Residential Sheltering: In-Residence and Stand-Alone Shelters

FEMA

FEBRUARY 2007 TORNADO RECOVERY ADVISORY *FEMA DR 1679 RA3*

Intended Audience and Purpose

The purpose of this advisory is to alert homeowners, renters, apartment building owners, and manufactured home park owners about the concept of in-residence and stand-alone storm shelters.

This Recovery Advisory Addresses:

- Consider a shelter for your home
- In-residence shelter construction and retrofitting options
- Sheltering options for when you can't place a shelter within your home
- Areas of last resort for those residents that don't have access to a shelter
- Emergency planning

See these 2007 Tornado Recovery Advisories for information about tornado risk, sheltering from tornadoes, and improving manufactured homes against damage from high winds:

- Tornado Risks and Hazards in the Southeastern United States (Tornado Recovery Advisory No. 1)
- Storm Shelters: Selecting Design Criteria (Tornado Recovery Advisory No. 2)
- Understanding and Improving Performance of Older Manufactured Homes in High-Wind Events (Tornado Recovery Advisory No. 4)
- Understanding and Improving Performance of New Manufactured Homes in High-Wind Events (Tornado Recovery Advisory No. 5)

Consider a Shelter for Your Home

The purpose of having a shelter (also known as a "safe room") in or near your home is to protect you and your family from injury or death caused by extreme winds. Shelters are intended to allow occupants to survive tornadoes and hurricanes with little or no injury. To determine your exposure to tornadoes, refer to FEMA 320, *Taking Shelter From the Storm: Building a Safe Room Inside Your House* (Second Edition, March 2004).[1] This publication provides information that can help you decide whether or not to construct a shelter to protect you and your family from injury or death during a tornado or hurricane. Additional information is provided in the Tornado Recovery Advisory titled *Tornado Risks and Hazards in the Southeastern United States.*

After determining that you live in a tornado- or hurricane-prone region, it is important to understand the risks. Most homes, even new ones constructed according to current building codes, do not provide adequate protection for occupants seeking refuge from tornadoes. A tornado or hurricane can cause wind and windborne debris loads on your house that are much greater than those on which building code requirements are based. Only specially designed and constructed shelters, which are voluntarily built above the minimum code requirements, offer occupant protection during a tornado or strong hurricane.

It is also important to remember that shelters offering protection against high-wind events should not be placed where flood waters have the potential to endanger occupants within the shelter. If your shelter is located where coastal or riverine flooding may occur during hurricanes, it should not be occupied during a hurricane. However, occupying such a shelter during a tornado may be acceptable, provided that the shelter is located where it will not be flooded by rains associated with other storm and tornado events. Consult your local building official or local National Flood Insurance Program representative to determine whether your home, or a proposed stand-alone shelter site, is susceptible to riverine or coastal flooding.

1. FEMA 320 is available online at http://www.fema.gov/plan/prevent/saferoom/fema320.shtm. Hardcopies may be obtained at no cost by calling 800-480-2520.

In-Residence Shelter Construction and Retrofitting Options

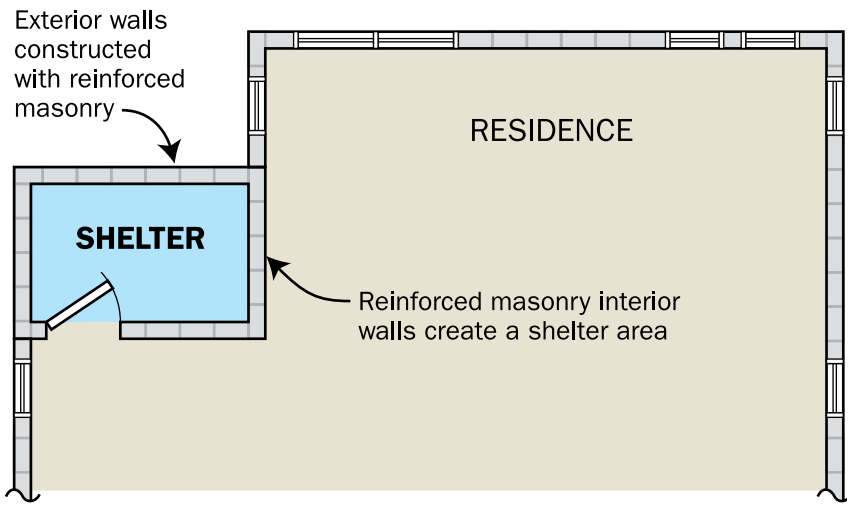
Constructing a shelter within your home puts it as close as possible to your family. A shelter may be installed during the initial construction of a home, or retrofitted afterward. As long as the design and construction requirements and guidance are followed, the same level of protection is provided by either type of shelter.

