

REPAIRING WINDOWS & DOORS

Hurricane damage can result from wind-borne debris, flooding, fallen trees, sustained winds and strong gusts, driving rains, and other water intrusion. This Technical Brief will guide homeowners and contractors when repairing damaged windows and doors.

STEP 1: Assess the Extent of Damage

Before expending time, effort, and money on a building that is not structurally sound, conduct a quick structural evaluation. If damage compromises the structural integrity of the home, consult a professional engineer. When in doubt, call a professional.

FIVE SIGNS OF STRUCTURAL DAMAGE:

- ▶ The structure shifted on the foundation
- ▶ There are broken pilings, shifted stairs, or slanted walls
- ▶ The foundation shifted or floors are not level
- ▶ Crawlspace or foundation walls have cracked or caved in
- ▶ Erosion cut into the soil to the bottom of the foundation or has undermined the foundation

Has a tree limb fallen through the window, or do you just need to replace broken glass? Does the wall have to be rebuilt first, or can you replace the existing window now? The answers to these questions will help you plan your window and door repairs.

When replacing storm-damaged windows and doors, look for signs of existing leaks (e.g., wet or water-stained wall framing or sheathing) and examine framing members for structural problems. While storm-damaged window and door components may be repaired in a variety of ways, the source of any pre-existing

moisture problems should first be identified and corrected. Otherwise, a mold problem may develop inside the walls or the repaired parts may deteriorate well before their time. New window and door components may be racked or damaged if they are made to fit in a water-damaged, out-of-square framing opening. **Figure 1** illustrates the different window and door components.

STEP 2: Determine the Most Appropriate Window and Door Repair Strategy

Depending on the extent of the damage, window and door repair may be as simple as replacing a damaged window sash or door. However, if the window track, jamb, or other frame components have been damaged, replacement of the entire unit may be required.

Table 1 highlights several different window and door repair options, which are described in more detail below.

WINDOWS

Replace Window Sash and Track—

Replacement sash units are popular for partial window replacement and are produced by most window manufacturers. These inserts come in a kit, which includes the sash and track (jamb liners) with a counterbalance mechanism and hardware. They are stocked in a variety of sizes or can be custom fabricated with a choice of glazing (window glass).

HOW TO'S *for the* HANDY HOMEOWNER SERIES

- ▶ Your House is a System
- ▶ Selecting the Right Product
- ▶ Repairing Walls & Floors
- ▶ Repairing Roofs & Ceilings
- ▶ Repairing Windows & Doors

This Technical Brief is one of a series targeted to skilled do-it-yourself homeowners in the Gulf States region. It provides general guidelines for repairing storm-damaged homes.

NOTE: Contact a professional engineer if there is any evidence of structural damage to the home. If filing an insurance claim related to the damaged area, consult an agent before conducting any repair work. The local building agency can provide further guidance on applicable codes.

CAUTION

TURN OFF UTILITIES: Turn off electricity, gas, propane, and other utilities before assessing damage and starting repairs to avoid accident or injury.

BE AWARE OF LEAD-BASED PAINT HAZARDS:

Many residences built before 1978 have paint that contains lead, which can pose a serious health hazard if paint, chips, and dust are not handled properly. See the U.S. Environmental Protection Agency's (EPA's) brief before disturbing painted surfaces in homes of this vintage: www.epa.gov/lead/pubs/leadinfo.htm#remodeling

BE AWARE OF ASBESTOS HAZARDS:

Homes older than 1977 may have building products that contain asbestos such as insulation, high-temperature gaskets, roofing and siding shingles, and vinyl sheet flooring. See EPA's brief before disturbing such materials: www.epa.gov/asbestos/ashome.html



REPAIRING WINDOWS & DOORS

6 STEPS FOR WINDOW & DOOR REPAIR

STEP 1:

Assess the extent of damage

STEP 2:

Determine the most appropriate window and door repair strategy

STEP 3:

Select replacement windows and doors

STEP 4:

Properly apply flashing, caulking, and sealants

STEP 5:

Weatherstrip

STEP 6:

