

Disaster Assistance Handbook

Third Edition, March 2017



AIA

Acknowledgments

AIA Disaster Assistance Handbook

Third Edition, Published March 2017

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Table of contents

04	Introduction
11	Chapter 1: Hazard, vulnerability, and risk
	» Hazards, hazard events, and disasters
	» Understanding hazard and disaster risk
	» Hazards: causes of damage, impact modifiers, and climate change
	» Hazard multipliers: secondary hazards
	» Built environment hazard impacts
	» Financial and environmental impacts
	» Classification of natural hazard events: minor, major and catastrophic events
	» Emergency management stages and the benefits of resilience and adaptation
28	Chapter 2: Hazard risk reduction and mitigation
	» The value of hazard risk reduction and mitigation
	» Federal, state, and local hazard mitigation
	» Role of land use and zoning: complexities of urban and rural communities
	» Hazard mitigation at scale: regional, local, neighborhood, and site
	» Relationship of contemporary codes and disaster resistance
	» Risk reduction tactics in the built environment
	» Building vulnerability assessments
	» Design for hazard mitigation: technical guidance, tools, and rating systems
	» Leveraging financial incentives in design for construction and operations
	» Risk transfer and insurance
	» Advocating for community resilience through hazard mitigation
49	Chapter 3: Emergency and disaster preparedness
	» The National Preparedness System
	» Partnerships in preparedness
	» Emergency preparedness plans and business continuity plans
	» AIA State Disaster Assistance Program: Preparing to provide building safety assessments
	» Policy and advocacy for enhanced disaster preparedness
	» Community Emergency Response Teams (CERT)
64	Chapter 4: Disaster response
	» Federal, state, and local government roles
	» Authorizing aid: Volunteers and the Emergency Management Assistance Compact
	» Assessing the post-disaster building stock
	» Mobilization of volunteers
	» Post-Disaster Building Safety (or Rapid) Assessments
	» Detailed and Engineering Assessments of buildings post-disaster
85	Chapter 5: Disaster recovery
	» Challenges to building back better
	» Temporary shelters and transitional housing
	» Government-sponsored repair and rebuilding programs
	» Policy and advocacy
	» Education and technical assistance
	» Stakeholder engagement and community planning
102	Appendix A: AIA member groups to connect with
107	Appendix B: Risk reduction and hazard mitigation resources
116	Appendix C: Emergency and disaster preparedness resources
122	Appendix D: Disaster response resources

Introduction

Introduction

Purposes of this Handbook

AIA members will better understand their role and how to prepare for and respond to 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 in mitigating, responding to and recovering from disasters.

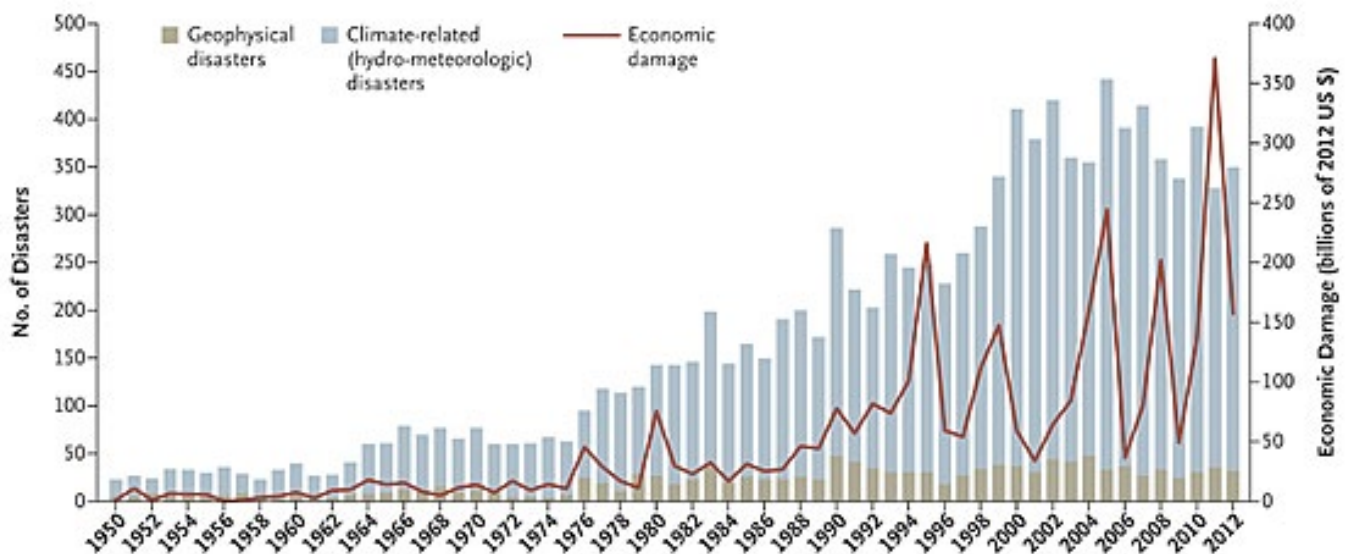
Third edition highlights

- » Case studies and best practices on disaster assistance from AIA chapters and members.
- » Changes and advances in emergency management protocols.
- » A new chapter on hazard mitigation and risk reduction.
- » Replicable disaster recovery projects and initiatives to enhance community resilience.

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.

In fact, overall disaster declarations worldwide have increased by a factor of ten since the 1950s. 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 seeks to balance the needs of the community and the environment.



DISASTER FREQUENCY AND ECONOMIC IMPACT

This graph displays the increasing number and costs of disasters world-wide since the 1950s. The upward trend is attributed to various environmental factors and land development patterns.

SOURCE

D. Guha-Sapir, R. Below, Ph. Hoyois – EM-DAT: The CRED/OFDA International Disaster Database – www.emdat.be – Université Catholique de Louvain – Brussels – Belgium. Used with permission.

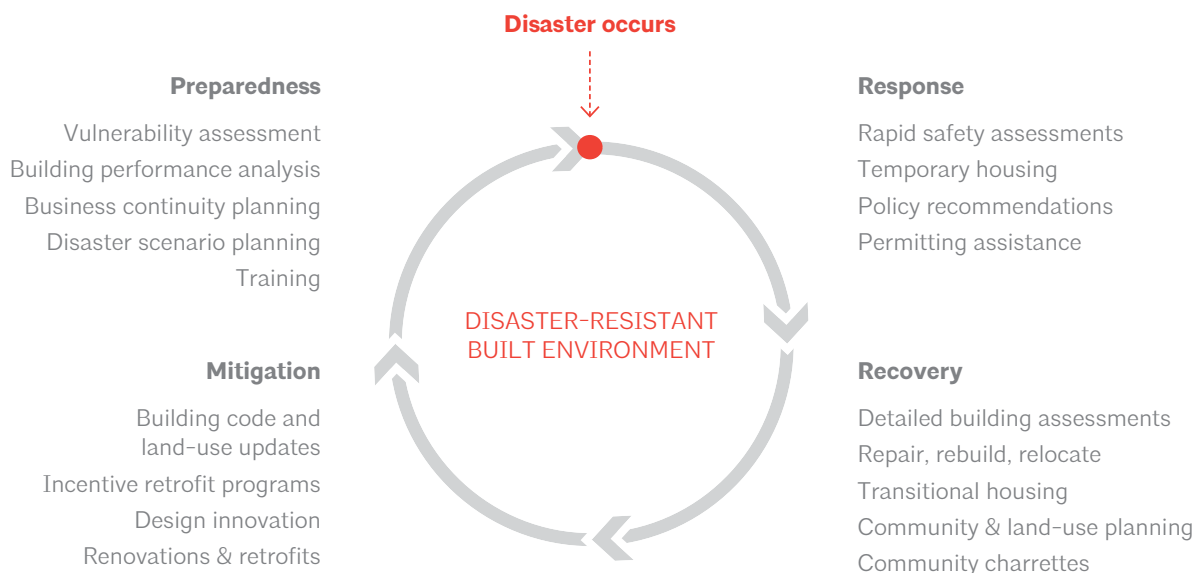
THE ROLE OF ARCHITECTS

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 skillset of architects is valuable in all phases of emergency management. AIA members are equipped to take action towards safer, healthier, and more resilient communities. Additionally, thousands of members 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 malfunction and failure. “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 uniquely 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 mitigation, preparedness and recovery.

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



ARCHITECTS' HOLISTIC APPROACH TO COMMUNITY RESILIENCE

Architects design for the interdependences of the natural, social, and built environment systems.

AIA DISASTER ASSISTANCE PROGRAM

Over the years AIA members have responded to several 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 prepare for, respond to, and recover from disasters. It provides training, support, and resources for architects through local, state, and national AIA chapters.

The Disaster Assistance Committee and AIA National have sustained the program providing guidance, recommendations, toolkits, and training to members, 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 members with the knowledge and skills needed to be of service before and after a disaster.

Specifically, the program's work has led to establishing Disaster Assistance programs in more than 25 states, Good Samaritan liability coverage in 29 states, and architects in 34 states and territories trained in AIA's Safety Assessment Program. Disaster and resilience education is regularly hosted at the AIA National Convention, on AIA's online education platform, AIAU, and throughout the country through AIA chapter offices.

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.

Architects volunteering pre- and post-disaster exemplify the 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 creating safe, secure, and resilient communities.

The experience gained from AIA's Disaster Assistance Program is captured in this third edition of the Disaster Assistance Handbook. Inside you will find first-hand accounts of disaster response and recovery, case studies and other best practices from AIA chapters and members. This edition also includes innovations in hazard mitigation and risk reduction strategies, projects and initiatives to enhance building and community resilience, and approaches to designing buildings to be more adaptable to uncertain changes of the future.

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



HISTORY OF AIA DISASTER ASSISTANCE

1972

AIA formally recognizes the role of architects in emergency response

1974

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

1978

The Federal Emergency Management Agency (FEMA) is created as an independent agency

1988

Congress passes the 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, NY, New Orleans, LA and Joplin, Mo

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

2017

AIA Disaster Assistance Handbook V3

Hazard,
vulnerability,
and risk

01

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

- 13 Hazards, hazard events, and disasters
- 16 Understanding hazard and disaster risk
- 18 Hazards: causes of damage, impact modifiers, and climate change
- 21 Hazard multipliers: secondary hazards
- 23 Built environment hazard impacts
- 24 Financial and environmental impacts
- 25 Classification of natural hazard events: minor, major and catastrophic
- 26 Emergency management stages and the benefits of resilience and adaptation

HAZARDS, HAZARD EVENTS, AND DISASTERS

We inhabit a wondrous and beautiful planet. We also inhabit a hazardous one. There are two primary types of natural hazards: climate and weather-related hazards (atmospheric) such as hurricanes, floods, and tornadoes and geologic events like earthquakes, landslides, and volcanoes. We also experience human-caused hazards (known as anthropogenic or technical hazards) caused by manufacturing, transportation, construction, agriculture, and governance.

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, sea level rise, tornado, wildfire, extreme heat, drought
Geologic & seismic hazards	Earthquake, tsunami/seiche, volcanic eruption, landslide, mudslide, 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 procedures

Key concepts

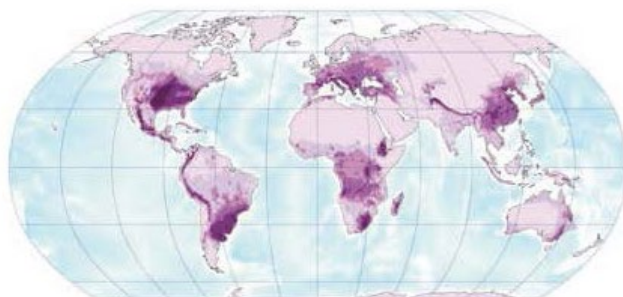
- » Understand the connection between risks and vulnerability, and how to communicate about these issues.
- » Recognize how “impact modifiers” such as climate change exacerbate hazards.
- » Understand the critical importance of considering secondary hazards—the cascading impacts of a disaster such as power loss or flooding from sewer overflow—in the resilience planning process.
- » Recognize the value of pre-disaster mitigation in the cycle of emergency management.

WORLD MAP OF NATURAL HAZARDS

These maps illustrate the probability of occurrence of specific hazards by location. Note that this is a partial list and does not include all hazard types.

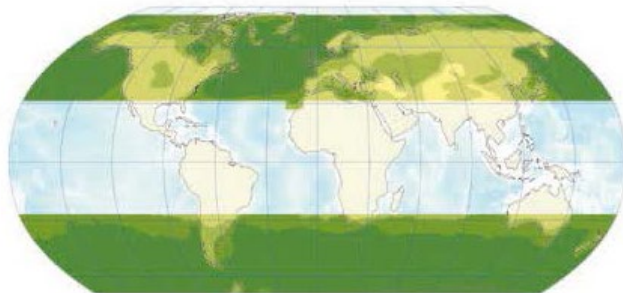
SOURCE

2011 Nathan World Map of Natural Hazards, Munich Re © 2011.
Used with permission.

**HAILSTORMS**

Frequency and intensity of hailstorms

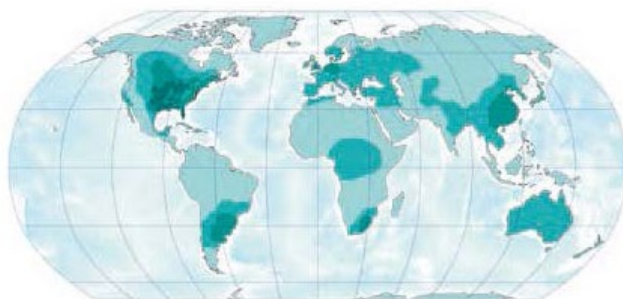
- Zone 1: Low
- Zone 2:
- Zone 3:
- Zone 4:
- Zone 5:
- Zone 6: High

**EXTRATROPICAL STORMS (WINTER STORMS)**

Peak wind speeds (in km/h)*

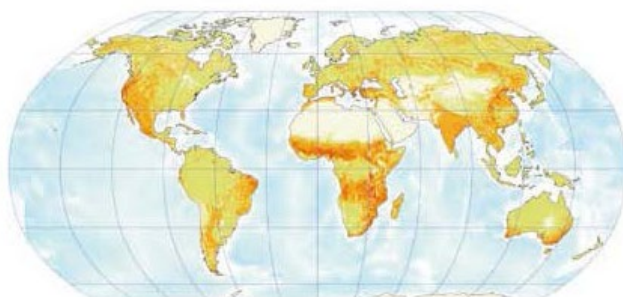
- Zone 0: ≤80
- Zone 1: 81-120
- Zone 2: 121-160
- Zone 3: 161-200
- Zone 4: >200

Areas were examined in which there is a high frequency of extratropical storms (approx. 30°-70° north and south of the equator).
*See "Tropical cyclones"

**TORNADOS**

Frequency and intensity of tornadoes

- Zone 1: Low
- Zone 2:
- Zone 3:
- Zone 4: High

**WILDFIRES**

Hazard

- No hazard for bodies of water, areas of urban development and areas without vegetation
- Zone 1: Low
- Zone 2:
- Zone 3:
- Zone 4: High

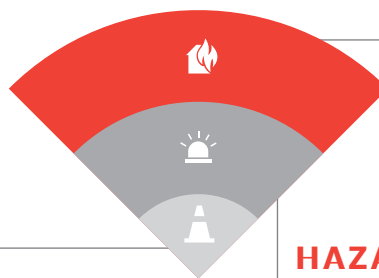
The effects of wind, arson and fire-prevention measures are not considered.

Hazards, such as hurricanes, floods, earthquakes, or winter storms, become hazard events when they impact a community, causing direct, indirect, or consequential damage that affects natural resources, infrastructure, transportation, utilities, and the exterior or interior of buildings.

From time to time this pattern of hazard events 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 will be 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.

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 does 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.

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 basically remain the same regardless of whether the disaster was caused by a natural or a human-caused hazard.



HAZARD

A hazard is something that is potentially dangerous or harmful, often the root cause of an unwanted outcome.¹ 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.²

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.³

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.

¹ FEMA Incident Command Resource Center

² "Hazards and Disasters." IB Geography. I-study, n.d. Web. 23 Feb. 2017.

³ "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 to natural hazards. Those that choose to occupy coastal land or areas along a riverbank are at a 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 risk. The probability that a given hazard may occur is known as hazard risk.

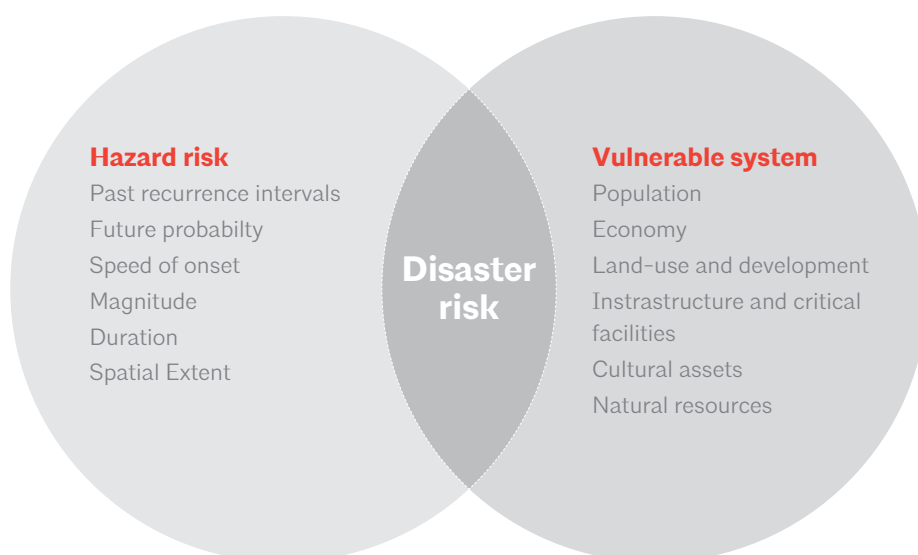
Disaster risk, on the other hand, is determined by the overlap between hazard risk and vulnerability –the exposure and sensitivity of a community that adversely affects its capacity to adapt and recover. Community components such as populations, economies, buildings, infrastructure, and natural systems individually have 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. 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 what the projected lifespan of the building is, 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 hazards.

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.”



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

USGS

One of the first steps architects take to address risks in the built environment is to study and clearly communicate scientific and hazard data's projected 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 two factors: how often a particular hazard may occur and the impact that hazard could have on the component in question.

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 storms 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 *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 public remained unprepared. This illustrates the critical need to study and communicate scientific hazard and climate data.

To further delineate risk, hazard events are categorized⁴ by regularity as referenced in policy and building codes for design and planning purposes:

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.

Risk = Probability x Magnitude

[how often]

[severity]

Risk is a measure of the probability and severity of adverse effects that result from exposure to a hazard.

⁴ Listed categorization adapted from NIST Community Resilience Planning Guide

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

Climate change and localized factors (both natural and human-made) disrupt the status quo in ways that positively or negatively change the impact of a hazard. Understanding the compounded impacts of climate change and other physical interdependencies enables architects to design climate and hazard mitigation measures that reduce potential damage from future hazard events.

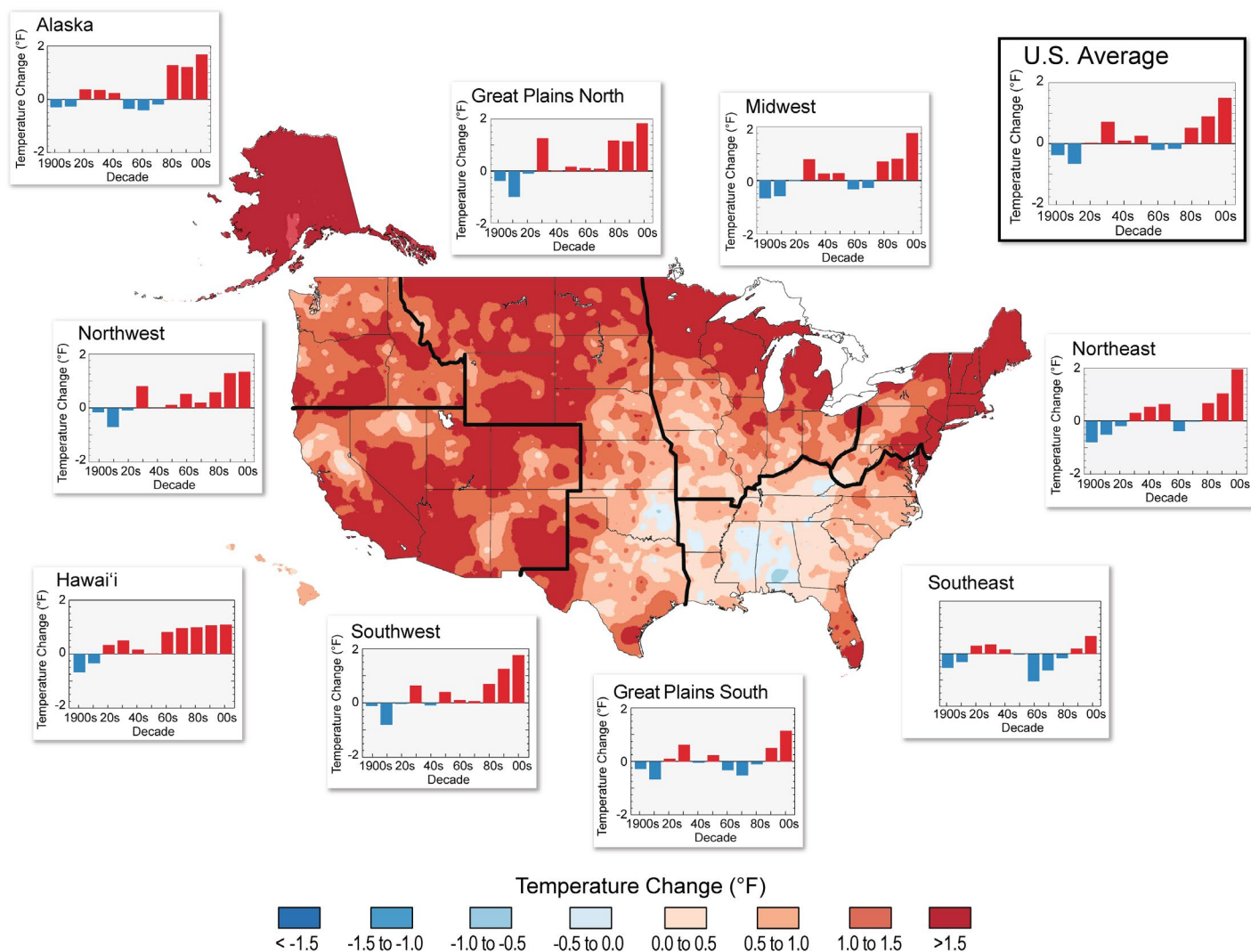
All hazards directly impact communities through damaging components—in hurricanes, for example, the damaging components are wind and water. Wind pressure can damage buildings in either positive (force) or negative (suction) ways, and wind itself can generate vortices and eddies along individual surfaces and throughout entire areas. 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. In the same manner of identifying damaging components, 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.

