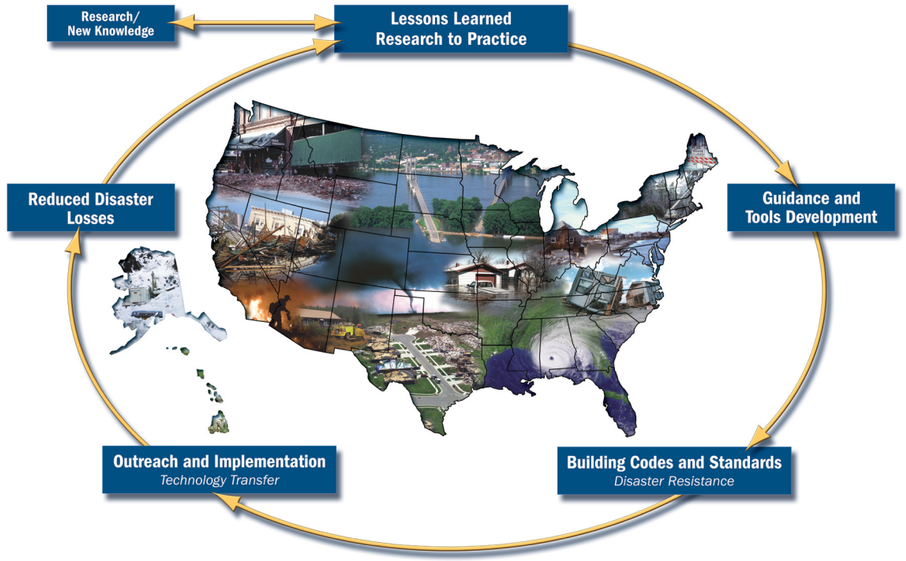
FEMA Building Science Branch Brochure

January 2016

FEMA

What is Building Science?



Every year, natural disasters and man-made hazard events cause fatalities and injuries, and cost billions of dollars in property damage throughout the United States. Mitigation creates real value for the American people by reducing loss of life, injuries and property damage for communities who are faced with these hazards as well as by minimizing disruption and enabling faster recovery.

What We Do

The FEMA Building Science Branch studies these hazards and provides technical services within FEMA, to the rest of the federal government and to our private sector partners. To help create disaster-resilient communities, key Building Science Branch activities include deploying Mitigation Assessment Teams to conduct post-disaster engineering investigations for a wide range of hazard events. The Building Science Branch is also one of four agencies that make up the National Earthquake Hazards Reduction Program (NEHRP).

www.nehrp.gov

With a focus on earthquake, wind, flood and other natural and man-made hazards, the Building Science Branch takes a lead role in developing state-of-the-art publications, guidance materials, tools, training, technical bulletins and recovery advisories that incorporate the most up-to-date building codes, flood damage resistant requirements, seismic design guidelines and wind design requirements for new and existing buildings.

For more information on the Building Science Branch, please visit: fema.gov/building-science

Cover photo: Oklahoma County, OK, May 24, 2010 -- Little remains of a home destroyed by one of the 22 confirmed tornadoes that swept across eastern Oklahoma on May 10. Photo by Win Henderson/FEMA.

Building Codes

What are Building Codes?

Building codes are sets of regulations governing the design, construction, alteration and maintenance of buildings and other structures. Through the work of the Building Science Branch, the nation's model codes are equivalent to the NEHRP recommended provisions and meet or exceed the National Flood Insurance Program (NFIP) regulations. They specify the minimum requirements to adequately safeguard the health, safety and welfare of building occupants.

Building codes are the cornerstone of effective mitigation, and the Building Science Branch supports and promotes building codes that help buildings resist the impacts of natural hazards.

To learn more about disaster-resilient building codes, please visit: fema.gov/building-code-resources

Building Codes Toolkit

The Building Codes Toolkit contains building code guidance and tools developed for property owners, engineers and design professionals, building codes officials and the general public.