Hurricane shutters

Figure 1. Window and Door Terminology

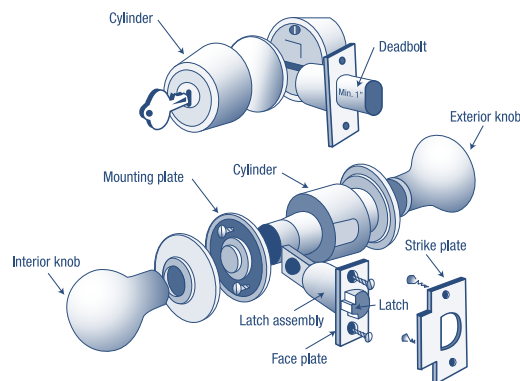
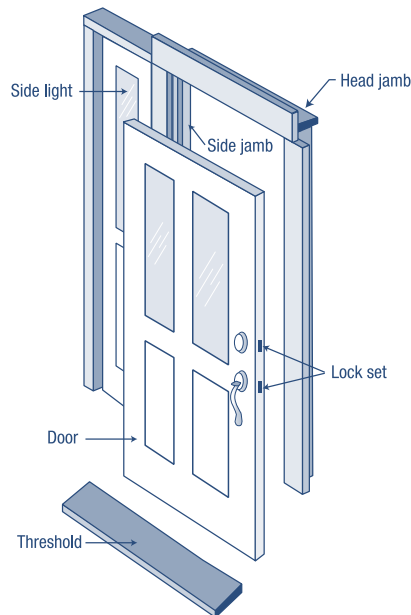
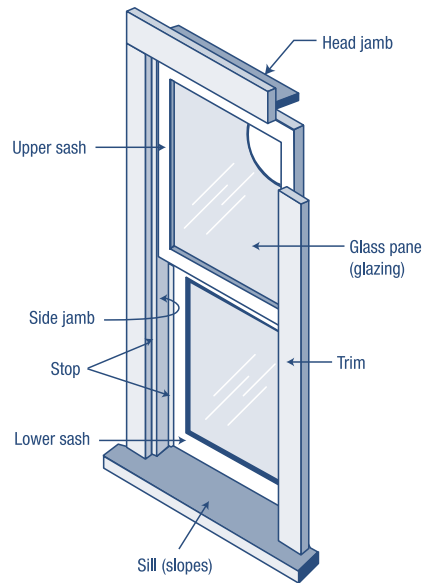


Table 1. Window and Door Repair Options

Only door lockset and/or hinge hardware is damaged:

- ▶ Replace door lockset and hinge hardware

Some window/door components are damaged, but frame and surrounding wall are undamaged, plumb, and square

- ▶ Replace window glass, sash, track, and/or sill
- ▶ Install new secondary window (which includes thin retrofit frame) within existing window frame
- ▶ Install new door in existing door frame and weatherstrip
- ▶ Install new secondary door (which includes thin retrofit frame) within existing door frame

Window/door components and frame are damaged, but surrounding wall is undamaged, plumb, and square

- ▶ Completely replace existing window assembly, including frame
- ▶ Completely replace existing door and frame with new pre-hung door

Window/door components, frame, and surrounding wall are damaged

- ▶ Rebuild/repair wall surrounding window/door so that opening is structurally sound, plumb, and square
- ▶ Completely replace existing window assembly, including frame
- ▶ Completely replace existing door and frame with new pre-hung door

ADVANTAGES

- ▶ Low degree of effort and skill required for installation.
- ▶ Adjacent surfaces and trim are preserved.

DISADVANTAGES

- ▶ Existing wood frame must be dry and in good condition with no rot, and relatively square with parallel jambs.
- ▶ Partial replacement does not address air leakage around the existing frame or causes of secondary damage that may be found within the wall cavity.

Install Replacement Sills—Fallen tree limbs may have damaged the sash and sill, but the rest of the window frame still may be intact. Or, while assessing storm damage to a window, you may discover that a wooden windowsill has deteriorated because of a pre-existing water leak, but the rest of the assembly is in good shape. Replacement sills have been developed expressly for this purpose. Newer replacement sills are made from wood composites and vinyl that better resist the elements and can be worked with conventional carpentry tools.

ADVANTAGE

- ▶ The most economical way to solve a common problem and preserve the weather-tightness of the building.

DISADVANTAGE

- ▶ May serve to hide a more critical problem in which a water leak causing the sill to rot goes unaddressed and continues to damage surrounding materials.

Install New Secondary Window within Existing Window Frame—A secondary window unit includes the sashes and tracks with a pre-assembled narrow frame and is installed within the existing window frame. The most popular secondary replacement windows are vinyl units, but wood and composite models also are available from most manufacturers. These

units are stocked in a variety of sizes or may be custom fabricated with a choice of glazing.