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

Also an impact modifier, climate change is exacerbating the impacts of hazards with 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 that are more damaging upon impact. 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. These environmental changes create new conditions that intensify hazard impact.

Impact modifier

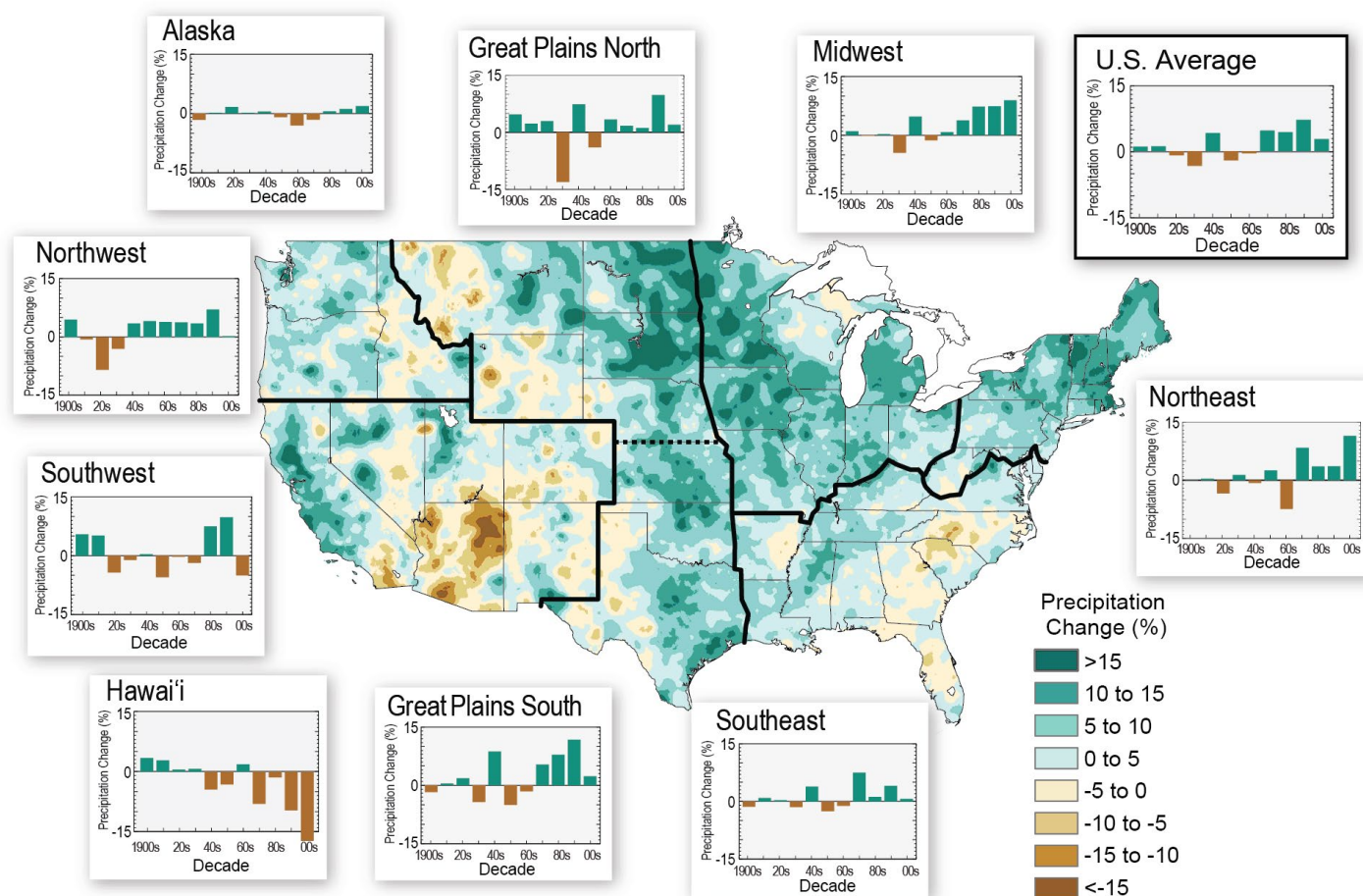
A local natural or human-made feature or characteristic of a community that alters the severity of a hazard.

**OBSERVED U.S. TEMPERATURE CHANGE**

Temperature changes over the past 22 years (1991–2012) compared to the 1901–1960 average; for Hawaii and Alaska compared with the 1951–1980 average. The bars on the graphs show the average temperature changes by decade for 1901–2012 (relative to the 1901–1960 average) for each region. The period from 2001 to 2012 was warmer than any previous decade in every region and according to the National Oceanic and Atmospheric Administration’s State of the Climate: Global Analysis, 2016 was the warmest year on record.

SOURCE

NOAA NCDC/CICS-NC

**OBSERVED U.S. PRECIPITATION CHANGE**

Annual total precipitation changes for 1991–2012 are compared to the 1901–1960 average in this map, and indicate wetter conditions in many regions.

SOURCE

National Climate Assessment, adapted from Peterson et al. 2013 “Monitoring and Understanding Changes in Heat Waves, Cold Waves, Floods, and Droughts in the United States: State of Knowledge”

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, 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 wind storms.

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 discount system performance to reflect the reduction in performance capacity. 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, from loss of the fire suppression system, to interior water damage, to 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. Power outages should be expected from even a minor disaster.

The source of secondary hazards aren’t always present at the building or property site, some are due to adjacent properties with collapse or fall potential. 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 hone in on the best areas to focus mitigation strategies.

Cascading effects⁵

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.

⁵ Pescaroli, G. and Alexander, D. (2015): A definition of cascading disasters and cascading effects: Going beyond the “toppling dominos” metaphor. In: Planet@Risk, 2(3): 58–67, Davos: Global Risk Forum GRF Davos.)

Secondary Hazard \ Primary Hazard	Earthquakes	Landslides	Volcano Hazards	Tsunami and Seiches	Disease Outbreaks	Civil Disorder	Terrorism	Mass Shootings	Transportation Incidents	Fires	HazMat Incidents	Infrastructure Failures	Power Outages	Excessive Heat Events	Flooding	Snow, Ice and Extreme Cold	Water Shortages	Windstorms
Earthquakes																		
Landslides																		
Volcano Hazards																		
Tsunamis and Seiches																		
Disease Outbreaks																		
Civil Disorder																		
Terrorism																		
Mass Shootings																		
Transportation Incidents																		
Fires																		
HazMat Incidents																		
Infrastructure Failures																		
Power Outages																		
Excessive Heat Events																		
Flooding																		
Snow, Ice and Extreme Cold																		
Water Shortages																		
Windstorms																		

CASCADING EFFECTS

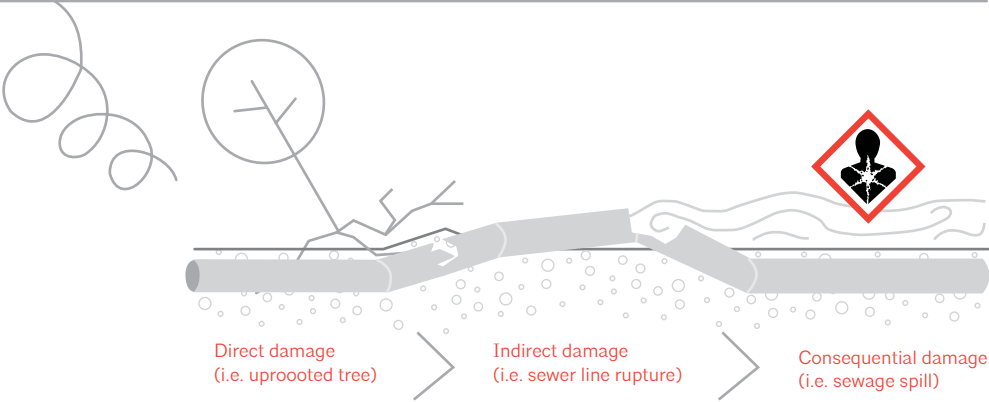
Secondary hazards vary by location. In this example from the City of Seattle, the initial event or primary hazard (far left column) triggers secondary hazards shown as medium probability (light grey) or high probability (dark grey).

SOURCE

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

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 inhabitable until the sewer line is repaired.



BUILT ENVIRONMENT HAZARD IMPACTS

Hazard events affect our world, and all of the people and places that matter to us. As previously mentioned, direct damage caused by the impact of a hazard can trigger secondary hazards, and both of these in turn may bring about consequential damage. The full scope of damage must be considered when assessing destruction that could be caused by a disaster.

In addition to considering the damage that may occur from hazard events that are likely to happen based on historic frequency, the impacts of an evolving climate must also be evaluated. Climate effects including increased flooding, storm surge, drought, and wildfires pose significant challenges for buildings and the infrastructure that enables their function and habitability. For example, many infrastructure systems like energy, transportation, water, and sanitation are at capacity, undersized, out-of-date, or

have not been built or upgraded to accommodate extensive growth and load changes. For buildings, mechanical systems and storm water management systems may be undersized to cope with extreme heat and increased levels of precipitation; placing additional strain on already stressed utilities. Backflow into buildings due to taxed combined sewer overflow systems pose a substantial health hazard. Older roofs may be 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. 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.



SCOUR

Local scour around a house's pile foundation; weakening the structural integrity of the foundation (Bolivar Peninsula, TX, Hurricane Ike).

SOURCE

FEMA

FINANCIAL AND ENVIRONMENTAL IMPACTS

Damages due to increasingly frequent hazard events can interrupt business continuity for months, crippling a community’s economy. 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 percent loss in economic activity and has never regained its leading position.⁶

A community’s natural environment is also adversely impacted by a hazard event. Post-disaster, large amounts of debris need to be removed and transported to landfills. Hazardous materials may also need proper disposal. 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 environmentally, with the need to manufacture construction products from raw materials and source fossil fuels to fabricate and transport construction supplies. These actions further degrade the natural environment, contributing to future adverse climate impacts.

As of February 2016	Fatalities	Estimated Overall Losses (US \$bn)	Estimated Insured Losses (US \$bn)*
Severe Thunderstorm	1,646	180	124
Winter Storms & Cold Waves	813	29	18
Flood, Flash Flood	333	33	6.5
Earthquake & Geophysical	5	1.5	0.4
Tropical Cyclone	425	128	65
Wildfire, Heat Waves, & Drought	511	77	28

NATURAL CATASTROPHE LOSSES IN THE UNITED STATES FROM 2006-2015, LISTED BY PERIL

The graph illustrates the gap between insured and uninsured losses. While some uninsured losses would never be insured (e.g. city streets and bridges), many uninsured costs fall on individuals. Increasing the resilience of all built environment structures will decrease the burden on the un- and/or under-insured.

SOURCE

Chart courtesy of 2016 Munchener Ruckversicherungs-Gesellschaft, NatCatSERVICE. Data source: Munich Re, NatCatSERVICE (2016). Used with permission.

⁶ duPont IV W, Noy I, Okuyama Y, Sawada Y (2015) The Long-Run Socio-Economic Consequences of a Large Disaster: The 1995 Earthquake in Kobe. PLoS ONE 10(10): e0138714. doi:10.1371/journal.pone.0138714

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

Fortunately, not all hazards 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. 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 non-governmental and nonprofit organizations.⁷ The major disaster declaration also triggers actions from other federal and state agencies and organizations, including the AIA’s Disaster Assistance Program.

Minor Event

A disruption; local response capability is adequate

Major Event

Serious disruption; state and/or Federal response required

Catastrophic Event

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.⁸

⁷ Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-288) as amended. FEMA. Jan. 2016. 5 Oct. 2016.

⁸ “National Response Framework.” Homeland Security, May 2013. Web. Sept. 30. 2016.

EMERGENCY MANAGEMENT STAGES AND THE BENEFITS OF RESILIENCE AND ADAPTATION

Since World War II, emergency management practices focused primarily on what was known as “preparedness.” Often this involved preparing for enemy attack. As methodologies for emergency management developed, natural hazards were included as threats and solutions were divided into four phases: response, recovery, mitigation, and preparedness. 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 mitigation. Experience has shown that this refocus can be a more cost effective approach. The National Institute of Building Sciences’ Multihazard Mitigation Council report *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Actions* found that every dollar spent on mitigation saves four dollars in recovery.⁹ This study, in part, made the case for the new attention towards resilience and adaptation.

Resilience is a dynamic quality of an entity at a given place and time. In an ever-changing environment, resilience is an aspired state of functioning 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 adaptation recognizes that certain disruptions are caused by permanent and even slow changes in the environment that will require innate flexibility and adjustment in order to be resilient. The AIA encourages practices that enhance resilience and adaptation to confront hazard risk and disasters.

Resilience

The ability to prepare for and adapt to changing conditions and to withstand and recover rapidly from disruptions. Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents.¹⁰

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 mutual opportunities.¹¹

⁹ National Institute of Building Sciences Multihazard Mitigation Council. *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities*. 2005.

Note: an updated version of this study is scheduled to be released in October 2017.

¹⁰ “Presidential Policy Directive/PPD-21 -- Critical Infrastructure Security and Resilience.” The White House. The United States Government, 12 Feb. 2013. Web. 30 Sept. 2016.

¹¹ “Glossary A-D.” Intergovernmental Panel on Climate Change. N.p., n.d. Web. 30 Sept. 2016.

FEMA DEFINITIONS OF DISASTER CYCLE

Mitigation

The activities designed to reduce or eliminate risks to persons or property or to lessen the actual or potential effects or consequences of an incident. Mitigation measures may be implemented prior to, during, or after an incident. Mitigation measures are often formed by lessons learned from prior incidents. 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. Mitigation can include efforts to educate governments, businesses, and the public on measures they can take to reduce loss and injury.

Preparedness

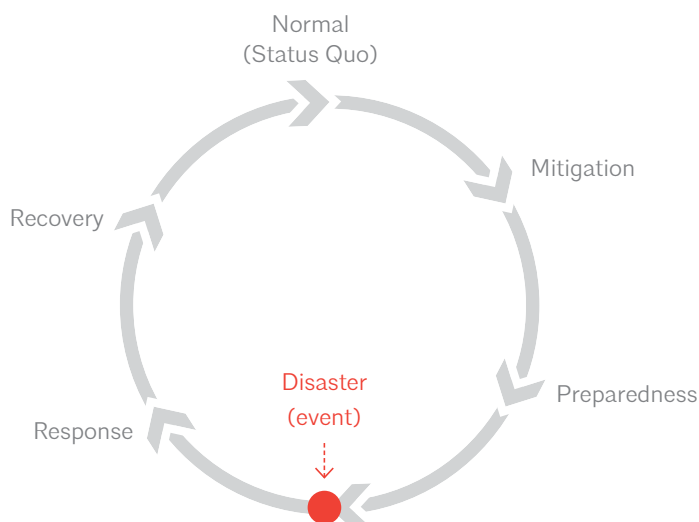
The range of deliberate, critical tasks and activities necessary to build, sustain, and improve the operational capability to prevent, protect against, respond to, and recover from domestic incidents. Preparedness is a continuous process. Preparedness involves efforts at all levels of government and between government and private-sector and non-governmental organizations (NGOs) to identify threats, determine vulnerabilities, and identify required resources.

Response

Activities that address the short-term, direct effects of an incident. Response includes immediate actions to save lives, protect property, and meet basic human needs. Response also includes the execution of emergency operations plans and of mitigation activities designed to limit the loss of life, personal injury, property damage, and other unfavorable outcomes. As indicated by the situation, response activities include applying intelligence and other information to lessen the effects or consequences of an incident; increased security operations; continuing investigations into nature and source of the threat; ongoing public health and agricultural surveillance and testing processes; immunizations, isolation, or quarantine; and specific law enforcement operations aimed at preempting, interdicting, or disrupting illegal activity, and apprehending actual perpetrators and bringing them to justice.

Recovery

The development, coordination, and execution of service- and site-restoration plans; the reconstitution of government operations and services; individual, private-sector, NGOs, and public-assistance programs to provide housing and to promote restoration; long-term care and treatment of affected persons; additional measures for social, political, environmental, and economic restoration; evaluation of the incident to identify lessons learned; post incident reporting; and development of initiatives to mitigate the effects of future incidents.



EMERGENCY MANAGEMENT CYCLE

The sequence of this handbook follows the emergency management cycle.

SOURCE

NIST National Institute of Standards & Technology

Hazard risk reduction and mitigation

02

LEARN: HAZARD MITIGATION CONTEXTUALIZED

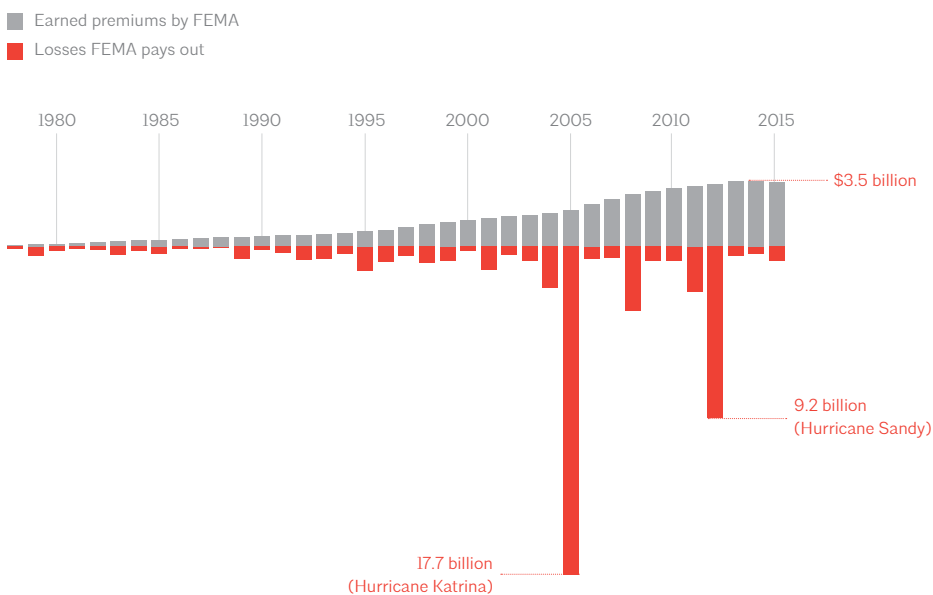
- 31 The value of hazard risk reduction and mitigation
- 33 Federal, state, and local hazard mitigation
- 35 Role of land use and zoning: complexities of urban and rural communities
- 36 Hazard Mitigation at scale: regional, local, neighborhood, and site
- 38 Relationship of contemporary codes and disaster resistance

ACT: HAZARD MITIGATION STRATEGIES FOR BUILDINGS

- 40 Risk reduction tactics in the built environment
- 41 Building vulnerability assessments
- 42 Design for hazard mitigation: technical guidance, tools, and rating systems
 - » Case study: Iowa state fair grounds
- 45 Leveraging financial incentives in design for construction and operations
- 46 Risk transfer and insurance
- 47 Advocating for community resilience through hazard mitigation

OVERVIEW

A disaster stems from the overlap between the hazard and vulnerable systems (such as people, buildings, or infrastructure) that must withstand the impacts of the hazard—the smaller the overlap, the smaller the risk. Mitigation diminishes this overlap by reducing vulnerability and therefore risk. Reducing risk minimizes lives lost and injury, reduces property damage, saves money in repairs and recovery, and allows operations and functionality to return to normal more quickly. Forty percent of businesses do not reopen after a disaster and another 25 percent fail within one year according to the FEMA.¹² Effective risk reduction enhances business continuity, ensuring supply chain operations and enabling a community to get the goods and services it needs. Disasters harm the natural environment too: coastlines are altered by storm surge, and with forest fires, millions of acres are lost each year. The nation cannot afford to ignore the value of mitigation and risk reduction.



NATIONAL FLOOD INSURANCE PROGRAM PREMIUMS AND LOSSES

FEMA's National Flood Insurance Program is \$23 billion in debt to the U.S. Treasury. This is just one example of why the Nation cannot afford to ignore the value of mitigation and risk reduction.

SOURCE

FEMA

Key concepts

- » Understand the value of approaching risk reduction and hazard mitigation from a community-wide, systems-based perspective.
- » Recognize the unique roles of federal, state, and local governments in mitigation funding, planning, and activation.
- » Understand how zoning and land use choices affect community resilience goals.
- » Recognize the difference between minimum requirements reflected in building codes and the more robust process of conducting a building vulnerability assessment.
- » Understand the role of architects in promoting disaster resilience by recognizing vulnerabilities, recommending performance goals, and integrating hazard mitigation strategies into their practice and advocacy efforts.

¹² "Protecting Your Businesses." FEMA, 24 June 2016. Web 1 Nov. 2016.

THE VALUE OF HAZARD RISK REDUCTION AND MITIGATION

When the risks associated with primary hazards, cascading effects, and community interdependencies are considered over the service life of a building, 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.¹³ 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 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 towards disaster resistant design and construction.

