise: Vigilant Guard, 2012

A CASE STUDY BY KENNETH J. FILARSKI, FAIA

Disaster Assistance Committee Co-chair 2021 | Disaster Assistance Committee member 2020

PHASE
Preparedness

HAZARD TYPE
Hurricane

SERVICES
Disaster scenario planning or exercise

COMPENSATION
Volunteer

During the early morning hours of July 30, 2012, a "Category 3 hurricane" hit Rhode Island with devastating force, causing catastrophic damage and overwhelming state and local resources. Fortunately, there was no actual storm. It was a statewide exercise known as Vigilant Guard, which tested first and second responders from Rhode Island and the New England region.

Vigilant Guard was designed as a simulated disaster scenario that replicated the impacts of a major hurricane hitting Rhode Island. The exercise served to field test and strengthen the existing relationship between the Rhode Island Architects and Engineers Emergency Response Task Force 7 (RI AEER TF-7) and the federal, state, and local governments and volunteer partners.

With sustained winds of 111 to 130 mph, the scenario modeled a storm surge of nine to 12 feet characteristic of a Category 3 hurricane, similar to the Hurricane of 1938 that devastated all of Rhode Island. Extensive residential and commercial building flooding, storm damage to a hospital, a chemical explosion in a manufacturing building, buried people, and extended power outages were a few of the damage impacts modeled.

During Vigilant Guard, the Federal Emergency Management Agency (FEMA) and the Rhode Island Emergency Management Agency worked to replicate the complexity of managing multiple responders, agencies, stakeholders, and more than 1,100 National Guard troops from Rhode Island and the surrounding states with an almost equal number of first and second responders. The RI AEER TF-7 team had the opportunity to observe other responder teams in action, build relationships, and experience the ebb and flow of disaster response. This led to a better understanding of the steps and protocols of damage assessment in the field.

Within months, the knowledge, skills, and relationships built during Vigilant Guard would be put to test following Hurricane Sandy when RI AEER TF-7 was called upon to provide post-disaster building safety evaluations. Because of the experience with Vigilant Guard, RI AEER TF-7 was prepared and able to respond within 24 hours. The exercise had ensured that volunteers were already familiar with proper badging, packing a "go bag," deployment staging areas, the roles of other responder teams, key field tools and equipment, report forms, and protocols. The Vigilant Guard experience was instrumental in creating a familiarization with the structure of the Incident Command System, which led to an efficient response during Hurricane Sandy.

Due largely in part to the experience gained through Vigilant Guard, the state of Rhode Island was able to efficiently estimate the economic impact of the storm based upon the field reporting of RI AEER TF-7 and other deployed teams in the disaster response. The field reporting enabled the state to quickly provide the necessary proof of impact, making Rhode Island eligible for more than $39.4 million in support from four federal disaster relief programs.

For their efforts, RI AEER TF-7 was recognized with the AIA National Service Award. In addition, the Westerly, Rhode Island, Town Council commended RI AEER TF-7 with an official proclamation noting its appreciation. This Hurricane Sandy rapid response success and appreciation directly stems from the preparedness efforts of Vigilant Guard.

Volunteers participate in Vigilant Guard

SOURCE
Kenneth Filarski, FAIA. Used with permission

Earthquake scenario planning: San Diego/Tijuana, 2013

A CASE STUDY BY ROBERT THIELE, AIA

AIA Disaster Assistance Committee member 2012-2016

PHASE
Preparedness

HAZARD TYPE
Earthquake

SERVICES
Disaster scenario planning or exercise

COMPENSATION
Volunteer

The San Diego-Tijuana Earthquake Planning Scenario Project was initiated in 2013 by the San Diego Chapter of the Earthquake Engineering Research Institute (EERI) for policy makers, emergency management, and government officials to reduce earthquake disaster vulnerability and increase resiliency in the San Diego-Tijuana metropolitan region.

The first San Diego-Tijuana Earthquake Scenario study was prepared by the State of California in 1990. However, over the last 25 years significant research has allowed officials to understand and increase their knowledge of fault regions and hazards that could potentially devastate the area. In addition, over the same period of time, the vulnerability of buildings, infrastructure, and the general community has changed.

A United States and Mexico-based team of engineers, geologists, architects, researchers, social scientists, and public officials are collaboratively working to study cross-border building and infrastructure vulnerabilities with expected damage, loss, casualties, and infrastructure disruption from a realistic 6.9 magnitude earthquake along the active Rose Canyon Fault zone.

To quantify these expected resulting losses, researchers on the team are utilizing the all-hazards loss estimation system “HAZUS,” a tool developed by FEMA, to develop pre-disaster planning techniques through the visualization of relationships between populations and their reliance on geographic resources.

The purpose of this planning scenario is to identify recommendations to policymakers that will improve the region’s earthquake awareness, emergency response, mitigation programs, building codes, cross border communication, and cooperation with resources that will facilitate faster recovery and rebuilding among the collaboration of architects, engineers, planners, and policy makers. Currently, EERI has sponsored a series of meetings, presentations, and workshops to better understand how and where the binational population will be impacted.

Passing Good Samaritan legislation: New Hampshire, 2015

A CASE STUDY BY CAROLYN ISAAK, HON. AIA NH

Former AIA New Hampshire Executive Director

PHASE
Preparedness

HAZARD TYPE
All hazards

SERVICES
Policy initiative or advocacy

COMPENSATION
Volunteer

The New Hampshire Architects and Engineers Emergency Response task force (NH AEER TF) formed in May 2013. The first hurdle facing the task force was adding architects and engineers to the state's Good Samaritan law. Recognizing that recruiting and training members for a Disaster Assistance Program would be in vain without this protection, they set out to update New Hampshire's Good Samaritan law.

The task force found sponsors and helped write legislation based on model guidelines from AIA. A bill, SB209, was introduced and approved on the Senate side quite easily. The task force then attended hearings and wrote letters to House representatives. Retrospectively, the task force recognized that they were buoyed by the Senate response and didn't realize the full strength of the opposition in the House. The bill ultimately failed.

When the NH AEER TF tried again during the 2015 legislative session, advocacy efforts included a public communications campaign, a grassroots campaign in the House, and an effort to reach out to those who had voted against the previous bill. The task force also gave a presentation at the NH Municipal Association Annual Conference, explaining what the group does and why they needed support for the Good Samaritan legislation. Some task force members spoke with police, fire, and building officials, as well as associations such as the Seacoast Fire Chiefs. A task force member who was a building official for the City of Nashua offered critical support. Additionally, the task force had the help of a lobbyist from the Structural Engineers of New Hampshire.

A key part of the task force's argument was that this bill would help individuals return to their homes and businesses more quickly. The biggest obstacle was to get legislators to understand why architects and engineers are under such risk of liability when performing volunteer services and that their professional insurance does not cover them in this instance.

Once the bill was filed, the task force attended hearings and distributed supporting documentation, including a list of sponsors, co-sponsors, and supporting organizations. They also identified legislators who were "hurdles" and reached out to them to fully explain the need for this law.

As a result of hearings, an amendment was ultimately filed and approved that stated this protection was offered only when architects and engineers are called into service by NH Homeland Security/Emergency Management, the State Fire Marshal, or a town or city emergency management director and that the service rendered applies to the structural integrity of buildings.

Finally, on March 12, 2015, the bill was passed by both bodies.

In-state post-disaster response: Hurricane Katrina, 2005

A CASE STUDY BY ANN SOMERS, AIA

AIA Mississippi Chapter President 2005-2006 | AIA Disaster Assistance Committee member 2007-2012

PHASE
Response

HAZARD TYPE
Hurricane

SERVICES
Post-disaster building safety evaluations

COMPENSATION
Volunteer

In the first week after Hurricane Katrina, most of Mississippi was in disarray. Even three hours from the coast, there were many damaged structures, no electricity for eight days, and no gasoline to fuel cars for about a week.

As soon as electricity was up and running, AIA Mississippi leveraged the supplemental cell towers that had been installed to reach out to architects on the coast via cell phone. AIA Mississippi became the information hub for affected architects all over the state. Architects who lost their place to work were networked with architects with extra space.

AIA National executives and staff visited the state and started the dialogue of how best to help. There was an outpouring of architects all over the country that wanted to help and offered their services. AIA National alone received over 600 calls from members wanting to help. Two tracks of aid were determined: getting Mississippi architects back up and running and implementing a Disaster Assessment Program for residential structures.

Back to business
AIA Mississippi, through dialogue with the architects that lost their offices, determined what supplies were needed and worked with AIA National counterparts to get the word out. Soon architects up and down the coast received computers and drafting supplies. It is critically important for architects to be available for their clients post-disaster, who need architectural services more than ever.

Building a Disaster Assistance Program
Several architects in the AIA Kansas and Texas Chapters had developed a State Disaster Assistance Program and shared their experience with Mississippi. Three Safety Assessment Program training seminars were held for architects and engineers to learn how to do assessments of residential structures. Over 100 professionals were trained in a two day period.

Although design professionals were trained, they could not start performing assessments until a liability waiver was secured. Mississippi did not, and still does not, have a Good Samaritan law. The two paths available to grant a liability waiver was a letter from the Governor or to make the trained design professionals consultants for the State Bureau of Buildings. It took a month and a half, but a letter was eventually signed by the Governor that provided a three month window to do assessments. Additionally, some preservation architects looking at state-owned historic structures and out-of-state disaster-trained architects from AIA Seattle and Architects Without Borders-Seattle volunteered with the Bureau of Buildings to inform State Building Assessment protocol and assess state owned structures.

Katrina was such a large storm, the typical FEMA command centers where nonprofits would congregate were not created, so the challenge for AIA Mississippi was how to get the word out to homeowners that AIA Disaster Assistance Program volunteers were available for assessments. AIA Mississippi listed an ad in the newspaper instructing residents to call a toll free number to request assistance. AIA National set up a phone bank and a list of questions were developed that helped AIA determine the level of destruction of the caller's home. The calls came pouring in at a completely overwhelming rate. Some days over 150 calls were received. Sadly, many of the callers' homes were so badly damaged that an assessment was not warranted. The important part of this process was to let the callers tell their story and recommend next steps.

AIA Mississippi stopped the ads after about two weeks due to the number of assessments requested. AIA National worked to get those who had wanted to volunteer integrated into the assessment scheduling process. AIA Mississippi was incredibly fortunate to have the spouse of an architect, Brenda Crane, on the coast who was hired to coordinate and schedule the trained volunteer architects. The Cranes' house became the hub the volunteers worked from. Brenda would contact the residents, set up a time, coordinate groupings of houses for each architect team, and provide teams with a map with the route highlighted, a backpack of supplies AIA National had put together, and a distinctive red AIA Disaster Assistance tshirt. It was important to have a "uniform" of sorts, to stand out and be easily recognized as a volunteer. At the end of the day, volunteers would return to Brenda's house with completed assessment forms—a triplicate style form where the top copy would be given to the homeowner, the second for the AIA, the third for the local AHJ. Typically five to seven homes were assessed per day. Over the course of three months about 1,400 assessments were completed. These assessments, now deemed by the AIA as Goodwill Assessments, were performed outside of the window of the declared disaster—as third party objective building damage evaluations they became invaluable to homeowners dealing with insurance claims and others.

That next summer there was a recognition ceremony at the AIA Mississippi Convention. It felt more like a reunion.

A home assessed after Hurricane Katrina, 2005

SOURCE
AIA Mississippi. Used with permission.

Out-of-state post-disaster response: Hurricanes Katrina and Rita, 2005

A CASE STUDY BY WILLIAM MELBY, FAIA

2021 AIA Disaster Assistance Committee member

PHASE
Response

HAZARD TYPE
Hurricane

SERVICES
Post-disaster building safety evaluations

COMPENSATION
Volunteer

In 2005, St. Bernard Parish in Louisiana was hit by two large hurricanes, Katrina and Rita. Protective levies around much of the parish were breached and flooding followed. Oil refinery tanks in the area ruptured, spilling their contents into the flood water. The parish was estimated to have had 81% of its dwelling units impacted by the storms, and of those dwellings, over 55% were determined to have been severely damaged or destroyed.[1] Nearly 20,000 dwelling units experienced either major or severe damage or were destroyed.

