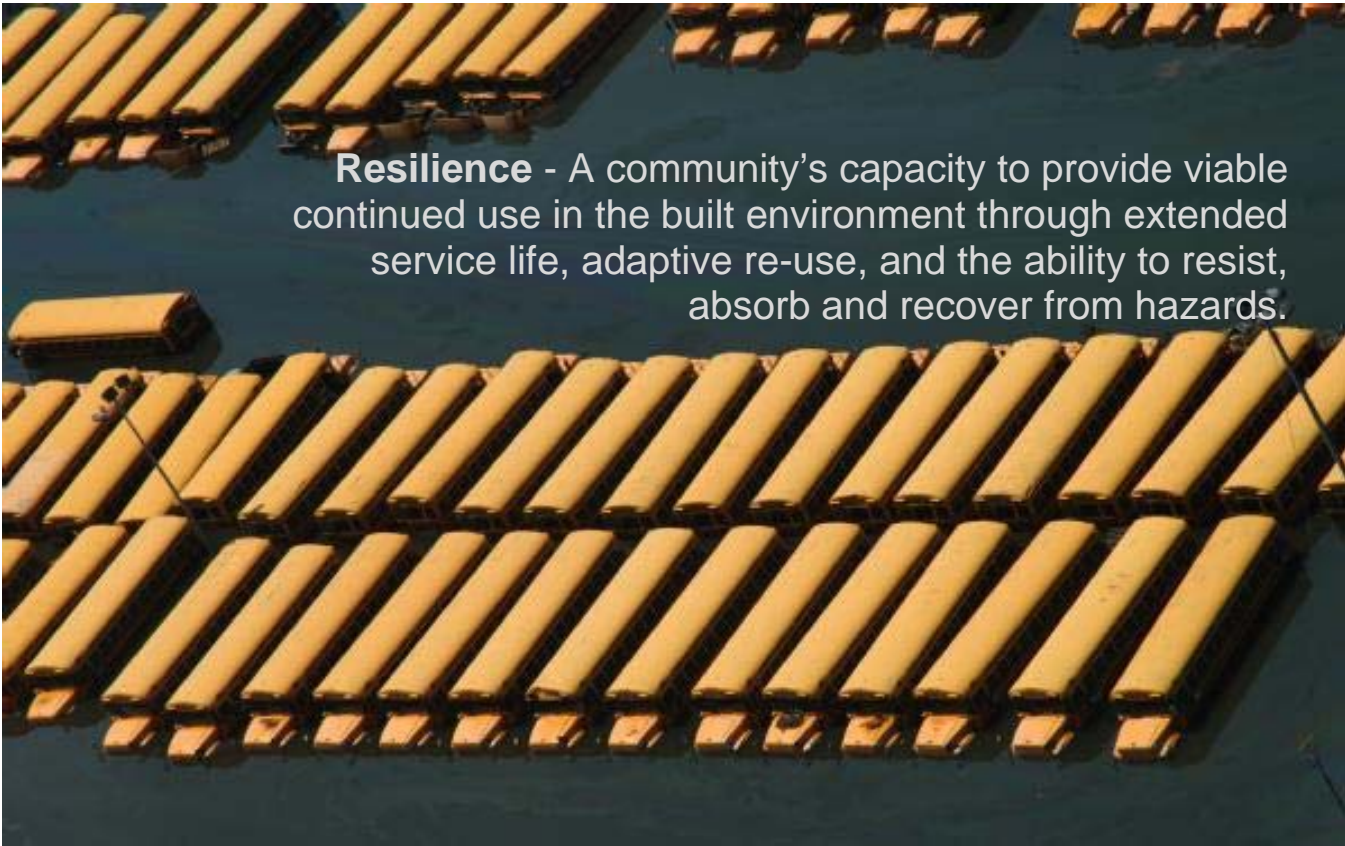


Pathway to Resilience

A Guide for Developing a Community Action Plan



Resilience - A community's capacity to provide viable continued use in the built environment through extended service life, adaptive re-use, and the ability to resist, absorb and recover from hazards.



www.nrmca.org/resilience

For millions of people in the United States, the consequences of natural disasters have become increasingly real, personal and devastating.

INTRODUCTION

Over the span of two years, from April 2012 to May 2014, the National Ready Mixed Concrete Association, other members of the Concrete Joint Sustainability Initiative (CJSI), along with the Insurance Institute for Business and Home Safety (IBHS) and local partners (a.k.a. Partners), held full-day workshops throughout the country to increase awareness of the benefits of disaster resiliency. The **Adopting Disaster Resilient Construction at the Local Level Workshop** [a.k.a. Workshop] calls for the reinvention of our infrastructure in the face of rising disasters from extreme weather events.

For millions of people in the United States, the consequences of natural disasters have become increasingly real, personal and devastating. In the time we have delivered the Workshops, the U.S. had experienced the warmest recorded temperature, a costly wildfire season in the West, the worst droughts in three decades and, in the aftermath of Hurricane Sandy, one of the most damaging storms to strike our coasts.

Natural and man-made disasters have been increasing exponentially over the past few decades, with climate change contributing to extreme weather. Degradation and loss of ecosystems have also been intensifying the hazards that, when combined with vulnerability, cause disaster. Moreover, it is well established that the poorest people in our communities suffer disproportionately. Lives, assets, products and crops are lost; livelihoods are cut off; economic growth is curtailed or sent into reverse.

