

# **Building Science Branch Brochure**

### Wind Hazards

FEMA P-1089 / March 2017



#### **Building Science Branch**



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.

The Federal Emergency Management Agency (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. With a focus on earthquake, wind, flood and other natural and human-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, seismic design guidelines, flood damage resistant requirements and wind design criteria for new and existing buildings.

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

*Front cover photo: Henryville, IN, March 8, 2012 – A series of tornadoes struck the area on March 2, killed 13 people and left hundreds homeless. Source: Gene Romano/FEMA.* 

## **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.

During a windstorm, the force of the wind pushes against the outside of your home. That force is passed along from your roof to the exterior walls and finally to the foundation. Homes can be damaged or destroyed when the energy from the wind is not properly transferred to the ground.

FEMA Building Science Branch provides recommendations for roofs as well exterior doors and windows. Some of these recommendations include truss bracing, gable end bracing, hurricane straps for roofs and how to secure your double entry doors, garage doors, and storm shutters.

The recommendations are not intended to replace local building code requirements or to serve as the only options for protecting your home from hurricane wind damage.

To help residents prepare and mitigate against wind hazards, view <u>FEMA L-780</u>, <u>Building Science for</u> <u>Disaster-Resistant Communities: Wind Hazard</u> <u>Publications</u> to learn more.



#### Tornado

Tornadoes are nature's most violent storms and can strike quickly, with little or no warning. All tornadoes produce high winds and carry windborne debris that can pose a danger to lives and property. Violent tornadoes (those rated EF4 or EF5) are capable of tremendous destruction with wind speeds of up to 250 mph near ground level. Violent tornadoes can rip buildings from their foundations, and the debris carried by their winds can easily break windows and even penetrate the walls or roof of a structure.

Tornadoes are most common between March and August, but they can occur at any time. Although tornadoes can occur anywhere in the United States, the frequency and intensity of tornadoes varies greatly and often varies within a State. For example, as a result of almost daily and relatively weak thunderstorms, Florida has a disproportionately high frequency of weaker tornadoes in the EF0 to EF2 range. The non-coastal regions of Alabama and Mississippi and the Southern Plains States of the central U.S. (a.k.a. "Tornado Alley") have a disproportionately higher frequency of intense thunderstorms, and thus stronger tornadoes in the EF3 to EF5 range.

The best protection against tornadoes is provided by a structure built to the FEMA safe room guidance publications (FEMA P-320 or FEMA P-361) or the International Code Council (ICC) 500 storm shelter standard. If you don't have a tornado safe room or storm shelter you should make sure you know the safest location in your building, called the Best Available Refuge Area by getting an evaluation by a qualified architect or structural engineer. This is the most commonly available protective action for tornadoes.

#### **TORNADO FAST FACTS**



On average, more than 1,200 tornadoes have been reported nationwide each year since 1995.



From 1950 through 2011, tornadoes caused about 5,600 fatalities in the United States.



Tornadoes cause devastating personal and property losses in the United States, more than hurricanes and earthquakes combined.

Visit <u>fema.gov/safe-room-resources</u> to learn more about safe rooms.



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 (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.

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#### **Safe Room and Wind Shelters**

Having a safe room in your home or small business can help provide near-absolute protection for you and your family or employees from injury or death caused by the dangerous forces of extreme winds. Near-absolute protection means that, based on our current knowledge of tornadoes and hurricanes, the occupants of a safe room built according to the guidance in FEMA P-320 or FEMA P-361 will have a high probability of being protected from injury or death.

FEMA Building Science Branch's knowledge of tornadoes and hurricanes is based on numerous meteorological records as well as extensive investigations of damage to structures from extreme winds. Having a safe room can also relieve some of the anxiety created by the threat of an oncoming tornado or hurricane.

Visit <u>www.fema.gov/building-code-resources</u> to learn more about FEMA Building Science Guidance.



Interview with Bob Franke (FEMA Region VII) regarding FEMA P-320 (Taking Shelter From the Storm: Building a Safe Room For Your Home or Small Business) and other guidance/research on regarding building a safe room.

<< Click to watch video</p>

#### Taking Shelter from the Storm Building a Safe Room for Your Home or Small Include Construction Plans RMA P-330, Fourth Edition / Detember 2014

🐨 FEMA

*Mayflower, AR, May 7, 2014 – A safe room still stands among tornado debris on Pinetree Loop (near Dam Road) in Mayflower, Arkansas following severe storms and a tornado on April 27. Source: Christopher Mardorf /FEMA.* 

#### Hurricane



Home Builder's Guide to Coastal Construction Technical Fact Sheet Series PMA R-499 / December 2010

FEMA

Union Beach, NJ, November 8, 2012 - The remains of a home stand as a stark reminder of the power after Hurricane Sandy swept through the area. Source: Patsy Lynch/FEMA.

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.

Before a hurricane occurs, the main goal is to reduce the risk of damage to structures from winds and flooding. This includes strengthening the building's outer shell—including the doors, windows, walls, and roof—and removing or securing all objects and non-building structures, as well as clearing the outside areas around the building. Measures to protect against potential flooding include waterproofing basements and elevating critical utilities (e.g., electrical panels and heating systems).

In flood-prone areas, consider elevating the entire structure. Wind can tear the roofs from buildings, rip siding from exterior walls, and throw debris through windows. Falling trees can crush roofs and walls. Of course, hurricanes and tornadoes generate exceptionally destructive winds that can turn buildings into piles of rubble. But high winds can happen anywhere, and strike during many types of storms.

#### View <u>FEMA L-781, Building Science for Disaster-Resistant</u> <u>Communities: Hurricane Hazard Publications (2011)</u> for a quick summary of publications that will help them prepare for and mitigate against hurricane hazards.

A disaster survivor of Hurricane Sandy acknowledges the importance of following FEMA's guidance and adhering to current building codes when building with mitigation in mind.

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## **Building Science Branch 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.

For more information about FEMA Building Science publications, please contact the FEMA Building Science Helpline by email at <u>FEMA-BuildingScienceHelp@fema.dhs.gov</u> or by phone at (866) 927-2104 (toll free).

To subscribe to FEMA Building Science e-mail updates, visit <u>https://service.govdelivery.</u> com/accounts/USDHSFEMA/subscriber/new?topic\_id=USDHSFEMA\_193.



Catalog of FEMA Building Science Branch Publications and Training Courses FEMA P-787 / Fourth Edition / March 2015



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. Source: Win Henderson/FEMA.

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