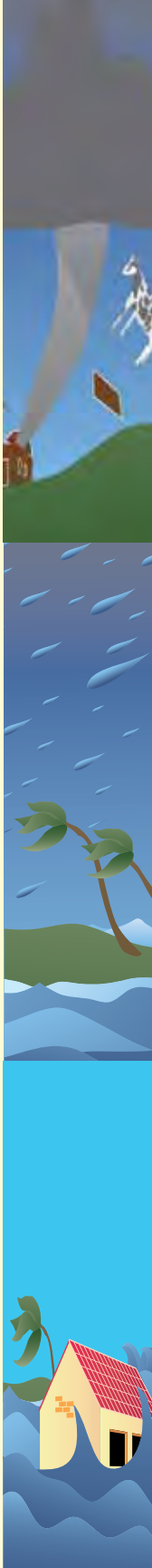
M I S S I S S I P P I

HOMEOWNERS HANDBOOK

TO PREPARE FOR

NATURAL HAZARDS



This book was developed as a project of the Gulf of Mexico Alliance (GOMA), a partnership of federal, state and local organizations that share a vision for healthy and resilient communities. A key priority of GOMA is to increase the resiliency of coastal communities from natural hazards. One major component of healthy communities is enhancing individual resilience and recognizing that adjustments to day-to-day living are necessary. This book is designed to promote individual resilience; thereby creating a fortified community.

Partners of GOMA that collaborated on this book include the National Oceanic and Atmospheric Administration (NOAA) Coastal Storms Program, the Mississippi-Alabama Sea Grant Consortium (MASGC) and the Mississippi Department of Marine Resources (MDMR). Authors include Tracie Sempier, Rhonda Price, Laura Bowie, Dennis Hwang and Darren Okimoto. This publication was supported by the Coastal Storms Program under NOAA grant number NA07-OAR4170510 as well as a GOMA grant number NA08NOS473398. The views expressed herein are those of the author(s) and do not necessarily reflect the views of GOMA, NOAA, MASGC, MDMR or any of its subagencies.

This document as well as other Coastal Storms Program resources are available on the Gulf of Mexico Coastal Storms Program website at: http://masgc.org/coastalstorms.

Homeowners Handbook for Natural Hazards in Mississippi
Publication # MASGP-10-022

The Mississippi-Alabama Sea Grant Consortium would like to thank the University of Hawai‘i Sea Grant College Program for allowing us to model this handbook after the original Homeowner’s Handbook authored by Dennis Hwang and Darren Okimoto. A special thanks to Darren and Dennis for providing text, graphics and technical review assistance in the preparation of the Mississippi handbook.

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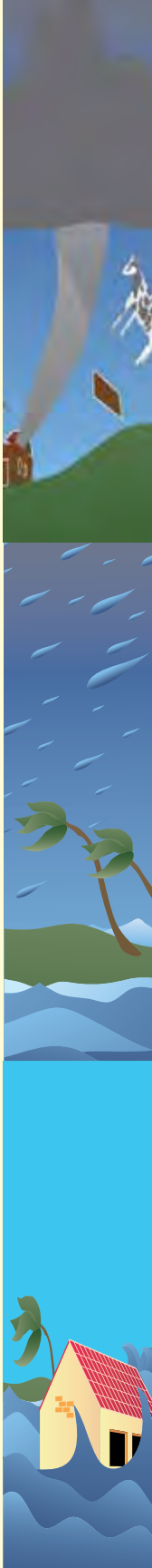

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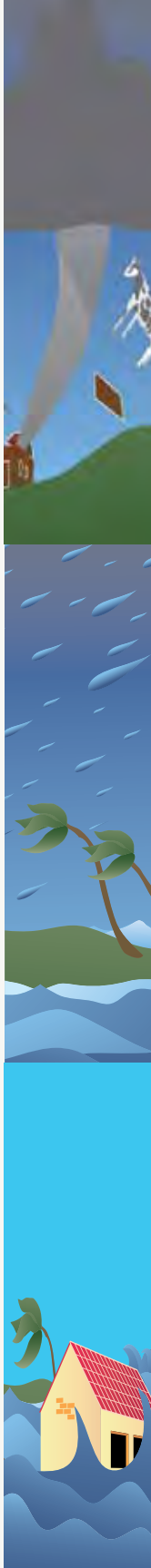
Part 1
Introduction

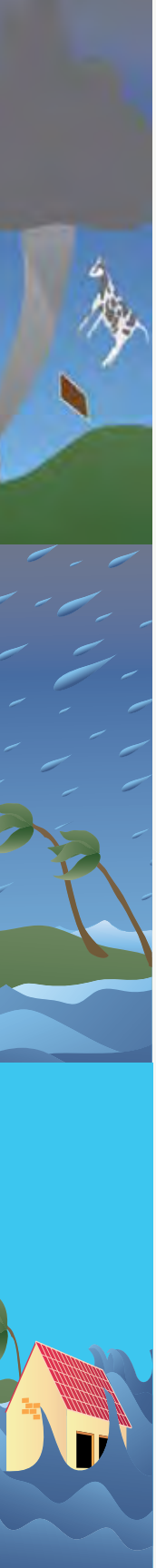
Your home is your castle. It protects you and your family, as well as your worldly possessions, from the elements. For many, the home is also your major investment. Yet natural hazards such as tornados, hurricanes, floods or high wind events can threaten your home, both the inhabitants and contents. When a natural hazard occurs, the results can be devastating.

This handbook was created to help you prepare for a natural hazard so that risks to family and property may be reduced. While it is never possible to eliminate all damage from a natural hazard, you as a homeowner can take action and implement many small and cost-effective steps that could significantly lower your risk. Mother Nature can be intense. Your family and home deserve protection that only you can provide.

This handbook is divided into five parts. This Introduction presents the purpose and layout of the handbook and includes a discussion of common myths that may have prevented you from taking action in the past. There is also a summary of the content of this handbook in the form of 10 action items. Part 2 provides basic information on tornados, hurricanes and flooding that will allow you to make an educated decision about the steps to take to protect your family and property. Part 3 discusses in detail how to protect yourself and your family. Included in this section are the stock of essential emergency supplies, evacuation kit, evacuation planning, evacuation procedures and important information that the civil defense and emergency management agencies want you to know even before a warning siren goes off. Part 4 covers how you can protect your property from wind and water hazards. Many examples are provided. Part 5 presents insurance resources to aid in recovery if storm damage occurs.

This handbook is available for free as a downloadable file at the Coastal Storms Program website designed for Mississippi: http://ms.stormsmartcoasts.org/.





This handbook will be updated on an as-needed basis as new information becomes available and feedback from the public is obtained. You can also contact your state or county civil defense and emergency management agencies by phone at the addresses and numbers provided (See Appendix B). In addition, many of the sponsors and participants of this handbook may have updated information on their own websites.

1.1 COMMON MYTHS AND REASONS TO PREPARE

You may be among the many homeowners in Mississippi who have not fully prepared for a natural hazard because of complacency caused by several myths. The most common myths appear as quotes below and are discussed in order to remove some of the major barriers to taking action and to encourage people to prepare.

1) "I survived Hurricane Katrina so I am sufficiently prepared." Many people have the impression that if they survived Hurricane Katrina, then they do not need to prepare any more than they did in 2005. Although Katrina was a storm with wide-spread damage, it was in fact a large, but otherwise typical, hurricane. The same storm could make landfall at a different location along the coastline and have much different results.

2) "If a hazard occurs, it won't be that bad." When a tornado, hurricane or flood event occurs, the damage can be devastating. Although Katrina was only a Category 3 hurricane when she made landfall, over 1,800 people were killed, making Hurricane Katrina the third deadliest hurricane in U.S. history. More than 275,000 homes were lost as a result of the hurricane, 10 times as many as any other natural hazard in U.S. history.[1]

5) "I don't live near the coast, so I am safe." In fact, the vast majority of damage or destruction by Hurricane Katrina was caused by the powerful winds of the hurricane. Storm surge from Hurricane Katrina was recorded traveling up to 12 miles inland and hurricane-force winds were felt near Hattiesburg, Mississippi.[2] Therefore, all homeowners should prepare, not just those along the coast.

6) "Installing hurricane clips doesn't guarantee there will be no damage after a hurricane, so I won't bother." Even though someone may wear a seat belt, shoulder belt, and have an airbag, there is no guarantee that

a person won't be injured in a major auto accident. Yet most people recognize the importance of these safety devices in reducing risk and use them. Likewise, the measures discussed in this handbook could significantly reduce risk, although there are no guarantees.

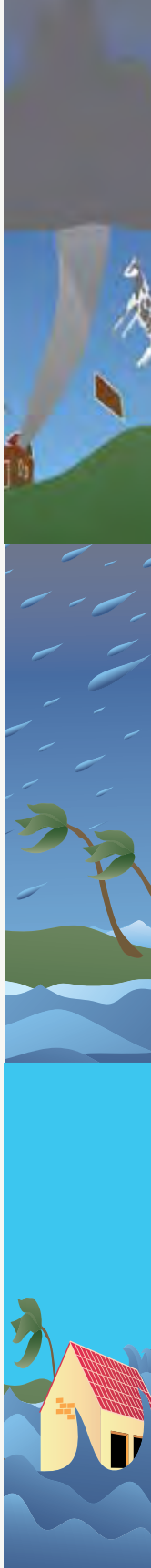
7) "If a natural hazard occurs, government will come to the rescue." After Hurricane Katrina, many residents found that the government would not repair their damaged houses or even provide adequate compensation for property damage. It is up to you to plan properly, strengthen your house and have the appropriate financial protections in place, such as insurance, if it is available. After a natural hazard, the government may also be overwhelmed by the number of people in need.

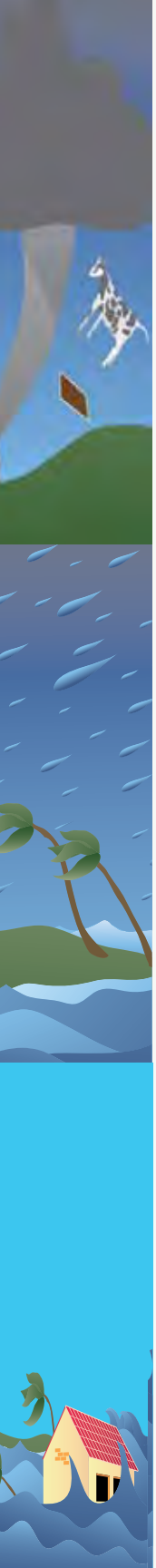
8) "My house survived Katrina, so I do not need to retrofit for hurricanes." If and when another massive natural disaster occurs, the resulting damage will be much greater. Homeowners in coastal Mississippi should consider retrofits that provide a continuous load path connection, which will help protect homes against both hurricanes and tornados. Additional simple measures are also possible.

9) "Even if a hazard occurs, there is nothing I can do." Fortunately, there are many small steps you can take to significantly reduce the risk of damage to life and property. While it is not possible to eliminate all risk or damage, these reasonable steps to plan and prepare can make a major difference and determine whether your house survives and just receives minor or no damage. Thus, the information in this handbook covers two major parts for preparation: (i) protecting yourself and your family, and (ii) protecting your property.

10) "Strengthening my house is too expensive and not worth the effort." The following list discusses various ways to strengthen your house and the associated costs.

    - Hurricane clips or window coverings can range from a couple of hundred dollars to a few thousand dollars. This alone offers significant protection.
    - For minimal costs, the roof structure (trusses and rafters) for many houses can be strengthened with bracing.





- Strengthening your roof can be expensive if done by itself. However, if it is done when you replace your roof at the end of its normal life, the incremental cost is reasonable.
- Foundation upgrades can be expensive, but considering your house is probably your major investment, it could be worth the immediate cost.

Strengthening your house can protect you from tornados, hurricanes and floods. This is a double benefit, especially for those in Jackson, Harrison and Hancock counties. Many of these upgrades can be offset with insurance premium discounts. Ultimately, strengthening your house should be considered a home improvement that adds value to your house and is worth the effort, even without external incentives. The time and money spent to prepare your house is a very small fraction of the resources that may be needed if you fail to minimize damage when a natural hazard strikes. In addition, when a hazard such as a hurricane nears, evacuation to a shelter should be considered a last resort. There will be minimal supplies, the simplest of sanitary facilities, a bare floor and little space (10 square feet per person). You will have to bring your own supplies, including bedding, medication, food and water. By preparing and strengthening your house, you are more likely to "weather the storm" in far more comfortable conditions and better take care of family members, including the elderly, those with special needs and pets. Also, by strengthening your house you protect your neighbors as well as yourself. A house that falls apart during a hurricane will create debris which can damage adjacent properties. You also help the emergency efforts of the local, state and federal governments by being able to assist other people instead of requiring help yourself.

1.2 THINGS YOU CAN DO TO PREPARE

As covered in later parts of this handbook, here are 10 things you can do to prepare that will provide greater protection to your family and your property.

1) Gather your emergency supplies. You can gather emergency supplies in your house now. Check and restock each month so that the supplies are complete, not outdated or used. Avoid rushing to a store during an emergency to gather your supplies. There will be long lines and empty shelves. You will add to the crowd and confusion. The good news is

many items you need are probably already in your home (see Part 3 of this book).

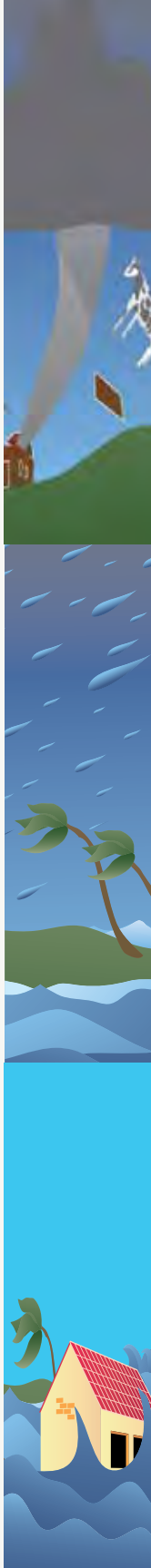
2) Create an evacuation plan for both a flood and a hurricane. They are different. For a hurricane, your plan may include sheltering in your house if it is outside the evacuation zone and sufficiently strong (see # 5). If you can't use your house, use a suitable alternative structure (a friend's or relative's house) or a shelter that is officially open (listen to local radio and television) (see Part 3).

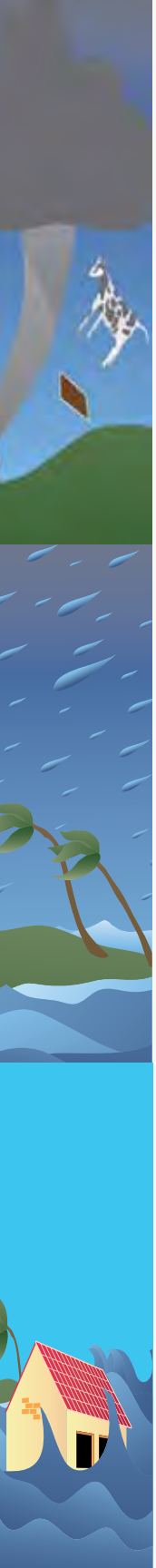
   For a flood, evacuate to high ground outside the evacuation zone if: (i) there is a flood strong enough so that you cannot stand, or (ii) you are instructed by local radio and television to evacuate. Once you have evacuated, the wait may be many hours (see Part 3). Discuss and practice drills of your evacuation plan with your family each year.

3) Know your property and take appropriate action. Look at where you are located. If the land floods or you live in coastal counties, you should consider flood insurance. You should consider trimming or cutting the branches that overhang your house since they may damage your house in a storm. If the property is near a ridge, it may be especially susceptible to wind damage during a storm or hurricane (see Part 4).

4) Know your house and take appropriate action. When was your house built? Does it have connectors to tie the roof to the wall or the wall to the foundation? When will you need to re-roof? Look at your blueprints. They may be available from your homebuilder, your local building department, or your architect (see Part 4).

5) Strengthen your house. A recently-built house should have hurricane clips to tie the roof to the wall and strong connectors from the wall to the foundation. If your house was built before then, you can still retrofit at a reasonable cost. All households should consider the many options now available to protect your windows, garage and doors. You can also strengthen your roof when it is time to re-roof. The steps a homeowner can take will vary with each house, but for a majority of homeowners, there are a few steps that can make a significant difference (see Part 4).





6) Finance creatively. Consider efforts to strengthen your house as an important home improvement project. Most projects are not that expensive. For the more costly ones, a small home improvement loan, combined with potential discounts from hurricane insurance premiums, make these projects within reach. It is a great investment to strengthen your house and provide more protection to your family (see Part 4).

7) Seek the assistance of a qualified, licensed architect, structural engineer, or contractor. This handbook covers work that you may be able to do yourself. If you cannot do the work, seek qualified assistance through trusted references from friends and family, the Structural Engineering Association, your county civil defense and emergency management agencies, or contractors associations. Even if you do the work yourself, it is always best to seek professional advice for initial guidance because every house is a little different (see Part 4).

8) Insurance. Don't gamble with your house. Obtain adequate insurance for hurricanes and floods (see Part 5).

9) Take advantage of potential discounts for your hurricane insurance premiums. Coverage may vary among insurance companies so call your insurance agent to find out about discounts that may be available. Significant discounts may be provided for reducing the risk to your house with window protection, roof-to-wall tie downs (hurricane clips) and wall-to-foundation tie downs (see Part 5).

Part 2
Natural Hazards: An Overview for Homeowners

In Mississippi, many different types of natural hazards can occur, such as flooding, fire, tornados, coastal erosion, sea-level rise, subsidence and hurricanes. This handbook concentrates on the most potentially devastating hazards in terms of loss of life and property damage: tornados, hurricanes and flooding.