It is important to recognize that hazards are addressed in building codes and policies based on a historical perspective, yet science tells us that hazard risk is increasing into the future, along with other climate impacts. In addition, building codes are based upon a life safety standard, and therefore require additional measures to plan for continuity of operations and property protection. Some communities are adopting more stringent building code standards to minimize loss of property as well as loss of property values and taxes, however, more often communities are adopting amendments that reduce the stringency of the code; often due to pushback from powerful lobbying associations. Therefore, effective mitigation measures will do more to support specific owner-identified performance goals.

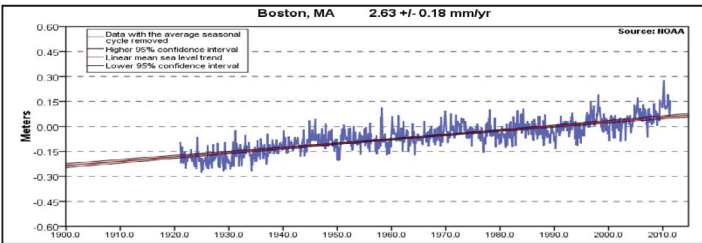
Mitigation measures, when based upon a comprehensive vulnerability assessment, offer the most direct opportunity for property owners, tenants, and occupants to act in their best self-interest. Too often risk reduction tactics focus on the narrow parameters that comprise ready responses (i.e., house-raising 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). Thus it is important to assess the full scope of vulnerabilities and interdependences before determining mitigation strategies.

Risk reduction may be site specific or related to community or regional systems. When Hurricane Katrina struck the Gulf Coast in 2005, hospitals in Baton Rouge, Louisiana admitted patients who evacuated. 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.¹⁴ This way of thinking about interconnected systems changes the contextual understanding of risk and vulnerability and provides a foundation for effective mitigation strategies.

¹³ Emrath, Paul. "Data Imply Most Homes Last More than a Century." Eye on Housing. N.p. 17 Oct. 2016. Web. 13 Nov. 2016.

¹⁴ Bruce, Chris. "Japanese earthquakes send ripples through auto industry." Autoblog. N.p., 18 Apr. 2016. Web. 20 July 2016.

The value of mitigation measures is recognized by the federal government. FEMA is the U.S. government agency designated with the responsibility to prepare for, prevent, respond to, and recover from disasters, and this includes many of the nation’s mitigation activities.¹⁵ 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 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. Metropolitan areas frequently have their own hazard mitigation plans that address county or city-specific issues. 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.



Source: National Oceanic and Atmospheric Administration (NOAA)

Table 11- Global Sea-Level Rise Scenarios²

Scenario	SLR by 2100 (m)*	SLR by 2100 (ft)*
Highest	2.0	6.6
Intermediate-High	1.2	3.9
Intermediate-Low	0.5	1.6
Lowest	0.2	0.7

* Using mean sea level in 1992 as a starting point.

Parameter	Current Conditions (1961–1990)	Predicted Range of Change by 2050	Predicted Range of Change by 2100
Annual temperature ¹ (°C/°F)	8/46	2 to 3 / 4 to 5	3 to 5/5 to 10**
Winter temperature ¹ (°C/°F)	-5/23	1 to 3 / 2 to 5	2 to 5 / 4 to 10
Summer temperature ¹ (°C/°F)	20/68	2 to 3 / 4 to 5	2 to 6 / 4 to 10
Over 90 °F (32.2 °C) temperature ² (days/yr)	5 to 20	—	30 to 60
Over 100 °F (37.7 °C) temperature ² (days/yr)	0 to 2	—	3 to 28
Ocean pH ³⁻⁴	7 to 8	—	-0.1 to -0.3*
Annual sea surface temperature (°C/°F)	12/53 ⁵	2/3 (in 2050) ⁵	4/8
Annual precipitation ¹	103/41 cm/in.	5% to 8%	7% to 14%**
Winter precipitation ¹	21/8 cm/in.	6% to 16%	12% to 30%**
Summer precipitation ¹	28/11 cm/in.	-1% to -3%	-1% to 0%**
Streamflow—timing of spring peak flow ¹ (number of calendar days following January 1)	85	-5 to -8	-11 to -13**
Droughts lasting 1–3 months ¹ (#/30 yrs)	13	5 to 7	3 to 10**
Snow days (number of days/month) ¹	5	-2	-2 to -4**
Length of growing season ¹ (days/year)	184	12 to 27	29 to 43

Table 1: Changes in Massachusetts’ Climate

Sources: 1-Hayhoe et al., 2006; 2-Frumhoff et al., 2007; 3-IPCC, 2007; 4-MWRA, unpublished; 5-Nixon et al., 2004
Note: All numbers have been rounded to the nearest whole number. Unless otherwise indicated, the predictions for the year listed as 2050 are for the period between 2035–2064. * Global data; **Predictions for period between 2070–2099

EXAMPLE OF CLIMATE CHANGE DATA FROM THE CITY OF BOSTON

Cities and states are including climate change impacts in their hazard mitigation plans or separate climate adaptation plans. Here is an example of Boston’s analysis of climate related hazards, specifically sea level rise (above) and temperature and precipitation changes (left).

SOURCE

City of Boston Natural Hazard Mitigation Plan Final 2014 Update- Approved by FEMA January 8, 2016. City of Boston © 2016. Used with permission.

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¹⁵ “About the Agency.” FEMA, 11 May 2016. Web. 17 Nov. 2016.

FEDERAL, STATE, AND LOCAL HAZARD MITIGATION

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

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 Assistance (HMA) Program provides an average of \$700 million annually in Hazard Mitigation Grant Program (HMGP) funds, Flood Mitigation Assistance, and Pre-Disaster Mitigation grants authorized under Section 404 of the Stafford Act.¹⁶ The HMGP provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. Of FEMA's financial assistance to states after a declared disaster, HMGP represents a mere 7.5–15 percent of public assistance funding. States that meet higher mitigation planning criteria may qualify for a higher percentage under the Disaster Mitigation Act of 2000.¹⁷

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 the FEMA's Pre-Disaster Mitigation Grant Program (PDMGP), designed to help communities implement a pre-disaster hazard mitigation program by providing grants to planning initiatives and projects that would reduce future losses. The City of Seattle and State of Florida, for example, are two jurisdictions that have received (very limited) pre-disaster mitigation funding from the federal government to create city or state recovery frameworks and plans. Because disaster recovery can last months to years, a recovery plan outlines how the city would partner with the community and government agencies and address priorities.

¹⁶ "Resilience and Climate Change Adaptation." (n.d.): n. pag. FEMA Federal Insurance and Mitigation Administration. Web. 19 Nov. 2016.

¹⁷ "Mitigation Funding in the FEMA Public Assistance Program." *Disaster Recovery Today*. Adjusters International, n.d. Web. 17 Nov. 2016.

In addition to formal federal programs, some private-public partnerships have emerged in recent years to fund mitigation and resilience, including Rebuild by Design and the US Department of Housing and Urban Development (HUD) National Disaster Resilience Competition. In the Rebuild by Design program, architects took part in multi-disciplinary 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 multi-disciplinary, 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. However, neither program has been institutionalized.

Examples of public-private building-specific mitigation programs¹⁸ include:

- » hazard-specific retrofit incentive programs, including Oregon's Seismic Rehabilitation Grant Program, California's Residential Mitigation Program, My Safe Florida Home, and South Carolina Safe Home
- » programs that encourage hazard-mitigation retrofits during energy upgrades, such as Portland, Oregon's Enhabit program
- » programs that offer insurance incentives for enhanced construction practices, including the Institute for Business and Home Safety's FORTIFIED program

¹⁸ A summary of these programs is available in the appendix.

ROLE OF LAND USE AND ZONING: COMPLEXITIES OF URBAN AND RURAL COMMUNITIES

Many of the nation's cities were built in vulnerable areas for close proximity to waterways to transport goods and services. 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 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. Unfortunately, too many regulations and policies lack the interconnectedness and investment necessary to plan better, build better, and/or to build back better.

Certain land use and zoning issues can contribute to vulnerability. A good comprehensive plan conveys an understanding of how community interdependencies and compounded effects impact vulnerability and then addresses vulnerabilities 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 nuisance flooding that cannot be absorbed 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 and stakeholders acknowledge that developing in high risk areas will require the most mitigation. Buildings and associated infrastructure built in hazard-prone areas, therefore, will necessarily cost more to construct and maintain.

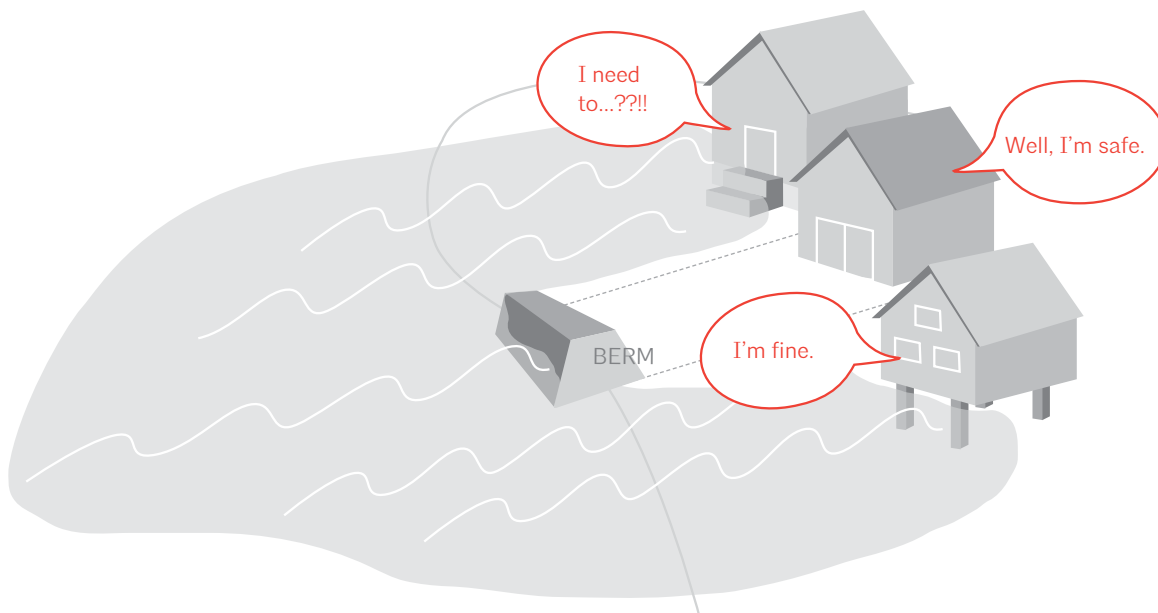
HAZARD MITIGATION AT SCALE: REGIONAL, LOCAL, NEIGHBORHOOD, AND SITE

Mitigation 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 flood waters are displaced to neighboring properties. Community wide levee systems also displace water and may cause flooding in up or down stream cities, or in “sacrificial” areas of their own town. If carefully planned, community-scale mitigation measures like levees, greenways, and sea walls not only protect more people, buildings, and infrastructure but also enable the community to spend their mitigation dollars more equitably and effectively.

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.

Key mitigation questions

- » What is covered in the city plan?
- » How does it impact the project?
- » What should 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

Mitigation tactics implemented at the building scale may result in maladaptation; causing harm to neighboring structures or communities.

SOURCE

Ilyia Azaroff, AIA. Used with permission.

An individual building or structure could serve as a larger community asset by providing safe haven (designated emergency shelters) 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 have their own hazard mitigation plan. A state or city plan is not an owner plan. Critical facilities such as hospitals already do this in many locations, but more private owners should consider the same for multiple reasons.

The owner will likely have to interpret how a particular site or facility fits into the larger mitigation framework and what is required for the owner's compliance and leverage of that framework. Some building owners manage multiple properties within the boundaries of a single Hazard Mitigation Plan, 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 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 mitigation plans must do so as well. In the near future, publicly traded companies will likely be required to disclose hazard risk to portfolios. As of this publication, the G20, an international forum for the governments and central bank governors of over 20 major economies, is working on a financial model that will make these financial risks more transparent and more easily quantified over time.¹⁹

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 to determine how the state and local 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.

¹⁹ "Climate Financial Risk Disclosure Stepped up at COP21: Bloomberg and Carney Launch Task Force." United Nations Framework Convention on Climate Change. United Nations, 4 Dec. 2015. Web. 23 Sept. 2016.

RELATIONSHIP OF CONTEMPORARY CODES AND DISASTER RESISTANCE

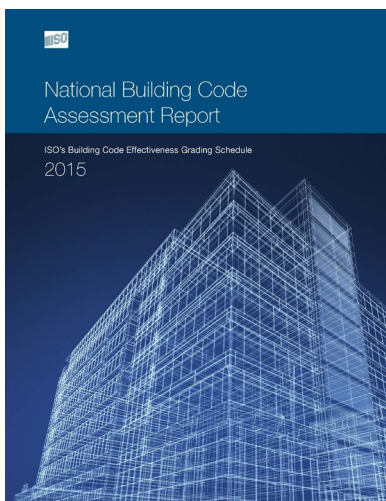
The adoption, application, and enforcement of current model building codes is the first step in reducing vulnerability, increasing public safety, and affording minimal property protection. At a fundamental level, model codes and standards move jurisdictions in the right direction; however, it is important to note that building codes are only a minimum requirement.

The International Code Council updates their 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 ASHRAE, NFPA, and IAPMO also make regular updates. Some local jurisdictions are required by state law to update their codes on a regular basis while others voluntarily adopt the model building codes.

The effectiveness of building codes has been evaluated by research institutions and nonprofit organizations like the International Organization for Standardization (ISO) that analyze building code enforcement. 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 should demonstrate fewer losses, and insurance rates can reflect that, thereby incentivizing rigorous code application.²⁰ Another study by the Institute for Business and Home Safety, 2015 Rating the States, also reveals that building codes are getting more stringent, yet some states remain susceptible to market and political pressures to eliminate certain sections of the code or reduce the regular 3-year update cycle of code adoption. “Opt-out” clauses by a state provide loopholes to local jurisdictions for specific code requirements. As a result, local jurisdictions within the same state can vary in the level of protection. 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.

However, unlike police and fire departments, building departments tend to lack the resources to ensure public safety, particularly human resources. 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 GAO’s report *Climate Change: Improved Federal Coordination Could Facilitate Use of Forward-Looking Climate Information in Design Standards, Building Codes, and Certifications* which recognizes the need for building codes to reflect climate projection data and FEMA’s Public Assistance Required Minimum Standards policy which requires code-minimum standards be used for Public Assistance projects.



THE VALUE OF ENFORCEMENT

The Building Code Effectiveness Grading Schedule (BCEGS®) assesses the building codes in effect in a particular community and how the community enforces its building codes, with special emphasis on mitigation of losses from natural hazards.

SOURCE

International Standards Organization © 2016. Used with permission.

²⁰ “About ISO.” ISO Mitigation. Verisk Analytics, n.d. Web. 05 Aug. 2016.

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 standards. 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.²¹ When powerful winds breached the light-duty garage doors, the garage area became pressurized and the roof experienced uplift. The walls of the garages collapsed, exposing the inside of attached homes to the destructive forces of wind and water damage. New codes in Moore, OK now require garage doors to be wind resistant.²²

Often it's not for lack of technical knowledge, but political will that creates the obstacle for disaster-resilient building code adoption and enforcement. After Hurricane Andrew in August 1992, FEMA's Building Performance Assessment Team (BPAT)²³ pointed to numerous factors that may have contributed to the poor performance, including inadequate county review of construction permit documents, county organizational deficiencies such as a shortage of inspectors and supervisors, and insufficient training of inspectors and supervisors. Those factors resulted in an estimated 33 percent increase in overall insured losses that could have been avoided had codes in effect at the time the buildings were constructed been adequately enforced. Similarly, 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 be reduced an estimated 75 percent if buildings in the affected area

had protected openings, improved roof-deck connections, and improved roof-to-wall connections. Those conditions would be enforced by model codes in at-risk wind zones along the coast."²⁴ Building codes are only as effective as the mechanisms in place to apply and enforce them.

It can't be overstated that model building codes are minimum standards for building design and construction that typically do not address extreme events such as hurricane or tornadic wind conditions. Furthermore, model building codes are based upon historical data, and therefore may be inadequate to address future risk over the service life of the building. This results in limited protection of property, particularly for existing buildings and those built prior to adoption of milestone code updates for specific hazards. In a design level event, the code essentially requires that the building 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 and demolition may be necessary. Furthermore, actual structural loads from snow, water, or wind during the service life of a building may exceed the design criteria derived from the codes. Clients 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 that are not satisfied with the minimal protection afforded by the code, a vulnerability assessment offers a more thorough understanding of issues to address.

²¹ Graettinger, Andrew J., Ph.D, Chris C.E. Ramseyer, Ph. D , Seamus Freyne, Ph. D , David O. Prevatt, Ph. D , Laura Myers, Ph. D, Thang Dao, Ph. D, Royce W. Floyd, Ph. D , Lisa Holliday, Ph. D, Duzgun Agdas, Ph. D, Fred L. Haan, Ph. D, Jim Richardson, Ph. D, Rakesh Gupta, Ph. D, Robert N. Emreson, Ph. D, and Christine Alfano. "Tornado Damage Assessment in the Aftermath of the May 20th, 2013 Moore Oklahoma Tornado." (n.d.): n. pag. Mar. 2014. Web. 20 July 2016.

²² Butler, Kyle. "Reducing Tornado Damage with Building Codes." AIR Worldwide, 29 July 2014. Web. 20 July 2016.

²³ FEMA's Building Performance Assessment Team/Mitigation Assessment Team (MAT) reports are available on-line and are a resource to better understand hazard impact and building performance.

²⁴ Louisiana State Hurricane Center. (October 3, 2005) Residential Wind Damage in Hurricane Katrina Improved Building Codes and Construction Practices.

RISK REDUCTION TACTICS IN THE BUILT ENVIRONMENT

There are a variety of ways to reduce damage and injury from a hazard event: 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. As an 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.

If a building must occupy a vulnerable site, hazard mitigation measures 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 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 shelter in place?

Risk transfer tools such as insurance are a common way to address risk, but it does not reduce damage or injury – only financial loss. The benefits of risk reduction may be economic (reduced insurance premiums or maintenance costs) but may also include intangible benefits such as personal safety, peace of mind, and the protection of irreplaceable personal belongings. Beyond a building by building basis, citizen architects can share these same lessons of risk awareness, vulnerabilities and hazard mitigation and apply the methodology to community plans, programs and initiatives.

Hazard Avoidance

Choosing to build in a less vulnerable area

Hazard Mitigation

Strategies that lessen the effects or consequences of an incident.

BUILDING VULNERABILITY ASSESSMENTS

Vulnerability assessments of buildings are essential to effective mitigation. These assessments are tools to understand the potential impacts to a building and its operations as a result of hazards and other threats. In a vulnerability assessment, hazard impacts are evaluated and factored against the building owner's appetite for risk. This type of analysis is not a typical part of the site selection and programming phases, but it can be to enhance and align building performance.

Building vulnerability assessment steps²⁵:

01 Identify hazards: determine those hazards that pose a threat, including the probability, frequency, and severity of each hazard type. Refer to regional, state, and local hazard plans, data, and maps and obtain site specific reports and analysis as needed to complete the assessment. Anticipate secondary hazards and cascading effects associated with the primary hazards.

02 Characterize interdependencies: assess utilities and infrastructure systems including location, age, and vulnerabilities that directly service the property or impact the operations of the building's function.

03 Characterize social dimensions: assess building function and capability in relation to building users as well as the larger community. Identify needs and consequences of a disruption.

04 Characterize the impacts of hazard events on building components: determine which systems may be impacted and the expected type of damage.

05 Recommend performance goals: prioritize issues to address given the exposure to risk and the consequences stemming from those risk.

When designing for resilience, a vulnerability assessment is completed. The architect and the design team use the vulnerability assessment to develop options to reduce exposure or otherwise enhance the buildings ability to withstand the force of the hazard. The end result is a building hazard mitigation plan that identifies long-term strategies as well as how to implement them. Hazard mitigation plans should be created and updated for development of all scales: residences, commercial buildings, institutions, and infrastructure.

Vulnerability Assessment

Identifies 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 you afford to be out of service due to disruption?
- » What is essential to meet acceptable operational requirements?

²⁵ Steps adapted from the NIST Community Resilience Planning Guide and the US Climate Resilience Toolkit

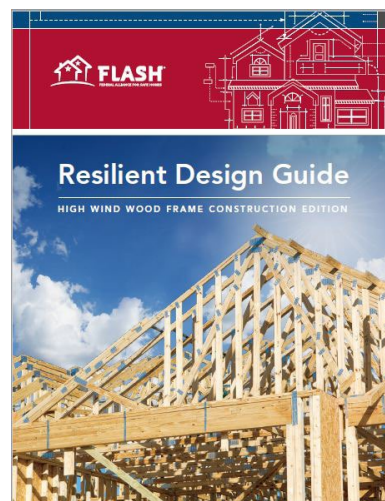
DESIGN FOR HAZARD MITIGATION: TECHNICAL GUIDANCE, TOOLS, AND RATING SYSTEMS

Architects promote disaster resilience by integrating hazard mitigation strategies into their practice and advocacy efforts: identifying policies and public incentives that can be leveraged for project funding, advising clients on vulnerability and risk reduction tactics, and engaging in public outreach to promote mitigation best practices.

An architect is able to target the most effective options for risk reduction only after completing a vulnerability assessment. Numerous resources describe hazard mitigation strategies; many of which are summarized on the AIA website ([see list in appendix](#)).

In addition to ICC's Performance Code for Buildings and Facilities, performance-based design guidelines have been developed by the FEMA Building Science Branch, the Insurance Institute for Building and Home Safety (IBHS), the Federal Alliance for Safe Homes (FLASH), and others, which have proven effective in improving performance under hazard conditions beyond that which is provided by the code. For example, FLASH—in collaboration with design professionals—published the *Resilient Design Guide (RDG) for High Wind Wood Frame Construction*. Realizing that more than 39 million US homes are at risk from winds that can exceed 110 mph, FLASH, in collaboration with the AIA and its Florida and New York chapters, the former Architecture for Humanity, and the Gulf Coast Design Studio worked together to create a series of recommendations for foundations/floor systems, roofs, landscaping, and the building enclosure to enable architects, designers, and homeowners to adapt any set of house plans for use in constructing wind-resilient homes.