State and local officials were overwhelmed by the magnitude of the damage. Faced with serious emergency management resource deficiencies, the governor looked to her counterparts around the country. The federal government does not have access to resources trained and experienced in local jurisdiction emergency operations; therefore, the governor turned to the Emergency Management Assistance Compact (EMAC). Governor Kathleen Babineaux Blanco declared a state of emergency, which allowed Louisiana to enter a request for assistance through the EMAC Operating System.

The EMAC state-to-state mutual aid assistance program was used to request trained post-disaster building damage assessment personnel from states across the country, including California's Office of Emergency Services (Cal OES). In response, Cal OES sent a team of 41 trained volunteers, including architects, over three separate deployments to evaluate the structural safety of more than 16,000 structures in the parish.[2]

Upon arrival, most neighborhood streets had been cleaned, much like snow removal, with a small mound of debris following the length of the street. Some roads remained blocked by homes that had been swept off their foundations and had come to rest in the middle of the street. Sidewalks and lawns were covered with debris and a layer of dried mud. In breezeways between buildings where the sun could not shine, the mud was six to eight inches deep and very wet and slippery and yet gooey.

Before beginning evaluations, all volunteer evaluators participated in two initial standardization evaluations to ensure everyone was using the same standard for our evaluation. This was very useful to the volunteers and brought consistency to the evaluations.

Over two weeks the California evaluators examined parish structures for structural safety issues. Once the evaluator determined the extent of safety concerns, the evaluation was then documented, and the evaluator moved to the next address. Evaluation sheets were then passed on to data entry people, hired from the local community, for input into a database. This database was used to plan local recovery efforts.

BUILDING SAFETY EVALUATORS
EMAC facilitated the deployment of California architects and building officials to Louisiana to evaluate damage from Hurricane Katrina.

SOURCE
William Melby, FAIA. Used with permission.

1 "Current Housing Unit Damage Estimates Hurricanes Katrina, Rita, and Wilma," U.S. Department of Housing and Urban Development's Office of Policy Development and Research, February 12, 2006. huduser.gov/publications/pdf/gulfcoast_hsngdmgest.pdf

2 "Emergency Management Assistance Compact (EMAC) 2005 Hurricane Season Response After-Action Report," EMAC, September 19, 2006. emacweb.org/index.php/files/89/2005-Hurricane-Season/83/EMAC-2005-Hurricane-Season-AAR-Final.pdf

International post-disaster response: Haiti earthquake, 2010

A CASE STUDY BY JANINE GLAESER, AIA

Disaster Assistance Committee Vice Chair 2020 | Disaster Assistance Committee member 2019

PHASE
Response

HAZARD TYPE
Earthquake

SERVICES
Post-disaster building safety evaluations

COMPENSATION
Volunteer

Design professionals in the United States are fortunate to have the specialized training to respond to disasters, so when an earthquake devastated much of the island nation of Haiti in 2010, All Hands, a NGO working in Haiti, contacted Architects Without Borders-Seattle. Architects Without Borders-Seattle and the Structural Engineers Association of Washington (SEAW) organized and sent volunteers to Leogane Haiti within several weeks of the quake and again to Petit Goave months later.

Nine months after the 2010 earthquake, little repair had been done and many basic infrastructure components—schools, hospitals, and clinics—had not been touched. Many families were still living in tents, unsure of whether or not their homes were safe to return to. In Petit Goave, the Architects Without Borders members sorted themselves into teams, each composed of an architect and a structural engineer. The teams spent 15 days walking through damaged buildings and assessing how safe they were to enter or occupy. Nearly half were tagged as safe for occupation, and another third were tagged for restricted use. The group also identified 45 buildings as potential hurricane shelters and 70 that could serve as shelter during earthquakes. They used the ATC-20 post-earthquake safety evaluation forms and field manual, kept detailed spreadsheets, and left behind repair guides in English and Creole for use by the building owners. However, as the majority were uninsured, their bigger challenge was finding the money for repairs as well as the availability of construction materials.

Architects, with their knowledge and expertise of building structures and infrastructure safety, combined with the support and coordination provided by NGOs, are uniquely positioned to play a vital role in post-disaster recovery and can greatly contribute to the long-term success of an affected region.

TENT CITY IN LEOGANE HAITI

SOURCE
Rachel Minnery, FAIA
Used with permission.

In-state post-disaster response: San Bruno gas line explosion, 2010

A CASE STUDY BY ROBERT S. GEORGE, FAIA

PHASE
Response

HAZARD TYPE
Explosion

SERVICES
Post-disaster building safety evaluations

COMPENSATION
Volunteer

In the early evening of September 9, 2010, a 30-inch-diameter natural gas line underneath a mature, residential neighborhood in the city of San Bruno, California, exploded without warning. The explosion killed eight people and destroyed 38 houses. The fire following this explosion added to the number of homes destroyed. The fire damage extended to a radius of about 600 feet from the pipeline blast center, mostly spreading in a northeast direction. The fire affected 108 houses—38 of which were destroyed, 17 of which received severe-to-moderate damage, and 53 of which received minor damage.

A few days after the explosion, the chief building official (BO) planned to assemble two teams to reevaluate damaged houses in the fire area. The BO estimated that two teams, each consisting of volunteer building officials from neighboring cities accompanied by an architect, could inspect the unsafe homes in one afternoon.

The teams were escorted to the scene of the explosion and fire by police. The explosion caused so much damage, leveling many homes, that even team members familiar with the area were significantly disoriented. So many houses had been leveled that gathering their bearings took quite a while.

Each team assessed about a dozen houses that afternoon. Structures that have been damaged by an explosion suffer unique kinds of damage, and the inspection environment is substantially different. Explosions break a lot of glass, and they distribute it across the ground, making walking difficult. This explosion occurred under a paved street, and it hurled several large chunks of pavement hundreds of feet. They found a chunk of pavement about the diameter and thickness of an automobile tire on the garage floor of one house. It had flown about 300 feet and penetrated both the roof and first floor of the house.

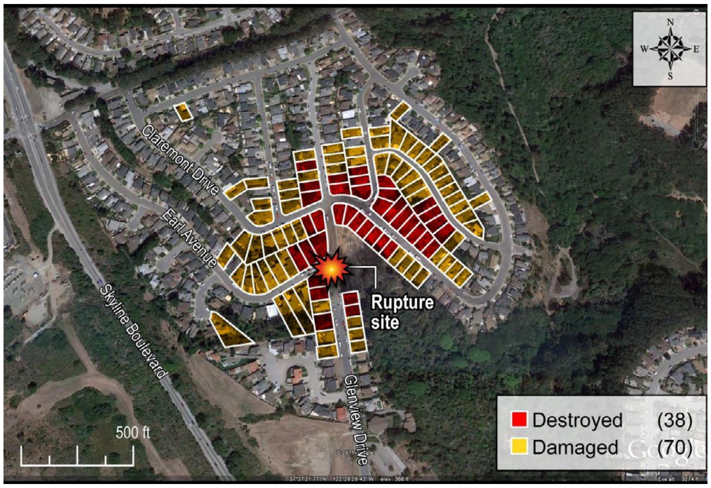
Structural damage to a property is somewhat proportional to its distance from the center of the explosion. Most of the damage was on the side of the house facing the center of the explosion. The houses that had been leveled or burned to the ground had already been appropriately red tagged. The teams were able to change a few Unsafe placards to Restricted Use that afternoon after careful consideration, which allowed residents to enter some or all of the structure to retrieve personal belongings. One additional condition for reentry was that the house had to be reviewed and repaired by a licensed electrician before restoring electrical service. Damage to mechanical and plumbing systems, similar to earthquake damage, was discovered as well.

Lessons learned

» Explosion disaster sites present a unique environment for inspectors that can be very hazardous. Broken glass scattered on the ground can be difficult to see and navigate.

» Evaluators need to wear appropriate shoes and to remain aware of circumstances that could lead to falling.

» As noted in post-disaster building safety evaluation training, placards are not permanent and should be reevaluated as circumstances warrant.



AERIAL IMAGERY AND OVERLAY MAP OF SAN BRUNO GAS LINE EXPLOSION DAMAGE

Explosive blast damage patterns are unique and dependent on the location and direction of the forces released. The fire following this explosion added to the number of homes destroyed. The fire damage extended to a radius of about 600 feet from the pipeline blast center, mostly spreading in a northeast direction. The fire affected 108 houses—38 of which were destroyed, 17 of which received severe-to-moderate damage, and 53 of which received minor damage.

SOURCE

"Pacific Gas and Electric Company Natural Gas Transmission Pipeline Rupture and Fire San Bruno, California, September 9, 2010," National Transportation Safety Board, Accident Report, NTSB/PAR-11/01 PB2011-916501, p. 19. ntsb.gov/investigations/AccidentReports/Reports/PAR1101.pdf

In-state post-disaster response: Tuscaloosa tornado, 2011

A CASE STUDY BY JAMES "BUTCH" GRIMES, AIA

AIA Disaster Assistance Committee member 2012-2015

PHASE
Response

HAZARD TYPE
Tornado

SERVICES
Post-disaster building safety evaluations

COMPENSATION
Volunteer

On April 27, 2011, more than 218 tornadoes were reported nationwide. On that day, two tornadoes passed through the City of Tuscaloosa, Alabama. The first was approximately an EF1 or 2 and though it was a damaging tornado, it was not considered a major problem outside of the impact area. The second left a path of damage more than a mile wide and the funnels stayed on the ground for over 80 miles. Both events were tornadoes, but the difference in scale between the two was tremendous. Most people in Tuscaloosa don't even remember the first storm, but will never forget the second.

Within the City limits, approximately 6,000 structures were damaged or destroyed. Electrical and all above ground utilities in the path were heavily impacted. Search and rescue efforts began immediately and went on through the night and into the following six days. Shelters were opened for the newly homeless and several food kitchens were opened. While these initial community services got up and running, the AIA Alabama sent out requests for members willing to help in assessing damage.

The AIA's State Disaster Assistance Coordinator met with the City of Tuscaloosa's Chief Building Inspector and was told the City needed the AIA's volunteers ready to deploy within the next two weeks or as soon after that as possible. AIA National sent an instructor to perform a special, AIA Safety Assessment Training session to build the cadre of volunteers, resulting in over 200 volunteer architects, engineers, building inspectors, and firemen prepared to respond. The volunteers were later sworn in as special City Building Inspectors and divided into teams. These teams received city provided badges, hard hats, reflector vests, hammers, duct tape, flashlights, and maps of the areas to be assessed. Volunteers used their own vehicles to approach the areas of damage.

In the course of five days, all 6,000 structures within the city limits were photographed, surveyed, and entered into the Inspection Departments' computer database—at least two weeks ahead of schedule.

Lessons learned

Be prepared: It's too late to exchange business cards after a disaster happens. Several years prior to the tornadoes of April 2011, AIA Alabama created an Emergency Response program. Strong relationships must be formed before a disaster occurs. If the local Emergency Management Agency (EMA) Director had not known and trained with AIA Alabama it is highly unlikely that he would have recommended AIA for this critical job. Similar offers of service to other Alabama cities and counties were rebuffed mostly because AIA was not as well known to their EMA personnel. By 2010 Alabama had approximately 40 architects and engineers trained. The AIA Alabama's State Disaster Assistance Coordinator lived in Tuscaloosa and coordinated with the Alabama State EMA Department. In the process, he met and shared information on Alabama EMA procedures and training opportunities with the local Tuscaloosa County EMA Director. This relationship dated back to before 2008 and was a critical factor in allowing architects to assist in the 2011 disaster.