Preparing for the larger hazard events (hurricanes, tornados and flooding) will often offer protection from smaller, more frequent events. Included here is basic information that may play a role in how you as a homeowner may prepare for larger hazard events.

2.1 TORNADO HAZARDS

Tornados are one of nature's most violent storms. Spawned from powerful thunderstorms, tornados can cause fatalities and devastate a neighborhood in seconds. A tornado appears as a rotating, funnel-shaped cloud that extends from a thunderstorm to the ground with whirling winds that can reach 300 miles per hour (mph). Damage paths can be in excess of one mile wide and 50 miles long.[3]

Large tornados can be weak and small tornados can be violent. The size of a tornado is not necessarily an indication of its intensity. The Fujita (F) Scale was originally developed by Dr. Tetsuya Theodore Fujita in 1971 to estimate tornado wind speeds based on damage left behind by a tornado. An Enhanced Fujita (EF) Scale, developed by a forum of nationally renowned meteorologists and wind engineers, makes improvements to and replaces the original F scale.[4]

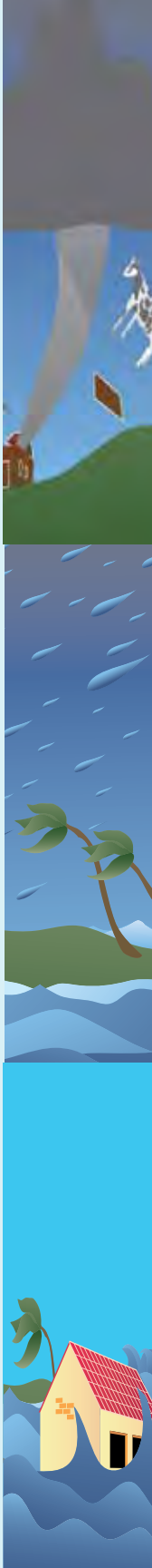


Table 2-1. The EF Scale[4]

EF-Scale Number	Class	Wind Speed	Description[5]
EF0	Weak	65-85 mph	Gale: Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.
EF1	Weak	86-110 mph	Moderate: Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
EF2	Strong	111-135 mph	Significant: Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
EF3	Strong	136-165 mph	Severe: Roof and some walls torn off well constructed houses; trains overturned; most trees in forest uprooted.
EF4	Violent	166-200 mph	Devastating: Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
EF5	Violent	> 200 mph	Incredible: Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-inforced concrete structures badly damaged.

Source: NOAA's National Weather Service – Thunderstorm Hazards, Tornados[4] and The Fujita Scale project[5]

Tornados are most frequently reported east of the Rocky Mountains during spring and summer months and the entire state of Mississippi is at nearly equal risk for tornados. Peak tornado season in Mississippi is March through May and they are most likely to occur between 3 p.m. and 9 p.m., but can occur at any time.[3]

Before a tornado hits, the wind may die down and the air may become very still. A cloud of debris can mark the location of a tornado even if a funnel is not visible. It is not uncommon to see clear, sunlit skies behind a tornado.[3]

Tornados generally occur near the trailing edge of a thunderstorm, or accompany a tropical storm or hurricane as it moves onshore. Waterspouts are tornados that form over water. The average tornado moves southwest to northeast, but has been known to move in any direction. The average forward speed of a tornado is 30 mph, but may vary from stationary to 70 mph.[3]

Figure 2-1. Major tornado damage in Yazoo County, MS, in April 2010. Source: NOAA National Weather Service, Jackson, MS.

2.2 HURRICANE HAZARDS

A hurricane is an intense tropical weather system with a well-defined circulation pattern and sustained winds of 74 mph or more. This compares to a tropical storm, which is also an organized weather system with well-defined circulation, but the sustained winds are between 39 and 73 mph. A tropical depression is an organized system of persistent clouds and thunderstorms with closed low-level circulation and sustained winds of 38 mph or less. Even a tropical storm or tropical depression can cause substantial damage.

Hurricane strength is often given in categories using the Saffir-Simpson Hurricane Scale, which rates hurricanes from 1 to 5 based on the intensity of the sustained winds (see Table 2-2). Earlier versions of this scale incorporated central pressure and storm surge as components of the categories. The central pressure was used during the 1970s and 1980s as a proxy for the winds as accurate wind speed intensity measurements from aircraft reconnaissance were not routinely available for hurricanes until 1990. Storm surge was also quantified by category in the earliest published versions of the scale dating back to 1972. However, hurricane size, depth of near-shore waters, topography and the hurricane's forward speed and angle to the coast also affect the surge that is produced. For example, the very large Hurricane Ike (with hurricane force winds extending as much as 125 miles from the center) in 2008 made landfall in Texas as a Category 2 hurricane and had peak storm surge values of about 20 feet. In contrast, tiny Hurricane Charley (with hurricane force winds extending at most 25 miles from the center) struck Florida in 2004 as a Category 4 hurricane and produced a peak storm surge of only about 7 feet. These storm surge values were substantially outside of the ranges suggested in the original scale.[6]

Thus to help reduce public confusion about the impacts associated with the various hurricane categories as well as to provide a more scientifically defensible scale, the storm surge ranges, flooding impact and central pressure statements have been removed from the scale and only peak winds are employed in the revised version known as the Saffir-Simpson Hurricane Wind Scale.

Table 2-2. 2010 Saffir-Simpson Hurricane Wind Scale[6]

Category	Sustained Wind Speed	Damage Expected
1	74–95 mph	No real damage to sturdy buildings; damage to poorly-constructed older homes and those with corrugated metal or temporary units; some tree damage. Examples: Hurricanes Danny (1991) and Gustav (2008).
2	96–110 mph	Some damage to building roofs, doors, and windows; considerable damage to poorly constructed or termite-infested homes; trees blown down, especially those that are shallow rooted. Example: Hurricane Georges (1998).
3	111–130 mph	Some structural damage to well-built small residences; extensive damage to termite-infested buildings; large trees blown down or snap in half. Examples: Hurricanes Fredric (1979), Elaina (1985) and Katrina (2005).
4	131–155 mph	Extensive damage to non-concrete structures; complete failure of many roofs, windows, and doors, especially unprotected, non-reinforced ones; many well-built wooden and metal structures severely damaged or destroyed; considerable glass failures due to flying debris and explosive pressure forces created by extreme wind gusts; complete disintegration of structures of lighter material; many large trees blown down; major erosion of beach area.
5	> 156 mph	Extensive or total destruction of non-concrete-reinforced structures; some structural damage to concrete buildings from debris such as cars or appliances; many well-constructed storm shutters ripped off from structures; many large trees blown down; flooding and major damage to lower floors near the shoreline. Examples: Hurricanes Camille (1969) and Andrew in Florida (1992).

Source: NOAA's National Weather Service website The Saffir-Simpson Hurricane Wind Scale

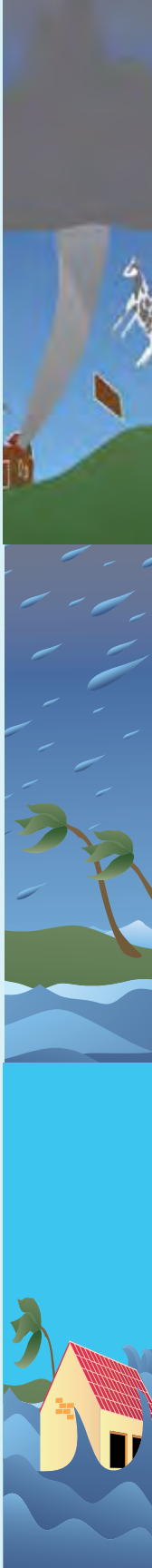


Figure 2-2. NOAA satellite image of Hurricane Katrina on August 29, 2005. Although it was a Category 3 at landfall, the band of strong winds, rain and storm surge spread from Louisiana to Alabama.

It is important to note that the Saffir-Simpson Scale only illustrates the "sustained winds" of a hurricane. Wind gusts can reach up to 135 mph for a Category 2 storm and up to 160 mph for a Category 3 storm.

During a hurricane, there is a triple threat of damage from high winds, storm surge and flooding associated with heavy rains. In a hurricane, the winds rapidly increase in strength from the weakest on the outer edge to the strongest near the eye. Hurricane winds are most intense around the eyewall. This area is generally 15 to 20 miles wide and contains the most intense rainfall. In 2005, Hurricane Katrina carried hurricane-force winds more than 160 miles north into the Metro-Jackson area, knocking down powerlines and trees in its wake.[1] Hurricanes also produce tornados which add to their destructive power.

Storm surge is a large dome of water, often 50 to 100 miles wide that sweeps ashore near where a hurricane strikes land and typically accounts for 90 percent of storm-related deaths. A surge of 10 feet or more can cause

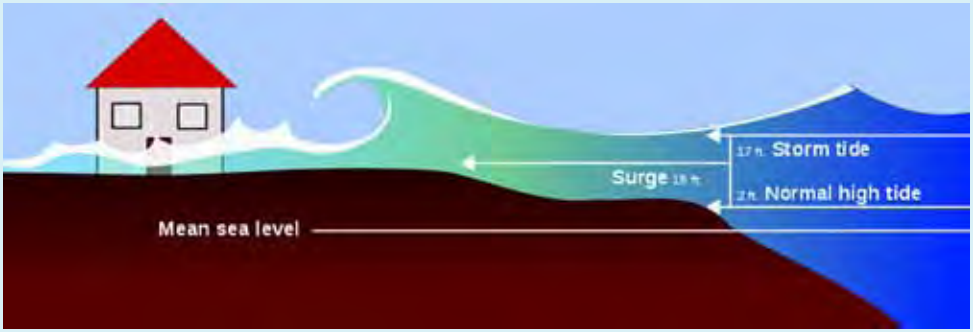


Figure 2-3. Storm surge depiction.

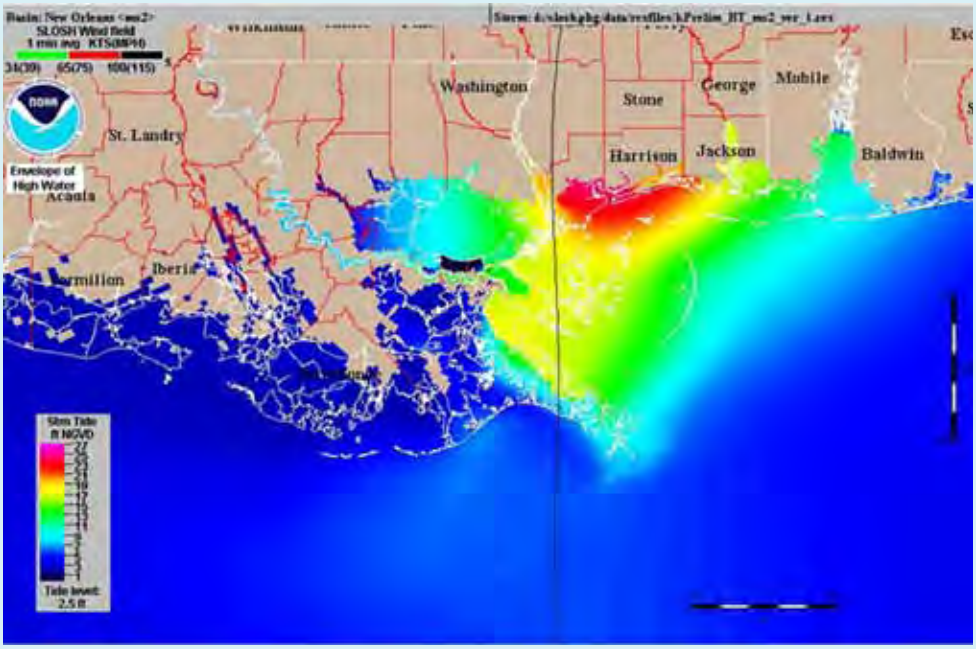


Figure 2-4. NOAA model depicting storm tide experienced by the northern Gulf of Mexico during Katrina on August 29, 2005.

severe flooding far inland and cause severe damage along the coast when wave action adds destructive power and height to the basic surge elevation, particularly, when storm surge coincides with high tide. Hurricane Katrina's highest officially surveyed storm surge was 28.1 feet and the highest officially recorded flood elevation including, wave action was 34.9 feet above sea level.[1]

Rainfall totals of 10 inches or more are not uncommon when a tropical storm or hurricane moves across a coastal location. Torrential rains continue in upland areas long after the high winds of a hurricane diminish. Rainfall totals of this magnitude can result in destructive flash flooding near streams, bayous and rivers. Flooding also causes extensive property and agricultural losses.

Figure 2-5. Storm surge associated with Hurricane Katrina caused damage to properties in Ocean Springs, Mississippi. Source: MASGC

2.3 FLOOD HAZARDS

Flooding in Mississippi is probably the most common natural hazard in the state, if not the most intense. Flooding can be caused not only by a hurricane, but also by a tropical storm, tropical depression, or other weather system that produces heavy rain. Flooding can build up gradually over a period of days, or suddenly in a few minutes (this is commonly known as a flash flood). In addition, coastal flooding and wave inundation can be produced by a hurricane or high-surf event with waves generated by local storms.

Mississippi ranks eighth in the nation for the number of repetitive loss structures.[7] Flooding can be associated with living near a body of water such

as the ocean or a stream, river, or reservoir. Mississippi has more than 5 million acres classified as floodplain, which is the fifth largest in the nation.[7]

You can determine if you are in a high-risk flood area by looking at the Federal Emergency Management Agency's (FEMA) flood insurance rate maps. These maps show what areas are susceptible to flooding and high velocity wave action (for those near coastal areas). Copies of the maps can be obtained digitally at www.msc.fema.gov. Copies may also be available for viewing at your city or county building departments.

Even if you are not in an official flood zone, you may be at risk from flooding. Go to the following website and type in your street address to determine a very general estimate of the flood risk for your property: www.floodsmart.gov/.

A good way to determine the risk of flooding for your house is to observe and study your property. Even inland properties may be susceptible to flooding if there is poor localized drainage or if recent development has altered the ability for water to drain out of your area. If your property floods during small rain events, then the problem will be greater during a storm or hurricane. You can protect yourself by improving the local drainage, making your house resistant to floods and purchasing flood insurance. You do not need to be in an official flood zone to obtain flood insurance.

For those located within a flood zone, elevating a building's lowest floor above predicted flood elevations by a small additional height (known as "freeboard") has very little effect on the look of a home, yet it can lead to substantial reductions in damages caused by flooding as well as reductions in flood insurance.[8] Consult with your local floodplain manager to determine

Figure 2-6. In this example, adding a small amount of height has very little effect on the look of a home, but resulted in a substantial flood insurance savings.[8] Source: Storm Smart Coasts-Mississippi

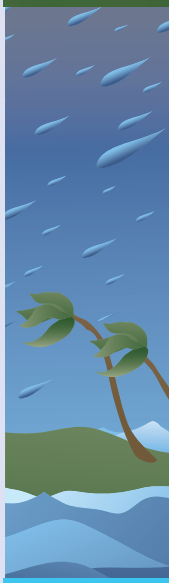
how much freeboard (if any) is needed for your property for flood insurance savings.

Even if you are not in a flood zone, you should consider purchasing flood insurance. The rates for properties outside declared flood zones are very affordable and are “priceless” if a flood event should occur.

Part 3
Protecting Yourself and Your Family

This part of the handbook covers the topic of protecting yourself and your family from natural hazards. In particular, it is important that your household has a stock of emergency supplies, an evacuation kit and evacuation plans for a tornado, flooding event and hurricane since each will differ depending on the nature of the threat. You should discuss and practice the plan with your family once a year, or whenever there is a major lifestyle change (for example, when a member of the family goes to a new school or is working in a different location).

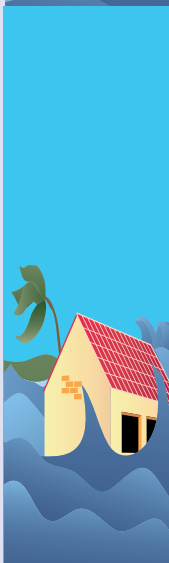
3.1 EMERGENCY SUPPLIES

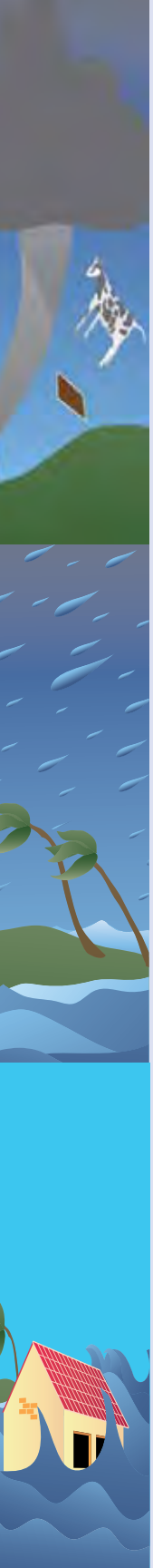


A general rule of thumb when preparing for a hazard event is to remember to be self-sustaining for the first 72 hours (3 days) after a hazard event. Due to a lack of access or availability, basic supplies may be unobtainable. Therefore, a stock of emergency supplies will be helpful during a major event like a hurricane or tropical storm, as well as for a minor event like a simple power outage. The importance of these supplies was demonstrated during Hurricane Katrina in August of 2005, which knocked out power in some areas nearest the Mississippi Gulf Coast for weeks.