In addition to performance-based design guidelines, rating systems are tools design professionals and owners can use to achieve performance goals. A number of voluntary performance-based rating systems have been or are being developed. One such effort began with the work of the Structural Engineers Association of Northern California (SEAONC) based on ASCE-41. They created higher than code seismic safety criteria and added performance criteria for cost of repairs and time to regain functionality. This was further developed by Arup's Resilience-based Earthquake Design Initiative (REDi) rating system—a framework for resilience-based earthquake design—and by FEMA P-58 Seismic Performance Assessment of Buildings. Further work on seismic safety has manifested in the US Resiliency Council's (USRC) Earthquake Building Rating System; a building performance rating system to assess structural capacity, MEP systems, and architectural components in new and existing buildings.



TECHNICAL GUIDANCE

The Federal Alliance for Safe Homes (FLASH) partnered with an array of design professionals to create a series of design guidelines that enhance high-wind resilience.

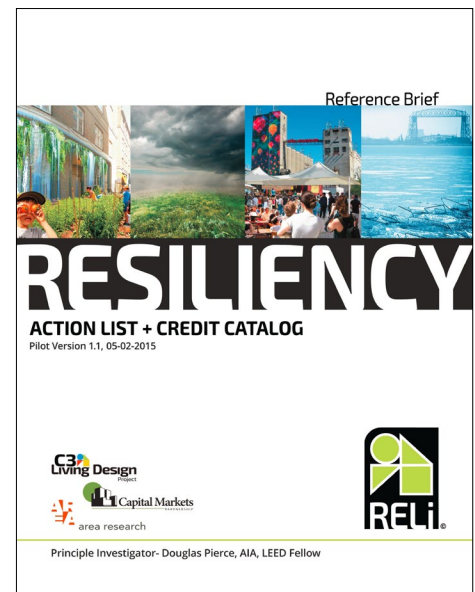
SOURCE

FLASH

In addition to USRC and the REDi rating system, another voluntary performance-based rating system is the set of Resilience Pilot Credits that the US Green Building Council added to their LEED rating system. These pilot credits help design teams address hazard risk throughout the phases of project design. The three credits—Assessment and Planning for Resilience, Design for Enhanced Resilience, and Passive Survivability and Functionality During Emergencies—create a framework that encourages designers, planners, and building owners/operators to proactively plan for the potential impacts of natural disasters or disturbances as well as long-term building performance from changing climate conditions. The credits also aim to ensure that buildings will maintain reasonable functionality, including access to potable water, in the event of an extended power outage or loss of heating fuel.

Another rating system, the Resiliency Action List and Standard (RELi) was developed by a collaboration of professionals, experts and graduate students through an ANSI recognized national consensus program. RELi includes a series of strategies for hazard mitigation, emergency preparedness and community resilience. RELi also catalogs existing sustainability strategies that support resilient design by referencing a number of guidelines, creating a holistic “to-do” list for owners and designers.

Rating systems can be of assistance to design teams in developing performance-based designs and meeting design goals that are above code. A partial list of rating systems at the time of publication can be found in the [appendix](#). Unfortunately, professional liability insurance often stops at the prescriptive building code performance level, so architects should contact their insurance providers for more information.



GREEN BUILDING RATING SYSTEMS ADDRESSING RESILIENCE

The Resiliency Action List (RELi) references other guides and includes many new strategies covering hazard mitigation, emergency preparedness and community resilience in an effort to establish a holistic tool for owners and designers. RELi was created by C3 Living Design, The Capital Markets Partnership's National Safety + Resiliency Committee, AIA Minnesota, AREA Research, Perkins + Will and the University of Minnesota School of Architecture Masters in Sustainable Design Program.

SOURCE

C3 Living Design/Perkins + Will.
Used with permission.

Design for hazard mitigation: the Iowa State Fairgrounds

A CASE STUDY BY THOMAS HURD, AIA

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

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.

LEVERAGING FINANCIAL INCENTIVES IN DESIGN FOR CONSTRUCTION AND OPERATIONS

When architects and development teams understand the financial incentives and co-benefits of hazard mitigation strategies, clients are better able to understand economic benefits and prioritize design decisions accordingly. For instance, using impact resistant roofing in hail-prone areas can reduce vulnerability as well as insurance premiums. Some communities have state- or city-funded programs that incentivize mitigation with grants, low-interest loan programs, tax rebates, or insurance premium reductions. There are thousands of programs for individuals, businesses, and public sector entities available nationally. Architects who understand the risk reduction programs applicable to their projects are of greater service to their clients and their wallets.

A core principle inherent in the effort to provide greater service to their clients is the ability of the architect to conduct a benefit/cost analysis (BCA) on the hazard mitigation investments intended. BCA is the method by which the future benefits of a mitigation project are estimated and compared to its cost. The end result is a benefit-cost ratio (BCR), which is derived from a project's total net benefits divided by its total project cost. The BCR is a numerical expression of the cost effectiveness of a project. A project is considered to be cost effective when the BCR is 1.0 or greater, indicating the benefits of a prospective hazard mitigation project are sufficient to justify the costs.²⁶ This quantitative proof enables owners to see the potential return that smart hazard mitigation planning and design provides, and makes the cost of the risk more transparent. This analysis helps architects to communicate the value of specific mitigation measures and possibly identify funding for projects. More importantly, it will help all project stakeholders to see the dividends that might be captured if planning and design were more hazard resistant from the beginning. Buildings in higher risk locations will invest more to be resilient, yet will also enjoy a higher benefit/cost.

In addition to hazard mitigation grants, understanding stacked financing strategies, green bonds, loan programs, tax incentives, and insurance discounts for hazard mitigation are also important. Insurance incentives are further discussed in the "Risk transfer and insurance" section.

Stacked financing

Creates incentive programs for risk reduction while offering pay for performance financial returns for investors. Leverage within the capital stack means greater returns for those most invested.

Green bonds

Bond financing specifically for environmental projects and their impacts.

Hazard mitigation loan programs

Hazard-specific financing for homeowners and small businesses.

Tax incentives

Deductions or credits that may be offered by the state or local government to home and business owners that incorporate hazard mitigation strategies.

Insurance incentives

Discounts that may be offered by an insurance company for implementing hazard mitigation strategies. Discounts are dependent on the project location and the hazard addressed.

²⁶ "Benefit-Cost Analysis." Benefit-Cost Analysis | FEMA.gov. FEMA, n.d. Web. 23 Jul. 26.

RISK TRANSFER AND INSURANCE

Owning a home exposes the owner to a certain amount of risk. Because a home is typically the largest asset a family has, the loss of the home can lead to a large financial downfall. Risk transfer is a risk management strategy that involves the contractual shifting of risk from one party to another, as is the case with an insurance policy, by which a specified risk of loss is passed from the policyholder to the insurer. The insured includes those who cannot afford to retain the full risk, those who are required to do so by their financial lender, or those who do not wish to have the financial risk. This “transfer of risk” is the underlying principle behind all types of insurance, and specific types of risk and coverages are detailed in the insurance contract. The insurer assumes the risk for a fee (premium). When a loss occurs, the insurer agrees to indemnify the policyholder, up to a certain amount, for the specified loss in exchange for that premium paid.

Insurers calculate premiums based on location, age, size, and construction type of the structure; among other factors which differ from company to company. Insurers take into account the building’s replacement value—which is not that same as the purchase price or tax assessor value, but rather what, under current economic conditions it would cost to rebuild the structure per the method outlined in the policy. This can be easy to identify on a newly constructed building, but may be more difficult for older or historic properties with ornate details, or unique designs. Architects knowledgeable about local construction practices and costs may be helpful to ensuring a desirable amount of coverage for a structure. Note that land values are not included in replacement cost valuation.

Understanding the type of risk covered and the level of coverage offered by an insurance policy is important. A typical homeowner’s policy does not include coverage from damage caused by earthquakes or flooding, but separate policies and coverage are available for those risks. Some covered risks may only be offered with a separate specific deductible. For instance, in coastal areas percentage deductibles are common for the wind damage portion of the policy.

In order to remain solvent and have sufficient capital to cover losses, insurers may need to limit their exposure to catastrophic losses from natural disasters. This trend is especially disconcerting as home and business owners have historically relied on risk transfer with insurance policies to respond to disaster risk. Deductibles can be quite high: for a newly constructed 1,300 square foot home in 2014, earthquake insurance carried a \$35,000 deductible in Seattle, Washington.

In some high risk areas, an owner may encounter an insurance coverage exclusion for a given hazard type because of the property’s high-risk location. Structures that have this exclusion do not pay a premium for the non-applicable coverages. In cases such as this, a state insurance program is typically available to supplement policies available in the private market, like the Texas Windstorm Insurance Association and Florida’s Citizens Property Insurance Corporation. Both of these programs were created to ensure that policyholders unable to find private coverage because of their property’s location can be covered. The California Earthquake Authority serves a similar function by providing “residential earthquake insurance and encouraging Californians to reduce their risk of earthquake damage and loss.”

Insurance discounts combine the concepts of insurance risk transfer with loss (hazard) mitigation. Programs vary from state to state and from insurer to insurer. Architects may contact insurers or the appropriate state Department of Insurance to obtain the latest information on discount programs and requirements. These discounts can be substantial, and understanding which ones apply and designing to them is a real service to the client, especially as they consider life-cycle costs.

ADVOCATING FOR COMMUNITY RESILIENCE THROUGH HAZARD MITIGATION

Architects 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. Architects 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—from educating their clients, to advocacy in public forums (supporting stronger codes and ordinances), to civic participation (planning boards and commissions), to engagement with community groups working towards resilience

An example of advocacy efforts is the BuildStrong Coalition which promotes the adoption and enforcement of model building codes. The work of the BuildStrong Coalition aligns with the AIA's advocacy of comprehensive, coordinated and current codes. The AIA worked with the BuildStrong Coalition to promote the National Mitigation Investment Act (H.R. 5177) which would make states that adopt and enforce a model building code eligible for additional federal disaster relief funding.

Opportunities to engage in community hazard mitigation include:

- » Participating in code development and public awareness of code benefits and limitations. This could be through the state building code commission, AIA Codes Advocacy program, or the International Code Council's national organization or local chapter.
- » Working with legislators or supporting legislative initiatives that encourage pre-disaster mitigation.
- » Supporting or volunteering with state agencies or non-governmental organizations like FLASH that are working on public awareness of hazards and disaster risk reduction.
- » Partnering with local universities on research and outreach initiatives.

AIA Position Statement on Building Codes and Standards

The AIA supports regulation by a single set of comprehensive, coordinated, and contemporary codes and standards, which establish sound threshold values of health, safety, and the protection of the public welfare throughout the United States.

ADDITIONAL MITIGATION RESOURCES

Federal, state, and local mitigation

[Hazard Mitigation Grant Program \(HMGP\)](#)

[Pre-Disaster Mitigation Grant Program \(PDMGP\)](#)

[City of Seattle Disaster Recovery Framework](#)

[State of Florida Recovery Plan](#)

[Rebuild by Design](#)

[National Disaster Resilience Competition](#)

Relationship of contemporary codes and disaster mitigation

[The Building Code Effectiveness Grading Schedule \(BCEBS\)](#)

[IBHS 2015 Rating the States](#)

[GAO Report entitled 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](#)

Building vulnerability assessments

[FEMA Risk Assessment](#)

Analyzing natural hazard threats:

- » [IBHS Risk by Zip Code](#)
- » [FEMA Flood Maps](#)
- » Your 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

[FEMA Building Science](#)

[Federal Alliance for Safe Homes \(FLASH\)](#)

[FLASH Resilient Design Guide for High Wind Construction Insurance Institute for Business and Home Safety \(IBHS\)](#)

For a list of technical resources and rating systems, please see [appendix](#).

Risk transfer and insurance

[The Insurance Information Institute \(III\)](#) provides information for consumers, the media, researchers and the general public on a wide range of insurance topics along with papers and presentations that focus on financial results, catastrophes, climate change and other key issues. Architects can find guidance on risks as well as information on insurance coverage on their website.

Leveraging financial incentives in design for construction and operations

[Developing Pre-Disaster Resilience Based on Public and Private Incentivization](#)

Emergency and disaster preparedness

03

LEARN: COMMUNITY-WIDE EMERGENCY PREPAREDNESS

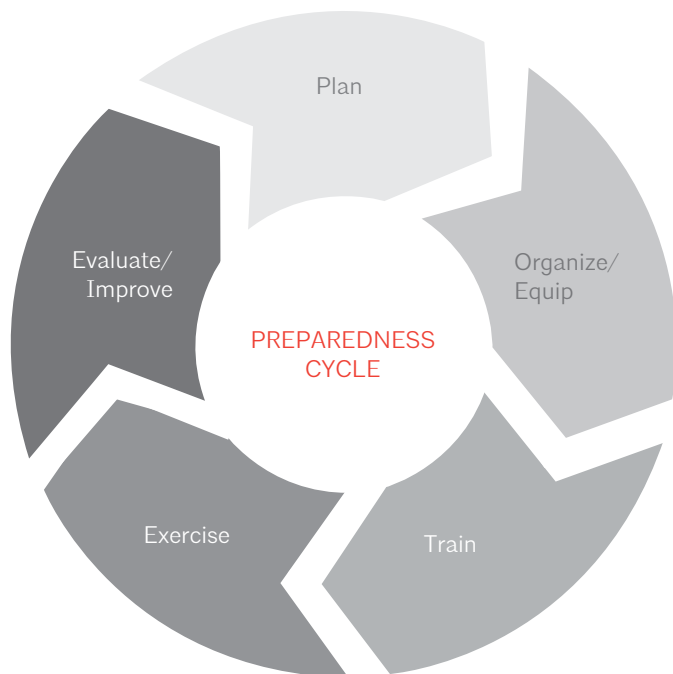
- 52 The National Preparedness System
- 52 Partnerships in preparedness

ACT: PREPARING FOR EMERGENCIES AND DISASTERS

- 53 Emergency preparedness plans and business continuity plans
- 54 AIA State Disaster Assistance Program: Preparing to provide building safety assessments
 - » Liability coverage (Good Samaritan law)
 - Case Study: Passing Good Samaritan Legislation in New Hampshire
 - » Clarity on workers' compensation
 - » Standard of training
 - » Specialized education, training, and certifications
 - » Portability of licensure
 - » Activation of volunteer network
 - » Case Study: Establishing a State Disaster Assistance Program in Iowa
- 60 Policy and Advocacy for enhanced disaster preparedness
- 60 Community Emergency Response Teams (CERT)
- 61 Disaster and hazard scenario planning, drills and exercises
 - » Case Study: Earthquake Scenario Planning for San Diego/Tijuana

OVERVIEW

The preparedness phase is a critical component of the emergency management cycle as it is a direct indicator of disaster response capabilities. Ongoing evaluation, maintenance, and development of emergency plans, supplies, and building systems and equipment is necessary to maintain readiness. 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. When buildings remain safe and resilient to the impacts of hazards, communities will reduce their vulnerabilities and needed level of response.



THE CYCLE OF PREPAREDNESS

A state of preparedness relies upon regular communication, evaluation, and improvement through a cycle of planning, organizing, training, equipping, exercising, evaluating, and taking corrective action.

SOURCE

FEMA

Key concepts

- » Understand the structure, elements, and utility of the national disaster preparedness system.
- » Understand the opportunities and responsibilities for architects in disaster preparedness, including emergency preparedness and business continuity planning, advocacy, and community engagement.
- » Be aware of the disaster preparedness education, training, and certification programs available to architects.
- » Understand the components of an AIA State Disaster Assistance Program and how to take action.
- » Identify other stakeholders architects collaborate with during the preparedness phase in anticipation of response activities.

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 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.”²⁷ To achieve this goal, the National Preparedness System outlines a process of six steps for communities to utilize:

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

The details of these steps are available on [FEMA's website](#).

PARTNERSHIPS IN PREPAREDNESS

Coordination and communication networks that are developed before the 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. 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) and others have specific responsibilities post-disaster, and it's important to understand what those duties are and how architects can collaborate on efforts before and after the disaster. 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. By establishing relationships early, all parties gain a better understanding of the opportunities each brings.

²⁷ “National Preparedness Goal.” FEMA, 5 July 2016. Web. 21 Feb. 2017.

EMERGENCY PREPAREDNESS PLANS AND BUSINESS CONTINUITY PLANS

Disaster preparedness begins at the individual level. Architects lead by example by having a family emergency plan and/or a business continuity plan in place. When such a plan is in place, individuals are better able to assist others post-disaster. Additionally, these plans are easy to incorporate in the programming stage for any new or renovation project. Furthermore, architectural firms that do this planning for their own firms are more able to discuss these issues with clients and track the design implications.

To start a plan, examine websites for your neighborhood associations, your city, or county to see what resources they have available for individual and neighborhood level disaster preparedness planning. Federal agencies and organizations like FEMA and the American Red Cross have resources and guides for creating personal, business, and community emergency preparedness plans. Architects may augment these plans with building and site-specific characteristics. Additionally, the Insurance Institute for Business and Home Safety (IBHS) provides the Open for Business tool for small business owners to create a post-disaster recovery plan.

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

The AIA Disaster Assistance Program supports a nation-wide 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 adequately to the challenges that confront them following a major disaster, and rely upon additional resources to meet the needs of the community. During response and recovery, Good Samaritan laws that limit liability, clear guidance to volunteers on workers compensation regulations, and the portability of licensure across state lines can allow communities to recover faster by providing protections that enable architects to service affected communities.

Liability coverage (Good Samaritan law)

Many states have extended protection from liability to doctors and various 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 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 creating an AIA State Disaster Assistance Program is to determine if the state has a Good Samaritan law and if so, what level of liability protection it affords architects. Not all Good Samaritan laws are written equally. Services, length of time, and required credentials can vary from state to state. Examples of adopted Good Samaritan laws and model language can be found in the [appendix](#).

Generally, a Good Samaritan law concludes that “if an architect provides professional services for free to a victim during a declared disaster or state of emergency, at the request of a public official, relating to a building or structure,” the architect is immune from civil damages (including personal injury, wrongful death, property damage, or other loss), unless the action of the architect involved gross negligence or wanton, willful or intentional misconduct. 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.

Several AIA chapters nationwide have actively pursued Good Samaritan legislation, some based on AIA’s model law, and at times in collaboration with engineers, code officials, and emergency managers who desire to be of service or those local agencies that benefit from the emergency services of volunteers.

Typically rooted within the state chapter, a **State Disaster Assistance Program** is a collaboration between member champions and local or state emergency officials to formally prepare architects to enter the chain of command in the event of a disaster.

A model state policy includes:

1. Liability coverage
(Good Samaritan law)
2. Clarity on workers’ compensation
3. Standard of training
4. Portability of licensure
5. Activation of volunteer network

Passing Good Samaritan Legislation: New Hampshire

A CASE STUDY BY CAROLYN ISAAK, HON. AIA NH

AIA New Hampshire Executive Director

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.

Clarity on workers' compensation

If an architect experiences an injury or fatality while performing pro-bono safety assessment services post-disaster, who will cover medical costs and associated expenses? It depends on whether the individual is volunteering under EMAC or the state or city. Under EMAC, workers' compensation travels with the individual being sent, unless a unique MOU says otherwise. If the individual is volunteering under the state or city, an understanding of responsibility benefits all parties and should be defined in an MOU or other agreement before volunteer services are rendered.²⁸ For example, the State of Rhode Island provides immunity from liability and workers' compensation for its disaster response architects and engineers by means of a contract between the State and each individual professional.

Standard of training

AIA Disaster Assistance volunteers are trained to respond to disaster situations before deploying into the field to perform building safety assessments. Required credentials and prerequisites of volunteers vary by state; however, most programs require architects and engineers to be licensed within the state they are volunteering. In many cases, trained professionals educated and working in the profession of architecture and engineering who are not yet licensed are able to volunteer under the supervision of a licensed professional.

Typically, most states and jurisdictions require that volunteers have post-disaster training related to incident management and/or technical building performance. FEMA and The National Incident Management System (NIMS) offer courses in government protocol for management of disaster situations that will provide context and awareness of mission control in disaster situations. The Applied Technology Council (ATC), the California Office of Emergency Services, and the International Code Council all provide highly regarded courses on evaluating damage caused to buildings post-disaster. It is recommended to first discuss training methods for credentialing with state or local emergency management officials.

Specialized education, training, and certifications

The AIA provides education on building safety assessments, hazard mitigation, climate change impacts, and community design at the AIA National Convention, online through AIA's educational platform AIAU, and by AIA chapters throughout the country. A list of currently available courses can be found in the [appendix](#).

The education backbone of AIA's Disaster Assistance Program is the building safety assessment program training based on ATC's method, an industry standard. In 2008 AIA National collaborated with California's Office of Emergency Services to adapt and adopt the California Safety Assessment Program (SAP). The AIA SAP training is an all-hazards training for architects and other built environment professionals to perform building safety assessments. The Safety Assessment Program utilizes volunteers and mutual aid resources to provide professional engineers, architects, and other certified professionals to assist local governments in safety evaluation of the built environment in the aftermath of a disaster. The program is managed by the California Office of Emergency Services (CAL-OES) with cooperation from professional organizations such as AIA and SEAOC.

The program works in compliance with the Incident Command System (ICS), and NIMS. The three Safety Assessment trainings associated with the program are:

- » **Evaluator training** educates architects, engineers, and building inspectors to perform field evaluations of buildings and other infrastructure for safety and habitability.
- » **Coordinator training** teaches local government representatives on how to estimate the local needs for the evaluators, how to request them, and how to manage them and the information they gather.
- » **Evaluator train-the-trainer** certifies individuals with disaster response experience to be official trainers for the program.

²⁸ Consult with the state department of labor on the administration of worker's compensation in your state

SAP has been used successfully in responding to disasters, such as the Northridge, Napa, and San Simeon earthquakes in California, as well as in response to Hurricane Katrina in 2005, the Tuscaloosa Tornadoes in 2007, and Hurricane Matthew in 2016.