Learning from disaster: Tornado effects vary by terrain and distance to the center. While the direct forces of EF4 or 5 tornados are hard for any structure to resist, much of that force was found at the center of the tornado path. Aftermath research has shown that as many as two thirds of the structures in the Tuscaloosa tornado's path received forces that were EF3 or less. That is around 4,000 buildings out of the 6,000 that were lost or damaged. In fact, with better construction standards many of those buildings could have been saved or had limited damage from the EF3 forces. Better construction standards would have saved lives and buildings.

In particular, the loss of a roof is devastating to a building. Roofs that were lightly attached blew away at relatively low wind speeds. The remaining, unsupported walls were left to collapse. When walls were sturdy, weak doors, windows and garage doors would fail and the resulting gust would lift and tear away roofs. The shape of buildings and roofs also affects their resistance to damage. As research has shown, structurally connecting the foundation through the walls and to the roof saves buildings.

Similar to the water borne debris produced by floods, tsunamis, or hurricanes, tornadoes provide their greatest blows to structures with wind borne debris. In all these cases, it is hard to plan a secure safe structure when it can be attacked by horizontal loads from big pieces of poorly built neighboring structures. Therefore, good disaster resistance needs to factor in the nearby natural and manmade features. This means that proper community planning and minimum standards for disaster design are truly necessary and good for everyone.

There is no time like disaster time. The time in the media spotlight after a disaster is a very short period. Be ready with a plan because funding and public attention disappear quickly. It took AIA Alabama years to find and train 40 volunteers. A week after the disaster, nearly 200 more arrived for training. It took six years of work to get a very restrictive Good Samaritan bill through the state legislature. Three weeks after the April 2011 tornadoes, the legislature expanded the bill and extended the window of service.

In-state post-disaster response: Hurricane Laura, 2020

A CASE STUDY BY

DARBY B. CLARKE, AIA, AIA Louisiana Disaster Assistance Team member

KATHLEEN GORDON, ASSOC. AIA, AIA Louisiana executive director and AIA Disaster Assistance Committee member 2017–2019

PHASE
Response

HAZARD TYPE
Extreme heat, flood, hurricane, environmental pollution, fire, infrastructure failure, pandemic, power outage, urban flooding

SERVICES
Post-disaster building safety evaluations

COMPENSATION
Volunteer, reimbursables only

On August 27, 2020, Hurricane Laura made landfall as a Category 4 storm. Laura tied with the 1865 “Last Island” hurricane as the strongest hurricane on record to make landfall in the state of Louisiana. The damage sustained to the area was devastating. Steel-framed buildings were twisted, a communications tower collapsed, and the National Weather Service’s radar dome and equipment in Lake Charles were destroyed. Nearly a million people were without utilities for nearly a month after the storm…all amid the uncertainty of the COVID-19 pandemic.

AIA Louisiana had been working on a memorandum of understanding (MOU) with the state fire marshal for approximately two years prior to Laura. The MOU was signed just before landfall thus providing efficiency to the deployment and engagement efforts. This deepened the “toolbox” available to the state in assisting communities to get back on their feet sooner as well as providing aid to contribute to the state’s cost share or matching funds needed for various federal funding awards.

The AIA Louisiana chapter was asked by the state fire marshal’s office to deploy Safety Assessment Program-trained architects. An in-person (and socially distant) deployment briefing was held, and volunteers were asked to be available after the upcoming Labor Day weekend. Nearly everyone asked to immediately help: The volunteers asked if they could respond that afternoon instead of waiting, and after a quick call to the command center in Lake Charles, an immediate deployment was approved. The fire marshal handed out iPads and registered the evaluators with the state GIS recovery system. Teams were assembled, deputized, and drove to Lake Charles from Baton Rouge.

The architects were split up and assigned to units of five to six people, consisting mostly of young fire fighters and an armed supervisor. The team was asked to focus on documenting whether the electrical service entry was damaged to ensure that any such damage was corrected prior to powering the grid as well as identifying structures that were unsafe for habitation. They were asked to assess

HURRICANE LAURA POST-DISASTER BUILDING SAFETY EVALUATORS
Volunteers observed COVID-19 protocols during their pre-deployment briefing.

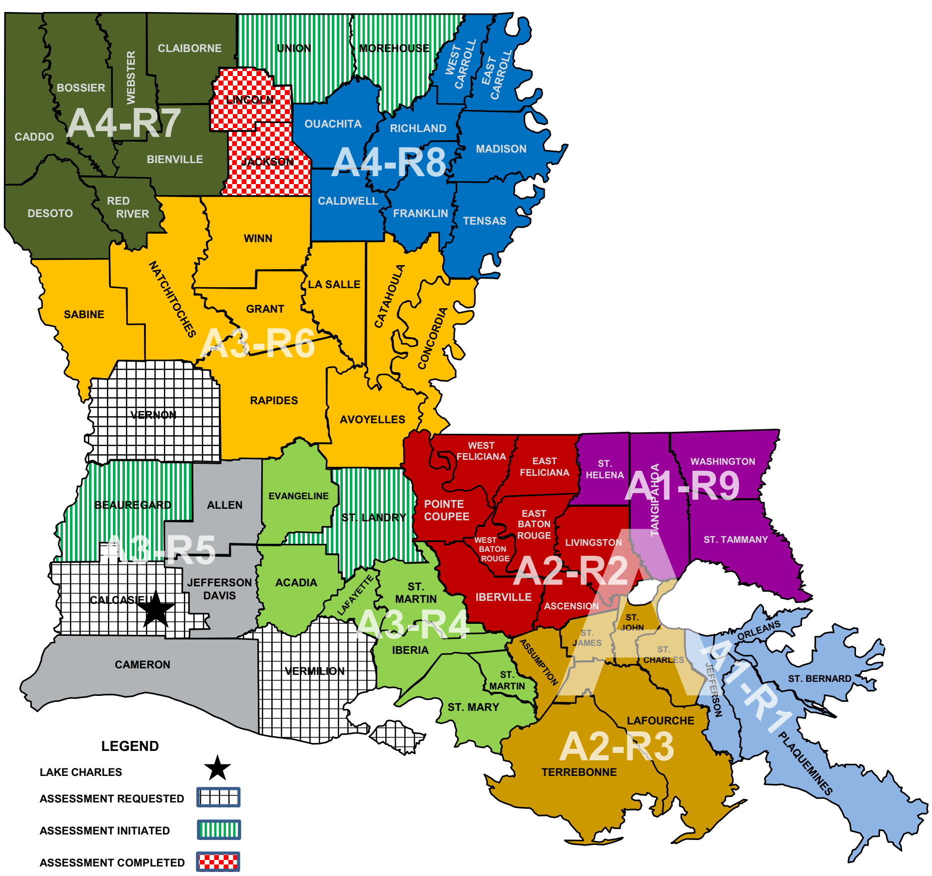
SOURCE
Kathleen Gordon, Assoc. AIA. Used with permission.

In-state post-disaster response: Hurricane Laura, 2020 (continued)

and tag every structure within a neighborhood or housing complex and upload photos and notes to the statewide GIS network. The technology provided made tagging and documenting more efficient than the traditional paper-based format. Using either a state-issued iPad or a smartphone, evaluators could quickly and effectively assess, note, document, and upload information to the state GIS network. Most of the dwellings/structures in an area were similarly affected, and the apps had a memory function to help expedite input. The technology ensured that there was no duplication of effort and minimized administration, dispatching, and coordination. After completing an area, the teams were dispatched to the next area to do it again.

The AIA volunteers were additional boots on the ground helping to cover a massive area. Their experience as licensed architects combined with AIA SAP training gave them the ability to conduct building assessments, and, importantly, the MOU with the Office of the State Fire Marshal allowed them to more quickly deploy and more effectively start helping with the response effort.

The AIA volunteers helped close the gap on untagged buildings. Statewide it was estimated that over 89,000 residential and commercial buildings were impacted by the hurricane. Over several weeks the 14 AIA SAP-trained volunteers evaluated and posted hundreds of these structures.



STRUCTURAL ASSESSMENT STATUS MAP

Structural Assessment Status Map for Hurricane Laura as of 9/3/2020

SOURCE

Louisiana Office of the State Fire Marshal. Used with permission.

In-state post-disaster response: Peabody flood, 2021

A CASE STUDY BY WILLIAM ROBARGE, AIA

AIA Disaster Assistance Committee member 2020–2021

PHASE
Response

HAZARD TYPE
Flood

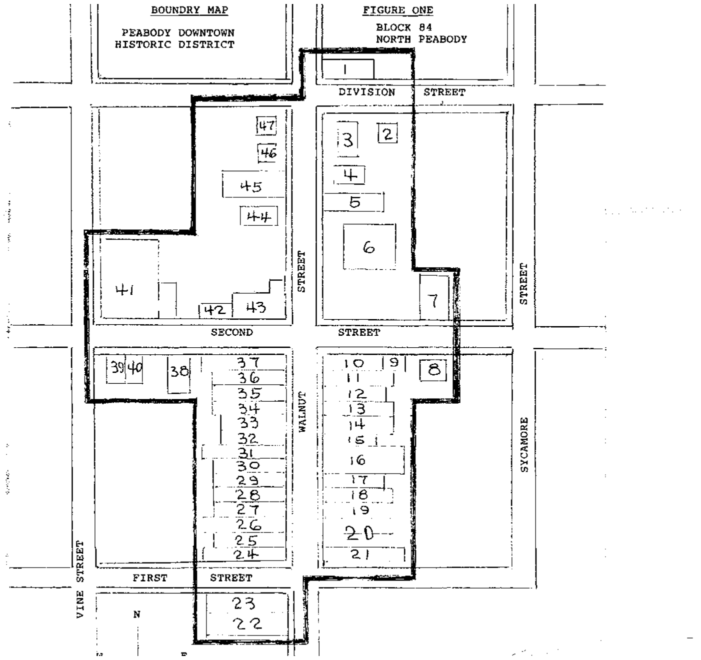
SERVICES
Post-disaster building safety evaluations

COMPENSATION
Volunteer

During the late night hours of June 21 and into the early morning of June 22, 2021, severe thunderstorms tracked over Marion County, Kansas, including the town of Peabody, delivering between five and eight inches of rainfall and leading to significant flash flooding. Weather spotters reported winds upward of 60 mph, which contributed to tree and building damage across the area. Overnight, emergency management officials reported water entering homes and commercial buildings in downtown Peabody, at which time police went door to door requesting a voluntary evacuation of residents.

A week later, the AIA Kansas Disaster Assessment Team was contacted by the Marion County emergency manager with a request for assistance in evaluating damage to historic downtown Peabody.[1] The 1880s-era buildings of downtown Peabody are registered on the Kansas State and National Register of Historic Places. In response to Marion County's request, a call was issued to AIA Kansas' roster of SAP-trained volunteers, soliciting volunteers with historic preservation project experience. AIA Kansas had offered SAP training for many years and had therefore established a diverse group of trained volunteers, enabling the chapter to meet the specific historic property evaluation needs of Marion County.

The assembled team included architects; building inspectors; a fire inspector from the neighboring town of Hillsboro, Kansas; and historic preservation specialists. The team gathered at the command and deployment center of operations, also known as the Marion County Fourth Fire District's Peabody Fire Department Station. The lead coordinator performed a pre-briefing addressing the area boundaries for the assessments, specific hazards of note,



PEABODY HISTORIC DISTRICT MAP

Map of the Peabody Historic District, as submitted on the National Register of Historic Places Registration Form to the U.S. Department of the Interior, National Park Service, 1998

SOURCE

National Park Service, npgallery.nps.gov/NRHP/GetAsset/NRHP/98000590_text

FLASH FLOOD WATERS IN PEABODY

Flash flooding inundated the historic downtown of Peabody as well as the surrounding area. View toward the intersection of Walnut and First Streets.

SOURCE

National Weather Service, weather.gov/ict/event_2019peabodyflood

[1] This case study is an example of a pro bono effort to assist a small community of just over 1,200 people. The Peabody National Historic District constitutes a cultural resource for the town.

In-state post-disaster response: Peabody flood, 2021 (continued)

and access points to each building. After the briefing, two teams were established, each consisting of an architect, a building inspector, and a historic preservation specialist.