Your emergency supplies should be gathered as soon as possible and checked monthly so that they are complete, unused and fresh (mark and check expiration dates). Old food should be used or discarded and replaced with fresh supplies. Do not keep expired supplies. Your supplies should include at least the following:

- Portable radio, flashlight and extra batteries (or flashlight and radio with hand-crank rechargeable batteries)
- NOAA weather radio
- First-aid kit
- List and supply of special medications (prescriptions and others)
- Three-day supply of nonperishable foods





- Hibachi with charcoal, camping stove with fuel, or barbeque grill with propane. (Do not use these items indoors or in an area with no ventilation. Follow all manufacturer instructions.)
- Manual can opener
- Matches or lighter
- Disposable plates and kitchen utensils
- Supply of water - A reasonable estimate is one gallon per person per day for drinking, cooking and personal hygiene needs. It is important to have available good water containers for any water-interruption situations. Four- to six-gallon water containers are readily available in stores. Remember to store water for toilet use (in bathtubs, rubbish containers, washing machines, water heater, etc.).
- Pet supplies (food, leash, medications)

Some additional items you may wish to add to your stock include:

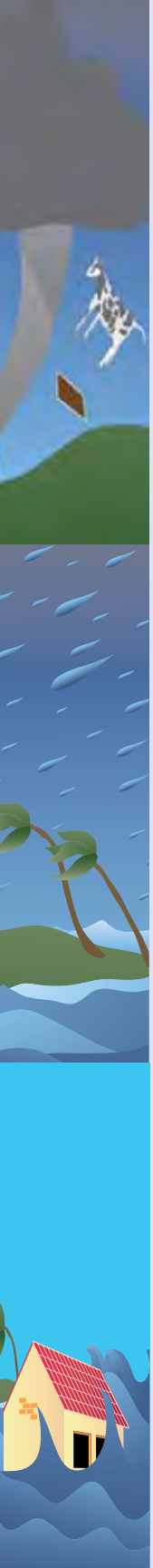
- Sanitary supplies or porta-potty
- Spare cash. Automated teller machines require electricity to operate and may not be available or accessible for weeks.
- Waterproof plastic sheeting or blue tarp, with string or rope
- Cell phone with a car charger and a hardwired single line phone - Cell phone networks may be overloaded during times of natural hazards. Cordless phones with a base station will not work without electricity. If you need to rely on cordless phones, get an alternate source of power. Otherwise, have an old-fashioned corded phone. Use your phone during a natural hazard only in an emergency.
- Bedding and clothing for each person
- Blankets and towels
- Rain jackets and pants
- Sunscreen and bug repellant
- Baby supplies (diapers, food, medication)

- Toothbrush, toothpaste, soap, shampoo, cleanser, bleach, trash bags, towellettes, water-free hand disinfectant
- Copies of important documents - driver's license, social security card, proof of residence, insurance policies, wills, deeds, birth and marriage certificates, tax records, medical records, family pictures, etc.
- Alternate power supplies - During an emergency or power outage, alternative sources of power may be needed (among these are generators, inverters, power stations and battery chargers). See Part 4 of this book for descriptions of alternative power sources that may supplement your emergency supplies.

Note that if you are taking shelter in your home (outside the flood evacuation zone, well inland of the strongest winds of the hurricane, and in an exceptionally strong dwelling), you may wish to have more than five to seven days of supplies. There is always the possibility that a major storm or hurricane could disrupt the supply line of goods. If the space is available and your house is protected, stocking up for a two-week period is prudent. Gather the supplies over a period of time versus during an emergency, when you could face or contribute to shortages.

3.2 EVACUATION KIT

The evacuation kit differs from your stock of emergency supplies because the kit is what you will take if you need to leave your house in an emergency. Your evacuation kit should be prepared as soon as possible and can be checked before the beginning of hurricane season, which runs June 1 to



November 30. The components of the kit should be stored in one place, perhaps in a duffle bag or backpack, so that it is ready to go at a moment's notice. The kit is primarily for evacuation during a hurricane, although it could be used for other situations. It may include:

- 1 gallon potable water per day per person
- Personal items and family needs, such as 2-week supply of daily prescription medications, a 3-day supply of nonperishable food and any special dietary foods, can opener, infant formula and diapers; prescription eyewear and personal hygiene items such as waterless cleaner, toothbrush/toothpaste, toilet paper roll;
- List of any required medications, special medical information, Medical Care Directives, health insurance card, personal identification and other important documents;
- First-aid kit;
- Flashlights, batteries and spare bulbs, portable radio with spare batteries;
- Change of clothes, towel;
- Pillows, blankets and folding mattresses/air mattresses.

The American Red Cross has been recommending that the evacuation kit should contain supplies for five to seven days. Should the supply chain be disrupted (because of, for example, a damaged airport or warehouses), you will be better off than others who do not have adequate supplies.[9]

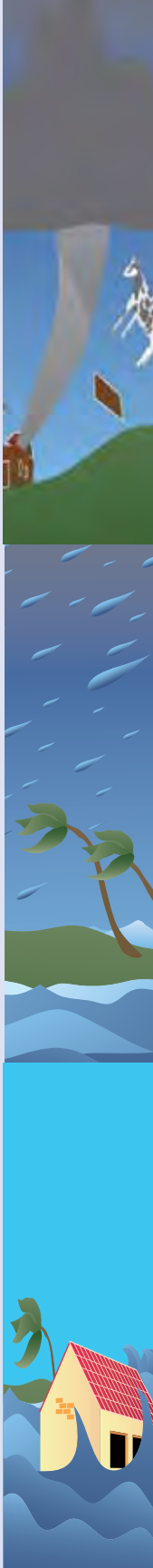
There is a fine line between bringing too many supplies that overload the limited shelter space of 10 square feet per person and not bringing enough. However, if you go to a shelter, keep in mind that there will be limited space, so bring only what is recommended unless you are instructed otherwise by your civil defense or emergency management agencies.

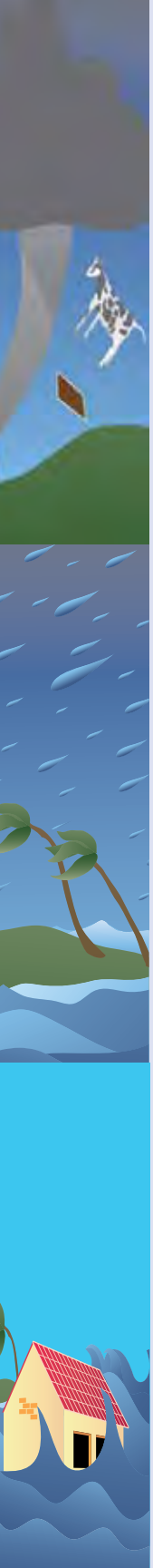
3.3 EVACUATION PLANNING

In Mississippi, it is important for families to plan for both flooding events and hurricanes. When you put your evacuation plan together, here are some things to consider:

- Stay alert, stay calm and be informed (tuning in to local radio and television is important). Create an evacuation plan and review it with your family every year.

- Evacuation procedures for a hurricane will differ from those of a flooding event. You must plan for both: in a hurricane, you must protect yourself from strong winds, torrential rain and coastal inundation. In a flood, you must protect yourself from inundation of rising water.
- Mississippi Department of Transporation (MDOT) regularly inserts evacuation maps in newspapers during hurricane season. These maps identify recommended routes and can help you avoid coastal inundation from a hurricane because these maps consider historical inundation from both hazards. Evacuation maps may be updated at any time, so do not depend on outdated versions. See www.gomdot.com for up-to-date evacuation maps for your area.[10]
- Listen to your local radio and television stations carefully as there may be additional or modified directions based on the best available information at that time. Mother Nature is unpredictable and a team of scientists will always be monitoring unusual conditions for public safety. "Local" means radio and television broadcasts specific to the area in which you live. Television is important but may contain information that is more applicable to one area than another, because it can be broadcast across state lines and may provide more pertinent information for the area where it is based.
- Your evacuation plan should consider yourself, the members of your family, those with special health needs for whom you may take responsibility (like the disabled or elderly) and your pets. Practice evacuation procedures with your family through yearly drills.
- In an evacuation or emergency situation, all able-bodied persons (men, women and children) should be able to take care of themselves if they act calmly and with proper direction.
- During flash flooding events, parents should confirm with their child's school the evacuation plans that are in place, specifically, where the students will be held and for how long during each type of natural hazard. You should not have to drive to school to pick up your children.
- As part of your evacuation plan, consider how family members will communicate if they become separated. Each family member should have a list of telephone numbers, cellular phone numbers and email addresses of everyone in the family and phone numbers of a few contacts outside of





the family. This list should be readily accessible and not require power to access (e.g., stored on a cell phone or computer).

- If needed, develop a plan to help those who cannot help themselves, such as the disabled or those with limited mobility. If people with special health needs are with a care-provider, confirm that the care-provider has an evacuation plan. Otherwise, you, your family, your friends or relatives, or someone nearby who is designated can take responsibility for that person(s).
- Develop a plan for your pets. Listen to local radio or check with your local civil defense department to determine if there are any pet-friendly shelter locations in your county. If possible, take your pet with you to anywhere that is high ground outside of the evacuation zone.
- If you use your house as a hurricane shelter and it is in an appropriate location, you may be better able to store food and water and take care of your loved ones, including those with special health needs, the elderly, and your pets. This is why it is important to strengthen your home as much as possible.
- If you are outside an inundation zone or flood zone and in a strong house, you still may be better off going to a public shelter.
- In general, stay off the roads. Only drive if it is absolutely essential. Your evacuation plan should emphasize reaching an area by walking. The police may close many roads during an emergency, so people can exit a freeway, but not necessarily get on it.
- There are a limited number of hurricane shelters and spaces that offer protection from wind, rain and coastal waters. Because there is a shortage of shelters, there may be a possibility you cannot get in, even if you wanted to. Therefore, plan to use a shelter only as a last resort.
- Become familiar with the closest shelter or shelters in case you have to evacuate to one (see Appendix A). Check for updates to the list of shelters on the Southeast Mississippi Red Cross website: www.redcross-sems.org/shelters.[11]
- Plan and prepare to be at your evacuation point for several hours.
- Know the difference between a hurricane watch and a hurricane warning. Do not confuse the two. When each is triggered, there are

different actions you and your family should take. Also note that the civil defense and/or emergency management agencies may issue what is called mandatory evacuation in the case of a hurricane warning.

3.4 KEY DEFINITIONS

Hurricane Watch - Issued when hurricane conditions and associated damaging winds, surf and flooding rains are possible within 48 hours. During this watch period, prepare your home and review your plan for evacuation in case a hurricane warning is issued. As discussed earlier in this section, preliminary preparations should begin even before a watch has been issued.

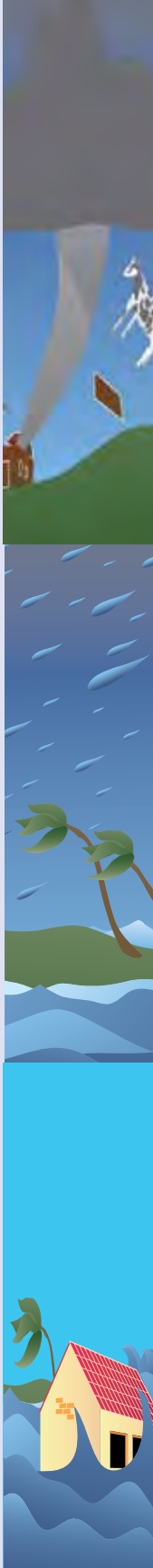
Hurricane Warning - Issued when hurricane conditions are expected within 36 hours. Complete all storm preparations and leave the threatened area if directed by local officials. Keep in mind that a hurricane warning may not always be preceded by a hurricane watch.

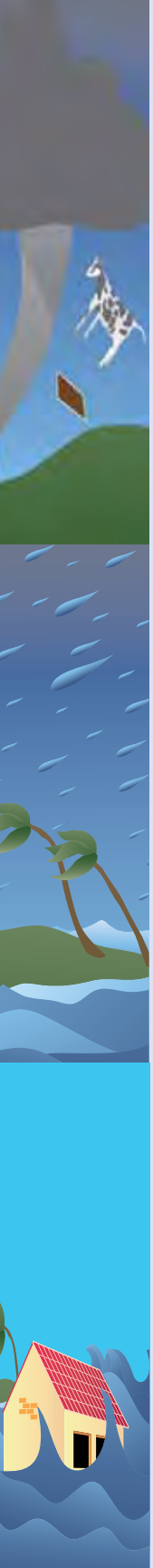
Flash Flood or Flood Watch - Issued when flash flooding or flooding is possible within the designated watch area. Be prepared to move to higher ground; and listen to NOAA Weather Radio, local radio, or local television for information.

Flash Flood or Flood Warning - Issued when flash flooding or flooding has been reported or is imminent. Take necessary precautions at once. If advised to evacuate to higher ground, do so immediately.

The Emergency Alert System (EAS) is the official source of natural hazard information and instruction in the state. This information can originate from county, state, or federal agencies. For example, the EAS could disseminate warnings and/or instructions from the governor's office during threats or emergencies affecting one or more counties within the state. The statewide network may also be activated by the National Weather Service Forecast Office to disseminate weather-related watches or warnings.

If a siren sounds, turn on your radio. Some radios with the NOAA weather radio band turn on automatically when an emergency broadcast through the EAS is announced. This could be useful for homeowners along the coast. The NOAA weather radio station broadcasts around-the-clock weather and also participates in the EAS.





All local radio stations have voluntarily agreed to participate in the EAS system. Additional information may also be available on local and cable television. There are also eight primary radio stations around Mississippi that have a wide circulation and specialized equipment including decoders and backup generators for use during emergency situations(Table 3-1).[2]

Table 3-1. Participating Radio Stations Broadcasting Emergency Situations

City	Radio Station
Biloxi	FM 90.3
Booneville	FM 89.5
Bude	FM 88.9
Greenwood	FM 90.9
Jackson	FM 91.3
Meridian	FM 99.1
Mississippi State	FM 89.9
Oxford	FM 90.3

3.5 PREPARATIONS BEFORE A HURRICANE

The following are some precautions that should be taken well before a hurricane arrives.

- Wedge sliding glass doors with a brace or broom handle to prevent them from being lifted from their tracks or being ripped loose by wind vibrations.
- Unplug all unnecessary appliances.
- Shut off gas valves.
- Turn refrigerators and freezers to their coldest setting.
- If you are going to evacuate, shut off electricity at the main switch, and gas and water at their main valves.
- Package your valuables, such as jewelry, titles, deeds, insurance papers, licenses, stocks, bonds, inventory, etc., for safekeeping in waterproof containers. Take these with you if you are going to evacuate.
- Outside, turn down canvas awnings or roll them up and secure them with sturdy rope or twine.
- Check door locks to ensure doors will not blow open.

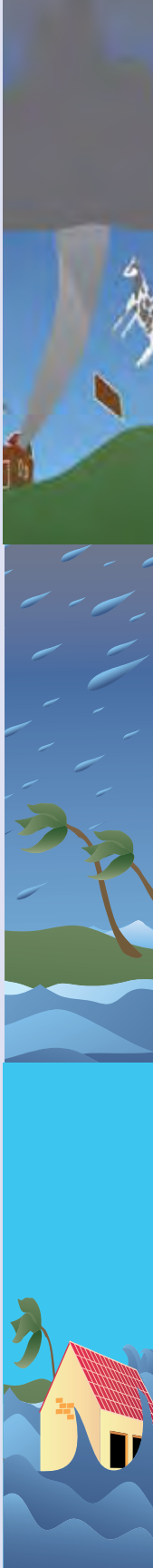
- Check outdoor items that may blow away or be torn loose; secure these items or move items, such as potted plants, inside.
- Store chemicals, fertilizers, or other toxic materials in a safe section or secure area of the premises.
- Secure propane tanks. They should not be stored near sources of heat (like your water heater or other appliances).
- Fill the gas tank of your car.
- Deploy window protections well in advance of the arrival of any winds (see Part 4).
- Ensure that you have a sufficient amount of cash in hand to purchase goods and items if needed following the hurricane, as banks and ATM machines may be inaccessible because of a lack of electricity.

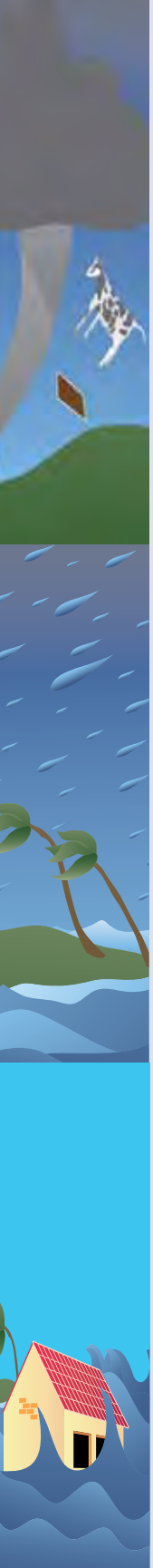
3.6 EVACUATION PROCEDURES FOR A HURRICANE

Your emergency supplies stock and evacuation kit should already be in place before there is a hurricane watch or hurricane warning. In your evacuation plan, you should already have decided if you will stay in your house, go to a shelter, or go elsewhere (friend's or relative's house). You should stay in a place that is away from any flood or inundation zones and that is able to withstand strong winds and rain. If you evacuate, you should already have made plans for your pet and prepared your house. If you plan to go to a shelter, you should already know the location of two or three shelters that are closest to your residence.

As a general guideline, you should evacuate if you are:

- Along low-lying coastal areas;
- Along low-lying areas subject to flooding (for example, near a stream or river);
- In any Federal Flood Insurance Zone such as a high velocity wave zone (V zone) or flood zone (A zone), even if your house is built for wave action and flooding;
- Along ridge lines exposed to strong winds;





- Living in certain wood frame structures (e.g., single wall without a continuous load path design) or lightly-constructed building.

Go to a hurricane shelter only if it is open. Listen to your local TV or radio station for shelters that are open to the public. A list of open shelters can also be found at:

George and Jackson Counties
www.redcross-sems.org/shelters.php

Harrison, Hancock and Pearl River Counties
www.redcross-msgc.org/shelters.php

Stone County
www.redcross-scms.org/shelters.php.