To prepare members and advocate for the architects' role in disaster assistance, the AIA offers SAP Evaluator Training courses to its members as building safety evaluators. Authorized AIA SAP instructors share their professional disaster response experience in the classroom with examples and case studies. The one-day training course consists of an overview of the AIA program, a performance of safety evaluations, and tips for working as a volunteer after a disaster where both technical and emotional assistance will be required. Students are taught what to look for and how, and are given step-by-step instructions for filling in assessment forms, including how to record a variety of building damage issues and circumstances. Local training sessions are often tailored to the type of development, construction, and hazards found in the region.

Eligible candidates holding a professional license will be issued a picture ID for use during an emergency or disaster event. Only licensed professionals and building inspectors with acceptable training will receive the photo ID, but this does not prohibit other persons with related skills or interest from being trained and receiving a certificate of training. SAP Training certificate holders are often welcomed and valued members of the disaster assistance teams. Unlicensed professionals are eligible for the Coordinator designation and if the individual becomes licensed during the valid certificate period, the Coordinator may be eligible to receive the Evaluator certificate.

As of this printing there are nearly 2,000 architects and other professionals in the field of architecture nationwide—including Puerto Rico and the District of Columbia—who have completed AIA's SAP training.

Portability of licensure

Because architects are licensed by each individual state rather than at a national level, during a large-scale disaster the legal limitations on practice can inhibit adequate response and resources. Local architects, for instance, are tending to their own families, businesses, and neighbors, and thus their communities may need volunteer assistance from architects in neighboring states. To overcome this legal barrier in this critical yet temporary situation, the state architectural licensing board can advocate for policies that allow out-of-state licensed architects to serve as "emergency workers" during a disaster declaration. The National Council of Architectural Registration Boards maintains model language 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.

Activation of volunteer network

AIA State Disaster Assistance Program administration may be led by the relevant AIA state chapter or a strong local chapter with a member champion, known as an AIA State Disaster Assistance Coordinator. Disaster assistance coordination includes maintaining rosters of potential volunteer members, organizing training, and providing communication between the AIA staff, state emergency management, and other governmental officials as well as outreach to allied building professionals. Depending on the size, density, or topography, it may be desirable to add local Disaster Assistance Coordinators 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. For example, AIA New York's Design for Risk and Reconstruction Committee and AIA Seattle's Disaster Preparedness and Response Committee work year-round to train, educate, and prepare members and allied professionals with updated hazard information and emerging practices to promote mitigation and resilience.

FEMA, in their resources published on the subject, encourages an MOU to be signed between the coalition providing volunteer services and the state or local municipality. The AIA State Disaster Assistance Coordinators may develop MOUs with the AHJ to formalize the response capabilities of architects, be able to reimburse volunteer expenses, ensure there is a streamlined method of engaging architects, and establish a monetary value for architects' services to the AHJ. MOUs can also include allied professionals such as structural engineers and civil engineers.²⁹

When a State Disaster Assistance Program has been established and a hazard event is forecasted, notifications may be sent to volunteers and AIA members 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, State Disaster Coordinators contact the appropriate state or local agency to convey readiness and capabilities of the AIA State Disaster Assistance Program.



ARCHITECTS PREPARE TO DEPLOY

Members of the Alabama State Disaster Assistance Team, (L to R): James E. "Butch" Grimes, AIA, State Disaster coordinator, Joseph "Wes" Wesley, AIA, Bruce N. Lanier III, AIA, Arch Trulock, AIA.

SOURCE

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

²⁹ Additional information on drafting MOUs can be obtained by emailing resilience@aia.org

Establishing a State Disaster Assistance Program: Iowa

A CASE STUDY BY THOMAS HURD, AIA

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

For many years, the State of Iowa did not enact a Good Samaritan law to protect architects and engineers that respond in disaster situations from liability. In absence of a Good Samaritan law, an agreement was developed with Iowa state agencies and AIA Iowa whereby the Iowa Department of Public Safety (IDPS) provided the needed liability and worker's compensation for volunteering architects as well as training and coordination after an event. This solution enabled volunteer architects to respond to disasters such as the 2008 flooding in eastern Iowa, however, this ad hoc method did not offer the benefits of an institutionalized program.

In 2014, AIA Iowa—in collaboration with Iowa lawmakers—advocated for and subsequently implemented a state-wide Good Samaritan law. The liability protection provided by this law provided a basis for AIA Iowa to work with Iowa agencies to develop a formal disaster response program, later deemed the Building Safety Assessment & Failure Evaluation (B-SAFE) program. Iowa's B-SAFE disaster response team is a program that was developed through AIA Iowa, the Iowa Homeland Security Emergency Management Division (HSEMD), the IDPS, and the State Fire Marshal's office. The B-SAFE program trains and equips volunteer member architects, engineers, emergency management, and building officials to evaluate damaged buildings to determine building safety and health. The B-SAFE Team has been designated as a state disaster specialty team, which allows communities to utilize this team as a state resource in times of disaster by contacting their county emergency manager.

The B-SAFE team not only performs post-disaster structural evaluations to determine building safety, it also provides technical and design assistance to local communities during the recovery and rebuilding process. The Iowa HSEMD and the State Fire Marshal Division of the Iowa Department of Public Safety manages the B-SAFE team and helps conduct training sessions with AIA Iowa on an annual basis to ensure coordination and response techniques are consistent with current disaster standards. Less than two years after establishing B-SAFE, dozens of architects, engineers, and building officials have participated in disaster response trainings around the state and are current members of the award-winning Iowa B-SAFE Team.

POLICY AND ADVOCACY FOR ENHANCED DISASTER PREPAREDNESS

The AIA supports advocacy efforts at the local, state, and federal levels. The AIA promotes the creation of State Disaster Assistance Programs along with the adoption of Good Samaritan legislation by all states. It also supports MOUs with state emergency management officials that provide architects and design professionals a formal process for engaging with the AHJ. The AIA also promotes appropriate modifications to the Stafford Act, which governs how FEMA operates, and enhancement of the Emergency Management Assistance Compact (EMAC) and other formal agreements that allow credentialed architects to provide safety assessments to affected areas across state-boundaries.

While the AIA recognizes that architects have a responsibility to design safe and healthy buildings and communities, sound risk reduction policies are essential to the work of architects and the communities they serve. This is why AIA advocates at the local, state, and federal level for model building code adoption and enforcement, comprehensive community planning for hazard and climate risk, and zoning and land use policies that address risk to make buildings and communities safer before a disaster strikes.

COMMUNITY EMERGENCY RESPONSE TEAM (CERT)

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.³⁰ 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 introduces the entities architects will be cooperating with as part of the AIA State Disaster Assistance Program.

³⁰ "Community Emergency Response Teams." FEMA. N.p., Aug. 2016. Web. 2 July 2016.

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 table top 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 mitigation and preparedness actions.



SOURCE

AIA Washington and FEMA

Earthquake Scenario Planning: San Diego/Tijuana

A CASE STUDY BY ROBERT THIELE, AIA

AIA Disaster Assistance Committee Member 2012–2016

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.

ADDITIONAL PREPAREDNESS RESOURCES

The National Preparedness System

[The National Preparedness System](#)

[The National Preparedness Goal](#)

[The National Response Framework](#)

Emergency and business continuity plans

[Emergency Communication Plan guide](#)

[FEMA Citizen Preparedness Guide](#)

[FEMA Business Continuity Planning](#)

[American Red Cross Prepare for Emergencies Site](#)

[IBHS Open for Business Business Continuity Guide](#)

AIA State Disaster Assistance Program: Preparing to provide building safety assessments

[AIA Safety Assessment Program Training \(SAP\)](#)

[Community Emergency Response Team \(CERT\)](#)

Policy and advocacy

[BuildStrong Coalition](#)

Disaster Scenario Planning, Drills and Exercises

[Great Shake Out](#)

Disaster response

04

LEARN: ROLES AND RESPONSIBILITIES IN THE AFTERMATH OF A DISASTER

- 67 Federal, state, and local government roles
- 68 Authorizing aid: volunteers and the Emergency Management Assistance Compact
- 70 Assessing the post-disaster building stock

ACT: RESPONDING TO DISASTERS IN THE BUILT ENVIRONMENT

- 72 Mobilization of volunteers
- 75 Post-Disaster Building Safety (or Rapid) Assessments
 - » Case Study: Tuscaloosa Tornado, 2011
 - » Case Study: Hurricane Katrina, 2005
 - » Case Study: Haiti Earthquake, 2010
- 83 Detailed and Engineering Assessments of buildings post-disaster

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 non-governmental 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.

Key concepts

- » Understand the “bottom-up” approach to disaster response employed by the Incident Command System, the foundation of the nation’s emergency management protocol.
- » 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.

FEDERAL, STATE, AND LOCAL GOVERNMENT ROLES

FEMA, the federal agency charged with management and coordination of disaster response, 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 and has been since the inception of the National Response Framework and the National Incident Management System (NIMS). Under ICS, the lowest level of government closest to 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 who coordinate interdepartmental response efforts.

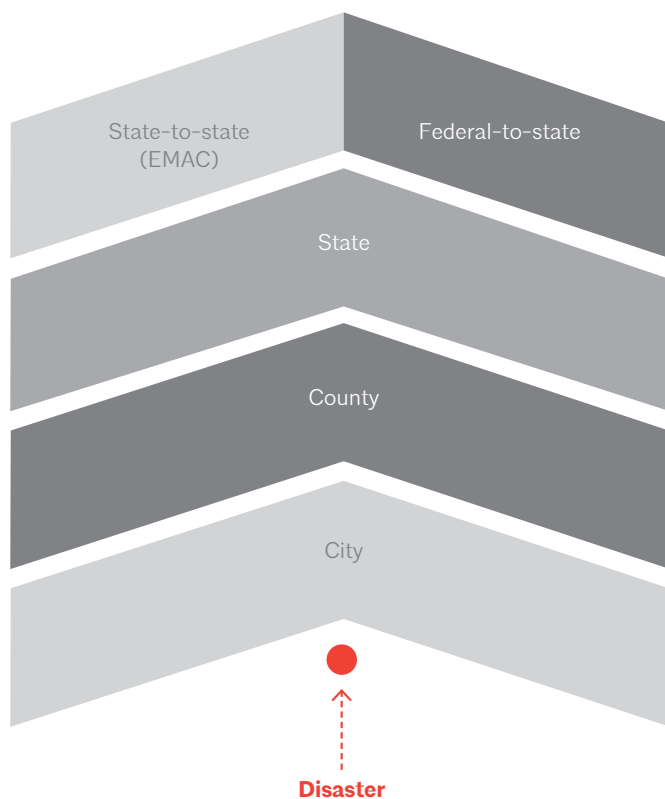
Control of operations starts with the incident commander, and each succeeding level of government provides support for those locally driven priorities. In a non-localized, diffused event, the emergency manager at the Emergency Operations Center (EOC) will consolidate the requests of incident commanders 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.

The lowest level of government closest to the disaster is always responsible for the management of the emergency response within its jurisdiction.

AUTHORIZING AID: VOLUNTEERS AND THE EMERGENCY MANAGEMENT ASSISTANCE COMPACT

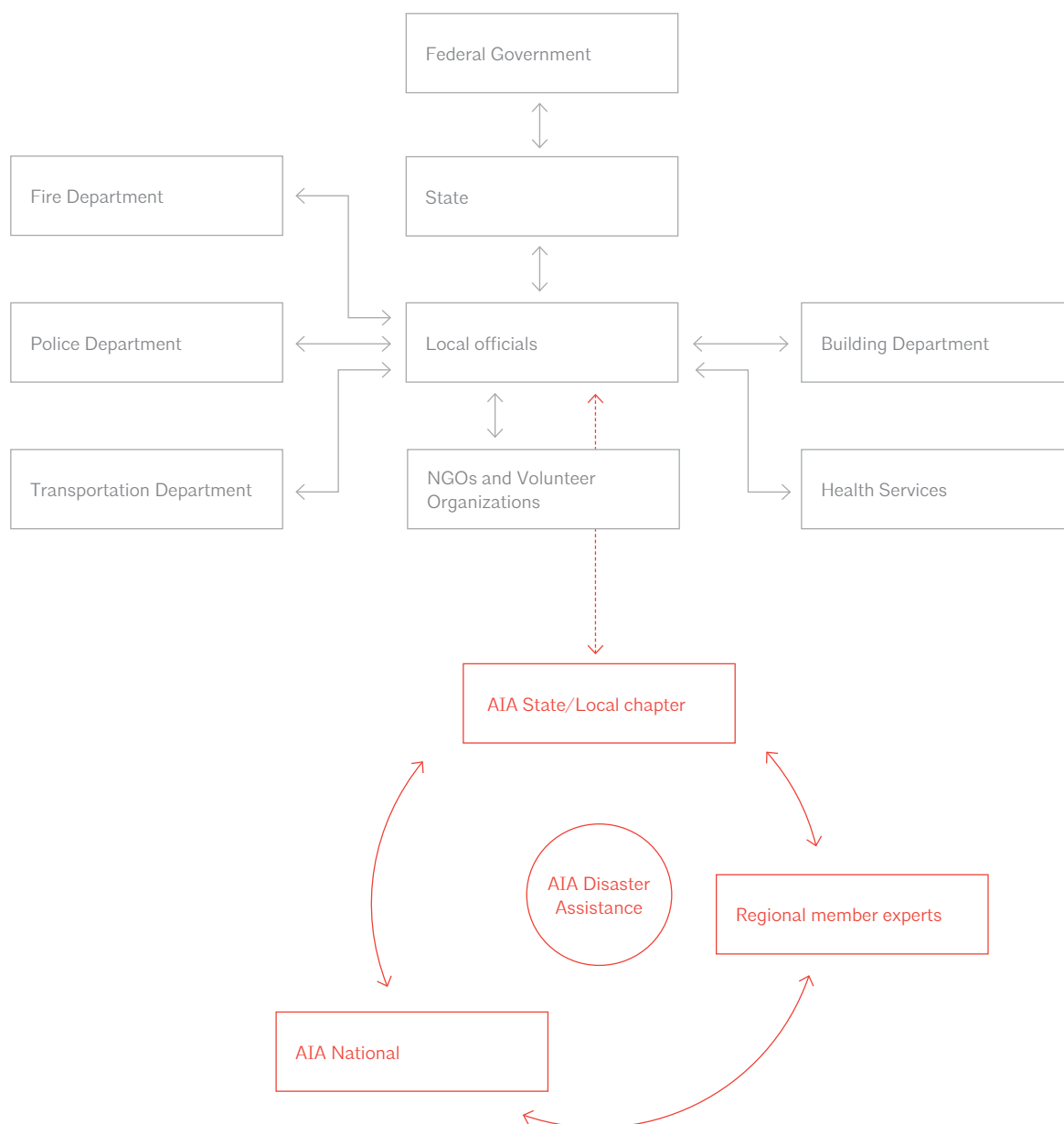
If assistance is needed from other states, the authority having jurisdiction (AHJ) can request volunteer assistance within the state, such as the AIA's disaster assistance program volunteers, and/or out of state aid through the Emergency Management Assistance Compact (EMAC). EMAC is a direct state-to-state mutual aid arrangement whereby states can share resources with other states during times of 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 other volunteers as temporary agents of the state, like the State of California, may legally deploy under EMAC. Under Article 5 and 6 of EMAC, those individuals sent under EMAC have immunity from liability and workers compensation, and 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.

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 the AIA.



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).

**ORGANIZATIONAL STRUCTURE OF DISASTER RESPONSE**

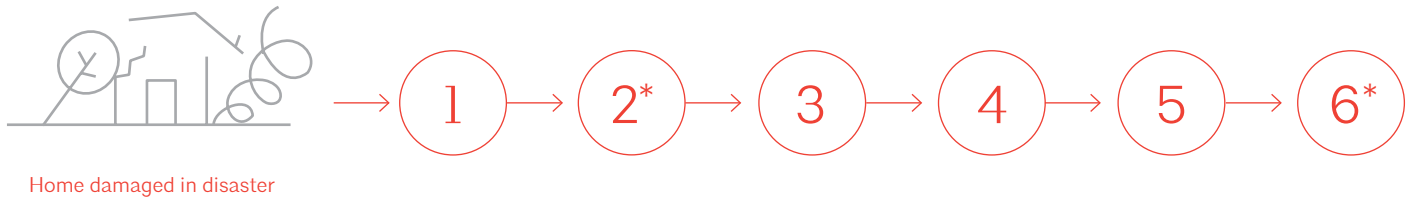
A partial organizational structure for emergency response. AIA is one of many NGOs/volunteer organizations. Depending on the state and situation, AIA disaster assistance coordinators may report to a state emergency management agency or local building department to deploy for building safety assessments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

ASSESSING THE POST-DISASTER BUILDING STOCK

When responding to disasters, on average, each building is 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 to process claims, FEMA or an authorized agent determines extent of damage for disaster assistance, and architects and engineers determine habitability (rapid assessment) and scope of repairs (detailed or engineering assessment). In addition, FEMA conducts both Preliminary Damage Assessments (PDAs), which are necessary for disaster declarations and funding, as well as Mitigation Assessments to determine points of failure. If the correct documentation process is in place, often times rapid assessments performed by architects and other volunteers are utilized as the PDA. This approach not only reduces time and resources but also saves tax payer dollars. Emergency management protocol is moving to the use of electronic data gathering and web-based information platforms to better consolidate and share the data obtained during each of these assessments.

One of the first actions taken after a hazard event, is a systematic and cursory observation of the affected area to assess the scope and scale of the hazard damage. Typically these are performed as a “drive by” visual observation from an emergency vehicle, hence the term, windshield assessment. Typically, at least two local government employees are involved, one to drive the vehicle, and the other to write down simple descriptions of the neighborhood damage. A city or county will usually need several teams to complete this effort. The windshield assessment tells officials where to send emergency and utility personnel to conduct search and rescue, tend to medical situations, address downed power lines, remove trees and debris, and restore bridge and road access. Until roads are clear, including receded flood waters, volunteers and residents will not be permitted to pass. In the future, drones may be utilized to determine the scale of damage and may even replace windshield assessments. This technology will be 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.³¹

³¹ “American Red Cross Study Shows Drones Used for Disaster Recovery Can Save Lives / Help Rebuilt Communities.” Zurich Insurance. American Red Cross, Apr. 2015. Web. 13 Nov. 2016.



*Role of Architect

SIX ASSESSMENTS

1. Windshield Assessment
2. Building Safety (or Rapid) Assessment*
3. Emergency services needs assessment
4. Assessment by Insurance Adjustor
5. Preliminary Damage Assessment
6. Detailed Assessment or Engineering Assessment*

(Demonstrates typical sequence, may vary)

POST-DISASTER BUILDING ASSESSMENTS

Post-disaster, each damaged building is evaluated on average six times. Rapid (also called Safety) Assessments and Detailed Assessments are performed by architects or other qualified built environment professionals. In some cases, the Rapid Assessment may be accepted by FEMA as sufficient documentation for the Preliminary Damage Assessment. Not shown: building performance assessments by University research teams.

MOBILIZATION OF VOLUNTEERS

AIA chapters contribute to the post-disaster response by supporting their 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 member volunteers and align response efforts with the needs articulated by the AHJ.

The AIA Disaster Assistance Program is fundamentally committed to equipping architects with the additional 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. The AIA encourages each state to prepare to respond to disasters by designating an AIA State Disaster Assistance Coordinator and developing 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 worker's compensation
- » propose policies that promote portability of licensure for out-of-state volunteers
- » create a communications network of trained volunteers

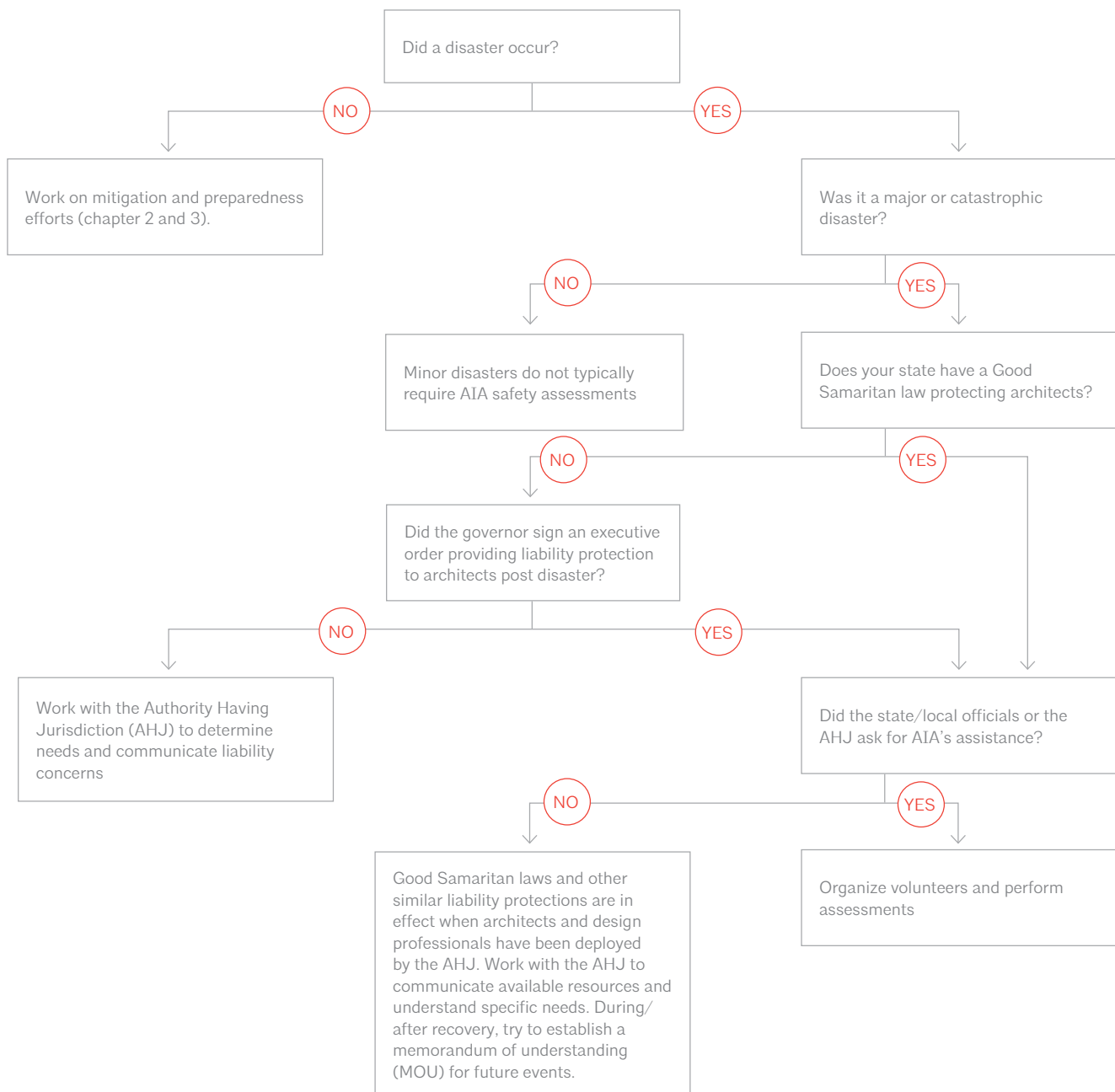
Before responding, it is critical that a Good Samaritan law or other liability protection is in place. For states that do not have a Good Samaritan law, architects can become deputized as contractors of the state or local government by way of an executive order (as was done after Hurricane Katrina in 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. Without an adequate Good Samaritan law in place or other legal indemnification, AIA state disaster assistance programs are wisely reluctant to volunteer. In states that have a Good Samaritan law, volunteers who engage in post-disaster services without a formal appointment by the AHJ are subject to a void in their Good Samaritan legal protection. A secondary reason to participate in AIA disaster response training is to be included in AIA's notification network to receive official communications after a disaster.