ADVANTAGES

- ▶ This replacement requires patience, but relatively little skill.
- ▶ The secondary frame may accommodate slightly out-of-square conditions.

DISADVANTAGES

- ▶ Secondary frames reduce the size of the glazing area and the available opening, which may be in conflict with applicable building code egress (emergency exit) requirements.
- ▶ This method does not address air leakage at the existing frame's edge.

Completely Replace Existing Window Assemblies—Replacing the entire existing window (including primary frame) is the only option when the existing window frame is damaged beyond reasonable repair or when the surrounding wall requires substantial repair or replacement. However, you may decide to replace the entire existing window, even when it's not absolutely necessary, in order to benefit from the features of new windows, such as modern design, ease of use, and energy efficiency.

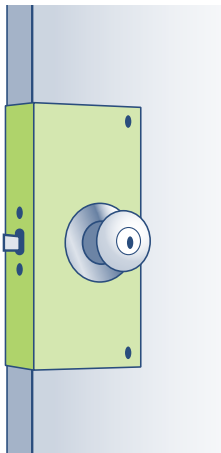
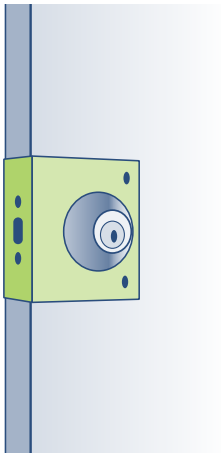
ADVANTAGES

- ▶ A new unit provides the longest useful lifespan and significantly improves energy efficiency.
- ▶ Pre-existing water leaks may be easier to identify and remedy when the existing window frame is removed to expose the rough opening in the wall framing.
- ▶ Air leakage between the window frame and the rough opening can be sealed with new, more effective materials, such as low-expanding foam.

DISADVANTAGE

- ▶ This is usually the most costly and time-consuming alternative.

Figure 2. Reinforcing Plate to Repair Damaged Door



DOORS

As with windows, storm damage to doors can range from failure of the lockset to destruction of the wall surrounding the door. The following door repair options are listed in order of severity of storm damage.

Replace Storm-Damaged Lockset and Hinges—Wind and water can put incredible stress on a door, frequently causing it to blow in. When this happens, the latch or deadbolt usually tears out the strike plate and damages the doorjamb. Hurricane-force winds also can rip the hinges from the door or doorjamb. While damage this severe usually requires that the door be replaced, occasionally damage is limited to the lockset or hinge hardware, which can be replaced. Figure 2 shows a reinforcing plate that allows a damaged door to be repaired. The reinforcing plate slips over the damaged lockset area and has cut-outs for replacement doorknob and lockset hardware. If the existing screws were ripped out of the door or doorjamb, use new screws that are longer and larger in diameter when replacing the damaged hardware.

The deadbolt should have a long throw (at least 1 inch) that should penetrate into the stud framing, not just the doorjamb. To strengthen the hinge side, ensure at least 3 hinges are properly installed with the hinge screws penetrating through the doorjamb into the studs. Installing slide locks (also called head and foot bolts) at the top and bottom of the door will further strengthen the door. Slide locks are absolutely necessary for double doors. Ensure that the locks are mounted securely to the subfloor and door header, not just into the trim.

ADVANTAGE

- ▶ Replacing just the damaged hardware saves time and money and does not require a great deal of expertise.

DISADVANTAGE

- ▶ You may be tempted to replace just the hardware when the door or entire door

assembly should really be replaced. Even with new hardware, a damaged door or doorjamb may cause misalignment, resulting in a door that does not open or close properly, cannot lock effectively, and is prone to air leaks.

Replace Existing Door with New Door and Weatherstripping—If the frame is in good condition and square, replace the door alone. Undamaged hardware from the existing door may be reused on the new door. Check the weatherstripping and replace, if necessary, to seal unwanted air leaks. Adjust the strike plate so the door latches easily, yet slightly compresses the weatherstripping.

ADVANTAGES

- ▶ Replacing the door alone usually saves time and money, compared with replacing the entire door assembly.
- ▶ It provides an opportunity to update the door's look and features.

DISADVANTAGE

- ▶ As mentioned, a door is often only as good as its frame. This is particularly true for security and fire resistance. Even with a new door, a damaged frame (head jamb and/or side jambs) may cause misalignment, resulting in a door that does not open or close properly and is prone to air leaks.