- Evacuate with your evacuation kit before danger arrives. Not all parts of a school serve as emergency shelter. Follow the directions of personnel who are staffing the shelter. If there are no personnel, the shelter is either not open or you are at the part of the facility that is not being used as a shelter.
- When you get to an evacuation shelter, you will have a maximum space of 10 square feet. There will be a bare floor. You will have to provide your own bedding, food, water and other essentials. Your evacuation kit should contain all of these important items. Make the best of the situation and cooperate with the volunteers.

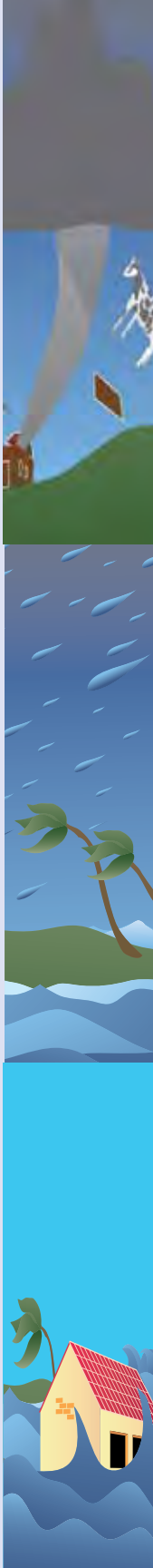
3.7 EVACUATION PROCEDURES FOR A FLOOD

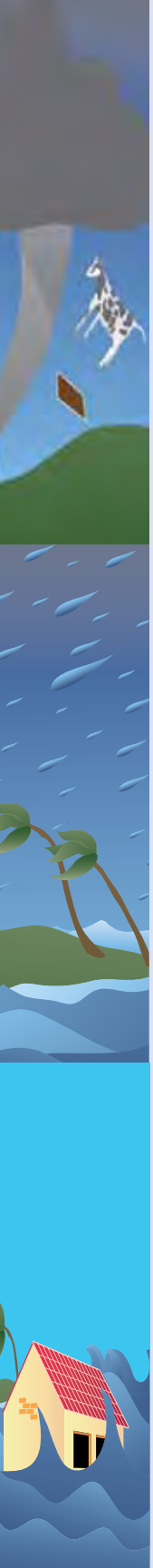
The general rule if you are evacuating from a flood is to stay away from flood waters and head to higher ground. Stay away from moving water. Even six inches can make you fall or cause your car to stall. Two feet of moving water can move your car. If there is a flash flood and you are caught in your house, go to the second floor or the roof, if necessary.

3.8 EMERGENCY INFORMATION AND CONTACTS

Each year, NOAA provides an "Extreme Weather Information Sheet" customized for Mississippi and each of the coastal states. This information sheet provides general information contact information and can be located at the NOAA website: www.ncddc.noaa.gov/.

For general emergency information, please contact your state or local civil defense and emergency management agencies. The best time to contact them is when there is no emergency and you are planning and preparing. The worst time is when there is an emergency and the agencies are responding to hundreds or even thousands of calls. Nevertheless, call them if you absolutely need to. However, by planning and preparing ahead, you can help yourself and the agencies. For a list of emergency contacts and contact information, please see Appendix B.





Part 4
Protecting Your Property

Protecting your property and protecting your family go hand in hand. You don't have to be blown away when a natural hazard strikes. It's never too early to prepare and you can take several basic steps right now to protect your family and your home from disaster. By strengthening your house, you can reduce the risk of damage to your home and possibly reduce insurance premiums. Additionally, you may be able to shelter in place during a minor hazard event.

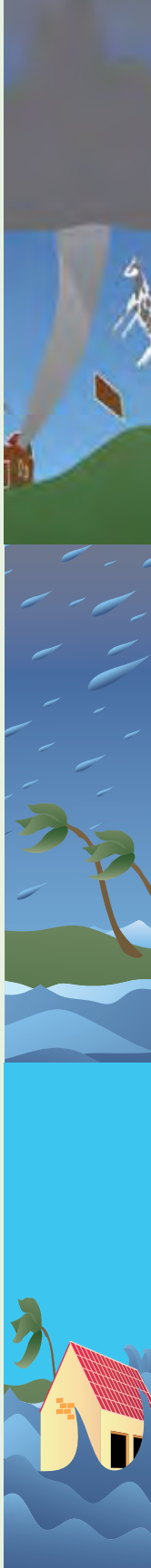
The amount of protection your house can provide from a natural hazard is limited by a number of factors which you should very carefully consider before taking shelter in your home:

1) The Severity of the Hazard Event. Protecting your home against a tropical storm or Category 1 hurricane is much easier than against a major event. For stronger storms, eliminating all damage is difficult, so the main goal is to significantly lessen the amount of damage which could occur. Each and every small improvement you invest in your home can make a difference. The more small improvements you make to your home, the less likely there will be severe damage to in minor events.

2) Your Location. Even though a hurricane may be a Category 1, you could experience much stronger wind. Being on a ridge, for example, amplifies the wind speed. Additionally, if your home is close to the open beach, a large bay, or a large marshland, the force of the wind will be much greater than if the house were surrounded in all directions by buildings, other homes and/or trees.

3) How Your House Was Built. The building codes adopted by many communities require new houses to have hurricane clips that tie the roof to the wall and other connectors that tie the wall to the foundation. This is known as a "continuous load path connection." Because of this requirement, many of the newer homes are generally much stronger than those built before this requirement was in effect.

4) How Your House Is Maintained. Maintenance of your house is important. Painting the exterior every five years protects the wood



and prevents rot, which can weaken the structure. Termites can also weaken a wood-framed house. If the wood in the house is rotten or has severe termite damage, it will be more difficult, or even impossible, to strengthen the home. So, it is important to maintain your house by periodic painting and eliminating termites. Proper maintenance will extend the life of a house in more ways than one.

5) How You Strengthen Your House. Even if your house was not built with hurricane clips, there are many small steps and some major ones that can be taken to retro-fit or address how to strengthen your existing home.

The remainder of Part 4 concentrates on many of the options to consider when strengthening your home, whether you're designing a new home or planning a retro-fit of an existing home, including:

a) Roof-to-wall connections
b) Wall-to-foundation connections
c) Hurricane clips with additional foundation connection
d) Stronger connectors than those required in the current building code
e) Protection for windows, doors and garage doors
f) Improving the connection of the roof-sheathing to roof-framing members (rafters or trusses)
g) Reinforcing gable ends with bracing
h) Reinforcing weak roof framing members and connections of auxiliary structures (porches, carports, storage rooms)
i) Alternate sources of back-up electricity
j) Flood Retro-Fit measures (strengthening existing foundations and piers for flood forces, elevating mechanical equipment, elevating structures

You may be able to perform the work for many of these measures. However, if the work is beyond your capabilities, consider hiring a structural engineer and/or architect to plan the strengthening/retro-fitting program for your home and a licensed contractor to do the installation/construction. Even if you do this work yourself, it is best to contact one or more of these professionals first to obtain guidance and details specific to your house.

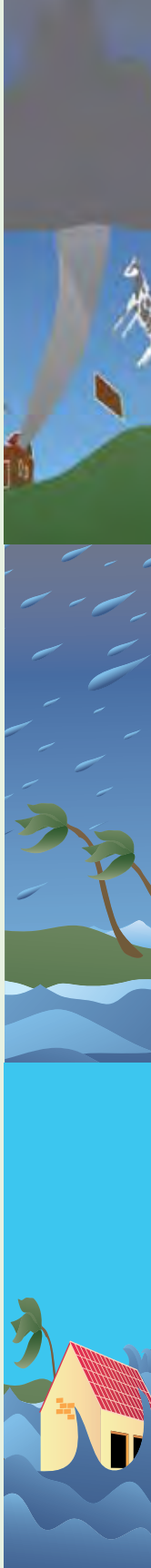
The complete topic of retro-fitting existing homes has been tackled by numerous non-profit organizations and governmental agencies and the

result of their hard work fills many reports and several excellent videos. The following sources can give you more information:

> The Institute for Business and Home Safety (IBHS) website has numerous articles, reports and videos which are extremely informative and explain preventative measures which reduces losses from all natural hazards, including hurricanes www.disastersafety.org.[12]
>
> The Mitigation Directorate of FEMA is continuously researching hurricane resistant designs and building methods for the construction of residences and the performance of residences which have been subjected hurricanes. All of the government publications are available for free and most can be downloaded conveniently from the FEMA website: www.FEMA.gov and from links at their Rebuild Smarter and Stronger page: www.fema.gov/rebuild/smart_strong.shtm.[13]

4.1 CREATING THE WIND- AND RAIN-RESISTANT ENVELOPE

During a hurricane, it is very important to protect the envelope of your house from wind and rain. The wind from a hurricane attacks any weaknesses in the roof. Once a weakness is exposed, adjacent areas can be more easily damaged and peeled away. Windows can serve to protect that envelope, unless they shatter, which is almost certain to happen if they are unprotected. Taping your windows will not protect that envelope. A broken window during a hurricane can be devastating in several ways: besides the incoming hurricane-force wind and torrential rain in your living room, there is shattered glass and debris from outside flying in. It can make walking in your own house hazardous. Even more importantly, there is the problem with internal pressurization of your house (see Figure 4-1).



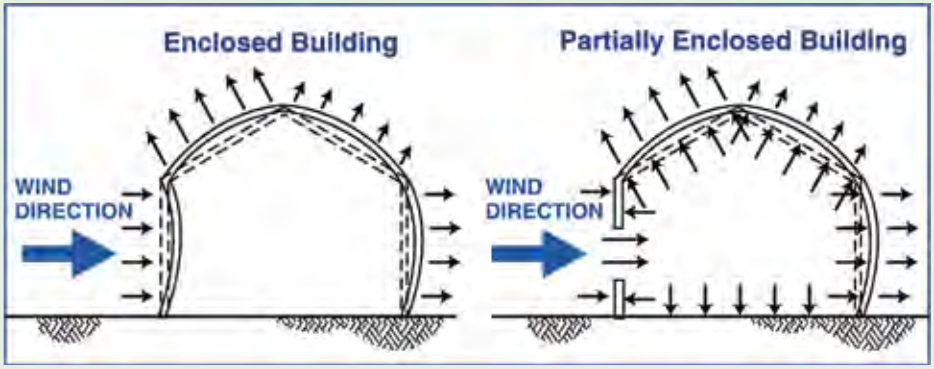


Figure 4-1. The diagram on the left shows a structure with the wind- and rain-resistant envelope intact. Pressure on the walls and roof comes from the outside only. In the diagram on the right, the structure's wind- and rain-resistant envelope has been breached due to a broken window. Now, pressure on the walls and roof comes from the outside and inside. The total amount of pressure on the roof and leeward wall increases significantly and can lead to the roof flying off and complete structural failure. Source: FEMA's Coastal Construction Manual (2000).[14]

Some reports indicate that a door or window breach can potentially double the uplift forces on your roof and can significantly increase the chances that your roof will lift off.[15] This is why FEMA indicated in their assessment report that breach of the building envelope and subsequent internal pressurization led to progressive structural failure for many houses.

4.1.1 Keep Your Roof On

Roof Framing/Truss Bracing

It is possible to significantly strengthen your roof by providing lateral and diagonal bracing to the rafter or trusses. This is particularly important for houses with gable-end roofs. This bracing can be done simply with 2-inch by 4-inch boards (2 x 4's) purchased at a local hardware store. Figures 4-2 and 4-4 are from the FEMA brochure "Against the Wind" (FEMA 247) which

In Figure 4-2, the trusses are built with a peak at the ridge line of the house. The trusses at the end of the house form an A-shaped pattern known as a gable end. During a hurricane, the gable end is subject to great forces from the wind and is likely to tip over, collapsing the other trusses in a domino fashion. Source: FEMA's "Against the Wind" brochure 247.

can be downloaded from FEMA's website www.FEMA.gov.

For lateral bracing, 2 x 4's are attached to the trusses that run the length of the roof. The 2 x 4's overlap over two trusses. Braces should be 18 inches from the ridge, in the center and at the base, about 8 feet to 10 feet. apart. You or a professional can do this work.

Figure 4-3. In this application of lateral bracing, the 2 x 4's are 18 inches from the ridge and connect to horizontal members that attach the opposing trusses. Not all roofs will have the horizontal members. The 2 x 4's are connected with two #14 3-inch screws (A) and overlap over two trusses (A and B). The end is connected to the gable end with an angle or L bracket (C).

Another important type of bracing for your gable end involves making diagonal braces (Figure 4-4). Diagonal braces provide additional support against collapse of the gable end.

Hip-style roofs do not need as much bracing, as they are aerodynamically superior and they have the bracing built into the design of the structure. While gable end roofs have a flat end that is A-shaped, hip-style roofs have all four sides of the roof sloping towards the center of the roof.

An additional source of information regarding roof bracing can be found at the IBHS web site www.disastersafety.org.[16] There is a video on their site, called "Gable End Retrofit" which explains many of the details for reinforcing your roof and gives several construction tips.

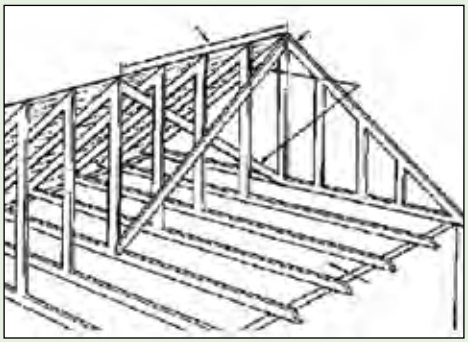


Figure 4-4. Diagonal braces form an X pattern from the top center of the gable end to the bottom center of the fourth truss and from the bottom center of the gable end to the top center of the fourth truss. The same screws as for lateral bracing are used. Source: FEMA's "Against the Wind" brochure 247.

Contiuous Load Path Connections

The continuous load path connection is analogous to a chain: both are only as strong as their weakest link. Historically, the weakest link has often been the roof-to-wall connection. Thus, the hurricane clip was created. The concept of continuous load path connection is illustrated in Figure 4-5. This

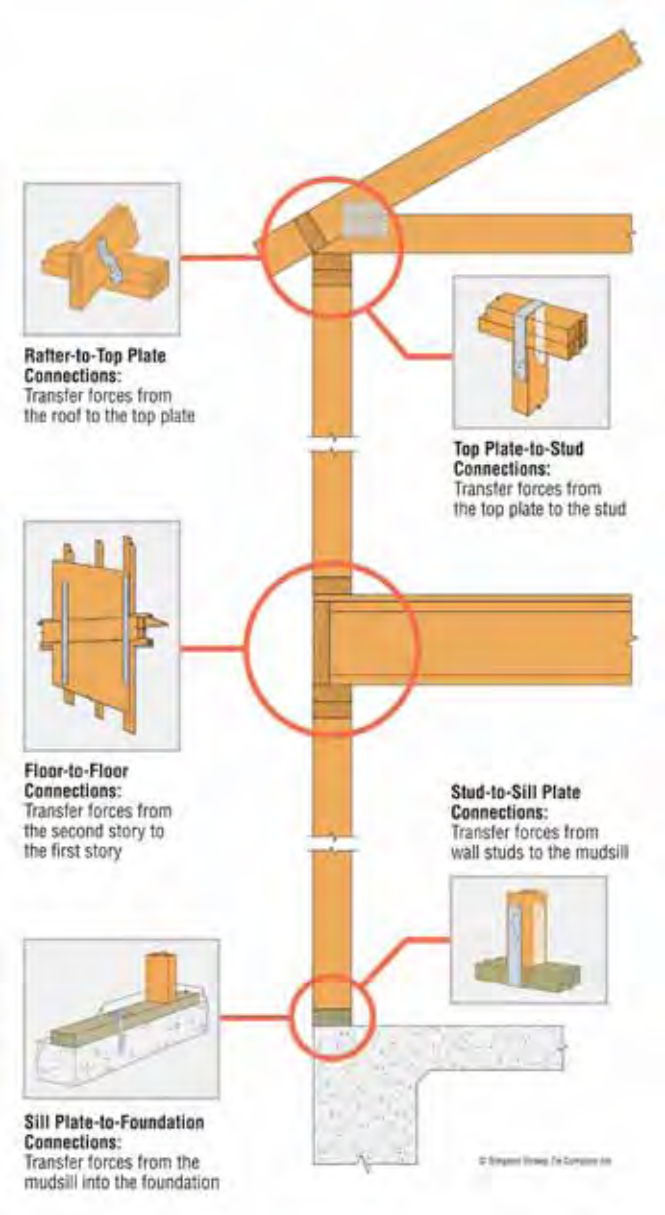


Figure 4-5: Continuous load path connection ties: (i) the roof to wall typically with hurricane clips (A) and plate ties (B); (ii) the wall of a higher story to the wall of a lower story with straps (C); and (iii) the wall to the foundation with plate ties (D and anchors (E). For a single story house, the connections at (C) are not needed. These connections are in all new houses (Table 4-1). Older homes usually will not have these features. In many cases, retrofit can easily be done for certain portions. Source: Simpson Strong-Tie

connection ties your roof to your house's foundation and helps to keep the roof from blowing off during a hurricane.

Naturally, all houses have some connection from the roof to the foundation, otherwise they would fall apart. However, in response to recent hurricane damage much stronger connections are now required in the form of straps, anchors and hurricane clips to protect against hurricane winds, as depicted in Figure 4-6.