Vilonia, AR, May 11, 2014 -- Vilonia's $13 million Intermediate School that was under construction and scheduled to open in July 2014 was destroyed by a tornado on April 27. Photo by Christopher Mardorf/FEMA.

Earthquakes

Napa, CA, August 24, 2014 -- This building was damaged by the magnitude 6.0 earthquake that struck Napa and is in dangerous condition, resulting in an unsafe building, fenced off street and closed businesses in the area. Photo by Eilis Maynard/FEMA.

Earthquakes are one of the most destructive natural phenomena and, if they occur in a populated area, can cause many deaths, injuries and extensive property damage. More than 143 million Americans living in the 48 contiguous states are exposed to potential damage from ground shaking earthquakes. When the people living in the earthquake-prone areas of Alaska, Hawaii and the U.S. territories are added, this number rises to nearly half of all Americans (Reference).

As a member of NEHRP, FEMA seeks to mitigate earthquake losses through implementation activities in the fields of earthquake science and engineering.

FEMA Building Science Branch has developed an extensive series of voluntary design and construction guideline publications that address both risk associated with new buildings and existing construction. A listing of these publications can be found at fema.gov/earthquake-publications.

QUAKESMART

QuakeSmart is a FEMA NEHRP initiative to help businesses in at-risk earthquake communities implement earthquake mitigation actions. To learn more, please visit: fema.gov/quakesmart.

Click to watch video ^^

Through this video, first responders will learn the importance of earthquake mitigation and seek out additional resources on how to ensure structures not only remain standing, but remain functional in the event of an earthquake. One such resource is FEMA P-1024.

High Wind

As a member of the National Windstorm Impact Reduction Program (NWIRP), FEMA supports initiatives that protect people and property from high wind events. By assessing building damage and identifying lessons learned after tornadoes and hurricanes, the agency develops best practices and technical manuals on wind resistance for the built environment; participates in updating wind resistant building codes and standards; provides grants for high wind mitigation; and produces state-of-the-art design and construction guidance for hurricane and tornado safe rooms.

Since the first edition of *FEMA P-320, Taking Shelter from the Storm: Building a Safe Room for Your Home* in 1998, more than 1 million copies of the publication have been distributed, and nearly 25,000 residential safe rooms have been constructed with FEMA grant funding assistance.

Tornadoes

Tornadoes typically affect much smaller geographic areas in comparison to other natural hazards but occur at a much higher frequency. From 1950 to 2011, tornadoes caused approximately 5,600 fatalities in the United States, more than hurricanes and earthquakes combined over the same period (Reference). Throughout the United States, tornadoes pose a serious threat to buildings and their occupants.

In May 2008, Tom Cook and his teenage daughter Ryanne survived a catastrophic tornado in Racine, MO, that leveled their home. But Tom's wife of 19 years and Ryanne's mother did not survive. Following this tragic event, Tom vowed to be prepared for disasters in the future. Tom and Ryanne moved to nearby Joplin, MO, to rebuild--this time with a safe room in their garage. This decision proved fortuitous when an EF-5 tornado touched down just three years later on May 22, 2011. The storm leveled their home; however, Tom and Ryanne were safe and unharmed.

Click to watch video ^^

Hurricanes

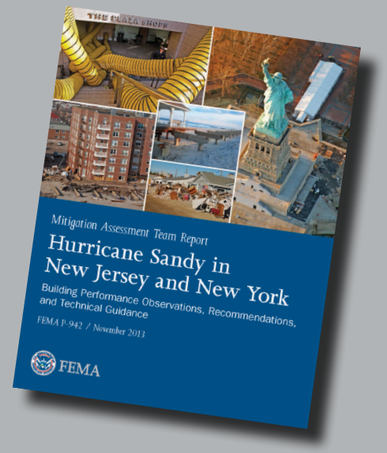
Hurricanes are one of the most dangerous and costly hazard events that occur in the United States. Homes, businesses, public buildings and infrastructure may be damaged or destroyed by many different storm hazards during a hurricane, including severe winds and flooding. Hurricanes pose a particular hazard to buildings, and proper design and construction are essential to help buildings withstand the impact of these storms.