But these impacts were rarely, if ever, addressed in a coordinated way in the same program, until now. The Workshops were a first step to communicate

the concrete industry's commitment to long-term sustainability and to enable local advocates to adopt resilient planning strategies, code adoption language and design criteria into their communities.

Motivated by the regularity of devastating events, the goal is to help communities address the need for resiliency while rebuilding to meet the challenge of the next natural or man-made disaster.

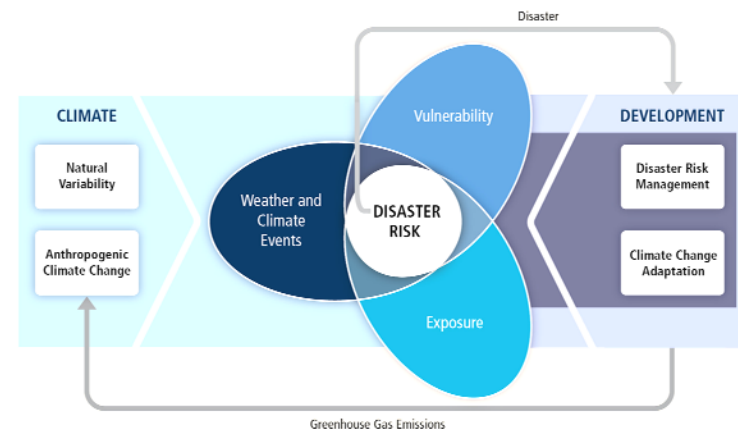


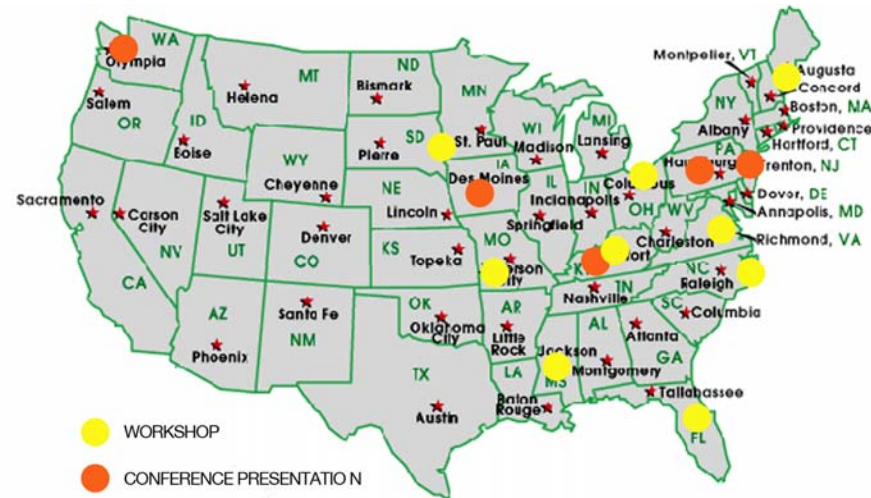
Fig 1. Core concepts from the IPCC SREX Report – Summary for Policy Makers. Exposure and vulnerability to weather and climate events determine impacts and the likelihood of disasters (disaster risk). It evaluates the influence of natural climate variability and anthropogenic climate change on climate extremes and other weather and climate events that can contribute to disasters, as well as the exposure and vulnerability of human society and natural ecosystems.



Fig 2. Springfield Underground, MO

Workshop Locations:

4/12/12 Springfield, MO
 4/17/12 Sioux Falls, SD
 5/17/12 Louisville, KY
 5/30/12 Portsmouth, NH
 9/7/12 Richmond VA
 11/7/12 Jackson, MS
 11/27/12 Wilmington, NC
 02/28/13 Orlando, FL
 08/27/13 Carrollton, KY
 05/15/14 Orlando, FL



This publication presents the recommendations of participants of the 2012-14 Workshops and is a record of the lively discourse around disaster mitigation and preparedness that took place during the Workshops. The Workshops attracted concerned citizen at every level, from design professionals, state agencies to local building officials and interested residents. The locations visited were as diverse as the participants representing the comprehensive list of hazard risks.

Objectives for the Workshops were to:

- Underpin a community's economic vitality, the health and safety of its citizens, and support long-term sustainability
- Recognize and assess local disaster risks
- Evaluate mitigation measures based on local disaster risks
- Understand the importance of incorporating stronger building codes to provide an optimum level of protection against a variety of natural hazards specific to the region
- Solidify knowledge of safe rooms and disaster resilient building systems

It is not the first time the industry has taken a leadership role in responding to contemporary developments and demands from natural disasters. In the wake of the deadly Atlantic hurricane season of 2005, NRMCA, along with industry partners, presented a similar educational series.

Today, we see an increased need to join efforts between the public and private sectors in educating building professionals and other community leaders on the vital role of resilient, high-performing structures. On October 18, 2012, an event sponsored by the CJSI and hosted by the Department of Homeland Security Science and Technology Directorate and the National Institute of Building Sciences was held at the National Building Museum to present and discuss a variety of strategies to ensure disaster resilient communities.