A total of 14 buildings were assessed; of these, 13 were historic with construction methods consisting of limestone basement and party walls, limestone parapets, wood framing, and lath and plaster interiors. The water had completely flooded the basements. In a few instances the limestone walls showed locations that were starting to fail, and one had already buckled. Rainwater had pooled on the roofs of two buildings, leading to the collapse of the limestone parapet wall between them as well as the partial collapse of their roof/ceiling assemblies. The basement of one of the buildings was still flooded. As a result, the water was actively migrating through the shared basement limestone wall into the neighbor's basement. Mold growth had started on the walls above the water level in the basement. Throughout the evaluations, great care was taken when deciding where/how to post placards on these buildings so as to limit any further damage.

OBSERVED DAMAGE
Flood damage to a historic property in Peabody, Kansas

SOURCE
William Robarge, AIA. Used with permission.

Community recovery: Greensburg, Kansas, 2007

A CASE STUDY BY AVA CHRISTIE, AIA, AND TRUDY ARON, HON. AIA

2017-2019 Disaster Assistance Committee member and former executive director of AIA Kansas

PHASE
Recovery

HAZARD TYPE
Tornado

SERVICES
- Community planning
- Stakeholder engagement
- Public/community information event or resource(s)

COMPENSATION
Grant, volunteer

In 2007, a colossal EF5 tornado devastated the town of Greensburg, Kansas, destroying 95 percent of the town's existing buildings and infrastructure. Kansas architects where there to aid not only in the initial response phase, but throughout recovery; helping Greensburg to emerge safer, healthier, and greener.

The AIA Kansas / Heart of America Chapter of the International Codes Council collaboration as the Kansas Disaster Assessment Team (KDAT) received a request from the Kansas emergency management agency that assessment teams were needed immediately in Greensburg to do on-site assessments of buildings and other structures. A number of teams were assembled to execute according to protocol but the destruction was so severe that few buildings remained standing, let alone habitable.

Less than a week after the storm, the Governor announced that AIA would be helping Greensburg recover and that her hope was that a vibrant sustainable town would emerge. AIA Kansas had received a grant from AIA National for a community outreach program to celebrate AIA's 150th Anniversary. A $10,000 grant went to the Kansas Design Team to help small communities address community problems requiring a strategic planning process. As AIA Kansas had not yet selected a city to help, Greensburg became the obvious choice.

AIA Kansas convened a meeting of the KDAT with state and federal agencies to explore ways to assist Greensburg. At the request of the Greensburg mayor, AIA discussed sustainable design: what it is and how you get it. A number of public events centered on sustainable design quickly followed; including a Green Fair. Architects and product vendors attended to help residents understand options for rebuilding their homes and city.

During the Green Fair tradeshow, AIA Kansas leaders met with the Greensburg Mayor, City Administrator, School District Administrator, FEMA Recovery Team, USDA Rural Development, DOE and EPA administrators and became a formal part of the Green Sector Team. As a team member, AIA Kansas advised on the rebuilding of local schools and assisted with planning community workshops (charrettes) to develop the framework for Greensburg's Long Term Recovery Plan.

In support of the Long Term Recovery Plan, AIA Kansas planned a Resource Fair to provide information on rebuilding Greensburg as a healthy, energy efficient, affordable community. The Resource Fair included a variety of seminars provided by the National Renewable Energy Labs (NREL) on green design for home and business owners as well as home builders and trades. AIA Kansas hosted one-on-one discussions between architects with home and business owners to answer questions on topics from building codes and regulations to how to build green.

The success of the Resource Fair led to another fair that featured four areas of education: Finance / Credit Counseling; Home Buyer Education; Home Builder and Trade Education; and Energy and Green Design. The education sessions were presented by experts in each field and exhibits included vendors as well as federal and state agencies and professional and trade associations. Also, AIA Kansas again provided one-on-one consultations with architects for home and business owners.

Greensburg continued the momentum of these events by forming the nonprofit Greensburg GreenTown to spearhead the City's green efforts and the commitment to rebuilding all public buildings at the LEED platinum level.

These collective efforts had a successful result as more than 50 percent of Greensburg residents returned and rebuilt their homes and businesses. More than half of the rebuilt homes were designed to use 40 percent less energy than the average home before the disaster occurred and many included hazard mitigation design strategies. For example, the town's Eco Silo Home was designed to be energy efficient and capable of withstanding future tornado winds of up to 200 mph.

Architects involved in the response and recovery from the Greensburg disaster made contributions to advancing relevant issues such as wind damage resistance and community sustainability within the town's public infrastructure, housing, code and zoning ordinances, and design. The outcome in Greensburg has acted as a model for community involvement in disaster assistance to enable resilience and long-term community recovery.

Policy and advocacy: AIA New York's Post-Sandy Initiative, 2012

A CASE STUDY BY AIA NY DESIGN FOR RISK AND RECONSTRUCTION COMMITTEE

PHASE
Recovery

HAZARD TYPE
Hurricane

SERVICES
Policy or advocacy initiative

COMPENSATION
Volunteer

Following Hurricane Sandy, AIA New York and AIA New York's Design for Risk and Reconstruction Committee (DfRR) initiated a collaboration between a wide range of professional organizations and concerned individuals to inform a variety of local, regional, state, and national public agency efforts regarding how to build back better. The Post-Sandy Initiative convened working groups to focus on several areas key to resilience, including:

» transportation and infrastructure

» housing

» critical and commercial building

» codes, zoning, and waterfront

Over 150 professionals gave their time to explore important issues about the emergency planning for and response to Sandy, both in terms of short-term recovery efforts and long-term resilience. Their contributions form the basis of the Post-Sandy Initiative Report, released on May 1, 2013 with a corresponding exhibit. The effort informed several recommendations, guidelines, and reports for the city and region including NYC's Retrofitting Buildings for Flood Risk and PlaNYC, a Special Initiative for Rebuilding and Resiliency. Recommendations were made for several regulations including NYC's building code and zoning resolutions, as well as FEMA flood regulations. Much of the post-flood recovery technical guidance to date was not intended for dense urban settings and would need to be updated to the construction types and land use practices of the nation's largest city. FEMA's policies included, for example, evacuation of threatened areas before floods occur to minimize risk especially to first responders. This may not always be possible in a dense urban environment. It is important in a flood event that those who do not follow government orders, for whatever reason, have a way to get out of their buildings and to safety during a flood.

Instituted recommendations included:

» permit handicapped lifts in flood zones

» wet floodproofed buildings should have an emergency exit at the first floor above flood elevation

» allow block-wide or neighborhood-wide floodproofing as an alternative to floodproofing individual buildings

» dry floodproofing of non-residential lobbies

POST-SANDY INITIATIVE
In response to Hurricane Sandy, the American Institute of Architects New York spearheaded a collaborative initiative investigating issues and outlining options and opportunities to address the short-, intermediate-, and long-term impacts of the storm and the escalating effects of climate change on New York City.

SOURCE
AIA NY Design for Risk and Reconstruction Committee

Regional recovery team: New York, New Jersey, and Connecticut, 2012

A CASE STUDY BY JUSTIN MIHALIK, AIA, AND ILLYA AZAROFF, AIA

Co-Founders of the AIA's Regional Recovery Working Group

PHASE
Recovery

HAZARD TYPE
Hurricane

SERVICES
Policy or advocacy initiative

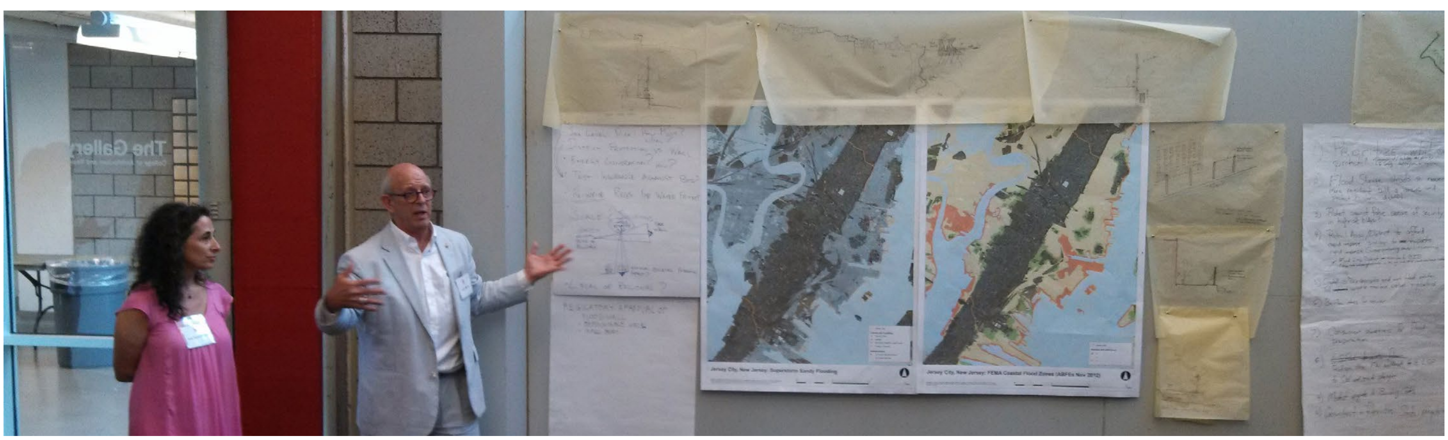
COMPENSATION
Volunteer

After Hurricane Sandy hit the East Coast in 2012, there were a total of 24 states damaged by the storm, including New York, New Jersey, Connecticut, and Rhode Island. Collectively, the four states faced 80 billion dollars in property damage, with 650,000 affected buildings, displaced communities, and a great degree of uncertainty.

In response, leaders from state and local AIA chapters of New York, New Jersey, Connecticut, and Rhode Island assembled at the AIA GrassRoots conference. Quickly recognizing the potential of a broad network to share recovery strategies and produce thorough results that supersede traditional state lines and governing bodies, the AIA Regional Recovery Working Group (AIARRWG) was formed. The group—comprised of community leaders, public agencies, architects, engineers, planners, and other stakeholders—sought to answer questions of temporality, resiliency, and adaptability that would enable a rapid recovery and produce resilient communities prepared for the next storm or catastrophic event.

Three initial workshops were held throughout the region, which covered the effects of Sandy on urban communities, Old Westbury Long Island coastal communities, and critical buildings, infrastructure, and transportation. All of the workshops included roundtable discussions and charrette-styled workgroups that developed tools for resiliency. Participants included federal, state, and local governing bodies, FEMA, planning agencies, code enforcement officials, insurance providers, allied professionals, the Department of Homeland Security, the Department of Health and Human Services, universities, community groups, and architect leaders.

As a result, more support was gained for an ultimate passage of Good Samaritan legislation in New Jersey, a mayors' summit on resiliency at the municipal scale was held, and numerous codes and practice changes were adopted by governing bodies. Additionally, there are now more than 400 Safety Assessment Program certified professionals in the New York and New Jersey area available to respond if such a disaster were to occur in the future. The AIARRWG continues to promote a culture of collaboration by conducting training, advocating for the inclusion of architects in post-disaster mitigation efforts, and promoting positive change for the region.



Lance Jay Brown, FAIA, Amy Schwartzman advisor to FEMA, and team presenting their Flood Resiliency and hardening design options at the first AIA Regional Recovery Working Group session at NJIT.

SOURCE
Justin A. Mihalik, AIA. Used with permission.