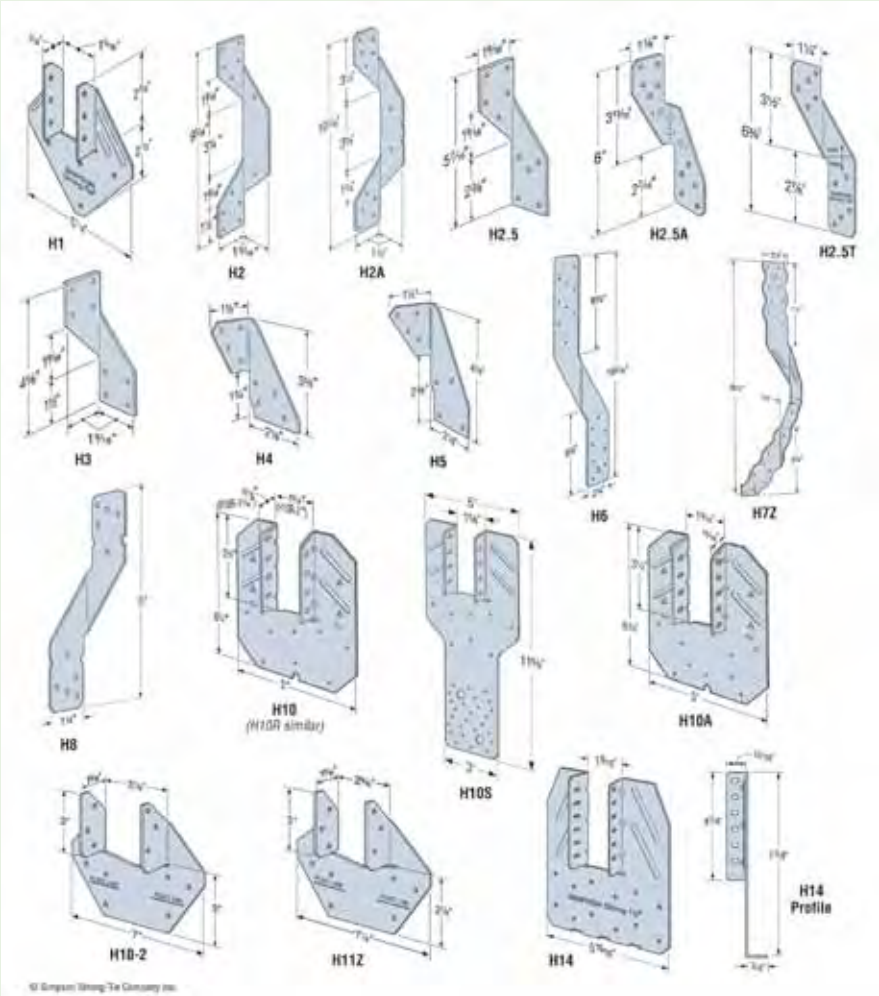


Figure 4-6. There are many different types of hurricane clips. Your licensed architect, structural engineer, or contractor can tell you what is suitable for your house and for the amount of protection you want. Source: Simpson Strong-Tie.

For many homeowners, even minor damage of 15 percent or less can be an extreme hardship. After Hurricane Iniki in 1992, FEMA conducted an assessment of building performance and determined the following:

> "Incomplete design and construction for load transfer and improper connections, especially between roof and walls, were found to be the most important factors causing structural failure of buildings due to uplift wind forces."[23]

Recently built houses are required to have a complete load path connection. For older houses, it is possible to retrofit to add components of the connection (see Figures 4-5 and 4-6). Each house is different but, in general, it will be easier and less expensive to put in hurricane clips than to do the foundation connection. Check with a licensed structural engineer or architect to determine what is feasible for your house.

It is preferable to do both the roof-to-wall connection and the wall-to-foundation connection. However, if the wall-to-foundation connection is too difficult or expensive because of the way your house was built, installing only the roof-to-wall connection is better than doing nothing. Remember, the weakest link for many homes is the roof-to-wall connection and thus the hurricane clip will make that weakest link significantly stronger.

Figure 4-7. This is the popular H2.5 hurricane clip installed during new construction of houses. Five nails are hammered into the lower beam (or top plate) and five more need to be used for the roof (truss-rafter) connection. A hurricane clip is required for each truss-rafter. Upon completion of this structure, the hurricane clip will be hidden from view. This particular clip costs 30 cents. For less than a dollar in material cost, stronger ones can be installed for both new and retrofit applications.

Synthetic Roof Underlayment

Until the twenty-first century, most residential sloped roofs received a layer of asphalt-saturated felt building paper underneath the roofing material.

Mimicking the attributes of housewraps, synthetic roof underlayments (Figure 4-5) are now available to serve the same function as a secondary weather barrier with better resistance to tearing, moisture and ultraviolet rays than traditional roofing felt.

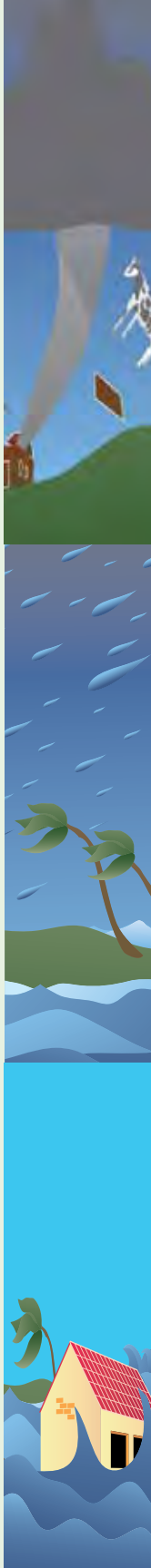
Figure 4-8. Synthetic underlayments are typically made from polypropylene, polyester or fiberglass fabric which weighs less than felt building paper, can be manufactured with anti-slip surfaces and can withstand exposure to the elements for six months. Source: Carlisle Coatings & Waterproofing

Recent natural disasters and subsequent rebuilding efforts highlighted the versatility of synthetics as roof underlayment by providing a real-life test environment. After several hurricanes ravaged southern coastal areas of the United States, many people were forced out of their damaged homes. At the same time, large numbers of homes required quick roof repair and "drying in" to minimize further damage due to water intrusion. With limited resources, contractors triaged homes, repairing the critical components and installing synthetic underlayments as temporary roofing. The underlayments performed better than FEMA's blue tarps and did not require removal and discard when the new shingles were installed.[17]

4.1.2 Keep Water Out

Flood Prevention

Protecting your property from flooding can involve a variety of actions, from inspecting and maintaining the building to installing protective devices. Most of these actions, especially those that affect the structure of your building or their utility systems, should be carried out by qualified maintenance staff or professional contractors licensed to work in your state, county, or city. The most important information to know about your home when considering flood prevention techniques is the base flood elevation (BFE) shown on the Flood Insurance Rate Map (FIRM) for your community.



The best way to protect a structure and its contents from flood damage is to seal the building so that flood waters cannot enter. This method, referred to as "dry floodproofing," encompasses a variety of measures:[18]

Figure 4-9. FIRM map in Harrison County indicating open coast BFE. Source: FEMA

- Applying a waterproof coating or membrane to the exterior walls of the building
- Installing watertight shields over doors, windows and other openings
- Anchoring the building as necessary so that it can resist floatation
- Installing backflow valves in sanitary and storm sewer lines
- Raising HVAC and electrical system components above the flood level
- Anchoring fuel tanks and other storage tanks to prevent flotation
- Installing a sump pump and foundation drain system
- Strengthening walls so that they can withstand the pressures of flood waters and the impacts of floodborne debris
- Building with materials that can withstand flood waters for at least 72 hours (examples: concrete, ceramic tile, pressure-treated lumber, steel, metal, brick, epoxy paint, foam and closed cell insulation)
- Ensuring wells are properly constructed to avoid contamination from flood waters

Keep these points in mind when you dry floodproof:

Dry floodproofing is appropriate primarily for slab-on-grade buildings with concrete or solid masonry walls. Concrete and masonry are easier to seal, more resistant to flood damage and stronger than other conventional construction materials.[18]

If you dry floodproof a "substantially damaged" or "substantially improved" building (as defined by the National Flood Insurance Program [NFIP] regulations) or a newly constructed building and if the building's lowest floor (including any basement) is below the BFE shown on the FIRM map for your community, your dry floodproofing must be certified as providing protection from the BFE. To obtain this certification, you must floodproof your building to a height at least 1 foot above the BFE. Check with your local floodplain manager or building official for more information.[18]

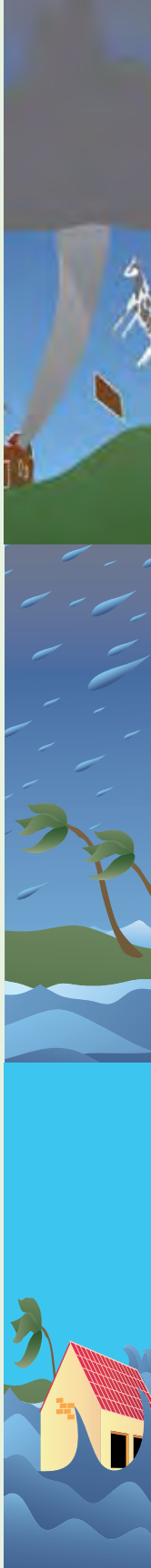
The height of your dry floodproofing should not exceed 3 feet. The pressures exerted by deeper water can cause walls to buckle or collapse. Before you use dry floodproofing to protect against greater flood depths, have a structural engineer evaluate the strength of your walls.[18]

If your dry floodproofing measures require human intervention before flood waters arrive, such as placing shields over doors and windows, you should have an operations and maintenance plan that describes all the actions that must be taken and lists the persons who are responsible. It must also include a schedule of periodic maintenance that states how often the dry floodproofing measures will be inspected and who will perform the inspections.[18]

The cost of individual dry floodproofing measures will vary with the size, condition and use of your building; the dry floodproofing height; and the extent to which you use contractors and engineers.[18]

In many cases flooding on a property can be caused by poor drainage. If this is the case, it may be of great benefit to address the drainage issue with the professional advice of a licensed civil engineer.[18]

An excellent source of information for protecting your property from flooding is found in the FEMA's Coastal Construction Manual available by search on FEMA's website: www.fema.gov/ or refer to the "Protecting Your Property from Flooding," found at: www.fema.gov/plan/prevent/howto/index.shtm#4.[19]



Window Coverings

Protection of your home's envelope from breaches during a windstorm is critically important, particularly its vulnerable windows and doors.

If your home is located in a windborne debris zone (any location where the basic wind speed for code purposes is 120 mph or greater), it is important that window coverings not only withstand hurricane force winds, but also withstand impacts. The usual standard for impact resistance is known as the "Large Missile Impact Test" as defined by several similar norms. Essentially, these tests determine whether a given shutter can withstand the impact of a nine-pound 2 x 4 fired at the shutter at 30+ mph, followed by cyclic wind load testing.

Coverings that are installed should be tested and approved to meet industry standards for hurricane impact. Check with the manufacturer. Always use only licensed contractors and reputable dealers.

The International Hurricane Protection Association (a trade association group comprising manufacturers, contractors and other industry professionals) has several tips regarding selection of products, selection of installing contractors and other useful information on its website: www.inthpa.com.[20]

Below, several types of opening protection systems are generically described. Within each category, numerous reputable manufacturers provide different products, each with individual features, benefits and cost. The prices shown are estimates for installed costs and represent local and nationwide averages as of May 2010. Pricing will vary between providers and will change over time. We encourage you to consult with a competent contractor specializing in supplying and installing these systems.

Roll-down Shutters

Roll-down shutters represent the window covering type that is easiest to deploy and offers the best overall protection features (Figures 4-10 and 4-11). These are permanently attached to the building. The shutter consists of a movable "curtain" of slats that is held in place by vertical tracks. When not deployed, the shutter stores in a hood that is housed above the window or

Figure 4-10. Coastal home protected with roll-down shutters on all windows and doors. The shutter is held in place by vertical guide tracks and can be deployed manually or with integrated electric motor.
Source: Roll-a-way/QMI

Figure 4-11. Interior of home with deployed roll-down shutters. Roll-down shutters can be used not only for storm protection, but also for security, privacy, light, heat and noise control.
Source: Roll-a-way/QMI

door being protected. Most of the components of roll-down shutters are made from extruded aluminum.

Because the roll-down shutter makes solid contact with the window sill, patio deck or other structure at the bottom, this shutter type demonstrates the highest level of protection against wind-driven rain in addition to wind and debris. Roll-down shutters can be deployed using a variety of operators – both manual and electric motor types. These can be installed directly over windows and doors, or in some cases, at balcony's edge to form an enclosure.

Since roll-down shutters are easily deployed, these often are used on a regular (non-storm) basis for light control, insulation against heat and noise, or for privacy and security.

The variety of features and methods of operation leads to a wide range of costs for this shutter type.

Accordion Shutters

One of the most commonly used shutter types in hurricane-prone regions is the accordion shutter (Figure 4-12). This is a permanently installed system with interconnected "blades" that operate between horizontal tracks. When not in use, the blades fold and are stored on either side of the door

or window being protected. Accordion shutters are manually deployed and can be deployed from the inside of the home, if the opening is a single- or double-hung window or an in-swinging window or door. Installed prices range from approximately $16 to $30 per square foot.

Figure 4-12. Accordion shutter (shown in the open position) installed over a large window of a coastal home. Shutter has been installed to allow deployment from inside the home. Source: Roll-a-way/QMI

Decorative / Protective Shutters

For homeowners who wish to add a decorative flair to the home's exterior while protecting windows against storm forces, Bahama (or Bermuda) and colonial-type shutters are available for window protection (Figures 4-13 and 4-14). These are most commonly made using extruded aluminum frames and louvers, although some composite materials have also found application in these types of shutters. Typically, these are finished using a durable exterior grade powder coating, or automotive-grade polyurethane paint system.

Figure 4-13. Bahama shutters made from durable extruded aluminum components add "Islands" flair to a home and provide effective opening protection. Source: Roll-a-way/QMI

Figure 4-14. Colonial shutters made from durable extruded aluminum components add a traditional look to the home and provide effective opening protection. Source: Roll-a-way/QMI

While these shutter types imitate the design of traditional wood shutters, it should be noted that no wood shutter of either type has been tested and approved as opening protection.

Storm Panels

Removable storm panel systems (Figure 4-15) are one of the most widely used and cost effective systems available for opening protection. These consist of a series of panels, made from steel, aluminum or impact-resistant polycarbonate.

Figures 4-15. These 0.050 gauge aluminum storm panels offer cost effective storm protection. In this example, panels slip into a track above the window and secure onto a bottom track using wingnuts. Source: Roll-a-way/QMI

When not in use, panels are stackable for convenient storage. A wide variety of track options are possible. While these systems are relatively inexpensive (approximately $7 to $15 per square foot, depending on panel type and track options), they require much more effort for the homeowner to deploy than the other types mentioned above.

In-Place Systems

Requiring no advance deployment, impact-resistant systems that are permanently installed on a structure can

Figure 4-16. In-place stainless steel impact screen protects several windows of a coastal residence. This system requires no deployment and provides shade. Source: Roll-a-way/QMI

be an attractive option for opening protection. Two types currently on the market are: 1) impact-resistant stainless steel screen units and 2) installed flat impact polycarbonate. Both of these have little, if any, negative aesthetic impact on the home.

Figure 4-17. Flat impact polycarbonate panels are installed directly over windows of a coastal home. This window covering provides excellent storm protection with minimal aesthetic impact. Source: Roll-a-way/QMI

Impact-resistant stainless steel screen systems (Figure 4-16) consist of a heavy-gauge stainless steel screen mesh that is secured in an extruded aluminum frame. This unit is installed over the window to be protected. These are available as operable units, which facilitates cleaning and emergency egress. Screen units also provide excellent solar shading characteristics. These systems cost approximately $25 to 50 per square foot.

Flat impact polycarbonate units (Figure 4-17) are available to protect most single and double window sizes and types found in residential homes. These are made from UV-stable optical quality grades of polycarbonate and provide excellent protection against all storm forces. Because these systems are not operable from the inside of the home, emergency egress from the home must be considered before installing this system. Typical systems cost approximately $25 to 35 per square foot.

Fabric Windscreen

Impact-resistant fabric panels (Figure 4-18) made from high-tensile strength geosynthetic fibers such as polyethylene, or from reinforced PVC have become

Figure 4-18. Polyethylene basketweave fabric windscreen deploys directly over ground floor windows of coastal home. Source: Roll-a-way/QMI

Figure 4-19. Polyethylene basketweave fabric windscreen is deployed at edge of patio, enclosing the entire area. Source: Roll-a-way/QMI

increasingly popular for use as window and door protection. These systems are attached on two opposite sides of the window or door, usually to permanently installed panel mates or tracks with mounting studs. The panels include integrated grommets, which facilitate the deployment of the windscreens. These systems are also relatively inexpensive, costing approximately $7 to 12 per square foot.

The polyethylene fabric types, which are basketweave systems, allow some light and visibility through the deployed screens. Some models incorporate emergency egress zippers. The PVC types are somewhat translucent, allowing light in the dwelling, but do not allow visibility through the screen.

The geosynthetic screens have also been extensively employed to enclose large, even irregularly shaped openings (Figure 4-19). Such systems range in price from $20 to 40 per square foot. Because of the installation requirements of such systems, site-specific engineering is often required. Consultation with a contractor is recommended.

Impact-resistant Windows and Glazed Doors

In order to withstand both wind forces and impact from windborne debris, window and door manufacturers have developed products (Figure 4-20) with both sturdier frames and laminated

Figure 4-20. This attractive window can be fitted with energy-efficient glass, impact-resistant glass, or both. The impact resistant glass consists of a laminate or film sandwiched between two glass panes. The frames are reinforced and the hinges have extra fasteners to withstand high wind events. During a wind event, debris may crack the glass, but the laminate will hold the window pane together in the frame and prevent breaching of the wind- and rain-resistant envelope. After the storm, the glass will need to be replaced.

(impact resistant) glazing. Such systems are available in a variety of styles, options and costs.