Replace Existing Door with New Secondary Frame Door—Steel frames, due to their inherent strength, allow thin jamb profiles that minimize reductions in the opening and provide the opportunity to use a steel door with better insulation and security properties.

ADVANTAGES

- ▶ The secondary frame is simple to install and preserves the interior casings.
- ▶ The secondary frame provides opportunity to improve the whole unit performance. Some secondary frames include integral trim that encases the existing door frame.

DISADVANTAGES

- ▶ Reduces the opening size, which may not be allowed by code.
- ▶ The adjacent framing must be in good shape.
- ▶ The new frame must be securely attached to the existing frame.

Replace Existing Door with New Pre-Hung Door

—Replacing the entire door (including the primary frame) is the only option when the existing doorframe is damaged beyond reasonable repair or when the surrounding wall requires substantial repair or replacement. Regardless of the damage, it is often easier to install a prehung door than it is to install a new door in an existing frame. You also may decide to replace the entire door to update the look, improve functionality, and increase energy efficiency. Exterior doors are commonly available pre-hung. Some units come complete with sidelights, but may require that the rough opening be enlarged as part of wall repairs.

ADVANTAGES

- ▶ A new unit provides the longest useful lifespan and significantly improves energy efficiency.
- ▶ Existing water leaks may be easier to identify and remedy when the doorframe is removed to expose the rough opening in the wall framing.
- ▶ Air leakage between the doorframe and the rough opening can be sealed with new, more effective materials, such as low-expanding foam.
- ▶ The pre-hung unit eliminates the need to cut holes in the doorframe to fit hinges.

DISADVANTAGE

- ▶ A high level of skill is required to install a pre-hung door unit plumb and adjust it to open and close properly.

STEP 3: Select Replacement Windows and Doors

Select ENERGY STAR qualified doors and windows to reduce your energy bills, increase the comfort of your home, and protect your valuable possessions from sun damage. Also **consider upgrading to impact-resistant doors and windows**. They will be more likely to withstand damage during future storms. If you do not install impact-resistant doors and windows, hurricane shutters are strongly recommended (see *Step 6: Hurricane Shutters*).

Careful measurements are crucial to ordering the correct size of window or door. If you are just replacing the sash or door itself, it is fairly straightforward to measure the existing unit, unless severe damage prevents accurate measurement. If this is the case, perhaps your house has other windows of the same type and size that are not damaged. Exterior doors are typically 32 or 36 inches wide.

If you are installing a window or door, measure the rough opening. Generally, the width and height of the window or door should be ½" less than the size of the rough opening. Check with the manufacturer or retailer for measurement recommendations for the particular units you are considering.

STEP 4: Properly Apply Flashing, Caulking, and Sealants

Window and door openings interrupt the waterproofing of the outside wall and often allow water infiltration. To avoid leaks, homeowners must ensure a continuous, impenetrable barrier or deliberately direct the flow of water with a series of lapped materials, such as flashing. **Flashing is one of the longest lasting components of a building system**, but installing it properly requires attention to detail. Flashing must be durable, weather resistant, able to accommodate movement, and compatible with adjacent materials.

The traditional overlapping assembly, composed of multiple layers of flashing, adjusts to movement much like scales on a fish and provides repetitive layers of resistant materials while covering the fasteners with each lap. Overlapping the layer below prevents water from being pushed back up and into the wall during storms with high winds.

The **proper flashing system** varies among window and door types. The introduction of integral nailing flanges has changed the common methods of providing a water barrier. **Contact the window and door manufacturers** to get their recommended installation and flashing instructions.

Pan flashing for windows and doors can speed installation and result in better protection.

Exterior doors, like windows, are available pre-hung with casings and integral nailing fins. Most doors are produced with extruded metal or polycarbonate sills that resist weather and have a low profile that can be attached flush to the subflooring and, thus, do not require flashing.

When repairing existing windows and doors, you often have the opportunity to examine and repair existing flashing.

Removing a window or door may result in the penetration of the moisture barrier, which can be repaired with additional flashing or sealant, depending on the size of the cut-out.

Figure 3 shows recommended windowsill flashing details for the rough opening. Cut and fold tar paper or housewrap per manufacturer's recommendations. *Figure 4* shows window-flashing details. Again, contact the window and door manufacturers for the recommended installation and flashing instructions.