ACKNOWLEDGEMENTS

The Workshop curriculum and the accompanying trainer's notes were prepared by members of CJSI, a coalition of industry associations representing companies who make or maintain concrete products. NRMCA, managing the logistics of the Workshops, would like to recognize the member organizations of the CJSI and partner organizations that contributed to the program:

- Concrete Reinforcing Steel Institute
- National Concrete Masonry Association
- National Precast Concrete Association
- Portland Cement Association (PCA)
- Precast/Prestressed Concrete Institute
- Insurance Institute for Business and Home Safety (IBHS)

In addition, the coordination of local facilities and professional contacts could not have been possible if not for the invaluable assistance of NRMCA affiliate organizations and members along with other key groups:

- South Dakota Ready Mixed Concrete Association
- Northern New England Concrete Promotion Association
- Kentucky Ready Mix Concrete Association
- Conco Companies, Inc.
- Roanoke Cement
- Mississippi Concrete Industries Association
- The Carolinas Ready Mixed Concrete Association, Inc.
- Titan America
- Habitat for Humanity Virginia
- Smart Home America

- Virginia Ready-Mixed Concrete Association
- Florida Concrete & Products Association
- Florida Independent Concrete & Associated Products, Inc.

The following documents served as reference documents for the Workshops and compilation of this report:

- High Performance Building Requirements for Sustainability v2.0 September 2010 (<http://www.cement.org/>)
- Building Community Resilience: A Summary of Case Studies from Charleston, Gulfport and Memphis, CARRI Research Report 9 (<http://www.resilientus.org/>)
- FORTIFIED for Safer Living Builders Standards (<http://www.disastersafety.org/>)
- FEMA - A Whole Community Approach FDOC 104-008-1 and FEMA documents 320, P-361, P-55 and P-499 (<http://www.fema.gov>)
- USGBC New Orleans Principles (<http://www.usgbc.org/>)
- Intergovernmental Panel on Climate Change (IPCC) Working Group Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) (<http://ipcc-wg2.gov/SREX/>)

Thanks to all the public agencies and schools who participated and offered valuable feedback to the Workshops:

North Carolina Dept of Agriculture
City of Greenville
Department of Defense
North Carolina Dept. Public Instruction
North Carolina Department of Transportation
US Nuclear Regulatory Commission
North Carolina Dept of Insurance
Town of Wolfeboro
Harvard University
Federal Emergency Management
Mississippi State University
Mississippi Dept. of Transportation
Mississippi Military Dept. National Guard
University of Kentucky Div. of Engineering
Lexington/Fayette Urban Government
City of Louisville
Commonwealth of Kentucky
Franklin County Fiscal Ct
City of Henderson, KY
Lexington Fayette Urban County Government
City of Altamonte
City of Fernandina Beach
State Farm Insurance
Virginia Society AIA
Build Smart Virginia
Virginia Beach City Public Schools
County of Prince George
State Farm Insurance
James City County
County of Gloucester
County of Lancas
Build Smart Virginia
Campaign for Safer Buildings
Virginia Bureau of Insurance
Surry County Building Official
Better Housing Coalition
James City County
Department of Housing & Community Development
City of Portsmouth
Drury University
City of Ozark
City of Springfield
City of Branson

THE PATHWAY TO RESILIENCE

The Workshop objectives centered on integrating disaster resilience into community planning and was designed for community leaders, code officials, builders, contractors, architects, engineers, planners and risk managers. The Workshops covered a wide range of topics designed to formalize the process of implementing disaster resilient construction at the community level. Emphasis was given to mitigation over response or solely preparedness and included a “breakout” session which encouraged participants to identify integrated design solutions and potential local advocates for resilience.

This report, along with the www.nrmca.org/resilience website, is intended to extend the impact of the Workshops so that it may serve local communities that intend to work in the area of planning and disaster resilience which demand interdisciplinary thinking.

Through the Workshops, the Partners first delivered the message of resilience; made the connection to sustainability; offered tools to help the community and documented what was suggested during the breakouts. By supporting the local advocates, we can determine what can be done and propose solutions not only to promote resiliency, but also to improve preparation for future disasters by addressing vulnerabilities exposed by disaster events. These sessions resulted in three (3) key strategies to community resilience:



Fig. 3 OAR/ERL/National Severe Storms Laboratory (NSSL), Wikimedia Commons

1. Strengthen the built environment: The two fundamental approaches to strengthening the built environment with the objective of reducing losses from natural hazards offered are:

- A. Voluntary, community-based enhancement programs
 - a. Encourage implementation of FORTIFIED Programs (IBHS)
 - b. Adopt Disaster Resilient Construction Incentives
 - c. Use FEMA Guides for Coastal Construction and Safe Rooms
- B. Mandatory adoption of stricter standards for construction of buildings and infrastructure
 - a. Adoption of model Building Codes (if not adopted)
 - b. Adoption of code amendments meeting High Performing Building Requirements for Sustainability (PCA or other)



2. Empower advocacy: The aim is to increase the capacities of local community organizations working on reducing disaster risk and strengthen cooperation between governmental knowledge centers, design and planning professionals, and nongovernmental actors. This is essential if community resilience is to be reinforced. The Partners seek to create a policy context more conducive to disaster risk reduction at the local and national level to make communities, landscapes and institutions all more resilient. The Partners role is to offer ideas and tools that support resilience advocates in the local communities with expertise and experience to policymakers. This may include as needed:

- A. Model code language
- B. Model ordinances
- C. Testify before state and local governments
- D. Coordinate future research activities, including supporting research on the economic, environmental and social benefits of resilience

3. Launch integrated dialogue: Formal coordination among design professionals and entities with similar goals is essential for implementing the resilience thinking in the public domain. Successful partnership of professional organizations and non-governmental agencies is at the core of innovation and would be a huge step in risk-reduction and code adoption. Here, the Partner's role is to deliver materials requested by local advocates such as resiliency assessment tools and define professional certifications for those performing physical security assessments, business impact analyses and resiliency functions. In addition, communication tools that support resilience advocates in brokering and sharing best practices such as:

- A. Create a network through social media to spread interest, share best practices and help accelerate local projects
- B. Issue press releases of resilience adoption successes
- C. Developing position papers

Partners to Engage

Emergency Management

Faith-based organizations

Community leaders (including seniors, minority populations and non-English speakers)

American Institute of Architects (AIA local chapters)

US Green Building Council (USGBC local chapters)

American Society of Civil Engineers (local chapters)

International Code Council (ICC)

Developers

Higher education institutions

Big-box stores

Medical facilities

Government agencies (all levels and disciplines)

Chambers of commerce

Nonprofit organizations

Advocacy groups

Media outlets

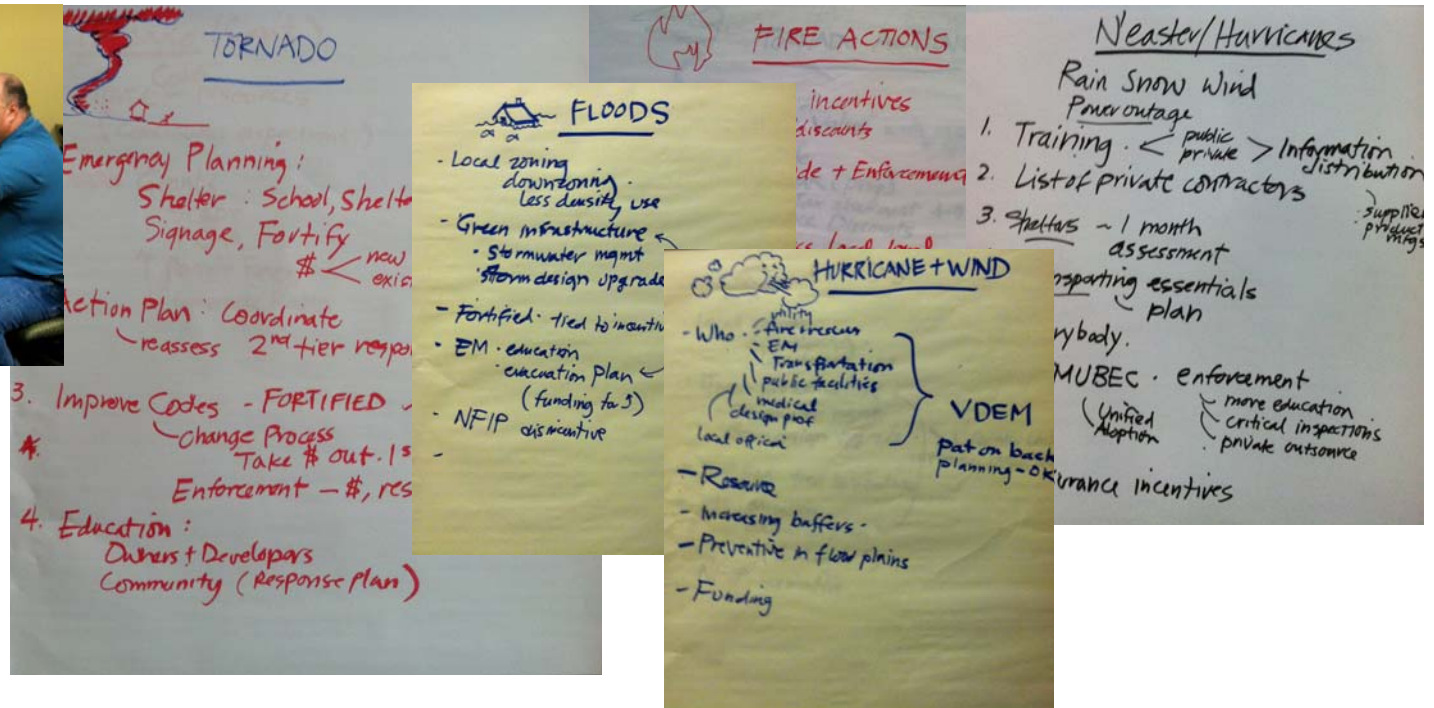
Airports

Public transportation systems

Utility providers



Fig 5 – By T. Peng. Participants at Disaster Resilient Construction Workshop, Wilmington, NC



HURRICANE

TORNADO

WILDFIRE

FLOODS

DROUGHT

STRUCTURAL FIRE

HEAT WAVE

BLIZZARDS

NOR'EASTER

VOLCANO

TERRORISM

HAIL

TSUNAMI

THE BREAKOUTS

The recommendations presented here are the result of facilitated breakout groups during the Workshops. The Workshops served as the enabler of the process that generated the recommendations. The breakout sessions were organized around hazard themes – fire, wind, earthquake, tornado, etc. We asked the participants and community leaders how they perceived their community's preparedness with respect to the hazard and what they wanted to see for their communities for the future. Their feedback was invaluable.