While impact-resistant openings offer deployment-free protection, the glass can still be broken (but remains in the frame). Also, while these products are often available to the consumer through home improvement stores, professional installation is highly recommended in order to insure that proper attachment of the windows to the structure is achieved.

Plywood

Historically, plywood has been the most commonly used option for protection of window openings. This is undoubtedly due to its relatively low cost and ready availability. However, plywood covers only offer a limited amount of protection in moderate level storms and only if it is properly installed (Figures 4-21 and 4-22).

Figures 4-21 and 4-22. Not only is it necessary to install plywood opening covers correctly, it is also important to correctly label them and store them away from heat and humidity.

The disadvantages of plywood are that it can rot or warp if stored in a wet or warm area. Also, plywood shutters are relatively heavy. You will need two people to help with the preparation and deployment of these shutters. Because of their weight, it would be difficult, or even dangerous, to install plywood shutters if a ladder is needed.

Most significantly, however, plywood is increasingly viewed by both code and insurance entities as an inadequate means of protecting openings. While the International Residential Code (and other similar codes) allow some use of plywood under very specific conditions, these are restricted to areas where

the design wind speed is 130 mph or less. Simply put, plywood does not demonstrate the levels of performance achieved by the engineered shutter types listed above.

Window Film

An after-market product used to enhance glass breakage characteristics is commonly known as security window film. Such products are often touted as "hurricane film" or similar – claims that cannot be substantiated by testing. Application of any of these window films to existing windows does NOT constitute adequate opening protection and should not be considered for use as opening protection. For more information, visit the website of the International Window Film Association (IWFA): www.iwfa.com.[21]

For further information regarding opening protection, visit the IBHS website, www.ibhs.org, in particular the Fortified for Existing Homes Program.

Table 4-1 lists the advantages and limitations of each type of window covering discussed above. For most homes, a combination of different covering types is employed, based on the needs and budget of the homeowner. Also, an estimate of the installed cost for each type is given,

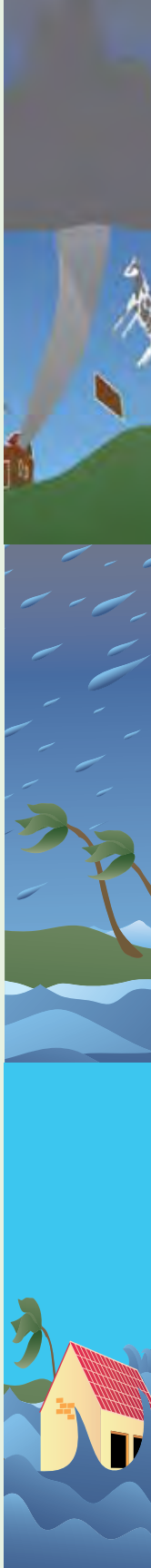


Table 4-1: Pros and Cons of Various Types of Window Protection

Type of Protection	Pros	Cons	Approx. Cost for 3'x5' Window Protection
Roll-down Shutters	Easiest to deploy Best overall protection, especially wind-driven rain	Expensive	$450 (manual) - $900 (electric motor)
Accordion Shutters	Easily deployed, Simple manual operation, Good overall protection, Modest cost	Possible aesthetic issues	$300 - $450
Bahama Shutters	Easily deployed, "Islands" decorative flair, Provides shade	Blocks some light and view	$450 - $675
Colonial Shutters	Easily deployed, "Traditional" decorative flair,	Cost, Requires adequate room for "swing" of shutters	$675 - $900
Storm Panels	Removable, Inexpensive	Manual deployment required, Must be stored when not in use	$105 - $225
Stainless Steel Impact Screens	Always in place, Provides shade	Some aesthetic impact, Egress issues must be considered, Less effective for wind-driven rain	$375 - $750
Flat Impact Polycarbonate Units	Always in place, Minimal aesthetic impact	Egress issues must be considered, Care must be taken in cleaning	$375 - $525
Fabric Windscreen (Direct Mount)	Inexpensive, Easy to handle and store	Manual deployment required, Greater shutter deflection than metal systems	$105 - $180
Impact Resistant Windows and Doors	Always in place, Many styles and options	Costs vary widely and can be high, Glass can still break, requiring expensive replacement	$450 - $900 and higher
Plywood	Inexpensive, Available	Manual deployment is difficult, Must be properly stored, Doesn't provide impact-resistance for winds > 130 mph	$120 +

Note: Window protection options were provided by Roll-a-way. Pricing is current as of May 2010.

assuming that the system will protect a 3-foot x5-foot (3'x5') window.

Impact-resistant Garage and Entry Doors

One of the most important, yet overlooked openings in a home that requires protection are its doors – both the garage door and entry doors. Most major suppliers of both types of doors offer products (with or without glazing options) that meet both wind and impact resistance requirements. Often, replacement of a non-rated door with one of these newer types is cost-effective, when compared to the cost of providing a covering for the door.

As with impact-resistant glazed windows and doors, any replacement of a door with an impact-resistant garage or entry door should be done by a qualified professional installer.

The garage door is a significant weakness during a hurricane due to its large area and the stress it is subject to (Figure 4-23). Garage door options include: (i) replacement with a stronger door, (ii) horizontal bracing, (iii) vertical bracing, or (iv) other types of a bracing kit. For many garage doors the vertical bracing is a popular and reasonably priced option.

Figure 4-23. Because of their width, double-wide garage doors are more susceptible to wind damage than single doors. The wind can force it out of the roller track, especially if the track is light weight or some of the anchor bolts are not in place. This occurs because the door deflects too much under excessive wind pressure and fails. You should reinforce your garage door by installing horizontal and/or vertical bracing onto each panel, using wood or light gauge metal girds bolted to the door mullions. You may also need heavier hinges and stronger end and vertical supports for your door.[27] Source: Florida Hurricane Depot

Double entry doors should have slide bolts at the top header and bottom threshold of the inactive door, a deadbolt with at least 1-inch throw length between each door and three hinges for each door. This requirement is similar to other guidelines for single entry doors, which call for at least three hinges and a bolt long enough that goes into the 2x4 framing of the door. Whenever entry doors are fortified, at least two of them must be operable for access and exiting at any time.

4.1.3 Trees

Cutting or trimming trees that overhang your house are additional measures that you can take to protect your property during a hurricane. However, even though trees provide a buffer to the full strength of the wind, there is a serious danger if there are large trees or limbs that are close enough to fall on the house. Few roofs are strong enough to withstand a falling 20-inch diameter, 40-foot tall pine tree.

Tree limbs or branches falling onto or impacting your house will cause considerable damage. Figure 4-24 illustrates the distance from the tree to the house to ensure that falling limbs do not affect the roof.

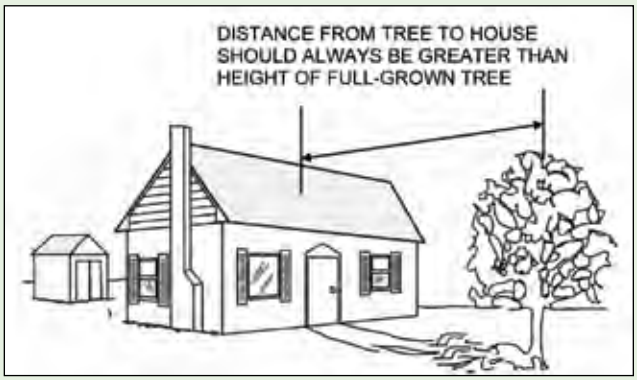


Figure 4-24. FEMA recommends that the distance between a tree and your house should always be greater than the height of the full-grown tree. This is to prevent trees from falling on the roof, either currently or in the future. Source: FEMA

If it is not possible to remove a tree, you can at least cut off all branches which hang over the roof of the house. Generally, you should hire a licensed tree trimmer to perform this work. More information regarding how and what to trim can be found at the Mississippi Forestry Commission's website: www.mfc.ms.gov/.[22]

4.1.4 Safe Rooms

A safe room is a room designed to withstand winds from the strongest hurricanes (Categories 3–5) and strong tornados. This option should only be considered if the house is outside of all known flood and storm surge zones and is strengthened to the highest level. Safe rooms should not be built in a flood zone, where there is threat of moving water. During a hurricane or other high flood event, even these areas need to be evacuated no matter how fortified the room is against the wind.

It is much less expensive to build a safe room during original construction of the house. FEMA notes that while construction costs vary nationwide, the cost to build a safe room inside a new house (which can also double as a master closet, bathroom, or utility room) ranges from $2,500 to $6,000.

The additional cost can be wrapped into the original home mortgage. This is a good investment that yields a sizable return in that it that adds value to your house as well as protection and peace of mind for your family.

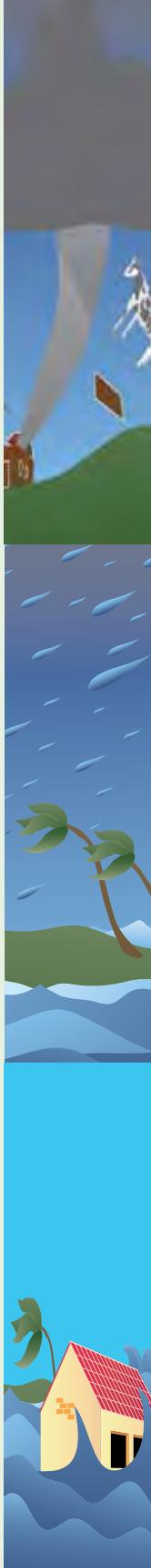
For more information regarding the design and construction of Safe Rooms see FEMA Publication 361, "Design and Construction Guidance for Community Safe Rooms" and FEMA Publication 320, "Taking Shelter From the Storm" available from www.FEMA.gov.

4.2 ELECTRICAL AND POWER ISSUES

In case of an emergency, the power to your house should be turned off through the main breaker switch, circuit breaker panel, or fuse box. In addition, all homes should be equipped with ground fault circuit interrupters (GFCIs). GFCIs are inexpensive electrical devices that, if installed in household branch circuits, are designed to protect people from severe or fatal electric shocks. GFCIs could prevent over two-thirds of the electrocutions.[24] Because a GFCI detects ground faults, it can also prevent some electrical fires and reduce the severity of others by interrupting the flow of electric current. GCFI's are commonly found in kitchens, bathrooms, laundry rooms, or other places where water and electricity are close together. If you don't have them, consider having them installed by a licensed electrician.[24]

By following key safety precautions when dealing with electricity during and after storms and other disasters, you can help prevent death, injuries and property damage. Take care when stepping into a flooded area and be aware that submerged outlets or electrical cords may energize the water, posing a potential lethal trap.[23]

Flooded Areas: Do not use electrical appliances that have been wet. Water can damage the motors in electrical appliances such as furnaces, freezers, refrigerators, washing machines, and dryers.[24]



Wet Electrical Equipment: A qualified service repair dealer should recondition electrical equipment that has been wet. For more information, the National Electrical Manufacturers Association (NEMA) has produced a brochure, *Guidelines for Handling Water Damaged Electrical Equipment*, for use by suppliers, installers, inspectors and users of electrical products to provide advice on the safe handling of electrical equipment that has been exposed to water. It outlines which items will require complete replacement or can be reconditioned by a trained professional. Equipment covered includes electrical distribution equipment, motor circuits, power equipment, transformers, wire, cable and flexible cords, wiring devices, GFCIs and surge protectors, lighting fixtures and ballasts, motors, electronic products including signaling, protection, communication systems, industrial controls and cable trays.[24] The NEMA brochure can be downloaded free of charge at www.nema.org/.[25]

Downed Power Lines: These can carry an electric current strong enough to cause serious injury or possibly death. The following tips can keep you safe around downed lines:[25]

- If you see a downed power line, move away from the line and anything touching it. The human body is a ready conductor of electricity.
- The proper way to move away from the line is to shuffle away with small steps, keeping your feet together and on the ground at all times. This will minimize the potential for a strong electric shock. Electricity wants to move from a high voltage zone to a low voltage zone—and it could do that through your body.
- If you see someone who is in direct or indirect contact with the downed line, do not touch the person. You could become the next victim. Call 911 instead.
- Do not attempt to use another object such as a broom or stick to move a

Figure 4-25. Downed or damaged power lines in a residential area can pose a serious danger to public safety. Source: U.S. EPA

downed power line or anything in contact with the line. Even non-conductive materials like wood or cloth, if slightly wet, can conduct electricity and then electrocute you.

- Be careful not to put your feet near water where a downed power line is located.
- If you are in your car and it is in contact with the downed line, stay in your car. Tell others to stay away from your vehicle.
- If you must leave your car because it's on fire, jump out of the vehicle with both feet together and avoid contact with the live car and the ground at the same time. This way you avoid being the path of electricity from the car to the earth. Shuffle away from the car.
- Do not drive over downed lines.

4.2.1 Alternate Power Sources

Before discussing alternate power sources during an emergency, one general suggestion is to make your house as energy efficient as possible as you replace equipment and appliances in your house after they have outlived their normal life. For example, if the lights, a television, or refrigerator need replacing, consider products with the EPA's Energy Star label (Figure 4-26). These products may cost slightly more, but over their lifetime, the energy savings will far outweigh the small initial cost increase.

Figures 4-26. Items with the Environmental Protection Agency's Energy Star Label use much less energy than standard models. Items include washing machines, dishwashers, refrigerators, freezers, air conditioning units, and light bulbs.

Energy efficient equipment will be especially useful during an emergency, when you may be on alternative forms of power with limited supply. For example, a regular 100-watt lamp running off an emergency power station (essentially built around a car battery) may run for two hours. That same emergency station can run a fuel efficient 23-watt compact fluorescent

light almost 8–9 hours with the same light output. As another example, a refrigerator with the EPA's Energy Star label can run on a fuel-efficient generator for 16 hours on one gallon of gas. Since most refrigerators do not need to run continuously, it may be possible to run the efficient refrigerator on one gallon of gas for one or two days.

4.2.2 Generators

Some households may require uninterrupted power because of the critical needs of some family members. For example, the elderly, disabled, or sick may require a respirator, dialysis machine, or other medical equipment. Some medicine such as insulin, which is stored over a month, may need to be refrigerated. For many families, the most important major power requirement is to run a refrigerator or freezer. If your family cannot get by without the refrigerator, or there are other critical power needs for medical or other purposes, then you may want to consider a portable generator.

Take special care with portable electric generators, which can provide a good source of power, but if improperly installed or operated, can become deadly.[24] Do not connect generators directly to household wiring. Power from generators can backfeed along power lines and electrocute anyone coming in contact with them, including line workers making repairs. A qualified, licensed electrician should install your generator to ensure that it meets local electrical codes.[25]

Other generator-related tips include:

- Make sure your generator is properly grounded.
- Keep the generator dry.
- Plug appliances directly into the generator.
- Make sure extension cords used with generators are rated for the load, and are free of cuts, worn insulation and have three-pronged plugs.

- Do not overload the generator.
- Use a ground fault circuit interrupter (GFCI) to help prevent electrocutions and electrical shock injuries. Portable GFCIs require no tools to install and are available at prices ranging from $12 to $30.

Most importantly, never run a generator indoors or in your garage because of the possibility of carbon monoxide gas accumulation, which cannot be detected by smell. Good ventilation is required. Operate your generator outside and away from open windows. Do not hook up a generator to your house power supply without a licensed electrician.[25]

In general, when running your refrigerator with a generator, keep the refrigerator and freezer at the coldest setting. Refrigerators may only need to run a few hours a day to preserve food. Using a refrigerator thermometer, you should aim to maintain 40 degrees in the refrigerator compartment and 0 degrees in the freezer. Open the refrigerator door as little as possible.

4.2.3 Power Stations

Power stations are found in many hardware stores and may have a radio, flash light, air compressor, battery jump starter, AC outlet, or DC outlet built around a modified car battery. These units can come in handy during a power outage, since they can form part of your stock of emergency supplies and also provide limited emergency power. If your cordless phone does not work because the base of the unit has no power, a power station could supply electricity so that calls could be made. (An alternative is to use a corded phone.) It should be noted that after an emergency, there may be many reasons the phone does not work that are beyond your control, such as heavy traffic or loss of function with the phone system.

4.2.4 Inverters

Inverters take the 12-volt DC power from your car battery and convert it to 115-volt AC power that can run household appliances. This can be very important if you need to run power tools in an emergency and the power is

out. The inverter will drain your car battery, but look for inverters that have a low battery shutdown feature to prevent total battery drain. You should not run an inverter with the car running unless the manufacturer provides specific instructions with safety guidelines. In addition, the car should not be run in a garage, but rather in a well-ventilated area if the manufacturer approves of such procedures.

4.2.5 Battery Chargers

Your car battery can be an important source of DC and AC power with an inverter. To keep the car battery charged, you should consider a battery charger as part of your emergency supplies. The charger only works when there is household power, or backup power through a generator, but it can recharge your car battery if it is needed. New units are small and portable and provide a quick charge to a dead battery in only a few minutes and a total charge in a few hours.

4.3 HAZARD MITIGATION ASSISTANCE PROGRAM

FEMA's Hazard Mitigation Assistance (HMA) program is intended to encourage investment in long-term mitigation measures to reduce vulnerability to natural hazards. The Mississippi Emergency Management Agency administers the HMA program to reduce the risk to individuals and property from natural hazards while simultaneously reducing reliance on federal disaster funds. As such, MEMA encourages state, local, tribal governments, and communities to take advantage of funding provided by HMA programs in both the pre- and post-disaster timeframes.