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 Coordinator is the point of contact between the AHJ and the AIA chapter(s) staff and 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 the AIA to quickly facilitate a Safety Assessment Training for architects, engineers, and building officials to prepare them for the field work ahead. After the 2011 Tuscaloosa Tornadoes, over 200 volunteer architects, engineers, building inspectors, and firemen participated in AIA Safety Assessment Training to prepare to assess homes and business.

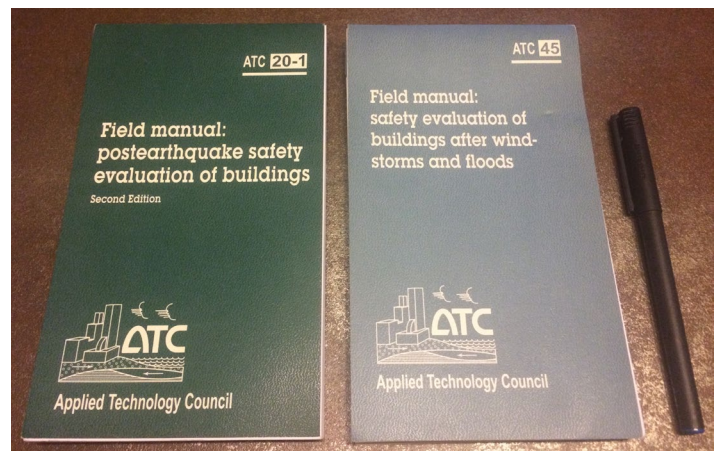
Volunteers serving as Building Evaluators need to be aware of, and prepared for, the conditions they will encounter. The volunteer's health and safety is of primary importance. Anyone anticipating field work should be up to date on vaccinations, especially tetanus, as debris can often hide rusty nails 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](#).

**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

The disaster-stricken area may be overwhelmed by the number of strangers “invading” their community at its darkest hour. Although a business card may be an easy form of identification to show a homeowner, the appropriate state authorized ID volunteer badge is the only personal identification that is appropriate to be used. It is important to communicate the role of the Building Evaluator and that you are an authorized agent of the jurisdiction. For this reason, volunteer teams may have a city staff member with them.

Finally, the authors do not anticipate that this Handbook or the equally large Safety Assessment Evaluator Training Manual 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 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. Building Evaluators should have field office supplies ([see list in appendix](#)) with them; however, the AHJ will provide any 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.

POST-DISASTER BUILDING SAFETY (OR RAPID) ASSESSMENTS

In a rapid assessment, the post-disaster habitability of homes and businesses are assessed, 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, interior environmental conditions, and minor chemical spills. For most buildings, the assessment can be conducted in 20–30 minutes with teams of two professionals. Determination of habitability will vary by disaster and is the determination of the AHJ. Generally, habitability is described as a structure that provides shelter from the elements, potable water, supplies and portable toilets, and access to sanitary sewer. 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.

By marking structures safe for occupancy and returning people to their homes more quickly, emergency shelters and community kitchens close and thereby reduce the strain on the government, NGOs, and supplemental resources. In addition, the posted warning signs in unsafe areas narrows the recovery focus to areas with greatest need. Disasters vary greatly in type and scale and the ability of local governments to provide personnel for such an undertaking is usually lacking in all but the smallest of disasters. Therefore it is of great value to communities to have certified professionals on hand and trained to quickly provide this assistance.

Volunteers are most often tasked to evaluate homes and small businesses. Large commercial and institutional buildings may have their own architects on retainer or as contracted consultants. In this case, the AHJ may accept the evaluation determination provided by the owner's consultant. For these large or more complicated buildings, the AHJ may bypass the rapid assessment and request a detailed evaluation by a specialist.

When an AHJ has requested assistance, able and willing volunteers will meet with the AHJ representative to be deputized and receive their orders before performing assessments. Assessment forms, maps, and building placards are provided by the AHJ. The only valid placard for a building is the one authorized by the AHJ. An example of the 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 and ATC-45 that describe the forms and provide examples.

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 actual posting of a structure is accomplished by mounting the appropriate placard in a clearly visible place near all usual points of entry to the building or, when unsafe or inaccessible, in another convenient location outside the structure that is readily visible to passersby. This evaluation process is similar even in international response situations, such as the 2010 Haiti Earthquake.



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.



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



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.

BUILDING ASSESSMENT 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. This table describes the general use of each placard. 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).

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 serve as some consolation.

An architect should not 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. Instead, building evaluators are encouraged to bring approved repair and recovery information sheets from the local municipality, FEMA Building Science, or other authorities that contain helpful information on clean-up, building permitting, post-disaster recovery best practices, and green strategies for rebuilding.

For consistent and current information, evaluators recommend that residents stay informed by listening to their radios and televisions, or checking social media and mobile phone applications to be aware of any evolving hazards and recovery tips. Some locations may have trained Community Emergency Response Team (CERT) members that can assist in providing local situational information. State and local AIA chapters can also assist by listing community resources on their website and communicating such resources to their members and allied organizations to share with the public.

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. Similarly, non-compliant design or construction issues may be detected. It is important to remember that Building Evaluators are assessing safety concerns and documenting hazardous event damage only. All other questions are referred to the AHJ.

Finally, observing damage to buildings provides an enormous building performance learning opportunity for volunteers and those they share lessons learned with. Before too much time passes, volunteers are encouraged to collect and share notes. Analysis of damage patterns may be the subject of future educational programming at AIA chapters or conferences and will inform best practices for design and construction.

Post Disaster Response: Tuscaloosa Tornado, 2011

A CASE STUDY BY JAMES “BUTCH” GRIMES, AIA

AIA Disaster Assistance Committee Member 2012–2015

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.

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

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.



COMMON TYPES OF WIND AND WATER 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.



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.



Note the red placard marked "unsafe" 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.

International Post-Disaster Response: Haiti Earthquake, 2010

A CASE STUDY BY JANINE GLAESER, AIA

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.

COMMON TYPES OF SEISMIC DAMAGE



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.



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

SOURCE

Diane Murbach. Used with permission.

DETAILED AND ENGINEERING ASSESSMENTS OF BUILDINGS POST-DISASTER

Typically, building owners contract with an architect to conduct a detailed assessment to better understand the scope of building damage. The architect may call on other experts to inform the assessment including environmental specialists and structural and civil engineers. Detailed Building Assessments typically consist of 1-2 hours of review of damaged facilities. In most jurisdictions, the detailed assessments are required to be submitted with the other construction documents for permitting to execute repairs and alterations. Depending on the extent of damage and request from the AHJ, volunteers may perform detailed assessments in lieu of rapid 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 key structural supports and bracing, and other necessary activities which are outside the scope of the rapid or detailed assessments. Typically, detailed and engineering assessments are fee-for-service work to establish a scope for repairs, reconstruction, or retrofitting as a basis of design.

Through proper training, architects have the opportunity to participate in both rapid and detailed assessments as well as work in collaboration with engineers on engineering assessments. In addition to the detailed and engineering assessments, architects will refer to updated hazard maps and newly adopted building and zoning codes to complete feasibility studies of repairs, reconstruction, or relocation.

ADDITIONAL DISASTER RESPONSE RESOURCES

Federal, state, and local government roles

[Incident Command System \(ICS\)](#)

[National Incident management System \(NIMS\)](#)

Emergency Management Assistance Compact, non-governmental organizations, and volunteer roles

[Emergency Management Assistance Compact \(EMAC\)](#)

Disaster response in the built environment

[FEMA Damage Assessment Operations Manual](#)

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

Disaster
recovery

05

LEARN: THE COMPLEXITIES OF DISASTER RECOVERY

- 88 Challenges to building back better
- 88 Temporary shelters and transitional housing
- 91 Government-sponsored repair and rebuilding programs

ACT: ENGAGING IN DISASTER RECOVERY

- 92 Policy and advocacy
 - » Case Study: AIA New York's Post-Sandy Initiative
- 95 Education and technical assistance
 - » Case Study: Sandy Design Help Desk
- 97 Stakeholder engagement and community planning
 - » Case Study: Greensburg, KS
 - » Case Study: NY/NJ/CT Regional Recovery Team

OVERVIEW

Emergency management today regards response and recovery activities as starting at about the same time. For example, debris removal—a recovery activity—may be necessary in order for first responders to gain access to an impacted area. A lesser damaged area may begin cleanup and repair efforts within a day of an event while the harder hit areas continue with search and rescue.

When the immediate security, safety, and health needs of the community are addressed, choices made during recovery ought to make a community more resistant to future hazards. Additionally, many of the challenges that exist during the response phase continue to manifest during the recovery phase. For example, 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.³² Furthermore, communities have struggled with the peace, safety, and health of residents because of close proximity, debris, and/or uncontained sewer and agricultural waste.

Key concepts

- » Recognize how and why housing and the ability to rebuild with resilience in mind may be a challenge during the recovery phase.
- » Be aware of the technical services architects can provide in the disaster recovery effort.
- » Be inspired by the many ways that architects have created new opportunities within disaster recovery to make their communities more vibrant and resilient – through design, policy and advocacy; education, technical assistance, stakeholder engagement and community planning processes.

³² Baussan, Danielle, and Miranda Peterson. "Lessons from the Storm: Climate Displacement Three Years After Hurricane Sandy." (2015): n. pag. Center for American Progress. Web. 18 Oct. 2016.

CHALLENGES TO BUILDING BACK BETTER

In the recovery phase, architects assist with temporary housing, insurance documentation, application for local/state funding assistance, technical assistance and education, and recovery planning. The timeframe for recovery is often lengthy, and presents frequent challenges. With a recognition of the complexities and steps involved in recovery, the AIA advocates for enhanced community resilience now, to reduce recovery needs in the future.

FEMA's National Flood Insurance Program, which provides affordable protection to property owners in return for local community commitment to sound floodplain management and disaster mitigation effort, also provides only replacement cost funding in most cases. After a flood FEMA typically reassesses the risk based on the extent of flooding, this may result in a change in boundaries or even coastlines. Individuals may find that after the reassessment, FEMA has raised the Base Flood Elevation (BFE) which then requires a change in the required minimum elevation of the finished floor. A requirement to retrofit or rebuild to this new elevation applies to properties with damage that is estimated at over 50 percent of the appraised value of the structure. The policy results in 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 the new flood elevations. This is intended to make communities less vulnerable to repetitive losses and more resilient to future flood events.

While most residents and business leaders are focused on returning to operations as quickly as possible after a hazardous event, 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 enable a more resilient response during a disaster. Did the building or neighborhood withstand the impact of the disaster? Did the building perform as intended? 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.

TEMPORARY SHELTERS AND TRANSITIONAL HOUSING

Following a disaster, affected individuals initially stay with nearby family or friends, rely on motel and hotel options, or occupy community shelters like schools and auditoriums. Other families migrate to nearby cities and regions. The choice made when one's home is compromised varies significantly. For example, post Hurricane Katrina, many families relied on the Astrodome shelter as they lacked the means to pay for car rentals and hotels elsewhere. In major disasters, the number of displaced residents often exceeds the number of citizens that the city or nearby areas can safely accommodate. For example, Baton Rouge absorbed a significant numbers of displaced residents following Katrina. Moreover, in many urban areas, such as New York City, where ongoing housing shortages are already a challenge, displaced residents may find it difficult or impossible to find temporary housing. Adding insult to injury, a disproportionate number of low-income or affordable properties suffer the greatest damage during a disaster event because these properties may be older and less well maintained and lowest cost land tends to be the most vulnerable to natural hazards.

The magnitude of population displacement due to a disaster presents an opportunity for architects and local jurisdictions to consider integration of temporary shelter strategies in both public and private sector environments. Some public buildings are more readily adaptable to function as temporary shelters during extreme events. For example, in Atlanta, many schools acted as shelters when motorists had to abandon their vehicles during Snowmageddon in 2014. Whether these schools were designed to accommodate this shift in program is a matter of planning and design. The question is whether there are other opportunities to intentionally shelter those in need through better initial planning or through adaptive planning, and then be sure the route and access to these facilities are safe and convenient.

If significant numbers of housing units are damaged, residents may require longer-term temporary housing during the recovery period. Transitional housing options in the United States have been comprised of apartment and/or housing vouchers, FEMA travel trailers, or longterm occupancy of motel/hotel rooms. The design of transitional housing solutions continues to offer opportunities for greater engagement by architects.

After Hurricane Katrina, FEMA purchased 145,000 travel trailers and manufactured homes. The travel trailers were later determined to have serious health impacts due to the presence of high concentrations of formaldehyde in the construction and finish materials. In response, the Mississippi Renewal Forum was held. The Forum, held in October 2005, included over 100 architects and planners charged with designing immediate housing solutions and plans for more compact, connected, and complete cities. The Katrina Cottage, a small, prefabricated house, was designed and immediately adopted as a prototype for a small “seed cottage,” which could provide immediate housing on a damaged property. When resources were available, it could be expanded to become a permanent part of the house. The original Katrina Cottage became a packaged kit of parts and sold by Lowe’s.

While interventions such as the Katrina Cottage have been successful in some areas, these low-density options are unsuited to larger cities. In recognition of this fact, New York City is experimenting with stackable units designed for universal access. The New York City Emergency Housing Prototype was designed by James Garrison of Garrison Architects as a modular post-disaster housing prototype for displaced city residents. The stackable, multi-family units can be deployed in vacant lots, private spaces, or public spaces.

It is important to note that temporary housing often persists for longer than expected: on the second anniversary of Hurricane Andrew, over 500 families were still in travel trailers, and many Katrina Cottages have become a permanent part of the landscape in the South.

Hurricane Katrina recovery persists through 2016 with many residents still displaced, including nearly one in three African-American citizens from New Orleans. This is despite the fact that FEMA expenditures totaled over \$24 billion. Additionally, homeowner insurance paid over \$41 billion in losses for Katrina and Rita in 2005 to Gulf States, Georgia, and Tennessee, and the National Flood Insurance Program paid out \$16.3 billion.³³ Inequity was present in vulnerability to flooding, as well as recovery—higher elevations were predominantly occupied by citizens with greater resources to rebuild.

³³ “Flood Insurance,” Insurance Information Institute. N.p., n.d. Web. 20 June. 2016.



In some cases, temporary shelter or transitional housing is unavailable to vast numbers of displaced residents. In these cases, displaced residents occupy significant encampments throughout the world. The design of these encampments tends to follow military design strategies, but frequently fails to address community integration. While the average lifespan of a camp is often 15–20 years, there is little architectural design integration into camp planning. Encampments present a two-fold opportunity. First is the opportunity to frame strategies for quick operationalizing post-event and second is the opportunity to think more holistically about community integration and larger urban scale planning frameworks. Both require greater integration of social and economic performance measures as well as a focus on health monitoring.

AN EMERGENCY HOUSING ALTERNATIVE

The New York City Office of Emergency Management Interim Urban Post Disaster Housing Prototype was designed to address humane, long term shelter within a dense urban community.

SOURCE

James Garrison, AIA. Used with permission.

GOVERNMENT-SPONSORED REPAIR AND REBUILDING PROGRAMS

Very few states and local jurisdictions have developed Recovery Plans. Instead, 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 Capacity Building Recovery Support Function (CPCB RSF) of the National Disaster Recovery Framework to support and build the recovery capacities and community planning resources of local, State and Tribal governments. Thus, the funding for these programs often comes from the federal government, but it is local authorities that manage the grant program.

Various federal agencies may be involved in the recovery process. For example, the US Army Corps of Engineers (USACE) assists by providing technical assistance, engineering expertise, and construction management. FEMA provides public assistance to state, local, and tribal governments and certain types of nonprofits to recover from disasters. This includes repairs, restoration, and replacement of damaged structures. However, 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 can supplement FEMA funds with other funding sources. The Department of Transportation (DOT), for example, may have funding to integrate resiliency into the transportation recovery process. The US Housing and Urban Development Department (HUD) also has 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.

Federal funding assistance leads to a variety of project types, including acquisition for redevelopment (i.e. “buy outs”), rehabilitation, elevation (in flood plains), and reconstruction.

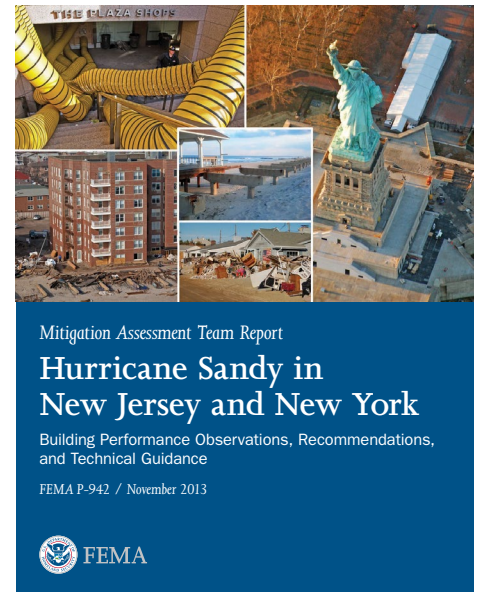
Recovery programs may be technically-focused, such as New York City’s Build It Back program which provided rebuilding funding and technical assistance to homeowners, landlords, and tenants in the five boroughs where homes and properties were damaged by Hurricane Sandy, or research and planning focused programs like Rebuild By Design that begin to incorporate mitigation goals.

POLICY AND ADVOCACY

Post-disaster, local communities are typically more open to new policy ideas that can enhance the way buildings are designed and built. By contributing their expertise, architects can make their communities safer and healthier. In some cases this may be through city work groups, round tables, or forums that address issues such as land use and zoning, building codes and standards, and rebuilding policies. In other instances, architects may participate in post-disaster forensic studies such as FEMA's Mitigation Assessment teams to identify points of failure and propose code changes that mitigate future loss.

One of the first steps taken by architects during the Hurricane Sandy recovery was the Post Sandy Initiative where architects collaborated with a wide range of professional organizations to inform the policies, codes, and investments later made in recovery. The initiative successfully advocated for a number of building policies that enhanced the health and safety of residents.

In a similar vein, an architect-led regional effort to aid recovery and enhance post-disaster mitigation efforts was also established after Hurricane Sandy. By bringing together local, state, and federal stakeholders the NY/NJ/CT Regional Recovery Team was able to influence legislation, codes, and policies; promoting positive change in the region.



MITIGATION ASSESSMENT TEAM REPORT

FEMA's Mitigation Assessment Teams (MAT) evaluate the performance of buildings and related infrastructure in response to the effects of natural and man-made hazards. The teams conduct field investigations at disaster sites; work closely with local and state officials to develop recommendations for improvements in building design and construction; and develop recommendations concerning code development and enforcement, and mitigation activities that will lead to greater resistance to hazard events. MAT Reports are publically available on FEMA's website.

SOURCE

Federal Emergency Management Association

Policy and Advocacy: AIA New York's Post-Sandy Initiative

A CASE STUDY BY AIA NY DESIGN FOR RISK AND RECONSTRUCTION COMMITTEE

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

Develop a regional recovery team: NY/NJ/CT

A CASE STUDY BY JUSTIN MIHALIK, AIA AND ILLYA AZAROFF, AIA

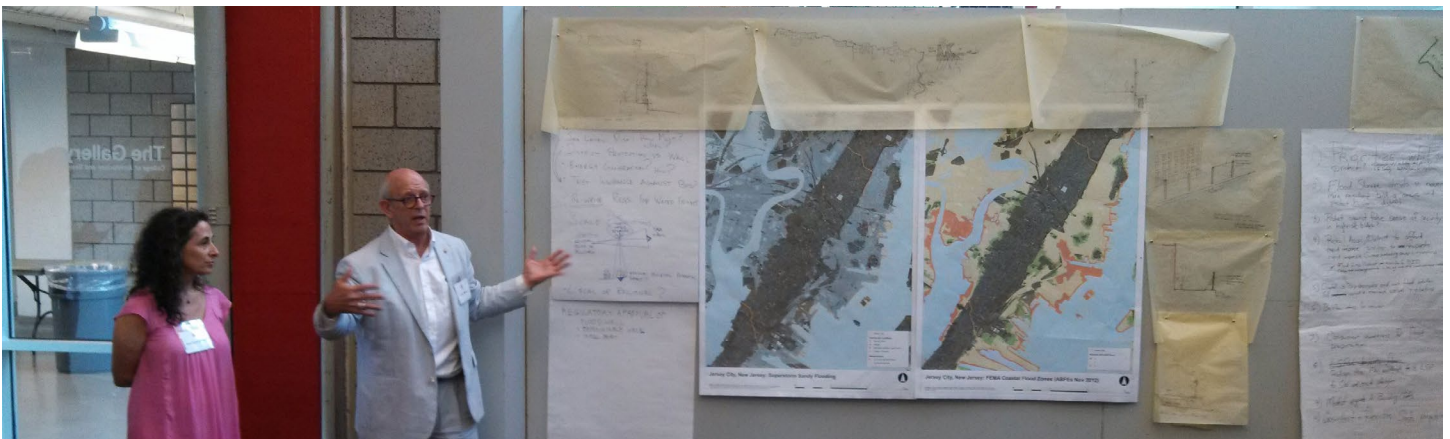
Co-Founders of the AIA's Regional Recovery Working Group

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.

