

Preparing You for Emergencies: Home Mitigation: Minimizing Damage and Injuries

Tornadoes, earthquakes, fires, flashfloods, sustained floods, extremes of heat and cold--natural disasters like these are in the news on a daily basis. As a result people are considering more about efforts to limit the destructive effects of natural disasters in their home, while still keeping occupants safe and comfortable. Homes designed as a system for both disaster mitigation and energy efficiency will protect the building and its occupants and also increase energy efficiency. A concrete or brick home built in tornado country (like Louisville and Southern Indiana), for example, can better withstand wind-borne missiles as well as offer higher insulating values.

Building for disaster mitigation has another benefit, too--it saves money. Rita Calvan, director of the Federal Emergency Management Agency (FEMA) regional office in Illinois, says, "For every dollar spent on mitigation, we realize two dollars of savings in aid to disaster victims." FEMA estimates that building to withstand disaster adds only 3%-5% to the cost of a building a new home.

Tornadoes and Straight Line Winds

High winds seek out openings, pry vulnerable areas apart and destroy homes. A garage door that is left open during a tornado will make it easier for the storm to tear the roof off of the house. Houses that are built to be both strong and airtight, therefore, can stand up better to powerful winds. Wind turns debris into missiles that easily puncture homes, creating openings for wind and rain to wreak even more destruction. Stronger, thicker walls that would hold up to such missiles can also have higher R-values and greater thermal mass.



Notice the tree branch that penetrated this sheet metal wall. (University of Maryland)

The Federal Emergency Management Agency conducted a summit in 1998 that resulted in a prototype house being built to mitigate the hazards of hurricanes. The Hurricane House is built with wood frame construction and has insulation values that are higher than is typical in southern regions--R-15 in the walls, R-19 in the floors, and R-30 in the roof. It includes numerous features to increase hurricane resistance, including wind-resistant doors and double-glazed, laminated windows. These types of windows are energy-efficient, but they also will not shatter into dangerous shards. They crack into harmless pieces, as a windshield does. The house also features a 10 ft x 14 ft "safe room" that provides extra storm shelter but also serves as a walk-in closet off the master bedroom. This room has a 12-inch-thick reinforced-concrete ceiling built to survive winds up to 250 mph, as well as falling trees.

The Hurricane House was built with traditional construction techniques, but some alternative construction wall assemblies (concrete, concrete block and brick) can provide substantial strength for hurricane resistance while also delivering inherent energy efficiency gains.

Safe Room

A Safe Room is an in-home tornado shelter built to withstand extreme windstorms and wind-borne debris where a family can survive a tornado with little or no injury.

For the in-residence shelter to be effective, it must be readily accessible from all parts of the house. The central portion is the favored location, for added protection as well as accessibility. The in-residence shelter must be able to resist the forces that extreme winds or interacting structural components place upon it. The in-residence shelter is designed to withstand wind speeds of 250 mph, which accounts for virtually all tornadoes which have occurred in the U.S.

The accessibility of a shelter within the house makes the in-residence shelter highly



Safe Room remains standing after a tornado destroys the house it was in. The residents were spared from any injuries. Photo from Texas Tech University

advantageous over an outdoor cellar or community shelter because it eliminates the extreme danger of being struck by flying debris while attempting to reach a cellar or community shelter. Unlike the cellar, the in-residence shelter has a daily functional use - bathroom, closet, utility room, etc. It permits a family to continue regular living patterns during a weather watch with the peace of mind of knowing that a place of safety from extreme winds is only a few seconds away. Properly reinforced basements with concrete roofs offer safe and readily accessible shelters from storms,

but in many areas of the country they are not commonly provided in residences. The cost of an in-residence shelter is substantially less than that of a basement.

People injured in earthquakes can be buried alive by collapsing buildings. Earthquakes also sever utility lines--who can forget the dramatic pictures of fire raging amidst flooding due to burst gas and water lines during the Northridge and Kobe earthquakes? And after the famous San Francisco earthquake of 1906, fire was a far greater culprit in the devastation than the earthquake itself.

Just as wind seeks out cracks, nooks, and holes to do its damage, earthquakes search for structural weakness. Earthquakes often involve more than just the familiar shaking and vibration. Unstable soils may liquefy and faults may literally split the earth. Thus, building designs that simply follow seismic codes do not guarantee against collapse or serious damage. Within Louisville, much of the old portion of the city, and the heavy

industry are located on the alluvial deposits adjacent to the Ohio River. The newer portions of the city, including many of the malls and surrounding suburbs are founded on the clay materials derived from the limestone bedrock. By knowing the expected earthquake damage, relative to the geologic conditions, different construction techniques can be implemented to reduce the system vulnerability and to assist with emergency response planning.

Weather Extremes

Heat and cold can kill people and damage homes, too. The summer heat wave in Louisville in 1998 had the mayor recruiting people to check on neighbors and setting up cooling centers; even so, some people died from heat stroke inside their homes. Positioning homes for passive solar orientation, installing appropriate insulation, and weather sealing are the first lines of defense against heat. These measures help keep heat inside during the winter and outside during the summer.

Problems with snow and cold typically involve property damage, largely from frozen water pipes or ice dams. Insulating exposed plumbing and placing plumbing in interior walls are two straightforward methods of preventing pipes from freezing, and of course will cut down on water heating energy losses, too.

Whole-House Savings

Obviously, not every disaster mitigation measure will make a home more energy efficient. Nor will every energy efficiency measure make a house more disaster resistant. Some builders may mistakenly conclude that spending money on improving energy efficiency will leave less money available for disaster measures. For example, they might say, spending extra on roof straps (steel straps that hold the roof onto the walls) means that there will have to be less insulation in the walls.

This reasoning is flawed, however, because it doesn't take a whole-house approach, which considers the many trade-offs that can be made through careful home design. Spending a little extra on first costs for energy efficiency measures will often dramatically lower the life cycle costs of the home, freeing up funds that can be put into disaster mitigation measures. For example, those roof straps might be paid for through energy savings from adding more insulation and properly downsizing the HVAC equipment.

A major benefit of all disaster-mitigation measures is that insurance companies are beginning to see advantages in promoting disaster mitigation, and are beginning to reward their customers who install such measures in their homes. According to Craig Horton, regional director of mid-Atlantic risk mitigation for United States Automobile Association insurance company, Florida homeowners who install storm shutters (to protect their homes from hurricanes) on their windows are eligible for a discount on their house insurance payments. Utility Companies and lenders are also starting to take part in

this trend toward disaster-mitigation building, Horton says, offering rebates and discounts to consumers who choose sturdier homes.

With today's nightly news stories of earthquakes, tornadoes, ice storms, and heat waves, it is likely that the home buyers of tomorrow will come to expect more from their homes.

FEMA Mitigation Division – How to Series

The Federal Emergency Management Agency has a series of articles on “How to” mitigate for specific hazards. The web site provides information about how to stabilize your hot water heater for earthquakes as well as how to protect your electrical system from flooding. This site is very beneficial for the homeowner and homebuilders. You can access this free web site at [FEMA Mitigation How To.](#)