Among other things, the program can provide funds to states to assist homeowners in implementing mitigation measures to existing structures. Some of the project types that have been approved by FEMA for use to assist homeowners are:

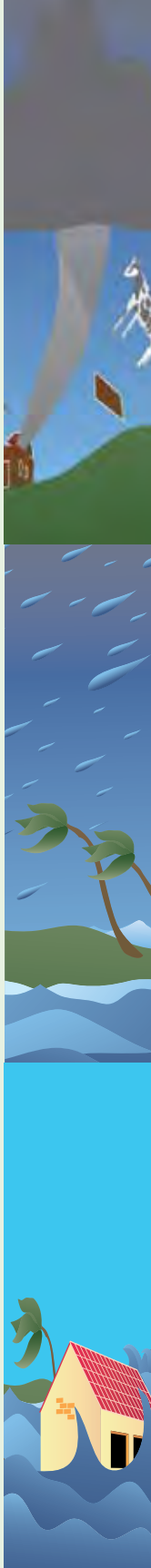
- **Property Acquisition and Structure Demolition -** the acquisition of an existing at-risk structure and, typically, the underlying land, and conversion of the land to open space through the demolition of the structure. The property must be deed-restricted in perpetuity to open space uses to restore and/or conserve the natural floodplain functions.

- **Property Acquisition and Structure Relocation -** the physical relocation of an existing structure to an area outside of a hazard-prone area, or a regulatory erosion zone and, typically, the acquisition of the underlying land. Relocation must conform to all applicable state and local regulations. The property must be deed-restricted in perpetuity to open space uses to restore and/or conserve the natural floodplain functions.

- **Structure Elevation - p**hysically raising an existing structure to an elevation at or above the Base Flood Elevation or higher if required by FEMA or local ordinance. Structure elevation may be achieved through a variety of methods, including elevation on continuous foundation walls; elevating on open foundations, such as piles, piers, posts, or columns; and elevating on fill. Foundations must be designed to properly address all loads, be appropriately connected to the floor structure above and utilities must be properly elevated as well. FEMA encourages applicants and sub-applicants to design all structure elevation projects in accordance with the American Society of Civil Engineers 24-05 *Flood Resistant Design and Construction*.

- **Structural Retrofitting of Existing Buildings -** modifications to the structural elements of a building to reduce or eliminate the risk of future damage and to protect inhabitants. The structural elements of a building that are essential to protect in order to prevent damage include foundations, load-bearing walls, beams, columns, structural floors and roofs and the connections between these elements.

Funding under HMA programs is subject to the availability of appropriations and, for Hazard Mitigation Grant Program funds, to the amount of FEMA disaster recovery assistance under the Presidential major disaster declaration. To assist in establishing funding priorities, local and state mitigation plans are utilized to identify the highest risks.



4.4 RETRO-FITTING AN EXISTING HOME

When retro-fitting an existing home, you should consult with a licensed structural engineer or architect. The structural engineer can go over the cost and benefits of installing the following common retro-fit options:

1) Roof-to-wall and wall-to-foundation connections;
2) Hurricane clips only without additional foundation connection; or
3) Stronger connectors than those required in the current building code.

4.4.1 Roof-to-Wall Connection

Concepts regarding the roof-to-wall connection were covered in Part 4.1. A properly selected hurricane clip is required for each rafter. In addition, the rafters at gable end eaves should be strapped down. Exterior beams supported by corner columns also require strap down. For houses with post and beam roof construction, fasteners should be for roof rafter to roof beams, top of post to horizontal ridge beam and post to beam connections located at the exterior wall (see Figures 4-27, 4-28 and 4-29).

Figure 4-27. This is an example of retrofitting an existing house, originally built without hurricane clips. The popular H3 clip is used here; four nails attach the clip to the roof (truss-rafter) and four more nails attach to the wall or top plate below. For a retrofit, the clips are exposed on the outside of the house; therefore, both the clip and fasteners should be corrosion resistant and painted to blend with the exterior of the house. With the correct clip and nails you could perform the work or, if you prefer, hire a licensed contractor.

Figure 4-28. In this retrofit example, a hurricane clip attaches the roof structure to a horizontal ridge beam, which is in turn attached to the vertical post with a metal strap. This is an attempt to tie the load from the roof to the foundation, or create the complete load path connection. Note that these clips and straps are in the process of being painted. Source: Hurricane Protection Services.

Figure 4-29. In some retrofit examples, it is possible to tie a portion of the house to the foundation. Here, a metal strap connects the vertical post to the foundation, which finishes the continuous load path connection from roof to the foundation. Source: Hurricane Protection Services.

You should seek a licensed structural engineer or architect to select the proper connectors and nails for your house. You can then do either all or part of this work yourself, or hire a licensed contractor.

4.4.2 Roofing

The wind from a hurricane attacks any weaknesses in the roof. Once a weakness is exposed, adjacent areas can be more easily damaged and peeled away. Thus, strengthening the roof is important and it should be considered for new construction and when a roof is replaced after its expected life.

The roofing option involves installing a continuous structural sheathing (for example, plywood where it is missing or damaged). Additional fasteners and a secondary waterproof membrane are required. You should seek a licensed roofing contractor to do this work.

As a side note, there are small things you can do to strengthen the roof even if is relatively new. For example, if you climb in your attic and see nails that are supposed to attach the plywood sheathing to the truss have missed the truss, then you have found what could be a structural weakness. The joint can be strengthened with a wood epoxy or the application of closed cell foam insulation.

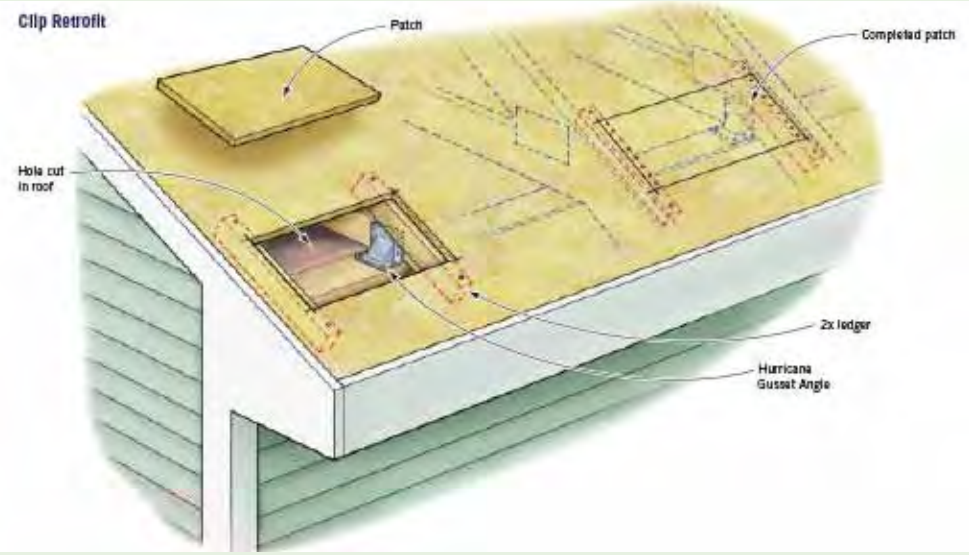
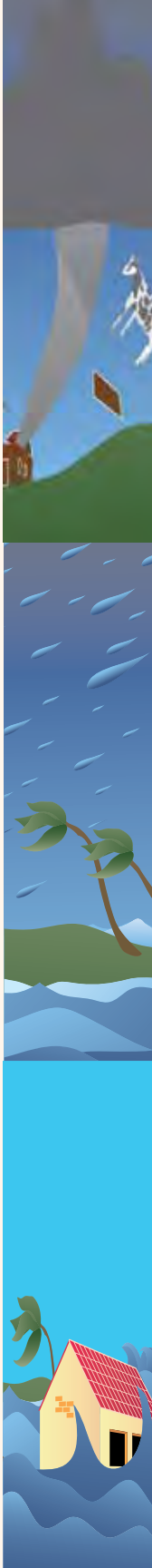


Figure 4-30. To install connectors with minimal demolition, cut rectangular holes between pairs of trusses. A connector can be attached to a truss on each side of the hole, allowing four trusses to be attached with just two holes. Holes are patched by resting the patch on scabs nailed to the sides of the trusses. Source: Coastal Contractors Online.

4.4.3 Foundation Uplift Strengthening Restraint

Strengthening the foundation to resist uplift will generally require the removal of interior finishes. The installation of uplift connections should be planned by a licensed structural engineer and only after they have inspected the home to understand materials and methods used to construct the home and have calculated the uplift requirements.

Part 5
Protecting Your Property with Insurance



There are two ways to protect your property from natural hazards. The proactive way is to strengthen your house to address the individual hazard. If, however, there is still damage, insurance can provide resources to aid recovery.

Wind and flood insurance are important for all residents and are often a requirement for bank loans. Flood insurance is not only important for those in flood zones and areas that are subject to periodic flooding, but can be if there is a flood.

5.1 WIND INSURANCE

Some, though not all, insurance companies offer substantial discounts in insurance premiums as an incentive for you to strengthen your house. There are five different ways to receive a discount if you are in the Mississippi Wind Underwriters Association or "Wind Pool" that is run by the Mississippi Underwriters Association (MWUA). They are as follows:

a. Wind Resistive Rating – This is based on specific materials used to construct the home and an uplift rating of 90 pounds per square foot (psf).

b. Semi-Wind Resistive Rating – This is based on specific materials used to construct the home and an uplift rating of 30 psf.

c. The MWUA Retrofit Program – This is a program that gives homeowners up to a 30% discount on their premiums for having or adding certain criteria as described on the Wind Pool's website: www.msplans.com/MWUA/Index.htm.

d. The Community Rating System (BCEGS) – This is a discount that is based on a grade that each municipality has been given called a BCEG rating. It allows for a discount of up to 30% depending on the rating.

For instance a rating of 1 will get the homeowners in that community a discount of 30% while a community with no rating will not receive any. Most communities currently have a rating of 5 or 6 and the discounts are around 15-20 percent. A chart that has all of the community ratings is listed on the MWUA website: www.msplans.com/mwua.

e. Fortified Program. This is a discount strictly for new homes. This discount is for getting the house designed for "code plus." It is based on designing the home for 20 mph above the current required wind speed and raising the house a minimum of three feet above the base flood elevation.

Discounts can be substantial for those in the Wind Pool. The following summarizes potential savings for retro-fit options:

1) 12% for Group A - Roof System retro-fits including roof-wall connections, tie-ridge board connections, hip rafter connections, gable-end bracing and soffit protection
2) 8% for opening protection (windows, doors and garage doors)
3) 5% for roof surface (high wind rated shingles or metal panels and water barrier underlayment)
4) 5% for site hazards (trees and limbs)

For more information regarding the Wind Pool's discounts are go to www.msplans.com/mwua. You will find all of the criteria for the discounts mentioned above including the specific criteria for the retrofit program.

Check with your insurance agent about the specific requirements for the MWUA/ Wind Pool, the availability of discounts programs from private insurance companies and the specific requirements needed to qualify for them. Each program and company is a little different.

A regular homeowner's wind policy will have a special "rider" for hurricanes. Coverage is typically provided in terms of replacement costs, or the cost to rebuild your house. Check with your agent and policy for the following:

- Does the policy have an inflation guard that increases each year as the cost to rebuild goes up? Construction costs have steadily increased and may increase even more so after a natural disaster.
- After a hurricane, there can be widespread damage and very few

contractors or supplies available to perform repairs. The heavy demand can result in an increase in cost and the length of time to rebuild.

- Additions or improvements to your house made since your initial policy purchase may not be covered, so it is important to have a periodic appraisal so that your coverage is adequate.
- Check with your insurance agent. Not all companies provide discounts for hurricane protective devices. These discounts over time can pay for the cost of certain retrofit upgrades.
- Understand your policy. Many policies cover only hurricanes and not lesser events such as a tropical storm or a tropical depression.
- Make sure you have coverage for: (i) your main structure, (ii) detached structures, (iii) the contents in your house, and (iv) expenses for loss of use (like hotel stays). Only the first item is required by the banks, so you may not have sufficient coverage for the remaining items.

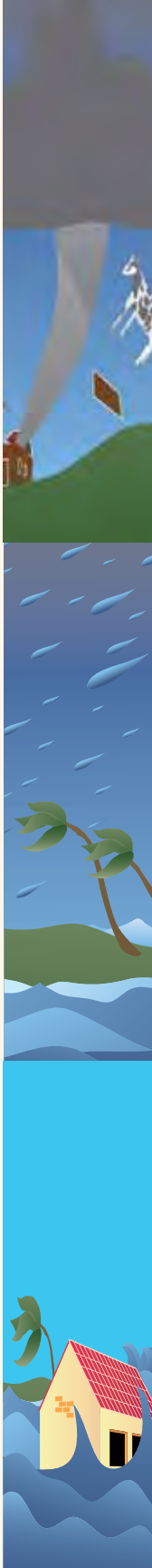
5.2 FLOOD INSURANCE

To obtain coverage from flood events, you need flood insurance. Your homeowner's insurance will not cover floods. Your wind insurance generally will not cover floods unless wind damage from a hurricane leads to rainfall intrusion and subsequent flooding of your house. However, check your policy to be certain.

Flood insurance will cover inundation or flooding for homes near a river, stream, or along the coastline. In addition mudflows (defined as movement of the land by viscous water saturated soil) are covered, but landslides are not (for example, movement of the land by earthquakes).

Consider flood insurance if you are at risk of flooding. You may need flood insurance if you live near the coastline, a river, or a stream system, or any other body of water.

Contact your insurance agent to see if he or she offers flood insurance. The following website provides a listing of agents issuing flood insurance for your community: www.floodsmart.gov/floodsmart/pages/riskassesment/findpropertyform.jsp.



Appendix A
South Mississippi Hurricane Shelters

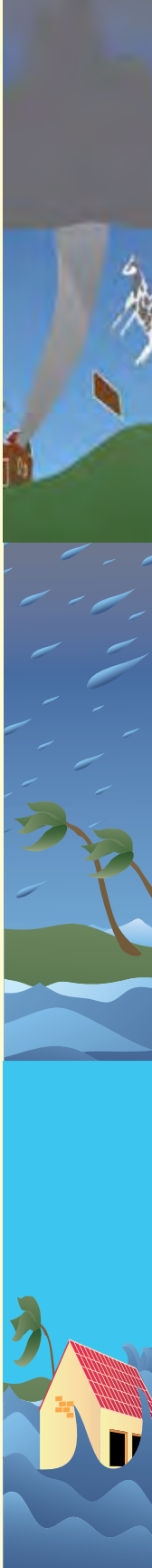
When a hurricane warning is issued, civil defense information will be released through local radio and television stations and other available means, concerning which shelters will be opened and when. Shelter personnel will be on site to direct you to the specific shelter buildings.

If you are advised to evacuate, try to keep family members together and don't forget your survival kit, including important papers. It is essential that you take your survival kit with you because food, cots, blankets and other comfort items will probably not be available. All three coastal counties use mostly public schools for hurricane shelters. The counties have made every effort to provide sufficient shelter space for expected evacuees. However, Category 3, 4 and 5 storms threaten many of these shelters and they can not be used so available shelter space decreases as the hurricane strength increases. It is very important to listen to your local emergency management office if you are considering going to a local public shelter to confirm the shelter will be open.

If you plan to seek a hotel or motel as your shelter in Mississippi you will what to be sure to make reservations early. Motel rooms tend to fill up quickly when a hurricane is in the Gulf of Mexico.

Prepare a plan for your pets in case you must evacuate. Public pet shelters are not yet available. Contact your veterinarian or the Humane Society for more information on pet arrangements. Only service animals are presently allowed in public shelters.

The following is a current list of shelters for the six coastal counties, but it is subject to change. Shelters may be opened selectively depending on the severity of the storm. **Should an evacuation become necessary, please listen to your radio or television for up to the minute information on shelters open in your area or log onto the following Mississippi Red Cross websites for hurricane shelters:**[8]



George and Jackson Counties
www.redcross-sems.org/shelters.php

Harrison, Hancock and Pearl River Counties
www.redcross-msgc.org/shelters.php

Stone County
www.redcross-scms.org/shelters.php.

When you arrive at your shelter, please follow Red Cross directions for the appropriate room or building.

HURRICANE SHELTERS

George County

1st United Methodist Church, Lucedale
Location: 5101 Main St.
Lucedale, MS 39452
Contact: 601-947-8132

Benndale Elementary School
Location: 5204 Hwy. 26 W.
Lucedale, MS 39452
Contact: 601-945-2933

George County Senior Citizens Center
Location: 7102 Hwy. 198 E.
Lucedale, MS 39452
Contact: 601-947-9378

George County High School
Location: 9286 Old 63 S.
Lucedale, MS 39452
Contact: 601-947-3116

George County Middle School
Location: 330 Church St.
Lucedale, MS 39452
Contact: 601-947-3106

Rocky Creek Elementary School
Location: 2183 Rocky Creek Rd.
Lucedale, MS 39452
Contact: 601-947-3886

Hancock County

Hancock County North Central School
Location: 6122 Cuevas Town Road
Kiln, MS 39556
Details: Please bring all necessary personal provisions.

Lagniappe Presbyterian Church
Location: 647 Demontluzin St
Bay St. Louis, MS, MS 39520
Details: These shelters are open to all (men, women and children). Pets, alcohol and weapons will not be allowed. Guests are reminded to bring a 3-day supply of essential provisions with them, including food, water and medication. These shelters will remain open until

weather conditions improve or until further notice.

Stennis Space Center
Location: Buildings 1105, 2204, 2105
Stennis, MS 39529
Details: NOT open to the public; Stennis employees and families only.

Harrison County

Latimer Community Center
Location: 10908 Daisy Vestry Rd.
Ocean Springs, MS 39564
Contact: 228-392-8878

Biloxi High School
Location: 1845 Richard Dr.
Biloxi, MS 39532
Details: Please bring all necessary personal items.

Central Elementary School
Location: 1043 Pass Rd.
Gulfport, MS 39501
Details: Please bring all necessary personal provisions.

Harrison Central Elementary School
Location: 15451 Dedeaux Rd.
Gulfport, MS 39503
Details: Please bring all necessary personal provisions.