EDUCATION AND TECHNICAL ASSISTANCE

During the recovery process, architects provide owners with an unbiased assessment regarding the extent of damage to their homes and businesses. Architects and design professionals perform detailed damage assessments and provide documentation relevant to insurance, city, and other agencies involved in recovery to ultimately make recovery decisions that define a scope of work. A vulnerability assessment, determination of damage, client's goals, and a feasibility study are used in recovery decision-making to select repairs, rebuilding, retrofits or relocation. By arming owners with knowledge from a licensed professional, they are empowered to negotiate and navigate through a rebuilding process that is not always friendly and easy to understand.

Architect led education and 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. Another instance of an architect-led education 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. AIA NY 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 hit the region. 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. These are just some of the many technical assistance projects undertaken by architects in disaster recovery.

Sandy Design Help Desk

A CASE STUDY BY RACHEL MINNERY, FAIA

Disaster Assistance Committee Chair 2008-2012 | Disaster Assistance Committee Member 2006-2007

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.

STAKEHOLDER ENGAGEMENT AND COMMUNITY PLANNING

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

Architects can also aid with design plans to help community rebuilding efforts incorporate resilience principles, establish efficient timetables, and leverage synergies between sustainability and hazard mitigation. By looking at multi-facet design features (for example, designs that provide energy conservation as well as storm protection) businesses and communities can get daily benefits while also mitigating risk.

One such program that has institutionalized community engaged planning and design is the AIA Communities by Design Regional/Urban Design Assistance program. This program, whose name has been shortened to Design Assistance Team (DAT) program, brings customized teams of multi-disciplinary experts and architects 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. Together, community members and the team of experts work to find design solutions to create healthier, safer, and more vibrant places.

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 the 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.

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 team outcomes include places such as Portland Oregon's Pearl District, East Nashville, and Santa Fe's Rail Yard Redevelopment.

The DAT methodology has inspired numerous AIA Chapters. For example, local design assistance efforts involving public participation occurred in Greensburg, Kansas, and Joplin, Missouri, after their 2007 and 2011 tornadoes, respectively. These examples and the many Design Assistance Teams that have engaged 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.

Increasing vulnerabilities to hazards, climate change, and other constantly shifting conditions are a foregone conclusion for the future of communities across the globe. Any one profession or sector can't do it alone. Architects are part of the client solution and the community solution—initiating new ideas that create policies, regulations, and incentives that lay the groundwork for sound development, design, and construction. Together with fellow design professionals, municipal leaders, community members, scientists, economists, ecologists, sociologists and so many others, communities can be made stronger, safer and healthier. Reducing vulnerability does not have to be synonymous with sacrifice. If we are pragmatic, flexible, and carefully manage the challenge ahead of us, we can design a better world, together.

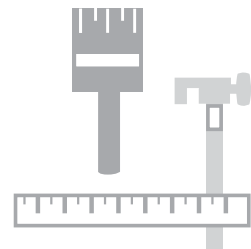
The DAT program has created a formula that requires three key ingredients to ensure success.



+



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INTERDISCIPLINARY TEAMS

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

PUBLIC PARTICIPATION

Cities 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 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.

Stakeholder engagement and community planning: Greensburg, KS.

A CASE STUDY BY AVA CHRISTIE, AIA, AND TRUDY ARON, HON. AIA.

2017 Disaster Assistance Committee Member and former executive director of AIA Kansas

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 were 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 green 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.

ADDITIONAL DISASTER RECOVERY RESOURCES

Temporary shelters and transitional housing

[The UN High Commission on Refugees \(UNHCR\) Handbook for Emergencies](#)

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](#)

[Resiliency through Energy Efficiency – Disaster Mitigation and Residential Rebuilding Strategies for and by State Energy Offices](#) See especially Appendix C.

Policy and advocacy

[AIA NY Post Sandy Initiative Report](#)

Stakeholder engagement and community planning

[AIA Design Assistance Team Toolkit](#)

[More information on Communities by Design DATs](#)

CONTENTS

Appendix A: AIA member groups to connect with

- 102 **A.1** AIA national committees, knowledge communities, and networks
- 102 **A.2** AIA chapter committees and initiatives related to disaster assistance
 - » **A.2.1** AIA disaster preparedness and response committees
 - » **A.2.2** AIA resilience and climate adaptation committees
 - » **A.2.3** AIA sustainability committees
 - » **A.2.4** Other related AIA committees

Appendix B: Risk reduction and hazard mitigation resources

- 107 **B.1** State & local hazard mitigation programs, a partial list
 - » **B.1.1** Oregon's seismic rehabilitation grant program
 - » **B.1.2** Enhabit: combined energy efficiency and seismic performance upgrades in Portland, OR
 - » **B.1.3** California's residential mitigation program for earthquakes
 - » **B.1.4** My Safe Florida Home for wind and hurricanes
 - » **B.1.5** South Carolina Safe Home for hurricanes and high-wind events
- 108 **B.2** Technical guidance documents & resources
 - » **B.2.1** Hazard mitigation
 - » **B.2.2** Climate adaptation
 - » **B.2.3** Community resilience
- 114 **B.3** Building rating systems

Appendix C: Emergency and disaster preparedness resources for built environment professionals and colleagues

- 116 **C.1** State good samaritan laws
 - » **C.1.1** AIA model good samaritan law
- 118 **C.2** Specialized education, training, and certifications
 - » **C.2.1** AIA online courses
 - » **C.2.2** Additional education courses by non-AIA providers
- 120 **C.3** Portability of licensure for architects
 - » **C.3.1** Example: Washington state legislation
 - » **C.3.2** National Council of Architectural Registration Boards (NCARB) model law
- 121 **C.4** Creating an AIA state disaster assistance program

Appendix D: Post-disaster evaluator resources

- 122 **D.1** Disaster responder resource list: commonly used clothing, supplies, and tools
- 122 **D.2** Sample post-disaster building evaluation forms and placards

A.1 AIA National Committees, Knowledge Communities, and Networks

The following are National engagement opportunities for AIA members available at the time of publication. See your local AIA chapter for 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 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 \(COTE\)](#): an AIA knowledge community that works to advance, disseminate, and advocate—to the profession, the building industry, the academy, and the public—design practices that integrate built and natural systems and enhance both the design quality and environmental performance of the built environment.
- » AIA Disaster Assistance Committee: a group of national experts that provide input and advisement for the AIA Disaster Assistance Program. To learn more, contact resilience@aia.org
- » [AIA Regional and Urban Design Committee \(RUDC\)](#): Resilience, climate change and natural disasters are at the top of many municipalities' watch list. AIA's knowledge community, RUDC, helps architecture professionals keep pace with changing conditions and improve regional and urban environments through excellence in design, planning and public policy. RUDC aims to improve the quality of the regional and urban environment by promoting excellence in design, planning, and public policy in the built environment. This will be achieved through its member and public education, in concert with allied community and professional groups.
- » [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. To join, fill out the member profile form in the link to share your interests and expertise.
- » AIA State Disaster Coordinator Network: a network of designated state disaster assistance coordinators that 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 assistance³⁴

Local chapters often offer the most direct and impactful engagement for AIA members in their communities. The following are state and local engagement opportunities known at the time of publication. Contact the listed chapter to learn more.

³⁴ All AIA chapter committee lists contain committees known at the time of publication. To add to a list; please email resilience@aia.org.

A.2.1 AIA disaster preparedness and response committees

AIA Alabama	Disaster Assistance Committee
AIA Arizona	Disaster Assistance Team
AIA Baton Rouge	Recovery task force
AIA Birmingham	Disaster Relief Committee
AIA California Council	Disaster Assistance and Preparedness Committee
AIA Central Kentucky	Disaster Assistance Committee
AIA Colorado	Disaster Assistance
AIA Dallas/AIA Fort Worth	Disaster Action Committee
AIA Florida	Safety Assessment Program
AIA Illinois	Disaster Recovery Assessment Committee
AIA Iowa	Disaster Assistance Committee
AIA Kansas	Disaster Assessment and Assistance Program
AIA Mississippi	Disaster Assistance 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	Homeland Security Committee
AIA New York	Design for Risk & Reconstruction (DfRR)
AIA North Carolina	Structural Engineering Emergency Response (SEER) Committee
AIA Oklahoma	Disaster Assistance
AIA Pasadena & Foothill	Disaster Preparedness & Resiliency
AIA Rhode Island	RI Architects & Engineers Emergency Response Task Force
AIA San Fernando Valley	Emergency Preparedness Committee
AIA Santa Barbara	Disaster Preparedness & Response Committee
AIA Seattle	Disaster Preparedness & Response (DPR) Committee
AIA South Carolina	Disaster Assistance Committee
AIA Tennessee	Tennessee Structural Assessment and Visual Evaluation (SAVE) Coalition
AIA Utah	Collaboration with Utah Safety Assessment Program Committee
AIA Vermont	Disaster Assistance
AIA Washington Council	Disaster Response Committee
AIA West Virginia	Disaster Assistance Committee
AIA Wilmington	Disaster Relief Committee
AIA Wisconsin	Disaster Preparedness & Assistance Committee
Boston Society of Architects	Renovate for Recovery Committee

A.2.2 AIA resilience and climate adaptation committees

AIA Baltimore	COTEIR
Boston Society of Architects	Committee on Resilient Environments (CORE)
AIA Colorado	Resiliency Committee
AIA Denver	Resiliency Committee
AIA Miami	Sea Level Rise Task Force
AIA Oregon	Resiliency Committee
AIA Pasadena & Foothill	Disaster Preparedness & Resiliency

A.2.3 AIA sustainability committees

AIA Asheville	COTE
AIA Atlanta	COTE
AIA Austin	COTE
AIA Baltimore	COTE R
AIA California Council	COTE
AIA Chicago	2030 Commitment, Environment Committee
AIA Colorado	COTE
AIA Columbus	COTE
AIA Connecticut	COTE
AIA Dallas	COTE
AIA Denver	COTE
AIA Detroit	COTE
AIA Honolulu	COTE
AIA Houston	COTE, Gulf Coast Green Committee
AIA Huron Valley	COTE
AIA Indiana	Sustainable Design Legislative Subcommittee
AIA Inland California	COTE
AIA Las Vegas	COTE
AIA Long Beach/South Bay	COTE
AIA Long Island	Sustainable Design
AIA Los Angeles	COTE
AIA Maine	COTE
AIA Miami	COTE
AIA Mid-Missouri	COTE
AIA Middle Tennessee	COTE
AIA Milwaukee	COTE
AIA Minnesota	COTE
AIA Mississippi	COTE
AIA New Hampshire	Environmental Guild

A.2.3 cont'd AIA sustainability committees

AIA New Jersey	COTE
AIA New Orleans	Sustainable Design Committee
AIA New York	COTE
AIA North Carolina	COTE
AIA Northeast Illinois	COTE
AIA Northern VA	COTE
AIA Orange County	COTE
AIA Oregon	COTE
AIA Philadelphia	COTE
AIA Phoenix Metro	2030 Professional Series Committee, COTE
AIA Pittsburgh	COTE
AIA Portland	COTE
AIA Rhode Island	COTE
AIA San Antonio	COTE
AIA San Diego	COTE
AIA San Fernando Valley	COTE
AIA San Francisco	COTE
AIA Santa Barbara	COTE, CalGreen Committee
AIA Seattle	COTE
AIA South Carolina	COTE
AIA Texas Society of Architects	Sustainable Environment Committee
AIA Triangle	COTE, R3 (Reduce, Recycle, Reuse)
AIA Utah	COTE
AIA Vermont	Energy + the Environment/2030 Challenge Committee
AIA Washington DC	COTE
AIA Wisconsin	Deep Energy Retrofit Committee
Boston Society of Architects	COTE, Passive House Massachusetts, Sustainability Education Committee

A.2.4 Other related committees

AIA Connecticut	Building Performance & Regulations Committee
AIA Dallas	Codes & Standards Committee
AIA Detroit	Building Codes & Regulations Committee
AIA Florida	Codes and Standards Technical Advisory Council (CSTAC)
AIA Honolulu	Code Committee Council (CSTAC)
AIA Inland California	Building Codes
AIA Long Beach/South Bay	Building Codes
AIA Long Island	Building Codes and Standards
AIA Los Angeles	Building Performance & Regulations Committee
AIA Minnesota	Building Codes Committee
AIA Nevada	Code Committee
AIA New Jersey	Codes & Standards Committee
AIA North Carolina	Code Committee
AIA Queens	Code and Zoning
AIA San Fernando Valley	Building Codes and Standards Committee
AIA Seattle	Code Committee
AIA South Louisiana	Building Codes and Standards
AIA St. Louis	Code Committee
AIA Texas Society of Architects	Codes & Standards Committee
AIA Virginia	Code Cadre
AIA Washington DC	High Performance Buildings Committee
AIA Wisconsin	Safety & Buildings Liaison Committee

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 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 earthquake 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 more quickly.

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. Earlier, 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 non-profit. The City and Enhabit realized that there were cost savings to doing energy upgrades and seismic upgrades at the same time. The pilot program would have provided grants to homeowners to cover half the cost of tying a house to its foundation. Funded by FEMA, the program was able to seismically retrofit 24 homes along with improved insulation and other energy saving measures. The program was so successful that the City received a \$500,000 FEMA Pre-Disaster Mitigation (PDM) grant to do 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 mitigation programs to assist California homeowners with seismic retrofits. The first of these programs, Earthquake Brace + Bolt (EBB), provides grant incentives that allow architects and owners to realistically 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 contractor work that needs to be done to raise the building's seismic resilience standard to the California 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 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 can work with clients and architects to properly address the complexities of increasing seismic risk in the world today.

B.1.4 My Safe Florida Home for wind and hurricanes

[My Safe Florida Home](#) offers free wind inspections to measure hurricane resilience. Following the inspection, homeowners receive a detailed report and recommended mitigation measures. The report includes applicable insurance discounts if the recommended steps are completed. Homeowners may also be eligible for a matching investment of up to \$5,000 to help make recommended improvements.

B.1.5 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 grant money to homeowners to make their property more resistant to hurricane and high-wind damage. SC Safe Home funds may not be used for remodeling, home repair, or new construction.

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. A sample of those resources are provided below and categorized as Hazard Mitigation, Climate Adaptation, and Community Resilience. Within each sub section, resources are listed in the following sequence:

- » Planning (e.g. community scale)
- » Site Selection (e.g. maps)
- » Pre-Design
- » Design
- » Construction
- » Post-Occupancy Evaluations
- » Existing Buildings/Retrofits

Refer to aia.org/resilience for new and revised resources.

B.2.1 Hazard Mitigation

The following resources support hazard risk reduction through design practices and provide data, maps, and design tools for mitigation for new and existing buildings. Local and state hazard mitigation plans, policies and regulations are a starting point for hazard and climate risk identification.

B.2.1.1 All Hazard

- » [FEMA EMI G3I8 Mitigation Planning Workshop for Preparing and Reviewing Local Plans](#): a FEMA-led training for professionals in conducting a hazard mitigation planning process.
- » [Mitigation Ideas: a resource for reducing risk to natural hazards](#): a resource for communities to evaluate a range of potential mitigation actions for reducing risk to natural hazards and disasters. Published 2013.
- » [My Hazards](#): an online, address-specific, hazard mapping tool for California from CAL-OES.

B.2.1.2 Coastal Design

- » [Coastal No Adverse Impact Handbook](#): a handbook from the Association of Flood Plain Managers and the National Oceanic and Atmospheric Association on coastal land development. Published 2007.
- » [Coastal Resilience Index](#): a step by step community self-assessment guide to help communities better prepare for coastal hazards. Published 2010.
- » [FEMA P-55 Coastal Design Manual: Principals and Practices of Design for Residential Buildings in Coastal Areas](#): FEMA design guidance for buildings in coastal environments. Includes information on hazard identification, siting decisions, regulatory requirements, economic implications, and risk management. Published 2011.
- » [Design in FEMA Coastal A Zones](#): recommends design practices for coastal areas where wave and flood conditions will cause significant damage to typical light-frame construction. Published 2005.
- » [Home Builder's Guide to Coastal Design](#): technical fact sheet that provides technical guidance and recommendations for coastal residential buildings. Published 2010.
- » [Hurricane Sandy in New Jersey and New York: Mitigation Assessment Team Report](#): an analysis of building performance observations including recommendations and technical guidance. Published 2013.
- » [Residential Coastal Design](#): based on investigations conducted by FEMA and other organizations after major coastal disasters, this resource is intended to help designers and contractors identify and evaluate practices that will improve the quality of construction in coastal areas and reduce the economic losses associated with coastal disasters.

B.2.1.3 Drought Risk

- » [NOAA Historical Palmer Drought Indices](#): Monthly maps of drought conditions in the contiguous U.S as measured by the Palmer Drought Severity Index, Palmer Hydrological Drought Index, Palmer Modified Drought Index, and Palmer Z-Index.

B.2.1.4 Flood Mitigation Strategies and Reference Materials

- » [NOAA Experimental Long-Range River Flood Risk](#): riverine flood projection tool
- » [FEMA Flood Map Service Center](#): Database of current FEMA flood maps.
- » [ASCE 24-14 Flood Resistant Design](#): a referenced standard in the International Code, this document states the minimum requirements and expected performance for the siting and design and construction of buildings and structures in flood-prone areas.
- » [EO 13690 Federal Flood Risk Management Standard](#): enhanced flood risk management standard for federal buildings. Guidelines can be utilized to reduce the vulnerability of non-federal buildings.
- » [FEMA 543 Design Guide for Improving Critical Facility Safety from Flooding and High Winds: Providing Protection to People and Buildings](#): based on the behavior of critical facilities during Hurricane Katrina, this document makes recommendations on the performance of these types of buildings. Published 2007.
- » [FEMA P-936 Floodproofing Non-Residential Buildings](#): guidance on dry floodproofing, wet floodproofing, and the use of levees and floodwalls; including tools to assist the designer in determining the best floodproofing option. Published 2013.
- » [Mitigation Lessons](#): description of wind and flood mitigation needs and lessons learned from the evaluation of seven relevant homeowner assistance mitigation programs. Published 2015.
- » [FEMA P-259, Engineering Principles and Practices of Retrofitting Floodprone Residential Structures](#): Engineering design and economic guidance on what constitutes feasible and cost-effective retrofitting measures for flood-prone residential and non-residential structures. Published 2012.

B.2.1.5 High-Wind Design

- » [NOAA National Climatic Data Center's US Tornado Climatology](#): map displaying average annual and monthly number of tornadoes across the US. Global map displaying enhanced likelihood of tornadoes also available.
- » [FEMA Wind Zone Map](#): tornado activity map available on page 3 and wind map available on page 6.
- » [FEMA P-361 Design Guidance for Community Safe Rooms](#): information on the design and construction of community and residential safe rooms. Published 2015.
- » [ASCE/SEI 7-10 Minimum Design Loads for Buildings and Other Structures](#): provides requirements for general structural design and includes means for determining dead, live, soil, flood, snow, rain, atmospheric ice, earthquake, and wind loads as well as their combinations.
- » [ICC500 Standard for the Design and Construction of Storm Shelters](#): a national standard for storm shelter design and construction.
- » [Foundation and Anchoring Criteria for Safe Rooms](#): communicates the requirements for safe room foundations and anchorings. This is of particular importance for prefabricated safe rooms. Published 2015.
- » [FLASH Resilient Design Guide for Wood Frame Buildings](#): Created by FLASH in partnership with the AIA and its chapters in New York and Florida, the former Architecture for Humanity, and the Gulf Coast Community Design Studio this Guide provides architects, designers and homeowners the information necessary to make any set of house plans useful for constructing a more wind resilient structure. Published 2015.
- » [FEMA P-320 – Taking Shelter from the Storm: Building a Safe Room for Your Home or Small Business](#): guidance on how to construct or retrofit a home or business to include a safe room. Published 2014.
- » [FEMA P-543 Design Guide for Improving Critical Facility Safety from Flooding and High Winds: Providing Protection to People and Buildings](#): based on the behavior of critical facilities during Hurricane Katrina, this document makes recommendations on the performance of these types of buildings. Published 2007.
- » [Mitigation Lessons](#): description of wind and flood mitigation needs and lessons learned from the evaluation of seven relevant homeowner assistance mitigation programs. Published 2015.
- » [FEMA P-431 Tornado Protection: Selecting Refuge Area in Buildings](#): guides identification of the best available refuge areas in existing buildings. Published 2009.
- » [FEMA P-804 Wind Retrofit Guide](#): provides guidance on how to improve the wind resistance of existing residential buildings. Published 2010.

B.2.1.6 Power Outage

- » [FEMA P-1019 Emergency Power Systems for Critical Facilities: A Best Practices Approach to Improving Reliability](#): provides guidance on the design and operation of emergency power systems in critical facilities. Published 2014.