Technical assistance: Sandy Design Help Desk, 2012

A CASE STUDY BY RACHEL MINNERY, FAIA

Disaster Assistance Committee Chair 2008-2012 |

Disaster Assistance Committee member 2006-2007

PHASE
Recovery

HAZARD TYPE
Hurricane

SERVICES
Technical assistance

COMPENSATION
Volunteer

The Sandy Design Help Desk was a recovery program created by a partnership of Enterprise Community Partners, Pratt Center, the AIA New York chapter, and the former Architecture for Humanity. The NYC neighborhood-based "open house" made free design and technical consultation available to residents and property owners recovering from Hurricane Sandy. The program engaged specially-trained volunteer architects and designers to guide homeowners through the complexities of recovery decisions including data on base flood elevations, building elevation requirements, implications of the expanded 100-year flood zone, safe locations for electrical and mechanical equipment, and flood proofing techniques of ground floors as applicable to their buildings. The Sandy Design Help Desk provided homeowners in a number of neighborhoods throughout the city with the pertinent resources and information to enable them to make the best repair and rebuilding decisions and obtain financial assistance.

AIA architects and other associated professionals offered free one-on-one consultations to those in need through the Sandy Help Desk on several key recovery areas, including:

» design and technical assistance

» insurance requirements

» mortgage and financial information and guidance

» new post-Sandy building codes and zoning requirements

» flood-resistant construction

Architects and design professionals answer residents' rebuilding questions after Hurricane Sandy.

SOURCE
Rachel Minnery, FAIA. Used with permission.

Community recovery: Sonoma County fires, 2017

A CASE STUDY BY JULIA DONOHO, AIA

PHASE
Recovery

HAZARD TYPE
Wildfire

SERVICES
- Public/community information event or resource(s)
- Policy initiative or advocacy
- Technical assistance

COMPENSATION
Volunteer

In October 2017, Sonoma County, California, suffered a wildfire that invaded the heart of the community of Santa Rosa. A total of 5,636 properties had structures that were destroyed. An additional 317 properties suffered partial damages to their structures. Most notably, several large subdivisions of workforce housing were completely destroyed.

The AIA Redwood Empire Chapter (AIARE) leadership immediately met to determine what resources could be provided. AIARE and members of the AIA San Francisco (AIASF) and AIA East Bay (AIAEB) chapters began by participating in the Local Assistance Center (LAC), which provides information on available services for individuals and businesses displaced by the hazard event, including replacement of personal documents, property information, and registration for FEMA and other state program assistance. For three weeks after the fire, architects volunteered their time to counsel homeowners on the rebuilding process at the LAC.

Additionally, AIARE created a Firestorm Recovery Committee (FRC) with participants from neighboring AIA chapters. During the recovery phase, the FRC engaged with a wide range of recovery actions in the community and with other professional colleagues. In total, the AIARE FRC stood up seven subcommittees that accomplished the following:

1. **Fire-resilient rebuilding** — Sponsored lunch-and-learns and seminars for design professionals that explored materials and methods that are resistive to wildfire.

2. **FRC advocacy project** — Engaged with the community by assisting politicians who advanced legislation that provided homeowners 36 months to rebuild in a declared disaster and allowed them to aggregate certain insurance policy provisions.[1]

3. **Community outreach** — Sponsored various events to engage the community, including a two-day Homeowner Workshop and multiple block captain group presentations, and assisted with two Rebuild Green Expos.

4. **Housing and ADU Committee** — Led changes in fees and regulations regarding development of accessory dwelling units (ADUs), becoming a model for the state. This committee, together with other community business organizations, spawned a new organization called Homes for Sonoma[2] to create an ADU in a box. Designed by local architects, it could be deployed in any California community, and beyond, and includes plans and a material list. They raised over $2,500,000 to build homes.

5. **Professional Knowledge Committee** — Presented various educational events to understand the performance attributes of heat-affected concrete and wildfire impacts on sites. Together with local engineers, they advocated for guidance to limit FEMA debris removal on sites with retaining walls and deep foundations.

6. **Sustainability project** — Coordinated with the Rebuild Green Expo to advocate for use of sustainable materials and methods for rebuilding.

7. **Sheltering and Temporary Essential Power (STEP) permitting** — Collaborated with building officials and engineers weekly to create streamlined permitting processes and bring professional concerns to AHJs.

8. **Whole neighborhood rebuilding** — Advocated for design and construction activities focused on helping the maximum number of people rebuild in developed subdivisions. Thirty-three months after the fire, 2,480 homes had been completed and 1,697 were under construction, with 4,177 permits issued. Mark West Estates (an HOA) has an 87% success rate, Coffey Park 80%, and rural areas 20-40%. Overall, the county has a 70-75% success rate at three years, far exceeding the national statistic of 25% at five years.[3]

The rebuilding continues, but the efforts in Sonoma County can serve as a model for recovery and an inspiration. “FEMA hasn’t seen recovery numbers like we’ve had anywhere,” said David Guhin, a Santa Rosa assistant city manager.[4]

1 “Governor signs five more Commissioner-sponsored bills to protect wildfire survivors,” California Department of Insurance, September 21, 2018. insurance.ca.gov/0400-news/0100-press-releases/2018/release117-18.cfm

2 Homes for Sonoma is a nonprofit developer creating quality workforce housing options that support a safe and sustainable community. homesforsonoma.org/

3 City of Santa Rosa and County of Sonoma Building websites

4 Guy Kovner, “Sonoma County rebuilds two-thirds of homes lost in 2017 wildfires,” The Press Democrat, June 27, 2020. pressdemocrat.com/article/special-sections/sonoma-county-rebuilds-two-thirds-of-homes-lost-in-2017-wildfires/

Community recovery: Thomas Fire and Montecito debris flow, 2018

A CASE STUDY BY ROBERT L. OOLEY, FAIA

PHASE
Recovery

HAZARD TYPE
Fire and debris flow

SERVICES
» Policy initiative or advocacy
» Stakeholder engagement
» Technical assistance
» Public/community information event or resource(s)

COMPENSATION
Volunteer

In late 2017 the Thomas Fire ignited. Over the course of several months, it burned over 400 square miles. The fire destroyed 1,063 structures and damaged 280 more. In addition to burning homes and businesses, the fire also destroyed large amounts of vegetation whose roots had helped stabilize the topsoil on the hillsides. Before the fire was out, the weather changed; a strong low-pressure system and cold front developed off the coast of California on January 5, 2018, bringing with it heavy rains.

As the system moved inland, mandatory evacuations for parts of Los Angeles, Santa Barbara, and Ventura counties were ordered due to fears of mudslides. Almost four inches of rain fell in two days, drenching the exposed earth. The water from the storm caused flows of mud and boulders from the fire-ravaged Santa Ynez Mountains to flow downward toward inhabited areas. Mud flows became debris flows that were up to 15 feet in height as mud, boulders, trees, and eventually cars, houses, and public infrastructure, moving at estimated speeds of 20 miles per hour, cascaded into the lower areas of Montecito.

GEOLOGICAL SURVEY WORKERS IN FRONT OF DESTROYED HOUSE
U.S. Geological Survey workers are deployed to Santa Barbara County to support geohazard assessment.

SOURCE
Jason Kean/USGS. See image 4 of 6 in the gallery after the section “Real-time Techniques Help to Monitor Hazards,” usgs.gov/news/usgs-geologists-join-efforts-montecito-assess-debris-flow-aftermath

On January 17 Santa Barbara County opened a Local Recovery and Assistance Center (LRAC) to serve as a centralized, single-point location for essential resources and services to help community members recover and rebuild. A number of local private sector organizations were invited to participate in the LRAC, including the American Institute of Architects-Santa Barbara Chapter (AIA|SB).

On January 19 AIA|SB conducted a Safety Assessment Program (SAP) training with the California Office of Emergency Management, and the next day the class was invited to tour the activated Emergency Operations Center (EOC). This meeting led to the formation of a multidisciplinary team of professionals—the Community Recovery Team (CRT). The CRT Steering Committee was comprised of county planning and development (P&D) executives and AIA|SB members. Through the CRT and AIA Santa Barbara, local architects advised local government agencies regarding opportunities for expediting their permitting and the rebuilding process, assisting the local county government in rebuilding the community in a more resilient way.

To expediate the permitting process, AIA|SB provided access to its archive (since 1975) of Santa Barbara County-permitted construction development drawings. AIA|SB CRT delivered to the P&D an image of each drawing that correlated to permit numbers. This information aided the P&D staff in the approval process for reconstruction requests.

To assist with the rebuilding process, the CRT focused on the location of rebuilt houses, creek management, and public outreach. The CRT held two public workshops and met with affected property owners, county staff, and elected officials to offer resilient design concepts to residents, property owners, and permitting officials. The CRT proposed a consolidation of property with a concentration of new buildings to replace those damaged. This strategy did not gain much support with the property owners. Relocating to higher ground or more inland sites was also not practical. After consideration of these options, a single strategy emerged: rebuilding on the same site.

Community recovery: Thomas Fire and Montecito debris flow, 2018 (continued)

Other recommendations included:

- Siting new structures to be parallel to the flow of the creek as a more resilient solution.
- Designing the upstream side of the structure to deflect oncoming debris so that the structure stood a much better chance of remaining functional after the event.
- Using the millions of tons of soil the area received to create barriers to protect affected homes and businesses from flood or debris flows in the future.
- Using raised foundation systems comprised of concrete caissons for vulnerable buildings. This allows the spaces between the supporting caissons to be designed to break away during flooding or debris flows.
- Complying with the requirement that structures that were damaged or destroyed were to be erected two feet above the new floodplain elevation.

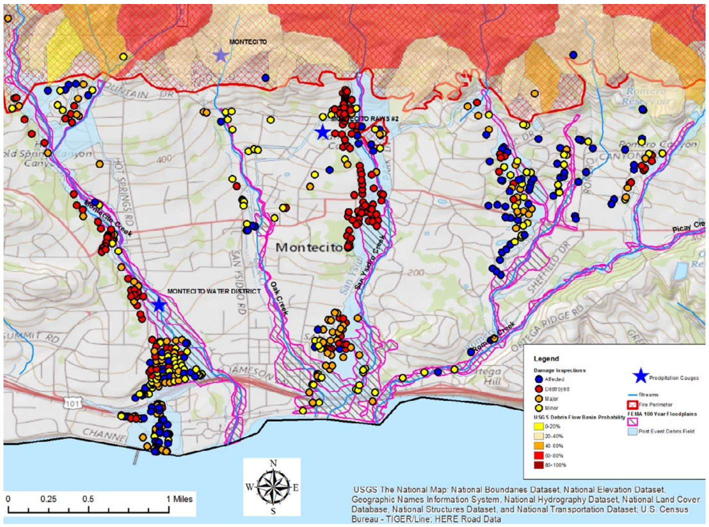
Additionally, architects led multidisciplinary teams to address the hardest hit “micro neighborhoods.” A CRT Area Team connected with all of the residents in a given micro neighborhood and began working with that area in recovery planning and execution.

For many of the affected property owners the existing codes would not allow them to rebuild or to make improvements that did not match what was on the land before the disasters.

A major difference with a debris flow is that the terrain levels can change dramatically; where once there was a creek, there is now filled-in land, and where there was once solid ground, now there is a creek. The prior ordinance, which allowed for rebuilding in a “like-for-like” manner, no longer worked as the mud flows had dramatically changed ground conditions and drainage patterns.

Members of AIA|SB provided valuable input into redrafting local ordinances to cope with the new unique situation. Rewriting the emergency “rebuild ordinance” allowed for relocation of destroyed or damaged houses away from water drainage courses. AIA|SB CRT mobilized to persuade county leadership to adopt the proposed revisions to the “like-for-like” zoning and design review rules. The “special ordinance” was adopted by the Board of Supervisors within five months, allowing residents to rebuild more safely.

The AIA|SB CRT is a highly scalable model. It began as a small team of government officials and design professionals (in this case six people), and as issues or topics arose, a subject matter expert was added. Ultimately, the CRT grew to over 70 subject matter experts. The collaboration between the various subject matter experts remained fluid and self-driven. A dynamic combination of subject matter experts self-formed around the needs of a micro neighborhood or individual property owner. This model allowed AIA|SB to work alongside government officials to help in the recovery, apply design thinking to guide rebuilding efforts, and support local officials in the recovery process.