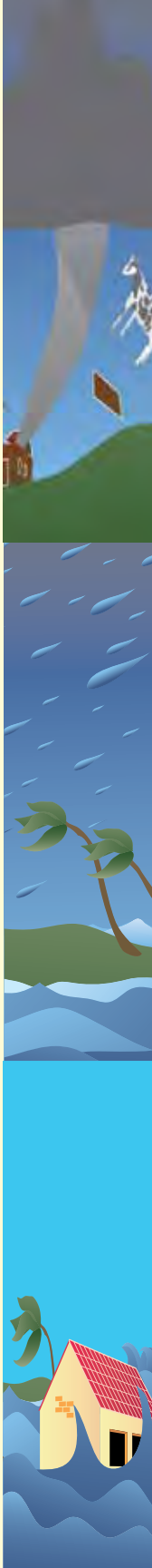
Harrison Central High School
Location: 15600 School Rd.
Gulfport, MS 39503
Details: This is a pet friendly shelter. People who STAY in the shelter may bring pets with them. Pets must have a hard carrier. Owners are responsible for all necessary pet provisions. Pets will not be in the same building as shelter guests.

Lizana Elementary School
Location: 15341 Lizana School Rd.
Gulfport, MS 39503
Details: Please bring all necessary personal provisions.

North Bay Elementary School
Location: 1825 Popps Ferry Rd.
Biloxi, MS 39532
Details: Please bring all necessary personal provisions.

West Harrison Community Center
Location: 4470 Espy Ave
Long Beach, MS, MS 39560
Details: These shelters are open to all (men, women and children). Pets, alcohol and weapons will not be allowed. Guests are reminded to bring a 3-day supply of essential provisions with them, including food, water and medication. These shelters will remain open until weather conditions improve or until further notice.

Woolmarket Community Center
Location: 16320 Old Woolmarket Rd
Biloxi, MS, MS 39532
Details: These shelters are open to all (men, women and children). Pets, alcohol and weapons will not be allowed. Guests are reminded to bring a 3-day supply of essential provisions with them, including food,



water and medication. These shelters will remain open until weather conditions improve or until further notice.

Jackson County

East Central Community Center
Location: 4300 Hwy. 614
Moss Point , MS 39563
Details: This is a special needs shelter. Contact: 228-588-3373

East Central High School
Location: 21700 Slider Road
Moss Point, MS 39562
Contact: 228-588-7000

East Central Lower Elementary
Location: 21700 Slider Road
Moss Point, MS 39562
Contact: 228-588-7060

Gautier Convention Center
Location: 2012 Library Lane
Gautier, MS, MS 39553
Details: These shelters are open to all (men, women and children). Pets, alcohol and weapons will not be allowed. Guests are reminded to bring a 3-day supply of essential provisions with them, including food, water and medication. These shelters will remain open until weather conditions improve or until further notice.

Moss Point High School
Location: 4913 Weems St.
Moss Point , MS 39563
Details: Will open for a tropical storm or hurricane categories 1 or 2 only. Contact: 228-475-5721

St. Martin East Elementary School
Location: 7508 Rose Farm Rd.
Ocean Springs, MS 39564
Contact: 228-875-3204

St. Martin High School - Blue
Location: 10800 Yellow Jacket Rd.
Ocean Springs , MS 39564
Details: Will open for a tropical storm or hurricane categories 1 or 2 only. Contact : 228-875-8418 ext. 101

St. Martin High School - Gold
Location: 10800 Yellow Jacket Rd.
Ocean Springs, MS 39564
Details: Will open for a tropical storm or hurricane categories 1 or 2. Contact: 228-875-8418 ext. 129

Vancleave High School
Location: 12412 Hwy 57
Vancleave, MS 39565
Contact: 228-826-4701

Vancleave Lower Elementary School
Location: 13901 Hwy. 57
Vancleave, MS 39565
Contact: 228-826-5982

Pearl River County

Pearl River Resource Center
Location: 140 Street A
Picayune, MS 39466
Details: Please bring all necessary personal provisions.

Poplarville First Baptist Church
Location: 203 S. Main Poplarville
Poplarville, MS 39470
Details: Please bring all necessary personal provisions.

Stone County

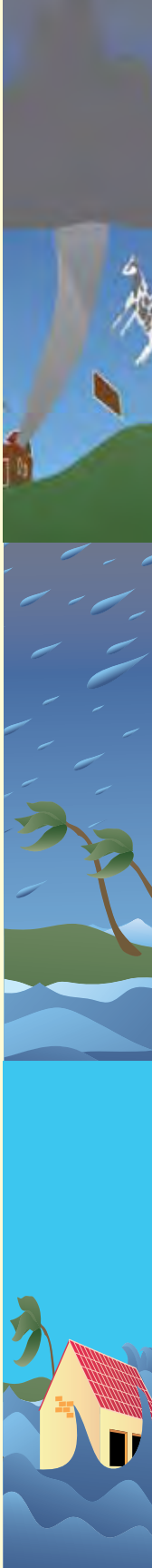
Perkinston Elementary School
Location: 40 2nd Street
Perkinston, MS 39573
Contact: 601-928-3380

Stone County High School
Location: 400 E. Border St
Wiggins (Stone County), MS 39577
Details: open at 1pm, Sunday
601-928-5492

Stone County Middle School
Location: 532 E. Central Ave
Wiggins (Stone County) , MS 39577
Contact: 601-928-4876

What to bring to a shelter?

- Water, food:
  Water-one gallon of water per person, per day.
  Food-Non-perishable, needing little or no cooking, such as ready-to-eat meats, fruits, vegetables and canned juices. High energy foods such as peanut butter, jelly, crackers, granola bars, trail mix and other snack foods. Special dietary foods--such as diabetic, low salt, liquid diet and baby food and formula. Manual can opener. Eating and drinking utensils including paper plates. Portable ice chest with ice.
- Clothing and bedding:
  One complete change of clothing including footwear. Sleeping bag, blanket and pillow (cots for elderly)--cots will not be provided. Rain gear and sturdy shoes.
- Personal items:
  Washcloth, small towel, soap, toothbrush, toothpaste, sanitary napkins, tampons, paper towels, toilet paper, towelettes, etc.
- Medications, first-aid supplies:
  Medications--clearly marked with your name, dosage, type of medication and prescribing physician. You must be able to take all medications by yourself. First-Aid kit in a waterproof box.
- Baby supplies:
  Clothes, diapers, formula, bottles, nipples, food, blankets.



- Important papers:
  Name and address of doctors. Name and address of nearest relative not living in area. Identification and valuable papers.
- Miscellaneous:
  Games, cards, toys, battery powered radios, flashlights (no candles or lanterns), batteries, or other reasonable items you may need.

Remember...

Take a bath and eat before you leave home.
Register immediately upon entering the shelter.
Obey shelter rules.
Keep the building safe and sanitary.
NO pets, alcoholic beverages, or weapons are allowed.

Appendix B
Emergency Contact Information

Local Emergency Management Agencies

George County
Lorraine Howell 1-601-947-7557

Hancock County
Brian Adam 1-228-466-8320

Harrison County
Rupert Lacy 1-228-865-4002

Jackson County
Donald Langham 1-228-769-3111

Pearl River County
Danny Manley 1-601-795-3058

Stone County
Raven James 1-601-928-3077

Mississippi Department of Transportation (MDOT)

1-866-521-MDOT (1-866-521-6368)
www.GoMDOT.com &
www.MSTraffic.com

American Red Cross

1-866-GET-INFO (1-866-438-4636)
www.mississippi-redcross.org

Jackson and George Counties
www.redcross-sems.org/shelters.php

Harrison, Hancock and Pearl River
www.redcross-msgc.org/shelters.php

Stone County
www.redcross-scms.org/shelters.php

Mississippi Emergency Management Agency (MEMA)

1-800-222-MEMA (1-800-222-6362)
www.msema.org

Federal Emergency Management Agency (FEMA)

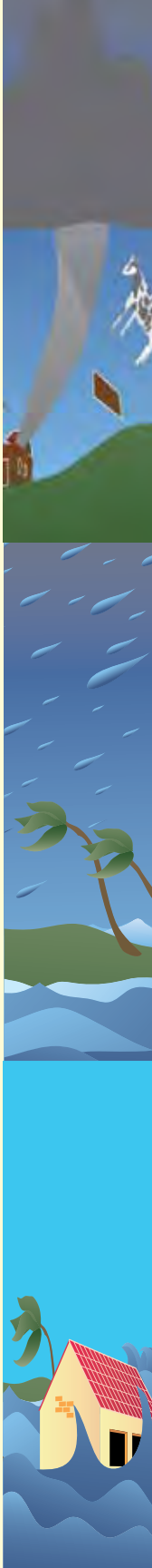
1-800-621-FEMA (1-800-621-3362)
www.fema.org

United Way 211

www.211ms.com

Mississippi Highway Safety Patrol

601-987-1212 (*hp from any cell)
www.dps.state.ms.us



Lodging

Mississippi Tourism
1-866-SEE-MISS (1-866-733-6477)
www.visitmississippi.org

Campsites

MS Wildlife, Fisheries & Parks
1-800-GO-PARKS (1-800-467-2757)
www.mdwfp.com

Animal Shelters

MS Board of Animal Health
1-888-722-3106
www.mbah.state.ms.us

Surrounding States Information

Louisiana DOT
1-877-4LA-DOTD (1-877-452-3683)
www.dotd.state.la.us

Louisiana Emergency Operations Center
1-866-892-0084
www.louisianaeoc.org

Louisiana State Police
1-800-469-4828
www.lsp.org

Alabama DOT
1-888-588-2848
www.dot.state.al.us

Alabama Tourism & Travel
1-800-252-2262
www.alabama.travel

Alabama Highway Patrol
1-334-242-4371
www.dps.state.al.us

Arkansas DOT
1-800-245-1672
www.arkansashighways.com

Arkansas State Police
1-501-618-8100
www.asp.state.ar.us

Tennessee DOT
1-615-741-2331
www.tdot.state.tn.us/tdotsmartway/

Tennessee 511
in state 511
out of state 1-877-244-0065
www.tn511.com

Tennessee Highway Patrol
1-800-342-3258
www.state.tn.us/safety/thp.htm

Georgia DOT
1-888-635-8287 or 1-404-635-6800
www.georgia-navigator.com

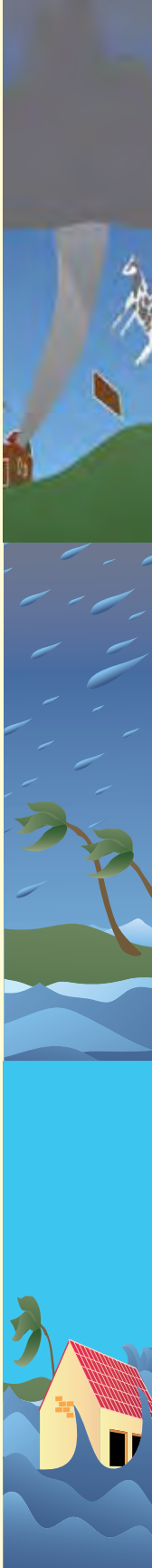
Georgia State Patrol
1-404-624-7000
www.georgiastatepatrol.com

Florida DOT
1-866-374-FDOT (1-866-374-3368)
www.dot.state.fl.us

Mississippi Insurance Department
1-800-562-2957
www.mid.state.ms.us

Mississippi Division of Medicaid
1-800-421-2408
www.medicaid.ms.gov

Mississippi Department of Health
1-866-458-4948
www.HealthyMS.com



Endnotes

1 "Hurricane Katrina Relief." Hurricane Katrina Relief. 2005. Accessed March 2010 from the World Wide Web: http://www.hurricanekatrinarelief.com.

2 Mississippi Emergency Management Agency and National Weather Service. 2010. Mississippi Hurricane Preparedness Guide.

3 "Tornado." Federal Emergency Management Agency's (FEMA's) Hazards webpage. March 10, 2010. Accessed March 2010 from the World Wide Web: http://www.fema.gov/hazard/tornado/index.shtm.

4 "Thunderstorm Hazards – Tornados." National Weather Service website. January 5, 2010. Accessed May 2010 from the World Wide Web: http://www.srh.weather.gov/data//www/html/srh/jetstream/tstorms/tornado.htm#ef.

5 "The Tornado Project." Fujita Scale of Tornado Intensity website. 1999. Accessed May 2010 from the World Wide Web: http://www.tornadoproject.com/fscale/fscale/htm.

6 "The Saffir-Simpson Hurricane Wind Scale." National Weather Service website. Modified May 21, 2010. Accessed May 28, 2010 from the World Wide Web: http://www.nhc.noaa.gov/sshws.shtml.

7 "Hurricanes." Mississippi Emergency Management Agency MEMA website. Accessed March 2010 from the World Wide Web: http://www.msema.org/preparation/hurricanes.html.

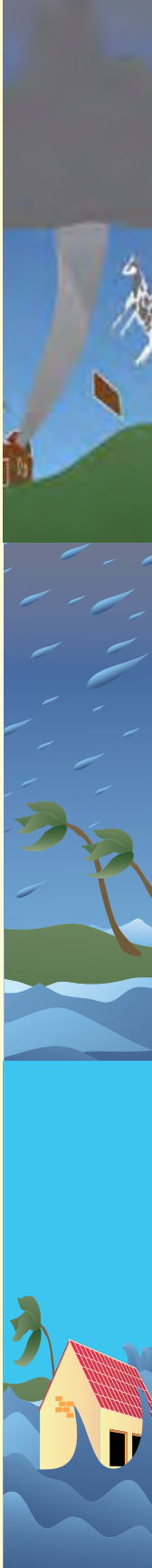
8 "Freeboard." Storm Smart Coasts-Mississippi website. Updated May 25, 2010. Accessed May 28, 2010 from the World Wide Web: http://ms.stormsmartcoasts.org/.

9 "Evacuation Kits." Red Cross website. Copyright 2010. Accessed April 2010 from the World Wide Web: http://www.redcross.org.

10 "Evaucation Routes." Mississippi Department of Transportation website. Accessed April 2010 from the World Wide Web: http://www.gomdot.com/Divisions/IntermodalPlanning/Resources/Maps/pdf/HurricaneEvacRoutes.pdf.

11 "Southeast Mississippi Hurricane Shelters." Southeast Mississippi Red Cross website. Copyright 2008. Accessed May 2010 from the World Wide Web: http://www.redcross-sems.org/shelters.php.

12 "Protecting You Where You Live." Institute for Business and Home Safety (IBHS) website. Accessed May 2010 from the World Wide Web: http://www.disastersafety.org/text.asp?id=hurricane_media.



13 "Mitigation Directorate." FEMA website: Accessed April 2010 from the World Wide Web: http://www.FEMA.gov.

14 FEMA. 2000. "Coastal Construction Manual."

15 Institute for Business & Home Safety. 1998. "Is Your Home Protected from Hurricane Disaster?—A Homeowner's Guide to Retrofit."

16 "Gable End Retro-fit Video." Institute for Business and Home Safety (IBHS) website. Accessed May 2010 from the World Wide Web: http://www.disastersafety.org.

17 "Synthetic Roof Underlayment." Toolbase Services website. Copyright 2001. Accessed May 2010 from the World Wide Web: http://www.toolbaseorg.

18 "Dry Floodproofing Your Home fact sheet." FEMA website. April 2008. Accessed April 2010 from the World Wide Web: http://www.fema.gov/library/typefile_dry_floodproofing.pdf.

19 "Protecting Your Property from Flooding." FEMA website. June 4, 2009. Accessed April 2010 from the World Wide Web: http://www.fema.gov/plan/prevent/howto/index.shtm#4.

20 "Hurricane Proofing Installation." International Hurricane Protection Association website. Copyright 2009. Accessed from the World Wide Web: http://www.inthpa.com.

21 "Window Film Information Center." International Window Film Association (IWFA) website. Accessed from the World Wide Web: http://www.iwfa.com.

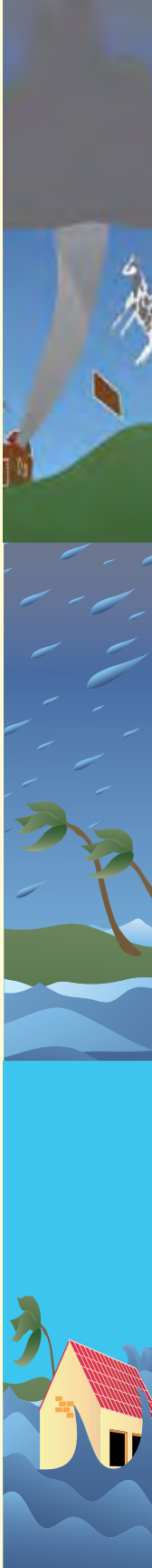
22 "Storm Damage Resources." Mississippi Forestry Commission's website. Accessed May 2010 from the World Wide Web: http://www.mfc.ms.gov/.

23 "Building Performance: Hurricane Iniki in Hawai'i—Observations, Recommendations, and Technical Guidance." FEMA in cooperation with the State of Hawai'i Civil Defense and Kaua'i County. January 1993.

24 "Electrical Safety Precautions During Disasters." Electrical Safety Foundation International website. Copyright 2010. Accessed May 2010 from the World Wide Web: http://www.pueblo.gsa.gov/cic_text/housing/safety/precautions.htm.

25 "Guidelines for Handling Water Damaged Electrical Equipment." National Electrical Manufacturers Association (NEMA) website. Copyright 2010. Accessed May 2010 from the World Wide Web: http://www.nema.org/stds/water-damaged.cfm.

26 State of Mississippi Loss Mitigation Program

27 "Bracing Garage Doors." National Hurricane Center website. Modified April 19, 2010. Accessed May 2010 from the World Wide Web: http://www.nhc.noaa.gov/HAW2/english/disaster_prevention.shtml.

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