Caulks and sealants are barriers to moisture and air infiltration with the ability to accommodate movement. However, not all joints should be caulked; some provide an exit for air or moisture trapped within the wall assembly. There is no single product that is suitable for all uses, nor that provides optimal properties for a specific use. **Manufacturers' instructions and technical assistance should be closely followed.**

If there is a choice between an installation that does not require caulking and one that does, the caulkless option is most likely the better, more maintenance-free choice.

STEP 5: Weatherstrip

Though sealants provide an uninterrupted barrier between materials, weatherstripping seals while allowing the movement of independently operating components, such as door panels and window sashes. Weatherstripping resists air and water infiltration. It also reduces noise transmission and acts as a barrier to smoke and fire. Three common weatherstripping applications are discussed below.

Install New or Replacement Interlocking Weatherstripping—Interlocking weatherstripping typically requires the modification of the door or window and jamb to provide a pair of aligned components. Older windows and doors commonly employ this type of weatherstripping and simply require replacement of these worn elements. This type allows the door or window to operate without resistance.

ADVANTAGE

- ▶ Provides a very durable seal that does not impede function.

DISADVANTAGE

- ▶ Does not provide for a full contact seal and requires skilled labor for new installations.

Install New or Replacement Resilient (Compression or Sliding) Weatherstripping

—The resilience of these materials provides the opportunity to accommodate irregular surfaces and those surfaces having a tight seal achieved with full contact. Numerous products are available for this purpose with a wide variety of performance. Compression does not necessarily ensure a tighter seal; manufacturer's recommendations for sizing should be carefully observed.

ADVANTAGES

- ▶ Compression materials typically provide the tightest seal and, generally, are very durable.
- ▶ Installation does not typically require a high degree of skill.
- ▶ New materials employed in sliding seals have significantly improved their durability while providing a tight seal. These materials are often applied to the surface of a door.

DISADVANTAGES

- ▶ Resilient materials may prevent the tight closure of the door or sash, impede the function of hardware, and, generally, are less durable.
- ▶ Some materials are subject to damage under cold conditions or exposure to natural light.

Install New or Replacement Door

Thresholds—Thresholds are available in a variety of configurations, which will determine the appropriate type of weatherstripping.

Thresholds that employ a raised stop may continue the compression seal around the full perimeter. Other assemblies work in combination with either sweep or compression seals that are attached to the door unit and compressed against the threshold. Some threshold units with integral seals are undesirable because the seals are subject to damage from foot traffic. A variation of a threshold seal is the automated door bottom that deploys a seal downward when the door is in the closed position.

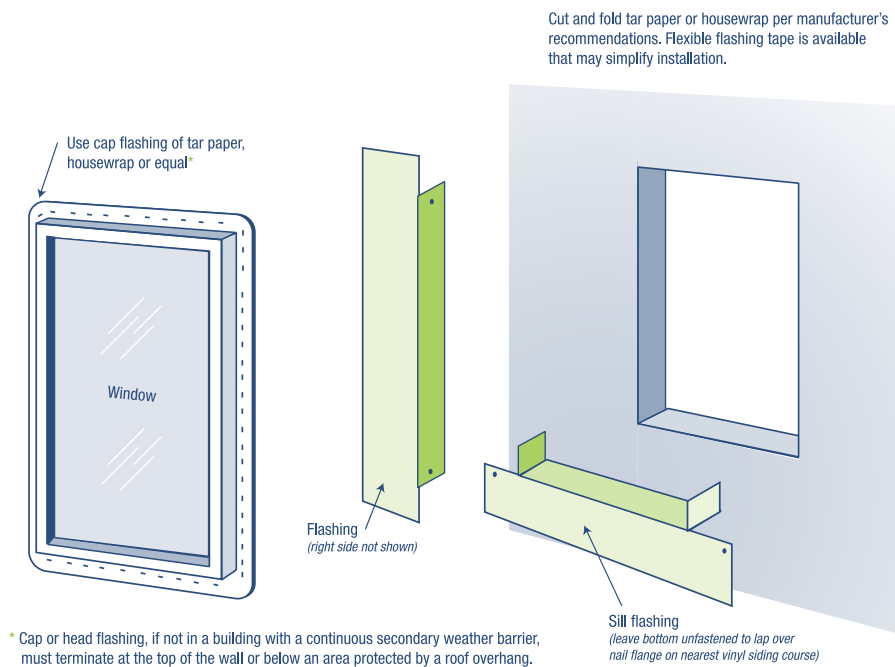
ADVANTAGE

- ▶ New, durable materials are designed to last many years while improving thermal performance of the assembly.