Each small group of diverse stakeholders was assigned a hazard (locale specific). For the hazard scenario, participants were asked to make a list of necessary resiliency actions to be taken to mitigate their community from disaster. Considerations included:

- Who needs to be part of the contingency planning process?
- Consider the appropriate codes or standards. What part of the code needs to be updated? Why?
- What coordination mechanisms will be in place? How will the local government, agencies and communities interact?
- What training and capacity building needs to take place? When?
- What do you need to request extra funding?

THE RECOMMENDATIONS

Recommendations include adding shelters and safe rooms, implementing statewide fortification standards and raising community awareness.

Mitigation benefits everyone. We see from the recommendations that disaster risk reduction can be combined with infrastructure planning to significantly boost resilience. Planning will enhance people's ability to withstand shocks in their environment which is critical for helping us address climate change and lessen the vulnerability of those with less means.

While the Breakout groups were organized around hazard themes, we saw an alignment of the responses organized around five (5) key action agendas:

- A. Raising Awareness
- B. Defining Vulnerabilities
- C. Codes & Fortification Standards
- D. Storm Shelters and Safe Rooms
- E. Incentives

A. RECOMMENDATION: RAISING AWARENESS

Significant knowledge gaps still remain, especially with respect to understanding the exposure and vulnerabilities within a given population. More education is needed to fully understand the risk tolerance thresholds of communities with respect to specific hazards. Addressing knowledge gaps through training and educational seminars requires multi-, inter-disciplinary teams, including emergency management professionals, design professionals, scientists, insurance agencies, governmental agencies, etc. working together.

Fig. 6 – US Green Building Council's Leadership in Energy and Environmental Design (LEED).



- Task A1 - Developing school curricula to further educate students about storms and shelters.
- Task A2 - Encourage the design community toward a greater focus on resilience. This may include incorporating these concepts into formal educational programming in schools of architecture and engineering so that buildings increasingly have disaster resilience as a core consideration from the beginning, reducing the need for retrofitting buildings over time.
- Task A3 - Provide compelling examples to the public of how disaster mitigation works financially; do a better job aggregating the costs of responding to natural disasters and revealing their impact on government budgets, at both the federal, state and local levels.
- Task A4 - Provide educational outreach to make property owners aware of the financial benefits of upgrading their new and existing buildings to high-performance standards.
- Task A5 - Require appropriate training for people managing buildings to increase both efficiency and resilience.
- Task A6 - Keep professional communities engaged with natural hazard mitigation through sessions at industry/trade association annual meetings, newsletters and accreditation programs.
- Task A7 - Include building resilience to natural hazards as a criterion for LEED and other green standards because of the reduced environmental impact involved in saving existing buildings rather than rebuilding after a disaster.

RAISING AWARENESS (CONTINUED)

Disaster mitigation is not solely the work of experts and emergency responders from government emergency management organizations. Local volunteers, citizens, organizations and businesses have an active and important role to play before, during and after major emergencies and disasters. Therefore, as stated in the Workshop presentations, community-based disaster mitigation is a process that seeks to develop and implement a locally appropriate and locally "owned" strategy for disaster mitigation and risk reduction.

- Task A8 - Launch an ongoing awareness campaign that educates local businesses, governmental agencies, non-profits and citizens about how to prepare for a natural disaster and about resources available when disasters strike.



Fig. 7 - New Orleans after Hurricane Katrina: Uptown house with wall blown off. Photo by Infrogmation

- Task A9 - Organize a conference to discuss strategies to prepare for natural disasters and engage government, the private sector and communities.
- Task A10 - Civic, educational, faith-based and other organizations could be enlisted to promote disaster awareness.
- Task A11 - Create public service messages to spread safety tips through print and broadcast media.
- Task A12 - Sponsor seminars on how to apply for disaster mitigation grants, submit insurance claims and deal with contractors after disasters.
- Task A13 - Utilize Facebook, Twitter, YouTube and other social media platforms to provide conduits for delivering resilience messages, answering questions interactively and, during actual emergencies, spreading warnings.
- Task A14 - Utilize social media to encourage ongoing, interdisciplinary discussions and exchange of best practices, policies and strategies.
- Task A15 - Provide educational outreach to ensure that stakeholders have a clear understanding of their authority and responsibilities in disaster situations.
- Task A16 - Establish Community Emergency Response Teams (C.E.R.T.).

B. RECOMMENDATION: DEFINING VULNERABILITIES

All planning and implementation of disaster preparedness measures should be based on an assessment and prioritization of the hazards and risks that people face, as well as their ability or inability to cope with and withstand the effects of those hazards.