New Construction

FEMA 320 provides detailed drawings and specifications that can be used by a builder/contractor to construct a shelter in your home. The designs provided are for shelters constructed of wood, masonry, or concrete. All of them are designed to resist 250-mph (3-second gust) wind speeds and impacts from windborne debris. Pre-fabricated shelters are also available for installation by a builder/contractor when first building your home. The basic cost to design and construct a shelter during the construction of a new house is approximately $6,000, with larger, more refined, and more comfortable designs costing more than $15,000.

It is relatively easy and cost-effective to add a shelter when first building your home. For example, when the home is constructed with exterior walls made from concrete masonry units (CMU, also commonly known as "concrete block," see sketch this page), the protection level in FEMA 320 can be achieved by slightly modifying the exterior walls at the shelter space with additional steel reinforcement and grout. The shelter is easily completed by adding interior walls constructed of reinforced CMU, a concrete roof deck over the shelter, and a special shelter door, as shown under construction in bottom photograph.

CMU was used for the exterior walls at this house under construction (New Smyrna Beach, FL).



Sketch of floor plan showing location of shelter area in house.

View of an in-residence shelter under construction. Steel reinforced and fully grouted CMU surround the shelter space (New Smyrna Beach, FL).

Retrofitting Existing Houses

FEMA 320 provides general guidance for retrofitting a house with a shelter. Building a shelter in an existing house will typically cost 20 percent more than building the same shelter in a new house while under construction. Because the shelter is being used for life safety, and because your home might be exposed to wind loads and debris impacts it was not designed to resist, an architect or engineer (A/E) should be employed to address special structural requirements, even if inclusion of an A/E in such a project is not required by the local building department.

Recommendations for Sheltering When You Cannot Place a Shelter Within Your Home

Many reasons may prevent a homeowner or renter from installing or constructing a shelter within their home. These reasons may include: lack of permission (the resident does not own the home or does not have rights to modify or change the home), lack of available space, or lack of technical or economic practicality. Nonetheless, homeowners or renters may want to proceed with installing a shelter. Stand-alone shelters can be designed and constructed outside of a residence. These shelters can provide the same level of protection against high winds and windborne debris as do the in-residence shelters.

Small Stand-Alone Shelters

Some site-built homes, and most manufactured homes, do not lend themselves to the structural modifications and retrofitting required to install or construct an in-residence shelter. In these instances, a stand-alone shelter may be constructed (either above-grade, partially above-grade [see photograph to right], or below grade) near the residence. Small stand-alone shelters can be constructed to accommodate the occupants of one house, a few houses, or a small apartment building. This photo, from Wichita, KS, shows how a manufactured home community provided small, pre-fabricated shelters as a refuge for the residents. Each shelter provides safety for several homes in the community.

View of a pre-fabricated shelter that serves a few manufactured homes (Wichita, KS).

Community Shelters

A community shelter can be constructed to accommodate the occupants of several apartments or homes (site-built or manufactured homes, see photograph to right). For information about community shelters, refer to the Tornado Recovery Advisory titled *Storm Shelters: Selecting Design Criteria.* Many different types of shelters can be designed and constructed to meet the needs of large groups of residents. A shelter may be a single-use building, or it may be a multi-use building, such

View of a partially below-grade community shelter at a manufactured home community (Wichita, KS).

as a clubhouse (at community pools, golf courses, etc.), school building, or recreation center. Selecting the right type of shelter will be a collective decision made by the residents, funding agencies, and property owners and managers. For information on community shelters for larger populations, including planning and operational issues, see FEMA 361, *Design and Construction Guidance for Community Shelters* (2000).[2]

For further information about pre-fabricated and stand-alone shelters, contact the National Storm Shelter Association (http://www.nssa.cc)

Areas of Last Resort

Occupants of dwellings that do not have in-residence shelters, or access to stand-alone or community shelters, should identify the best available refuge area within their home before an emergency happens. When people identify and take refuge in the best available space within a building, they are less likely to be injured or killed. However, it is important to remember that "best available refuge areas" are not specifically designed as shelters, so occupants may be injured or killed during a tornado or hurricane event.

View of remnants of an interior room of a house that survived a strong tornado.

The following criteria should be used in identifying the best available refuge area in your home:

- Choose the lowest floor of the residence (a basement is preferable, or first floor if there is no basement).
- Choose a small interior room without windows (i.e., none of the room's walls is an exterior wall), such as a bathroom or closet, preferably with only one door.
- Choose a room located away from masonry chimneys, trees, or power poles.

Avoid selecting a refuge area that is near a masonry chimney (Moore, OK).

- Keep the room relatively free of clutter so you and the other residents can enter and remain in the room for up to several hours.

Emergency Supply Kits and Weather Radios

FEMA 320 provides information to use in preparing a Family Emergency Plan and an Emergency Supply Kit for the shelter. Further, all individuals living or working in tornado-prone areas should have a weather radio within their home or place of work. For more information about weather radios, see the Tornado Recovery Advisory titled *Tornado Risks and Hazards in the Southeastern United States.*

2. FEMA 361 is available online at http://www.fema.gov/fima/fema361.shtm.