DISADVANTAGES

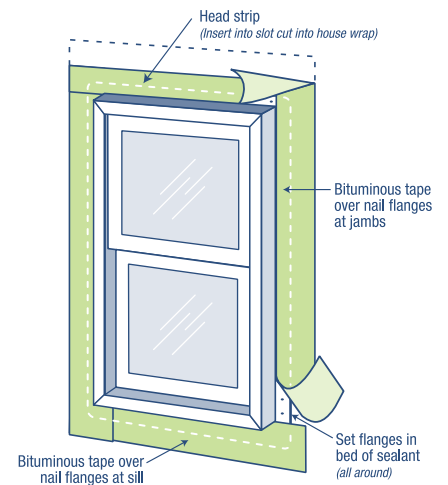
- ▶ Replacing the entire threshold requires a higher degree of skill.
- ▶ New, unique designs may prove to be difficult to repair in the future.

Figure 3. Window Sill and Jamb Flashing Detail



Source: Durability by Design, U.S. Department of Housing and Urban Development

Figure 4. Window Flashing



Source: Durability by Design, U.S. Department of Housing and Urban Development

STEP 6: Hurricane Shutters

For repair and retrofit, hurricane shutters are the most economical solution for most homeowners to protect windows in a storm. Impact-resistant windows are best for windows not easily fitted with hurricane shutters or those that are hard to reach. Make sure to install an impact-resistant system on sliding glass doors because they are larger and more vulnerable to wind and debris than windows. If these doors cannot be replaced, then at the very least, install hurricane shutters.

A brief listing of the various types of hurricane shutters and window shutters follows.

While **plywood** is probably the most commonly used hurricane shutter, it **does not meet most codes**. Below are some code-compliant methods that are more effective and more easily reusable than plywood in protecting windows and doors from storm damage.

Storm panel hurricane shutters are overlapping panels made of steel or aluminum that attach to the walls around windows and doors with bolts or tracks. At an average cost of \$4.00-\$7.00 per square foot, they generally are the most inexpensive of the permanent shutter systems. They are removable and require storage, but usually stack together tightly and take up little space. Hanging these shutters can require more than one person.

Accordion hurricane shutters are 1- or 2-piece hurricane shutters that are permanently attached. They unfold accordion-style to cover and protect during a storm. They fall into the moderate average price range of \$14.00-\$15.00 per square foot.

Colonial hurricane shutters are the traditional 2-piece louvered shutters, attached to the wall beside each window, which fold together to protect the window. They are attractive and can easily be made storm-ready by one person, but cannot be used to protect doors. Installation costs range from \$18.00-\$30.00 per square foot.

Bahama hurricane shutters are 1-piece louvered shutters that attach directly above the windows and prop open to provide shade for the window. Bahama shutters are storm-ready when lowered and secured to the wall. They are attractive and provide shade, and can easily be made storm-ready by one person; however, they cannot be used to protect doors. Installation costs can be \$18.00-\$30.00 per square foot.

Roll-down hurricane shutters attach above the window and easily roll up and store in an enclosed box when not in use. They are lowered either manually by a hand crank or automatically by push button, and lock in place for storm protection. At \$26.00-\$40.00 per square foot, they are the most expensive of the popular shutter systems.

The material in this Tech Brief was adapted from the following sources:

Durability by Design: A Guide for Residential Builders and Designers
U.S. Department of Housing and Urban Development, May 2002

Field Testing of Energy-Efficient Flood-Damage-Resistant Residential Envelope Systems, Summary Report
Oak Ridge National Laboratory, 2004

Rebuilding After a Hurricane
Institute for Business & Home Safety (undated)

Repairing Your Flooded Home
American Red Cross, 1992

The Rehab Guide Volume 4: Windows & Doors
U.S. Department of Housing and Urban Development, August 1999

Hurricane Shutter Guide: Compare types and calculate costs
Sun-Sentinel.com

FOR MORE INFORMATION SEE:

Building America Best Practices Series:
Volume 1: *Builders and Buyers Handbook for Improving New Home Efficiency, Comfort, and Durability in the Hot and Humid Climate*
www.buildingamerica.gov

Practices for Improving Hurricane Resistance
www.pathnet.org/hurricane

ENERGY STAR
www.energystar.gov