- Task B1 - Identify the characteristics, frequency and potential severity of the hazards a community faces. Utilize tools provided in the Workshops, including IBHS www.disastersafety.org, Natural Resource Defense Council's (NRDC) www.nrdc.org/health/climate, US Department of Homeland Security's (DHS) OPRtool.org and/or Resilience Star.
- Task B2 - Identify the main sectors of a community (population, infrastructure, housing, services, etc.) affected by a specific type of hazard and anticipate how they might be affected. Assess the ability to withstand and cope with the effects of the phenomena.
- Task B3 - Identify the particular geographical areas and communities that are most susceptible and vulnerable to those hazards.
- Task B4 - Consider the costs associated with the risk of natural hazards in developing zoning rules and enforcement standards.
- Task B5 - Work with FEMA to update Flood Maps.
- Task B6 - County EMAs and municipalities to assess their emergency needs ("gap analysis,") and then determining if there are enough resources on hand.
- Task B7 - Target older/historic buildings for resilient retrofits.

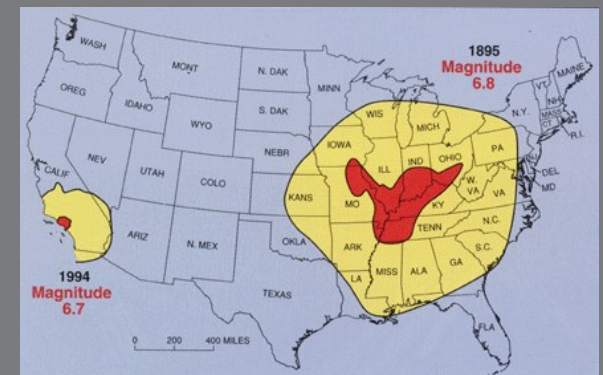
C. RECOMMENDATION: CODES & FORTIFICATION STANDARDS

Whether a state mandates a statewide building code or allows its local jurisdictions to adopt building codes by themselves, regulation of building design and construction is primarily conducted through authorities of local jurisdiction. Due to various challenges at the local level, building code adoption and enforcement by the local jurisdictions can be a critical weak link.

- Task C1 - Participate in code formation, like the current process used by the International Code Council, so that all model codes include hazard mitigation for water, energy, conservation and land use.
- Task C2 - Establish local fortification standards for construction of new, rebuilt and extensively remodeled homes to save lives and property when severe weather or other hazard hits the community; provide in the code inspection procedures and enforcement rules that apply statewide.
- Task C3 - Reconsider existing codes and zoning rules to identify those codes that interfere with more resilient planning and design by preventing adoption of measures that go beyond existing practices.
- Task C4 - Reconsider and update standards and codes along high-risk areas (i.e. coast).
- Task C5 - Encourage use of green infrastructure strategies and natural systems to help mitigate the impact of some disasters like flooding. Protect natural systems so that they can function as buffers in large events.
- Task C6 - Upgrade building codes to make structures more disaster resistant and leverage solutions applied to other code priorities like security.
- Task C7 - Budget money for code compliance and change the current fee-driven structure that results in cutbacks in inspection and enforcement resources when construction activity is down.
- Task C8 - Require existing hospitals and clinics to meet not only building codes but also FEMA's recommended code enhancements.
- Task C9 - Integrate disaster planning into larger economic planning.

The New Madrid Seismic Zone (NMSZ) presents the greatest seismic hazard in Mid-America. Between one and two hundred earthquakes occur annually in the NMSZ, as compared to the two to three thousand that occur annually throughout the United States, many in California. The majority of these earthquakes are too small to be felt. In spite of the potential for seismic activity, a review of the states in the NMSZ indicates mixed progress in adopting building codes with seismic provisions. To date, among the seven States in the NMSZ, only three (Arkansas, Kentucky, and Mississippi) have updated statewide building codes as minimum requirements. Three (Indiana, Tennessee and Illinois) have limited or out-of-date codes, and one (Missouri) does not, passing the responsibility to the local jurisdictions to adopt the codes themselves under state guidance. While all the statewide building codes reference the national model codes, one state also adopted amendments that weakened the model codes. In the states where statewide building codes are mandatory, often a local jurisdiction still must introduce ordinances to adopt and enforce the state building codes for the jurisdiction.

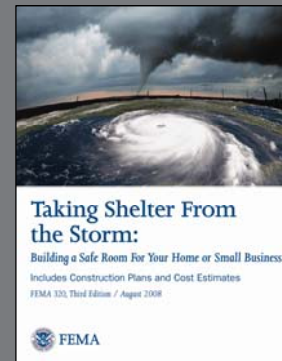
Fig. 8. By User Soronk on de.wikipedia [Public domain], via Wikimedia Commons



D. RECOMMENDATION: STORM SHELTERS AND SAFE ROOMS

More shelters — either those specifically designed to withstand fierce winds and flying debris or other fortified structures where taking refuge improves people’s chances of surviving killer storms — should be designated where they already stand, built where none currently exist and publicized better.

- Task D1 - Increase the number of storm shelters available to the public and publicize their locations so people know where to go when severe weather approaches.
- Task D2 - Factories, schools, shopping centers, “big box” stores, office and apartment complexes, municipal and public safety buildings, and mobile home parks that don’t already have storm shelters should consider adding them.
- Task D3 - Everyone’s personal disaster plan should include identifying nearby shelters beforehand and even practicing getting to them quickly. Or a family should consider installing a safe room in their home.
- Task D4 - Work with industry representatives to require that community storm shelters be included at any new apartment complexes and mobile home communities built in tornado-prone regions, and offer incentives for adding them to existing facilities.
- Task D5 - Seek opportunity to use a proposed project as “demonstration” of resilient construction.