St. Bernard Parish Sheriff Jack Stevens' home survives a devastating storm because it was built to FEMA's best practice guidance.

Click to watch video >>

Floods

Floods are one of the most frequent hazards in the United States. In the past five years alone, all 50 states have experienced floods or flash floods (Reference). Flooding is a process that may occur in a variety of forms, including, but not limited to, coastal flooding from hurricanes and tropical storms and flooding from inland floodplain hazards.



The Building Science Branch provides technical support for the NFIP for public and private sector stakeholders. Support includes NFIP Technical Bulletins; flood design, construction and retrofit guidance; tools to estimate and manage substantial damage/improvements in the floodplain; and flood-damage resistant building codes, standards and model ordinances that comply with the NFIP and incorporate higher standards. The NFIP requires participating communities to adopt and enforce floodplain management regulations.

Increased flood damage resistance is achieved through improvements in codes and standards, designs, methods and materials used for new construction and post-disaster repair and recovery. FEMA's Mitigation Assessment Team (MAT) Program develops reports and recovery advisories as part of the process.

By following MAT recommendations, many of todays model codes and standards contain provisions that help to better mitigate the damaging effects of floods on buildings, reduce disruption and downtime and yield flood insurance premium discounts for buildings in Special Flood Hazard Areas.

Click to watch video ^^

After being flooded by Hurricane Sandy, homeowners Al Grover and his wife raised their home 13 feet in order to mitigate from any future flood damage.

Long Beach Island, NJ, November 2, 2012 -- Hurricane Sandy moved sand off the beach and ocean water undermined beachfront properties. Photo by Liz Roll/FEMA

Other Hazards

Wildfires

During an average fire season, hundreds of homes are damaged or destroyed by wildfire, and in extreme fire conditions, thousands of homes can be damaged or destroyed. Severe fire weather in areas with significant amounts of wildland fuels can lead to extreme fire behavior.

Winter Storms

Buildings may be vulnerable to structural failure and possible collapse if basic preventative steps are not taken in advance of a snow event. Knowledge of the building roof framing system and proper preparation in advance of a snow event is instrumental in reducing risk to the structure.

Tsunamis

Earthquake-induced movement of the ocean floor can generate tsunamis that can strike anywhere along the United States coastline although the highest risk is along the Pacific Northwest, Alaska, Hawaii and Puerto Rico. Tsunami waves and the receding water are very destructive to structures in the run-up zone.

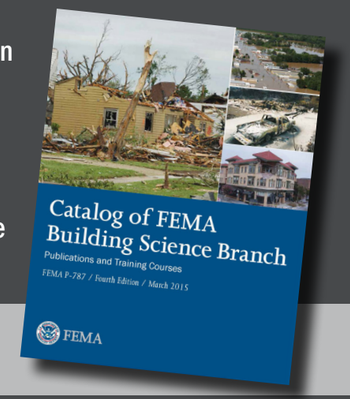
Man-Made

FEMA created a series of man-made disaster publications directed at strengthening the building inventory to reduce the potential impact from the forces that might be anticipated in a terrorist assault. The objective of the series is to reduce physical damage to structural and nonstructural components of buildings and related infrastructure, and to reduce resultant casualties from impact by conventional bombs, chemical, biological, and radiological agents; earthquakes; floods; and high winds.

To learn more about other hazards, please visit: fema.gov/building-science-publications-multi-hazard.

FEMA Building Science Library

Communities can strengthen their ability to reduce the loss of life, injuries and property damage by taking advantage of the vast resources available in the FEMA Building Science Library. The information in the library can help communities and interested citizens understand impacts from hazards, determine the appropriate standards for new construction, determine how best to retrofit existing structures to mitigate the risk of damage, and understand the benefits of enhancing or updating building codes to reduce the community's risk.



To view the catalog of FEMA Building Science Library publications, please visit: fema.gov/media-library/assets/documents/12909

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