JANUARY 9, 2018, MONTECITO, CALIFORNIA, DEBRIS FLOW MAP

The mapped debris field (light blue), the 100-year floodplain (pink hatching), the Thomas Fire perimeter (solid red line with red hatching), and the locations of affected and damaged properties (colored circles). The damaged properties are along and adjacent to the stream channels.

SOURCE

arcgis.com/sharing/rest/content/items/541c23aa483b48978d1bc9904a6fb14d/resources/LOX_Montecito_DebrisFlow_Jan92018_GIS_Layers_ver2__1523993114265__w1500.png

Re-occupancy guidance: COVID-19, 2020

A CASE STUDY BY THE 2020 AIA DISASTER ASSISTANCE COMMITTEE AND KNOWLEDGE COMMUNITIES

PHASE
Recovery

HAZARD TYPE
Pandemic

SERVICES
Technical assistance

COMPENSATION
Volunteer

After the first cases of COVID-19 were diagnosed in December 2019, an unprecedented number of daily lifestyle changes and changes to the built environment were necessary to reduce the likelihood of disease transmission in the U.S. Physical distancing requirements forced the cancelation of all school activities, transitioning children and young adults to learn from home. Many commercial office buildings were abruptly closed, pushing workers into home office environments. Nonessential businesses were closed to avoid unnecessary gatherings of people, impacting restaurants and bars, shopping malls, and entertainment and sport venues. Additionally, public amenity spaces in many multifamily or senior living units were closed or restricted to avoid exposure to the virus. To assist building owners and operators and those designing buildings in navigating evolving health and safety protocols, including occupancy guidelines on physical distancing and the removal of virus droplets, AIA provided a number of guidance documents throughout 2020.

In the immediate response phase to COVID-19, architects mobilized and created a tool for evaluating alternative care sites for patient care surge capacity. Meanwhile, essential facilities like grocery stores embraced temporary design interventions, including one-way directional aisles, plexiglass barriers at cashier registers, and myriad forms of signage to promote physical distancing. Many of these built environmental actions were an impromptu response. Environmental science terms this the "precautionary principle," in which measures are taken to reduce the threat of harm to human health even in the absence of scientific evidence. The AIA Disaster Assistance Committee, recognizing that the growing COVID-19 pandemic was indeed a disaster, built on the alternative care site assessment tool to help building owners and operators move beyond this impromptu response and implement a strategic set of strategies based on the CDC's Hierarchy of Controls. The result, the Re-occupancy Assessment Tool, provided a framework of strategies for reoccupying buildings. This tool was adopted by the U.S. Green Building Council (USGBC) as the basis for one of the USGBC's LEED "Safety First: Re-enter Your Workspace" pilot credits.

The Re-occupancy Assessment Tool also formed the foundation for a series of workshops that engaged architects, engineers, facility managers, public and environmental health experts, and epidemiologists. The AIA multidisciplinary team conducted virtual charrette workshops to develop strategies that reduce the risk of virus transmission in buildings. Typically, charrettes include easels and large white pads for sketching and note taking; however, this pandemic required new virtual collaboration methodologies. In an online meeting platform with presentation, webcam, and "white board" capabilities, the charettes focused on retail, restaurants, offices, schools, multiunit dwellings, and senior care facilities—all of which have unique requirements and considerations. Outcomes from the charettes included a Risk Management Plan for design firms to utilize with building owners and operators when developing design solutions for building re-occupancy, an interactive map of COVID-19 response and recovery case studies for continued learning, and a series of building-specific reports with guidance for safer office buildings, schools, retail stores, senior living communities, multifamily housing, and polling places.

Community recovery: Santa Cruz County fires, 2020

A CASE STUDY BY KATHARINE RHEIN, INTL. ASSOC. AIA

PHASE
Recovery

HAZARD TYPE
Wildfire

SERVICES
- Public/community information event or resource(s)
- Technical assistance

COMPENSATION
Volunteer

On August 16, 2020, a series of dry lightning strikes started several severe wildfires across Northern and Central California. The fires impacted San Mateo and Santa Cruz counties, burning 86,509 acres before being contained on September 22. The fire destroyed 928 residences, 174 commercial properties, and 388 accessory structures and damaged another 50 buildings. The main impacted areas were in the Santa Cruz mountains, including Bonny Doon, Boulder Creek, and Empire Grade.

Typically, community outreach post-fire would include architectural workshops and booths at Recovery Resource Centers, but these engagement methods were limited to governmental organizations only due to the COVID-19 pandemic. With limited face-to-face outreach opportunities, AIA Santa Cruz pivoted to a virtual hotline where several local licensed architects offered pro bono architectural consultations for homeowners who needed assistance throughout the month of October. The service was promoted through social media, by email and flyers, and via referrals from the county supervisor and County Planning Department. Homeowners were sent a link to an application form, which requested information about their project as well as a waiver. The architects on the Rebuild Santa Cruz Design Team then scheduled time to meet with each homeowner and respond to their questions.

The response from homeowners was heartwarming. They were extremely appreciative of the effort and made the architects volunteering their time feel that they made a real difference. The virtual service was extremely successful and potentially reached more people than the in-person service. Not only could more homeowners be served virtually, but more architects were able to volunteer their time as they were able to schedule homeowner meetings that aligned with their availability.

Appendix

Appendix

CONTENTS

A.1 AIA National Committees, Knowledge Communities, and Networks

The following are national engagement opportunities for AIA members available at the time of publication. Local AIA chapters have additional volunteer and engagement opportunities. At AIA National, all members are welcome to participate in AIA's Knowledge Communities and Resilience Network at any time for knowledge sharing and engagement. A call for applications from interested members is released annually for AIA National committees. Contact the listed group to learn more.

» AIA Building Performance Knowledge Community (BPKC): The mission of BPKC is to increase building performance related to occupant comfort and health and to building function, durability, sustainability, and resilience.

» AIA Codes Network: The Codes Network gives members a voice and a role in code development, adoption, and interpretation. The work includes updating and streamlining codes to ensure they protect public health, safety, and welfare and encourage sustainable, high-performance buildings in our communities.

» AIA Committee on the Environment (COTE): COTE is an AIA knowledge community working for architects, allied professionals, and the public to achieve climate action and climate justice through design. COTE believes that design excellence is the foundation of a healthy, sustainable, and equitable future. COTE's work promotes design strategies that empower all AIA members to realize the best social and environmental outcomes with the clients and the communities they serve.

» AIA Disaster Assistance Committee: This group of national experts provides input and advisement for the AIA Disaster Assistance Program, including stewardship of this handbook. To learn more, contact resilience@aia.org.

» AIA Historic Resources Committee (HRC): The mission of the HRC is to identify, understand, and preserve architectural heritage, both nationally and internationally. HRC is engaged in promoting the role of the historic architect within the profession through the development of information and knowledge among members, allied professional organizations, and the public.

» AIA Regional and Urban Design Committee (RUDC): Resilience, climate change, and natural disasters are at the top of many municipalities' watch list. AIA's RUDC helps architecture professionals keep pace with changing conditions and improve regional and urban environments through excellence in design, planning, and public policy.

» AIA Resilience Network: a forum for discussion and resource sharing with fellow AIA members on issues related to hazard mitigation, climate adaption, and community resilience. AIA members can join by filling out the member profile form.

» AIA State Disaster Coordinator Network: This network of designated state disaster assistance coordinators liaise between AIA chapters within the state, state/local emergency management offices, and the AIA Disaster Assistance Committee to promote architect engagement in post-disaster response and the emergency management cycle. To learn more, contact resilience@aia.org.

A.2 AIA chapter committees and initiatives related to disaster assistance

Local chapters often offer the most direct and impactful engagement for AIA members in their communities. Following are state and local engagement opportunities known at the time of publication. Contact the listed chapter to learn more.

A.2.1 AIA disaster assistance and resilience committees

AIA Alaska	State Disaster Assistance Program Committee
AIA Arkansas	Disaster Assistance Committee
AIA Baltimore	COTE+R
AIA California Council	Disaster Assistance and Preparedness Committee + Resilient Design Committee
AIA Dallas/AIA Fort Worth	Disaster Action Committee
AIA DC	Resiliency & Disaster Relief Committee
AIA Honolulu	Design for Risk and Resilience Committee
AIA Illinois	Disaster Recovery Assessment Committee
AIA Iowa	Disaster Assistance Committee
AIA Kansas	Disaster Assessment and Assistance Program
AIA Las Vegas	Disaster Preparedness Committee
AIA Louisiana	COTE
AIA Miami	Resilience & Adaptation Committee and Sea Level Rise Committee
AIA Missouri	Missouri Structural Assessment and Visual Evaluation (SAVE) Coalition
AIA New Hampshire	New Hampshire Architects/Engineers Emergency Response Task Force
AIA New Jersey	Resiliency/Homeland Security Committee
AIA New Mexico	Disaster Assistance Committee
AIA New York	Design for Risk and Reconstruction
AIA Oregon	Resiliency Committee
AIA Pasadena & Foothill	Disaster Preparedness & Resiliency
AIA Pennsylvania	Disaster Assistance Committee
AIA San Fernando Valley	Emergency Preparedness Committee
AIA Seattle	Adaptation & Resilience Committee
AIA South Carolina	Resilience and Disaster Assistance Committee
AIA Tennessee	Tennessee Structural Assessment and Visual Evaluation (SAVE) Coalition
AIA Virginia	Disaster Assistance Committee
AIA West Virginia	Disaster Response Committee
AIA Wisconsin	Disaster Assistance and Preparedness Committee
Boston Society of Architects	Committee on Resilient Environments (CORE)
Massachusetts	Massachusetts Architect & Engineer Disaster Assistance Task Force
Rhode Island	Rhode Island Architects & Engineers Emergency Response Task Force 7

A.2.2 Related AIA committees

AIA Asheville	COTE
AIA Atlanta	COTE
AIA Austin	COTE and RUDC
AIA Baltimore	RUDC
AIA California Council	Climate Action Committee and RUDC
AIA Central New York	COTE
AIA Central Valley	COTE
AIA Chicago	COTE and RUDC
AIA Cincinnati	RUDC
AIA Cleveland	COTE and RUDC
AIA Colorado	COTE and RUDC
AIA Columbus	COTE
AIA Connecticut	COTE
AIA Dallas	COTE
AIA DC	RUDC
AIA Detroit	COTE and RUDC
AIA East Bay	COTE and RUDC
AIA Grand Rapids	COTE
AIA Honolulu	RUDC
AIA Houston	COTE and RUDC
AIA Indianapolis	RUDC
AIA Las Vegas	COTE
AIA Long Beach	COTE
AIA Los Angeles	RUDC
AIA Maine	COTE
AIA Minneapolis	RUDC
AIA Minnesota	COTE
AIA New Hampshire	COTE
AIA New Jersey	COTE
AIA New Mexico	COTE
AIA New York	COTE and RUDC
AIA North Carolina	COTE
AIA Northern Virginia	COTE
AIA Oklahoma City	COTE

A.2.2 Cont'd Related AIA committees

AIA Orange County	COTE
AIA Pennsylvania	COTE
AIA Philadelphia	COTE and RUDC
AIA Pittsburgh	COTE
AIA Portland	COTE and RUDC
AIA San Antonio	COTE and RUDC
AIA San Diego	RUDC
AIA San Francisco	COTE
AIA Seattle	COTE and RUDC
AIA Silicon Valley	COTE
AIA South Bay	COTE
AIA South Carolina	COTE
AIA Southern New York	COTE
AIA Tampa Bay	RUDC
AIA Western MA	COTE
Boston Society of Architects	COTE and RUDC
Texas Society of Architects	RUDC

B.1 State & Local Hazard Mitigation Programs, a partial list

Many state and local governments have implemented hazard mitigation policies, incentives, and other programs to reduce risk within their communities. A few examples of building-specific programs are discussed below. A description of federal, state and local hazard mitigation efforts can be found in Chapter 2.