Building a Safe Room

Want more information on safe rooms, including how to build your own? Download the document “FEMA 320 — Taking Shelter from the Storm: Building a Safe Room for Your Home or Small Business” at [fema.gov/plan/prevent/saferoom/fema320.shtm](https://www.fema.gov/plan/prevent/saferoom/fema320.shtm).



Fig. 9. By Warrenlead69 (Own work) via Wikimedia Commons



Fig. 10. Concrete home survived the devastating effects of high winds and storm surge of Hurricane Katrina (FEMA/John Fleck)

E. RECOMMENDATION: INCENTIVES

Yes, it costs money to build a resilient home or building or install a safe room. But anyone who has survived a deadly storm in a safe room or lost family members for lack of one or witnessed some of the worst destruction will agree that the investment is worthwhile. It was made clear from the 2005 Multihazard Mitigation Council (MMC) of the National Institute of Building Sciences Study that every dollar spent on mitigation saved four dollars in avoided future losses. The benefits of mitigation were defined as the potential losses to society that were avoided as a result of investment in mitigation.

- Task E1 - Offer incentives to add safe rooms to new construction as well as existing homes and businesses.
- Task E2 - Utilize the existing system by which FEMA, using disaster assistance funding, offers matching grants that reimburse homeowners for 75 percent of safe room costs.
- Task E3 - Initiate discussion with State Insurance Commissions regarding premium incentives for building to code-plus or FORTIFIED standards or with robust materials.
- Task E4 - Propose income tax credits for building to code-plus or FORTIFIED standards modeled on other successful programs that reward, for example, the purchase of energy-efficient heating, ventilating and air conditioning systems, windows, insulation or solar panels.
- Task E5 - Tax incentives should be extended to businesses offering essential services during storm events (gas stations so that fuel supplies are assured, pharmacies so that vital medicines can be dispensed, kidney dialysis, etc.).
- Task E6 - Advocate for code-plus, FORTIFIED or other programs on hazard reduction and ensure the results are widely distributed.
- Task E7 - Focus more resources on building science research by type of natural hazard through national entities such as National Science Foundation.

- Task E8 - Use life-cycle costs and savings rather than short-term expenditures to determine infrastructure spending.
- Task E9 - Since disaster preparedness depends on shared goals and activities across sectors, it is important that the concept be integrated into all ongoing projects. For instance, all climate change planning should include assessment of potential natural hazard impacts. Partner with carbon reduction goals.
- Task E10 - Propose the US Green Building Council should expand its definition of environmental sustainability certification to include resiliency issues.
- Task E11 - Initiate discussion with banking industry regarding resilient mortgage rates (similar to energy-efficient mortgages based on Energy Star) for building to code-plus or FORTIFIED standards or with robust materials.

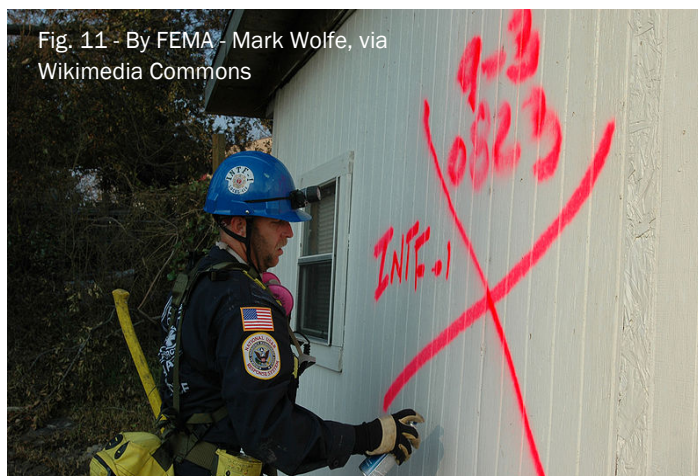


Fig. 11 - By FEMA - Mark Wolfe, via Wikimedia Commons



Fig. 12. By Marvin Nauman FEMA website, via Wikimedia Commons



Fig. 13 Hurricane Katrina, By NOAA via Wikimedia Commons



Fig. 14. By Thomas Altfather Good via Wikimedia Commons



Fig. 15. By Forest Service Northern Region from Missoula, MT. via Wikimedia Commons



Fig. 16. By Official Navy Page from USA MC1 (Sailors assist with Hurricane Sandy) via Wikimedia Commons

THE FUTURE

When we set out to draft this report, the Partners' charge was to develop a set of action-oriented recommendations that would:

- Save lives through mitigation
- Increase cooperation between agencies
- Improve infrastructure planning through code and code-plus adoption
- Reduce the negative economic impact of future hazards

We recognize that not everyone will agree with/or have the resources to implement each recommendation outlined in this report. That's understandable. We are not looking for the easiest path. Instead, we wanted to create a path for disaster risk reduction with common-sense solutions. We wanted proposals that would increase preparedness without expanding the footprint of government.

This is an opportunity for the community, and we must not waste it. To that end, in addition to the five key recommendations outlined here, we propose that the group monitor, follow the progress and support the implementation of these recommendations. We encourage local advocacy groups to communicate progress with the NRMCA and take advantage of resources available at www.nrmca.org/resilience.