B.2.1.7 Seismic Design

- » [FEMA P-154 Rapid Visual Screening of Buildings for Potential Seismic Hazards](#): handbook to identify, inventory, and screen buildings that are potentially vulnerable to seismic forces. Published 2015.
- » [FEMA P-58 Seismic Performance Assessment of Buildings](#): methodology for seismic performance assessment of individual buildings. Published 2012.
- » [FEMA Earthquake Hazard Maps](#): displays likelihood and intensity of earthquakes across the US.
- » [USGS 2016 Seismic Hazard Forecast for the Central and Eastern United States from Induced and Natural Earthquakes](#): map can be used to identify increased seismic risk in areas not typically susceptible to seismic activity.
- » [USGS Earthquake Hazards Program Maps](#): seismic hazard maps and data, seismic hazard analysis tools, and seismic hazard primers.
- » [FEMA E-74 Reducing the Risks of Nonstructural Earthquake Damage](#): explains the sources of nonstructural earthquake damage and provides methods for reducing potential risks. Published 2012.
- » [FEMA P-454 Designing for Earthquakes](#): explains the principles of seismic design and mitigation measures for nonstructural components. Published 2006.
- » [FEMA P-749 Earthquake-Resistant Design Concepts](#): an introduction to recommended seismic provisions for new buildings and other structures. Published 2010.
- » [Safe Enough to Stay](#): recommended steps for the City of San Francisco to enable most residents to shelter in place after a major earthquake. Published 2012.
- » [ASCE 41 Seismic Evaluation and Retrofit of Existing Buildings](#): systematic procedures used to evaluate and retrofit existing buildings to withstand the effects of earthquakes
- » [Resilient Masonry Buildings](#): an overview of the challenges of preserving historic masonry buildings as well as proposed recommendations for making masonry buildings more resilient. Published 2012.

B.2.1.8 Tsunami Design

- » [Designing for Tsunamis: Seven Principles for Planning and Designing for Tsunami Hazards](#): guidelines to enhance understanding of tsunami hazards, exposure, and vulnerability, and to mitigate the resulting risk through land use planning, site planning, and building design. Published 2001.
- » [Pacific Northwest Seismic Network Tsunami Maps](#): maps indicating tsunami risk and lessons learned from recent tsunamis.
- » [ASCE 7 and the Development of a Tsunami Building Code for the US](#): a proposed national standard for engineering design for tsunami effects.
- » [FEMA P-646 Guidelines for Design of Structures for Vertical Evacuation from Tsunamis](#): information to assist in the planning and design of tsunami vertical evacuation structures, general information on the tsunami hazard and its history, guidance on determining the tsunami hazard, including tsunami depth and velocity, options for tsunami vertical evacuation structures, guidance on siting, spacing, sizing, and elevation considerations, and how to determine tsunami and earthquake loads and related structural design criteria. Published 2012.

B.2.1.9 Wildfire Mitigation Strategies and Reference Materials

- » [Wildland Urban Interface \(WUI\) Toolkit](#): a number of resources including a community assessment tool for hazard risk and case studies of successful adaptation to wildfire risk.
- » [FEMA Wildfire Map](#): displays wildfire activity by county 1994–2013.
- » [FEMA Federal Fire Occurrence Map Viewer](#): interactive map of fire occurrences.
- » [International Wildland–Urban Interface Code](#): minimum requirements for wildland–urban interface.
- » [NFPA 1144: Standard for Reducing Structure Ignition Hazards from Wildland Fire](#): methodology for assessing wildland fire ignition hazards around existing structures and requirements for new construction to reduce the potential of structure ignition from wildland fires. Published 2013.
- » [University of California Publication 8228: Home Landscaping for Fire](#): recommendations for reducing fire risk through appropriate landscaping.
- » [FEMA P-754 Wildfire Hazard Mitigation Handbook for Public Facilities](#): handbook can be utilized to identify mitigation measures that can be implemented during the repair and rebuilding of damaged facilities. Published 2008.

B.2.1.10 Winter Storm Risk

- » [FEMA Winter Storm Website](#): two maps that present the frequency of winter storms and abnormally cold days between 1996 and 2013 as identified by data from the National Oceanic and Atmospheric Administration (NOAA).

B.2.2 Climate Adaptation

Buildings that incorporate projections for changes in temperature, precipitation, and extreme events and their cascading effects may experience enhanced performance over the life of the building. The following resources provide data about climate change projections for reference. Science and climate data is subject to regular changes.

B.2.2.1 Climate Change Projection Tools

- » [Risk Based Adaptation & Adaptation Planning Workbook](#): provides guidance for conducting risk-based climate change vulnerability assessments and developing adaptation action plans. Published 2014.
- » [Climate Change World Weather File Generator](#): creates location-specific climate data files for use with building performance modeling tools.
- » [EPA Scenario Based Climate Projections Map](#): Provides changes in annual temperature and precipitation in two time periods (2035 and 2060) for three climate model projections that represent the range of projections. Note that these projections are provided to illustrate the range of potential changes in climate and no single scenario is more likely to occur than any other.
- » [New York Climate Change Science Clearinghouse](#): provides climate change data and information relevant to New York State.
- » [US Climate Resilience Toolkit](#): scientific tools, information, and case studies to help manage climate-related risks and opportunities and improve resilience to extreme events.

B.2.2.2 Climate Change Resources

- » [California Climate Adaptation Planning Guide](#): provides guidance to support regional and local communities in proactively addressing the unavoidable consequences of climate change. Published 2012.
- » [Building Resilience in Boston: Best Practices for Climate Change Adaptation and Resilience for Existing Buildings](#): review of national and international programs, initiatives, and activities related to improving the resilience of existing buildings to climate change impacts. Published 2013.
- » [National Climate Assessment Report](#): examines projected regional impacts of climate change.
- » [Promising Practices in Adaptation & Resilience](#): a compilation of case studies examining climate adaptation planning at the community scale.

B.2.2.3 Extreme Heat

- » [Extreme Heat Hot Cities: Adapting to a Hotter World](#): AIANY Symposium Summary Report on extreme heat. Published 2016.

B.2.2.4 Sea Level Rise

- » [Climate Central Surging Seas](#): Sea level rise analysis tool.
- » [NOAA Sea Level Rise Viewer](#): can be used to identify storm surge risk and impacts associated with sea level rise.
- » [Sea Level Rise and Nuisance Flood Frequency Changes around the United States](#): NOAA technical report on sea level rise. Published 2014.

B.2.3 Community Resilience Resources

The following resources provide indicators and guidance on community process, urban design, and public health of resilient communities designed to thrive with social, economic, and environmental sustainability.

- » [Community Resilience Planning Resources](#): resources to define vulnerabilities, involve community members, and design for resiliency.
- » [NIST Community Resilience Planning Guide for Buildings and Infrastructure Systems](#): provides a practical and flexible approach to help communities improve their resilience by setting priorities and allocating resources to manage risks for their prevailing hazards.
- » [Livability Index](#): this tool scores community resources in seven categories; housing, neighborhood, transportation, environment, health, engagement, and opportunity. Designers can use this tool to understand the existing strengths and weaknesses of a community.
- » [Principles of Community Engagement](#): this guide provides both a science base and practical guidance for engaging partners and stakeholders. Developed with health outcomes in mind, the principles of engagement can be used by a variety of professionals to support community engagement. Published 2011.
- » [Sustainable Communities Indicators Matrix](#): compilation of indicators that can be utilized to measure community sustainability. Each indicator's relationship to sustainable communities and calculation method is described. Communities that utilize a given metric are also listed.
- » [Sustainable Communities Initiative \(SCI\) Resource Library](#): includes tools, reports, fact sheets, and case studies developed by SCI grantees, HUD, and its Capacity Building partners.
- » [ARUP City Resilience Index](#): international framework to help cities understand and measure their capacity to endure, adapt and transform.

B.3 Building Rating Systems

Rating systems are tools for design professionals and owners to achieve performance goals. The following is a partial list of rating systems 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: a code-plus new construction program that 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.

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, from agriculture to ecological building, from appropriate technology to 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 liveable 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.

STAR Community Rating System: The rating system's evaluation measures collectively define community-scale sustainability, and present a vision of how communities can become more healthy, inclusive, and prosperous across seven goal areas. The system's goals and objectives provide a vocabulary that local governments and their communities can use to more effectively strategize and define their sustainability planning efforts.

B.3 cont'd Building Rating Systems

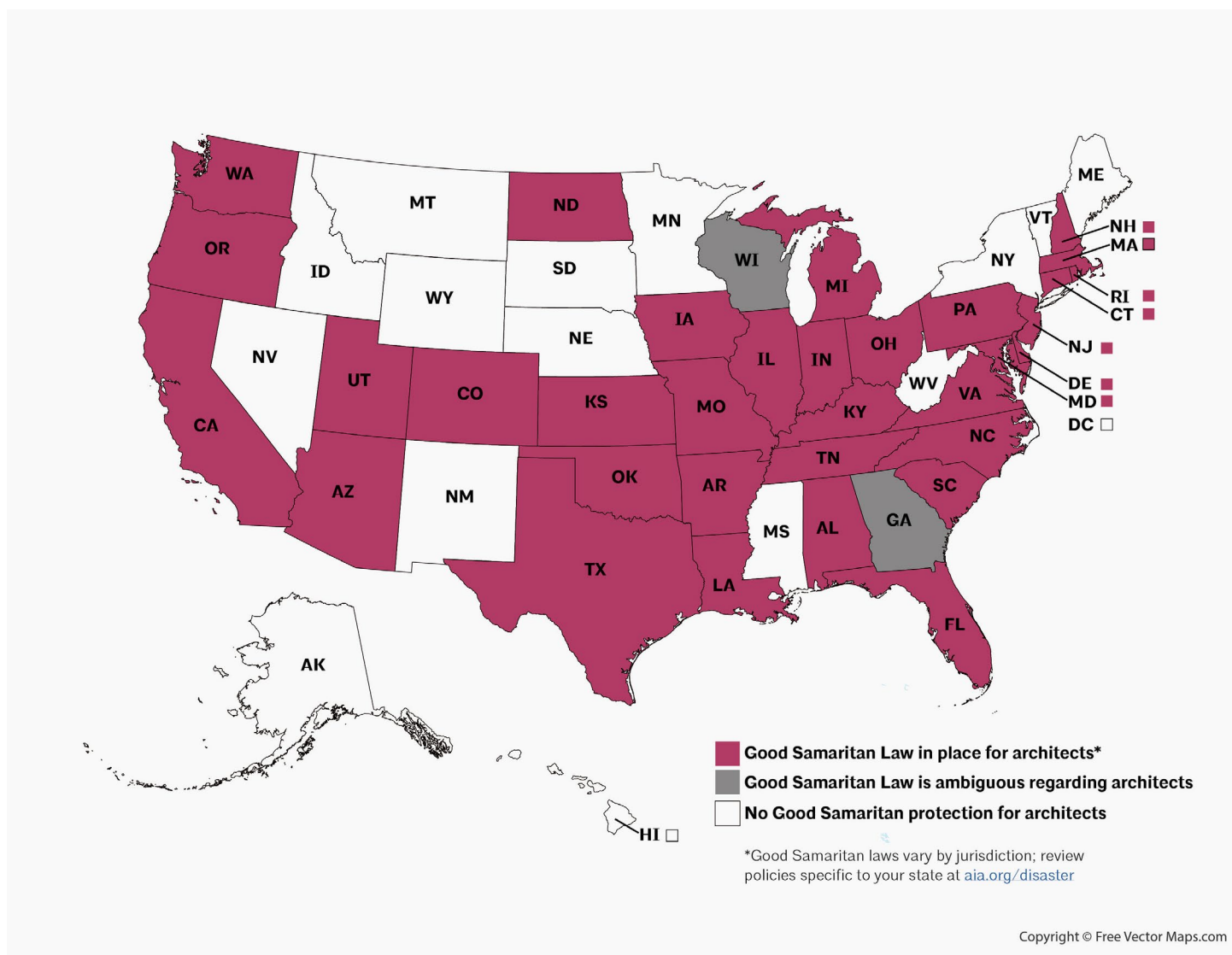
[USGBC LEED](#): LEED works for all buildings—from homes to corporate headquarters—at all phases of development. Projects pursuing LEED certification earn points across several areas that address sustainability issues. Based on the number of points achieved, a project then receives one of four LEED rating levels: Certified, Silver, Gold and 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 you can begin using the building 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. This map indicates the states known to have Good Samaritan laws at the time of printing. The language of each state law can be found in the [AIA Good Samaritan Legislation Compendium](#).



C.I.1 AIA Model Good Samaritan law, updated January 2015

Architects and engineers are obligated under their respective licensure board rules of professional conduct to protect public health, safety, and welfare. In times of natural disasters or other catastrophic events, architectural and engineering expertise and skills are needed to provide structural, mechanical, electrical, or other architectural or engineering services to determine the integrity of structures, buildings, piping, or other systems. Architects and professional engineers are often called upon to voluntarily assist their communities, states, and the nation in these times of crisis.

Architects and engineers, however, may face substantial liability exposure when performing voluntary services. Many states have recognized this liability threat and have enacted laws, which provide immunity to some professionals for their voluntary performance of services. Roughly half of all U.S. states have extended this type of protection, known as “Good Samaritan” protection, to registered architects, professional engineers, and other licensed professionals.

Architects and engineers are encouraged to advocate the enactment of state laws which provide immunity from liability for any personal injury, wrongful death, property damage, or other loss of any nature caused by the architect’s or engineer’s acts, errors, or omissions in the performance of voluntary architectural or engineering services. To aid in advocacy efforts, the AIA offers the below model Good Samaritan Law that states may adapt.

1. As used in this Section:

- » “Professional Engineer” shall mean a person duly licensed under the state engineering licensure law as a professional engineer;
- » “Registered Architect” shall mean a person duly licensed under state architectural licensure laws as a registered architect;
- » “Public Official” means any federal, state, or locally elected official with executive responsibility in the jurisdiction in which the emergency or event has occurred;
- » “Public Safety Official” means any appointed or elected federal, state, or local official with executive responsibility to coordinate public safety in the jurisdiction in which the emergency or event has occurred;
- » “Law Enforcement Official” means any appointed or elected federal, state, or local official with executive responsibility to coordinate law enforcement in the jurisdiction in which the emergency or event has occurred; and,
- » “Building Inspection Official” means any appointed or elected federal, state, or local official with executive responsibility to coordinate building inspection in the jurisdiction in which the emergency or event has occurred.

C.1.1 cont'd AIA Model Good Samaritan law, updated January 2015

2. A registered architect or professional engineer who voluntarily, without compensation (other than expense reimbursement), provides architectural, structural, electrical, mechanical, or other design professional services related to a declared national, state, or local emergency caused by an earthquake, hurricane, tornado, fire, explosion, collapse, or other similar disaster or catastrophic event, at the request of or with the approval of a national, state, or local public official, law enforcement official, public safety official, or building inspection official believed by the registered architect or professional engineer to be acting in an official capacity, shall not be liable for any personal injury, wrongful death, property damage, or other loss of any nature related to the registered architect's or professional engineer's acts, errors, or omissions in the performance of any architectural or engineering services for any structure, building, facility, project utility, equipment, machine, process, piping, or other system, either publicly or privately owned.
 - » The immunity provided in this Section shall apply only to a voluntary architectural or engineering service(s) that occurs during the emergency or within 90 days following the end of the period for an emergency, disaster, or catastrophic event, unless extended by an executive order issued by the Governor under the Governor's emergency executive powers.
 - » Nothing in this Section shall provide immunity for wanton, willful, or intentional misconduct.

C.2 Specialized Education, Training, and Certifications

The primary response training for AIA members and colleagues is the [AIA Safety Assessment Program Training](#). Additional information on Safety Assessment Program (SAP) training is available in this [handout](#) and is supported by information found in Chapter 3.

C.2.1 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 members as well as to the public.

[Architecture and Social Infrastructure](#)

Explore projects and concepts on how architecture can bring social structures together, be a long term fix against natural destruction, and address other issues for future living.

[Beyond Single Building Toward a Community and Regional Resilience Approach](#)

Effective solutions for building resilient communities, and how to establish design criteria and long-term hazard mitigation and adaptation measures, resulting in better protection for coastal communities.

[Defining an Agenda for Resilient Design](#)

Resilient design can improve how structures respond to impacts from major disturbances like hurricanes to more subtle, gradual influences.

[Designing for Future Generations: Zero Energy Housing and Building the Foundation for Resilient Communities](#)

Speakers discuss the research of university students and the programs of a non-profit organization making strides in efficiency and resiliency for the future.

C.2.1 cont'd AIA online courses

[Design Innovation: How Architects Can Lead in Building Resilient Communities](#)

After natural disasters like Katrina and Sandy, experts present steps to move your practice into a community leadership role on smart growth, emergency planning, and responsiveness.

[Disaster Recovery and Learning Lessons: Hurricane Sandy Disaster Relief](#)

How design can assist in disaster recovery including resilient shelters, thoughtful interior design, and successes and failures following Hurricane Sandy.

[Political Discourse and Community Engagement](#)

Explore the impact of design and designers politically and in the community through projects inspiring creativity and habitat reclamation; learning how architecture can encapsulate historical memory to the challenges of building in conflict zones.

[Framework for Resilient Design: Lessons from New Orleans Go National](#)

Critically examine the rebuilding of New Orleans after Katrina, and use the practical knowledge and real-world examples to better equip yourself to build resilient communities.

[Gimme Shelter](#)

Explores the emerging area of disaster mitigation through design and implementation of relief shelters, dedicated community shelters, and temporary housing.

[Infrastructure, Resilience, and Public Space](#)

Designers must prepare now for a changing global environment. You'll use international case studies to explore tools, frameworks, and strategies for building resilient urban systems and site-specific solutions.

[Leveraging Health Data to Enhance Place-Based Resilience in Green Building Design](#)

An overview of the tools architects can use to integrate public health evidence and data analytics in design processes to pursue improved health outcomes.

[Net-Positive Design: Creating Regenerative Buildings and Communities](#)

Analysis of regenerative-design buildings and its concepts and philosophies of product selection, implementation, and measurement for net-positive impact. The University of British Columbia building is a living laboratory for restorative design practices, offering a real-time case study on the future of sustainable buildings that contribute to creating regenerative and resilient communities.

[Proving Grounds for Net-Zero Water Buildings and EcoDistricts](#)

Learn how we can improve the resilience of our nation's water infrastructure.

[Thinking Beyond the Building: Aging-in-Place and Lifelong Communities \(No LU\)](#)

Creative solutions to walkability, transportation, infrastructure, and urban design are needed to design communities that support older adults aging in place.

C.2.2 Education courses by non-AIA providers

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 garnered from these Incident Command System (ICS) online courses:

- » [IS-100: Intro to the Incident Command System](#)
- » [IS-200: ICS for Single Resources and Initial Action Incidents](#)
- » [IS-700: A National Incident Management System](#)
- » [ICS-800: Introduction to National Response Framework](#)
- » [ICS-803: Public Works and Engineering](#)
- » [ICS-809: Search and Rescue](#)

C.3 Portability of Licensure for architects

Portability of Licensure enables assistance beyond state lines. An example law from Washington State is shown below along with model 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 legislation

Disaster relief licensing

RCW 18.08.400: Registration of out-of-state registrants

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.

C.3.2 National Council of Architectural Registration Boards (NCARB) Model Law

[NCARB 2016-2017 Legislative Guidelines and Model Law](#)

Section 11 Exceptions

Nothing in this chapter shall be construed to prevent:

11. A person who is not currently registered in this state, but who is currently registered in another United States or Canadian jurisdiction, from providing uncompensated (other than reimbursement of expenses) professional services at the scene of an emergency at the request of a public officer, public safety officer, or municipal or county building inspector acting in an official capacity. "Emergency" shall mean earthquake, eruption, flood, storm, hurricane, or other catastrophe that has been designated as a major disaster or emergency by the President of the United States or *[the governor or other duly authorized official of the state]*.

C.4 Creating an AIA State Disaster Assistance Program

This handout provides an overview of the roles and responsibilities in establishing and maintaining an AIA Disaster Assistance Program. This one page [handout](#) is best used in conjunction with Chapter 3 of this handbook.

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.

CLOTHING	SAFETY & PROTECTION	TOOLS	ASSESSMENT MATERIALS
<input type="checkbox"/> Work Boots	<input type="checkbox"/> First aid kit	<input type="checkbox"/> Hammer	<input type="checkbox"/> Pens and Black fine point Sharpie
<input type="checkbox"/> Gloves	<input type="checkbox"/> Disposable facemasks or dust mask	<input type="checkbox"/> Screwdriver(s)	<input type="checkbox"/> Clipboard
<input type="checkbox"/> Heavy pants/jeans (weather permitting – long shorts that can cover legs from damage)	<input type="checkbox"/> Goggles/sunglasses	<input type="checkbox"/> Tape measure	<input type="checkbox"/> Safety Assessment Program ID Number or other credential
<input type="checkbox"/> Rain Gear (light or heavy dependent on temperature – should be wind resistant)	<input type="checkbox"/> Sunscreen	<input type="checkbox"/> Flashlight	<input type="checkbox"/> ATC Field Manual
<input type="checkbox"/> Sun protection (hats/visors)	<input type="checkbox"/> Water/small snacks	<input type="checkbox"/> Digital Camera	<input type="checkbox"/> Yellow Caution Tape
	<input type="checkbox"/> Hardhat	<input type="checkbox"/> Pocketknife	
	<input type="checkbox"/> Safety Whistle	<input type="checkbox"/> Walkie Talkies	
	<input type="checkbox"/> Bug repellent	<input type="checkbox"/> Pencils and pens (for sketching out issues/ taking quick notes)	
	<input type="checkbox"/> Lip Balm	<input type="checkbox"/> Notepad	
	<input type="checkbox"/> Mobile phone		
	<input type="checkbox"/> Additional phone, camera, and flashlight batteries/chargers		

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 Rapid Evaluation](#) » [ATC 20 green INSPECTED placard](#) » [ATC 45 yellow RESTRICTED USE placard](#)
- » [ATC-20 Detail Evaluation](#) » [ATC 20 yellow RESTRICTED USE placard](#) » [ATC 45 red UNSAFE placard](#)
- » [ATC-45 Rapid Evaluation](#) » [ATC 20 red UNSAFE placard](#)
- » [ATC-45 Detail Evaluation](#) » [ATC 45 green INSPECTED placard](#)



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