B.1.1 Oregon's Seismic Rehabilitation Grant Program

In 2005, Oregon recognized that many of its schools and essential facilities were very vulnerable to earthquakes, especially from a Cascadia subduction zone fault that had been recognized a decade earlier. The program began with a Statewide Seismic Needs Assessment that used a rapid visual screening (RVS) of existing schools to develop a ranking based on the results. Bonding authority was approved by the public for the rehabilitation work, and a grant committee formed to award grants to seismically upgrade the facilities to current seismic code standards. The program started slowly, but in 2015 the legislature renewed its commitment and budgeted $205 million with the expectation of further such investments to accomplish the task. In the same session, the legislature passed a Schools Modernization Match Program that, among other things, allowed schools to upgrade to higher seismic performance standards to ensure that the schools could be used as shelters following an earthquake and shortening the time it takes to reopen. Essential facilities are required to be upgraded to immediate occupancy structural performance levels. This means that not only will the building remain standing after an earthquake, but emergency services will be able to continue to operate and provide services.

B.1.2 Enhabit: combined energy efficiency and seismic performance upgrades in Portland, OR

The city of Portland developed an innovative program that combined its twin goals of resilience and sustainability. In 2009 the city had started a program to encourage homeowners to improve the energy efficiency of their homes. This program, Enhabit (previously Clean Energy Work), was spun off as a nonprofit. The city and Enhabit realized that there were cost savings to doing energy upgrades and seismic upgrades at the same time. The pilot program provided grants to homeowners to cover half the cost of tying a house to its foundation. Funded by FEMA, the program to-date has been able to seismically retrofit 100 homes and provide improved insulation and other energy saving measures. The estimated avoided disaster recovery cost savings of this effort is $2.7 million. The program was so successful that the city received a $500,000 FEMA Pre-Disaster Mitigation (PDM) grant to retrofit an additional 200 homes.

B.1.3 California's Residential Mitigation Program for earthquakes

The California Residential Mitigation Program (CRMP) was formed in August 2011 to implement hazard mitigation programs to assist California homeowners with seismic retrofits. California has two Earthquake Brace + Bolt (EBB) programs. The CRMP program is open to Californians in higher seismic risk ZIP codes. The California Earthquake Authority's (CEA) Brace + Bolt grant program is open to all eligible CEA policyholders. The grants provide incentives that allow architects and owners to design and pursue these retrofitting projects as a way to increase the total resilience of the homes within their communities. Eligible projects can receive up to $3,000 in incentive funds to help offset the cost of architect and the contractor's work that needs to be done to raise the building's seismic resilience standard to California's existing building code. The program is limited to funding retrofit expenses that:

» Strengthen cripple walls to enable them to function as shear members, significantly protecting the dwelling from collapse.

» Bolt the building to the foundation, enabling the dwelling to remain in place rather than sliding off the foundation during an earthquake.

» Properly strap the water heater to reduce the likelihood of water and fire damage and to protect the water supply.

The CRMP holds a list of eligible, EBB-participating contractors that work with clients and architects to properly address the complexities of seismic risk in the world today. The CEA offers earthquake insurance premium discounts for properly retrofitted qualifying homes.

B.1.4 Additional California hazard mitigation programs

- Property Assessed Clean Energy (PACE) financing, offered in cities such as Berkeley, allows property owners to borrow money to pay for seismic retrofits and spread the cost of the upgrade over a period of time through a special assessment on their property tax bill.

- The California Capital Access Program (CalCAP) Seismic Safety Financing Program is designed to assist California residential property owners (including multiunit dwellings and registered manufactured homes) with financing the costs for seismic retrofits.

- Low-income and fixed-income residents of the San Francisco Bay Area may be eligible for grants specifically designated for home earthquake strengthening through the U.S. Department of Housing and Urban Development's block grant program.

- In the city of Oakland, low-income homeowners in the redevelopment zone may qualify for a grant for 50% of the cost of the work (up to $5,000) matched with a low-interest loan for the remaining 50% of the cost. Retrofit permit fees for all residents are fixed at $250.

- The cities of Berkeley and El Cerrito offer transfer tax rebates for recently purchased homes. Homeowners can receive rebates or refunds on a percentage of a home's transfer tax if voluntary seismic retrofit of the residential property has been completed. Money can be borrowed to strengthen a home without paying any upfront costs. Homeowners or contractors must file a Seismic Retrofit Verification & Refund Application after the seismic work is completed.

- Under California law a homeowner can carry out seismic-strengthening measures without a property tax reassessment. To receive the exclusion, homeowners must have the work approved by the local building department and file a claim form with the county tax assessor.

B.1.5 Boulder County, Colorado's Wildfire Partners Program

Wildfire Partners is a hazard mitigation program to help homeowners prepare for wildfire. It provides education on how to mitigate a home against the threat of wildfires. A hazard mitigation specialist conducts a property assessment and compiles a comprehensive report of recommended actions. Upon completion of these required items, the property is issued a certification that can be used as proof of hazard mitigation for insurance purposes.

B.1.6 South Carolina Safe Home for hurricanes and high-wind events

The South Carolina Safe Home program, administered by the South Carolina Department of Insurance, provides grants of up to $5,000 to homeowners to make their property more resistant to hurricane and high-wind damage. The funds provided by this program are for the sole purpose of retrofitting owner-occupied, single-family homes. SC Safe Home funds may not be used for remodeling, home repair, or new construction.

The SC Safe Home program has partnered with the IBHS FORTIFIED program to provide participating homeowners the possibility of achieving dual designations when hazard mitigation work is performed on the roof of their homes. In choosing the dual designation, the homeowner may qualify for additional insurance benefits based on meeting the shared standards of the Safe Home program and the FORTIFIED Roof program.

B.1.7 King County, Washington, C-PACER Program

In 2021 King County began development of the Commercial Property Assessed Clean Energy + Resiliency (C-PACER) program. This is an innovative financing mechanism to help commercial, industrial, agricultural, and multifamily buildings become more efficient and resilient. Examples of projects that can be financed under C-PACER include those dealing with energy and water efficiency, seismic hardening, fire protection, flood readiness, and energy storage. This county program is part of a statewide initiative that is under development.

B.1.8 Rhode Island Infrastructure Bank—Municipal Resilience Program

Resilient Rhody, Rhode Island's first comprehensive climate resilience action strategy, was released by Governor Raimondo in July 2018. The strategy identifies priority actions the state can take to build statewide resilience. Common throughout Resilient Rhody is the need to work collaboratively with and in support of municipalities statewide.

The Municipal Resilience Program (MRP) provides direct support to cities and towns to complete a municipal-driven process that will bring together climate change information and local knowledge to identify top hazards, current challenges, and community strengths. This process is designed to identify priority projects and strategies to improve the municipality's resilience to all natural and climate-related hazards using a flexible, tested approach called Community Resilience Building (CRB).

Upon successful completion of the CRB process, municipalities will be designated as a "Resilient Rhody municipality," which enables municipalities to apply for dedicated action grants to implement identified projects ranging from green infrastructure, increased resiliency of buildings, property buy-outs in flood hazard zones, wetland restoration, and soft shoreline enhancements.

B.2 Technical Guidance Documents & Resources

The federal government and standards-producing organizations regularly publish and update technical guidance to inform practices and policies to reduce risk and recover from disasters.

Refer to aia.org/resilience for new and revised resources, including: hazard mitigation design resources, climate change adaptation design resources, and community resilience design resources.

B.2.1 State-level tools and resources

The Rhode Island Coastal Resources Management Council (RI CRMC) developed STORMTOOLS, an interactive tool accessed online through ArcGIS.com. STORMTOOLS is a method to map storm inundation, with and without sea level rise, for varying return period storms that covers all of Rhode Island's coastal waters. It provides predictions of water extent and depth at any given point for nuisance floods (1-, 3-, 5-, and 10-year recurrence intervals) and 25-, 50-, 100-, and 500-year storm scenarios at a 95% confidence interval. Sea level rise of 1, 2, 3, 5, and 7 feet calculation scenarios are modeled, and sea level rise can be combined with each storm scenario. To better assist citizens, businesses, floodplain managers, and cities and towns, the Rhode Island Emergency Management Agency incorporated STORMTOOLS and other geographic information system (GIS) mapping in the Rhode Island Floodplain Mapping Tool on its website.

The Pennsylvania Flood Risk Assessment Tool provides access to the best available flood data from FEMA and other authoritative sources. Data layers include roads, aerial photos, and parcel data. The Expert Mode provides access to more extensive data layers and capabilities that can be used for analysis purposes by flood managers and other stakeholders.

Iowa has developed county-wide Flood Insurance Rate Maps (FIRMs). During the flooding of 2008 Iowa became aware of the need for up-to-date flood risk data. Nearly a third of the counties in the state were without FIRMs, while nearly half were working with data that was 20–30 years old. The collection of LiDAR data (completed in 2010) allowed the state to develop new regulatory (FIRM) maps. Preliminary mapping has been completed for all county-wide FIRMs for the entire state.

B.3 Building Rating Systems

Rating systems allow design professionals and owners to achieve performance goals. The following is a partial list of rating systems commonly used in the U.S. known at the time of publication.

EcoDistricts: To foster a new model and era of urban regeneration, EcoDistricts has created the EcoDistricts Protocol, a framework for achieving people-centered, economically vibrant, planet-loving neighborhood-level sustainability.

Envision: Envision provides a holistic framework for evaluating and rating the community, environmental, and economic benefits of all types and sizes of infrastructure projects. Criteria addresses a project's impact on the surrounding community and environment, technical considerations regarding materials and processes, and other critical choices spanning the project's lifecycle. Envision also provides a framework for facilitating discussions with stakeholders.

FORTIFIED for Safer Business: This code-plus new construction program offers a package of improvements that increase a new light commercial building's durability and resilience to natural hazards.

FORTIFIED Home: The Insurance Institute for Business & Home Safety created the FORTIFIED Home program to help strengthen homes from hurricanes, high winds, hail, and severe thunderstorms.

Green Globes: Green Globes is a building rating system used in the U.S. and Canada. Green Globes is structured so that it can be done as an in-house self-assessment with the project manager and design team. It uses a questionnaire that is aimed at helping the user make changes to complete the certification. Green Globes can be used in new construction, existing buildings, and commercial interiors. This certification program focuses on energy usage, water, waste management, emissions, indoor environment, and environmental management.

Living Building Challenge: The Living Building Challenge is a performance standard that calls for the creation of building projects at all scales to operate as cleanly, beautifully, and efficiently as nature's architecture. To be certified under the challenge, projects must meet a series of performance requirements over a minimum of 12 months of continuous occupancy.

Permaculture Principles: Permaculture is a design process based on whole-systems thinking informed by ethics and design principles. This approach mimics the patterns and relationships found in nature and can be applied to all aspects of human habitation, including agriculture, ecological building, appropriate technology, education, and even economics. The techniques and strategies used to apply these principles vary widely depending on the location, climatic conditions, and resources that are available.

REDi Rating System: The Resilience-based Earthquake Design Initiative (REDi) Rating System, developed by Arup's Advanced Technology and Research team, proposes a framework for owners, architects, and engineers to implement "resilience-based earthquake design." It describes design and planning criteria to enable owners to resume business operations and provide livable conditions quickly after an earthquake according to their desired resilience objectives. It also presents a loss evaluation methodology for assessing the success of the adopted design and planning measures in meeting the resilience objectives.

Resiliency Action List (RELi): RELi (pronounced rely) integrates a listing of resilient design criteria with an integrative process for developing next-generation communities, neighborhoods, buildings, homes, and infrastructure. RELi was developed through an American National Standards Institute (ANSI) accredited process as a National Consensus Standard.

B.3 cont'd Building Rating Systems

The Sustainable SITES Initiative: SITES certification is for development projects located on sites with or without buildings and is used to align land development and management with sustainable design. SITES provides a guiding framework for "sustainable landscapes that create ecologically resilient communities better able to withstand and recover from episodic floods, droughts, wildfires, and other catastrophic events."

USGBC LEED: LEED works for all buildings—from homes to corporate headquarters—at all phases of development. Projects pursuing LEED certification earn points across several areas that address sustainability issues. Based on the number of points achieved, a project then receives one of four LEED rating levels: Certified, Silver, Gold, or Platinum.