The policies local advocacy groups put into place in the next several years will potentially impact millions of people for decades to come. We need planning and action that will transcend political administrations and short-term corporate interests.

Consider the reality: In 2012, there were 11 natural disasters costing \$1 billion or more in damage, making 2012 the second highest year with billion-dollar disasters. Early season

tornadoes, the widespread and intense drought that covered at least 60 percent of the contiguous U.S. and Hurricane Sandy will go down in history as one of the most costly weather-related disasters in U.S. history. The number of billion dollar disasters these past years may be historic, but it should not have been unexpected. If we did not know better before, we do now.

Certainly, the people in the communities directly affected by disasters, natural or man-made, have been humbled by the destruction of that day. Those of us more fortunate to have escaped a major disaster should take heed as they recover and make plans for a stronger future. We have heard their stories, we can learn from their lessons.

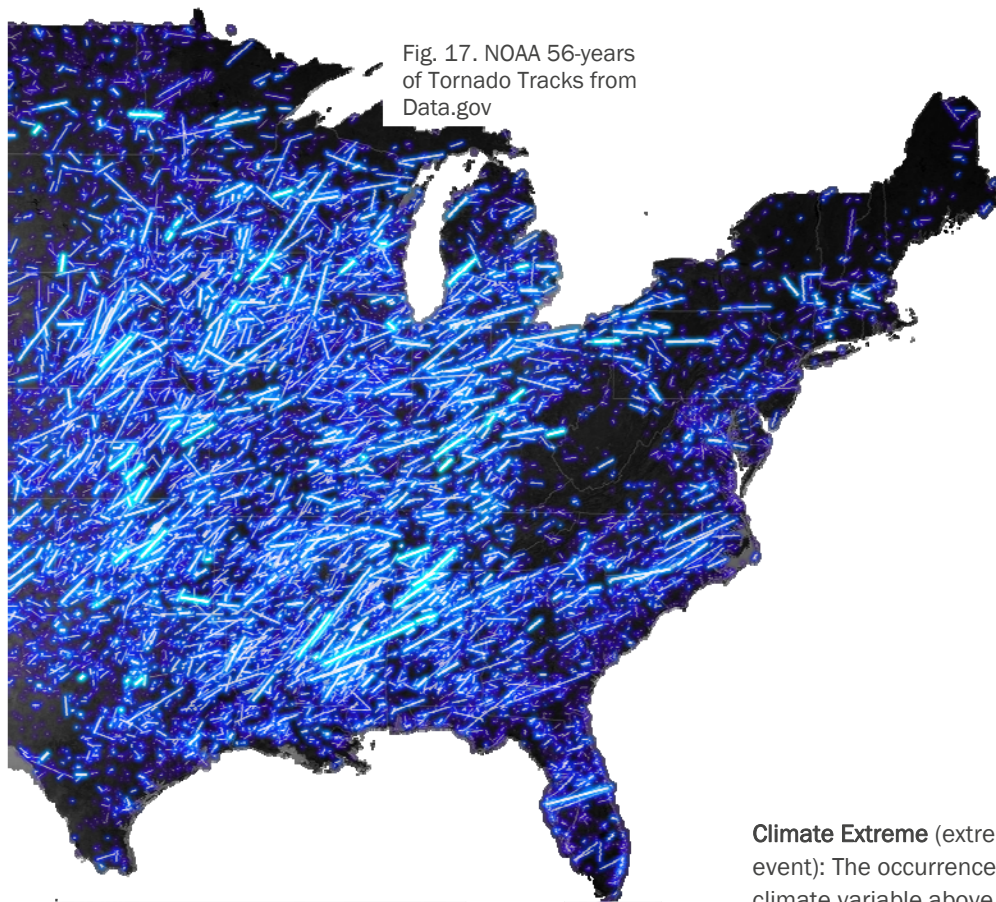


Fig. 17. NOAA 56-years of Tornado Tracks from Data.gov

DEFINITIONS

Core concepts adopted from the IPCC SREX glossary and used throughout this report include:

Climate Change: A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.

Climate Extreme (extreme weather or climate event): The occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable. For simplicity, both extreme weather events and extreme climate events are referred to collectively as ‘climate extremes.’

Exposure: The presence of people, livelihoods, environmental services and resources; infrastructure, or economic, social or cultural assets in places that could be adversely affected.

Vulnerability: The propensity or predisposition to be adversely affected.

Disaster: Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to

widespread adverse human, material, economic or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery.

Disaster Risk: The likelihood over a specified time period of severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery.

Disaster Risk Management: Processes for designing, implementing and evaluating strategies, policies and measures to improve the understanding of disaster risk, foster disaster risk reduction and transfer, and promote continuous improvement in disaster preparedness, response and recovery practices, with the explicit purpose of increasing human security, well-being, quality of life, resilience and sustainable development.

Adaptation: In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate.

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

Transformation: The altering of fundamental attributes of a system (including value systems, regulatory, legislative, or bureaucratic regimes, financial institutions and technological or biological systems).

Fig. 18. Hurricane Sandy By
National Environmental
Visualization Laboratory, GOES-13
(www.nnvl.noaa.gov) [Public
domain], via Wikimedia Commons



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www.nrmca.org/resilience