USRC Earthquake Building Rating System: The USRC Building Rating System identifies expected consequences of an earthquake or other hazards affecting buildings. The rating considers the performance of a building's structure; its mechanical, electrical, and plumbing systems; and architectural components such as cladding, windows, partitions, and ceilings. The performance of these elements affects occupant safety, the cost and time to carry out necessary repairs, and when the building can be used following an event. The USRC Building Rating System assigns one to five stars for three performance measures—safety, damage expressed as repair cost, and recovery expressed as time to regain basic function.

WELL Building Standard: WELL is an evidence-based system for measuring, certifying, and monitoring the performance of building features that impact human health and well-being.

C.1 State Good Samaritan laws

Good Samaritan laws provide liability protection to architects and other licensed professionals who have been called upon to respond during a declared disaster. Additional information on Good Samaritan laws can be found in Chapter 3. AIA's model law, as well as the unique language of each state law, can be found in the AIA Good Samaritan Legislation Compendium.

C.2 Standard of training

The primary response training for AIA members and colleagues is the AIA Safety Assessment Program (SAP) training. Additional information on SAP training can be found in Chapter 3.

In addition to architects, the Cal OES Safety Assessment Program recognizes individuals with the following licenses and/or certifications.

CERTIFYING AGENCY	PROFESSIONAL LICENSE OR CERTIFICATION	CARD DESIGNATION
Any state	Architect	Architect
Any state	Civil Engineer	Civil Engineer
Any state	Structural Engineer	Structural Engineer
Any state	Geotechnical Engineer	Geotechnical Engineer
Any state	Engineering Geologist	Engineering Geologist
CA DGS/DSA[1]	DSA School Construction Inspector, Classes 1 & 2	Building Inspector
CA OSHPD[2]	OSHPD Hospital Inspector - Class A	Building Inspector
ACIA[3]	Registered Construction Inspector, Division II	Building Inspector
ICC[4]	Building Inspector	Building Inspector
ICC	Commercial Building Inspector	Building Inspector
ICC	Residential Building Inspector	Building Inspector
ICC	Combination Inspector	Building Inspector
ICC	Commercial Combination Inspector	Building Inspector
ICC	Residential Combination Inspector	Building Inspector
ICC	Building Plans Examiner	Building Inspector
ICC	Residential Plans Examinuer	Building Inspector
ICC	Combination Plans Examiner	Building Inspector
ICC	Building Code Specialist	Building Inspector
ICC	Building Code Official	Building Inspector
ICC	Certified Building Official	Building Inspector
ICC	Master Code Professional	Building Inspector
ACIA	Registered Const. Insp. Div. IV	Public Works Inspector
City of Los Angeles	Construction Inspector	Public Works Inspector

[1] CA DGS/DSA - California Department of General Services (DGS) / Division of the State Architect (DSA)
[2] CA OSHPD - California Office of Statewide Health Planning and Development (OSHPD)
[3] ACIA - American Construction Inspectors Association
[4] ICC - International Code Council

CAL OES SAFETY ASSESSMENT PROGRAM APPROVED LICENSES AND CERTIFICATIONS
Individuals holding one of the listed licenses or certifications may be credentialed as a Cal OES SAP Evaluator after completing the SAP Evaluator training course

SOURCE
California Office of Emergency Services (Cal OES)

C.2.1 Modifications to the Stafford Act & the National Incident Management System—Adding architects as defined resources

On October 5, 2018, the Federal Disaster Recovery Reform Act (DRRA) became law, amending the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) and modifying the Pre-disaster Hazard Mitigation Grant Program. The act required the federal government to work with architects and engineers to develop best practices for building-safety assessments that focused on a building's structural integrity and post-disaster livability/habitability, resulting in FEMA P-2055 Post-disaster Building Safety Evaluation Guidance (November 2019).

Additionally, Section 1241(b) of the DRRA directed FEMA to "develop a National Incident Management System (NIMS) Resource Typing (RT) Building Safety Assessment Team and associated job titles." To accomplish that mandate, FEMA recruited a group of stakeholders—including AIA—to revise, update, and enhance the resource type definitions associated with post-disaster building evaluations. This effort led to the development of the following new and revised resource types:

» Post-Disaster Building Safety Evaluation Strike Team Leader 10-509-1447

» Post-Disaster Building Safety Evaluation Strike Team Technical Supervisor 10-509-1445

» Post-Disaster Building Safety Evaluator 10-509-1448

» Post-Disaster Complex Architectural System Condition Evaluator 10-509-1446

» Post-Disaster Complex Structural Condition Evaluator 10-509-1449

» Post-Disaster Building Safety Evaluation Team 10-508-1261

Detailed information on the training and qualifications required for each of these resource types is available by searching the resource type number on the FEMA Resource Typing Library Tool website or via the links above.

C.2.2 Additional training

State and local authorities may require specific credentials and training before allowing professionals to volunteer in a disaster. This standard of training is further discussed in Chapter 3. Additional disaster response training can be obtained from these Incident Command System (ICS) online courses:

» IS-100: Intro to the Incident Command System

» IS-200: Basic Incident Command System for Initial Response

» IS-700: An Introduction to the National Incident Management System

» ICS-800: Introduction to National Response Framework

To be deployed through EMAC as a NIMS resource (building safety evaluator, strike team technical supervisor, complex architectural system condition evaluator, or complex structural condition evaluator), the training listed above is required in addition to the AIA Safety Assessment Program Training (or equivalent).

To be deployed as a NIMS post-disaster building safety evaluation strike team leader, in addition to the courses above and SAP training, the following is also required: AHJ-approved safety assessment coordinator training, such as Cal OES Safety Assessment Coordinator training, Missouri Structural Assessment and Visual Evaluation (SAVE) Coalition team leader training, or similar.

C.2.3 AIA online courses

AIA offers a series of on-demand courses through its online web portal, AIAU, in addition to in-person courses at state and national conferences. AIAU courses are available to AIA members as well as to the public. The online AIA Resilience and Adaptation Certificate Program includes:

» Resilience + Adaptation—An Introduction

» Hazards, Vulnerability, and Risk in the Built Environment

» Responding to Climate Change

» Codes and Rating Systems for Resilience

» Conducting Vulnerability Assessments

» New Construction: Hazard Mitigation Strategies

» Existing Buildings: Hazard Mitigation Retrofits

» Professional Risk and the Business Case for Resilience

» Community Design & Engagement for Resilience

C.3 Portability of licensure for architects

Portability of licensure enables assistance beyond state lines. Example laws from Washington state and Rhode Island are described below along with language from the National Council of Architectural Registration Boards (NCARB). Additional information on portability of licensure can be found in Chapter 3.

C.3.1 Example: Washington state and Rhode Island disaster relief licensing legislation

Out-of-state architects entering Washington state to do work under disaster relief must be licensed in Washington. If the architect is a National Council of Architectural Registration Boards (NCARB) certificate holder, the Washington State Board for Architects will expedite the licensing process and issue a license within seven working days.

If an architect is not licensed in Washington state and is not an NCARB certificate holder, the architect must align with a local, licensed architect.

POL400-3, Board, 3/2007.

Rhode Island has a similar provision in its Good Samaritan legislation.

Rhode Island General Laws Title 5. Businesses and Professions

5-1-16. Architects rendering assistance during disaster emergency—Immunity from civil liability

(e) In the event that the governor of Rhode Island declares a state disaster, all registered architects with a National Council of Architectural Registration Boards (NCARB) certification will be allowed to practice for a period of ninety (90) days from the date of the declared disaster.

C.3.2 National Council of Architectural Registration Boards (NCARB)

R301.5 Qualifications for Practice Under Disaster Declaration

Any individual licensed to engage in the Practice of Architecture in another Jurisdiction may provide disaster assessment services within the scope of their License and in response to a disaster declared by the U.S. Federal Government, governor, or other appropriate authority of (Jurisdiction). On written notice to the Board, such services may be provided in (Jurisdiction) without a License for the duration of the incident period, defined as the time interval during which disaster-causing incident occurs, as established by the U.S. Department of Homeland Security's Federal Emergency Management Agency in the FEMA-State Agreement and Published in the Federal Register. The individual providing services pursuant to this regulation is bound by (Jurisdiction) law. The Board reserves the authority to remove, revoke, rescind, or restrict this disaster-declaration practice privilege of any individual without a hearing by a majority vote of its members.

"Disaster assessment services" are limited to evaluation of structural integrity or nonstructural elements affecting life, safety, and habitability. Other architectural services beyond disaster assessment services, including but not limited to design of repairs, demolition plans, construction documents, or construction administration, should only be undertaken by an Architect licensed in the Jurisdiction.

D.1 Disaster responder resource list: commonly used clothing, supplies, and tools

Below is a list of commonly used clothing, supplies, and tools when performing building safety assessments. Assessment forms and placards will be provided by the authority having jurisdiction (AHJ). Additional information on performing building safety assessments can be found in Chapter 4.

PROTECTION AND SAFETY ITEMS

- [ ] Cell phone with charger
- [ ] NIOSH N-95 masks, or respirator
- [ ] Earplugs
- [ ] Gloves
- [ ] Flashlight with extra batteries
- [ ] Hand sanitizer or hand wipes
- [ ] Hard hat
- [ ] Safety shoes
- [ ] Insect repellant
- [ ] Magnetic compass
- [ ] Rain gear and rubber boots (if rain and mud are issues)
- [ ] Safety glasses
- [ ] Safety whistle (wear around neck)
- [ ] Small first aid kit
- [ ] Sunscreen
- [ ] Water container or canteen
- [ ] Water purification tablets (only if there is a boil water notice for potable water)

FIELD WORK ITEMS

- [ ] Backpack with lock (most things can be put in this)
- [ ] Clipboard
- [ ] ATC-20-1 and ATC-45 field manuals
- [ ] Paper or notebook
- [ ] Proof of licensure
- [ ] SAP ID card with lanyard
- [ ] Waterproof marking pens
- [ ] Waterproof writing pens or pencils
- [ ] Binoculars (to observe conditions too high or remote to see easily)
- [ ] Caution tape

NECESSARY PERSONAL ITEMS

- [ ] Credit card, cash (small bills are best), change for pay phones
- [ ] Extra clothing, ball cap, and towels
- [ ] Personal hygiene supplies
- [ ] Personal identification (driver's license is OK)
- [ ] Prescription medication for at least the length of stay plus two days
- [ ] Sleeping bag and inflatable mattress if tents will be used

SUGGESTED ITEMS

- [ ] Global positioning system (GPS) unit with charger and/or batteries
- [ ] Knee pads
- [ ] Reading materials for after-hours
- [ ] Small battery-powered radio for after-hours
- [ ] Reflective safety vest
- [ ] Shower slippers, if in a tent or camping setting
- [ ] Swiss army knife or multi-tool
- [ ] Tape measure
- [ ] Waterproof paper or notebook
- [ ] Ziplock bags
- [ ] Headlamp
- [ ] Facial tissues
- [ ] Lip balm

D.2 Sample post-disaster building evaluation forms and placards

The following are sample rapid and detailed assessment forms and placards from the Applied Technology Council (ATC). Rapid and detailed assessments are discussed in Chapter 4. Safety Assessment Program training provides an in-depth understanding of how to use these forms. Assessment forms and placards will be provided by the authority having jurisdiction (AHJ).

» ATC-20-1 Rapid Evaluation

» ATC-20-1 Detailed Evaluation

» ATC-45 Rapid Evaluation

» ATC-45 Detailed Evaluation

» ATC-20-1 green INSPECTED placard

» ATC-20-1 yellow RESTRICTED USE placard

» ATC-20-1 red UNSAFE placard

» ATC-45 green INSPECTED placard

» ATC-45 yellow RESTRICTED USE placard

» ATC-45 red UNSAFE placardATC-45 yellow RESTRICTED USE placard

» ATC-45 red UNSAFE placard

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